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# A New Perspective on Thinking, Memory and Learning in Gifted Adults with Asperger Syndrome: Five Phenomenological Case Studies

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A New Perspective on  
**Thinking, Memory and Learning**  
in Gifted Adults with Asperger Syndrome

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Five Phenomenological Case Studies

A thesis presented in fulfilment of the requirements for the award of the degree

Doctor of Philosophy  
from the  
University of Wollongong

By  
Nola Grace Norris, M.Ed., B.Ed., Dip.Teach.

School of Education  
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## **Certification**

I, Nola Grace Norris, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Education, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Nola Norris  
20 March 2014

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## Abstract

In response to the call for first-hand accounts of individuals experiencing autism, this study addresses the need for qualitative investigation of the thinking and learning of gifted adults with Asperger syndrome (AS). The findings represent a broad phenomenological ‘map of the landscape’ of the experience of the participants and take the form of: (a) five case study reports; and, (b) a conceptual framework for understanding thinking and learning in autism, which was developed from the research literature. The need for such a framework is particularly relevant for professional development of teachers of students with AS in mainstream schools, however, the framework also addresses the need for information and understanding concerning thinking and learning by: parents of children with AS; life partners of individuals with AS; and, individuals experiencing AS.

Utilising phenomenological case study methodology, five in-depth case studies were conducted and analysed employing interpretative phenomenological analysis (IPA). The case studies were interpreted in the light of an iterative review of the neuroscience and autism research literature, which was also used to construct the conceptual framework for teacher professional development: the ‘Thinking, Memory and Learning Framework’ (TML).

The five themes emerging from the case studies of thinking, memory and learning are: (a) compensatory learning; (b) self-referential thinking *vs.* externally oriented thinking; (c) enhanced perceptual functioning and giftedness; (d) temporality; and, (e) language. The primary participants as a group demonstrated a distinct cognitive profile while displaying some within-group differences. Their narratives exposed existential problems with the trustworthiness of knowledge and identity formation: this led to the super-ordinate theme of ‘Knowledge and the knower’.

The conceptual framework that is an outcome of this doctoral study illuminates the thinking, memory and learning of gifted individuals with AS and has implications for the development of teachers’ understanding of learning *per se*. It also indicates a hierarchy within explicit mental learning activities with learners with AS benefitting at the lower end of the hierarchy and being challenged at the higher end. Pedagogical

insights based on the findings are proposed. This thesis presents a new perspective on thinking, memory and learning in gifted individuals with Asperger syndrome.

## **Acknowledgements**

My recognition of the need for research into the experience of gifted individuals with Asperger syndrome (AS) was birthed in 2005 at a meeting of ASPIA (Asperger Syndrome Partner Information Australia), a Sydney-based partner support group. The topic was the neurological foundations of AS and the presentation was being given by Eleanor Gittins, one of the group's wonderful mentoring psychologists. I was on a crash-course of learning about AS and, up until this point, had only been able to conceptualise AS in terms of behaviour. The idea that neuroanatomy and 'brain wiring' was the basis of the condition was, to me, revolutionary. My profound thanks are given to the mentors who have had such longstanding engagement with us, AS partners, through ASPIA: Eleanor Gittens, Jeroen Decates and Professor Tony Attwood.

The one person who has most impacted this area of my life is my friend, Carol Grigg, who co-founded ASPIA over ten years ago in order to help others navigate the waters of mixed Asperger syndrome/neurotypical life partnerships, based on her own journey. In the Australia Day 2014 Honours List, Carol's volunteer work was recognised by the Australian nation through the award of the Order of Australia Medal. Carol has supported, nudged, nurtured and provided a platform for my work throughout the entire process of this doctorate and I am deeply grateful to her for being my friend and confidante.

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## Acronyms

<b>AM</b>	Autobiographical memory
<b>ADHD</b>	Attention Deficit Hyperactivity Disorder
<b>AS</b>	Asperger syndrome
<b>ASD</b>	Autism spectrum disorder(s)
<b>DSM</b>	<i>Diagnostic and Statistical Manual of Mental Disorders</i>
<b>EAM</b>	Episodic autobiographical memory
<b>EF</b>	Executive function(s)
<b>EI</b>	Eidetic imagery
<b>ESL</b>	English as a Second Language
<b>HFA</b>	High(er)-functioning autism
<b>HSC</b>	Higher School Certificate
<b>IPA</b>	Interpretative phenomenological analysis
<b>IPT</b>	Information processing theory
<b>IQ</b>	Intelligence quotient
<b>KI</b>	Key informant
<b>MI</b>	Multiple Intelligences
<b>NT</b>	Neurotypical
<b>OCR</b>	Optical character recognition
<b>PD</b>	Professional development

<b>PRS</b>	Perceptual Representation System
<b>TD</b>	Typically developing
<b>TML</b>	The Thinking, Memory and Learning Framework
<b>ToM</b>	Theory of mind
<b>WCC</b>	Weak central coherence

## **Glossary**

### **Anoetic, noetic and autonoetic consciousness**

Also described as anoetic, noetic and autonoetic awareness: different forms of human consciousness. ‘Anoetic’ means ‘without knowing’ awareness, described as implicit or non-declarative (can’t be spoken about) and is the type of consciousness associated with procedural and perceptual memory. ‘Noetic’ refers to ‘knowing’ consciousness, is associated with semantic memory and is explicit and declarative (can be spoken about). ‘Autonoetic’ consciousness is ‘self-knowing’ awareness and is characterised by ‘mental time travel’, which is the means of retrieval of episodic memories. Along with noetic consciousness, autonoetic consciousness is explicit and declarative. See Figure 4.8: ‘Hierarchy of learning and memory systems and their associated forms of consciousness’.

### **Central coherence**

An information-processing style: strong central coherence refers to a ‘top-down’, ‘global’ or gestalt style of thinking; weak central coherence refers to a ‘bottom-up’ or detailed-processing style.

### **Eidetic imagery**

Eidetic imagery, or memory, is defined as ‘a rare form of visual memory ... distinguished from ordinary visual imagery by its vividness and by the fact that it is “seen” projected in front of the viewer as opposed to being merely remembered’ (Furst, Gardner & Kamiya, 1974, p. 603).

### **Episodic memory**

The human long-term learning and memory system that registers personal experience. Retrieval of memories from episodic memory is characterised by ‘mental time travel’. Episodic memory is responsible for complex mental functions such as abstract reasoning, relational memory, memory binding, simultaneous processing, executive functions, temporality, source memory and attribution. It is explicit and declarative. Episodic memories are said to be ‘episodic’ in that they are incomplete and change from recall to recall, depending on salience and reason for recall. The latest maturing form of memory, it relies on pre-frontal cortex development.

### **Human Learning and Memory Systems**

The memory systems model proposed by Schacter and Tulving (1994) that has been widely adopted in the neuroscience and autism research literature. Consists of five ‘systems’ of human learning and memory: procedural, perceptual, semantic, episodic and working memory.

## Memory binding

Memory binding is a function of episodic memory, where the relationship between elements is stored in memory in addition to the elements themselves, e.g., the spatial, temporal, affective contextual elements of an experienced event are bound together with the memory of the event itself in episodic memory.

## Mental time travel

The means of recalling a personally experienced event: an act of autonoetic awareness. One mentally travels into one's past and re-experiences elements of an event, including the event's contextual detail (source memory) such as location, subjective sense of time and emotion.

## Neurotypical (NT)

A term used in the autism literature to describe typically developing individuals. Mostly used in this thesis to refer to adults, while the term 'typically developing' is used to refer to children and adolescents: e.g., neurotypical adult, typically developing child.

## Perceptual Representation System (PRS)

The human long-term learning and memory system that registers experience and sensation. Along with procedural memory it is implicit and non-declarative. Early developing.

## Procedural memory

Commonly referred to using terms such as 'tactile memory' or 'muscle memory', procedural memory is long-term memory for motor actions and skills that become automatic. It is implicit and non-declarative. Early developing.

## Prototype

A symbolic representation in memory of an item, category or concept, e.g., a dog, a happy face. **Not** a remembered instance of the category but a summary representation that incorporates the salient criteria for membership of the category. Comparison with a single representational prototype is more efficient than comparing an unknown item, in order to label or categorise it, with every previously encountered instance.

## Relational memory

Associated with memory binding, relational memory is a function of episodic thinking and memory, where the relationship between events or ideas is stored in memory, along with the ideas themselves. In contrast to the single-item processing of semantic memory, relational memory affords a capacity for simultaneousness processing, where one idea or

event is processed simultaneously in light of its relation to others. Foundational to executive functionality, e.g., in prioritising, sequencing, planning, etc.

## **Remember vs. know responses**

In Tulving's human learning and memory systems model, acts of memory recall that are attributable to noetic awareness are described as 'know' responses, such as the recall of factual information: 'I know Paris is the capital city of France'. Acts of memory recall attributable to autonoetic awareness are described as 'remember' responses, which relate to mentally re-experiencing a personally experienced event: 'I remember how beautiful Paris looked at night in summer'.

## **Schema**

An abstract, mental representation of ideas, notions, phenomena or concepts that incorporates relational information. An example of the use of mental organisational strategies or top-down processing. More memory-efficient than, and confers understanding beyond, processing and remembering single items without relationships. From a constructivist perspective, a schema represents a personally constructed understanding of a concept. Used in this thesis as a synonym for 'conceptual framework'.

## **Semantic memory**

The human long-term learning and memory system that symbolically represents single-item factual information. It is explicit and declarative. Unlike episodic memories, the content matter of factual memory does not change over time, e.g.  $2 + 2 = 4$ , regardless of how one feels or why one recalls the fact. Later developing.

## **Source memory**

Memory for the contextual detail of a personally experienced event that is encoded, along with the memory, at the source: spatial (location), temporality (subjective time), affect (emotion). Source memory confers attribution: e.g. temporal – 'before', 'during' or 'after' my visit to Paris, location – 'I remember standing in the queue to go up the Eiffel Tower', emotion – 'I remember how beautiful the lights were at night'. Factual memories do not include source information, they are context-less and are therefore said to be 'single-item'.

## **Theory of mind (ToM)**

The capacity for meta-representation: to know that oneself and other people have minds and are capable of different mental states. Mental states include thoughts, emotions, attitudes and physical sensations. Closely associated with the notion of metacognition.

**Typically developing (TD)**

A term used in the autism literature to describe individuals whose neural developmental pathway conforms to the expected pattern of typical development in contrast to the neural development of an individual with AS. See also neurotypical (NT).

**Working memory**

Working memory is the location of time limited, 'online' information-processing. Working memory is the interface with the long-term memory systems: encoding and retrieval to and from the long-term memory systems is via working memory.



# Part A

Chapter 1 Introduction

Chapter 2 Theoretical Framework & Background Literature Review

Chapter 3 Methodology & Method



## **Chapter 1 Introduction**

### **1.1      *Introduction***

Utilising a phenomenological case study approach, this thesis reports an investigation of thinking, memory and learning in gifted individuals experiencing Asperger syndrome (AS). Semi-structured interviews of gifted adults with AS and key informants were conducted. Key informants were close family members who provided elaborative information, corroboration and interpretation, which guided the analysis of the case studies. The study was conceived within the framework of interpretative phenomenological analysis (IPA) (Smith, Flowers & Larkin, 2009). Data consisted of interview transcripts, interview notes and artefacts. The study drew upon cross-disciplinary bodies of research literature: education, neuroscience and psychology. It aimed to provide a broad phenomenological map of experiential aspects of AS cognition in response to calls for such case studies by Gardiner (2008) and to assemble and characterise, for educational purposes, the myriad findings from quantitative research. Due to the open-ended nature of this doctoral study, many more questions for future research were posed by the findings. The theoretical output of this doctoral research was the development of a conceptual framework for understanding the thinking, memory and learning of individuals with AS, for the purpose of professional development (PD) of teachers. During the course of the study, relevance of the developing framework for parents and individuals with AS was uncovered.

### **1.2      *Background to the study***

The study comprised personal and professional elements, which are presented later in this chapter as my ‘personal journey’ and ‘professional journey’ in order to explicate my situatedness and because the research question was separately and concurrently posed within the two domains. This chapter assumes the first-person voice as being the most appropriate means to provide the background to the study.

#### **1.2.1      *Rationale***

After my husband’s diagnosis of Asperger syndrome (AS) in 2005, and the realisation that there are lots of learners who have ‘differently wired’ brains (to use a common metaphor), I began to appreciate that most of the pedagogical understanding I had faithfully learned and practised in my teaching career failed to account for the

‘differently wired brains’ of learners with AS. In the school where I worked at that time, there were a number of students diagnosed with AS and more who were high in traits. Most of their teachers reported in conversations, as word of my husband’s diagnosis spread, that they, too, felt they had little or no understanding of how these students learned: this was a school where teachers’ self-perceived understanding of the learning of their students was highly valued as a guide to pedagogical decision-making. In 2008, the decision to commence a part-time research doctorate with the support of the school leadership was made. In the initial phase, the study provided the means to access research journals and share that knowledge within the school but it became apparent that, despite the advent of a plethora of neuroscience research giving new insights into brain function that opened new opportunities for understanding, research studies that reported the perspectives of gifted adults with AS on their learning and thinking were absent from the literature, with the exception of a single case study (Boucher, 2007).

### **1.2.2 The educational problem: Thinking and learning**

The educational problem identified was our lack, as a teaching staff, of conceptual understanding of the differences between the thinking and learning of typically developing (TD) students and students with Asperger syndrome (AS). We believed we understood a significant amount about the thinking and learning of our students, with and without AS, based around the Visual-Auditory-Kinaesthetic (VAK) learning styles framework (Lovering, 2004), Bloom’s taxonomy of thinking skills (Bloom, 1974), left-brain/right-brain thinking and Gardner’s Theory of Multiple Intelligences (MI) (Gardner, 2006). When these frameworks were promoted within the school, they occupied the theoretical space that rightly should be occupied by evidence-based understanding of cognition, both for students with AS and those without. The VAK framework and Bloom’s taxonomy have been criticised for lack of research support (Pashler, McDaniel, Rohrer & Bjork, 2009; Ravitch, 1986; Ritchhart, Church & Morrison, 2011) while left-brain/right-brain thinking has been designated as a ‘neural myth,’ prompted by misreported evidence from brain-imaging studies (Lindell & Kidd, 2011; Pasquinelli, 2012). On the other hand, the Theory of Multiple Intelligences enjoys wide acceptance and performs an important role in this study (Section 2.7.11). A framework for professional development of teachers that drew upon evolving understandings of cognition and autism based on evidence from neuroscientific research was lacking. As a teaching staff, our beliefs about the thinking of our students were partly influenced by

trends and models that lacked research support and older behavioural and cognitive psychology theories without the benefit of recent findings from neuroscience.

### **1.2.3 Research question**

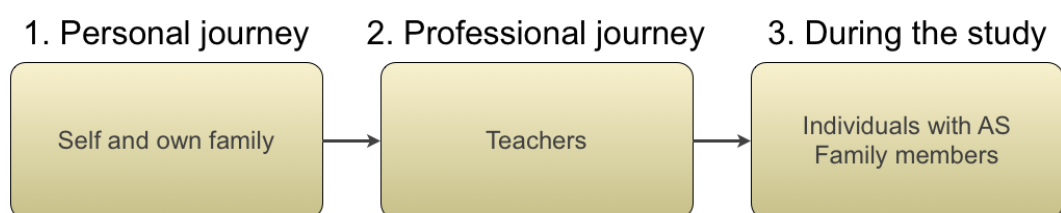
This study was a cross-disciplinary, open-ended investigation focused on the research question ‘How do gifted adults with Asperger syndrome think and learn?’

### **1.2.4 Aim of the study**

The aim of the study was to investigate the thinking and learning of gifted individuals with AS in order to develop a conceptual framework for understanding Asperger cognition for professional development purposes. The conceptual framework that evolved over the course of the study was based on an iterative literature search augmented by the findings of this doctoral study, with the interpretive analysis of the case studies being informed by the research. It was ‘road-tested’ and evaluated in conference presentations and presentations to teachers, parents, individuals with AS and life partners of adults with AS, with adaptations in emphasis and language to suit each audience. The aim was to provide a theoretical understanding that each teacher, parent, individual or partner could apply to gain insight into their own context.

### **1.2.5 Change of scope and audience**

Initially, the investigation of the thinking and learning of people with AS was to provide teachers with structured understanding; to give generalisable insights for them to apply to their own learning and teaching situations with individual students. However, during the course of the study, two issues arose. The first was that high relevance to individuals with AS and their family members was discovered through feedback from the data collection process, professional development presentations and individual consultations, so that the audiences for the study expanded, as shown in Figure 1.1.



**Figure 1.1 Expanding audiences**

The second was that the scope of the study broadened from my local educational context to a focus on theory development. Taken together, these two things mandated an upgrade in December 2012 from a Doctorate in Education (a combination of coursework and research focusing on an educational problem within a local teaching context) to a Doctorate in Philosophy with a focus on theoretical outcomes and broader audiences.

### **1.3      *Personal journey***

To a family in decline, my husband's diagnosis of Asperger syndrome in 2005 was a turning point. Long-term unemployment and low day-to-day functioning were affecting our lives so that the family's future looked bleak. One day, I had an epiphany that dramatically altered my perspective.

Epiphanies...are sudden and abrupt insights and/or changes in perspective that transform the individual's concept of self and identity through the creation of new meaning in the individual's life. (McDonald, 2008, p. 90)

New meaning was suddenly constructed after lengthy, unproductive participation in relationship counselling.

Determined to leave no stone unturned in order to support my husband of 17 years, we had been seeing a gifted psychologist for some time. I had reached the point where I realised that nothing was going to change for the better while I continued the role of 'supportive wife' during the counselling sessions as, while my husband was cooperative and even seemed to enjoy the sessions, it bore little relationship to what was actually happening in our lives beyond the counselling room. I made an appointment to see the counsellor by myself to explain why I wouldn't be participating in further counselling sessions, but many things conspired against me keeping the appointment on the day. Despite the delays, I resolved that the journey itself had symbolic significance and that I still needed to make it, even if I couldn't see the counsellor when I got there. The result was that I arrived at the counselling rooms 15 minutes before the end of my 90 minute session. From my perspective, more was achieved in that 15 minutes than all the sessions previously.

The psychologist listened while my story tumbled out, beginning with, 'This is what my life is **really** like...' I spoke about the dichotomy between the appearance and the

reality and my confusion caused by a husband whose commitment to our family was evident, but whose actions often seemed to indicate the opposite, and whose persistent behaviours were counter-productive to achieving even his own articulated goals. The epiphany came when the psychologist interrupted with the (to me) memorable words, ‘Sounds like Asperger’s’. As an educator with an interest in gifted education, I knew a little about AS, however, the session ended and I left feeling angry with the psychologist for having said, ‘Sounds like Asperger’s.’ In the three minute walk to the car, I successively: (a) decided that the psychologist had ‘lost the plot’; (b) thought that I should at least eliminate the possibility he raised; and, (c) resolved to keep an open mind as this was an unexplored avenue. The epiphany was sealed as I reached the car with the decision to think through how this knowledge would change our lives **if** it proved to be true.

With this new frame of reference—‘perhaps he has Asperger syndrome’—my life was transformed. Even in the weeks before formal diagnosis, my life changed powerfully for the better due to the transformation in my interpretation of our reality. The transformation in my thinking was like the Copernican Revolution where the chaotic mapping of planets revolving around the earth was replaced with the simple, theoretical elegance of planets revolving around the sun. The confused chaos of our lives which had eluded my understanding for so many years resolved into a relatively easy-to-understand paradigm. Understanding led to new strategies for management, individually and corporately transforming the family’s quality of life. I re-imagined myself as an empowered learner rather than a victim. Simple explanations and discussions with our 11 year old typically developing (TD) son allowed him to develop understanding and management strategies. My husband consented to the diagnosis of Asperger’s as an act of trust in the psychologists, both the original psychologist and the specialist psychologist who completed the diagnosis, but stated it didn’t make a difference to him, while accepting, also as an act of trust, that it made a difference to me and our son. It wasn’t until some months later that my husband also had an epiphany.

Several months after the diagnosis, the *Sydney Morning Herald* (SMH), a leading newspaper in Sydney, Australia, published a lift-out feature on AS with the dual themes of diagnosis in adulthood and the benefits of acceptance and understanding (Molloy, 2005). The feature included our family as a case study. During the interview with the

*SMH* reporter in our home, our son was playing a computer game nearby. After hearing my story, the reporter asked my husband, ‘What difference does the diagnosis of Asperger’s make to you?’ and he replied, ‘None’. She then asked if she could put the same question to our son and we agreed. Our son described the changes for the better that he had experienced since the diagnosis. Hearing his son explain the difference the diagnosis had made in his life was the epiphanic moment for my husband. From this point, he embraced the diagnosis with the result that it became a very powerful paradigm-shift for all three family members.

### 1.3.1 Functional challenges

Lest such a positive outcome from diagnosis give an impression of ‘happily ever after’, it is important to establish the level of impairment that accompanies our daily experience. A recent event illustrates the challenge to communication and relationship that is experienced, even in trivial matters. Interpreting and making sense of the confusion is, for me, the key to the transformation from family-in-decline to family-thriving-despite-challenges.

My husband (H) and I were facing each other across a café table having just finished morning tea. I could see out into the main street of our home town and he was facing the back of the café, behind which there is a car park.

Me: My car’s that way. (I point over my shoulder in the direction my husband is looking.) Where’s yours?

H: I’m seeing the post office.

His reply, ‘I’m seeing the post office,’ stopped me in mid-communication as his assured reply seemed to have no bearing to my question. I was expecting an answer about his car being parked either in the street out front or the car park out back. I stared at him and saw the post office across the street **behind him**, framing his head as I looked directly at him: but he was looking **at me**, not behind himself. When I asked him where he had parked his car, I had a mental map in my mind: of the street outside, the carpark behind the café, and ourselves in relation to them. Figure 1.2 shows a sketch of the location where this scenario took place.

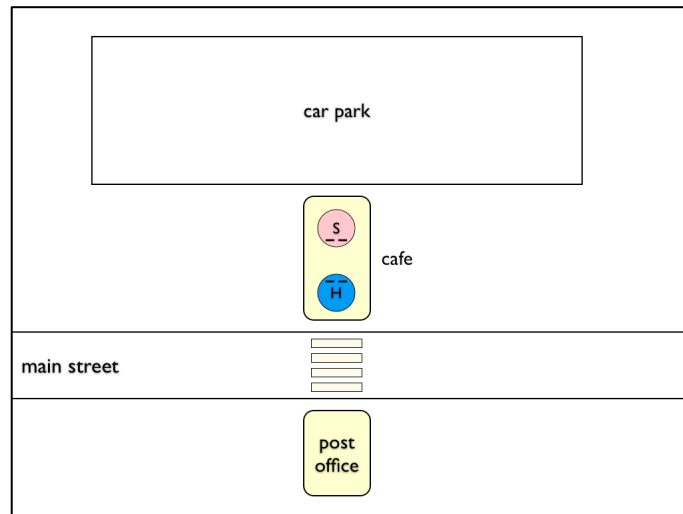


Figure 1.2 Map showing self ('S', represented by pink circle), facing into the street, and 'H' (represented by blue circle), facing the car park.

I turned and looked in the same direction as H was looking, and saw a highly reflective glass panel at our eye level on the staircase behind me. The glass panel was perpendicular to us and mirrored the reflection of the post office across the street (Figure 1.3). At that moment I realised that he was not referring to a mental construction of the area we were in, which was well-known to us both. After a moment of thought, I rephrased my question, which elicited the appropriate response.

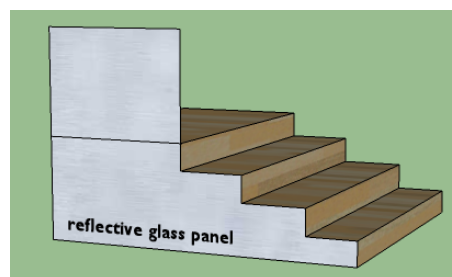


Figure 1.3 Glass panel behind Self, in which H was seeing the reflection of the post office

On the surface, H's response, 'I'm seeing the post office,' defied my understanding. I had asked him about parking as we had arrived in separate cars and were about to leave. Forgetting that H has great difficulty with abstraction and is mostly bound to the literal perception of his senses, I believed he was imagining a similar mental map to mine. However, understanding something of the differences between my thinking and the way he thinks allowed me to reinterpret and respond a few seconds later with a re-phrased question. H literally **saw** me point at the reflection of the post office, **heard** me talk about car parking and was having trouble integrating those two sensory inputs and understanding what I meant (Stevenson, *et al.*, 2014). His attention was captured by the

literal and, when he responded ‘I’m seeing the post office,’ he was yet to process what I **said**: he was responding to what he saw me **do**, in isolation. Answering my question required several more seconds of processing time before he indicated that his car was also parked out the back of the café. Instead of referring to a mental map cross-referenced with location and temporal information about the current location of our cars, which for me is an instantaneous process, he referred to what he could literally see. Discussing this event with him helped me understand more about his literal thinking: abstract mental constructions are not available to him in the same way as they are for me. Whereas my sensory input is continuously updating my mental construction without conscious effort (in this case an imagined map of the area), he is dependent upon the perceptual input of the moment.

There are many instances each day where there is a functional communication mismatch indicative of differences in thinking. These fuel my desire to know more about cognition and thinking, both AS and TD, so I can better understand and contribute to this partnership, which I now liken to a cross-cultural relationship. These experiences also posed questions within my professional sphere, such as how a changed frame of reference—like my ‘Copernican Revolution’—would impact on teaching and learning for students with AS at my school. The desire to understand the thinking and learning of people with AS culminated in the commencement of this doctoral study. With access to research databases established in 2008, my early reading disclosed: (a) the relatively new, highly productive field of functional brain imaging that facilitates understanding of Asperger cognition beyond the limitations of behavioural and cognitive psychology; and, (b) that phenomenological methodology had been successfully employed with participants with AS. However, my quest for information about thinking and learning from the perspective of individuals with AS was largely unaddressed within the research literature.

## **1.4 Professional journey**

At the time of my husband’s diagnosis, I was employed fulltime as an educator in the professional development of teachers in the use of computing technology in teaching and learning. The school where I worked was a co-educational K-12 (Kindergarten to Year 12) independent school on the outskirts of Sydney with a focus on academics and high-value co-curricular activities, catering to higher socioeconomic status families.

Following the disclosure of my husband's diagnosis, the school leadership was supportive of my commencing a doctorate to investigate AS and learning as there was an over-representation of students with AS, both diagnosed and undiagnosed. With the commencement of my doctoral studies, I became, in effect, a consultant providing advice and support for teachers and the school leadership to build knowledge and understanding. Parents of students, both diagnosed and undiagnosed, were sometimes referred by the school leadership. Numerous informal conversations in the staff common room took place and I provided some formal training sessions. I observed during this period that we, as a staff, did not have a theoretical understanding of the learning of our students with AS and didn't have the means to move beyond aiming for behavioural compliance, social training and classroom management. This led to the formulation of the educational problem and research question for this study. Although I left the school part-way through my doctoral research to focus on full-time study, my experiences there over many years formed the professional background to this research.

## **1.5 Contribution of the thesis**

The thesis contributes a new perspective on thinking, memory and learning in AS through the development of a theoretical framework for professional development of teachers and other stakeholder audiences. It 'maps the landscape' of issues encountered by five gifted individuals with AS based on their narratives and artefacts and draws upon recent neuroscience research to interpret and represent this knowledge in a way relevant to education. Specifically, this thesis: (a) is a response to the call by memory-in-autism researchers for first-hand reports; (b) extends the application of phenomenological methodology in autism research; (c) provides a new educational perspective on memory and learning; (d) considers the philosophical life questions that impact on identity formation in AS; and, (e) provides a framework for teacher PD. Each of these contributions will be addressed separately in this section.

### **1.5.1 Response to the call for first-hand reports**

In an important book on memory in autism, John M. Gardiner (2008) discusses the importance of converging sources of evidence overtaking older behaviourist and cognitive theories of autism (see Figure 1.4). Newer brain-imaging techniques have contributed a fresh round of evidence to information-processing theories and Gardiner makes the point that theoretical assumptions must now be consistent with

neuroanatomical function. Along with these two sources of evidence—neuroscience and behaviourist/cognitive theories—he proposes that a third source of evidence is needed: the reports of people experiencing the phenomenon of autism.

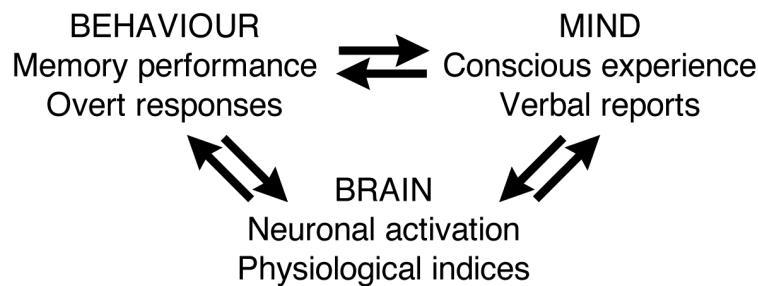


Figure 1.4 Three kinds of converging evidence (Gardiner, 2008, p. 16)

This is controversial in an area dominated by quantitative research but Gardiner argues that memory theorists have ‘increasing willingness’ (p. 15) to consider first-hand reports alongside more traditional forms of evidence: the case study of ‘JS’, which examined memory in a gifted individual with AS, is a ground-breaking example (Boucher, 2007). The move to recognise the value of qualitative studies in autism is gathering support (Bölte, 2014). This doctoral study contributes by providing case studies focused directly on thinking, memory and learning in response to Gardiner’s call for first-hand reports of people experiencing autism to contribute to memory research.

### 1.5.2 Phenomenological methodology

A small group of phenomenological case studies examined educational and social issues for people with AS and these studies, collectively, provided the model for the research design of this doctoral study: Carrington and Graham (2001); Carrington, Papinczak, and Templeton (2003); Griffith, Totsika, Nash, and Hastings (2011); Humphrey and Lewis (2008); Hurlbutt and Chalmers (2002); and, Müller, E., Schuler, and Yates (2008). These studies also demonstrated that people with AS are willing, and have the capacity, to contribute to qualitative research and that interpretative phenomenological analysis (IPA) has been utilised productively with this group. None of the studies, however, focused directly or indirectly on thinking or learning. This doctoral study follows the six studies noted above and is significant for its contribution to the extended application of IPA through the provision of case studies that directly address thinking and learning.

### 1.5.3 Memory and learning

In this doctoral study, when participants with AS were asked how they think and learn, they talked instead about their **memories of learning** and their memories generally. The ways in which they described their memories of learning became a central focus of the study. It will be argued throughout this thesis that learning and memory are intrinsically associated and that a key to understanding learning in AS is available in the memory research. Studies of amnesia and selectively impaired memory with participants such as ‘KC’ (Tulving, 2002) have demonstrated that learning is not possible without the ability to form new long-term memories. Work that began as amnesia research led to an influential model of human learning and memory (Schacter & Tulving, 1994), represented in Figure 1.5, which has wide acceptance among memory theorists (for example, Ben Shalom, 2003; Boucher, 2007; Gardiner, 2008) and is employed within education to conceptualise learning (Magnussen & Brennen, 2011).

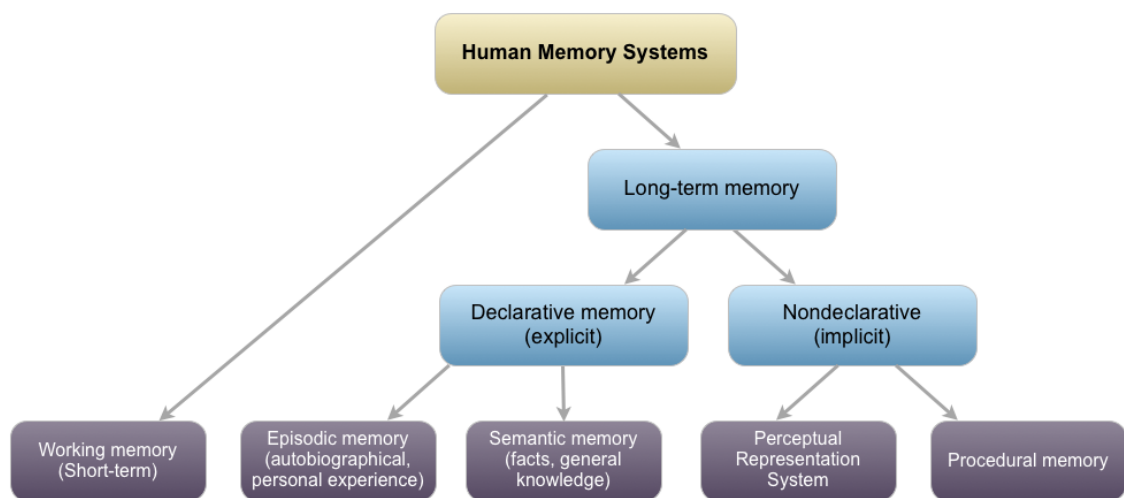


Figure 1.5 Major systems of human learning and memory

Memory is required to process, encode, retain and retrieve past learning. The relationship between memory and learning can be summarised as ‘there is no learning without memory’. New memories must be encoded as a necessary prelude to reconciling new knowledge with existing knowledge and using it to extend one’s understanding of the world. See Section 2.6.1 for a more detailed discussion of learning, which is viewed from within a constructivist perspective.

This doctoral thesis contributes significantly to educational research by providing case studies focused directly on thinking, memory and learning, where previously only a

single case study was described (Boucher, 2007). The emergent themes (Section 9.2), and their significance for learning (Section 10.3), shaped the development of the conceptual framework for teacher professional development. Furthermore, the framework sheds light on learning processes *per se* that are relevant to education and learning theory development.

#### 1.5.4 Identity and knowledge in Asperger experience

Gardiner (2008) outlined the deep implications of the field of memory for its relevance to an understanding of the formation of the ‘concept of self’ (p. 16). Inevitably, a phenomenological exploration of thinking and learning in AS must encounter the ontological and epistemological issues raised by the Asperger experience as, when dealing with lived experience and naturalistic settings, the data do not neatly conform to the research question. Questions of ‘knowledge of the self’ and ‘trustworthiness of knowledge’ emerged from the data so the current study makes a contribution in these areas by illuminating identity and epistemology in the perspectives of five gifted adults with AS. The philosophical presumptions posed by Lincoln and Guba (2013) were utilised as a framework for the consideration of identity and knowledge of the self within the participants’ experiences.

**Table 1.1 Four philosophical questions (Lincoln & Guba, 2013, p. 37)**

The <i>ontological</i> question	What is there that can be known? What is the nature of reality?
The <i>epistemological</i> question	What is the nature of the relationship between the knower and the knowable?
The <i>methodological</i> question	How does one go about acquiring knowledge?
The <i>axiological</i> question	Of all the knowledge available to me, which is the most valuable, which is the most truthful, which is the most beautiful, which is the most life-enhancing?

Knowledge of the self and identity formation in AS emerged as the super-ordinate theme of this doctoral study using the phrase ‘Knowledge and the knower’, which was coined from Guba and Lincoln’s question: ‘What is the nature of the relationship between the knower and the knowable?’ (2013, p. 37). This doctoral study makes a significant contribution to the field of identity formation in AS through the presentation of case studies that characterise the evidence for different processes of formation of the concept of self in individuals with AS.

### **1.5.5 Teacher professional development and multiple audiences**

Over the course of the research, professional development sessions for teachers, parents and partners, and consultations with individuals with AS and their family members, were delivered as a means of returning a benefit to the participants and ‘road-testing’ the evolving conceptual framework. The positive reaction to the sessions demonstrated the significance of the study and showed that wider application beyond mainstream classrooms—to parents, partners and individuals with Aspergers—is warranted. The study therefore has multiple audiences: mainstream classroom teachers who find that their pedagogical framework is inadequate to explain and understand the learning of students with AS; individuals with AS; and those closely involved with them (family members such as parents and life partners).

### **1.5.6 Summary**

The thesis makes a significant contribution because: first-person perspectives that focus directly on the thinking, memory and learning of individuals experiencing Asperger syndrome are largely absent from the research literature with the exception of a single case study (Boucher, 2007)—however, it is noted here that there are significant examples in the mainstream literature, such as Grandin (2013) and Lawson (2011); the study employs methodology which has rarely been used with this population (but in a small number of studies it was used successfully); it contributes to the field of memory in autism through the case studies that elicited first-person responses from individuals with AS; it furthers teacher professional development with its application to teaching and learning in the form of a conceptual framework; and, the framework represents knowledge that is valuable to gifted individuals with autism and their family members.

## **1.6 Chapter conclusion**

Through my personal experience as an ‘Aspie wife’ and my professional experience as an educator, I became aware that there are other ways of thinking and being beyond my understanding. By consciously adopting the role of learner in my personal journey, I re-positioned myself from ‘victim of circumstance’ to ‘empowered learner’. I found that there was a need for the application of my learned knowledge to my educational environment as we, as teachers, lacked a coherent framework for understanding Asperger cognition and yet we based much of our pedagogical practice on our belief

that we understand our students' cognition. In the face of lack of understanding of the cognition of students with AS, the fall-back position was to focus on students' behaviour management, development of social cognition and teachers' classroom management. In this, I believe we were under-serving our students with AS in that we did not apply the same level of professional insight into their learning as we did for TD students.

This doctoral study was undertaken with the aim of addressing the identified educational problem through the development of a conceptual framework for understanding the cognition of students with AS. During the course of the study, the target audience broadened from teachers to include individuals with AS and their family members, while the research focus shifted from the local school context to theoretical outcomes.

## **1.7 *Outline of the thesis***

This thesis is constructed in three parts. Part A includes Chapters 1 to 3. The literature that was reviewed as the background to the study is outlined in Chapter 2. This literature led to the development of the study's theoretical framework, which is included in the same chapter. Chapter 3 documents the methodology employed for the study, interpretative phenomenological analysis (IPA), and the methods used to conduct the study.

Part B presents the five cases of this doctoral research in five chapters, Chapters 4 to 8. As the case studies were conducted, an iterative literature search was required and the literature review on memory and memory-in-autism is provided throughout Part B, particularly within Case 1 in Chapter 4 (Sections 4.3—4.5), when the emergent themes were becoming clearer. The cases are presented in the chronological order of the interviews in order to reflect the sequence in which the themes and the conceptual framework developed.

Part C, Chapters 9 and 10, presents the discussion, findings and conclusion of the thesis. Chapter 9 discusses the emergent themes separately from the individual case studies, comparing the thematic material across the cases. The diagrams that are the culmination of the conceptual framework, the 'Teaching, Memory and Learning Framework' (TML),

are included in Chapter 9: the TML is presented in full in Appendix C. Chapter 10 presents the super-ordinate theme, addresses the research questions, provides pedagogical insights arising from the findings and poses questions for further research.



## Chapter 2 Theoretical Framework & Background Literature Review

### 2.1 *Introduction*

This chapter addresses the background literature utilised for the study. It includes definitions of important concepts and presents the study's starting-point theoretical framework. As this study was cross-disciplinary with multiple stakeholder audiences (educators; individuals with AS; and, family members), working definitions and explanations using non-technical language were developed. A principle of this study was that, 'the study of learning unites education and neuroscience' (Goswami, 2008, p. 33), therefore, the working definitions of concepts were drawn principally from neuroscience research and served for explanatory purposes in presentations to the stakeholder audiences. The review of the relevant cross-disciplinary literature is addressed thematically within this chapter.

### 2.2 *Cross-disciplinary literature*

This doctoral study drew upon the research literature of three disciplines; neuroscience, education and psychology, in order to investigate the research question; 'How do gifted adults with Asperger syndrome think and learn?'

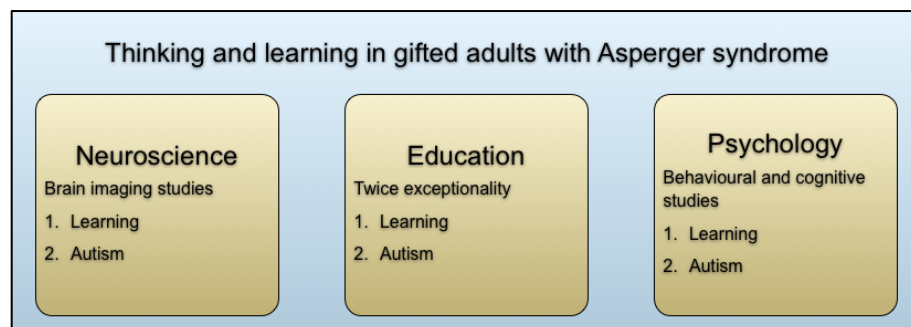


Figure 2.1 The cross-disciplinary literature that informed this study

The confluence of neuroscience and education, known as 'neuroeducation' by Gardner and others (Gardner, 2008a; Pasquinelli, 2012), has provided opportunities to study thinking and learning in ways not previously possible in educational research. In this study, the neuroscience evidence on autism and learning was considered alongside learning theory, set against a background of psychology, which has had historical influences on understandings of autism, cognition and learning.

### 2.2.1 Neuroscience

Newer brain-imaging techniques have provided the means of investigating thinking and learning that were not previously possible through psychological research, providing novel insights to the fields of learning and autism.

In particular, the last decade has seen huge advances in *in vivo* neuroimaging technologies. Scientists are now able to study the workings of the human mind in healthy participants as they solve problems and perform other sorts of cognitive and emotional tasks in real time. ... these recent advances in neuroimaging have had a profound effect on the field of neuroscience and its potential relevance to education. (Immordino-Yang & Fischer, 2011, p. 10)

Through behavioural and cognitive psychology, the ‘black box’ of the learning brain was not directly available for study: theories of learning relied heavily on observations of the inputs and outputs of human behaviour. The affordances of neuroimaging have opened the ‘black box,’ allowing the human brain to be studied during acts of learning and providing powerful implications for teaching and learning (Fischer, 2009). At the same time, autism research has blossomed, also due to the affordances of neuroimaging (Abu-Akel, 2003; Anagnostou & Taylor, 2011; Jordan & Murphy, 2011).

At the commencement of this doctoral study, as a newcomer to neuroscience research, it was necessary to learn how to read the research literature, filtering for relevancy, and to develop a working understanding of the brain and learning. This task was greatly assisted by attendance at two conferences and a workshop in the *Learning and the Brain* series (for example, *Focusing the mind: Using brain research to enhance learning, attention and memory*, 2008), staged by a collaboration between researchers and educators from many major universities in the USA.

In order to determine the relevancy of domains within the literature, an attempt was made to ‘map the landscape’ of concepts and relationships within the neuroscience literature. The map of the landscape that follows in Figure 2.2 is by no means definitive, but indicates the areas of reading that provided the background to the current study. The areas shaded in grey are those that were early exclusions as the focus of this study narrowed.

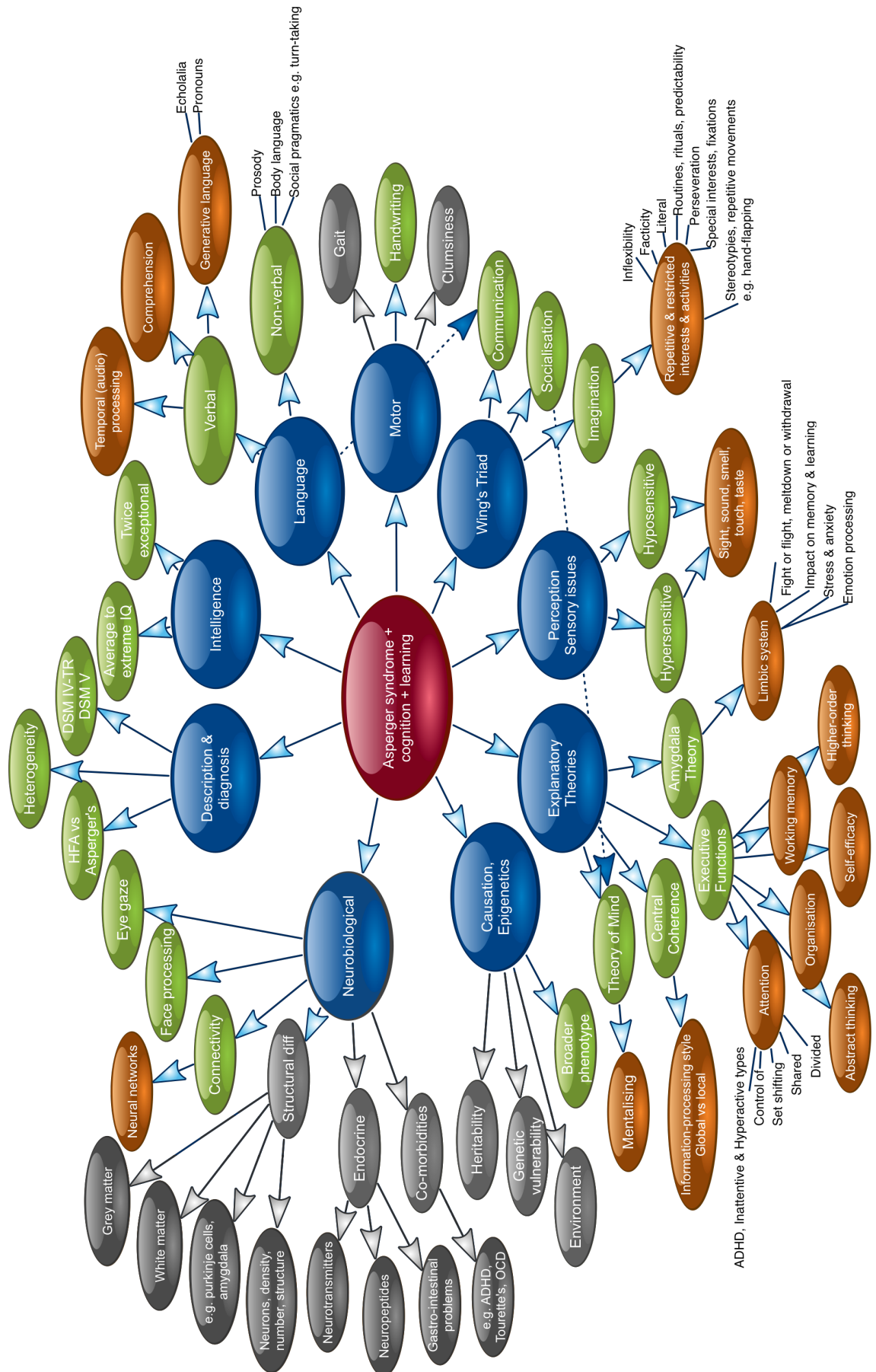


Figure 2.2 Mapping the landscape: cross-disciplinary literature relevant to Asperger syndrome and cognition

The concept map of the literature in Figure 2.2 demonstrates the breadth of, and cross-disciplinary relationships within, the neuroscience and autism literature that informed this study.

### 2.2.2 Education

The learning theory that informed this study is located as the foundation to the theoretical framework (see Figure 2.6). This is a Vygotskian socio-cultural approach to learning (Brown, J. S., Collins & Duguid, 1989; Collins & Greeno, 2011; Säljö, 2011; Wertsch, 2011) that operates within a constructivist view of education (Brown, G., 2009; Dennen, 2004; Duffy & Cunningham, 1996; Jonassen, Peck & Wilson, 1999). The foundational constructs of ‘learning’ and ‘the researcher as situated learner’ are understood within the context of the socio-cultural approach. Educational literature relevant to the theoretical framework sets the stage for the study by providing background concepts such as ‘giftedness’, ‘learning disorder’ and ‘twice exceptionality’ (Gardner, 2000, 2006; Norris & Dixon, 2011).

### 2.2.3 Behavioural and cognitive psychology

The significance of behavioural and cognitive psychology as providing a backdrop for this study is acknowledged for the following reasons. First, behavioural and cognitive studies, prior to recent neuroimaging advances, have provided much of the evidence upon which theories of autism **and** learning are based. Indeed, psychological views of situated cognition (see, for example, Hobson, 2008) align with active, constructivist views of situated learning in education and both fields, education and psychology, owe much to Vygotskian psychology for the development of their respective theoretical understandings (Wertsch, 2011; Yasnitsky & Ferrari, 2008). This is understandable, given that Vygotsky was both a psychologist and an educator. Hobson, a psychotherapist, applied a Vygotskian perspective to the study of autism in his discussion of thinking as situated cognition (Hobson, 2008, 2010). The study of thinking in children with autism also serves to illuminate the thinking of TD children. The following quotation provides an example of the contribution of psychological research to the study of both thinking **and** autism.

In the present context, a special focus is how intimately or otherwise **thinking** is intertwined with interpersonal relations. Here, there is much to be gained from the study of children with autism who have profound difficulties in their emotional engagement

with other people. Research on autism may do more than give us new facts about typical as well as atypical development – it may also prompt us to reconfigure the concepts in terms of which those facts are framed. (Hobson, 2008, pp. 378-379) [emphasis added]

Phenomenology is claimed as a field within psychology and is appropriate to a qualitative investigation of thought. Constructs such as ‘embodied, active, situated, cognition’ and the ‘foundational concept of a situated, meaning-making person’ (Larkin, Eatough & Osborn, 2011, p. 319) are drawn from phenomenological psychology and have shaped this study: these particular constructs are intended, in this study, to refer to the subjective positions of both the researcher and the participants. The use of IPA resonates with a constructivist, Vygotskian approach to active, situated learning.

Secondly, the language used by neuroscientists is heavily influenced by psychology. Influential neuroscientists, such as Minshew and her colleagues (Minshew, Meyer & Goldstein, 2002; Minshew & Williams, 2007; Williams, D. L., Minshew & Goldstein, 2008), continue to employ the language of information-processing theory that pre-dates functional magnetic resonance imaging (fMRI) and the other newer forms of brain imaging. Thirdly, four of the explanatory theories of autism (Section 2.7) were in development prior to the neuroimaging resources now available and owe much to behavioural and cognitive psychology (see, for example, Happé, 1994). Fourthly, behavioural diagnostic criteria are employed to diagnose AS, and this has been the case since the third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* (APA, 1994; Witwer & Lecavalier, 2008). Fifthly, many treatment approaches to autism are based on psychological research and practice and are administered by psychologists, even though the intervention itself may be carried out by an allied health professional, such as a speech pathologist, or a volunteer (see, for example, interventions discussed by Darrou, *et al.*, 2010; Davis, Rosswurm & Zane, 2008; Francis, 2005). Sixthly, psychological experimental methodology has been widely used for autism research (see, for example, Williams, D., Happé & Jarrold, 2008). The use of psychometric instruments in autism research studies, such as Baron-Cohen and Wheelwright’s (2004) study, has generated a large body of research findings. Seventhly, psychology has been pivotal for education and the development of theories of learning through the use of psychology experimental methodology and the use of psychometric instruments in educational research (see, for example, studies by Barton & Starnes, 1989; Mayer & Chandler, 2001).

The foundational role of relevant psychological research for this educational study is recognised. However, as Gardiner (2008) asserts, behavioural and cognitive theories that do not accord with new evidence from neuroscience must be weeded out: neuromyths are examples of psychological theories that have been discounted by neuroscience (Lindell & Kidd, 2011; Pasquinelli, 2012). On the other hand, theoretical understanding arising from the research on memory led by Tulving (for example, Tulving, 1985) is an example of psychological theory that has been strengthened over time as a result of supporting evidence from neuroscience.

## **2.3      *Defining autism***

Autism, a term independently adopted by Leo Kanner and Hans Asperger (Meyer & Minshew, 2002), has become known as ‘autism spectrum disorder’ (ASD) (APA, 2013). As it is a complex, heterogeneous condition (Frith, U., 2004; Szatmari, 2011), within the research literature it has been variously recognised as: having subtypes (Noterdaeme, Wriedt & Hohne, 2009; Witwer & Lecavalier, 2008), including autism, Asperger syndrome and ‘Pervasive Developmental Disorders Not Otherwise Specified’; as a spectrum disorder (Golan, Baron-Cohen & Golan, 2008; Happé, Booth, Charlton & Hughes, 2006); or, even as ‘many autisms’ (Amaral, Schumann & Nordahl, 2008; Dawson, 2008a). The difficulty of description, conceptualisation and diagnosis is testament to the complexity and heterogeneity of the phenomenon of autism.

### **2.3.1      *DSM-IV and DSM-5: Subtypes or spectrum?***

In the researcher’s experience, the term ‘Asperger syndrome’ has entered the mainstream vocabulary in Australia in the time since the researcher’s husband’s diagnosis in 2005. In this period of time, AS has become commonly understood as associated with autism, although there is confusion about whether AS **is** autism or a separate condition: this debate is reflected in the research literature (Ghaziuddin & Mountain-Kimchi, 2004; Yu, Cheung, Chua & McAlonan, 2011). The reclassification of autistic spectrum disorders from *DSM-IV* (APA, 2000) to *DSM-5* (APA, 2013) was prompted by the need for greater ‘diagnostic sensitivity and specificity’ (Huerta, Bishop, Duncan, Hus & Lord, 2012, p. 1056). Under the influence of the *DSM-IV*, the construct of ‘Pervasive Developmental Disorders’, of which AS was a subtype, was employed (Szatmari, 2011). However, prior to the publication of *DSM-5*, it was foreshadowed that AS would no longer be seen as a separate subtype but would be

merged into ‘autism spectrum disorder’. For those with a diagnosis of ‘Asperger’s Disorder’ (APA, 2000) and their family members, the impending reconceptualising of AS in the *DSM-5* was the cause of considerable anxiety.

The prospect of losing the ‘Asperger’s syndrome’ label has also caused widespread anxiety among parents and among affected individuals. (Skuse, 2012, p. 345)

This anxiety should be alleviated by the following acknowledgement in the *DSM-5*, which: (a) indicates the change from subtypes to spectrum; and, (b) provides for the continued use of the term ‘Asperger syndrome’ by the use of ‘encompassing’ rather than ‘replacing’.

Autism spectrum disorder is a new *DSM-5* disorder **encompassing** the previous *DSM-IV* autistic disorder (autism), Asperger’s disorder, childhood integration disorder, Rett’s disorder, and pervasive developmental disorder not otherwise specified. (APA, 2013, p. 809) [emphasis added]

From a clinical perspective, the change from subtypes to spectrum may ‘increase the specificity of diagnosis, thus clarifying the distinction of ASD from other nonautistic disorders,’ but be ‘at the expense of sensitivity’ (Skuse, 2012, p. 344). The classification debate continues (Giles, 2014; Kite, Gullifer & Tyson, 2013; Wing, Gould & Gillberg, 2011).

### 2.3.2 Use of the term ‘Asperger syndrome’ in this study

Changes to autism diagnostic classifications and criteria in the editions of the *DSM* to date reflect evolutionary development of understanding rather than a definitive set of definitions and diagnostic criteria. While the primary audience for the various editions of the *DSM* is diagnosing clinicians, the influence of the *DSM* on cultural conceptions of disability is significant: for example, *DSM* diagnostic criteria are used by *Centrelink*, the Australian government department responsible for social security payments, to determine eligibility for support payments. However, it needs to be acknowledged that the *DSM-5* terminology is not binding on the stakeholders in this research study. The lay audience is undoubtedly influenced by, and dependent upon, influential diagnostic manuals such as the *DSM*, but it is not bound by them. The term ‘Asperger syndrome’ in Australia was, in early 2013, significant for the provision of support funding in schools, and remains significant for those with a family member diagnosed with AS, and for diagnosed individuals themselves. For these reasons, in this doctoral study, the

use of the term ‘Asperger syndrome’ was maintained and it is accepted that: AS is an autism spectrum disorder; that people with AS are ‘on the spectrum’; and, that research findings on the construct of ‘autism’ are applicable (taking into account differentiating features between subtypes or across the spectrum).

### **2.3.3 What is ‘the spectrum’?**

‘Classic autism’ or ‘Kanner’s autism’ is the expression of autism accompanied by moderate to severe intellectual delay, and was first described by Leo Kanner (1943). Cognitive capacity (IQ) continued to be the distinguishing feature between subtypes of autism, or across the spectrum (see, for example, Witwer & Lecavalier, 2008), until the publication of the *DSM-5*. Differentiation of severity across the spectrum, previously determined by IQ, is now determined by ‘adaptive functioning’.

Diagnostic criteria emphasize the need for an assessment of both cognitive capacity (IQ) and adaptive functioning. Severity is determined by adaptive functioning rather than IQ score. (APA, 2013, p. 809)

Under the *DSM-5*, ‘the spectrum’ has evolved from a spectrum of intelligence to a spectrum of adaptive function.

### **2.3.4 High(er)-functioning autism versus Asperger syndrome**

This doctoral study followed Baron-Cohen (2004) and Howlin (2003), who did not distinguish between high-functioning autism (HFA) and Asperger syndrome for the purposes of their research. However, the research effort to distinguish between HFA and AS has been extensive (for example, Noterdaeme, *et al.*, 2009; Yu, *et al.*, 2011). For the purposes of the current study, which began in 2008, starting-point definitions of the terms ‘autism,’ high-functioning autism,’ and ‘Asperger syndrome’ followed Baron-Cohen and Wheelwright.

Autism is diagnosed when an individual shows abnormalities in social and communication development in the presence of marked repetitive behavior and limited imagination (American Psychiatric Association, 1994). The term HFA is given when an individual meets the criteria for autism in the presence of normal IQ. AS is defined in terms of the individual meeting the same criteria for autism but with no history of cognitive or language delay (World Health Organization, 1994). (Baron-Cohen & Wheelwright, 2004, p. 166)

Not mentioned in this definition is the group of those diagnosed with autism, whose IQ is above-average to superior. As the term ‘Asperger syndrome’ indicates average to superior IQ (Ozonoff, Dawson & McPartland, 2002), it is inclusive of HFA (see, for example, Howlin, 2003) and the terms are sometimes used interchangeably within the literature (Yu, *et al.*, 2011), although developmental language delay and verbal ability have been employed as differentiating criteria (Bradshaw, 2013; Ghaziuddin & Mountain-Kimchi, 2004; Noterdaeme, *et al.*, 2009). A further point of confusion with the term HFA is that it has sometimes been used in a relative sense, ‘higher functioning autism,’ where its meaning is defined explicitly or by context (see, for example, Estes, Rivera, Bryan, Cali & Dawson, 2011; Klin & Jones, 2006; Tsatsanis, 2004). Furthermore, Boucher (2007) used the phrase ‘very high functioning autism’ to indicate an individual with superior IQ and Asperger syndrome.

### 2.3.5 Locating the current study on the autism spectrum

In this doctoral study, phrases such as ‘gifted individuals with Asperger syndrome’ have been purposefully utilised to highlight the region of the autistic spectrum of interest and to indicate individuals with higher-than-average to superior cognitive ability. As qualitative research, this study was not concerned with measures of cognitive capacity (IQ). Instead, the Multiple Intelligences framework (Gardner, 2006), which has wide acceptance in education, was employed. Evidence of giftedness in at least one domain of the Multiple Intelligences framework was accepted as placing the participant within the area of interest. This approach is particularly appropriate in ASD, given the narrow strengths and uneven cognitive profile of gifted individuals with AS (Barnhill, Hagiwara, Myles & Simpson, 2000; Cash, 1999). Figure 2.3 illustrates the conceptualisation of the spectrum for this study and shows the region of interest in blue.

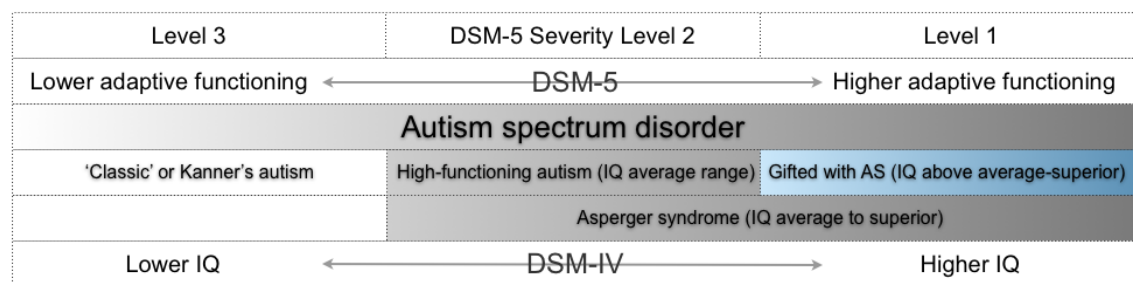


Figure 2.3 Conceptual map of the autism spectrum

### 2.3.6 ‘Typically developing’ and ‘neurotypical’

Difficulty with descriptive terms follows from diagnostic confusion. The importance of non-discriminatory language is a core value of this research. The preferred phrase ‘gifted adults/individuals with AS’ (or similar) is used throughout the thesis. To distinguish individuals without AS, the term ‘typically developing’ (TD) is used for children who are experiencing a neurotypical developmental path (Kjelgaard & Tager-Flusberg, 2013). Some authors refer to adults using the term ‘neurotypical’ (NT) (Lombardo, *et al.*, 2009; Pelphrey, Morris & McCarthy, 2005). Both of these terms, ‘typically developing’ and ‘neurotypical’, have wide acceptance throughout the literature. However, it is acknowledged here that the use of words such as ‘typical’ to indicate someone without AS and ‘compensatory’ (Section 2.7.5.3) to indicate features of AS cognition compared to NT cognition is inherently discriminatory: such usage positions NT individuals as ‘normal’ and individuals with AS as other-than-normal. Mottron, Dawson and Soulières (2008) have discussed the use of ‘normocentric’ language in autism spectrum disorders. It is entirely contrary to the intention of this study to promote such discrimination and the necessary usage is offered with an apology.

### 2.3.7 Wing’s Triad

No discussion defining autism would be complete without mentioning the significance of ‘Wing’s Triad.’ The autistic triad of features of socialisation, communication and imagination became known as ‘Wing’s Triad’ (Cashin & Barker, 2009) after Lorna Wing (1981), who first described Hans Asperger’s work (1944) for the English-speaking world. However, Wing later gave joint credit to Gould for suggesting that there was a triad of basic impairments in autism (Wing, *et al.*, 2011). According to Yu, *et al.*, (2011), Wing disagreed with Asperger, ‘who had regarded Asperger syndrome as distinct from Kanner’s autism’ (p. 412), thereby foregrounding the relevance of the two bodies of literature on autism and AS to each other, and locating AS as a variant of autism.

Wing’s Triad has been influential in defining, describing and diagnosing autism and AS for professional **and** lay audiences. The three behavioural categories of ‘impairment of social interaction,’ ‘impairment of social communication’ and ‘impairment of social imagination’ (Wing, *et al.*, 2011, pp. 768-769) provided the structure for the

behavioural diagnostic criteria in the *DSM-IV* and *DSM-IV(TR)* (APA, 1994, 2000), with the exception that ‘imagination’ was re-classified as ‘repetitive behaviour patterns’ in the *DSM-IV* (Wing, *et al.*, 2011). Wing’s Triad according to Happé (1994) is illustrated in Figure 2.4.

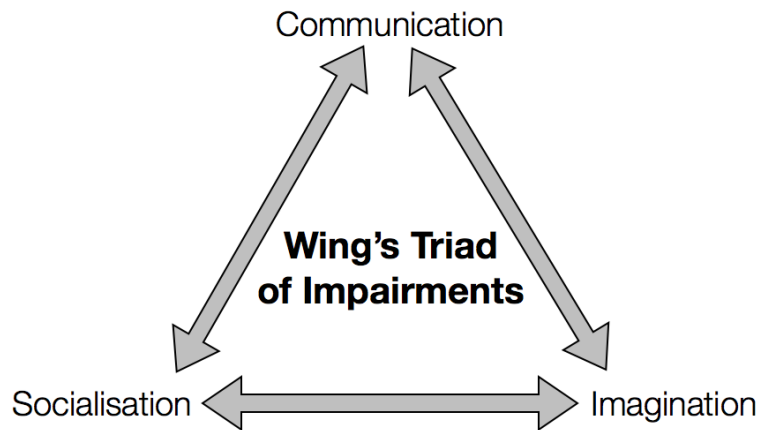


Figure 2.4 Wing's Triad of Impairments

In the *DSM-5*, the three behavioural categories of Wing’s Triad were collapsed to two, merging communication and socialisation into a category called ‘social communication’. The second behavioural category is ‘restricted, repetitive behaviours’ (APA, 2013, p. 52). Even though the *DSM* no longer follows Wing’s Triad, the *DSM-5* category of ‘social communication’ descriptively aligns with the ‘socialisation’ and ‘communication’ categories in Wing’s Triad. Wing’s Triad continues to be historically significant in the evolving understanding of autism.

## 2.4 Defining Asperger syndrome

The question ‘What is Asperger syndrome?’ is a simple question with a very complex answer. This study aimed to provide an elaborative answer to this question by building conceptual understanding using non-technical language and explanations, drawing upon the literature, and illustrated by the case studies. Following the course of historical developments in the field, the four major explanatory theories, shown in Figure 2.6, are an important way of elaborating on Wing’s Triad and interrogating the neuroscience and autism literature to gain insights into the nature of AS. To provide a brief answer to the question ‘What is Asperger syndrome?’ as a background for this thesis, some guiding statements based on the neuroscience, educational and autism literature follow.

- (a) AS is a complex neurological condition that involves different (from typically developing) functional connectivity **between** brain regions and different levels of activity **within** brain regions. Therefore, metaphorically speaking, the brain can be said to be ‘wired’ differently (Anagnostou & Taylor, 2011; Baron-Cohen & Belmonte, 2005; Baron-Cohen, *et al.*, 2000; Frith, U., 2004; Gotts, *et al.*, 2012; Jordan & Murphy, 2011; Minshew & Hobson, 2008; Mottron, Dawson, Soulières, Hubert & Burack, 2006; Müller, R-A., *et al.*, 2011).
- (b) There is strong evidence for structural differences between the brains of individuals with AS and neurotypical individuals in, for example: the volume and distribution of grey and white matter (Beacher, *et al.*, 2012; Cauda, *et al.*, 2011; Ecker, *et al.*, 2012; Zilbovicius, *et al.*, 2006); the reduced size of the corpus callosum (Casanova, *et al.*, 2011); the size difference of the cerebellum and reduced numbers of Purkinje cells within the cerebellum (Amaral, *et al.*, 2008; Hodge, *et al.*, 2010); the structure and connectivity of the amygdala and limbic system that is fundamental to the development of social cognition (Abu-Akel, 2003; Ashwin, Chapman, Colle & Baron-Cohen, 2006; Pelphrey, *et al.*, 2005); and, enlargement of the hippocampus (Ben Shalom, 2003; Schumann, *et al.*, 2004).
- (c) There is emerging evidence for neurobiochemical differences, such as ‘altered metabolite levels in the amygdala [being] associated with a more severe early developmental course in ASD’ (Kleinmans, *et al.*, 2009, p. 1079) and decreased levels of the neuropeptide oxytocin (Schulkin, 2007).
- (d) AS is neurodevelopmentally distinct from typical development, meaning that brain growth follows a different developmental trajectory, for example: early overgrowth is followed by abnormally slowed growth (Carper, Moses, Tigue & Courchesne, 2002; Courchesne, *et al.*, 2001); the size of the amygdala and hippocampus differs from typical development through developmental stages (Groen, Teluij, Buitelaar & Tendolkar, 2010; Nordahl, *et al.*, 2012; Schumann, *et al.*, 2004); and, there is decreased synaptic pruning (Dawson, 2008a; Hill & Frith, 2003).
- (e) The complexity of autism is such that a number of authors conclude that AS is a symptomatically and cognitively heterogeneous condition (Amaral, *et al.*, 2008; Ashwin, Chapman, *et al.*, 2006; Chen, Rodgers & McConachie, 2008; Frith, U.,

2004; Klin & Jones, 2006; Szatmari, 2011; Williams, D. L. , Goldstein & Minshew, 2006), a complication that contributes to the difficulty of conceptual understanding and diagnosis.

- (f) Cognition (encompassing thinking and learning) in AS is distinct from TD cognition, as first noted by Hans Asperger.

The idea that people with autism miss out on socially transmitted skills and information, despite apparently intact information processing potential, fits well with Asperger's (1944; trans. Frith, 1991) original insights into the puzzle of autistic intelligence: [T]here is an inability to learn from adults in conventional ways. (Scheuffgen, Happé, Anderson & Frith, 2000, p. 89)

The differences in cognition are noted in all three bodies of literature that informed the current study: neuroscience findings (for example, Schipul, Williams, Keller, Minshew & Just, 2012); educational research (for example, Cash, 1999); and psychological research (for example, Kilincaslan, Mukaddes, Kucukyazici & Gurvit, 2011).

- (g) AS can be viewed as producing strengths as well as impairments (Assouline, Foley-Nicpon & Doobay, 2009; Baron-Cohen, 2002; Baron-Cohen & Belmonte, 2005; Rutherford, Richards, Moldes & Sekuler, 2007). The capacity to be completely immersed in detail without consideration of context appears to be at the cost of holistic (top-down) and social processing, as summarised in the theory of central coherence (Section 2.7.6). Rather than focusing on impairments, this doctoral research followed the values, espoused by Baron-Cohen and others, of considering strengths alongside impairments. Within the wider literature, focus on strengths has principally been applied to issues of employment for individuals with high-functioning autism or AS, however, this is outside the scope of the current study (Mottron, 2011; Parr & Hunter, 2013). Within the current study, the application of the Multiple Intelligences framework to the phenomenon of AS in education facilitates the consideration of strengths alongside weaknesses.

## **2.5 Qualitative Studies**

Autism research has traditionally been conducted **on** rather than **with** individuals with AS (Humphrey & Lewis, 2008). A small body of seven qualitative studies drew upon

the perceptions and experiences of people with AS with a focus on social life and school experience. None directly addressed learning or thinking, with the exception of a single case study that examined memory (Boucher, 2007). Collectively, these seven studies, which employed IPA (except Boucher's, which employed a traditional case study approach), served as models for this doctoral study. The studies are reviewed here because of their foundational role in this doctoral study. They are discussed again in Section 3.2 for their methodological contribution.

### **2.5.1 School studies**

Two phenomenological studies by Carrington and her colleagues were conducted with school students in Australia (Carrington & Graham, 2001; Carrington, *et al.*, 2003). One was a case study that collected data from two 13-year-old males with AS, while the other collected data from five secondary school students, four male and one female, focusing on the difficulties of socially navigating aspects of schooling. Humphrey and Lewis (2008) interviewed 20 students with AS or HFA from mainstream secondary schools in England and identified barriers to successful educational experiences: their study produced similar findings to the Australian studies. Humphrey and Lewis's study confirmed the paucity of literature that illuminates the perspective of pupils in special education, while calling for more research studies of this kind. These three studies provided valuable insights into the experience and world of students with AS but did not investigate thinking or learning.

### **2.5.2 Adult studies**

Four studies drew directly on adult perspectives. Hurlbutt and Chalmers (2002) conducted a 9-month qualitative study in the USA with three adults with HFA. The findings of their study related to the participants' views about their experience of having autism: they concluded that 'High-functioning adults with autism want to be considered experts on, have opinions on and be consulted on issues related to autism' (Hurlbutt & Chalmers, 2002, p. 109). In the second study, Müller, E., *et al.*, (2008), used interviews to ask adults with AS to describe their 'social worlds' and to recommend social strategies. One finding of this US study was the desire of adults to develop self-awareness. The third study, '*I just don't fit anywhere: Support experiences and future support needs of individuals with Asperger syndrome in middle adulthood*' (Griffith, *et al.*, 2011), examined adults' experiences of accessing support services in the community.

Along with several of the other qualitative studies, this study reported explicitly on the use of IPA to analyse and interpret the data. Collectively, these studies demonstrated a consistent approach to the use of phenomenological methodology in AS research. The only article to directly address cognition (in this case, memory) from an experiential perspective was the single case study by Boucher (2007). The participant is a person with AS, who, himself, has considerable expertise in the area of memory. The use of a single case is a limitation, particularly in the light of the heterogeneity of AS, however, it demonstrated: (a) the possibility of metacognitive self-reflection on the part of a gifted adult with AS; and, (b) the use of case study methodology and personal perspectives by a respected researcher in the field of memory in autism (see Boucher & Bowler, 2008). Therefore, these studies demonstrated: the need for further research; that participants with AS have the capacity to participate in research that contributes to a greater understanding of AS; that, despite challenges (Newman, Cashin & Waters, 2010; Russo, *et al.*, 2007), participants with AS are able to reflect upon their own thinking; and, that a phenomenological case study approach is appropriate to a qualitative educational research study of thinking and learning.

## **2.6      *Learning, thinking and cognition***

The term ‘cognition’ is used in a broad sense in the autism and neuroscience literature to encompass neurocognitive activity, including ‘thinking’, ‘memory’ and ‘learning,’ as these terms are generally understood within education. The term ‘social cognition,’ for example, is so widely used as being synonymous with ‘social **thinking**,’ ‘social **understanding**’ or ‘social **intelligence**,’ that there is rarely a need to define the term (see, for instance, David, *et al.*, 2008; O'Connor & Kirk, 2008). Garfield, *et al.*, (2001), citing Baron-Cohen (1991), stated: ‘... we use the term “social intelligence” synonymously with “social cognition” to refer to “those aspects of the cognitive system that are used in understanding the social world”’ (p. 507). ‘Cognition’ is a term widely employed in the research literature to embrace thinking and mental activity (implicit and explicit) and to distinguish between mental activity (visible on functional brain scans) and the physical brain that does the processing. In autism research, both cognition **and** the physical brain, together and separately, are the objects of study. As can be seen in the following quotation, the distinction is drawn between the physical brain (by the use of the words ‘neural’ and ‘brain’), and the mental processes of the brain (by the use of the words ‘cognitive’ and ‘cognition’).

If individuals with HFA [high-functioning autism] have difficulty with processing complex information, this difficulty must result from a neurobiologic difference. ...there is a fundamental problem with functional underconnectivity of the neural systems of the brain in HFA. ...result[ing] in reduced integration of information at the **neural and cognitive level**. Clearly, whatever is going on with **cognition and the brain** in autism extends considerably outside the social, language and range of activities domains constituting the *DSM* diagnostic triad of autism. (Williams, D. L., Minshew, *et al.*, 2008, p. 139) [emphasis added]

By contrast, practising teachers are more likely to speak in terms of ‘thinking’ and ‘learning’ than ‘cognition.’ Since the researcher is a teacher and not a psychologist or neuroscientist, and as this study was initiated within a particular school context by the identification of an educational problem, the preferred terms for the research question were ‘thinking’ and ‘learning’ as teachers were more likely to speak in those terms.

The working definition of cognition for this study was simply ‘brain processes and mental activity, both implicit and explicit, associated with thinking and learning’. This definition incorporates ‘information processing’, a phrase inherited from information processing theory (Section 2.7.3), as referenced in the quotation above through use of the terms ‘processing’ and ‘reduced integration of information’. ‘Thinking’, for the purposes of this study, was used to mean explicit, intentional mental activity. ‘Learning’ (in the cognitive domain) was used to mean mental activity that leads to increasing understanding and skills, understanding being the goal of learning (Ritchhart, *et al.*, 2011). Thinking may, or may not, result in learning. Learning may result from explicit, intentional cognition (thinking) and/or implicit, unintentional cognition. Figure 2.5 shows the relationship of the working definitions to each other.

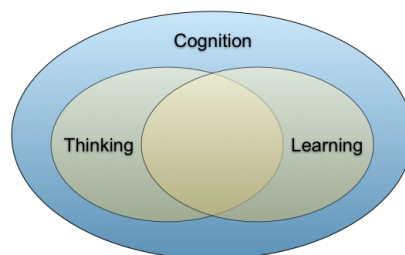


Figure 2.5 Learning and thinking as subsets of cognition

As shown in Figure 2.5, cognition subsumes both thinking and learning: cognition is defined as referring to all mental activity; thinking refers to explicit, effortful mental activity; and, learning refers to implicit and explicit mental activity that leads to increased understanding and skills. While these are shallow, working definitions, they were a required starting point for the phenomena under investigation.

### **2.6.1 Cross-disciplinary perspectives on learning**

For this study, the educational perspective on learning was based on a constructivist view: ‘... the student ... construct[ing] his or her own reality or knowledge, and this construction [is] based on the learner’s prior experiences, mental structures, and beliefs’ (Mory, 2004, p.770). However, from a neuroscience perspective, learning is understood in terms of ‘neuroplasticity’, which is ‘the brain’s capacity to adapt continually to changing circumstances’ (Blakemore & Frith, 2005, p. 205) or ‘changes in neural connectivity’ (Wolfe, 2001, p. 195). In the past, the brain was theorised by behavioural psychologists as a metaphorical ‘black box’ (Fischer, 2009) with learning processes being unknowable, however, brain imaging studies provide evidence of neural connectivity and activity that are the neurobiologic correlates to learning (Blakemore & Frith, 2005; Wolfe, 2001). Within a neuroscience perspective then, learning is ‘the act of making (and strengthening) connections between thousands of neurons forming neural networks or maps’ (Wolfe, 2008, p. 17). Within education, learning is demonstrated in terms of changed behaviour and outputs that are indicative of increased understanding and skills. While a neuroscientist is interested in the changes in the brain that are the physical correlates of the changed behaviour and outputs, an educator is focused on assessable outputs that demonstrate learning. The neuroscience view of learning is important to this study as so much evidence has accrued to show that the neural processes affecting learning are disrupted in autism in ways not definable using psychological methods. Therefore, throughout this thesis, evidence from neuroscience research is used to illuminate the thinking and learning processes under investigation, for educational purposes. The term ‘neuroeducation’ has been coined to describe such a use of neuroscience in education (Battro, 2010; Pasquinelli, 2012).

### **2.6.2 Relationship between metacognition and theory of mind**

Metacognition and ‘theory of mind’ are constructs within the educational and autism literatures that share a close association. ‘Metacognition’ is a more familiar term in education (Hannah & Shore, 1995; Shore, 2000; Sodian & Frith, 2008) and is significant in this study for its relatedness to the notion of ‘theory of mind’ in the autism literature (Neihart, 2000). Theory of mind is a phenomenon in human cognitive development and Theory of Mind Theory is a major explanatory theory of autism (Section 2.7.5).

### **2.6.3 Twice exceptionality**

Individuals with AS have ‘uneven cognitive profiles,’ a mixture of academic strengths and weaknesses (Attwood, 2007; Lind & Bowler, 2010; Lovecky, 2004). They can be both gifted **and** have learning difficulties and therefore are recognised as ‘twice exceptional’ (Cash, 1999; Foley-Nicpon, Allmon, Sieck & Stinson, 2011; Foley-Nicpon, Assouline & Colangelo, 2013; Norris & Dixon, 2011). Twice exceptionality, also known as ‘dual exceptionality’ or ‘gifted with a learning disorder’ (Assouline, Foley-Nicpon & Dockery, 2012; Kennedy, 2004; Wormald & Vialle, 2010), has its own challenges in addition to the challenges of giftedness or a learning disorder alone (Amend, Schuler, Beaver-Gavin & Beights, 2009; Bianco, Carothers & Smiley, 2009; Jensen, 2008). For this doctoral study, Howard Gardner’s (2006) Theory of Multiple Intelligences provides the framework that accommodates an understanding of giftedness, disability and the complexities of twice exceptionality in relationship to AS. A number of authors have proposed that twice-exceptional students’ strengths are the key to successful learning, whereas many reports imply that the focus in schools tends to be on weaknesses (Foley-Nicpon, *et al.*, 2011; Foley-Nicpon, *et al.*, 2013; Lovecky, 2004; Willard-Holt, Weber, Morrison & Horgan, 2013). The participants in this doctoral study are twice exceptional and their stories offer important insights. The core values of this study include first recognising and valuing the strengths of individuals with AS, and acknowledging weaknesses second.

## **2.7 Theoretical framework**

This section elaborates the philosophical position and working theories that informed this study: a socio-cultural approach to learning within a constructivist philosophy; information processing theory; theory of mind; central coherence; executive function; amygdala theory; and the Theory of Multiple Intelligences. The theoretical framework is illustrated in Figure 2.6, which now shows the theories were conceptualised in relationship to each other.

### **2.7.1 Constructivist philosophy**

The theoretical framework is located within a constructivist worldview with the researcher as ‘situated learner’ with membership of a particular socio-cultural group: life partners of individuals with AS. A socio-cultural (Vygotskian) approach provides

the basis of understanding learning and learners as culturally situated. Phenomenology was employed to elicit the experience of participants, in order to investigate their learning. The grey shaded area of Figure 2.6 represents the foundation of constructivist philosophy upon which the study is based, and encompasses situated learning. This philosophy is central to the study's conception, methodology, role of the researcher and the application of the findings.

### 2.7.2 Working theories

Information processing theory (IPT) was the starting-point for the working theories (see the cyan-coloured sections in Figure 2.6, reading from left to right) because of the wealth of evidence from brain-imaging studies of autism that contributed to the development of the four major explanatory theories of autism—Theory of Mind, Central Coherence, Executive Function and Amygdala Theory—and these provided the starting-point framework for the development of a conceptual understanding of Asperger thinking and learning. Intelligence, giftedness and cognitive profiles are at the heart of this research study so the Theory of Multiple Intelligences (Gardner, 2006) completes the theoretical framework as Gardner's framework accounts for the twice-exceptional nature of Asperger syndrome and is strengths-focused. The relationship between the theories is illustrated in Figure 2.6.

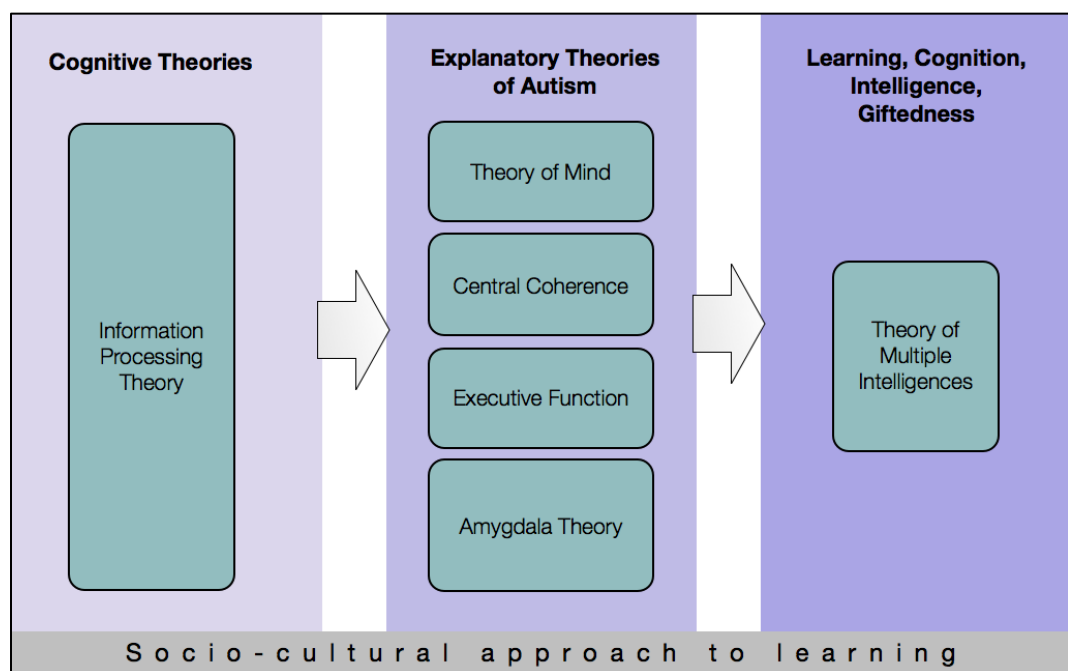


Figure 2.6 Theoretical framework

The following discussion of each of the working theories illustrated in Figure 2.6 demonstrates their significance to education and to this study of thinking and learning in gifted adults with AS.

### 2.7.3 Information Processing Theory

Information Processing Theory (IPT) historically underpins models of learning, such as Gagné's work in the 1970s, with recent breakthroughs in imaging technologies greatly contributing to the development of our understanding of cognition and learning (Wolfe, 2001). Gagné (1974) identified his work on learning as based on information-processing and his learning model (Fournier, 1996), although decades old, continues to stand well in the light of current findings from neuroscience. Information-processing models of cognition are foundational to the four major explanatory theories of autism and IPT underpins many authors' discussions of cognition in people with autism: for instance, Scheuffgen *et al.*, (2000) concluded that information-processing capacity in autistic children with low IQ is preserved. Weak central coherence in AS is described in information-processing terms (Happé, 1994) with strong central coherence equated with 'global' or 'top-down' **processing** and weak central coherence with 'local' or 'bottom-up' **processing** (Jacobsen, 2005), indicating contrasting cognitive-processing styles. Kanner, the researcher who originally described classic autism, used the term 'fragmentary **processing**' (Kanner, 1943, cited in Happé, 1994, p. 127). IPT allows the processes of cognition and learning to be conceptualised from a neuroscience, psychology and education viewpoint and is commonly held across all three bodies of literature.

### 2.7.4 Explanatory theories of autism

The explanatory theories of autism are summarised here as Theory of Mind, Central Coherence, Executive Function and Amygdala theory. Following Wing's (1981) proposition of AS as a form of autism to describe 'those very able autistic people who do not fit the Kanner stereotype of being silent and aloof' (Happé, 1994, p. 83), there was a concerted research effort to achieve theoretical understanding of AS as a subtype of autism. Competing theories of autism emerged. Decades later, each of these four working theories is still the organising theme for a body of research. None has become a grand theory and all make novel contributions to theoretical understanding of autism. The literature reveals unsuccessful attempts to unite two or more of the theories, for

example, Happé and Frith's (2006) defence against the proposition that central coherence is a 'mere side-effect of executive dysfunction, and may be independent of theory of mind deficits' (p. 5), or that 'pure' theory of mind 'involves no executive function component (no attention switching, inhibition, planning, etc., ...) and no central coherence component' (Baron-Cohen, Jolliffe, Mortimore & Robertson, 1997, p. 816). Therefore, all four explanatory theories were needed to encompass the breadth of literature and to provide conceptual keys to understanding autistic cognition for this study. A brief description of each follows.

### **2.7.5 Theory of Mind**

Theory of Mind (ToM) is the ability, which begins to develop in infancy, to represent and attribute mental states—beliefs, emotions, thoughts and bodily sensations—to oneself, and other people (Baron-Cohen, 1995; Frith, U., 2001). Also known as 'empathy', 'mentalising' and 'mindreading', ToM is the basis of social cognition (Baron-Cohen & Wheelwright, 2004). ToM allows an individual to predict the likely meaning and purpose of others' behaviours and words and provides social cues that may be overlooked by a person with poor ToM (Perner, Frith, Leslie & Leekam, 1989). People with AS have impaired ToM (Boucher, 2012; David, *et al.*, 2008). The notion of ToM, as noted earlier, is closely associated with the educational literature on metacognition, which is the ability to mentally represent one's **own** thoughts and feelings (Sodian & Frith, 2008). Developmentally, ToM begins early in infancy and is usually developed by 9-11 years (Frith, U., Morton & Leslie, 1991), although advanced ToM tasks may require further maturity. The neural networks that confer ToM capacity have been the subject of much research (Abu-Akel, 2003; Frith, C. D. & Frith, 2008; Frith, U., 2001; Gilbert & Burgess, 2008).

#### **2.7.5.1 False belief tests**

Theory of mind capacity is clinically tested with children through 'false belief tests': simple scenarios (such as through the use of puppets) that allow the observer to predict another person's behaviour based on knowledge of the other person's beliefs (Baron-Cohen, Leslie & Frith, 1985). An example of a false belief test in comic-strip form is shown in Figure 2.7.

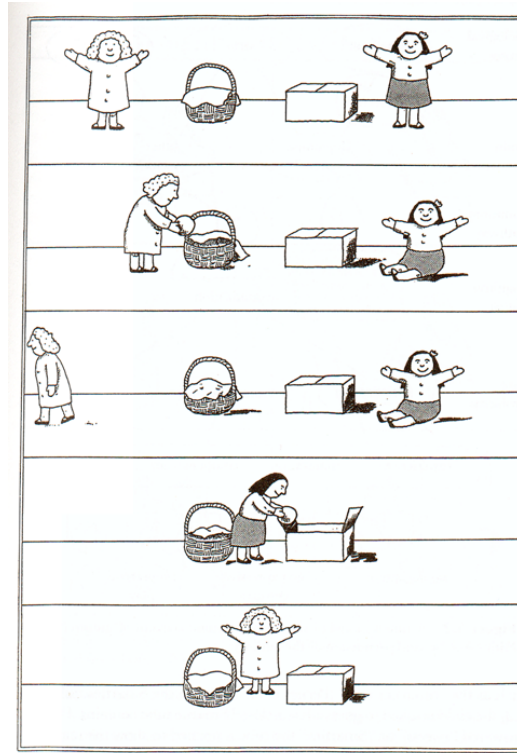


Figure 2.7 The 'Sally-Ann' False Belief Task (Happé, 1994, p. 41)

Tests such as the 'Sally-Ann' task are used to assess a child's theory of mind capacity. In this task, a scenario using two dolls is acted out by the assessor, with the child observing. The first doll, 'Sally', has a basket with a marble in it. The second doll, 'Ann', has an empty box. While Sally is out of the room, Ann moves the marble from Sally's basket to her box and closes the lid. When Sally returns, the assessor asks the child, 'Where will Sally look for the marble?' (In other words, 'Where does Sally **believe** the marble is?') Sally's belief about the location of the marble is an example of a mental state. Most TD children by about four years of age are able to distinguish between their own belief about the location of the marble, having observed the scene being played out, and the 'false belief' of Sally, who believes the marble is still in her basket: they will therefore answer the question, 'Where will Sally look for the marble?' with, 'In the basket.' However, most children with autism are not able to distinguish between their own knowledge of the marble's current location and Sally's false belief, so will most likely answer the question, 'Where will Sally look for the marble?' by saying, 'In the box' (Boucher, 2012; Happé, 1994).

The capacity to pass false belief tests demonstrates an appreciation of the representational nature of mental states, that is: an individual's mental representation of a state of mind (for example, happiness) is distinct from the actual state of mind itself;

and, the representation may represent or misrepresent the reality. Understanding the nature of mental representation of mental states has been described as ‘metarepresentational ability’ (Leekam & Perner, 1991, p. 204) and has been proposed as the underlying mechanism in the development of theory of mind that is responsible for ToM deficits in autism (Baron-Cohen, *et al.*, 1985).

#### 2.7.5.2 *Development of ToM in AS*

ToM development in individuals with AS may be delayed or it may not develop into the advanced theory of mind capacity anticipated in maturity (Baron-Cohen, *et al.*, 1997; Meyer & Minshew, 2002). ToM underlies social cognition by providing the capacity to predict, to a fair degree of accuracy, what another person is thinking or feeling, even if the other person has a mistaken belief, as a way of making sense of the behaviour of others (Baron-Cohen, 1989). ‘Theory of **own** mind’, being aware of one’s own mental states and the emotions that accompany those mental states (Frith, U. & Happé, 1999), has been posited as diminished, similar to social ToM capacity in individuals with AS and suggests a different experience of the self (Williams, D., 2010). Some individuals with AS may learn compensatory social ToM skills through memorising social scripts or rules for social behaviour (Boucher, 2012). However, mature social cognition in natural settings relies on advanced, spontaneous ToM and in this context individuals with AS display impairment (Senju, 2012). Intuitive understanding of other people’s perspectives, taken into account together with one’s own, are likely to be beyond the meta-representational capacities of most individuals with AS, however, compensatory mechanisms may develop that allow them to factor the perspectives of others into their thinking (Senju, Southgate, White & Frith, 2009).

#### 2.7.5.3 *Compensatory ToM mechanisms*

High-functioning individuals on the autistic spectrum may develop compensatory mechanisms for ToM to overcome the social problems raised by lack of ToM (Frith, U., 2001): for example, memorising a list of ‘rules’ for social interactions to compensate for lack of intrinsic ToM (Williams, E., 2004). Lack of intrinsic ToM results in social awkwardness: where spontaneous reactions are required in response to others’ behaviours, compensatory mechanisms for ToM may not serve the individual well (Bowler, 1992). Compensatory learning of social rules (or memorisation of social scenarios, events, or scripts), in lieu of typically developing ToM, may be useful for

situations involving basic ToM tasks (Hill, Berthoz & Frith, 2004; Minshew, *et al.*, 2002), but lack of ToM will be socially restrictive in tasks requiring spontaneous, advanced ToM (Meyer & Minshew, 2002; Senju, 2012).

#### **2.7.5.4 ToM and identity**

Theory of mind is associated with the development of identity (Lind & Bowler, 2009), although the mechanism for this is debated (Ben Shalom, 2003; Hobson, 1990; Hobson & Meyer, 2005). Identity formation is related to episodic memory and autonoetic consciousness (Perner, 2000) and is progressively addressed throughout the case studies (for example, Sections 4.9.4 and 5.6.2).

#### **2.7.5.5 Summary**

Individuals with AS will, most likely, master basic ToM tasks later in development than TD individuals, probably, in part, through compensatory learning. In natural social situations where advanced spontaneous mentalising is required, lack of ToM capacity contributes to the well-documented social disadvantage that is a feature of AS.

### **2.7.6 Central coherence**

The term ‘central coherence’ refers to an information-processing style, described as a ‘perceptual-cognitive style’ (Burnette, *et al.*, 2005, p. 63), and is weak in autism. Klin and Jones propose that it leads to social impairment (2006). As with theory of mind and executive function, central coherence is not a single cohesive construct (Lopez, Leekam & Arts, 2008). Weak central coherence is sometimes referred to as ‘local’ or ‘bottom-up processing’ and is contrasted to strong central coherence, ‘global’ or ‘top-down processing’ (Neumann, Spezio, Piven & Adolphs, 2006). Individuals with weak central coherence tend to focus on one detail in an event, picture or experience, not seeing the bigger picture, context or *gestalt* (Blakemore, *et al.*, 2006).

### **2.7.7 Executive function**

Executive Function (EF) is the umbrella term that encompasses mental functions that are reliant upon the prefrontal cortex (Adams, N. & Jarrold, 2012; Hill & Frith, 2003). The prefrontal cortex in AS does not appear structurally abnormal. Instead, impaired functional connectivity with other parts of the brain leads to decreased prefrontal cortex activity, as demonstrated by blood flow rates (Kleinhans, *et al.*, 2008), so AS is

sometimes described as a disorder of integration of brain functions or brain connectivity (Steyaert & De La Marche, 2008). Examples of EF mental activities are inhibition, flexibility, planning, working memory, problem solving, multi-tasking, task switching, control of attention (such as divided, joint, and so on), inner speech and decision-making (Hill, 2004a, 2004b; Williams, D., Happé, *et al.*, 2008). A review of definitions given in the literature for executive functions was provided by Kalbfleisch and Loughan, and is substantially reproduced in Table 2.1.

**Table 2.1 Definitions of executive function (Kalbfleisch & Loughan, 2012, p. 391)**

Skills related to planning, monitoring, and regulating behaviour.
Ability to maintain adequate problem solving set over time for the purpose of attaining future goals. Planning, inhibition, mental representation of the tasks.
Multiple component processes that include planning, decision-making, judgment, self-perception. It is the most supra-ordinate level of cognitive processes.
Executive function resembles metacognition, a construct that includes monitoring, planning, organization, coordinating knowledge and resources, and self-regulation.
Control processes involving inhibition and delay of responses.
Skills that are requisite for goal-directed and purposeful activity: volition, planning, purposeful action, effective performance.
Goal-directed behavior.
A special case of attention including nonverbal working memory, verbal working memory, internalization and self regulation, reconstitution.
Problem representation, planning, execution, evaluation of the complete process—skills making reference to, but not equated with, goal-directed problem solving.
Executive function viewed in the context of metacognition, knowledge and process(es) that monitor and control cognition.
A set of higher-order functions and behaviours that are responsible for purposeful, goal-orientated, problem-solving activities.
Anticipation, goal selection, planning, initiation of activity, self-regulation, mental flexibility, deployment of attention, utilization of feedback.
Skills aligned with reasoning and perceptual speed performance in adults.

Baron-Cohen and Belmonte (2005) proposed ToM as the basic construct and that EF impairments and weak central coherence processing style in autism are consequences of impaired ToM. Booth *et al.*, (2004) maintain that executive function and central coherence are distinct cognitive phenomena. Although there is debate about the

relationship between the three explanatory theories, whether one subsumes the others, there is agreement that EF impairments are a feature of AS (Hala, Rasmussen & Henderson, 2005; Happé, *et al.*, 2006; Landa & Goldberg, 2005).

### **2.7.8 Amygdala theory**

Unlike the previous three explanatory theories, which are conceptual, amygdala theory is based on research into an organic brain structure. The amygdala, a pair of almond-shaped organs (amygdalae) in the midbrain, is centrally involved in the processing of emotions and emotional regulation (Bechara, Damasio & Damasio, 2000). The amygdala is an important part of the neural network underlying social cognition (Baron-Cohen, *et al.*, 2000) and in autism is abnormal in size, poorly connected to the prefrontal cortex and shows abnormal activity. People with damage to the amygdala may acquire autistic qualities (Ashwin, Chapman, *et al.*, 2006). Work by Damasio and Immordino-Yang (2007) has suggested a crucial link between emotion processing and learning: this is an emerging connection of potentially key importance to educators (Immordino-Yang, 2008). When there is a greater body of research explicating the relevant mechanism, amygdala theory may contribute substantially to educators' understanding of thinking and learning in autism as it occupies an important place in autism research (Ben Shalom, 2003; Munson, Dawson & Abbott, 2006; Schulkin, 2007; Schumann, *et al.*, 2004) and is therefore included in the theoretical framework of this doctoral study. The role of the amygdala and its profound influence on thinking is acknowledged, however, it did not play a direct role in the findings of this doctoral study as the theoretical relationship between learning and the amygdala did not appear to develop significantly within the research literature over the study's timeframe.

### **2.7.9 Purpose of theories that form the theoretical framework**

The purpose of each theory for this study, with indicative references, is summarised in Table 2.2.

**Table 2.2 Theories and their rationale for inclusion in the theoretical framework**

<b>Theory</b>	<b>Indicative references</b>	<b>Reason for inclusion</b>
Socio-cultural approach to learning, situated cognition (Vygotsky)	(Brown, J. S., <i>et al.</i> , 1989) (Larkin, <i>et al.</i> , 2011) (Vialle, Lysaght & Verenikina, 2005b) (Wertsch, 2011)	<ul style="list-style-type: none"> <li>• Core learning theory for this study</li> <li>• Elaborates what is understood by the word ‘learning’ and the nature of learning processes</li> <li>• The data suggest that AS thinking and learning can be understood in cultural terms and the education of students with AS as a cross-cultural transaction requiring different cultural understanding</li> <li>• The role of the researcher is understood as ‘situated learner’</li> </ul>
Information Processing Theory (IPT)	(Williams, D. L., Minshew, <i>et al.</i> , 2008)	<ul style="list-style-type: none"> <li>• Neuroscience research relies upon IPT</li> <li>• Neuroscience is contributing greatly towards new understanding of autism and learning</li> <li>• IPT is foundational to the explanatory theories of autism</li> </ul>
Theory of Mind Central Coherence Executive Function Amygdala Theory	(Baron-Cohen, 1995) (Happé & Frith, 2006) (Happé, <i>et al.</i> , 2006) (Immordino-Yang & Damasio, 2007)	<ul style="list-style-type: none"> <li>• Four major explanatory theories of autism provide a starting-point conceptual framework for understanding thinking and learning in Asperger syndrome.</li> </ul>
Theory of Multiple Intelligences	(Gardner, 2006)	<ul style="list-style-type: none"> <li>• Provides the basis for reconceptualising learning in gifted individuals with AS</li> <li>• Accounts for giftedness, intelligences, disability, cognitive profiles, twice-exceptionality</li> <li>• Supports development of a conceptual framework of Asperger thinking and learning</li> </ul>

The theories selected for the theoretical framework of this study provided the philosophical foundation and the scaffold for understanding autism and AS based on research across the disciplinary areas of neuroscience, education and psychology.

### **2.7.10 Implications of explanatory theories for this research**

The implications of each of the explanatory theories for this research are summarised in Table 2.3 below.

Table 2.3 Implications of theory for research

Theory	Implications for this research
Theory of Mind	<ul style="list-style-type: none"> <li>• Theory of Mind is impaired with people with AS. (Frith, U., 2001)</li> <li>• Participants with AS may have found it challenging to reflect on their own mental states in order to be able to describe their thinking processes to the researcher. (Frith, U. &amp; Happé, 1999)</li> <li>• Theory of mind conceptually aligns with ‘metacognition’ in the educational literature. (Neihart, 2000; Sodian &amp; Frith, 2008)</li> <li>• Metacognitive capacity is viewed as a characteristic of successful learners. (Hannah &amp; Shore, 1995; Schneider, W., 2008; Shore, 2000)</li> </ul>
Central Coherence	<ul style="list-style-type: none"> <li>• Central coherence in autism is said to be ‘weak’ indicating a detail-focused information-processing bias. (Blakemore, <i>et al.</i>, 2006; Jarrold, Butler, Cottington &amp; Jimenez, 2000)</li> <li>• Data collected from participants with AS may contain detail without reference to context. (Hill &amp; Frith, 2003)</li> <li>• The strategy of using key informants and artefacts will be employed to account for likely weak central coherence by providing contextual information.</li> </ul>
Executive Function	<ul style="list-style-type: none"> <li>• Executive function is impaired in AS and is associated with under-connectivity of the prefrontal cortex and other brain regions serving executive control. (Hill &amp; Frith, 2003; Kalbfleisch &amp; Loughan, 2012)</li> <li>• Essential cognitive components of learning being impaired (Battro, 2010; Davis-Unger &amp; Carlson, 2008; Meltzer, 2010) posed the key research question, ‘How do gifted adults with AS think and learn?’</li> <li>• Participation in the study required executive skills such as keeping appointments, focused attention, and so on. This posed challenges to data collection and influenced the research design. Flexibility to contribute using asynchronous methods such as email, and contribution of artefacts catered for this challenge.</li> </ul>
Amygdala Theory	<ul style="list-style-type: none"> <li>• The amygdalae show structural differences in people with autism, including different developmental growth trajectories. (Amaral, <i>et al.</i>, 2008; Baron-Cohen, <i>et al.</i>, 2000; Kleinhans, <i>et al.</i>, 2009)</li> <li>• As a key component of the limbic system (emotion-processing), the amygdala is involved in executive function. (Bechara, Damasio &amp; Damasio, 2003)</li> <li>• Building a comfortable relationship with participants was an important feature of this study to overcome anxiety associated with encountering new situations and people. (Burnette, <i>et al.</i>, 2005)</li> <li>• The limbic system is implicated in social anxiety and sensory sensitivities. The setting of interviews and meetings had to account for these. (Jennes-Coussens, Magill-Evans &amp; Koning, 2006)</li> <li>• Amygdala theory may have particular relevance to how people learn with regard to affective aspects of learning. (Immordino-Yang &amp; Damasio, 2007)</li> </ul>

### **2.7.11 Reconceptualising Asperger learning within the framework of Multiple Intelligences**

Gardner's Theory of Multiple Intelligences (1993) provides the framework that accounts for twice-exceptionality. Gardner has wrestled with the issues of intelligence in autism and giftedness (2006) and the Multiple Intelligences framework is therefore suitable for an exploration of Asperger thinking. Theories of intelligence where a single, rankable IQ is thought to exist are unhelpful and lead to lack of recognition of intelligence in people who do not fit the learner profile being captured by the IQ testing employed (Gould, 1981). Such a view of intelligence is, according to Gardner, impoverished (2000). Many people with AS, including the participants of this study (see, for example, Section 4.9.5), report that they have been told they are 'stupid' and that their intelligence is not recognised (Attwood, 2007; Carrington & Graham, 2001; Carrington, *et al.*, 2003). Gardner's framework has fostered a new discussion of intelligence and learning, one in which a learning disorder does not disqualify one from being intelligent (Gardner, 2008b).

## **2.8 Chapter conclusion**

This chapter has provided a discussion of the cross-disciplinary nature of this doctoral study, which draws upon the fields of neuroscience, education and psychology. Contributions from the literature in each of these disciplines was foundational to the development of this study's research question and design. From the literature review of the three bodies of research, definitions were provided and theoretical propositions were drawn together into a theoretical framework. The theoretical framework informed the study itself and provided the starting point for the development of the conceptual framework of understanding that was the output of this study.



## Chapter 3 Methodology & Method

### 3.1 Introduction

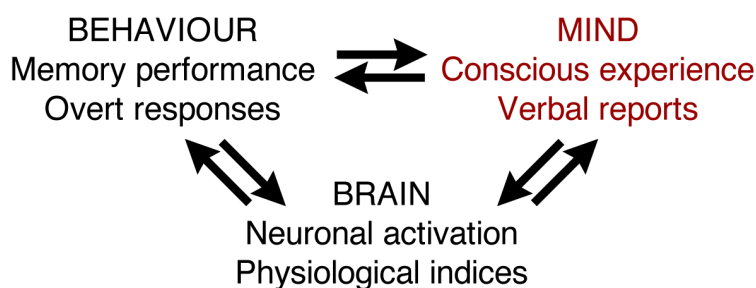
This study was conceived within a constructivist theoretical paradigm (Lincoln & Guba, 2013), which was formerly designated as ‘naturalistic inquiry’ (Lincoln & Guba, 1985). Within this paradigm, Lincoln and Guba described the appropriate methodology as ‘hermeneutic/dialectic’ (Lincoln & Guba, 2013, p. 65), terms that are compatible with the phenomenological methodology employed in this doctoral study. The research strategy utilised was a phenomenological case study approach using interpretative phenomenological analysis (IPA).

Table 3.1 Paradigm, methodology and method, according to Lincoln and Guba’s (2013) taxonomy

Taxonomy	This study
Paradigm	Constructivist (Naturalistic)
Methodology	Phenomenology
Method	Case studies employing interpretative phenomenological analysis (IPA)

### 3.2 Methodological influences

As discussed briefly in Chapter 1, Gardiner, in the introductory chapter to *Memory in Autism: Theory and Evidence* (2008), raised the need for converging sources of evidence where previously the research community relied on behaviourist and cognitive theories of autism. He argued that functional brain-imaging techniques have provided empirical evidence requiring theoretical assumptions to be consistent with neuroanatomical function. Gardiner proposed that a third source of evidence, which he called ‘Mind’, is now required alongside behavioural and brain studies. This category refers to the reports of people experiencing the phenomenon of autism, and he asserts that ‘there is an increasing willingness amongst memory theorists to take on board mental life as experienced, and reported verbally, by participants in memory research’ (p. 15). Gardiner’s illustration of the three converging sources of evidence in the field of memory in autism is reproduced below in Figure 3.1 (see also Figure 1.4).



**Figure 3.1 Three kinds of converging evidence (Gardiner, 2008, p. 16)**

Gardiner's call for first-hand reports contributed to the rationale for the choice of phenomenological methodology here and this doctoral study augments the autism research by providing case studies that focus directly on cognition and learning, where previous case studies—listed in Table 3.2—examined social and educational issues. The six phenomenological studies cited in Table 3.2 supplied the model for this current study through the use of a similar research design that involved analysis and interpretation of first-hand reports by participants with autism and AS.

**Table 3.2 Six phenomenological studies of relevance**

<b>Author and Year</b>	<b>Title of Journal Article</b>
Carrington & Graham (2001)	Perceptions of school by two teenage boys with Asperger syndrome and their mothers: A qualitative study.
Hurlbutt & Chalmers (2002)	Adults with autism speak out: Perceptions of their life experience.
Carrington, Papinczak, & Templeton (2003)	A phenomenological study: The social world of five adolescents who have Asperger's Syndrome.
Humphrey & Lewis (2008)	'Make me normal': The views and experiences of pupils on the autistic spectrum in mainstream secondary schools.
Müller, E., Schuler, & Yates (2008)	Social challenges and supports from the perspective of individuals with Asperger syndrome and other autism spectrum disabilities.
Griffith, Totsika, Nash & Hastings (2011)	'I just don't fit anywhere': Support experiences and future support needs of individuals with Asperger syndrome in middle adulthood.

Each of the studies in Table 3.2 utilised some form of what Humphrey and Lewis (2008) called 'interpretive phenomenological analysis' (IPA) (p. 23). It is noted here that most sources used the longer form of the word interpretive—interpretative—when referring to IPA. In this current study, and drawing on the six studies cited above, an interpretative phenomenological approach provided the framework that guided data

collection, analysis and interpretation: generalisable themes were distilled that were consistent with the literature within the boundaries defined by this study's theoretical framework. The six studies cited above employed different terms to describe their methodology, however, they clearly followed a similar research process. Carrington and Graham (2001) labelled their study a 'case study approach ... through the use of semi-structured interviews ... An inductive approach to data analysis [that] identified four themes' (p. 37). Carrington, *et al.*, (2003) described theirs as a 'phenomenological approach, within an interpretative sociological framework, [which] facilitates an understanding of the participants' experience' (p. 16). Humphrey and Lewis (2008) described the IPA approach they used as semi-structured interviews and 'descriptive coding of data leading to the eventual organization of analytical themes' (p. 28). Müller, E., *et al.*, (2008) conducted interviews where participants articulated their experience, the outcome being the themes that emerged. Griffith, *et al.*, (2011) used the phrase, 'interpretative phenomenological analysis (IPA)' (p. 1).

The six phenomenological studies cited above together represent an evolving methodology: a phenomenological case study approach using IPA, successfully applied to autism and AS research; that results in the development of themes, which are assessed for generalisability. The increasing validation of IPA as a distinct methodology situated within a recognised research paradigm was confirmed for this doctoral research with the publication of the reference book by Smith, Flowers and Larkin (2009). Indeed, further reports have since been uncovered that indicate increasing recognition and appreciation for the productive findings available through IPA (Huws & Jones, 2008, 2013; Larkin, *et al.*, 2011; Newman, *et al.*, 2010; Williams, E., 2004). Although none of the reports listed in Table 3.2 focused directly on thinking and learning, one report was discovered that did and that study also exerted a major influence upon the methodology of this doctoral study. Boucher's (2007) single case study report is significant in that it directly addressed memory in very high-functioning autism using a qualitative approach, demonstrating that a cognitive phenomenon can be investigated using a case study approach which is both descriptive and interpretive, and is an example of the first-hand reports called for by Gardiner (2008).

The choice to utilise an inductive, qualitative study based on a broad research question—'How do gifted adults with Asperger syndrome think and learn?'—using

semi-structured interviews, artefacts, and an IPA framework to arrive at emergent and super-ordinate themes was modelled on these seven studies. Taken together, the studies provide the precedent for using a phenomenological case study research design with gifted people with AS and confer face validity on this doctoral study.

### **3.3      *Research design and methods***

This study employed a case study design in line with the studies discussed in the previous section. A case study design allowed for the heterogeneity of AS (Szatmari, 2011) while examining the phenomenon of Asperger thinking and learning across multiple cases, allowing for theory formation which can be assessed for generalisability (Punch, 1998). Working within an interpretative phenomenological framework (IPA) as a situated learner (Brown, J. S., *et al.*, 1989; Larkin, *et al.*, 2011), triangulation of data with multiple sources across five cases of gifted adults with AS was employed. Data were collected through: semi-structured, audio-recorded interviews of primary participants (gifted adults with AS) and secondary participants or key informants (without AS); and, artefacts, such as emails, photographs, and documentary evidence. Analysis was conducted through iterative reflection, frequent comparison with neuroscience and autism research literature, data coding and categorisation, leading to emergent and super-ordinate themes and the development of a conceptual framework.

### **3.4      *Research question and sub-questions***

The starting-point research question:

How do gifted adults with Asperger syndrome think and learn?

The sub-questions:

- (a) Can gifted individuals with AS describe how they think and learn? Given the ToM issues noted in the autism research literature, what means will they use to describe their thinking and learning?
- (b) Is there a distinct cognitive profile (information-processing style, memory, and learning) that emerges from the case studies of gifted individuals with AS?
- (c) What pedagogical insights emerge from the case studies?

- (d) Do neuroscience, autism and memory research inform educational theory development with respect to learning as it is understood by teachers? Can understandings of thinking, memory and learning from neuroscience and psychology be mapped to a framework that has meaning for teachers seeking to understand differences between the thinking, memory and learning of their typically developing students and their students with AS?

### **3.5      *Aim***

The aim of the study was to investigate the thinking and learning of gifted adults with AS and, with the benefit of current neuroscience research, to utilise the perspectives of gifted people with AS and their key informants to develop a conceptual framework of thinking and learning in AS, for the understanding of individuals with AS, teachers, parents and partners. Furthermore, the purpose was to support the stakeholders' move beyond deficit views of AS and to facilitate bi-directional acceptance and understanding of the differences between cognition in AS and typical development.

The intellectual functioning of gifted people with AS can appear mysterious to others, exposing cultural differences (in the broadest sense of 'culture'). This scenario was being played out in the researcher's former school setting (Section 1.4) by the teachers who forthrightly professed themselves to be mystified by the behaviours of their students with AS and what those behaviours indicated about the students' learning. This observation does not reflect harshly on those teachers: on the contrary, they were expressing an authentic need for professional knowledge that was not available to them in their pursuit of what was best for their students. The lack of conceptual understanding made it difficult for the teachers to 'problem-solve' in their efforts to facilitate their students' learning. Wertsch, writing from a Vygotskian perspective, recently stated:

Some dyads and larger groups...seem to function differently and perhaps at more advanced levels than others. ... This raises questions requiring conceptual frameworks that will be quite different from those we currently employ. (Wertsch, 2011, p. 43)

While the teachers' current frameworks for understanding the thinking and learning of their students were recognised as inappropriate for students with AS, the conceptual framework that could facilitate their understanding was not available to them. The aim of developing a conceptual framework of the thinking and learning of students with AS

was born out of this need, expressed by teachers. It may be appropriate, within a Vygotskian perspective, to conceptualise Asperger and neurotypical cognition as indicative of different **intellectual or mental cultures**. If so, then the conceptual framework that is the theoretical outcome of this doctoral study—the ‘Thinking, Memory and Learning Framework’ (TML)—potentially contributes to improved relationships between those cultures on a micro (in individual teacher-student dyads) and macro level (teacher professional development, pre-service teacher training). It is also anticipated that teacher professional development using the framework will contribute to a culture shift within schools and education more broadly, away from a deficit view and towards a view of the twice-exceptional student with AS as a gifted learner.

### 3.6 *Sampling strategy*

IPA employs ‘purposive sampling’, which ‘resembles theoretical sampling’ (Smith, *et al.*, 2009, p. 252). Theoretical sampling is a sampling technique employed in grounded theory, a methodology that may be viewed as ‘the main alternative method for someone considering IPA for a research study’ (p. 201). Mertens (2005) refers to Guba and Lincoln (1989) to outline this notion of sampling:

... respondents who will enter into the hermeneutic process must be selected. But such sampling is not carried out for the sake of drawing a group that is representative of some population to which the findings are to be generalized. Nor is the sample selected in ways that satisfy statistical requirements of randomness. The sample is selected to serve a different purpose, hence the term ‘purposive sampling’ ... (pp. 177-178)

They go on to describe a sampling process that is not preordained but allowed to evolve with the emergence of issues in the research. (Mertens, 2005, p. 324)

The principle of theoretical sampling is ‘the idea that subsequent data collection should be guided by theoretical developments that emerge in the analysis’ (Punch, 2009, p. 133). Therefore, the final selection of cases may not occur until late in the process (see Figure 3.2).

Small sample sizes are appropriate in IPA research: ‘IPA utilizes small, purposively-selected and carefully-situated samples, and may often make very effective use of single case analyses’ (Smith, *et al.*, 2009, p. 29). The researcher’s own position and personal contacts may be a key element in the recruitment of participants and selection of cases.

...samples are selected purposively (rather than through probability methods) because they can offer a research project insight into a particular experience. Most frequently, potential participants are contacted via: *referral*, from various kinds of gatekeepers; *opportunities*, as a result of one's own contacts; or *snowballing* (which amounts to referral by participants). Participants are selected on the basis that they can grant us access to a particular perspective on the phenomena under study. That is, **they 'represent' a perspective**, rather than a population. (Smith, *et al.*, 2009, pp. 48-49) [emphasis added]

Purposive sampling in IPA is not intended to be representative of a population and is not suitable for the purposes of measurement, comparison or statistical manipulation. Participant selection, instead, aims to represent perspectives on human lived experience and the cases in this doctoral study were selected with this purpose: that is, for their capacity to provide information-rich perspectives on the phenomenon of interest.

IPA facilitates the study of invisible or elusive phenomena. Smith, Jarman, and Osborn (1999) made this point with regard to cognition, while contrasting IPA with discourse analysis.

While IPA shares with discourse analysis (DA) a commitment to the importance of language and qualitative analysis, where IPA researchers would typically differ from discourse analysts is in the perception of the status of cognition. DA, as generally conceived of in contemporary social psychology, is sceptical of the possibility of mapping verbal reports on to underlying cognitions ... IPA by contrast is concerned with cognitions, that is, with understanding what the particular respondent thinks or believes about the topic under discussion. Thus, IPA, while recognizing that a person's thoughts are not transparently available from, for example, interview transcripts, engages in the analytical processing in order, hopefully, to be able to say something about that thinking. (Smith, *et al.*, 1999, p. 219)

The choice of IPA as the research design for this study is appropriate for a study of cognition as the IPA framework confers acceptance of the perspectives of the participants on their thinking as valid data for analysis.

Operating, like ethnography, within a naturalistic paradigm, IPA recruits participants from a particular community or group of people who are experiencing a phenomenon in common: the phenomenon in the case of this doctoral study being the intellectual or 'mental culture' of gifted individuals with Asperger syndrome (AS) (Section 3.5). The phenomenological methods focus on the participants' lived experience, as described by themselves. Bogdan and Biklen (1998) state that:

Researchers in the phenomenological mode attempt to understand the meaning of events and interactions to ordinary people in particular situations. ... Phenomenologists ...

attempt to gain entry into the conceptual world of their subjects (Geertz, 1973) in order to understand how and what meaning they construct around events in their daily lives. Phenomenologists believe that multiple ways of interpreting experiences are available to each of us .... (Bogdan & Biklen, 1998, p. 23)

However, IPA moves beyond ‘classic’ phenomenological research by self-consciously adopting a hermeneutical approach to the data analysis: that is, undertaking an interpretive analysis and situating that analysis within a context that makes the position of the researcher and the theoretical developments undertaken transparent to the reader.

It can be said that the IPA researcher is engaged in a double hermeneutic because the researcher is trying to make sense of the participant trying to make sense of what is happening to them. (Smith, *et al.*, 2009, p. 3)

This doctoral researcher is also a member of the ‘community’ impacted by the phenomenon of thinking and learning in gifted individuals experiencing AS, by means of her own lived experience (documented in Section 1.3), and, therefore, she selected a methodology and methods that leveraged her position as being most appropriate to answer the research questions. As the life partner of a person experiencing AS, she provided an ‘insider’s view’ to the case selection, analysis and interpretation of the research.

... the researcher as an individual, complete with values, opinions, biases, and feelings, brings an experiential world to the research process that influences the phenomena studies. Rather than adopt a position of ‘omniscient observer’ that may be apparent in varieties of quantitative research, the qualitative researcher instead seeks to interpret, understand, and describe in a reflexive process. Because qualitative research rests on such ontologic and epistemic foundations, it enables the acknowledgement of complexity, ambiguity, and dynamism in human phenomena. It centralizes individuals’ experiences and the meanings they ascribe to them. It also places the participant as the ‘experiencer’ in the position of expert, and the investigator in the position of learner. (Wilding & Whiteford, 2005, pp. 98-99)

The ‘community’ from which this study drew were people in the researcher’s local context of Sydney, NSW, Australia, who identified themselves as experiencing AS, and where there was significant supporting evidence, such as: a formal diagnosis by a qualified professional; AS traits exhibited during interview; or, educational accommodations offered during the participant’s schooling. This approach is supported by Jones, Quigney and Huws (2003), who reported the use of the criterion of self-identification as a basis for participant selection in their study.

Although the diagnosis of these persons was not independently confirmed, all of these individuals described themselves as high-functioning autistic individuals. (p. 113)

Evidence of giftedness was also required for inclusion. This was established simply in the light of: personal histories of learning; career achievements; and, artefacts; for Kahla (a successful artist), Rhoda (a graphic design teacher), Colin (a long successful career in publishing, broadcasting and photography), and Riley (numerous academic publications in his field). To characterise the individual participants' giftedness in multiple intelligences terms would be interesting but was not the purpose of the study. Gifted in one domain (for example, the visual-spatial domain in Rhoda's case, where she is able to accurately render detailed 3D drawings of buildings from 2D blueprints despite never having seen the building) satisfies Gardner's description of giftedness.

Giftedness is a sign of early or precocious biopsychological potential in the domains of a culture (Winner, 1996). A person who advances quickly, who is 'at promise' in an available task area or domain, earns the epithet 'gifted'. Individuals can be gifted in any area recognized as involving intelligence. (Gardner, 2000, pp. 78-79)

Rhoda recounted in her interview that she exhibited this superior artistic capacity in childhood. In 18-year-old Nadia's case, giftedness was established through: samples of her schoolwork (a stage play written for her HSC major work, photographs of fashions she designed and made modelled on the catwalk); and, her and her key informant's (mother) verbal recounts of teachers' reports and comments regarding her giftedness.

The interpretive analysis was conducted with extensive reference to the research literature from neuroscience and psychology as the findings of these disciplines clearly contribute enormously to the understanding of the mental phenomenon of 'learning', formerly said to be unknowable, inside a 'black box'.

... we can begin to use research tools, such as brain imaging, analysis of cognitive processing and learning, and genetics assessment to illuminate the "black box" and uncover underlying learning mechanisms and causal relations (Hinton & Fischer, 2008). (Fischer, 2009, p. 3)

Further literature reviews were called for throughout the interpretive process as the need for new conceptual understandings was realised: the researcher viewed herself as a learner moving beyond previous knowledge domains, thus needing to build accurate conceptual understanding from primary sources to undergird her analysis and interpretation.

A number of interviews took place that were ultimately excluded from the final case selection, including some where the transcriptions had been completed. These interviews did not represent the phenomena under investigation richly enough in a form amenable to analysis and interpretation: for example, a shy 15-year-old male school student with a formal diagnosis and a highly articulate key informant (father), where the primary participant's interview and artefacts provided insufficient evidence of giftedness. His non-selection as a case was not a judgement on his giftedness, rather that the data collection process had failed to provide solid triangulated evidence of giftedness in one or other multiple intelligence domains.

The sampling strategy of this doctoral study was to allow the criteria for the final selection of cases to evolve over the course of data collection (see Figure 3.2). The emergence of early themes (for example, memory in autism, and the role of memory in learning) facilitated a greater focus on eliciting rich information in these areas in the later interviews and contributed to the selection and exclusion of cases at the conclusion of the data collection phase.

### **3.7      *Generalisability***

Generalisability of the output of this doctoral research is claimed on the basis of its theory development activity: that is, the development of a conceptual framework based on the iterative literature search conducted throughout the study; not on the selection of the case studies as being representative of a population. The question of generalisability from a single or small number of case studies has been discussed by Punch (2009) and Smith, Flowers and Larkin (2009) and, it is argued, validity is maintained if the case studies are utilised in two ways: 'The first is by conceptualizing, the second is by developing propositions' (Punch, 2009, p. 121). The development of a conceptual framework is a means of conceptualising the themes emerging from the cases, interpreted in the light of relevant research literature.

A conceptual framework is a representation, either graphically or in narrative form, of the main concepts or variables, and their presumed relationship with each other. (Punch, 2009, p. 83)

The issues surrounding case selection in IPA have been discussed in Section 3.6. The case studies of this doctoral research are viewed within a naturalistic paradigm as information-rich, phenomenological 'units', capturing instances of the phenomenon of

thinking and learning in gifted individuals experiencing AS from the participants' own perspectives, thus making those data available and amenable to interpretation. In order for the interpretation of the data that is offered throughout this thesis to hold validity, it must be judged as being a creditable interpretation against the literature upon which the interpretation relies.

The early interviews and artefact collection served to focus the field of investigation, and indicated the need for an iterative literature search throughout the study. The conceptual understanding of interest to this study contained within the literature was documented (Appendix B is an example) and mapped into diagrams that ultimately formed the conceptual framework, 'The Thinking, Memory and Learning Framework (TML)' (Appendix C). The need for an iterative approach to the research literature became obvious soon after the analysis of Case 1 commenced and, therefore, the unusual step was taken to include another substantial literature review within Case 1 (Sections 4.3 to 4.6). Following the development of the TML framework, in presentations to stakeholders the case studies then served a different purpose. Figure 3.2 illustrates the evolving nature of the study and its impact upon case selection and claims of generalisability.

Figure 3.2 maps case selection, the iterative literature review and generalisability for this doctoral study within an IPA framework. After initial contact by potential participants with the researcher, if the enquirer met the criteria for the study, an information package was mailed to them. When the signed consent form was received, the date, time and venue for the interview were arranged. Interview and artefact collection was based on semi-structured interview schedules (see Appendix 1). After the first interview, which was with 'Kahla' (Case 1), the issues raised that were not already well-understood from the background literature review, necessitated further ongoing literature searches (shown in Figure 3.2 in green). The need for clarification and ongoing refinement of the researcher's conceptual understanding from the literature also emerged from other interviews. The literature search, therefore, became a central pillar of the study and continued throughout as: (a) new research reports significantly impacting upon an understanding of the phenomena described by the participants were published month by month; and, (b) the need became apparent for deep and broad 'mining' of the literature as the lens through which the interpretation was conducted. As

the data collection and analysis continued, conceptual mapping of important notions within the literature was undertaken (shown in blue to the right of the iterative literature search), initially as a way of summarising and clarifying the literature, but eventually this was recognised as a central strategy for each stage of the analysis, and finally it was apparent that the conceptual mapping (shown in pink) was, itself, an important product of the study and represented the study's theoretical output. As discussed within Section 3.6, the final case study selection (shown in beige to the left of the iterative literature search) was not possible until the data collection was finalised and the major themes across the data that were reflected in the literature became apparent. It was only then that the most information-rich cases could be selected. As the case studies are not representative of a population, but rather a perspective, generalisability is not claimed for the case studies. However, the conceptual mapping of the literature that was prompted by issues arising from the data collection is generalisable. Once the data collection was completed and the emergent themes recognised, the case studies then served a further, different purpose (shown in beige on the right), that of illustrating the conceptual framework.

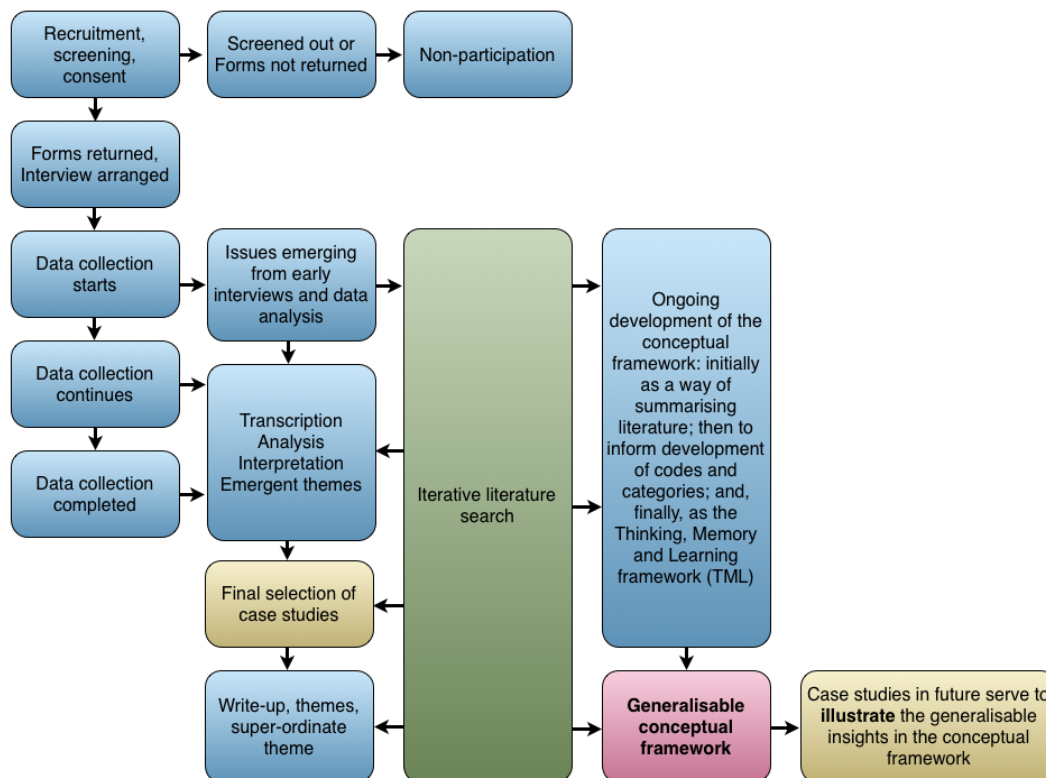


Figure 3.2 Case selection and generalisability

As shown in Figure 3.2, final selection of case studies was late in the research process,

after the emergence of themes and with concurrent literature searches. Generalisability is not claimed on the basis of case study selection or sampling techniques; instead it is claimed for the conceptual framework that was developed as the theoretical output of the study. Following the completion of the study, the case studies then served the further purpose of illustrating and providing examples for the framework to be utilised for professional development.

### **3.8        *Participants***

The primary participants were gifted adults who had received a diagnosis of AS or were of the view that they had AS, where there were significant supporting indicators. Key informants (KI), such as life partners or parents, were also participants for each case, where available. Priority was given to participants where there were significant indicators of giftedness, as defined within the Multiple Intelligences framework (Section 2.7.11), demonstrated throughout a participant's personal history by: career achievements and artefacts such as publications; a formal diagnosis by a psychologist or psychiatrist; and, availability of a key informant and artefacts. An accessible location facilitating face-to-face interviews was important to the study. In one case, the interviews were conducted at the participants' request via *Facetime* (*Apple* software similar to *Skype*).

### **3.9        *Recruitment***

Participants were drawn from people who made contact by phone, email or in person after limited advertising through word of mouth, the ASPIA (Asperger Syndrome Partner Information Australia) and 'Aspect' (Autism Spectrum Australia) newsletters, and through submissions to the newsletters of four local schools. A total of 39 people made contact. From the initial contact, people who did not meet the criteria for the study, or who did not fall within the boundaries set by the ethics approval, were screened out.

### **3.10       *Case selection***

Sixteen interviews were conducted. Five cases, consisting of nine interviews, were selected as the focus for this study because of the quality of the data and the fulfilment of Punch's (2009) 'four characteristics of case studies' (p. 120) in the data collected. Young people with AS, aged 14 to 17 years, were initially included as participants and

several interviews took place, however, the most ‘information-rich cases’ (Speirs Neumeister, Yssel & Burney, 2013, p. 265) all had adult primary participants so the focus of the study shifted onto the reflections of adults on their schooling and learning. The primary participant in one of the selected cases was aged 18 at the time of the interview and was still at school so this case, Case 4, offered a perspective on recent experiences of schooling. The other interviews that were not selected did not fulfil Punch’s criteria for various reasons, such as where triangulation of data was not available due to divorce, or because of non-disclosure of participation to the partner.

### **3.11 Case descriptions**

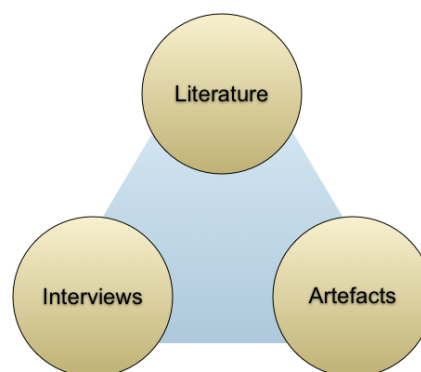
The cases were bounded by the focus on the thinking and learning of a gifted individual experiencing AS. In four cases, the person with AS had received a formal diagnosis by a psychologist or psychiatrist. Case 5 involved a person represented by his wife, with his agreement, as having AS without a formal diagnosis: the wife is a teacher of children with special needs, including autism spectrum disorders, and, within her professional capacity, recognised her husband as meeting the criteria for AS. The traits presented and discussed during both interviews and a requested follow-up interview affirmed the view that a working diagnosis of AS was justified. Case 1 had no key-informant interview as all of her immediate family members were also diagnosed with AS. The decision to include the case was made due to the richness of the data provided, the presence of similar themes to the other cases, and the provision of artefacts. Table 3.3 provides a summary of the cases.

**Table 3.3 Cases, participants and artefacts**

Case	Participant	Description	Key Informant <sup>1</sup>	Artefacts
1	Kahla	48 yo female	No key informant	Emails Artworks
2	Rhoda	Female in her 60s	Partner (Steve)	Artwork Digital publication
3	Colin	Male in his 50s	Partner (Wendy)	Emails Photographs Magazine publication
4	Nadia	18 yo female	Mother (Lydia)	HSC major work Photographs of fashion creations
5	Riley	Male in his 60s	Wife (Renaë)	Newspaper articles Publication list Résumé Awards

### 3.12 Data collection

Triangulation of data, represented graphically in Figure 3.3, was achieved through audio-recorded, semi-structured interviews, artefacts and continual reading of the research literature in neuroscience and autism.

**Figure 3.3 Triangulation of data**

#### 3.12.1 Literature

As shown in the theoretical framework (Section 2.7), the neuroscience and autism literature were foregrounded in this study. Because the phenomena under investigation—thinking and learning—are not themselves observable, and this study directly investigated these phenomena (not their behavioural outcomes), this was possible only in the light of recent advances in neuroimaging that provided evidence of

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<sup>1</sup> Nomenclature employed aligns with participants' usage

neural differences between the thinking of individuals with AS and those experiencing typical development. The literature was foundational to decision-making in regard to: research design; data collection; analysis; the development of categories and codes; thematic development; and, trustworthiness; and it played a key role in the interpretive process.

### **3.12.2 Interviews**

The semi-structured interview format allowed participants to determine the direction of their interview. Participants were given a copy of the interview schedule (Appendix A) prior to the interview. If a lull in the conversation occurred, the interview schedule was referred to. Where possible, the participants' recollection and reflections were given free rein within the topic area. The interviewer's focus was on: the comfort and ease of participants with AS to reduce the stress of being in a new situation with a stranger; clarifying meaning and ensuring audio clarity for the recording; probing for greater depth; verbally validating contributions; sharing information in response to questions as a means of returning a benefit to participants; and, taking limited notes. The interviews were conducted over the course of 12 months in 2011 and 2012 and included several interviews with young people or their family members. During that time, the focus sharpened onto gifted adults and their memory processes. More talk on memory processes was therefore elicited in the later interviews than in the early ones. All interviews, with the exception of Case 2, were conducted face-to-face at a time and location of mutual convenience, with priority placed on ensuring the least stress possible to the participants and on achieving a good-quality audio recording. In Case 2, the interviews were conducted via *Facetime* (software similar to *Skype*) at the participants' request. The computer screen was recorded using software called *iShowU* and the audio track was stripped out for transcription. Key informant (KI) interviews were conducted for corroboration, elaboration, assistance with meaning, and to give different perspectives and independent interpretations. KI interviews were an important member-checking strategy for establishing truth value and credibility (Section 3.14).

### **3.12.3 Artefacts**

Artefacts were collected as evidence of gifted achievement, as well as for corroboration and elaboration. Examples are the academic publication list of Riley and photographs by Colin. A number of participants maintained contact after the interview via email and,

with their permission, their emails were treated as artefacts to complement the interview data. In each case, data collection procedures were negotiated with participants to align with their ability and willingness to contribute.

### 3.13 **Data analysis**

This section describes the process of data handling and analysis, including the categorisation and coding structure developed for the study.

#### 3.13.1 **Transcription**

Audio recordings of the semi-structured interviews were transcribed. The transcripts were subjected to at least two passes of accuracy checks, line by line, by the researcher and an associate. The challenge was to be faithful in meaning to the utterance while transcribing mid-sentence changes of direction, unfinished utterances, and repetitious verbal habits: which were, in some interviews, excessive. Where participants displayed perseverative use of phrases, words or sounds that did not convey verbal meaning (such as ‘sort of’, ‘you know’, ‘um...um...um’), these were edited out in the later accuracy checks. An excerpt of a transcript before and after redrafting is provided here to demonstrate the type of editing that was employed to move from a literal transcription to formatted quotes for this thesis.

**Table 3.4 Transcript excerpt before and after editing**

<b>Original literal transcription</b>	<b>After redrafting</b>
I’m, you know, I’m I’m actually on sick leave because of all the stress and all the stuff that’s been going on. It’s you know. And I think part of it is Asperger’s and part of it is people who want power and a whole lot of things. It’s complicated.	I’m on sick leave because of all the stress and all the stuff that’s been going on. I think part of it is Asperger’s and part of it is people who want power and a whole lot of things. It’s complicated.

#### 3.13.2 **The analysis process**

Müller, E., *et al.*, (2008), described their process of analysis as ‘qualitative analyses of the interview transcripts [that] revealed a number of common experiences’ (p. 173), a process very similar to those described in less detail in the other IPA studies cited in Table 3.2. Müller’s team coded the transcripts with a ‘preliminary coding structure’ (p. 176) in mind, while other studies allowed categories and themes to emerge through repeated readings, coding and interpretation. Hurlbutt and Chalmers (2002) described the purpose of their study as being to ‘investigate and describe [participants’]

perceptions of their life experiences’ and the process as ‘asking them about their experiences’ (p. 103). They used interviews and artefact examination to form themes:

As we read the data, we documented recurring ideas and thoughts and identified emerging patterns. We made comparisons and analyzed data using an open coding procedure. To understand the phenomenon of the perceptions of the lives of adults with autism, we inductively formed categories. ... Thoughts believed to be important or significant were identified. ... coding was done by paragraph and/or main idea ... the next step involved identifying concepts ... the codes were collapsed into seven categories ... eventually four patterns emerged ... (Hurlbutt & Chalmers, 2002, p. 104)

In Hurlbutt and Chalmers’ terms, the significant elements for this doctoral study were: (a) documenting ‘recurring ideas and thoughts’ as the data from the current study were read and re-read, feedback from presentations to stakeholders was received, and further reading of the literature was undertaken; and, (b) employing an ‘open coding procedure’ of inductively formed categories, which was understood to be an organic process of category development, where ‘organic’ indicates that the codes and categories are suggested by the data rather than imposing a pre-existing structure upon the data. For example, when primary participants in three of the five cases talked about memories from infancy, a literature search was conducted on ‘infantile amnesia’: the literature search revealed diminished childhood amnesia as a recognised phenomenon in autism. ‘Childhood amnesia’ was then used as the name of a code (*NVivo* ‘node’) that was grouped under the category of ‘Memory’. Other references to diminished childhood amnesia were then coded using this node. Further information on coding and category development is given in Section 3.13.3.

While the team approach adopted by Müller, E., *et al.*, (2008) facilitated discussion as part of the analysis and interpretation process, being a sole researcher mandated internal reflection, which was based on these guiding questions: (a) What does this mean? (to the participant; to the researcher; to stakeholder audiences); (b) How are the data illuminated by the autism and neuroscience literature?; (c) What are the common themes across cases?; and, (d) What are the issues that arise in one case and not others? Feedback from presentations given to stakeholder audiences and further reading of relevant research literature was also used to reflect on the data.

### 3.13.3 Coding, categories and the development of themes

Using the qualitative analysis software *NVivo*, the evolutionary development of categories and codes was a critical process throughout the analysis and is, according to Guba and Lincoln (1981), a key to the trustworthiness of a study. Codes, and the folders they were stored in (representing categories), were developed from the research literature **and** from the data, as shown in Figure 3.4.

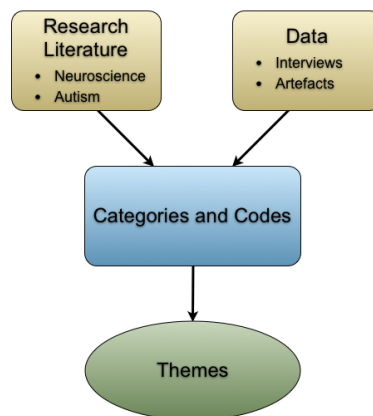


Figure 3.4 Category and code development

Initially, codes were created to reflect ideas or topics raised in the relevant research literature in neuroscience and autism. As an open-ended, cross-disciplinary investigation, the number of codes required to reflect all the notions raised was too large to be meaningful, hence the need to create a structure for the codes. Organisation was achieved through the creation of category folders and the codes were allocated to the categories. The naming and definitions of categories and codes were drawn from the literature, which then informed the development of categories and codes used for transcripts and artefacts. Throughout the study, categories and codes were reorganised to align with clarified understanding and insight, in order to reveal the emerging themes.

As a naturalistic study, the study design mandated triangulation to establish trustworthiness. The interpretive process of category and code development could not be member-checked by participants (the reasons for this are discussed in Section 3.14) so must be judged against the literature by which it was informed. The process that Carrington, *et al.*, (2003) described reflects the strong reliance on the research literature that was also a feature of this doctoral study.

Meanings and words that emerged from the data were organized into categories, however, the categories of data were also influenced by the literature that informed the research... (Carrington, *et al.*, 2003, p. 16)

The coding structure was developed organically. As passages were read and re-read for meaning, codes (nodes) were created and allocated to folders that represented categories, until redundancy was achieved. Nodes were keywords and phrases, such as ‘episodic memory’, ‘concept formation’ and ‘amnesia’. The categorising of these three nodes into the folder ‘Memory’ was guided conceptually by the literature (for example, Ben Shalom, 2003; Boucher & Bowler, 2008; Klinger & Dawson, 2001; Markowitsch & Staniloiu, 2011; Minshew, *et al.*, 2002).

Transcripts and artefacts were, at first, coded with a separate node structure to the research literature. Part-way through the analysis, transcript nodes were rolled over into the same folders as literature nodes and then combined, resulting in a single coding structure. This became possible once confidence in definitions and concepts was achieved. Ongoing refinement of the node structure took place as more was learned from the research literature about the subject areas raised in the transcripts. For example, at first there were separate nodes for ‘Autobiographical memory’ and ‘Episodic memory’ but after further reading it was realised, for the purposes of this study, the passages coded to ‘Autobiographical memory’ could be rolled over into ‘Episodic memory’ as, conceptually, episodic memory subsumes autobiographical memory. This is true with the exception of certain fine distinctions: for example, see Crane and Goddard (2008). The end result was, in the ‘Memory’ folder for example, a single node called ‘Episodic memory.’ Every ‘source’ (journal article, transcript or artefact) with an excerpt coded to the ‘Episodic memory’ node was then accessible by opening the node (double-clicking on the node name), which opened a new window showing all source excerpts coded to that node.

As an idea or a popular culture reference was noted in a transcript—for instance, *The Cabinet of Dr Caligari* (Wiene, 1920), in Case 2—time was spent researching the idea until confidence was achieved that the speaker’s intended reference was understood by the researcher. In the example just given, it was important to the analysis to understand both the reference itself and the speaker’s purpose for raising the reference. The reference to *Dr Caligari* was coded as ‘Metaphor’ in the category ‘Cognition’ as the

speaker was using the reference to describe her horror of certain objects, thus providing a clue to her visual processing. Excerpts were most often coded to multiple nodes, facilitating extensive cross-referencing: hence, the reference to *Dr Caligari* was also coded to ‘Emotion processing’ in the ‘Emotion’ category and ‘Bullying’ in the ‘School’ category as the speaker was using the reference to explain why she repeatedly ran away from school. Refinement of the coding structure involved the combining of nodes where different nodes contained similar data (through a process of clarifying definitions and meaning over time), prioritisation of significant nodes, and grouping into a smaller number of categories. In this way, definition of terms, where different phrases had been used, were reconciled and conceptual categories became clearer, allowing themes to emerge.

### 3.14 Trustworthiness

To address aspects of trustworthiness in this study, the structure provided by Guba and Lincoln (1981, p. 104), reproduced below in Table 3.5, was employed.

**Table 3.5 Scientific and naturalistic terms appropriate to various aspects of rigor**

Aspect	Scientific Term	Naturalistic Term
Truth value	Internal validity	Credibility
Applicability	External validity/generalizability	Fittingness
Consistency	Reliability	Auditability
Neutrality	Objectivity	Confirmability

Since this is a naturalistic—later described as ‘constructivist’ (Lincoln & Guba, 2013, p. 23)—study, it utilises what Guba and Lincoln (1981) described as credibility, fittingness, auditability and confirmability. Truth value in this doctoral study is asserted through credibility with the stakeholder audiences of the research, along with prolonged, substantial engagement, member checks and triangulation (Mertens, 2005). Applicability, equated with external validity, was formatively and summatively evaluated by the ‘fittingness’ of the research findings based on feedback from stakeholder audiences and by generalisable or transferable findings in the form of theory development (Punch, 1998, 2009). The theory development activity of this doctoral study resulted in the conceptual framework for understanding thinking, memory and learning in AS: the TML (Appendix C). Transferability was achieved by thick description and multiple cases. Consistency, equating to reliability in the positivist paradigm and also described as ‘dependability’, is demonstrable through the auditability of the research process and documentation, providing a ‘chain of evidence’ (Mertens,

2005, p. 253). Consistency is founded on the audit trail so that ‘a competent judge’ could ‘[attest] that [the study] was carried out in a competent manner’ (Guba & Lincoln, 1981, pp. 122, 123). Neutrality, replacing objectivity and replicability, which are not claimed in phenomenology, can be ascertained by a competent judge who, using the audit trail, would examine the methods and outcomes of this study based on accurate documentation, rich description, sustained engagement of the researcher, feedback from stakeholder audiences and triangulation of data.

... one would be more inclined to accept the reports of one magician standing in the wings during another magician’s performance ... (Guba & Lincoln, 1981, p. 125)

As in the analogy of the ‘magician standing in the wings’, a competent judge, in this instance, is necessarily **not** a research participant but, rather, someone well-versed in the relevant research design and literature.

### **3.14.1 Credibility and fittingness**

Claims of credibility and fittingness for this doctoral study are based on the following criteria: prolonged engagement, persistent observation, triangulation and member checking (Lincoln & Guba, 1985).

#### **3.14.1.1 *Prolonged engagement***

Since the diagnosis of the researcher’s husband in 2005, a period of three years was spent ‘learning the culture’ (Lincoln & Guba, 1985, p. 301) as a situated learner prior to commencing the study part-time in 2008. Personal and professional associations established through this time were maintained throughout the study. This represents a nine-year engagement with the audiences and culture of the investigation and contributes to the claim of credibility of this study.

#### **3.14.1.2 *Persistent observation***

Persistent observation helps distil the ‘things that really count’ (Lincoln & Guba, 1985, p. 304) in the inquiry and sort out irrelevancies. This is accomplished by:

... continuously engag[ing] in tentative labelling of what are taken as salient factors and then exploring them in detail, to the point where either the initial assessment is seen to be erroneous, or the factors are understood in a nonsuperficial way. To satisfy this criterion of trustworthiness, the naturalist must be able to describe in detail just how this process of

tentative identification and detailed exploration was carried out. (Lincoln & Guba, 1985, p. 304)

In this doctoral study, persistent observation was employed to engage with the phenomena of potential interest until the salience of each phenomenon to the inquiry was ascertained. That persistent observation has been a feature of this inquiry is demonstrated by: (a) the evidence of wide reading through recorded *Endnote* references and notes; (b) the *NVivo* coding structure, whose evolution can be traced through frequently archived backups; and, (c) engagement with stakeholder audiences through meetings and presentations. Some of the phenomena that were examined were ultimately deemed to have no salience for the research questions of the study, for example: causation, including genetic studies; educational, behavioural and social interventions; the role of the cerebellum in autism; mirror neurons; oxytocin; and, pharmacological research. These were excluded as the emergent themes came into focus.

#### 3.14.1.3 *Triangulation*

The term ‘triangulation’ is used here to mean ‘contextual validation’: both, (a) to compare similar evidence from different sources about the same phenomenon; and, (b) to validate the sources (Lincoln & Guba, 1985, pp. 305-306). Examining the phenomena in the research literature and across multiple cases is an example of the first form of contextual validation. Use of artefacts and key informants is an example of the second. As previously noted, triangulation of data sources was required by the research design in order to investigate the cognitive phenomena of thinking and learning. Interview data were collected from two sources, primary participants and key informants, along with artefacts from the primary participants. These were analysed in the light of the relevant research literature in neuroscience and autism. The studies listed in Table 3.2 examined human experience relating to observable, behavioural phenomena. On the other hand, the current study investigated mental phenomena and a study of this nature was not possible prior to the recent advances in neuroimaging techniques and the theoretical developments in autism that followed; the research literature has therefore been pivotal to each stage of this study.

#### 3.14.1.4 Member checking and multiple audiences

Lincoln and Guba (1985) assert that in naturalistic inquiry, truth value or credibility, is established through exposing the process and outcomes to the various audiences from which the data were drawn.

In order to demonstrate ‘truth value,’ the naturalist must show that he or she has *represented those multiple constructions adequately*, that is, that the *reconstructions* (for the findings and interpretations are also constructions, it should never be forgotten) that have been arrived at via the inquiry are *credible to the constructors of the original multiple realities*. (Lincoln & Guba, 1985, pp. 295-296) [italics in original]

As the naturalistic inquirer is dealing with multiple realities, it is for the audiences to determine whether the description and interpretation of the data is credible and applicable to them. Therefore, the multiple audiences for this inquiry were central to establishing credibility and fittingness. The audiences were teachers, individuals with AS, life partners and family members. Exposing audiences to the progress and outcomes of the study (‘road-testing’) was the core strategy for establishing truth value (credibility) and applicability (fittingness). The audiences provided an intrinsic member-checking process through their responses to presentations given throughout the study. Feedback received from all presentations was evaluated. Well-attended sessions running overtime by demand, email correspondence, absence of negative feedback, and follow-up invitations, were testament to the positive reception of the presentations. Questions from audience members were sometimes influential in determining an aspect of the study when the incompleteness of the explanatory framework at that time was exposed by the questions. Tables 3.6 to 3.10 list the audiences, presentations and documentary evidence.

**Table 3.6 Member checking: Teachers**

<b>Presentations Given</b>	<b>Evidence</b> <i>Stored files in italics</i>
In-service and post-graduate teachers, 'Autism Certificate'. Lectures given: January 2008, January 2009, January 2010, June 2010, January 2011, January 2013, January 2014.	Verbal feedback from January 2013 session: students gave session high rating. Presentation handout Email <i>Feedback.pdf</i>
Professional development, K-12 school teachers: May 2008, October 2009.	Email <i>MAS Email to teachers.pdf</i> <i>MAS feedback 1.pdf</i> <i>MAS feedback 2.pdf</i> <i>Teacher consultations.pdf</i> <i>MAS Leadership Support.pdf</i>
Professional development, K-12 school teachers: 3 sessions in April-May 2011	Email <i>Hope PD 1.pdf</i> <i>Hope PD 2.pdf</i>
'Learning & the Brain' <a href="http://www.learningandthebrain.com">www.learningandthebrain.com</a> Conference Poster Boston, MA, USA: November 2011	Recipient of research Scholarship Award, \$5,000 study tour to USA. <i>Award Letter Cert.pdf</i>
Professional development, K-12 school teachers: May 2012	<i>Feedback.pdf</i>
Teacher's Guild of NSW, Annual Poster Presentation Lecture Evening: July 2012. Brief presentation and poster. Selected for award.	Runner-up Research Award 2012 <i>Guild Research Award.jpg</i> <i>Guild Research Poster.pdf</i>
Higher Degree Research Conference: October 2012	<i>HDR Conference 2012.pdf</i> <i>Feedback HDR Conf.pdf</i>

**Table 3.7 Member checking: Individuals with Asperger syndrome**

<b>Presentations Given</b>	<b>Evidence</b>
Support group for people with Asperger syndrome: March 2013	Presentation handout Copies of email with arrangements <i>ArrangementsEG.pdf</i> Feedback and correspondence with a participant <i>Feedback1.pdf</i> Report to supervisors <i>Report for supervisors.pdf</i>

**Table 3.8 Member checking: Life partners of people with Asperger syndrome**

<b>Presentations Given</b>	<b>Evidence</b>
Support organisation for life partners of individuals with AS, 3 hour workshops: July 2010, April 2011, October 2011, May 2012, February 2013, March 2014.	Presentation handout <i>Feedback.pdf</i> <i>120512 Notes on presentations.docx</i>

**Table 3.9 Member checking: Parents**

<b>Presentations Given</b>	<b>Evidence</b>
K-12 school Asperger syndrome parent support group: May 2012	<i>Feedback.pdf</i> <i>120512 Notes on presentations.docx</i>

**Table 3.10 Member checking: Personal consultations**

<b>Formal Consultations</b>	<b>Evidence</b>
MT: regarding adult brother	August 2011, diary entry
Case 5: follow-up consultation	July 2012, diary entry
MO: regarding partner	Meeting May 2012 Extensive email correspondence

Member checking usually involves the submission of data that has been gathered and interpreted back to the participant. In this doctoral study, stakeholder audiences provided the member-checking process. This elicited more than accuracy of the data, instead, stakeholders responded with questions and commentary that offered nothing but positive ‘fit’ for the listeners’ context.

#### **3.14.1.5 *Member-checking by study participants***

Key informant (KI) interviews were designed as a member-checking strategy for the data provided by primary participants (gifted adults with AS) and were conducted, in all but one case (Case 5, where the delay was due to the participant’s health), soon after the primary participant interviews. Notions raised by the primary participants that called for elaboration were discussed with KIs to check and enhance the researcher’s observations and interpretations. Artefacts also played a member-checking role as: they were considered alongside interview data; they supported claims made by the participants; and, they influenced the researcher’s interpretations.

There were two obstacles to be navigated regarding post-interview member-checking of the researcher’s interpretations by the nine study participants. First, participants in four cases specified that either they didn’t want to see their own, or both, they didn’t want their partner or family member to see their transcript or hear the interview recording. In Case 5, copies of the transcripts were given to the primary participant and key informant during the requested follow-up consultation, where they reviewed the transcripts and asked follow-up questions to advance their understanding, so this was the only case where direct member-checking was possible. Secondly, it was not appropriate to undertake member-checking by participants of the category and coding structure as it was based on the research literature and, without knowledge of the literature and the theoretical framework of the study, participants were not in a position to verify that the codes, categories and thematic interpretation were credible and applicable. Furthermore, the literal, concrete, cognitive style of participants with AS mandated against direct member-checking as this study involved theory development. Therefore, the literature was relied upon to guide and authenticate the category and coding structure. *NVivo* project backup files demonstrate the development of the evolving coding structure for the study and are available for audit.

### 3.14.2 Auditability and confirmability

The auditability and confirmability of the study was addressed by: the researcher keeping a reflective journal and a diary from the beginning of the study; the storage of all documentation and digital evidence, such as email correspondence; double-checking by a colleague of interview transcripts with the audio recordings for accuracy; and, a comprehensive backup archive that provides evidence of originality and the developmental course of the study. The files shown in Tables 3.6 to 3.10 (filenames are italicised) contain evidence that the presentations and consultations took place, and give examples of feedback from audience members. This evidence has not been included in the thesis because it necessarily identifies individuals and the inclusion of the identifying information would be a breach of privacy. The complete information, files with names and contact details, will be stored for five years after the conclusion of the inquiry and is available for auditing and confirmation by a competent judge (Guba & Lincoln, 1981).

## 3.15 Limitations

The limitations of this research will be outlined under the headings ‘Generalisability and the heterogeneity of AS’, ‘Number of cases’, and ‘Metacognition’.

### 3.15.1 Generalisability and the heterogeneity of AS

Limitations of this doctoral study related to generalisability are: (a) the findings are based on **gifted** individuals who have particular cognitive features not shared with individuals with other autism spectrum disorders; (b) the perspectives of adults reflecting on past experience may not relate to current school practices or the views of school-aged children and adolescents; and, (c) the inherent heterogeneity of AS presents challenges to the generalisability of findings.

Heterogeneity in autism, and within AS itself (Frith, U., 2004), signifies that the manifestation of autism varies from person to person (Williams, E., 2004), leading some researchers to prefer the term ‘many autisms’ rather than speaking of a spectrum (Amaral, *et al.*, 2008). Focus on gifted people with AS overcame this limitation to an extent by defining the region of the autism spectrum from which participants have been drawn (see Figure 2.3), but, as it is a complex disorder, to differentiate between the

heterogeneity of the condition and personal individuality is an ongoing challenge that must be met by a thorough grounding in the research literature. The underlying mechanisms of autism allow generalisations to be made, as evidenced by the vast literature based on the common features of a diagnosis of autism or AS. There is an implicit acknowledgement of both the commonalities and heterogeneity of AS in Humphrey and Lewis' (2008) discussion citing Norwich and Lewis (2005), who proposed a conceptually layered approach to this problem to facilitate educational problem-solving:

‘[Norwich and Lewis] argue that we can address pedagogic needs in three ways: first, by thinking about those needs that are *common to all*; second, by thinking about those needs that are *specific to group* (e.g. pupils with AS); and third, by thinking about those needs that are *unique to individuals*.’ (Humphrey & Lewis, 2008, p. 41) [italics in original]

The heterogeneity of AS and autism is well established (Motttron, *et al.*, 2006) and is, in itself, acknowledgement of the commonality between ‘autisms’ as heterogeneity is a feature of all autism spectrum disorders. It is, therefore, a reality for any research study of autism. While care must be taken during data analysis to avoid over-generalising at a low-level (between individual cases), distilling themes to inform conceptual understanding with applicability across multiple cases of AS is a legitimate form of theory development (Punch, 1998, 2009) with the precedent having been set by the studies listed in Table 3.2.

### 3.15.2 Number of cases

While the number of cases in this study is small, the design is appropriate for a qualitative research study that focuses on the perceptions, experiences and interpretations of people with AS, while gathering rich, in-depth data. Punch (1998) argued that such case studies can produce generalisable findings if the case is used to conceptualise or develop propositions that can be ‘assessed for their applicability and transferability to other situations’ (p. 154). Punch later stated that:

When generalizability is a goal, and we are focusing on the potential common elements in a case, it is necessary for the analysis of the case study data to be conducted at a sufficient level of abstraction. The more abstract the concept, the more generalizable it is. Developing abstract concepts and propositions raises the analysis above simple description, and in this way a case study can contribute potentially generalizable findings. (Punch, 2009, p. 122)

The aim of this doctoral study was to develop a conceptual framework of understanding of the thinking and learning of gifted people with AS and so a small-scale collective case study approach was suitable for this purpose within the chosen research paradigm.

### **3.15.3 Metacognition**

The third area of limitation is the well-documented problem with metacognition, closely related to theory of mind, for those with AS (Neihart, 2000; Sodian & Frith, 2008; Williams, D., 2010); therefore, the challenge was to locate participants who were able to articulate their thinking processes. There were concerns early-on that recruitment was going to be a particular challenge, however, as the literature later confirmed, many of the individuals who made contact with a view to participating in this research were able to narrate eloquent accounts of their thinking and learning, although the different qualitative characteristics of those accounts became apparent.

Frith and Happé (1999) suggest that those high-functioning individuals who do develop some introspective awareness (many individuals produce elaborate autobiographical accounts) have done so is through a ‘slow and painstaking learning process’ (Frith & Happé, 1999, p. 2), developing a qualitatively different kind of self-consciousness. ... Specifically, participants with Asperger syndrome reported thoughts that were concrete and factually based comprising mainly visual images. Most intriguingly, they did not report any form of inner speech and tended not to report emotions or bodily sensations. This suggests that private self-awareness, like conceptual self-awareness, is qualitatively different in individuals with ASDs. (Lind & Bowler, 2008, p. 178)

The anticipated limitation was not encountered in this doctoral study as participants who volunteered made successful contributions in line with the research design employed. The corroboration of key informants assisted in catering for this potential limitation by providing another perspective on the contribution of participants with AS. However, the findings of this research are limited by the participation of people who are articulate and therefore this study does not present the perspectives of individuals who are unable to articulate their thoughts.

### **3.16 Ethical considerations**

Ethics approval was granted by the University of Wollongong Human Research Ethics Committee to conduct research with adults and young people (14 years and older) according to the research protocol described in this chapter. The Ethics Approval and Renewals are attached in Appendix A.

#### **3.16.1 Treatment of participants**

Potential participants were provided with an information sheet and a consent form. The wording of the information sheet and consent form was based on templates provided by the University. Participants were free to withdraw from the project, including withdrawal of data collected from them, at any time up to publication. Participants were assigned pseudonyms so they would not be identifiable in any publication resulting from the study. Participants under 18 years of age required parental or guardian consent. Location of interviews was negotiated individually with each participant, the choice of location and timing being in the individual participant's full control to facilitate their ease.

#### **3.16.2 Risks and benefits**

There were no anticipated risks to participants. A benefit to participants was offered in the sharing of information about AS in response to questions within the context of a framework that affirms and values the Asperger attributes of intelligence and giftedness. *Pro bono* presentations at schools, support groups and personal consultations were provided as a means of returning a benefit to stakeholders.

#### **3.16.3 Treatment of data**

Pseudonyms were allocated to each participant to protect identity. Transcripts will be held in a locked filing cabinet for five years from the conclusion of the study. The researcher's laptops were password-protected to secure digital data. Some interviews were transcribed by a transcription service and the files were password-protected when they were transported. Data were backed up to external hard drives and DVDs which are kept in the researcher's office. Printouts and notes taken on paper will be held in a locked filing cabinet for the required time to protect the identity of participants.

#### **3.16.4 Publication**

Publication of findings from the research will preserve the confidentiality of the participants and will be by thesis, submission of articles to scholarly journals and by conference presentations.

### **3.17 *Chapter conclusion***

Working within a constructivist paradigm, a qualitative, case-study approach using an interpretative phenomenological analysis framework was chosen as the most appropriate design to investigate the thinking and learning of gifted adults with AS. The research design was modelled on six phenomenological case study reports that used similar designs to investigate social and educational issues in the experience of people with AS. The current study provided first-hand accounts as called for by Gardiner (2008) with the aim of developing a conceptual framework for understanding the thinking and learning of gifted people with AS. Trustworthiness was established through: prolonged engagement with the phenomena under investigation; persistent observation; triangulation of data; member-checks by stakeholder audiences; and, compilation of comprehensive documentation and files to provide an auditable chain of evidence, enabling confirmability by a competent judge.



## Part B

Part B includes Chapters 4 to 8, which contain the descriptions and interpretations of the five phenomenological case studies. As this doctoral study utilises an emergent design, the metaphor of a jigsaw puzzle is apt: through the act of analysis and interpretation, the pieces of the puzzle gradually come together to form a coherent picture. Unlike a traditional thesis, the review of the substantive body of literature is included within the case studies in line with emergent design, while the primary literature that provided the background to this doctoral study was reviewed in Chapter 2.

Five case studies were selected from the sixteen semi-structured interviews that were conducted. The selection of these five as cases was based on: the quality and richness of the data provided by the interviewees; the ability of participants to reflect on their own thinking and learning experiences; the provision of a key informant (in four cases); and, the availability of artefacts.

**Table B.1 Case studies**

<b>Case Number</b>	<b>Pseudonym</b>	<b>Notes<sup>2</sup></b>
Case 1	Kahla – 48 yo female	No key informant
Case 2	Rhoda – female in her 60s	Steve – partner
Case 3	Colin – male in his 50s	Wendy – partner
Case 4	Nadia – 18 yo female	Lydia – mother
Case 5	Riley – male in his 60s	Renae – wife

The cases are sorted by the chronological order of the interviews. One of the issues that became apparent was a sharpening focus on emergent themes of memory and identity, so that the later interviews were more directed towards these themes than the earlier ones. Interviews took place over a year from May 2011 to April 2012. This length of time facilitated the development of ideas across the five cases.

The iterative literature review was conducted in order to develop the framework for understanding the issues raised in the interviews: for example, references to memory within the data required an understanding of memory-and-autism research so that the cases could be interpreted in the light of the existing body of knowledge. The interpretation of data was based on the conceptual understanding embodied in the

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<sup>2</sup> Nomenclature employed aligns with participants' usage

framework, which acted as a summary representation of the literature. The interpretive framework developed over the course of this doctoral study into the conceptual framework that was the theoretical output of the study.

## Chapter 4 Case 1 ‘Kahla’

### 4.1 Introduction

Kahla is a 48 year old married woman. Her husband is the step-father of her two children. Kahla reported that her children’s biological father had received a diagnosis of Asperger syndrome, along with herself, her current husband and her two sons, who were 11 and 13 years at the time of her participation in the research. Both sons were in the same class at the local public school, the oldest having repeated a year of school, and had been placed together in a mainstream class, along with a small group of children with learning difficulties. There was no key informant for Case 1 as key informants were neurotypical adults, usually close family members, who were able to give corroborative and elaborative data for the case. Kahla’s interview was selected as a case despite the lack of a key informant because of the richness of the descriptions of her own and her sons’ thinking, and because she supplied artefacts in the form of an extensive email correspondence that included interpretations of her own, and her sons’, thinking. Kahla’s case illuminates many issues that appear in the research literature, so the literature provides a corroborative perspective.

The broader phenotype of autism, where a genetic connection is expressed through a higher incidence of autistic traits (De la Marche, *et al.*, 2012; Hill & Frith, 2003), even where too mild to merit a diagnosis, is evident in Kahla’s extended biological family. Kahla’s family reveals a pattern of diagnoses of AS and evidence of giftedness. Her two sons have both been assessed using psychological testing procedures that resulted in IQ scores at the high end of the average range. The results were accompanied by the disclaimer that the boys did not fully cooperate with the testing process, meaning that the IQ scores were likely to underestimate the scores that would be obtained through full cooperation. Kahla reported that a number of her immediate family members, her brother, sister, father and nephew, have IQ scores in the superior range, and that her mother is high in autistic traits, moderately expressed. This family appears to typify the broader autistic phenotype.

Kahla is a very verbally fluent and intelligent woman. Through an extended interview and correspondence she gave a credible and detailed account of her cognition and her reflections on the thinking and learning of her sons. She is an accomplished visual artist

and held a solo exhibition in a major regional city in New South Wales in 2013. The themes of her art exhibition were fantasy and imagination. Her artworks display immense richness of colour and texture, as can be seen in the following example (Figure 4.1; see also Figures 4.2 and 4.13).



Figure 4.1 'Garden of Dreams' Photomedia on Harnemuhle cotton rag, A3 size.  
Reproduced by kind permission of 'Kahla'

Discrete issues arising from Case 1 are addressed first under the heading of 'school experience'. Shortly after beginning the analysis of Case 1, it became necessary to acquire a working knowledge of memory in AS: after introducing the analysis of Case 1 in Section 4.2, the memory literature is reviewed in Sections 4.3 – 4.5 and an organisational framework for the literature is proposed (Section 4.6) before returning to the analysis and interpretation of the more complex, interrelated issues of Case 1 in Section 4.7 and following.

## **4.2 School experience**

Kahla is active in advocating for her sons' educational needs but recounts many communication and social difficulties generally and in her relationships with her sons' schools. At the time of the interview, her boys were still in primary school (prior to entering secondary school at the usual age of 12 years in NSW) even though the older boy was 13. They had been to a succession of schools, with a breakdown of relationships (between Kahla, the sons' teachers, and the school leadership) being the trigger for the move to the next school.

In Kahla's experience, the heterogeneity of Asperger syndrome and its expression in individuals with AS is not well understood, with teachers and school leaders imposing their understanding, based on knowledge of typically developing (TD) learners, in lieu of treating each child on the basis of their individual strengths and weaknesses.

K: There is the danger with assuming how Asperger's people learn because, within that diagnosis, there is a variety. And one of the problems is that often we [individuals with AS] do present as being really intelligent ... but, along with that, people make these huge assumptions that it means we can learn equally, and possibly more easily, than other people ... I've had teachers go, 'All Asperger's people are good at maths.' (Interview)

At another point in her interview, Kahla noted that 'on [the autistic] spectrum there's huge individual learning differences' and she made a plea for individual treatment of each learner with AS, set against a background of accurate understanding.

K: And so I would like people to understand in general terms what Asperger's is and then realise that every single person is an individual. So you can't just think, 'Oh, ... children with Asperger's do this,' because we have as much variety as neurotypical people have in a circumstance. But the saddest thing ... is that we usually look quite normal and so people expect things from you and from children ... that are completely unreasonable because there's not an obvious deficit there. (Interview)

The individuality of people with AS, as noted in the research literature, and the injustice of characterising people using stereotyped expectations, is confirmed by Kahla's account. In addition, there is the danger of judgements being made based on knowledge of TD learners alone, inappropriately generalised to learners with AS.

K: A lot of people could just ask the child why they thought that, or why they're doing that, but they don't. They either judge it on their own narrow perception or they judge it basing what they expect of neurotypical children and not children with Asperger's. (Interview)

Kahla's recent experience of her sons' schooling reinforces the needs for teacher professional development in the thinking and learning of gifted students with AS. The following sections (4.2.1 – 4.2.4) are concerned with issues that arose within the context of Kahla's own school experience as well as that of her young sons.

#### **4.2.1 Bullying**

Along with the primary participants in the other four cases of this study, bullying is a major feature of Kahla's experience. Kahla left high school before completing her final

year, despite being an ‘A grade student’, as a result of her ‘social incompetence and the resulting bullying’.

K: By the time I went to high school I was heavily ridiculed and people used to call me ‘witch’ ... I became quite depressed and anorexic ... and I had no idea why I was so bullied. I was pushed down stairs and I was constantly tricked [by] people. I believed **really** ridiculous lies, which everyone thought was just hilarious. (Interview)

Kahla’s sons have experienced bullying from peers and teachers and she seems to accept bullying as inevitable, although she moved her sons to another school when the bullying was severe.

K: [At one school my sons attended, there were] 800 children there. They could not control the bullying, which was severe. I did not blame the school at all because the grounds were huge and there were too many children involved. (Interview)

It is also important to acknowledge within Kahla’s narrative there are signs, while growing up, that her lack of social cognition and subsequent behaviours were construed by others as bullying.

K: And at school, I was called ‘Hammer’ because I would nail the point home. ... this girl, who kind of liked me, said, ‘Oh, why did you say that, you hammer?! ... You’re always doing that, tapping the nail in, if someone bullies you or confronts you. You make it worse. They just come back to give you more’. (Interview)

In line with other first-hand accounts and reports (Attwood, 2000; Humphrey & Lewis, 2008; Huws & Jones, 2008; Jackson, 2002; Monger & Johnson, 2010; Osler & Osler, 2002; Scitutto, Richwine, Mentrikoski & Niedzwiecki, 2012), bullying is a reality within Kahla’s experience. Cappadocia, Weiss and Pepler (2012) suggest that bullying is twice as prevalent among individuals with AS compared to the wider population. Kahla has experienced prejudice, based on other people’s lack of conceptual knowledge of AS, while interacting with teachers and school leaders, including being treated as mentally ill or retarded once she disclosed her own diagnosis of AS.

K: The school ... treated me as if I had a mental illness. They could not comprehend that you could have Asperger’s and be intelligent. To them, Asperger’s meant retarded. ... they spoke to me -- like -- this. ‘Ah -- you -- need -- to -- come -- this -- way -- please’, which was very humiliating and embarrassing. They told other parents that I was retarded ... so no wonder a lot of people not only keep their child’s diagnosis private, to their detriment, but their own. (Interview)

Bullying and the prejudicial views of others have had a formative impact upon Kahla and her sons and continually contribute to their problematic social experiences. One of Kahla's expressed aims in participating in this research study was to support the education of others in order to facilitate accurate understanding of AS cognition.

#### **4.2.2 Learning disorder: A first-hand account of dyscalculia**

Kahla's narrative gives important first-person insights into the nature of her cognitive experience of having a learning disorder in relation to the use of numbers (dyscalculia). This is of great interest for the window it provides into the experience of having a learning disorder.

K: As soon as I get a small bit of maths, it is almost as if it would slide off. It's almost as if I just get a little bit of the information and it slides across [gestures across front of body] so I can't see it. (Interview)

K: Yeah, so I can't [see it], or the information just moves out of my sphere of vision so I can't get it. I have no idea why, and it's frustrated me a lot. (Interview)

Of interest is Kahla's description of the visual experience of seeing and processing information in a numeric symbolic system: the visual symbols appear to be animated and move so as to evade her vision. In contrast, language symbols are visually stable for her: easily read and remembered. This is interpreted as a visual perception and processing problem specific to mathematical symbols. Further, Kahla seems to be describing an inability to develop abstract understanding where number concepts are concerned: she was distracted by non-salient visual features in the learning demonstrations given by her teachers using concrete mathematical materials.

K: In primary school we had Cuisenaire rods. I failed utterly to grasp the concept. I had a great love and flair for colour and was totally confused to discover for some unfathomable reason that two pinks equalled a blue, and a yellow and white equalled a green etc. I had no idea that the rods had any numerical value. I was further confused by the teacher introducing fruit and slicing it in order to demonstrate fractions. I believed there was something mysterious and important about cutting fruit but I failed utterly to grasp what it was! (Email)

In the first example she gave, Kahla perceived each Cuisenaire rod as a single item with its own intrinsic features. She was unable to conceptualise the rods as having any relationship to each other and, as she possesses extraordinary colour perception (Section

4.7.7.2), the colours of the rods were a distraction from the teacher's purpose in using them.

### **4.2.3 Twice exceptionality**

Twice-exceptionality issues are clearly exposed within Kahla's account. At one school, her sons were excluded from smaller-sized special needs classes, where the learning environment was more appropriate for them, because they were judged as having an IQ too high to qualify. Yet, within mainstream classes, they were treated as learning disabled (which Kahla accepts) and were recognised for their deficits. Their strengths were under-recognised within the busyness of multi-age, mixed ability, mainstream classrooms taught by teachers without special-needs expertise. Anxiety and school refusal have resulted from Kahla's sons' keen awareness of teachers' attitudes towards them, experienced via teaching methods that have included shaming. Kahla gave the following example and concluded with the poignant statement, '... there's no real place for them. They're not really catered for.'

K: ...the teacher had a shame-and-name and humiliation method that she openly termed 'The Humiliation Method for Making Children Learn', which made my sons absolutely collapse and [my older son], in particular, just couldn't even get out of bed in the morning. He just refused to go to school and the school didn't have any understanding of him at all. For instance, he was told to draw the school grounds and [he] drew these incredible blue exploding circles over and over again. The school called me down and said, 'We're seriously concerned about your son's mental health. He can't even draw.' And he **could** draw. And so I said, 'Well, that's very unusual. I don't know why he's done those blue circles. Have you asked him?' And they said, 'No. We have not asked him.' ... So they got [my son] and I said, 'Why did you draw these blue circles when you were asked to draw the school grounds?' And he said, 'Because I find architecture boring and I decided that I would draw the beginning of the cosmos instead.' (Interview)

The recognition of twice-exceptional children for their weaknesses alone runs counter to recommendations in the literature on twice exceptionality, which advises that children's strengths be utilised as leverage for their learning (Section 2.6.3). Kahla's account highlights the need for teacher professional development in this area.

### **4.2.4 Uneven cognitive profile**

The Multiple Intelligences framework (Gardner, 2006) facilitates an explanation of twice exceptionality in educational terms, where Kahla's cognitive profile (her strengths and weaknesses) could be mapped, relatively, across the eight domains: linguistic,

logical-mathematical, musical, spatial, bodily-kinaesthetic, naturalistic, interpersonal, and intrapersonal. Such a mapping would show unevenness with logical-mathematical being extremely low while visual-spatial and verbal ability would be very high. Kahla's verbal ability throughout her participation, spoken and written (excluding spelling and punctuation), was superior. Visual ability is evident as, at the time of writing, she had recently held a solo exhibition of her artwork, which display very rich visual imagery, colour and texture. A further example of Kahla's artwork is reproduced here as evidence for her giftedness in this domain.



Figure 4.2 'The Last Wish' Photomedia on Harnemuhle cotton rag, A3 size.  
Reproduced by kind permission of 'Kahla'

A number of researchers have documented the unevenness of the cognitive profile of individuals with AS (Barnhill, *et al.*, 2000; Cash, 1999; Foley-Nicpon, Assouline & Stinson, 2012; Minshew, Goldstein & Siegel, 1997). Uneven cognitive profiles in gifted individuals with AS, such as Kahla, are well recognised, whether measured through psychological testing or evaluated in educational settings by teachers using an MI framework.

### 4.3 **Memory systems: Literature review**

During the interview with Kahla, it became apparent that she has profound differences in her qualitative experience of memory and the meanings she derives from memory. For example, descriptions of her memory that pointed to her heightened perceptual powers led to Kahla wondering if I (the researcher) have a disability (colourblindness)

because, while I could imagine the phenomena she described, she was surprised I could not directly perceive them for myself (Section 4.7.7.2). At this point in the current study, it became necessary to read deeply in the memory and autism literature to explore the differences between the memory of TD individuals and individuals with AS. The literature is essential to an understanding of the nature of memory as described in Kahla's narrative and provided the background for the analysis of Kahla's data that follows, as well as for the other four cases. Therefore, before considering Kahla's data, some further background is necessary: this will take the form of a literature review of the memory, and memory-in-autism, research that is founded upon Schacter and Tulving's (1994) model of human learning and memory. This thesis builds upon the notion that the phenomenon of atypical memory in autism reported by the literature and reflected in Kahla's case, has corresponding associations with the human learning and memory systems of Schacter and Tulving (1994), a conceptual framework of memory that is widely supported by many researchers in the field of memory and autism (Boucher & Bowler, 2008; Bowler, Gardiner & Grice, 2000; Lind, 2010; Magnussen & Brennen, 2011; Markowitsch & Staniloiu, 2011; Tulving & Markowitsch, 1998; Wheeler, Stuss & Tulving, 1997). In addition, sensory sensitivities and enhanced perceptual functioning are a significant cognitive feature of Kahla's account of her thinking, memory and learning, and can best be understood within Tulving's approach.

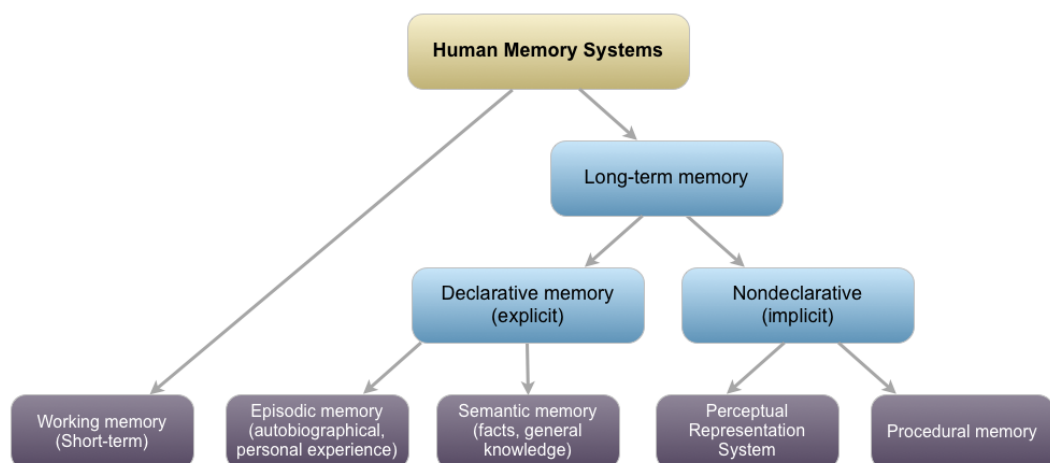
### 4.3.1 Tulving's memory systems framework

Table 4.1 reproduces the memory framework provided by Schacter and Tulving that was translated into the diagram in Figure 4.3.

**Table 4.1 Major systems of human learning and memory (Schacter & Tulving, 1994, p. 26)**

System	Other terms	Subsystems	Retrieval
Procedural	Nondeclarative	Motor skills Cognitive skills Simple conditioning Simple associative learning	Implicit
Perceptual representation (PRS)	Nondeclarative	Visual word form Auditory word form Structural description	Implicit
Semantic	Generic Factual Knowledge	Spatial Relational	Implicit
Primary	Working	Visual Auditory	Explicit
Episodic	Personal Autobiographical Event memory		Explicit

Although semantic memory is described in this table as ‘implicit’ and ‘relational’, more recent memory literature supports the notion of semantic memory as explicit, declarative and ‘single-item’: that is, under conscious control; its processes and content can be verbalised; and, non-relational. The term ‘implicit’ in this context refers to the operation of the memory system as being outside conscious, effortful, mental control. However, implicit memory systems are still **learning** systems, meaning that they respond to training. Since the publication of the table above in 1994, not all writers have agreed upon the precise definition of the terms. Part of the process of interpretation of this doctoral study was the clarification, after wide reading, of the meaning of terms for the purposes of the study. The memory systems approach, with each memory system being served by discrete neural networks, is supported by brain imaging studies from neuroscience, particularly studies of amnesia (Ben Shalom, 2003; Tulving & Markowitsch, 1998). While there is debate about some of the details, for example, ‘relational memory’ is later used to describe a function of episodic memory (Boucher, 2007; Gaigg, Gardiner & Bowler, 2008), and ‘priming’ and ‘conditioning’ are thought by some to be separate memory systems rather than subsumed under procedural or perceptual memory (Magnussen & Brennen, 2011; Markowitsch & Staniloiu, 2011), the model of memory associated with Tulving has been widely adopted in autism research (Gardiner, 2008) and serves as the framework for understanding memory in this thesis. For the purposes of the current study, the memory framework is illustrated by Figure 4.3. The Perceptual Representation System (PRS) is sometimes referred to as ‘perceptual memory’ (Ben Shalom, 2003).



**Figure 4.3 Major systems of human learning and memory**

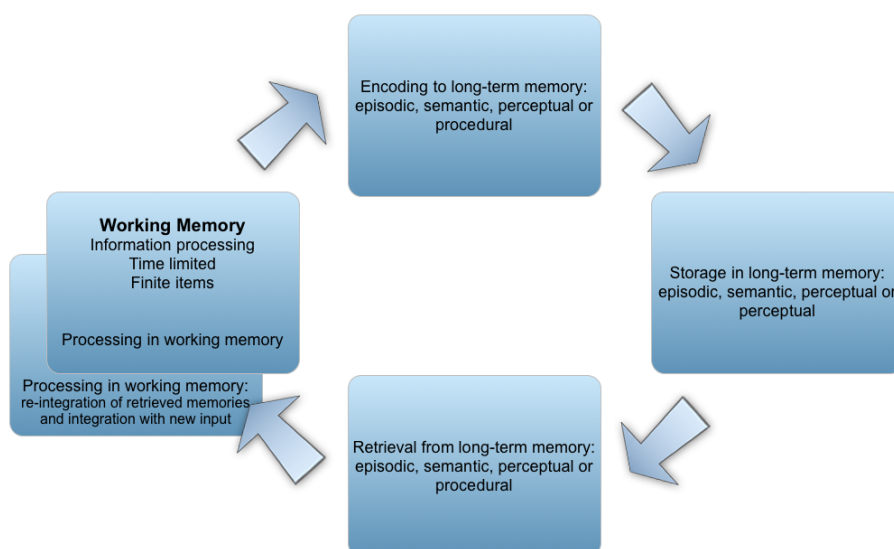
In Tulving's approach, there are five memory systems, three of which are of particular interest because of the accrued body of evidence relating to memory enhancements and impairments in autism (Ben Shalom, 2003; Faran & Ben Shalom, 2008), relevant to the research questions of this study. These three, perceptual, semantic and episodic, are also of interest because of the type of memories native to each system, and the related states of human self-consciousness associated with them (anoetic, noetic and autonotic – see Section 4.4.8). Each of the five memory systems will be described and reviewed next.

### 4.3.2 Working memory

Working memory, where items are held short-term for processing, is the interface through which implicit and explicit long-term memories are encoded and retrieved. Working memory has its own qualitative and neural characteristics (Baddeley, 1994; Boucher, 2007), thus qualifying it as a separate memory system.

...working memory refers to working with memory - this involves not only time-limited online holding of new information, but also retrieving portions of old, already stored information. (Markowitsch & Staniloiu, 2011, p. 18)

Baddeley (1994) defines working memory as 'the system for the temporary maintenance and manipulation of information, necessary for the performance of such complex cognitive activities as comprehension, learning and reasoning' (p. 351). Figure 4.4 depicts working memory as the location of 'online' information processing: it is the interface between embodied thought and long-term memory storage.



**Figure 4.4 Working Memory: the information-processing interface with long-term memory systems**

‘Reasoning’ and ‘processing’ are words used in the literature to describe the type of explicit thinking that takes place in working memory, which, if committed to long-term memory, are encoded into, and retrieved from, one or both of the explicit long-term memory systems. Thus, where researchers use terms such as ‘abstract reasoning’ (Minshew & Goldstein, 2001; Minshew, *et al.*, 2002) or ‘relational processing’ (Boucher, 2012), they are describing the type of thinking that takes place in working memory that is native to one of the memory systems; episodic memory in the case of abstract reasoning and relational processing. The relationship between working-memory processing and the corresponding memory systems is detailed by Baddeley (1994), who used terms such as ‘episodic-learning mechanism’ (p. 353) to encapsulate both the processing and memory elements of conscious thinking and learning. Thus, it is asserted that each memory system has a corresponding type of information processing—for example, ‘perceptual and semantic processing’ (Lopez, *et al.*, 2008, p. 165)—that is enacted in working memory (although, importance was placed on avoiding confusion from uses of ‘semantic processing’ to refer to language processing rather than with a focus on the semantic memory system itself, as clarified by context). Within the executive functions framework, working memory is said to be an executive function and shows some impairment in autism. Working memory limitations in autism may be natively impaired, or they may be a consequence of cognitive load or poor executive function (Poirier & Martin, 2008).

#### **4.3.3 Episodic memory**

Episodic memory is memory for personally experienced events. It is the most complex and late-maturing form of human memory and involves a sense of personal involvement, of ‘warmth and intimacy’ (Vandekerckhove, 2008, p. 16).

The episodic memory systems enables individuals to remember happenings they have witnessed in their own personal past, that is, to consciously recollect experienced events as embedded in a matrix of other happenings in subjective time. Episodic memory is assumed to be the most recently evolved system that has grown out of semantic memory through working memory. (Schacter & Tulving, 1994, p. 28)

Episodic memory is associated with a unique form of retrieval called ‘mental time travel’: one imagines oneself back in the remembered event and re-experiences it (Lind & Bowler, 2010; Perner, Kloo & Stöttinger, 2007; Wheeler, *et al.*, 1997). This memory system is ‘episodic’ in that episodic memories are incomplete (that is, **not** a complete

recording of an event) and subject to change as they are retrieved and re-experienced based on salience and personal meaning: ‘human beings construct and reconstruct their personal memories’ (Markowitsch & Staniloiu, 2011, p. 19). That which is salient and meaningful to a person within their own experience changes over time and is dependent upon factors such as how they feel at the time of retrieval, their purpose in retrieving the memory, and so on.

Temporality is a feature of episodic memory: that is, a personal, subjective sense of one’s place **in** and **over** time including a sense of ‘past self’, ‘present self’ and ‘future self’. The ability to realistically imagine oneself in the future is described as ‘episodic future thinking’ (Lind & Bowler, 2010; Lind, Williams, Bowler & Peel, 2014).

[Episodic memory] is the kind of memory that renders possible conscious recollection of personal happenings and events from one’s personal past and mental projection of anticipated events into one’s subjective future. As such, it is the memory system that mediates mental time travel. (Wheeler, *et al.*, 1997, p. 332)

There are consistent findings that episodic memory is impaired in autism, demonstrated through impaired: temporality; source memory (Section 4.4.2); and, ability to retrieve memories through mental time travel (Section 4.4.8) (Boucher & Mayes, 2012; Bowler, Gardiner & Berthollier, 2004; Bowler, *et al.*, 2000; Williams, D., 2010). Memory in autism is described as being ‘selectively impaired’ (Ben Shalom, 2003; Gardiner, 2001; Zahavi, 2010) because, while episodic memory is impaired, the perceptual and semantic memory systems are spared (or even enhanced), giving rise to a different cognitive profile when compared to TD individuals.

#### **4.3.4 Semantic memory**

Semantic memory is memory for facts and general knowledge about the world (Tulving & Markowitsch, 1998). It is ‘oriented to the present and represents general context-free facts’ and ‘awareness of symbolic representations of the world’ (Markowitsch & Staniloiu, 2011, p. 18); the symbolic representation may be language, numerical or visual. Semantic processing involves mental representation (of, for example, objects or concepts), apart from, or separate to, the physical perception or experience of those things (Tulving, 1985) but without the personal involvement of first-hand experience: for example, knowledge about Paris gained from a book is represented in semantic

memory (Baddeley, 1994); knowledge about Paris gained through visiting is represented in episodic memory.

Semantic memory makes possible the acquisition and retention of factual information about the world in the broadest sense. The knowledge and beliefs about the world that people gain, possess, and use ... is critically dependent upon semantic systems. (Schacter & Tulving, 1994, p. 28)

Semantic memories are 'context-free' or decontextualised, that is, the semantic memory of a fact stands alone without reference to location, time or affect (emotion) (Lind, 2010).

Semantic memory refers to generic knowledge that is context-free (e.g., the name and color of a banana) ... Episodic memory, on the other hand, refers to information that is unique to an individual, is tied to a specific context (e.g., I ate a banana at lunch yesterday), and requires conscious recollection to be retrieved. (Wiggs, Weisberg & Martin, 1998, p. 103)

Language-learning and the use of symbolic representation to mentally represent perceived objects or ideas is a function of semantic memory (Markowitsch & Staniloiu, 2011; Vandekerckhove, 2008). Simple labelling, sorting, matching, classifying and categorisation of objects using a semantic label (for example, 'green objects') is a function of semantic memory as these functions involve detail-focused processing of single items, regardless of context. However, complex categorisation requiring relational processing is handled by episodic memory (see Section 4.3.3).

The serial association of words and ideas ('associative thinking') without an overarching organisational structure as described by Dr Temple Grandin, a world expert on autism, and Kahla (see Section 4.7.2), is, it is reasoned, a function of semantic memory processing. It is noted that, in the literature, the term 'associative learning' is used by some authors to refer to an episodic memory process akin to memory binding (Baddeley, 1994; Johnson & Chalfonte, 1994; Schacter & Tulving, 1994), which is part of the process of concept formation. This is not the linear word/idea association that Temple Grandin and Kahla described. Neither is it 'associative learning' in the sense of Pavlovian conditioning (Esteves, Parra, Dimberg & Öhman, 1994) or the 'simple associative learning' in Table 4.1 Major systems of human learning and memory (Schacter & Tulving, 1994, p. 26), both of which refer to procedural, non-declarative memory. Grandin's use of the term 'associative thinking' is, however, in line with

Tsatsanis (2004), who described explicit ‘associative learning (e.g., stimulus-response learning, paired learning)’ as a relative strength in children and adolescents with high-functioning autism and, it is reasoned, this serial (or linear) phenomenon relies on semantic memory, due to the absence of personal experience and contextual detail involved in the processing and memorisation, while still being an explicit act. Boucher (2007) also uses the term ‘associative learning’ in this sense in the case study of ‘JS’. Clearly, caution must be exercised with the use of the term ‘associative’ as it is used to refer to a number of different memory phenomena. However, the declarative, linear connection between words and ideas, described by Grandin and Kahla, is an instance of semantic processing.

Semantic memory is: (a) unimpaired, or possibly superior, in gifted individuals with autism (Ben Shalom, 2003; Boucher, 2007; Salmond, Adlam, Gadian & Vargha-Khadem, 2008); (b) associated with rote learning, which is intact, or superior, in individuals with autism (Ben Shalom, 2003; Bowler, *et al.*, 2004; Chen, *et al.*, 2008; Crane & Goddard, 2008; DeLong, 2008; Gardiner, 2001; Toichi & Kamio, 2002); and, (c) along with perceptual memory, functionally aligned with detail-focused, bottom-up information processing tasks, which do not require complex mental organisation or use of abstraction strategies for encoding, for example, learning rules and rote memorisation (Minschew, *et al.*, 2002).

#### **4.3.5 Perceptual Representation System**

The Perceptual Representation System (PRS) is also known as perceptual memory. It is implicit (Baddeley, 1994), that is, it does not require effortful thought, and is operational at birth. Therefore, newborn babies have the capacity to process sensory experience and to register those experiences: for example, in the early recognition of the mother’s face or the sensations associated with breast feeding. The baby is a sentient, ‘experiencing being’ who registers his or her experience via the PRS even though he or she has not yet developed semantic or episodic memory systems that confer the capacity to explicitly reason and represent thoughts within memory. Perceptual memory is the most primitive and early developing of the three memory systems under consideration.

Of these three memory systems, the perceptual representation system is clearly the most basic – a limbic (probably rhinal cortex) representation of ‘raw’, nondeclarative, perceptual and cognitive information. (Ben Shalom, 2003, p. 1130)

Adults with dementia that spares the PRS retain implicit cognitive capacities relating to recognition and familiarity, even though the semantic-memory representation through language (of an item, notion, concept, person or relationship), or the episodic-memory representation from previous encounters with the item (or notion, concept, person or relationship), is no longer available to them.

Patients with semantic dementia, who lose the capabilities for language and semantic memory, may still be able to distinguish, for example, an apple from a peach or pear without the need to access semantic information, by accessing perceptual representations of information via the perceptual memory system. (Markowitsch & Staniloiu, 2011, pp. 18-19)

Even when the more complex memory (and processing) systems are impaired through injury or disease, a person continues to be a sentient, experiencing being, although they are limited in the type of self-consciousness they experience (Section 4.4.8). Perceptual memory may be associated with judgements of familiarity: that is, an item is recognised as either being familiar or not, without being named or recalled from previous experience (Markowitsch & Staniloiu, 2011). It is consistently reported within the reviewed literature that perception is intact or enhanced in autism (see, for example, Blakemore, *et al.*, 2006; Boucher, 2007; Crane, Goddard & Pring, 2010) (see also Section 4.5).

#### **4.3.6 Procedural memory**

Procedural memory is memory for encoded automatic motor routines and skills (Markowitsch & Staniloiu, 2011) and was not a significant feature arising from the data of this doctoral research. It is not one of the three long-term memory systems of interest and will not be reviewed in detail.

#### **4.4 *Crucial conceptual characteristics of memory: Literature review***

There are other kinds of memory, described in the literature using terms such as ‘source memory’ or ‘single-item memory’, that are not memory systems. Instead, they represent characteristics of one of the memory systems that are essential to an understanding of the selective impairment of memory in autism.

#### 4.4.1 Single-item memory

Semantic memory is described by some writers as ‘single-item’ or ‘item-specific’ and correlates with low-level, bottom-up or detail processing (Boucher, 2007; Lind, 2010). Low-level processing is characterised by lack of organisational strategies or contextual information to assist or enhance memory encoding and retrieval. Other writers contrast single-item or item-specific memory with relational memory or memory binding (Gaigg, *et al.*, 2008; Johnson & Chalfonte, 1994), which is a function of the episodic memory system. Single-item memory is a notion that helps distinguish the lower-level processing of semantic memory from the complex information processing of episodic memory and is an important point of difference between semantic memory and episodic memory.

#### 4.4.2 Source memory

Episodic memories are rich with encoded contextual information, which is described as ‘source memory’: spatial (location), temporal (subjective time), affect (emotion) (Markowitsch & Staniloiu, 2011; Vandekerckhove, 2008), as illustrated in Figure 4.5. Source memory is ‘memory for the particular situation in which a fact was learned’ (Ben Shalom, 2003, p. 1133).

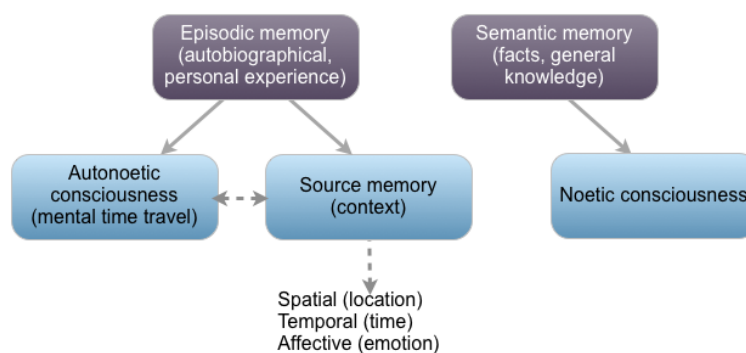


Figure 4.5 Source memory: memory for the spatial, temporal, affective context of events

Source **monitoring** is the mental processing of information about the source of the memory, which is encoded, along with the event, in episodic memory. Source monitoring confers attribution capacity to episodic memories.

Source monitoring refers to the set of cognitive processes involved in recalling the origins of memories, knowledge and beliefs ... discriminating between memories of internally generated information vs. memories of externally generated information (e.g., ‘Did I say that or did Jack say that?’) ... discriminating between memories of at least two externally derived sources (e.g., ‘Did Jack say that or did Jill say that?’) ... ability to discriminate

between at least two types of internal or self generated memories ('Did I say that or only think that?'). (Hala, *et al.*, 2005, p. 75)

Source memory and monitoring is impaired in individuals with autism and AS (Bowler, *et al.*, 2000; Hala, *et al.*, 2005; Lind, 2010). A close relationship between autonoetic consciousness and source memory has been reported (Bowler, *et al.*, 2004) and source memory is a function of the episodic memory system (Ben Shalom, 2003; Lind & Bowler, 2010; Wheeler, *et al.*, 1997).

#### **4.4.3 Temporality and temporal processing**

Temporality is defined as a personal sense of subjective time that is foundational to a sense of self: past self, present self and future self. Elements of temporality in relation to AS are noted within the literature and have an impact upon thinking and memory (Lind & Bowler, 2010; Tulving, 2002; Vandekerckhove, 2008; Zukauskas, Siltan & Assumpcao Jr., 2009). The impact of temporal processing deficits upon thinking and language has been described (Perkins, Dobbinson, Boucher, Bol & Bloom, 2006). In writing about the subjective stance and use of third person terms when referring to self, Perkins *et al.*, stated:

... deficits of temporal processing would cause problems in the acquisition of those temporal concepts which cannot be rote learned (e.g. *soon, before, first*—as opposed to *Wednesday, 4 o'clock, 2004*). This would in turn cause impaired acquisition of concepts with shifting referents, especially deictic temporal terms such as 'now', 'today', 'tomorrow' etc. (Perkins, *et al.*, 2006, p. 796) [italics in original]

Problems with relative temporal terms in speech also indicate an issue with the temporal processing necessary for the theory of mind mechanism. Shifting between different mental states requires the capacity to concurrently represent mental states from different moments in time, as well as the perspectives of another person. The temporal aspect of ToM is illustrated by the false photograph theory-of-mind task, shown in Figure 4.6.

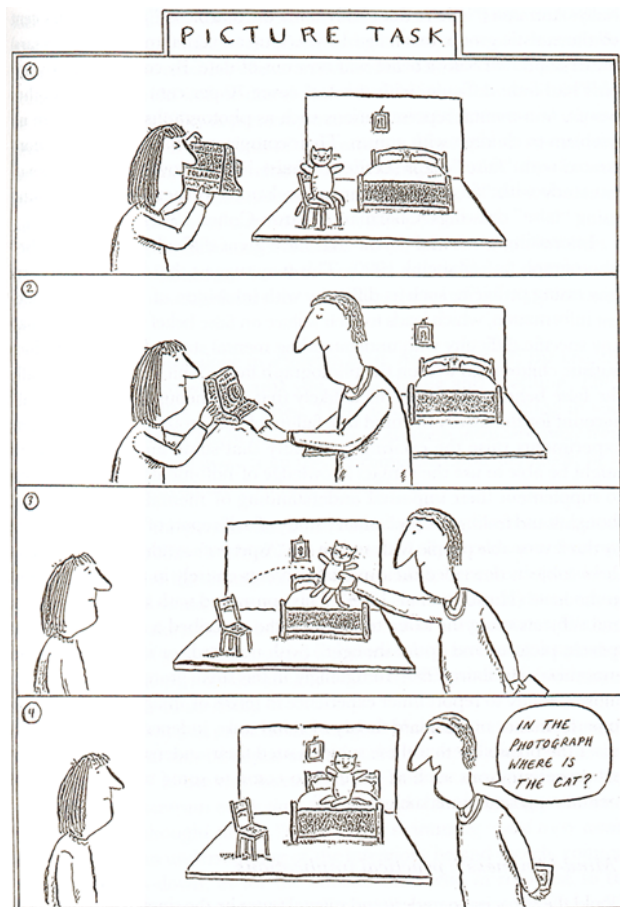


Figure 4.6 The false photograph task (Happé, 1994, p. 47)

In Figure 4.6, a child with poorly developed ToM and temporal processing is unlikely to be able to discriminate between their own current knowledge of the cat's present location ('on the bed') and the previous location ('on the chair'), represented in the polaroid photograph being held out of sight by the researcher. This task demonstrates that the capacity to flexibly shift between two perspectives, known as 'set-shifting' (Van Eylen, *et al.*, 2011), is affected even when those two perspectives, which may be only minutes apart, **are different knowledge states in the same person.**

Reduced temporal processing capacity and subjective stance have an impact upon mindset shifting and are components of the ToM capacity. Wheeler, Stuss and Tulving (1997) drew upon the literature to show that the temporal processing of episodic memory negatively impacts upon executive functions (planning, sequencing, goal selection, anticipation, behaviour monitoring, and so on) when there are episodic memory deficits as these are mental processes with temporal elements. Beyond episodic memory functions, other temporal processing issues are noted in the literature. 'Temporal binding' refers to the timely integration of incoming signals to the brain

from the different sensory modalities. A number of authors (Brock, Brown, Boucher & Rippon, 2002; Stevenson, *et al.*, 2014) assert that temporal binding difficulties in autism operate at multiple levels: across neural networks; within neural networks; and, multimodal sensory integration; with a cascading effect on the higher-order processes of language productive and central coherence. Therefore, the neurobiological aspects of temporal processing **and** the phenomenon of ‘temporality’ (Zukauskas, *et al.*, 2009) are both likely to be adversely affected in gifted individuals with AS.

#### **4.4.4 Relational memory**

Relational memory is a distinguishing feature of episodic memory (Markowitsch & Staniloiu, 2011; Sluzenski, Newcombe & Kovacs, 2006). Relational memory is the capacity to draw relationships between items or ideas and to ‘bind’ them together ‘to form new memories’ (DeLong, 2008, p. 108).

Remembering an episode ... involves bringing together information that has been registered in different modalities, in different parts of the brain, some of which is new (a first sight of the Eiffel Tower) but some of which is not new (knowing from pictures what the Eiffel Tower looks like). Because it involves bringing together diverse information, episodic memory is sometimes referred to as ‘relational’ memory. (Boucher, 2007, p. 261)

Memory binding is a ‘constructive process’ (Lind & Bowler, 2010, p. 897). It is reasoned for the purposes of this thesis that relational memory is central to abstract thinking and it is noted that a relationship to executive function in the autism literature is observed. It is further reasoned that relational memory relies on ‘simultaneous processing’ (DeLong, 2008; Goldstein, 2009): being able to hold two or more ideas in working memory and to switch attention between them in order to dynamically process relationships. Executive control of attention is said to be impaired in AS (Nyden, Gillberg, Hjelmquist & Heiman, 1999; Van Eylen, *et al.*, 2011). Attentional control is said to be an executive function, leading to the proposition that executive functions are themselves examples of complex or top-down processing (Hill & Frith, 2003). Relational memory can therefore be associated with: complex reasoning, abstract thinking and top-down processing (Meyer & Minshew, 2002); meaning making (Crane, *et al.*, 2010); and, concept development and central coherence (Minshew, *et al.*, 2002). Relational processing is contrasted with item-specific processing (Gaigg, *et al.*, 2008).

Given that episodic memories involve multiple features, the features comprising an episode must be linked together at encoding to form a **coherent** or ‘bound’ representation (Chalfonte & Johnson, 1996). Thus, featural or relational binding plays a key role in episodic encoding. Correspondingly, episodic retrieval involves bringing multiple features together in order to re-construct a **coherent** event representation (Baddeley, 2000). (Lind, 2010, p. 433) [emphasis added]

Through the construct of relational memory, a connection with the executive function and weak central coherence accounts of autism (note the use of the word ‘coherent’ above in the sense of ‘central coherence’) becomes apparent that facilitates a mapping of these features of autism onto Tulving’s learning and memory systems (Section 4.6).

#### 4.4.5 Autobiographical memory: Refining the concept

Autobiographical memory was originally associated with the episodic memory system. However, the semantic memory system has a role to play in autobiographical memory and this assists in understanding the interplay between the semantic and episodic memory systems in memory and learning. While episodic memories are memories of personal experience, facts **about** oneself are an important facet of autobiographical memory. An example is one’s name (a stand-alone fact stored in semantic memory) contrasted with a memory of being called by name (context-rich event stored in episodic memory). Markowitsch and Staniloiu use the term ‘Episodic-autobiographical memory’ (EAM) to distinguish episodic remembering from autobiographical factual knowledge.

Nowadays episodic memory is defined as the conjunction of subjective time, autoegetic consciousness and the experiencing self and subsequently the episodic memory system is currently viewed as being equivalent to the episodic-autobiographical memory system (EAM). Though the term autobiographical is still at times used interchangeably with the term episodic, not all the components of autobiographical memory, however, have an episodic quality. (Markowitsch & Staniloiu, 2011, p. 19)

Lind (2010) has proposed the existence of **non**-autobiographical episodic memory, for example, remembering what was in the newspaper you read this morning, but this finer point of **how** the facts were committed to memory has not been widely taken up in the literature. However, she has successfully highlighted the complex nature of autobiographical memory and the involvement of semantic memory, even for personal memories.

Autobiographical memory refers to memory for information pertaining to the self and is often considered to be synonymous with episodic memory (Gilboa, 2004). However, the term ‘episodic’ refers to a distinct type of memory system, whereas the term

‘autobiographical’ refers to a particular type of memory *content*. Indeed, both the episodic and semantic systems are capable of processing autobiographical content. (Lind, 2010, p. 431) [*italics in original*]

Lind’s distinction between autobiographical and non-autobiographical memory and the interplay of episodic and semantic memory in coding and retrieval of explicit memories is illustrated in Figure 4.7 and provides good examples of ‘remember’ and ‘know’ responses (see Section 4.4.8 for a description of the ‘remember’ responses of autonoetic consciousness and the ‘know’ responses of noetic consciousness).

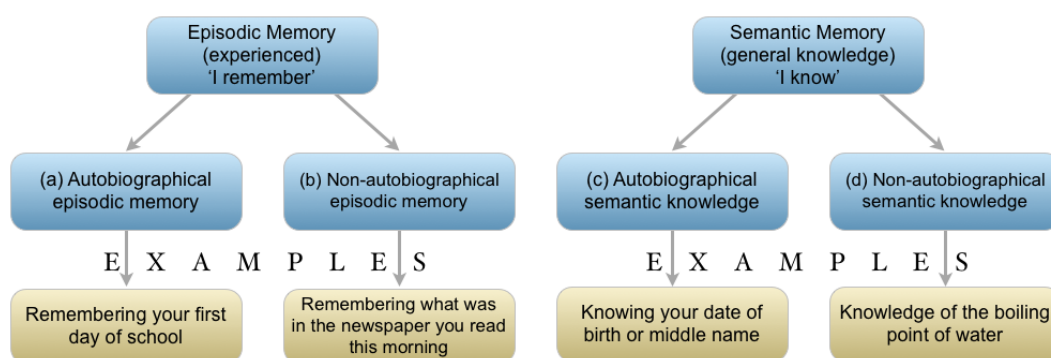


Figure 4.7 Autobiographical memory according to Lind (2010, p. 431)

However, Markowitsch and Staniloiu (2011) dispute the category of (b) Non-autobiographical episodic memory. This researcher concurs with them that a separate category for (b) is confusing as, in the example given, it depends upon **how** the content of ‘the newspaper you read this morning’ was encoded: if it is remembered by an act of mental time travel, then it is episodic ‘remembering’; if it is remembered by rote memory or eidetic memory, then it is semantic ‘knowing’; or, it may possibly be recalled by a combination of both types of memory processing, reinforcing each other. Therefore, along with Markowitsch and Staniloiu, this doctoral study accepts that autobiographical memory is a function of episodic memory and semantic memory as represented by (a) and (c) in Figure 4.7, without subscribing to the notion of (b) non-autobiographical episodic memory.

#### 4.4.6 Interplay between explicit memory systems during learning

In the current educational climate in Australia, high value is placed on the role of first-hand, authentic experience, which is contrasted with rote memorisation. Rote memorisation is a function of semantic memory, while memory for first-hand

experience is a function of episodic memory. The interplay between memory systems for retrieval of first-hand memories is well described by Cabeza and St Jacques.

Episodic memory refers to remembering unique past events together with their associated contextual details and involves autonoetic consciousness, the capacity for mental time travel. By contrast, semantic memory refers to knowing facts about the world and about our life that is associated with noetic consciousness. Autobiographical memories (AMs) are an integration of episodic and semantic contents. For example, the AM of a birthday party might include a vivid image of the cake and the people singing around the table (episodic memory) intermixed with knowledge about the date of the birthday and the standard sequence of events (script) of a birthday party (semantic memory) ... **Episodic and semantic contents in AM dynamically interact during memory construction.** (Cabeza & St Jacques, 2007, p. 222) [emphasis added]

The dynamic interaction of memory systems during thinking, memory and learning in the way described is a key understanding for educators in the light of selective impairment of those systems in autism. It is proposed that Kahla and the other cases in this doctoral research are using their considerable intellectual resources to compensate for diminished aspects of episodic memory, relying on superior perception and semantic memory and that this constitutes authentic learning when their cognitive profile is taken into account.

#### **4.4.7 Self-referential processing**

Autobiographical memory plays a key role in the development of a sense of identity (Wilson & Ross, 2003), with ‘self-referential processing’ understood to be a factor that accounts for differences in identity formation between individuals with AS and TD individuals: self-referential processing is impaired in individuals with autism. The ‘self-referencing effect’ is described as ‘typical individuals show[ing] enhanced memory for information that is self-relevant or encoded in relation to the self’ (Lind, 2010, p. 441). Self-referential processing is not only foundational to a sense of self but is also integral to the way individuals process information about the world: that is, incoming perceptual information is processed in relationship to oneself and one’s own perspective. Self-referential processing is advantageous for memorisation compared to no self-referencing (material that is meaningless to the memoriser). Perner (2000) ventures the notion that episodic memory is a ‘self-referential mental state’ (p. 300). For educators, the broader implications of this finding are self-evident: personal engagement and active meaning-making have long been recognised as contributing to deeper learning.

A number of authors have concluded that the self-referential processing effect is diminished in autism (Crane & Goddard, 2008; Crane, *et al.*, 2010; Tanweer, Rathbone & Souchay, 2010; Toichi, 2008) due to the different patterns of activity and under-connectivity of the neural networks that serve this type of processing (Lombardo, Barnes, Wheelwright & Baron-Cohen, 2007; Mundy, Gwaltney & Henderson, 2010; Northoff, *et al.*, 2006). In memory terms, self-referential processing translates to ‘self-referenced memory’ (Mundy, *et al.*, 2010, p. 420). Autobiographical memory is dependent on self-referential processing: ‘Self-referential processing is an integral, defining component of AM [autobiographical memory]’ (Cabeza & St Jacques, 2007, p. 220). A study reviewed by Cabeza and St Jacques found that autobiographical memory tasks involved more self-referential processing compared to a semantic memory task. According to Northoff, *et al.*, (2006), self-referential processing affects every aspect of identity and their list of ‘domains of the self’ (pp. 446-447) ties together many of the seemingly disparate features of Asperger cognition: verbal, spatial (the physical body), memory, emotional, facial, social, and a sense of personal agency.

Most authors emphasise the particular role of the self-referential effect in episodic autobiographical memory, as in the following:

On the brain level these EAM [episodic autobiographical memory] developmental changes in humans (from infancy to early adulthood) are reflected in the extensive structural and functional reorganization of different components of the neural networks supporting EAM, autonoetic consciousness and self-referential processing, ToM [theory of mind] capacities and ability for emotional regulation (Shing *et al.*, 2010). (Markowitsch & Staniloiu, 2011, p. 17).

Northoff and colleagues offer a hierarchical model showing the mediating role of self-referential processing between perceptual input and ‘higher-order processing’ (Northoff, *et al.*, 2006, p. 450). The purpose of their study was to locate the neural networks that serve self-referential processing, however, the main interest of that study for the current study is: (a) the significant role that self-referential processing plays in higher-order cognitive processes; (b) the processing **hierarchy** of lower (sensory) to higher, which correlates with the theory of central coherence (see also Plaisted, Saksida, Alcantara & Weisblatt, 2003); and, (c) the association of top-down modulation and bottom-up modulation with that processing hierarchy. Insights from Northoff’s paper clarified many references in the memory literature and assisted with the task of mapping the

explanatory theories of autism to Tulving's memory systems as a step along the path of developing a coherent framework for teacher professional development (Section 4.6).

Self-referential processing is a key aspect of episodic memory, affecting the encoding and retrieval of memories for personal, autobiographical experiences and events. There is wide agreement in the literature that self-referential processing is related to identity formation and is affected in autism: **individuals with autism do not benefit from the memory advantage of self-referencing** to the same extent as TD individuals. This thesis proposes that impaired self-referential processing in AS is the 'other side of the coin' to the externally oriented focus of cognition in AS (Section 4.8.5).

#### 4.4.8 Memory, consciousness and identity

As noted in Section 4.3.1, each memory system is hallmarked by a corresponding form of human consciousness. The form of consciousness ascribed to the perceptual memory system is 'anoetic awareness', semantic memory is described as having 'noetic awareness', and episodic remembering is described as having 'autonoetic awareness' (Tulving, 1985).

In line with Tulving's (2002, 2004) conceptualization, we use anoetic consciousness for almost always implicit experiential and procedural memory, noetic consciousness for semantic memory—context-free facts of the world—and autonoetic consciousness for consciousness related to episodic memories, context-rich events that are often of an emotional and time-related character. However, in addition to this present theorizing, we also point to the importance of a first sort of "self-experience" or self-consciousness apparent at an anoetic level. Children, we suggest, already very early in development, develop an implicit awareness of their own organism and of its influence on the surrounding world. Even though they are still not capable of reflecting on the perceptual origin of their own knowledge, they possess already very early, implicit experiential information about themselves (as we call it: 'anoetic self-consciousness') or a sense of self and identity. (Vandekerckhove, 2008, p. 5)

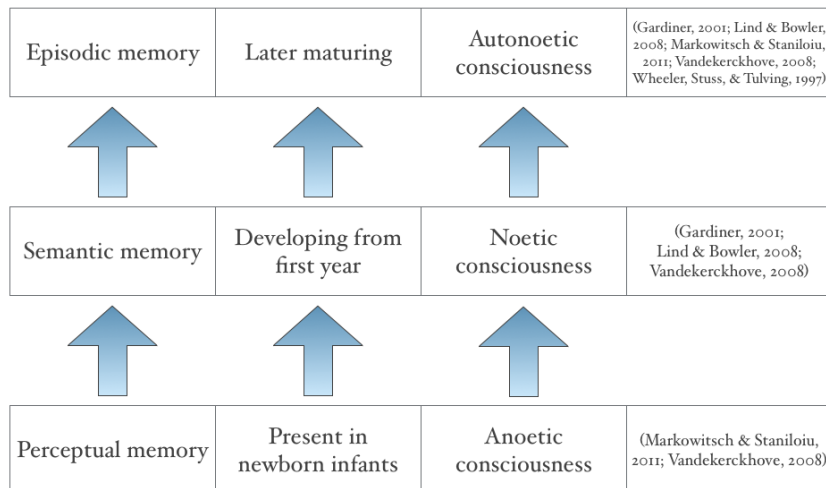
Anoetic consciousness is 'non-knowing', that is, it is 'implicit'. In earlier psychology, terms such as 'sub-conscious' or 'unconscious' were used but, in recent memory research, anoetic consciousness is viewed as a form of awareness, rather than the absence of awareness that is implied by 'unconscious'.

Anoetic consciousness is a kind of procedural, sensory, and primary affective level consciousness along the continuum of consciousness. It is based on information that one can act upon without bringing this information into explicit awareness ... a continuous stream of affective sensory input ... As a neurophysiological state it is only accessible in

awareness as the simplest non-reflective ‘stream of experience,’ determined by the immediate and continuous flow of events in the here and now. (Vandekerckhove, 2008, pp. 13-14)

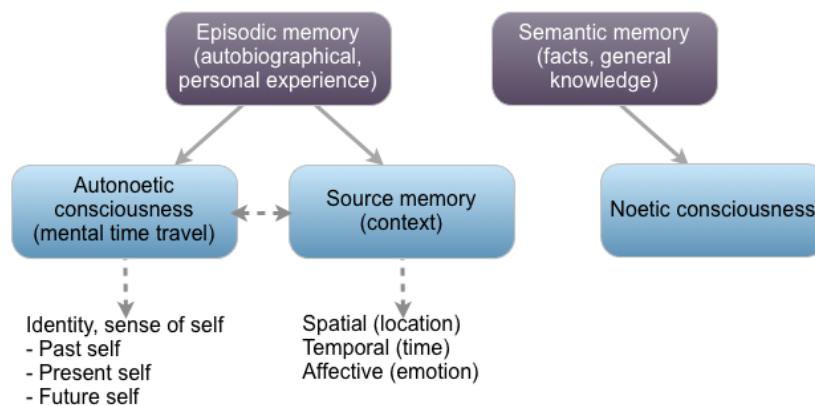
Noetic consciousness is the form of consciousness associated with semantic memory (Gardiner, 2008). Autonoetic consciousness is the highest form of human self-consciousness and is associated with episodic memory (Markowitsch & Staniloiu, 2011). Additionally, ‘knowing’ and ‘remembering’ are technical terms that indicate the qualitative characteristics of explicit memory retrieval from, respectively, semantic memory and episodic memory. For instance, one can ‘know’ one had a birthday party for one’s tenth birthday: this would involve remembering facts about the party such as the names of the guests who attended; or, one can ‘remember’ one’s tenth birthday party: this would involve the type of self-consciousness (autonoetic) that experiences a reconstruction of the event in imagination, known as ‘mental time travel’. In an oft-quoted scenario (Baddeley, 1994; Boucher, 2007; Gardiner, 2001), one can ‘know’ that Paris is the capital city of France without having been there (for example, through a documentary or book), but, for the person who has been to Paris, they both ‘know’ and ‘remember’ Paris: episodic re-experiencing is context-laden with emotion and subjectivity in a way that semantic memory retrieval is not. Memories are ‘native’ to their respective memory system as the act of memory retrieval requires the form of consciousness (anoetic, noetic or autonoetic) that is specific to that system.

Relying on the memory systems framework of Schacter and Tulving (1994), researchers have supported the notion of a hierarchy, both developmentally and of complexity, within the long-term memory systems (Gardiner, 2001, 2008; Lind & Bowler, 2008; Markowitsch & Staniloiu, 2011; Tulving, 2001; Vandekerckhove, 2008; Wheeler, *et al.*, 1997). Perceptual memory is a more primitive memory system than the semantic memory system, and is functioning at birth (Vandekerckhove, 2008). The semantic memory system relies on perceptual memory, emerges in the second year of life (Vandekerckhove, 2008) and is a prerequisite for development of the episodic memory system. The episodic memory system is later maturing, becoming evident around four years of age (Lind & Bowler, 2010), and is the most complex form of human memory (Gardiner, 2008). The hierarchy of memory systems and consciousness, with indicative references, is illustrated in Figure 4.8.



**Figure 4.8 Hierarchy of learning and memory systems and their associated forms of consciousness**

With theoretical understanding of the relationship between information processing, the operation of memory, and the associated forms of self-consciousness, the issue of personal identity comes into focus. Identity emerged as a major theme in Case 1, as predicted for many IPA studies (Brocki & Wearden, 2006; Smith, 2004). Figure 4.9 shows two of the five memory systems with some elaboration to show the relationship of memory to identity: autonoetic (‘self-knowing’) consciousness is the experience of explicit self-awareness. Source memory is a feature of episodic memory that is related to autonoetic consciousness: it confers attribution of personally experienced memories; and, it embeds contextual information (spatial, temporal and affective) as characteristics of those memories. The temporal aspect of episodic memories is evident in the notion of mental time travel, which is the capacity that enables a sense of the self ‘in time’: past, present and future self. In the memory systems, autonoetic consciousness is contrasted with noetic consciousness, which is the type of explicit consciousness associated with semantic memory.



**Figure 4.9 Identity as a component of autonoetic consciousness**

As shown by the relationships in Figure 4.9, episodic autobiographical memory and autoethic consciousness play ‘an important role in the construction of personal identity’ (Wilson & Ross, 2003, p. 137). An investigation into autoethic consciousness in Asperger syndrome found that participants relied more on semantic memory ‘knowing’ recall of events in their lives, and less on episodic ‘remembering’ of personal events (Tanweer, *et al.*, 2010). Similar findings have been reported by other researchers (Crane, Goddard & Pring, 2009b; Hare, Mellor & Azmi, 2007; Lind & Bowler, 2010; Williams, D., 2010). In the face of atypical episodic memory and diminished autoethic consciousness, there is increased reliance by individuals with AS on semantic memory for memory of personal experiences, supported by intact or superior perceptual representation, impacting upon identity formation.

#### **4.5      *Enhanced perceptual functioning: Literature review***

Within education, there is a tendency to negatively ascribe the label of ‘sensory sensitivities’ to the same phenomenon that is elsewhere positively characterised as ‘enhanced perceptual functioning’. Therefore, if an individual experiences overwhelming sensory input that disrupts their social function, it may be described as ‘sensory sensitivities’; if an individual exhibits capacities or gifts based on the same perceptual processes, it may be attributed to ‘enhanced perceptual functioning’. In support of this statement, see Mottron (2011), who proposed the theory of enhanced perceptual functioning in autism, for a discussion of bias in the way autistic sensitivities are reported. For the purposes of the current study, it was concluded that sensory sensitivities and enhanced perceptual functioning in autism are closely related, although these two themes appear separately in the literature. It is accepted that sensory sensitivities are the experiential outworking of brain activity and connectivity that also confer enhanced perceptual functioning. In this way, sensory sensitivities, which were not previously accounted for in the theoretical framework (although each of the four major theories contributes to an understanding of sensory sensitivities), is satisfactorily accounted for via enhanced perceptual functioning, allowing it to be mapped to the memory systems theory of Tulving.

##### **4.5.1      Sensory integration and sensory sensitivities**

The impact of sensory sensitivities on the thinking and learning of gifted students with AS is widely reported (Betts, Betts & Gerber-Eckard, 2007; Gere, Capps, Mitchell,

Grubbs & Dunn, 2008; Jacobsen, 2003). Sensory issues in autism may take the form of hypersensitivity or hyposensitivity (Blakemore, *et al.*, 2006; Crane, Goddard & Pring, 2009a; Jennes-Coussens, *et al.*, 2006; Mottron, *et al.*, 2006). Problems with the integration of sensory inputs is understood to be the basis of sensory sensitivities (Minshew & Hobson, 2008; Minshew & Williams, 2007; Paton, Hohwy & Enticott, 2012). Sensory issues are reported as being the cause of many problems for individuals with autism (Attwood, 2007; Kunc, 2003; Lovecky, 2004; Prior, 2003; Tantam, 2003) and this is certainly supported by Kahla's account. Accounts of well-known individuals with AS, such as Glenn Gould and Temple Grandin, include descriptions of sensory sensitivities (Arsenault, 2000; Attwood, 2007; Boso, *et al.*, 2010; Minshew & Hobson, 2008). Gifted children, including those without autism and ADHD, are reported to have heightened sensory sensitivities (Gere, *et al.*, 2008; Lovecky, 2004). Keane (2004) reported 'early-arising and pervasive impairments in sensory processing' (p. 8) from first-hand accounts of individuals with autism. Sensory issues can disrupt social interaction and are considered a contributing factor to impaired development of social cognition (O'Connor & Kirk, 2008). Sensory sensitivities in autism indicate altered perceptive processes, as noted in this commentary on first-hand accounts.

Most writers comment on the disruptive effect their sensory problems have on sustaining social engagement. Not only do they report that they are hyper- or hypo-sensitive to everyday sounds, smells, tastes, lights and textures ... they also comment that they actually perceive things ... differently... (Williams, E., 2004, pp. 712-713)

Sensory integration issues experienced by individuals with high-functioning autism pertain to 'both basic perceptual functions and ... higher-order processes' (Brandwein, *et al.*, 2013, p. 1329), pointing to the broad impact of sensory integration problems for different memory systems, not just perception. Sensory issues, while being a disadvantage in some environments, may result from functional neural connectivity that simultaneously contributes to the giftedness of the individual (Boso, *et al.*, 2010).

#### **4.5.2 Enhanced perceptual functioning in autism**

Perceptual processing differences, impairments and enhancements, have been a feature of autism since the earliest descriptions: 'perception plays a different and superior role in autistic cognition' (Mottron, *et al.*, 2006, p. 39).

Dating from the earliest clinical observations (Kanner, 1943), atypical perceptual processing has been documented widely in autism spectrum disorder (ASD; Ben-Sasson

et al., 2009). Perceptual differences likely play an important role in complex behavioral, social, and cognitive deficits that define ASD (Zwaigenbaum et al., 2005; Mottron et al., 2006; Samson et al., 2011). ... Both visual impairments, such as face perception deficits (Simmons et al., 2009), and enhancements, such as superior perception of local visual features (Dakin and Frith, 2005) and enhanced visual search (Plaisted et al., 1998; Joseph et al., 2009), have been observed. (Foss-Feig, Tadin, Schauder & Cascio, 2013, p. 8243)

Sensory sensitivities and enhanced perception were not part of the diagnostic criteria for autism until the publication of the *DSM-5* (APA, 2013) and did not find a theoretical ‘home’ among theories of autism until 2006, when Mottron and his colleagues proposed the ‘enhanced perceptual functioning’ theory of autism (Gastgeb, Dundas, Minshew & Strauss, 2012; Gastgeb, Wilkinson, Minshew & Strauss, 2011). Both the social disadvantages and the advantages of enhanced perception were noted.

As a part of superior perceptual functioning, a superior perceptual trace was believed to be responsible for enhanced memory of the surface properties of visual and auditory patterns. Some positive symptoms, such as the apparent hypersensitivity to noise, represented the detrimental effect of discrepancies between autistic and non-autistic processing of perceptual information. (Mottron, *et al.*, 2006, p. 28)

Elsewhere in the same report, Mottron *et al.* related enhanced perceptual functioning to the theory of weak central coherence (WCC) in autism, thereby suggesting a relationship between Tulving’s memory system approach and the WCC account. Wallace and Happé (2008) also related perceptual abnormalities in ASD to the central coherence account of autism and, along with Mottron and others (see also, for example, Baron-Cohen & Belmonte, 2005), shifted the focus to the potential strengths of this cognitive profile.

A number of theoretical accounts now focus on superior processing of perceptual elements (Mottron, Dawson, Soulières, Hubert, & Burack, 2006), increased discrimination (Plaisted, 2001) and imbalance between local and global processing (Happé & Frith, 2006), which may play a part in superior performance on certain perceptual tasks by ASD groups, and the high rates of savant skills in ASD (Heaton & Wallace, 2004). (Wallace & Happé, 2008, p. 448)

The research literature on enhanced perceptual functioning provides a comprehensive theoretical understanding of the role of sensory sensitivities in autism and was therefore included as a fifth explanatory theory for this research, alongside theory of mind, executive function, central coherence and amygdala theory. The theoretical framework was updated accordingly and is shown in Figure 4.10.

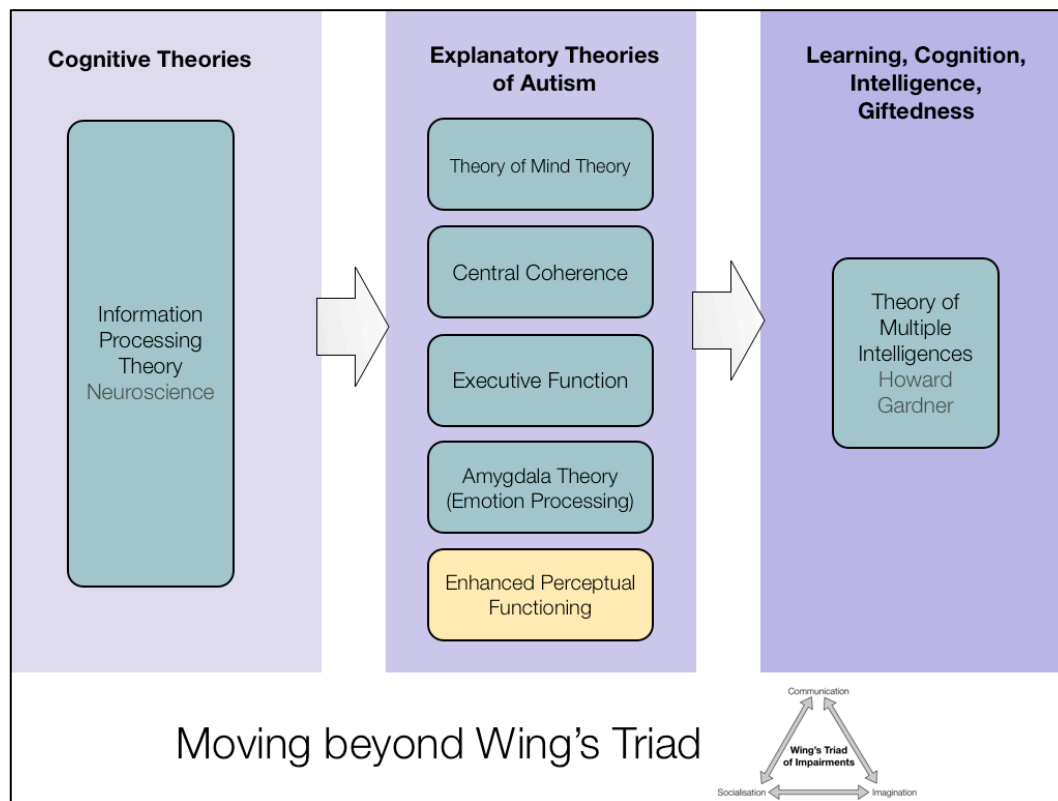


Figure 4.10 Theoretical framework updated

The updated theoretical framework is the starting point of the TML professional development package (Appendix C).

#### 4.6 Mapping autism theories to Tulving's memory systems

The theory of central coherence theory states that 'lower-level' (also known as 'weak central coherence', detail-focused, or bottom-up) information processing is enhanced in autism, at the expense of 'higher-level' (also known as global-focused, top-down, or Gestalt) information processing (Blakemore, *et al.*, 2006). One aspect of 'strong' central coherence is the capacity to form prototypes and concepts: moving beyond literal, or concrete, detailed-style processing towards the abstract. This is a capacity that shows impairment in AS (Gastgeb, 2010; Gastgeb, *et al.*, 2011; Klinger & Dawson, 2001). Concept formation is an act of abstract reasoning, which is a function of episodic memory, and abstraction ability shows impairment in AS (DeLong, 1992; Minshew, *et al.*, 2002; Newman, *et al.*, 2010). Abstract reasoning is also said by some to be an executive function (Solomon, Buaminger & Rogers, 2011). Therefore, there is a relationship between enhanced perceptual functioning in autism, the weak central coherence and executive function accounts of autism. However, the relationships are

conceptually vague in the literature: in order to resolve the vagaries, for the purposes of this thesis, the following ‘mapping’ was devised.

Mapping the explanatory theories of autism, showing relationships between theories, memory systems and corresponding mental activity, allows diverse elements within the literature to be viewed in relationship to each other for educational purposes. This process facilitates an interpretation of Kahla’s case and the other cases of this doctoral study and contributes a key component to the conceptual framework that is the theory development activity of this study. It brings insights from the memory and neuroscience fields more readily into the sphere of educators. The mapping process was undertaken through careful reading of the research literature over a long period of time, drawing upon existing literature and newly published studies. Comparisons between the memory literature and the information-processing literature revealed that ‘strong’ central coherence involves greater reliance on episodic thinking for: abstract, conceptual understanding; context-laden memories; and, construction of personal meaning. Weak central coherence indicates reduced reliance on abstract or episodic thinking and greater reliance on perceptual or sensory input (perceptual processing) and knowledge without context (semantic processing). The explicit act of thinking and reasoning episodically, or semantically, takes place in working memory and leaves, or fails to leave, a ‘memory trace’ (Tulving, 2002, p. 19). Different types of **encoding** and **retrieval** memory processes (see Section 4.3.2), such as those listed by Gardiner (2008), shown in Table 4.2, provided further keys to the mapping process.

**Table 4.2 Encoding and retrieval processes (Gardiner, 2008, p. 9)**

Deep <i>vs</i> shallow level
Item-specific <i>vs</i> relational
Explicit <i>vs</i> implicit
Conceptual <i>vs</i> perceptual
Effortful <i>vs</i> automatic
Recollection <i>vs</i> familiarity

Through this mapping process, novel pedagogical insights into the thinking and learning of **all** students, not just gifted students with AS, were revealed. The resulting ‘map’ is presented in Table 4.3.

Table 4.3 Mapping autism theories to Tulving's memory systems

Episodic memory	Semantic memory	Perceptual memory
<b>Type of consciousness</b>		
Autonoetic consciousness	Noetic consciousness	Anoetic consciousness
<b>Explanatory theories associated with this memory system</b>		
(Strong) Central coherence Executive function	Weak central coherence	Enhanced perceptual functioning
<b>Mental construct functions</b>		
Prototype formation Concept formation Meaning-making	Naming, labelling, classifying Simple category formation	
<b>Critical features</b>		
Source memory Temporal memory Prospective memory Relational memory Autobiographical memory Greater role of self-referential processing	Single-item memory Item-specific memory Symbolic systems e.g. language, mathematics, visual symbols Rote memory Associative thinking	Sensory processing Experiential
<b>Processes and descriptions associated with this memory system</b> <div> <div> <b>Top-down processing</b>  Other terms: Global processing, gestalt, high-level or complex information processing </div> <div> <b>Bottom-up processing</b>  Other terms: detail-focused processing, local processing, low-level processing </div> </div>		
Mental representation Top-down, global processing High-level processing Complex information processing Memory for personal experience Subjective Contextual (spatial, temporal, affective) Memory binding Abstract reasoning Organising strategies Interpretative, constructive Metacognitive	Mental representation Bottom-up, local, detail-focused or low-level processing Not contextual No memory binding Not interpretative Literal, concrete Object-focused	No mental representation Direct perception Low-level processing Raw experience Being 'in the moment' Registration of sensory input Sensory sensitivities in ASD

Table 4.3 is intended as a broad summary of concepts drawn from the literature reviewed in Sections 4.3 to 4.5, allowing theoretical relationships to be revealed. For the purposes of this conceptual mapping process, the Theory of Mind theory is accounted for under the umbrella of the Executive Function theory. The Amygdala theory is omitted from the table as the research findings about the amygdala are largely neurobiological in nature, rather than conceptual, with the exception of Immordino-

Yang and Damasio's theory of emotion 'tagging' for learning (Immordino-Yang, 2008; Immordino-Yang & Damasio, 2007). The process of mapping autism theories with conceptual terms from the memory research laid the foundation for the Thinking, Memory and Learning Framework, which is discussed in Chapter 9 and shown in full in Appendix C. The references utilised are listed in full in Appendix B.

## **4.7 Qualitative characteristics of memory in Case 1**

Having established the theoretical foundation to support interpretation of the issues of memory that arose from Kahla's account, the analysis of Kahla's data is resumed.

### **4.7.1 Eidetic imagery**

Kahla described her memories as being an unvarying 'experience' of the original event, including all the emotions and perceptions experienced at the time.

K: I totally relive it. I relive every emotion that I felt at the time. Everything that I thought, or saw, or felt, or smelled at the time is still trapped in that memory. (Interview)

Memories are indexed and filed, available for retrieval at any moment, and are 'enjoyed' through being replayed.

K: I can't ever be bored ... I know people experience boredom because I've seen it, read about it, seen how people react to it, seen how they don't like it, but I can't actually experience [boredom] because I can always have a look at something in my head. (Interview)

Kahla spoke of **looking** at her autobiographical memories to relive them. The term 'eidetic memory' for the phenomenon Kahla described was suggested by another person with AS in a personal communication. While that communication did not translate to the person's participation in this research study, it was valuable for the imparting of this concept, which was new to the researcher. The early research interest in 'eidetic imagery' appears to have been a field that had its day last century (Allport, 1924), however, after a break of decades, the term 'eidetic' has been revived in the literature and associated with individuals with autism. Eidetic memory is defined as 'a rare form of visual memory ... distinguished from ordinary visual imagery by its vividness and by the fact that it is "seen" projected in front of the viewer as opposed to being merely remembered' (Furst, *et al.*, 1974, p. 603). Eidetic imagery (EI) is associated with unusually high patterns of occipital alpha-wave activity in contrast to the usual case,

where ‘visual stimulation tends to block alpha-wave production in the visual cortex’ (p. 605). Furst, *et al*, further suggested that ‘EI is produced by an entirely different memory mechanism than that responsible for the more usual kind’ (p. 605).

A discussion of eidetic imagery was advanced by Haber (1979), who disputed a prevailing hypothesis that EI is ‘a developmentally less mature memorial representation, which is gradually replaced by more abstract representations as the child acquires abstract thought, reading, and more advanced cognitive abilities’ (p. 583). Hurlburt, Happé, & Frith (1994), without using the term ‘eidetic’, noted the centrality of visual imagery in relation to three case studies of adults with AS, when the participants described their inner experiences.

Sometimes, the visual images served useful or problem-solving functions, e.g. visualizing the result of some action. In many cases, visual images were accompanied by emotions. (Hurlburt, *et al.*, 1994, p. 386)

Cash described 27 year-old Jim, who has high-functioning autism, as ‘having an exceptional, perhaps eidetic memory’ (1999, p. 25). Wallace and Happé described ‘eidetic-type imagery’ as ‘a pure recording of a stimulus’ (2008, p. 447). Eidetic memory may sometimes be associated with synaesthesia, where, for example, super-human recall of numbers is associated with ‘seeing’ a colour that represents the next number (Brang & Ramachandran, 2010). This capacity is manifest in Daniel Tammet, a young man with high-functioning autism who recited *pi* to 22,514 places (Attwood & Garnett, 2012; Gooder, 2005). Brang and Ramachandran (2010) postulate brain over-connectivity (‘defective pruning’) as a possible factor in explaining ‘enhanced visual (eidetic) imagery’ (p. 173) and this explanation of the possible role of neuronal pruning in heightened perception is supported by Hill and Frith (2003). Newman, *et al.*, (2010) noted that eidetic memory encoding, being visual, does not rely on language.

For persons with autism, information is processed visually, as opposed to linguistically. Thoughts about the world, or about experiences, are stored chronologically as discrete chunks of visually coded information, as opposed to linguistically coded and stored with similar concepts or experiences. (Newman, *et al.*, 2010, p. 268)

The characterisation of individuals with autism as ‘thinking in pictures’ (Grandin, 2006; Sacks, 2011) is relevant within this discussion.

Eidetic memory is contrasted with abstraction: ‘Without abstraction, a more eidetic or documentary style of memory and thinking formation occurs’ (Cashin, Gallagher, Newman & Hughes, 2012, p. 143). Memories are encoded without interpretation, as they were literally perceived (although, errors are possible).

Sacks (1986) highlighted this interpretation-free recall of memory in his description of how his patients with autism recalled memories. As he noted: One is dealing with memories that seem of a ‘documentary’ kind, in which there is no personal reference, no personal relation, no living center whatever. ...It might be said that personal involvement, emotion, has been edited out of these memories (p. 198). (Newman, *et al.*, 2010, p. 269; citing Sacks, 1986)

Precise agreement on what is meant by ‘eidetic’ is lacking, however, the notion of eidetic-style memory in association with individuals with autism is well documented in the literature.

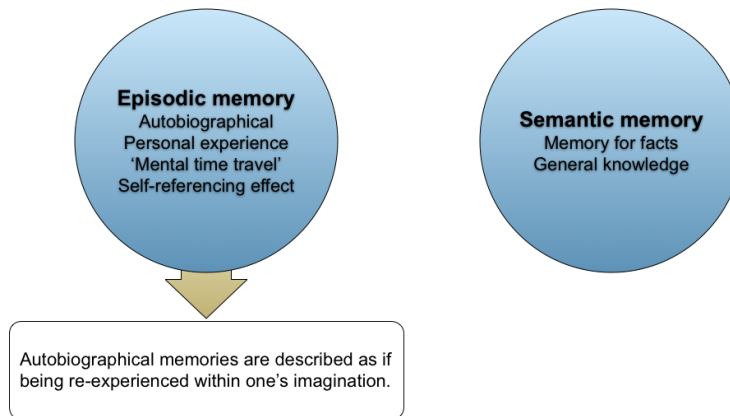
The absence of encoded interpretation of an eidetic-style memory is noticeable in the following comment by Kahla about reviewing memories at different ages, where the eidetic-style memory is encoded as raw material that can be viewed through the eyes of a 4 year-old or a 48 year-old and interpreted for meaning from the perspective of being that age.

K: It’s really interesting because, as you get older, you can look at the same memories and learn something different from [them]. Because the memory’s intact, so you can see it. But seeing it through the eyes of a 4 year-old to a 12 year-old, up to 48, ... I suddenly think, ‘Oh, look! That was happening!’ or, ‘When that person said this, **this** was happening.’ (Interview)

Episodic memories in TD individuals are encoded on the basis of salience for the self (Lind, 2010) and have therefore already been subjected to an interpretive process at the point of encoding, whereas Kahla described having complete, verbatim recordings, without the forgetting that is characteristic of episodic memory.

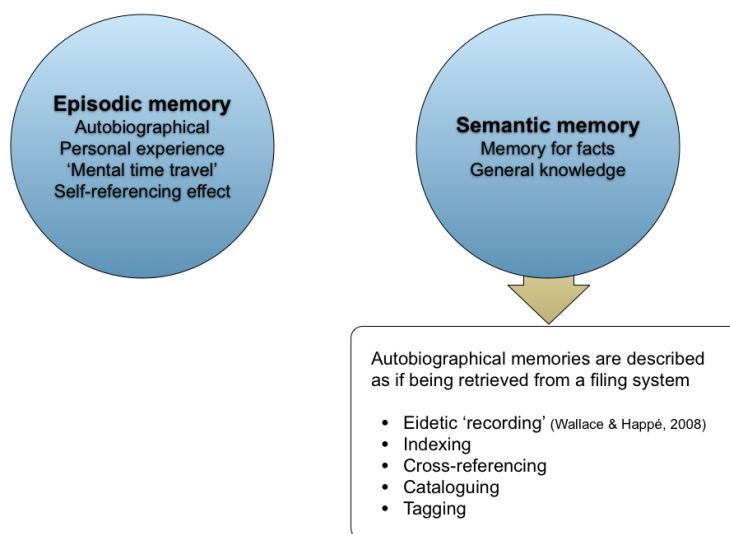
The modern study of the accuracy of episodic memory has convincingly disproved another popular metaphor, the idea of memory as a video recorder taping and replaying the original events. Episodic memory does not reproduce, it constructs, and the reconstruction of previous episodes is based on information from many sources with the assistance of many neural system (Rubin, 2006). As some of the sources of information used in the construction of episodic memories are external to the original event, memory accuracy suffers. (Magnussen & Brennen, 2011, p. 87)

In contrast to Magnussen and Brennen's account, Kahla, along with Grandin (2006) and the other cases of this research, used terms indicative of autobiographical memory that indeed functions like a video recording, pointing to a reliance on the semantic memory system for memories of personal experience. Figures 4.11 and 4.12 depict the explicit (declarative) memory systems based on the memory systems model of Schacter and Tulving (1994). Figure 4.11 represents typically developing autobiographical memory.



**Figure 4.11 Explicit memory systems**

In contrast, the representation of autobiographical memory based on Kahla's narrative is shown in Figure 4.12. Kahla's account of autobiographical memory displays a reliance on semantic memory, even for autobiographical memories that are typically the domain of episodic memory.



**Figure 4.12 Autobiographical memory from the narrative of Case 1**

Kahla is describing a qualitative experience of memory that accords with the literature references to eidetic-style memory in autism. Even though she used the word ‘reliving’ at one point, at other times she, instead, used terms such as ‘playing’ or ‘looking’ at her memories. Kahla’s articulation of her autobiographical memories is qualitatively different to the ‘remembering’ or ‘mental time travel’ of typical episodic memory (Lind & Bowler, 2010). The distinction between typical episodic autobiographical memory and the phenomenon of autobiographical memory expressed in Kahla’s narrative is further discussed in Section 4.7.3.

#### **4.7.2 Memory as ‘filing system’**

Kahla described an encoding process with her memory continuously working to index and cross-reference features of remembered events and objects. She used the metaphors of a library and a filing system: her memory is a vast storehouse of information that is available for her to review, when she chooses.

K: The other thing I love about my mind is my filing system. All memories and thoughts are stored in sections with related links. ... My mind is constantly sorting out these files, adding to them and creating more links. ... The other useful thing is that my mind operates these files by itself. (Interview)

Memory is described as if it is external, rather than being an integral part of herself. However, memory has an internal, active role to play in Kahla’s thinking.

K: I can’t ever actually feel alone because there’s so much in [my memory] that I can have a look at and relive. And it’s interesting. It’s like visiting an enormous library. There’s all kinds of things in there. There’s everything that I’ve seen that I’ve liked. Because it’s all catalogued, I can find an interesting leaf and then if I want to, I can enjoy all the other different leaves that I’ve seen ... it’s all cross-referenced, so that I could retrieve a memory about a balloon and then go into balloons, or I can go into circles, things that are circular shaped. I collect tones of voice, sets of words, the way things look. (Interview)

There is no room for a socially constructed view of knowledge in this ‘library’. Knowledge is viewed as a ‘collection’, perfectly tailored to the self. However, the library contains knowledge that assists with social learning.

K: I like scenes, so things that I saw, people interacting that I liked, I can put in there and then take out and have a look again. (Interview)

Remembered social scenes that were effective provide event scripts and are used as templates for future social interaction. The indexing and cross-referencing process happens without conscious effort and leads her to think of her memory as being a separate entity.

K: What I like is my brain cross-references by itself, so it does work that I'm not aware of. Sometimes when I bring up a memory and I'm interested to see the other ones that are associated, there might be a new one there and I'll think, 'Oh, good.' It's one that I've actually had before, it just hasn't been cross-referenced to that one. ... It's as if my brain's always doing it itself. So the more memories that I accumulate, the more my brain does that. ...

Res (Researcher): So does this require conscious effort on your part for that to happen?

K: It can, if I want it and, but not always. (Interview)

'Associative thinking' is the term used by Temple Grandin for this phenomenon: the indexing, cross-referencing and cataloguing of memories, where one thought leads to another thought by categorical association in a linear (or serial) progression. Grandin stated:

Not long ago I was walking through the United Airlines terminal in Chicago, which has a glass roof. I looked up, and in my mind I saw pictures of the greenhouse at my university, the Crystal Palace from the 1851 World's Fair in London, a botanical garden and the Biosphere in Arizona. These structures weren't the same shape as the airline terminal, but they were all in my glass-roof file. Then when I saw the Biosphere in my mind, I noticed the turrets in the structure. They reminded me of the turrets on the Hoover Dam. So I started seeing pictures of turrets: on a castle in Germany, on the Disney Fantasyland castle, on a military tank. At that point, I could have gone either way. I could have continued to root around in my glass-roof file. Or I could have stayed in the turret file. To an outsider, my thoughts might appear random, but to me, I'm simply selecting which file folder I want to explore. I've often said that my brain works like a search engine. (Grandin & Panek, 2013, p. 125)

To take a short detour from the qualitative nature of memory in Case 1: with personal memories being captured by continuous multiple associations, the issue of executive control of attention, also referred to a 'set switching' or 'cognitive flexibility', is raised. Said to be faulty in autism (Happé, *et al.*, 2006; Van Eylen, *et al.*, 2011), the accounts of Grandin and Kahla suggest that, rather than attentional capacity itself being diminished, attention may be so overloaded with internal associations that there is little capacity left for attending to external, social stimuli. This accords with the cognitive load

explanation of executive function deficits proposed by Schneider, Lam, Bayliss, and Dux (2012).

Returning to Kahla's account of autobiographical memory, Kahla's memory filing system includes metadata or 'tags' that allow her to make a decision whether to retrieve the memory or not. The 'tag' contains information about the memory but is not the memory itself.

K: For instance, I was wondering the other day why I didn't enjoy painting as much as I did, and why I had reduced it. I said that out loud because that's [an] important part of the process, hoping that my brain would do its own work and then give me the answer. When I woke up in the morning ... my brain just delivered a block of memory to me ... I can [choose] **not** to open it. I can still see it, recognise it, the way you file and there's a little tag on it to show you what's in the file. I can do that or I can retrieve more of it. (Interview)

Kahla's characterises her autobiographical memory as a filing system of print, video and audio recordings, a virtual library for one, continuously updated with links (cross-references) between memories, in the phenomenon described by Temple Grandin as 'associative thinking'. Metaphors of a library and a filing system containing 'recorded' material were employed consistently throughout Kahla's account.

### 4.7.3 Autobiographical memory

Autobiographical memory in TD individuals functions very differently to the autobiographical memory in Kahla's account. Typical autobiographical memory is 'episodic' in nature, that is, more is forgotten than is remembered: that which is remembered, is remembered for personal salience and meaning. Episodic memory typically involves: 'self-referential processing', also known as the 'self-referencing effect' (Cabeza & St Jacques, 2007; Lind, 2010); 'autonoetic awareness', self-consciousness, within which a sense of self, or identity, is formed and maintained (Markowitsch & Staniloiu, 2011; Tanweer, *et al.*, 2010; Tulving, 1985; Vandekerckhove, 2008); and, 'mental time travel,' the means of retrieving autobiographical memories through stepping back into the memory to re-experience it within one's imagination (Perner, *et al.*, 2007; Tulving & Markowitsch, 1998; Wheeler, *et al.*, 1997). Episodic memories change over time, through decay, lack of rehearsal and re-interpretation (Cabeza & St Jacques, 2007), however, semantic memories, being factual in nature, are 'interpretation-free' (Newman, *et al.*, 2010, p. 269) and do not

change their nature over time. One either remembers or forgets a fact ( $2 + 2 = 4$ ); unlike episodic memories, a fact doesn't change depending on, for example, why the person remembers it or how they feel when they are recalling it. In autism, compared to typical development, memory is not processed self-referentially to the same extent (Cashin, *et al.*, 2012; Crane & Goddard, 2008; Mundy, *et al.*, 2010); 'autonoetic awareness' is reduced (Bowler, *et al.*, 2004); and, there is a greater reliance on the semantic memory system, even for autobiographical memories (Goddard, Howlin, Dritschel & Patel, 2007).

The semantic memory system contains factual knowledge that, in Kahla's case, includes data about personal memories, which she described as 'tags'. It has been suggested that the semantic memory system may be superior in gifted individuals with autism (Boucher, 2007; Gaigg, *et al.*, 2008) as evidenced, for example, by superior rote memory (Bowler, *et al.*, 2004; Crane & Goddard, 2008).

In fact, there is substantial evidence to indicate a selective diminution in episodic remembering and increased reliance on semantic knowing among individuals with autism, including high-functioning adults. (Williams, D., 2010, p. 482)

Against the background of the autism and memory literature, it can be seen that Kahla's firsthand descriptions of her memory exhibit the qualitative characteristics attributable to less reliance on episodic memory and a greater reliance on semantic memory, even for autobiographical memories. Thus, according to Kahla's account, eidetic-style memory recordings are stored in a memory repository that is viewed as operating both like a library and a filing system: it operates in place of typical episodic re-experiencing (mental time travel), which is the hallmark of episodic autobiographical memory (Bowler, *et al.*, 2000). Furthermore, Kahla's account aligns with Lind and Bowler's (2010) findings that the autobiographical memory retrieval stance of individuals with autism is 'observational', rather than displaying a sense of personal involvement: 'of "being there" (autonoetic awareness)' (Boucher, 2007, p. 261).

Participants with ASD demonstrated impaired episodic memory and episodic future thinking. In line with this finding, participants were less likely than comparison participants to report taking a field (first-person) perspective and were more likely to report taking an observer (third-person) perspective during retrieval of past events ... highlighting that they were less likely to mentally re-experience past events from their own point of view. (Lind & Bowler, 2010, p. 896)

According to these reports, the individual with ASD tends to ‘observe’ his or her own memories, rather than re-experience them. Kahla used terms such as ‘looking’ and ‘replaying’ her memories, reinforcing the notion of an observational stance. Although she also used the terms ‘reliving’ and ‘experiencing’, this is likely to be a different phenomenon to the re-experiencing of episodic mental time travel, with its sense of personal involvement. Indeed, from Kahla, one gained the sense that her reviewing of memories had functional purposes of enjoyment and meaningful learning that are not usually intrinsic to typical episodic remembering.

#### **4.7.4 Memory as a separate entity**

Kahla personified her memory (see also the transcript excerpts in Section 4.7.2) and referred to it as though it was a separate entity.

K: My memory is very interesting and I love my memory. I am attached to it as if it’s an object that you could actually have. Like the way someone has a special necklace that they could take out and look and admire and enjoy just having. I’ve noticed people enjoy expensive objects. I enjoy my memory the same way. So I’m constantly kind of looking at it and patting it almost, and enjoying it as if it’s a separate thing to myself. It’s part of me but it’s also a very separate thing and I absolutely love it. It’s almost so big that it’s almost got its own identity so that it’s another entity. (Interview)

K: ... I actually thank my brain. I go, ‘Oh, thank you for that information’, as if it is another identity to [me] and it’s working on a completely different level. ... As if there is another one of you, almost, in there, living on a slightly separate level but working (in) conjunction ... it’s almost like it’s a twin. (Interview)

The external characterisation of memory appears to have the function of bringing the abstract notion of memory into the literal domain, where Kahla may feel she has a measure of cognitive control. This is consistent with the externally oriented thinking that is a feature of cognition in individuals with autism (Section 4.8.5).

#### **4.7.5 Language: ‘You don’t have to say everything you think’**

The reification of thought and memory in Kahla’s case is further evident in her encoding and retrieval process, which is via spoken language. By speaking aloud, Kahla is able to ‘record’ her experiences in the complete way implied by eidetic memory. Kahla is hyperlexic, having had a precocious facility with words, both written and spoken. Unfortunately, the need to speak her thoughts aloud has greatly contributed to her social challenges as a teenager and adult. In the previous two years, Kahla had

received social skills coaching from a psychologist in order to understand the role of voice modulation and the separation between spoken language and verbal thinking, something she was not previously aware of.

K: This is [an] amazing thing for me, that you don't have to say everything that you think. Oh! I had absolutely no idea. ... [The psychologist] ... told me to think it, wait, and then think about what might happen if I actually said that, and what I could say instead. If I put the two together—the voice modulation and the not saying everything I think—I have noticed an absolutely amazing difference. ...

Res: So there was a direct connection between your thought processes and your verbalising?

K: Yes. It's really important to me to talk to myself and I sometimes wonder how many people might have been burnt as witches for doing it. (Interview)

Kahla proceeded to explain that verbalising her thoughts aloud allows them to be committed to memory verbatim.

K: Once I've spoken it, it becomes extremely etched in my mind so that ... it's always there for my retrieval, like **always**. I can adjust it, I can add to it, I can bring up that block of speech and I can think, 'Okay, I thought that, then. Now I'm just going to add to it, rewrite to it.' So then I have a different block that I can also retrieve, as long as I say it out loud. Then I can hold up the two conversations side-by-side and weigh them, see what they sound like. I can recall conversations from my earliest childhood because I've said it out loud. As long as I say it out loud, it's **always** there for me to retrieve. ... I can actually see the conversations ... as well as hear [them]. (Interview)

In place of typical episodic memory for personally experienced events (Ben Shalom, 2003; Boucher, 2007; Goddard, *et al.*, 2007; Williams, D., 2010), Kahla uses eidetically recorded event memories as templates for social interaction and conducts mental rehearsal.

K: So I can shift [a conversation] into a space and hear it and see it and then think, 'Hmm, if I say that, that sounds really good.' Because a lot of it's planning what I'll do, if I meet this person, what I should say in that situation. ... A lot of my talking to myself is actually replaying an event out loud and then adjusting it so that it might have worked, or had a different outcome and then I can refer to it if a similar situation comes up again. (Interview)

Boucher reports a comparable account by 'JS', a highly gifted individual with autism, who employed a modified form of event memory with a similar purpose to Kahla.

[JS] has learned to compensate by memorizing events involving other people in terms of remembered conversations. Many or even most sentences in a conversation are memorized verbatim. (Boucher, 2007, p. 256)

For Kahla, memory **retrieval**, as well as encoding, is mediated through speech. Voice modulation (volume, pitch and tone) and non-verbal language have a direct, literal relationship with words and thoughts for her. Kahla's association between thought language and spoken language was so fixed that her volume and tone reflected the strength of her thoughts. If the thought was very important to her, she would shout the words. The problems with her manner of speaking became apparent to her during a series of court hearings, where she was reprimanded when she shouted and did not understand why. Working over an extended period of time with a specialist psychology practice gave Kahla opportunities to learn compensatory strategies to overcome the mismatch between her speech and situations requiring higher-level social understanding.

K: I didn't realise that a loud voice was interpreted as aggressive or unfriendly. The stronger the thoughts came to me, the more emphasis I would put on them. Particularly if I liked the thought. ... Because when a thought appears in your mind, it's got a weight. If you like it, or you think it gets across what you want to say, it becomes heavier or more visible ... and so I give that weight the sound-weight. ... If I was more uncertain, my voice would become smaller. ...

Res: Does the weight of your thoughts equate to importance, or passion?

K: Both. ... when I was in court, if someone had lied and I had the correct piece of information, I would shout it because it was true. ... I knew something was going drastically wrong ... And so, as I talked to [the psychologists], they finally said, 'Well, one thing you need to do is stop standing up and down, stop waving your arms around, stop shouting.' (Interview)

Through compensatory learning, she has been able to learn appropriate voice modulation and the beauty and precision of her use of voice during the research interview was noted. She has also gained a measure of awareness that her use of verbal and non-verbal language (for instance, standing up and down to reinforce the 'sound-weight' of a thought) has a potentially negative effect on other people, and, knowing this, has been motivated to change her behaviour in order to communicate more effectively.

Spoken language for Kahla represents a 'memory stream' or flow, both in and out, for encoding and retrieval. She thinks by speaking aloud and hearing herself speak. She encodes to, and retrieves from, memory by speaking aloud. **Rather than having**

**implicit knowledge of her thoughts, she knows what she thinks by listening to herself speak.** Voice modulation and body language have, for her, a direct association with the meaning of the words, rather than functioning for social purposes. Thoughtful reflection is an active, externalised process. Through explicit learning, Kahla has been successful in achieving more effective strategies for communicating in various social situations.

#### **4.7.6 Childhood amnesia**

A feature of Kahla's account of memory was her unsolicited references to early memories, which seemed to indicate clear, eidetically recorded, autobiographical memories at age one.

K: ...my long-term memory is superior and I can provide any details from my past you require right back to age one. (Email)

At the time, the researcher was dismissive of this early memory account but began to pay closer attention when the same phenomenon arose, also unsolicited, in two other cases. A literature search on childhood amnesia in autism revealed reports of this phenomenon. Crane and Goddard (2008) described typical 'childhood amnesia' as the case where 'people tend to recall few memories from the first few years of their life', and stated that this is a 'robust temporal characteristic' of autobiographical memory (p. 503). In contrast, spontaneous reports from individuals with autism of autobiographical memories going back to birth were reported by Lee and Hobson.

It was also remarkable (and rather mysterious) that no fewer than nine autistic participants but no nonautistic participants talked about experiences of babyhood. (Lee & Hobson, 1998, p. 1140)

Williams (2010) proposed that diminished childhood amnesia in autism might be attributable to the increased reliance on semantic memory and this explanation aligns with Kahla's description of eidetic recordings of autobiographical memories. In response to Lee and Hobson's report, Williams reported the ensuing debate over whether the memories were confabulated.

Lee and Hobson found that a substantial proportion of the participants with autism, but no comparison child, spontaneously described 'recollections' of their own birth. Importantly, Hobson (personal communication) reports that these recollections were as vivid and descriptive as their other personal recollections. The phenomenon of childhood amnesia, which concerns the fact that the vast majority of typical adults do not recall events which

happened prior their fourth birthday, suggests that any memory of one's birth (or of early life, *per se*) is most likely the result of confabulation. On the other hand, Lyons and Fitzgerald (2005) argue that early autobiographical episodic memories reported by some people with autism are accurate and this apparently exceptional ability to report events from early in life should be considered a savant talent. (Williams, D., 2010, p. 482)

While noting the debate, which is conducted in the context of a discussion about individuals with autism and their knowledge of their own mental states over time (including in early childhood), Williams issued his own *ad hoc* 'credibility test' based on whether the memories involve skills that have not been developmentally achieved at the time.

The most important thing to note from all of this is that we should be cautious about any individual's memories that include details of skills or capacities that the individual probably would not have possessed at the time of the original event, even if they possess those skills at the time of 'remembering'/reporting. (Williams, D., 2010, pp. 483-484)

Lending authenticity to Kahla's report is that the nature of her memories changed when she acquired language (keeping in mind that she had precocious language development). Applying William's test of caution, Kahla's report acquires credibility. The following lengthy excerpt from Kahla's account, describing the difference in her memories before and after language acquisition, is reported here so that the credibility of her account can be judged on its merits.

Res: How far back do your memories go?

K: My memories go back to before speech and they're catalogued differently ... because you don't have words ... so it's a sensation. ... I wouldn't know how old I am but logically you can apply it because ... my obsession with the sky and what it looks like, comes directly from this memory. I like things around my neck, like that (gesture: tucks scarf around neck and smiles) so I'm clearly tucked into my pram. ... I did not know it was my pram **then** because I didn't know what a pram was. It's only with distance that I can see that it's a pram. And my mother must be moving the pram up when it goes to a curb. But I can remember all the lifts and downs and the way the sky looked when you're moving. So I must be very young because I have no memories other than sensation. It's sensation. And visual. I can recall the exact intense 'ah!' (gasps with delight) of seeing the sky. [I'd] no idea what it was but, the moving past and the clouds, I absolutely love it.

Another memory that I have is seeing a red marble in the grass and I've got blue soft pants on over a nappy, and then over that is the plastic. And I didn't like the feeling of the plastic at all or the elastic that goes around your leg. I did not like that feeling and I'm in the grass and I did not like the way the grass dug into my knees. You know how mothers always put babies on grass? I didn't like it. So I used to go like **that** (hand gesture indicating rocking) rather than crawl across the grass. But I saw this bright, orange round thing. I didn't know it was round. When I go back into my memory, I only see the round

thing (makes round shape with hands), and it's from a child's perspective. When I noticed it, everything else shifts out of focus in my memory. It's this thing that I want and I want to put it in my mouth. I want to feel it in my mouth (puts fingers inside mouth) but I had one second of enjoyment, of feeling it in my mouth, before I felt this huge blow on the back of my head (hits self on back of head), and this scream, which was my mother. I **still** remember the **exact** feeling, and the wail and the shock and of it, without any language at all.

I spoke quite early, at 10 months. I still remember my first word. I remember being in the high chair and having a damp cloth. I'd eaten apple sauce with bits of what I now know is pork. I wasn't keen on those because my mum used to leave this bit of fat on and I used to get this texture in the roof of my mouth. So I remember going round trying not to get those pork bits in but Mum used to cut them really small. And then I used to try and get them out of my mouth so she had a blue cloth that was wet that she would keep wiping my fingers with. And then I lifted it on my face and pulled it down and said, 'Peek-a-boo'. Whereupon my mother shrieked and left the room, which really scared me. But Mum said later, when I brought back the memory with her, that she rushed off to tell everyone I'd said my first word. I know from my mother that two months after that I was speaking quite well, in strings of sentences. So memories with feelings must come before 12 months. Some of them are not very detailed the way my older [more recent] memories are. Once I got language, the memories are concreted in a completely different way. They're retrievable in a different way. ... like when you hop into a bath and you're just immersed in the warm water, hopping into one of those memories is very much like that. It's being, it's bathed in sensation. You don't get words like, 'I'm looking at the sky,' it's you just instantly go back into a state of being. ... that's why I've been so obsessed with language all my life and I've liked words because it's like a key to creating your world. (Interview)

It is interesting to note Kahla's switch between past and present tense, her gestures throughout this passage that were essential to the narrative, and her use of metaphor to describe the switch between two mental states ('like when you hop into a bath'). While it is unexpected that infants would have colour representation at the age Kahla describes, given the proof of her heightened colour perception (as evidenced by her artwork), caution was applied before dismissing that aspect of her account. It may be that the description of the cloth as blue and the marble as red and orange is a recent application of language to the remembered sensation that does not necessarily undermine the credibility of the account. Although she used the phrase 'you just instantly go back into a state of being', the extensive use of language throughout her account indicating documentary-style, eidetic recordings of memory preclude the interpretation that she is describing an act of mental time travel but rather is recalling the vividness of childhood memories that have not been subject to typical decay. This interpretation is supported by Kahla's explanation for the difference between her own early childhood memories and the childhood amnesia of TD individuals.

K: I have observed that neurotypical [individuals] seem to experience time and their life events in a linear fashion, a line extending from their earliest memory to the present day. I have also observed that many of these memories, unless significant or traumatic, fade with time so that the earlier memories are not as distinct as the current ones. However, I and my sons experience time and our life events in a circle, as if we are in the middle, with events being equally significant and clear and within equal distance of each other, like beads on a necklace, and, in our case, infancy is within easy grasp. So events that occurred when we were 1 or 2 are just as vivid as if we were 10 or 20 and so on. This causes certain problems and difficulties. For example the distress I felt at losing a toy when I was 3 is just as painful now as it was all those years ago if I choose to select that memory. (Email)

Once again, Kahla eloquently employs metaphor to illustrate her conception of her memory and to contrast her experience with TD individuals. Her description of the decay of episodic memory accurately reflects the research literature.

The phenomenon of spontaneous reports indicating lack of typical childhood amnesia by individuals with autism is not widely reported but certainly has a presence within the research literature and was a surprise finding of this doctoral study. Against the background of the extensive research literature on episodic memory and semantic memory, both typically developing and in autism, a reasonable explanation for the phenomenon of Kahla's detailed descriptions of incidents from her infancy is that the 'forgetting' function of episodic memory has not been activated due to the memories being eidetically recorded (a function of the semantic memory system). This is an interpretation supported by Vandekerckhove, speaking about the phenomenon of childhood amnesia itself: 'The lack of remembering in an episodic way is related with the phenomenon of infantile amnesia before the age of 3 or 4' (Vandekerckhove, 2008, pp. 10; citing Perner & Ruffmann, 1995). Vandekerckhove associated episodic forgetting (childhood amnesia) with brain maturation in an inverse relationship: as the prefrontal cortex matures, episodic memory develops and typically assumes the primary role in autobiographical memory from semantic memory, which is an earlier developing system. Childhood amnesia, therefore, allows greater organisation of personal autobiographical memories and abstraction of meaning from experience, beyond the recording of the memories, and suggests a role in the heightened reliance on semantic memory that Kahla exhibits. Although the origin of the reduced incidence of childhood amnesia in autism is not well-understood, the research literature certainly supports Kahla's claims to having such early memories: as a visual 'recording' of sensation, with the addition of language as it developed and, in Kahla's case, it is suspected that

enhanced visual perception and precocious language facility may have contributed to the vividness of the memories.

#### **4.7.7 Enhanced perceptual functioning in Case 1**

Enhanced perceptual functioning in Case 1 was demonstrated through evidence of sensory sensitivities and visual-spatial giftedness.

##### **4.7.7.1 Sensory sensitivities**

Sensory sensitivities may be an advantage, with regard to heightened perception and giftedness, or a disadvantage. Kahla gave instances where her own and her son's sensitivities had been both an advantage and a disadvantage. While at school, Kahla described the difficulty of having super-acute hearing combined with attentional control issues.

K: When teachers talked in the class room, I was distracted by the myriad of sounds both near and distant. My hearing is in the top 7% so I could hear very well. The problem is that my brain loves to categorise things so, instead of listening to the teacher with my full attention, I would be busy identifying the bird species based on the sounds I heard (magpie, magpie-lark, wattle bird, willy wagtail ...), labelling the various insect sounds (fly, wasp, bee, cricket, cicada) and identifying dog barks (sad, lonely, frustrated, greeting, warning, excited, puzzled) as well as papers rustling, children fidgeting, teachers in other rooms, etc., etc. In addition I would fantasize about the sounds. For example if I heard the distressed bark of a Labrador I would imagine rescuing it and giving it a walk. (Email)

Sensory sensitivities may be viewed, in some contexts, in a very positive light, as super powers (Huws & Jones, 2013). Two such examples were given by Kahla.

K: My dearest friend once asked me to bring [my son] to her home as her son had lost his [School] Captain's badge and although they had turned the house upside down it was nowhere to be found. My son ran through the front door, raced down the hall and swerved suddenly into the lounge with a joyful 'WHOOOP' as he swiftly knelt beside the sofa and extracted the badge from beneath it to the amazement of all present! When asked how he found it [my son] tapped his eye and solemnly declared he had seen a 'glimmer where there had never been a glimmer before.' On taking him to a park recently he suddenly set off at a sprint and was soon nearly lost to sight. In a panic, I and several others chased him ... Finally he stopped after covering an incredible distance and shouted, 'Look up there...a baby kookaburra!' A man who had assisted said, 'Good God! How did he see that without binoculars? It's almost impossible to see now!' [My son] replied, 'I made everything into a green grid divided by red lines. In one of the squares, I could see something different.' (Email)

In agreement with Kahla's account, Mottron (2011) stated that the altered brain function of autism confers advantages as well as disadvantages: 'redistribution of brain function may nonetheless be associated with superior performance' (p. 34), thereby drawing a relationship between a perceived weakness and a corresponding strength. Enhanced perception may impart a disadvantage in social settings when sensory stimulation levels are outside one's control, but the perceptual advantage may be nonetheless treasured by the individual themselves.

#### 4.7.7.2 *Visual-spatial giftedness*

Kahla's heightened visual perception is apparent in her artwork, which is rich in visual texture and colour. This characteristic was expressed in concern for the researcher's 'colourblindness' as she became aware that the researcher does not see as she sees.

Res: What you write [about seeing colour] is really fascinating. ... my experience with seeing colour is very different. I have trouble even seeing the colours that make up other colours on physical objects and still find it hard to distinguish between a 'warm red' and a 'cold red', as artists refer to paint colours. They all look 'red' to me and I've been taught that red is 'warm' so how can you have a 'cool red'...? (Email)

K: I was VERY interested in your email. Are you colourblind? I was fascinated by your difficulty with red because it is my favourite colour and what I love about it is its extreme diversity of hue from hot to warm to cool to cold. Different reds have various amounts of yellow or blue in them to push them to the extreme ends of the red spectrum, vermilion has more yellow and so is warm but cadmium has blue in it and so it becomes cooler. (Email)

The researcher is not colourblind in the medical sense but, to Kahla, she does have a kind of blindness, as she cannot perceive colour in Kahla's rich way. Kahla's perception of the researcher's 'disadvantage' accords with the findings of a recent IPA study.

When comparisons were made to people without autism, everyone except Joshua and Darren talked about themselves as being more fortunate in some respects because of their heightened abilities in some modalities. (Huws & Jones, 2013, p. 4)

Kahla's heightened perception as an infant is reflected in her accounts of experiences from babyhood (Section 4.7.6). Perceptual experiences have been retained verbatim (eidetically) and are available for 'replay': for instance, the account of being a baby in the pram looking at the sky and having a changing view as the pram was wheeled up and down over the roadside kerb. Where, typically, childhood amnesia mitigates against the permanency of these memories, their retention is suggestive of heightened

perception. In an email, Kahla wrote extensively about ‘dots’, and this account would appear to be an example of enhanced perceptual functioning as described in the literature. The following six excerpts are a continuous passage (from an email), which has been segmented to allow for analysis and commentary.

K: This email is about ‘dots’...it’s how I and [my two sons] see. I’ve often wondered if more autistic people see these dots and if they are so overwhelming on a sensory level that they can’t see beyond them and are locked into this very visually isolating process.

Kahla reflected on the sensory sensitivities of her autistic experience and how these create social isolation. She then provided an explanation of the experience of her enhanced visual perception.

K: ... The most fascinating thing about the ‘dots’ and possibly the most difficult thing to explain is that they are so small that, even if I made the smallest pinprick with my pencil on a piece of paper, that would be way too big, so the quandary is: how do I and [my sons] see them? The word ‘pixelated’ is the closest word to describe the effect and yet even that word falls short. When [my son] asked me if he was seeing molecules or atoms, I had to wonder.

She further described how the ‘dots’ are animated, which began to convey a sense of the sensory and mental load she was describing.

K: The other interesting and amazing thing about the ‘dots’ is not only do they pulse or vibrate but they also whiz around in all directions at incredible speed. As a young child, I used to think the dots were deliberately making patterns ... Because there are billions whizzing about in all directions, your brain can literally join the dots as it pleases. Thankfully, as an adult, I no longer have this problem. I use the word ‘problem’ because it was so distracting when I was a child ...

At this point, it became clear why she thinks the researcher is colourblind: she was describing visual perception of colour that is beyond the researcher’s experience.

K: For example, although I see a purple cushion as overwhelmingly purple, I also simultaneously see the other colours in the purple (mostly red and a range of blues). There are always black dots in everything, even the lightest colours. When I was younger, my mind used to jump between the two effects but now the process is seamless.

Along with the liabilities of this visual perception, Kahla recognises that the same mechanism may contribute to her giftedness.

K: I also used to find the rapid movement of the dots highly distracting and, at times, disturbing but that process has also become integrated. There are usually red dots in

greater or lesser degrees in most colours. I have wondered if seeing these ‘dots’, whatever they are, has helped with my fantastic night vision. ...

It is apparent that trying to make sense from these visual experiences of the world must impact upon the individual’s developing view of the world: particularly where it has been assumed that all people see in the same way, followed by the realisation, from negative or absent feedback, that this is an experience singular to oneself. Assigning an entity to the ‘dots’ is reminiscent of Kahla’s view of her memory (Section 4.7.4): that is, she exhibits a tendency to externalise mental processes by speaking of her perception as though it were external to herself, or concrete.

K: Like [my sons] I went through various stages as a child of trying to understand what I was seeing. At first I believed the dots were sentient and alive. At times, like [my sons], I was not certain if they were friendly or not. I then went through a stage of wondering if they were microbes or bacteria and, just like [my sons], came to wonder if I was somehow seeing on a molecular level. What I did learn relatively early was that other people did NOT see them. ... When I was a child, I tended to over-focus on the dots. This was not just distracting but also intensely fatiguing. Following the rapid motion can be tiring and stressful. It can create a state of hyper-alertness. As an adult, I have retrained my brain to find the same motion soothing and I am also able to blur the effect (or turn down the volume). (Email)

The effect of this experience of the world has had an impact on every level of Kahla’s development and world view: social (‘isolating’), emotional (‘stressful’), physical (‘fatiguing’), perceptual, intellectual (theorising about whether she is seeing molecules), and lends weight to the notion that attention and working memory are so overloaded processing internal perceptual experience that there is little available to ‘spend’ on the external social world. Kahla’s description in this email communication and at other points in her narrative suggests an association between sensory sensitivities, enhanced perceptual functioning and her artistic giftedness. However, it is evident that the enhanced function comes at a cost: social, physical, emotional, intellectual.

#### **4.7.8 Summary**

Kahla’s memory account indicates profound differences from memory in TD individuals. The notion of eidetic memory, where verbatim, visual and documentary-style autobiographical memories are ‘recorded’ and ‘filed’, aligns with Kahla’s descriptions. She described her memory as independently conducting its own ‘indexing, cross-referencing and cataloguing’ and her explanation of this process is very similar in nature to Temple Grandin’s account of ‘associative thinking’. Both women used

metaphoric language relating to a filing system to describe the functioning of their memory. Kahla's descriptions of her memory indicate a strong reliance on semantic memory and reduced reliance on episodic memory, in line with the autism and memory literature. She conceives of her memory almost as if it is a separate, twin-like entity. Through difficult social experiences and the intervention of a specialist group of psychologists, Kahla's underlying beliefs about memory and language have been exposed—'you don't have to say everything you think'—and she has been successful in learning compensatory social strategies. Those beliefs provide insight into the nature of her memory, where spoken language plays a particular role in her encoding and retrieval thinking processes. Reduced childhood amnesia, which is evident in Kahla's account, is an indication, supported by the literature, that she has a greater reliance on semantic and perceptual memory and a reduced reliance on episodic remembering, for autobiographical memories. Aspects of Kahla's narrative indicate enhanced perceptual function, particularly in relationship to visual acuity.

Against the background of the memory systems approach, mapped with executive function, weak central coherence and enhanced perceptual functioning theories of autism, Kahla's case demonstrates an instance of superior perceptual processing/memory and superior semantic processing/memory. Her superior perception and visual representation abilities confer artistic giftedness that has resulted in a prolific output of visually rich, imaginative artworks. Episodic memory is evidently diminished as her first-hand autobiographical memories are documentary, eidetic-style, memories that can be mentally viewed as a 'pure recording of a stimulus' (Wallace & Happé, 2008, p. 447): sometimes for enjoyment (as if a spectator); or, for purposes of learning, evaluation and social problem-solving. Kahla did not recount autobiographical memories that appeared to be the result of mental time travel. Many of her memories have apparently been resistant to the effects of childhood amnesia. Reliance upon superior semantic and perceptual processing/memory, with diminished reliance upon episodic processing and memory, accounts for the characteristics of Kahla's memories.

## **4.8      *Learning***

The analysis now turns to themes that are not directly about memory but have a bearing upon learning.

### 4.8.1 Compensatory learning

Many individuals with AS employ their intellect to learn compensatory strategies in order to manage their social cognition deficits (Frith, U., 2001; Hill & Frith, 2003; Williams, E., 2004) and there are references to compensatory learning, or strategies, in relation to other domains as well.

Uta Frith has written, in her book *Autism: Explaining the Enigma*, ‘Autism ... does not go away. ... Nevertheless, autistic people can, and often do, compensate for their handicap to a remarkable degree. [But] there remains a persistent deficit ... something that cannot be corrected or substituted.’ (Sacks, 1995, p. 241)

Compensatory learning is described as a ‘slow and painstaking learning process’ (Frith & Happé, 1999, cited in Lind & Bowler, 2008, p. 178) and contributes to a different form of self-consciousness, founded on cognition that relies on external referents in place of self-referential processing. This style of thinking is described in this thesis by the use of the term ‘externally oriented thinking’. The phenomenological nature of these compensatory learning techniques has not yet been subjected to close scrutiny and is of particular relevance to the research question of this doctoral study.

Kahla’s compensatory learning certainly fits the description of ‘slow and painstaking’. She typified compensatory development of awareness and ability to articulate inner experiences and she employed externally oriented ways of thinking to achieve this. Kahla’s account indicates the ways she has developed ‘work-around’ solutions to compensate for: deficits in eye gaze and face recognition (Section 4.8.2); communication (Section 4.8.3); and, social skills, through the study of people, to develop social understanding of human behaviour (Section 4.8.4).

### 4.8.2 Eye gaze and face recognition

Eye gaze, for experimental purposes, is usually treated independently of face recognition (see, for example, Davies, Bishop, Manstead & Tantam, 1994; Grynspan, *et al.*, 2012; Kliemann, Dziobek, Hatri, Baudewig & Heekeren, 2012; Langdell, 1978; Parvizi, *et al.*, 2012; Pelphrey, *et al.*, 2005). However, phenomenologically, and for the purposes of this study, there is a clear relationship between the individual’s use of eye gaze to garner social information and the ability to decipher identity and social meaning conveyed through looking at faces, so these elements are treated as interrelated. This approach is supported by a recent study that proposes an association between: eye gaze;

face recognition; amygdala activation; and, social and emotion processing (Kana, Libero, Hu, Deshpande & Colburn, 2014).

Individuals with AS have different patterns of eye gaze and find it difficult to make appropriate eye contact during social interactions (Brenner, Turner & Müller, 2007; Neumann, *et al.*, 2006). Kahla described how she deliberately worked on mastering eye contact as she was motivated by the realisation that her social interactions and other people's impressions of her were hampered by lack of eye contact.

K: I've been practising eye contact for about seven years. ... I changed my eye contact seven years ago myself because I realised people didn't like it at all. [They] kept saying to me, '**Look** at me!' Even adults would get really annoyed. I had this reputation for not looking at people and I got quite desperate. I thought, 'Gosh, not only do people think I'm rude, but they are so hostile if I don't look at them.' The other thing that really concerned me was how it's interpreted by so many people as being dishonest, or lying. I could hardly sleep at night, understanding that that was the perception that people had, because I'm rigidly honest. So I wanted to do it. I have to say I don't like it, but I am quite good at it, I think. (Interview)

There is a limited capacity to recognise faces and process facial information in individuals with AS (Faja, *et al.*, 2012; Meyer & Minshew, 2002; Schultz, *et al.*, 2000). Many authors have documented atypical face processing in ASD, with the fusiform gyrus—a small 'valley' in the temporal cortex dedicated to face processing—implicated as underactive and under-connected with the neural network responsible for face processing (Ashwin, Wheelwright & Baron-Cohen, 2006; Dawson, 2008b; van Kooten, *et al.*, 2008). Attwood described this phenomenon as 'prosopagnosia' or 'face blindness' (2007, p. 130)—see also Sacks (2011). Individuals with ASD tend to focus on less salient elements, such as the mouth or clothing, avoiding the eyes (Davies, *et al.*, 1994; Grynszpan, *et al.*, 2012).

Face blindness poses a major social problem for individuals with autism. For people with poor face recognition, contextual cues, such as being in the family home or wearing a particular style of clothing, may provide the clue to a person's identity, rather than implicit face-recognition ability. Grandin described how she manages her face blindness by using external objects to identify people.

I myself didn't know that people have subtle eye signals until I was fifty. I have so much trouble remembering faces that in a business meeting, for instance, I'll force myself to

recognize physical details: *Okay, she's wearing big glasses with black rims. He's the one with the goatee.* (Grandin & Panek, 2013, pp. 121-122) [italics in original]

There is another report of an individual with autism using contextual cues to recognise people: associating a preference for striped shirts with a person, or silver jewellery, or the sound of their voice, in order to identify them (Dawson, 2008a). This is a successful strategy only as far as the context remains stable. If location is one of the contextual cues used, then the same person may not be recognised in a different location, posing the social problem experienced by Kahla.

K: The reason I taught myself [to recognise faces] was because people thought that I was really rude and hostile for just walking straight past them. This lady got really angry with me in the street because she said, 'You know, it's all very well when you walk past my house, you say hello, but if I see you out here, you don't.' I was like, 'Goodness! Who **are** you?' She said, 'Don't be ridiculous! I live across the road,' and she was quite agitated. Then I said, 'Look, this might sound strange but I've got this problem with recognising people's faces,' and she thought that was really weird. And my children have huge trouble, absolutely dreadful. They didn't even recognise their stepfather properly for about two years. Even though they loved him and they knew, if he was in the home, it was him, once we got out[side the house], any bald man was J- if he was tall and thin. (Interview)

Even when the person is as well-known as a new stepfather, recognition of faces out of context may still pose problems. Kahla's children required repetition and practice over a long period of time before being able to recognise their stepfather independently of context. Kahla gave the following account of how she achieved a measure of ability to recognise faces out of context, using a visual memory strategy, via compensatory learning. She was clearly already employing contextual cues but needed a technique that would enable her to identify a person when the context changed.

K: The other ... disability I have is faces but I taught myself how to recognise those last year. ... I noticed that, when I'd seen a two-dimensional photograph of a person, I was more likely to remember them. When I'd seen a picture of a movie star in a magazine, I could recognise them if I saw them in a movie. So I thought about those two things: about what it was if I'd seen a photograph of a person, why I could remember them more easily. But, the thing is, there's a lot of people out there that you don't get a chance to have a photograph of. You don't go to school with your children and see all the mothers, take a photograph and go home and study it. So I thought, 'OK, let me create a two-dimensional image in my head when I look at somebody, as if it is a photo,' would that help? Well, it certainly did. It was incredible and within three months I was recognising everyone. (Interview)

Although facial recognition via matching a magazine photo to a face in a movie is not the same thing as recognising faces in natural social interactions, Kahla nevertheless reported that she has achieved a level of mastery she did not previously have. Kahla's technique is an explicit strategy to memorise a 'mental photo' of the person's face, a strategy which employs her superior visual processing and semantic memory to rote-remember images. In contrast, typical face recognition employs a strategy of forming prototypes (summary representations) of faces (for example, male or female, older or younger): this strategy allows a speedy, intrinsic matching process to take place, providing almost instantaneous, implicit recognition. The capacity to form prototypes for faces is impaired in individuals with autism (Gastgeb, *et al.*, 2011).

#### 4.8.3 Communication

Explicit teaching and learning is required for a motivated individual, such as Kahla, to learn social skills through compensatory learning. The following section of Kahla's transcript is an example of her hard-won social learning and gives insight into her thought processes.

Res: Your voice modulation is really beautiful.

K: Yes, I worked a lot on that though over the last two years. How it happened was in my dealings with [a government department], I realised that I was not getting my message across somehow. ... But one of the problems I had, and it became huge when I was [a plaintiff] in [court], the judge just hated the way I spoke. ...

Res: So what would be your natural way of speaking?

K: (very loud volume with equal emphasis on most words) 'Well, the thing is my child needs a lot of help in this area.' **That** loud and really full-on. I would stand and wave my arms around and stand up and down and up and down and up and down, like a yo-yo. I might even walk around the table while people were sitting and I might bang the desk (thumps the table several times) to make my point. I didn't realise that a loud voice was interpreted as aggressive or unfriendly. (Interview)

Prosody, or voice modulation (for example, pitch, volume, tone), is defined as 'the use of acoustic features of speech to complement, highlight, or modify the meaning of what is said' (Van Santen, Prud'Hommeaux, Black & Mitchell, 2010, p. 215). Prosody in individuals with AS may be poor (Klin & Volkmar, 1995) and require specific tutelage, as in Kahla's case.

K: [Learning] voice modulation ... changed my life remarkably. Just in the last year, I would say I really noticed an astounding impact. I wish I'd known all about it before. (Interview)

In the experience shared by Kahla above, the socially inappropriate use of her voice was determined by her mistaken belief in a simple direct relationship between thought and speech (Section 4.7.5). Through experience of failure, she became highly motivated to change her behaviour but this could only be done through explicit teaching that challenged the underlying belief. That explicit teaching was provided by a specialist psychology practice and, from this tutoring, Kahla learnt socially appropriate alternate event 'scripts', or ways of behaving. While she did not learn the **solution** to the problem from her own experience, she did acquire the **motivation** to learn. Hans Asperger noted that:

[T]here is an inability to learn from adults in conventional ways. Instead, the autistic individual needs to create everything out of his own thought and experience. More often than not this results in defective performance, even in the more able autistic individuals (p. 56). (Asperger, 1944, trans. Frith, 1991, cited in Scheuffgen, *et al.*, 2000, p. 89)

This provides a pedagogical insight into teaching students with AS: although perhaps not learning directly through experience itself, individuals with AS may instead find the motivation to learn. Teachers may be able to recognise and capitalise on that motivation to explore a compensatory means of learning with a student with AS.

Kahla's experience in the modulated use of voice and language shows, on one level, the tortuous learning path she has followed, having not been able to learn from prior experience. On another level, it reveals her shocked surprise at discovering that thoughts and words operate independently, with contingent outcomes for establishing trustworthiness and truth of verbal utterances. Kahla's reaction of shock points to the ontological problem that gifted individuals with AS may have, which can be summarised in the question 'What is real and true?'

#### 4.8.4 Study of people

The study of people as a special interest is a theme that draws on several others: fixations and special interests; externally oriented thinking; and, compensatory learning. Studying people to see how they 'tick' (in the words of Case 5, where 'tick' is used as a clockwork metaphor meaning 'function' or 'operate') is a special interest which leads to

compensatory learning. The interest in people is akin to a scientific study for the purposes of social problem-solving. Observations are made, evidence gathered, analysis conducted and conclusions drawn. Social decision-making is based on the findings and helps address the felt need of poor social cognition. Kahla is highly motivated in her study of people as evidenced by her increasing awareness, over time, of the extent of her social deficits.

K: Now I've got the type of brain that likes analysing things. I like looking at 'Why?' I particularly like behaviour. I like watching people and thinking, 'Why are they doing that? What does that mean?' I like the psychology of it. I think I'm lucky in that I can look at it and pull it apart in such fine detail, about myself and other people. (Interview)

K: It is a special interest and it came from two things. It came from my inability, or my mismanagement of my world when I was a child, [so I became] interested in what other people were doing and thinking and feeling. (Interview)

In this portion of Kahla's account, she is also expressing a compensatory theory of mind (Frith, U., 2001; Hill, *et al.*, 2004; Meyer & Minshew, 2002; Williams, D., 2010; Williams, E., 2004): an explicit, learned theory of mind to account for her own and others' behaviours and mental states, based on a study of people.

K: You are right in thinking that I think a lot about how I and my sons think. I constantly evaluate and assess and pull apart our minds and events. At about age 4, I realised something was wrong, and by age 5 I was certain. It was then I began to study human behaviour intently. Unfortunately, I also decided to study animal behaviour by reasoning that we are animals, and, for many years, applied what I had learned about cats, dogs and birds, to people, with dismal results. (Email)

Kahla compared her study of people to her special interest in animals, both subjects for her detached, scientific-like study. She later recognised, through trial and error, that this was an unsuitable comparison for the purposes of compensatory learning of social skills. This theme contributes to the super-ordinate theme of identity and the formation of self-concept, which is addressed in Section 4.9.4.

Kahla's scientific-like study of people extends to an analysis of the observation of tiny muscle movements in faces for the purpose of emotion recognition and trustworthiness judgements: a clear example of detail-focused processing of faces, and expressive of her weak central coherence information-processing style and externally oriented thinking. The effectiveness of this technique may be open to question, however, one can applaud

the high level of motivation, detailed observations, analysis and work that Kahla invests to develop compensatory strategies.

K: Because I found faces so difficult to remember and because facial expressions were so confusing, I taught myself to focus on the muscles of the face—they have their own language. Nervous people flex and unflex certain muscles in their necks, as do angry people (but then the flex extends into the jaw). People who are lying often tense the little bunch of muscles where the cheek bones hinge. It has taken years of excruciating observation to define and correlate these signals. But the downside is that becoming so lost or absorbed in these details can cause you to miss other important information. (Email)

Kahla has made extensive observations of family members and gives a well-reasoned argument for their placement on the autistic spectrum. She compares herself with her sister, with herself having superior skills in the study of human social behaviour and her sister excelling in mathematics, while being disinterested and ‘more coldly scientific’.

K: In regards to my superior memory, it is flawed by my poor memory for numbers (although I am better with dates). My sister can state, with utter confidence, a page number from a book years after reading it and refer you to a bit of information. That said, I have superior ability to record ‘human and social’ details than her. She has a more coldly scientific personality, devoid of strong emotions, and she is far less interested in people than I am. (Email)

Kahla’s study of people is a special interest that provides a compensatory path to improved social functioning.

#### **4.8.5 Externally oriented thinking**

Kahla’s description of being able to remember a photographic image of a face, while not being able to remember the face *in vivo*, accords with the research on face perception and processing in ASD: less activation of the brain networks responsible for face processing and greater activation of brain networks that process objects (Kleinhans, *et al.*, 2008; Klin, Jones, Schultz, Volkmar & Cohen, 2002). Of interest to the current study is that individuals with AS rely more on object-processing neural networks to process objects **and** faces, perhaps even processing faces **as if** they are objects: as evidenced, for example, by focusing more on the mouth and less on the eyes (Kliemann, *et al.*, 2012). This explanation would clarify why Kahla’s compensatory learning is successful in the absence of implicit face perception: her strategy of taking a mental photograph of a face treats the face as an object (a photo), which can be rote-remembered visually, and provides her with an alternate strategy when context clues to

a person's identity are not available. Kahla's compensatory learning is in harmony with a cognitive profile of externally-oriented—or concrete—thinking (Hill, *et al.*, 2004; Lind & Bowler, 2008; Newman, *et al.*, 2010).

Other features of Kahla's narrative display a reliance on externally oriented thinking: memory as an external entity; speaking aloud to encode to and retrieve from memory; compensatory learning using external referents; and, study of people. Within the research literature, the preference for externally oriented thinking is also described as 'concrete' thinking (Lind & Bowler, 2008; Newman, *et al.*, 2010), literal thinking (Cashin, *et al.*, 2012) or 'black and white thinking' (Meyer & Minshew, 2002) and is contrasted with abstraction and the ability to form mental representations (such as prototypes for faces). Concrete thinking is defined by Minshew, Meyer and Goldstein (2002) as 'the inability to form concepts based on experience' (p. 327). The phrase 'externally oriented thinking' was adopted by Hill, *et al.*, (2004), from the Toronto Alexithymia Scale and defined as 'a tendency to focus on external events rather than inner experiences (concrete thought)' (p. 229). Thus, Kahla's compensatory learning strategy of utilising visual mental representations of external objects to solve the problem of lack of implicit face-recognition is well recognised within the literature as being characteristic of autistic thinking.

#### **4.9 Philosophical questions**

Many features of Kahla's case suggested existential problems with reality, truth and identity. Lincoln and Guba's framework of philosophical questions was employed as the framework within which to examine these issues (Lincoln & Guba, 2013). Their 'four fundamental questions' of philosophy—ontology, epistemology, methodology, axiology—are apparent within Kahla's experience and these questions are used to frame this aspect of the thesis. The ontological questions—'What is there that can be known?' and 'What is the nature of reality?'—can be summed up in the word 'reality'. The epistemological question—'What is the nature of the relationship between the knower and the knowable?'—can be summed up in the words 'knowledge' and 'identity'. The methodological question—'How does one go about acquiring knowledge?'—is summed up as 'methodology'. The axiological question—'Of all the knowledge available to me, which is the most valuable, which is the most truthful, which is the most beautiful, which is the most life-enhancing?'—is summed up as 'values' (Lincoln & Guba, 2013,

p. 37). These four notions, Reality, Knowledge/Identity, Methodology and Values, were adopted as the framework for the existential themes emerging from Kahla's account.

Furthermore, there is a question of culture. Kahla articulated one of the most important, and indisputable, principles of education: the centrality of the learner and their response to the learning environment.

K: When you see a child with Asperger's who has a reasonable IQ or a high IQ and they're failing to learn, it's really important for teachers to think, 'What can I do then to make sure that child learns?'" (Interview)

Building on Kahla's statement, this thesis reasons that gifted individuals with AS operate within a particular cognitive cultural milieu that may not be perceived or understood by their neurotypical teachers: restated, this means that teachers may be blind to the different intellectual culture of their student. Fundamental issues of educational philosophy such as 'What is learning?', 'What is knowledge?' and, 'What is trustworthy?' may have different meanings within the culture of AS cognition. Kahla's descriptions are a window into what it means to be experiencing Asperger syndrome in an education system intended for typically developing learners, where the individual's ontological and epistemological worldviews differ substantially from those of the dominant educational system, thus posing life-defining problems: ontological, epistemological, methodological and axiological.

#### **4.9.1 Life-defining problems**

Kahla's narrative reveals that much of her thinking is occupied with questions of reality, the trustworthiness of knowledge, identity and value. These questions touch not only the core of what it means to be human, but also the heart of learning. The chain of reasoning for this proposition is: learning is not authentic unless it is based in reality; if Kahla's perception of reality disagrees with other people's (in particular, her teachers), and her means of learning differs from theirs (or from how she is being taught), how can she **know** what is real and true? (note the association of knowledge **and** identity along with method); and, given conflicting information, is she valuable or not? This is a personal and social problem-solving situation for Kahla on a massive scale and her account reflects the many attempts, over time, to come up with definitive answers. These attempts also help to understand many of her self-named eccentric behaviours.

#### 4.9.2 Mindblind schools: Knowledge of AS is a key to scaffolding learning

Kahla described experiences of schooling that displayed ignorance of the possibility of her non-neurotypical mental and physical states. Keeping in mind that Kahla was 48 years old at the time of her contribution and that knowledge of AS is now widespread through the education profession, relatively recent reports by students with AS suggest that schools, enacted through individual teachers and leadership teams, may persist in a mindblind attitude towards the thinking and mental states of their students with AS (Carrington & Graham, 2001; Humphrey & Lewis, 2008). Indeed, this is the educational problem that prompted this doctoral research.

Kahla reflected on what she would have liked to have known, and what she would have liked her teachers to know, while she was at school.

K: I would have liked the teachers and parents just to know what Asperger's is so I could have been accommodated a bit more. For instance, I broke a lot of school rules because they didn't make any sense to me ... but I would have liked them to appreciate things that I found very, very stressful and to be more understanding instead of angry. When I resisted going into the really crowded [school assembly] hall, they would have known why, that there was a big sensory overload and it was too overwhelming, rather than thinking I was being deliberately disobedient... And I would have liked to have known just for my own understanding. Because **knowing** has actually enabled me to put a lot of strategies into place like looking in eyes, modulating my voice, understanding what some people find eccentric and annoying, and modifying it, while still being true to yourself but just being able to adapt enough so that you fit more comfortably in. (Interview)

Kahla has clearly come to place high value on the compensatory social learning she has acquired late in life through explicit teaching. While it is impossible to say whether she would have benefited or had the same motivation to learn as a teenager, she pointed to the lack of understanding that she experienced in a school system designed for TD learners. Ironically, it could be said that schools need to develop a 'theory of mind' towards their students with AS as, in Kahla's case, her school was 'mindblind' to **her** mental states (see Baron-Cohen, 1995). This issue is captured by Jacobsen from the perspective of a psychotherapist but can be applied to education; educational terms have been substituted.

Those with AS are often described as having difficulty understanding and accepting the perspective of others or even recognizing that others have a perspective. Yet the key to ~~psychotherapeutic work~~ [teaching] and case management with AS, and the challenge for

the ~~therapist~~ [teacher], is *our* understanding of *their* perspective. (Jacobsen, 2004, p. 571)  
[italics in original: strikeout added]

Therefore, one aspect of the philosophical problems Kahla has is that, rather than helping to build her knowledge construction, the education system she experienced was blind to her authentic experience and ways of knowing.

#### **4.9.3 What is true?: Lying and a sense of justice**

The well-documented sense of justice (Attwood, 2007; Bogdashina, 2013; Williams, E., 2004) and insistence on adherence to rules, whether dogmatic adherence is socially appropriate or not, is, this thesis contends, indicative of the philosophical problems experienced by individuals with AS, like Kahla. The problem can be elaborated like this: if one's sensory input gives information that does not reconcile with the observed behaviours of others (as in the example of Kahla not wanting to enter the crowded school hall while the other students did not object); and, with diminished theory of mind and capacity to construct abstract frameworks of understanding to guide her behaviour; then Kahla has no choice but to fall back on the memorised rules and patterns of behaviour (her own and others') she has experienced. Perseverative and dogmatic adherence, and the urge to have others also conform to the expected behaviours, could be the expected result of this method of understanding the world. It follows that the expression of this worldview would be inflexibility, insistence on sameness, routines, predictability, and a strong sense of the 'right and wrong' ways of doing things.

The combination of: (a) compromised capacity to intuitively understand whether other people are telling the truth (as well-developed theory of mind is needed in order to do this with a reasonable degree of reliability); and, (b) a strong sense of justice; contributes to the inexplicability, from Kahla's point of view, of processing what other people say when it does not match her mentally constructed view of the world.

K: I know some Asperger's people have been recorded as being able to lie to a small degree, but in my experience it's unlikely. My son [name] could not do it even if it was a choice of 'death or say it'. It's so foreign to me that I will be continually shocked until I die when I come across the fact that some people do it. So I think there are really valuable assets to being Asperger's: the sense of social justice, the right and wrong, the fairness. (Interview)

Kahla is reliant on people telling the truth in lieu of her absent, socially constructed knowledge. She is missing a body of knowledge that other people have and is literally

reliant on other people telling her. When they lie, even the knowledge that people do lie, it is a profound shock. It points to the questions ‘What is real?’ and ‘How can I know what is real?’: that is, the critical issue of the trustworthiness of knowledge.

K: See, for me, lying is the most shocking thing human being can do, because the word is a truth on its own. Words were our keys to escaping from being an animal and without them, we couldn’t be as human as we are. Words make the solid foundations of things because only with words can you understand clearly. Once you start saying something that isn’t true, to me that’s like building a house on a big hole, it’s shaky, it’s not reliable. To me, words are almost sacred... (Interview)

However, with regard to deception and lying, it needs to be noted here that, due to a compromised episodic memory system, particularly source monitoring and temporality problems, the attribution of what oneself or others have said or done in the past (unless accurately remembered verbatim in semantic memory) is open to question. Anecdotally, and in the researcher’s own experience, it has been reported by many life partners of people with AS that their partner has said or done something that they have contradicted at a later time, denying they said or did it, which, from the life partner’s perspective, is an act of deception or deliberate lying on the part of an individual with AS. With an understanding of source monitoring problems and the role of temporality in cognition, these conflicting phenomena (strong sense of justice and adherence to the truth contrasted with life partners’ reported experiences of acts of deception and denial of previous words or actions) become amenable to explanation.

Against this background, the complexity of the problem of establishing truth and trustworthiness as a basis for learning about the world (and learning in general) becomes apparent in Kahla’s account. Kahla has to live with the unresolvable inconsistencies of life (such as the mismatch between what she hears some people say and what she believes to be true from her own experience and learning), and the emotional turmoil that must result: she must do this without the benefit of the cognitive flexibility or emotional processing capacity to resolve and integrate such mismatches into higher-order understanding, such as that possessed by mature TD individuals of equivalent intellectual capacity to Kahla.

#### **4.9.4 Identity formation**

As discussed earlier, autobiographical memory, self-referential processing and autonoetic consciousness are atypical in autism. The development of a sense of self, or

identity, is typically achieved through these mechanisms, however, these processes operate differently in autism. ‘The autobiographical memory difficulties in ASD may ... be related to the development of self-identity in this group’ (Crane & Goddard, 2008, p. 504). It was therefore expected that the participants’ expression of identity would take a different form. Despite the challenges, the development of ‘introspective awareness’ in gifted individuals with AS is clearly possible, as demonstrated by the eloquent self-narratives in the five case studies of this doctoral research, published accounts (Grandin, 2006; Williams, E., 2004), and other phenomenological studies (Carrington, *et al.*, 2003; Hurlbutt & Chalmers, 2002), although the evidence on memory and consciousness points to compensatory pathways to achieve this.

Lind and Bowler (2008) reported that the characteristics of thinking will take the following form: concrete, fact-based, employing visual imagery, lacking inner speech; and ‘this suggests that private self-awareness, like conceptual self-awareness, is qualitatively different in individuals with ASDs’ (Lind & Bowler, 2008, p. 178). Further to the life questions that are in the subtext of Kahla’s narrative, the search for identity through external referents—to answer the question, ‘Who am I?’—can be seen. Kahla described her attempt to answer this question throughout her childhood, through her own observations and actions, and through the feedback (hostile or otherwise) of others. The sub-textual question, ‘What is real?’, is coupled with the search for identity. Kahla described a period of her childhood when she decided she had more in common with dogs than people, so she would be a dog. She found success for some time in being Pollyanna, after reading one of the Pollyanna books (Porter, 1913), through a period of recuperation after a car accident when she was ten. This was a persona that served her well during her later primary school years but broke down during adolescence. She felt for some time that she was a changeling, a ‘strange fairy child’, who had been substituted for a human child. As an adolescent, because of her eccentricities, she was hostilely cast as a witch. She speaks of alienation, complicated by the fact that she believed things she read in books, such as seeing unicorns by looking in a mirror, or communicating with the ancient Norse gods.

K: I **loved** fairy tales and mythology and no one had **ever** suggested to me that they weren’t real. The written word has such a huge power for me, I assumed that it was true. I had no doubt in my mind. I was very fond and familiar with all the Norse gods who I spoke to, thinking, imagining that they would hear me. I constantly thought I could see glimpses of magical and mystical beings because I knew they were there, the books

described them so realistically. So I really entertained the idea that perhaps I was a changeling, that I'd been swapped at birth and the **real** me was being looked after by fairies and I was really some kind of strange fairy child that had been left for my parents to raise and I certainly hoped that they would come and get me soon. (Interview)

The naïve inability to distinguish between reality and fantasy, based on what she read in books, left her at the mercy of others' taunts and with a clear problem of identity formation. As noted in the four philosophical questions, the answer to the epistemological question, which includes knowledge of the self, is contingent upon the ontology question, 'What is real and true?' (Lincoln & Guba, 2013, p. 37). Hence, Kahla has feelings of alienation where she is not with her 'tribe': born out of place or out of the time where she belongs. As an adult, she continues to come to terms with the sense of being an alien within her social context, but has a strong identification with other people with AS, seeing TD individuals as outsiders, even disadvantaged, as in the case of the discussion of the researcher's so-called 'colourblindness'. Kahla is ambivalent with regard to identity: she feels sorry for people who do not have her perceptive capacities and has a sense of TD individuals as lacking a special set of capabilities. At the same time, she is aware of her own alienation and disadvantages.

#### **4.9.5 Am I smart, or am I dumb?**

In addition to the questions of reality, knowledge, identity and methods, Kahla's comments revealed that she and her sons have an axiological problem: that is, the value of the self gained through participation in schooling, as reflected by teachers and peers. This is summarised by the propositional question, 'Am I smart, or am I dumb?' and is a common theme through all five cases. Inevitably, Kahla herself is grounded in her own cognitive cultural milieu and her interpretations of good teaching and learning also follow from her ontological and epistemological beliefs. Throughout her interview and her correspondence, she expressed confusion and personal angst about the value of her intelligence and gifts.

K: The one thing all Aspergers people are good at learning is a sense of failure. Once instilled it is very difficult to shift and I personally have struggled with overwhelming onsets of a sense of failure all my life—particularly on a social level but some times academically. There were situations when I was actually excelling at a subject but the teacher for whatever reason chose to ridicule me or mark down my work. (Email)

Kahla has the problem of maintaining a belief in the value of her own intelligence while being exposed to day-to-day challenges to this belief. This issue played out in her

experience of school, highlighting the ambivalence of being gifted and learning disabled, along with other issues of being autistic.

K: I feel I must warn you that maths is my deepest failing and I am VERY ashamed of this flaw, as most people in my family are genius and are fluent in astro- and quantum physics ... Most teachers were furious, believing in error that, as I was so advanced in other areas, I was deliberately withholding my maths ability in a strange bid for attention. I was regularly punished by being left alone in the class room at lunch with a pile of maths books. The teachers left no instructions. I had no idea I was supposed to do anything with the books and sat there in silent misery amusing myself by listening to the sounds outside. I only learnt to tell the time at the half [hour] two years ago and mastered the art of navigating calendars last year. This issue caused tremendous shame. (Email)

The confusion between building a sense of self as a gifted person while building a sense of self as a person with a learning disability is also expressed in the lived experience of her sons.

K: My older son, who is 13, is very intelligent but utterly failing in the school system. Nobody understand the incredible achievements he has made! He is perceived by teachers as an idiot when he is in fact truly remarkable! He did not talk until he was five and a half. ... I devised my own program and saturated my son with language. I wove words like a tapestry and wrapped him in them. Now he writes poetry. Now his eloquence is capable of inducing tears! (Email)

Kahla's younger son is a quiet, emotionally sensitive child who wants to please his teachers. However, he has been the recipient of negative feedback from teachers about his efforts that has affected his developing sense of self.

K: Despite being known fondly in our family circle as 'the little professor or philosopher,' the teacher said to me one day, 'You should be really worried. He is so stupid, I simply can't imagine a job he could have when he grows up.' This about a child at age 3 who stated that he doubted the ability of ghosts to see anything due to the fact they would not have functional optical nerves!!! And who regularly wondered at the same age who he would be after death if all the things that made him '[child's name]', ... and defined him; in what identity or form would he exist? (Email)

Even allowing for the subjectivity of Kahla's comments about her children's negative experiences at the hands of their teachers, it is clear that mainstream classroom teachers are working at a disadvantage in understanding the learning needs of their students with AS.

#### 4.10 *Being a member of a minority 'cognitive cultural group'*

Vygotsky's sociocultural theory is an appropriate 'fit' for Case 1: reality, knowledge and values are constructed and maintained within a cultural context (Brown, J. S., *et al.*, 1989). Kahla has a strong grasp of the values attached to 'being Asperger' as culturally constructed and recognises that her personal values are at odds with the social culture in which she lives.

K: I've thought about the traits that make up what somebody with Asperger's is and I like it. I think there's a lot more value in it. A lot of people think 'Asperger's' and they put it over here (gestures to one side), and you read these big labels like 'socially impaired' and you get these almost cartoon-like Asperger's representations. When, in actual fact, a lot of what we are is highly valuable. (Interview)

Kahla is also keenly aware of the tension between her own values and the values being imposed upon her within her own culture. However, she has travelled widely and explored primitive cultures: Amish and Indian tribal culture.

K: I find primitive cultures incredibly civilised and interesting. I think that we use that concept of 'primitive' as meaning 'uneducated' because they haven't been through our school system. Their learning is so intense. It's so complicated. (Interview)

The rote memory and pedantic interests of AS would be viewed as strengths, according to Kahla, in the primitive cultures she has experienced.

K: ... I've travelled the world and in other settings I think Asperger's would be incredibly useful. I think it would be very useful in an Amish community because it's very ordered and structured, a bit like the insect world, and the work is very ordered.

Res: So it wouldn't be seen as a disability?

K: No. They're very task-orientated. ... they care a lot about patterns and the way things look. ... I really liked how they don't just chop fruit up and bottle it. They actually arrange it aesthetically in patterns and then group the yellow fruits with the orange fruits with the red fruits. I noticed in tribal cultures and when I crossed from [the Maneri region of India] onto the other side, where you get ... tribal people who are ... hunting-gathering. ... skills like cataloguing and recognising insect life and what you can eat and what [you can't]. Specialised interests are really, really important and valued. A really **big** auditory and visual memory is essential for those tribal communities and the ability to relay long stories and oral histories, which I see as a skill. All the skills that I saw were highly valued in those types of communities were things that I had and that I recognise other people with Asperger's as having. They were also incredibly tolerant to eccentric behaviours and those people were quite revered. ... I can't think of anything more wonderful than having a place to use that mind, like Celtic tradition, that big oral history,

I would have been perfect. I've got a lot of Celtic blood anyway but I could have relayed the stories back to the beginning of time and been a bard. (Interview)

Within a sociocultural view, individuals' personal strengths and weaknesses are culturally determined. Kahla laments that the westernised culture she operates within does not place the same value on the type of learning and memory she excels in and proposes that, had she been born into primitive Celtic culture, she may have been a celebrated bard whose learning, memory and skills were of critical value to that culture. She noted that social aspects of the tribal life she experienced were highly structured, with rules for interacting, ceremonies and rituals, while the hunter-gatherer lifestyle facilitated silence and solitude. In these situations, Kahla did not have the sense of alienation that is her usual experience.

One might be tempted to label Kahla's views as escapist or a defensive mechanism, however, her cultural understanding aligns with a sociocultural approach to learning and deserves serious consideration for the insight it offers into cognition. For this reason, a proposition of this thesis is that gifted individuals with AS may be understood as operating within a different internal 'culture of the mind', or 'cognitive culture', and that application of a socio-cultural view of cognition in AS provides new possibilities for insights relevant to education. The need for cross-cultural understanding between teachers and learners with AS, in relation to language, thinking and learning within educational settings, will be considered further in this thesis. A cultural approach is supported by Jacobsen (2004) who was looking for a frame of reference within which to relate her psychotherapy practice.

I developed a frame of reference to help in my role with these children. Though not a true analogy to the Asperger experience, the analogy that worked for me was one in which I might find myself in the 'alien' role. If I were to live in a very different culture, as I tried to learn what is appropriate, I might constantly commit faux pas. I would undoubtedly be misunderstood, behave in ways that seemed inappropriate or even offensive, and I would misunderstand others. I would need to learn new rules, the meaning of my behavior to others, and I would probably have to do that **cognitively translating**, rather than emotionally 'getting it'. (Jacobsen, 2004, p. 571) [emphasis added]

The experience of being an 'alien' appears in the autobiographical and biographical accounts of individuals with AS (Hedgcock, 2010; Sacks, 1995; Williams, E., 2004). The different 'mental culture' that is suggested supports the proposition of 'translation', described by Jacobsen as 'cognitively translating'. Kahla's narrative exposed the issues

of identity and cognitive culture that became evident throughout the case studies of this doctoral research.

#### **4.11 Conclusion**

The life problems faced by Kahla are complex in nature and ultimately need to be addressed at a philosophical level: pertaining to the nature of reality, knowledge, identity and value. Learning for Kahla is a matter of adapting to ways of being in her social context that will facilitate better functioning, social integration and problem solving. Kahla appears to need very little support to learn *per se* as her mind is very active: observing; making associations; filing memories; and, seeking out information related to her special interests or needs. Kahla demonstrates a methodological need for access to trustworthy knowledge that will result in her learning being accurate and appropriate. She needs access to teaching methods that will assist her to analyse and make the adaptations to behaviour that will help her be more successful socially. She deserves the same unconditional acceptance and respect that others deserve, while she undergoes this compensatory learning process, which is counterintuitive to her native intelligence and ways of learning. From an examination of Kahla's data, a philosophical scenario of unresolved 'life questions' and a quest for epistemic certainty emerged. Clearly, Kahla has wrestled with existential issues that have impacted her thinking and learning and her account seems to show that she has fewer pathways to resolution than might be expected for someone of her intelligence and giftedness. If resolution of existential questions is a matter of learning from experience, then Kahla has overcome great challenges to achieve her present level of resolution and social competence. Learning from one's prior experience has been noted as highly problematic for individuals with AS (Crane, *et al.*, 2010; Klinger & Dawson, 2001; Williams, E., 2004). However, through compensatory learning strategies, employing externally oriented thinking, Kahla has achieved a measure of personal success and a place within the artistic community as a valued contributor. Her reflections on thinking, memory and learning point to a cross-cultural approach as an effective means to understanding the thinking and learning of students with Asperger syndrome.



**Figure 4.13 'Contemplation with Fish and Lilies' is a mixed media work comprising digital media, hand drawn elements and photography. Reproduced by kind permission of 'Kahla'**



## Chapter 5 Case 2 ‘Rhoda’

Rhoda is a woman in her sixties, who, at the time of the interview, was investigating retirement. She was on stress leave from her teaching job in the tertiary training sector in New South Wales. Rhoda was born in London but grew up in South Africa and has lived in a number of countries, finally settling in Australia and meeting her life partner, ‘Steve’, through shared interests. She married very young and moved with her then-husband from England to Morocco but the marriage ended and she was left traumatised and alone. Rhoda is an accomplished musician, who plays many instruments and specialises in early music, particularly polyphonic music and music for lute, recorder and voice. She was an architectural draftsman with a particular gift for hand drawing three-dimensional (3D) realisations from architectural plans. In more recent times, she has specialised in graphic design and multimedia, eventually becoming a teacher. She has published a multimedia (print and software) work involving the 3D mapping of imagined landscapes based on the use of fractals.

Rhoda’s partner, Steve, is also a musician and teacher. He has had a long career as a professional musician playing the French horn, but also plays many other instruments. Rhoda and Steve met in 1986 at a workshop on early music, discovered a common interest in playing and performing lute music, and had been together for 25 years at the time of their interviews. Rhoda gave a coherent narrative of her personal struggles and past history. Steve delivered a premeditated, structured treatise of his interpretations of Rhoda’s cognition and behaviours based on his observations and interactions with her over the years they had been together.

Rhoda and Steve made contact with this research study through a word-of-mouth recommendation and requested that their participation be conducted via *Facetime*, *Apple* video-calling software. The ethics approval for this study was amended to cater for this request. The researcher did not meet with Rhoda and Steve in person. Both were present in the room while the other gave his or her interview and there were numerous discussions between them during the course of the interviews but only the person in front of the computer was audible. This meant that there was frequent cross-checking for meaning between them but it resulted in a less fluent transcript.

Rhoda, being a high-level *Apple Macintosh* user, suggested the method for conducting and recording the interview: while the interviews were in progress via *Facetime*, screen-recording software called *iShowU* was used to record the *Facetime* window. After the interviews, the audio track was stripped out of the resulting video file and transcribed. Due to the unreliability of the internet connection during the *Facetime* calls, Rhoda's interview was conducted in two parts, on separate days. There was some delay in the transmission so sometimes speakers' utterances overlapped or were hesitant. Transcription attempted to preserve meaning for the reader rather than provide a verbatim record of the delays and overlaps. Despite the challenges of an intermittently reliable internet connection, this proved to be an expedient means of conducting the interviews as it allowed the participants to maintain their privacy and reduced the social demands of the interview process.

Rhoda's biological family, like Kahla's, displayed the broader autism phenotype. Her brother was mute until he was five or six years old and she, herself, had delayed onset of expressive language. Rhoda described her brother as 'semi-autistic' and other family members as 'eccentric'.

R: My grandmother apparently was [eccentric], on my father's side. I'd say my mother was a bit eccentric. My brother was almost semi-autistic as a kid. He [went] like this (rocks back and forward on her chair) so it's interesting. ... He was very non-verbal. He couldn't express himself ... he became a hardware engineer, electronics, in America, surgical instruments. (Interview)

From this and other similar references, it appears that Rhoda comes from a family with a genetic inheritance of autism traits and high intelligence, aligning with the broader family phenotype of autism (Baron-Cohen & Hammer, 1997).

## **5.1 A sense of difference, alienation and isolation**

One of the overarching impressions from Rhoda's narrative was her sense of sadness at the losses and alienation she has experienced: awareness of what her life could have been with a measure of understanding and tolerance, contrasted with sadness over the difficulties she has experienced. When asked to explain her understanding of Asperger syndrome, her answer was imbued with that sense of difference.

R: [AS is] ... an abundance of nerves or intelligence in certain areas and a lack of it in others. And for different people, it's different. So it's like an imbalance in the nervous system. For me, it involves difficulty as far as socialisation, because I can't get into that, I

can't see what other people like. I used to be in a drawing office and the girls used to talk about TV and *Brevilles* and that, I just could not get into that. So that's where it affects me. And also the fashion thing, I couldn't get into all that preening and primping, that stuff. (Interview)

Rhoda's sense of isolation was exacerbated during her developmental years through mental health (mis)treatments and she reported she was, at one time, at risk of being lobotomised.

R: I was misdiagnosed around the age of 13 [in South Africa] because I found becoming a teenager was really hard to cope with. I had special interests and I'm afraid the special interests got me into a lot of trouble because I had this fascination for Arabs and that just wasn't appreciated. ... I ended up being misdiagnosed, getting shock treatment ... and the psychiatrist who diagnosed me called me obsessive-compulsive. I wasn't schizophrenic. I didn't hear voices but I talked to things and I was very anti-social, I just used to sit in my room. As I grew up, I got more withdrawn because of everything that was going on. So it's been a sad time and I wish people had known about [Asperger syndrome] then, but they didn't. Remember that the 50s and the 60s ... was a time they were giving people lobotomies ... and I'm lucky it didn't happen to me. ... It's scary because it was touch and go. They could have done it to me as well. So it's just been a case of survival. ... [My diagnosis of AS was] a big relief because it explains everything. It explains my aloneness. If anything characterises an Aspie person, I mean, for me, it's a feeling of disconnection or aloneness from the rest of the world. (Interview)

Depression is a feature of Rhoda's experience and this exposes a dilemma for gifted individuals with AS: without intelligent awareness of the possibilities for oneself in the world, it is unlikely one would be so profoundly sad at the lack of realisation of those possibilities. Based on Rhoda's narrative, reactive depression at perceived lost opportunities is assumed to be, at least, a component of her depression.

Rhoda embraces isolation as a necessity and as a lover of solitude but, at the same time, she is aware of a sense of missing out. She gave examples from her workplace.

R: ... things were really getting bad at work. ... I had been diagnosed with depression a number of times ... When I started at this [current] job, which is teaching ... multimedia and graphic design, ... there were just two others and myself, and because the other people had been there for a year, they marginalised me. Some people think I'm arrogant and I don't know why. But anyway, the other chap wanted power so of course he marginalised [me], he made sure I was out of the running for anything even though I was the most experienced and the most qualified person in the place, because before that I was a graphic designer and I was an architectural drafter. (Interview)

Rhoda appears to manage her sadness and find meaning in her life through her special interests, which are extensive. She is a prolific photographer and photo-blogger and she and Steve share an interest in 'narrow boats'. Since Rhoda retired the year after the

interviews, they have purchased their own narrow boat and divide their time between Australia and the United Kingdom, spending many months each year motoring through the canal systems of the UK.

## **5.2 School experience**

Rhoda experienced major problems in her schooling, which took place in South Africa. She was ‘persecuted’ for poor handwriting and seems to have encountered very few teachers who extended understanding and tolerance for her unusual behaviours. She said that she did not suffer much bullying from her peers because she was known to have a temper, so was left alone. However, school peers did exploit one of her phobias and, as Rhoda tells it, they seem to have enjoyed scaring her.

R: When I was about eight, I wanted to know what [a leaf damaged by a leaf miner] was but it still gave me the horrors and somehow it came out that I was scared of them because I told one person and ... it spread about the girls and these girls started chasing me with the leaves and I was cowering under a bench. That was horrible. I think I ended up with an asthma attack soon after that. I know that I wasn’t at school for a long time and it didn’t happen after that. So either they forgot or they were told, ‘Don’t do that’. (Interview)

Experiencing horror at the sight of certain shapes is discussed further in Section 5.4.1.

Rhoda’s sense of sadness and regret is apparent in the following summary of what her schooling meant to her. Like Kahla (who didn’t attend school for a long time after a car accident, aged 10), she had long periods of absenteeism, in this case, due to sickness. These long absences at home seem to have been productive times of self-learning without the interference of the social restrictions of formal schooling.

R: ... I was able to get through school without much help. Perhaps my mother teaching me [to read] when I was three ... I was too way ahead. What would have helped and perhaps I would have had a better life, I would have gone to academia or something that really interests me, would have been to have encouraged me to get ahead, rather than hold me back. ... To not have persecuted me because I had bad handwriting and made disparaging remarks about my untidy work. To have encouraged me with the things that I enjoyed doing and not forced me to do things that I was no good at. (Interview)

Rhoda’s and Kahla’s cases indicate that, as gifted children with strong special interests, their learning thrived in the solitary home environment, but was very disrupted and stressful in the formal school environment. Rather than being disruptive to their

education, long periods of absenteeism had the opposite effect: a redemptive effect of allowing them to learn in their own time and pursue their own interests.

R: When I was at school, I had these IQ tests and I just did them like this (gestures that she did IQ tests easily), this is primary school ... and after that the teachers started to treat me differently, in a way that they expected me to achieve more than I did ... but there [was] some kind of dichotomy between what I achieved on the IQ tests and my performance at school, which isn't surprising, considering. I'm amazed I got [good results], when you think about how often I was away with asthma and bronchitis, I'd be away about two thirds of the year ... and what would I be doing at home? Jigsaw puzzles and listening to the radio, which I loved, and it was good because Meena [her nanny] would bring me breakfast in bed. I'd be sick, I wouldn't have to go to school. I read Enid Blyton books, I liked comics ...

Res: So that was really your own home-schooling, your own home curriculum, self-controlled.

R: Oh yes, yes, yes. And I used to read the dictionary and Arthur Mee's Encyclopaedia, I liked that. ... number 10 was my favourite encyclopaedia because it had pages of illustrations and it was from the Victorian era ... they had architectural details and then they'd have heraldic details ... and all the different parts of armour. I used to love that ...

Res: So it sounds like you learnt more by staying away from school than by going.

R: Oh, absolutely! And I'd come back to school and they'd be doing something just [too easy] and I'd think, 'Arrrg'. (Interview)

Rhoda and Kahla's narratives lend weight to the idea that, as gifted children with autism, they enjoyed and took responsibility for their own learning in a way that was disconnected from their school experiences.

### **5.3 Learning**

A number of issues arising from Rhoda's case that relate to her thinking and learning processes are discussed in this section.

#### **5.3.1 Language: verbal vs. visual processing**

The findings of several reports (Harris, *et al.*, 2006; Kana, Keller, Cherkassky, Minshew & Just, 2006; Koshino, *et al.*, 2005), a review (Williams, D. L. & Minshew, 2010) and a firsthand account (Grandin, 2006) suggest that language and visual processing have a unique relationship in learning for individuals with AS. In typical verbal processing, the concept of an object is symbolically represented by the noun or pronoun that describes it. However, in the findings of a key study with individuals with autism, the difference in visual processing of verbal and linguistic content was described in terms of

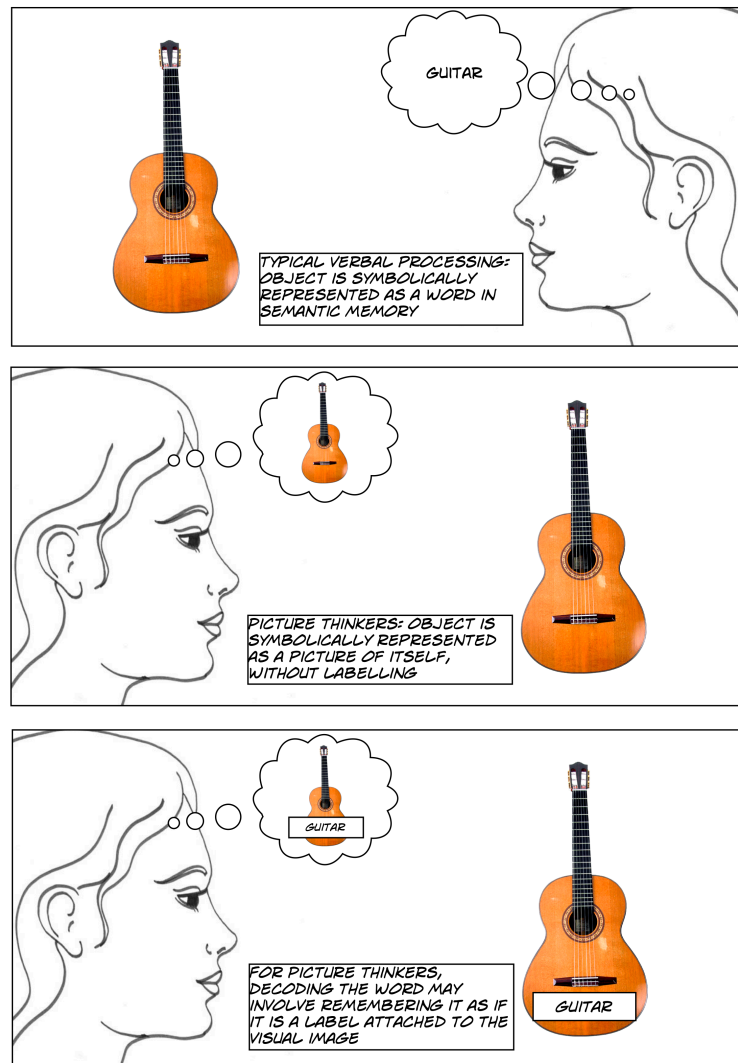
neurological connectivity, which correlated with the way language was processed, using visual imagery instead of typical language processing.

Our interpretation of the pattern of results is that the autism group used a more nonverbal and visually oriented processing style and that they retained the stimuli as visual-graphical codes. ... On the other hand, the control group relied on a verbally oriented style in which they converted the letter stimuli into verbal-phonological codes. (Koshino, *et al.*, 2005, p. 819)

Williams and Minshew (2010) interpreted these findings by stating ‘... when adults with ASD viewed a letter, they processed the information in the right-hemisphere visuo-graphic brain regions, **failing to recode the information linguistically**’ (Williams, D. L. & Minshew, 2010, p. 10) [emphasis added]. Similar findings were related to Grandin’s account of ‘thinking in pictures’.

Participants with autism showed more activation in parietal and occipital regions, suggesting that they were using visual imagery more widely than control subjects to support understanding of sentences. In Temple Grandin’s terms, they were probably ‘thinking in pictures’ much of the time (Grandin, 1995). ... The result suggests that the autism group might routinely recruit visual imagery for comprehending sentences rather than comprehending them on a purely linguistic basis. (Kana, *et al.*, 2006, p. 2491)

Rhoda’s data, considered in the light of the references cited above, suggest the idea that, in autistic thinking, an object may be represented symbolically as a visual image of itself, rather than a word: and, if so, the word does not represent the object but instead it is the other way around; **the visual image of the object would be required to remember how to decode the word**. For example, it’s possible that the word for ‘guitar’ is memorised for decoding purposes by picturing the object it is mentally attached to, as shown in Figure 5.1.



**Figure 5.1 Symbolic representation in verbal thinker vs. ‘picture thinker’**

For ‘picture-thinkers’ such as Rhoda, it may be that they are using a language-learning technique, such as that shown in Figure 5.1, for remembering how to decode letters and words that imparts a heavier cognitive load when reading and writing. Building on the research by Perkins, *et al.*, (2006), further investigation into the nature of word-object processing is required to illuminate the mechanism and load resulting from this cognitive feature. This would, among other things, provide evidence for the need to free up timing constraints in learning for gifted learners with AS, which is one of the proposals emerging from this study. In the meantime, anecdotal reports are suggestive. Grandin describes the way she remembers a word as picturing it as a label on the object it describes (although it is unclear whether she is actually decoding the word or seeing it as a graphical representation). For her, the process of working with words is similar to translating into, and from, a second language and she uses terms that indicate a reliance on eidetic-style semantic memory.

When I read, I translate written words into color movies or I simply store a photo of the written page to be read later. When I retrieve the material, I see a photocopy of the page in my imagination. (Grandin, 2006, p. 15)

Rhoda's description of the way she sees, and represents what she sees, suggests that she is seeing words and objects in a similar way. This may be an advantage for accurate representation in drawing but a disadvantage in the additional process of working with language. For Rhoda, working with language appears to require an extra, effortful dimension of cognitive processing, suggesting that verbal thinking, for her, is not a native way of thinking but a learned compensatory skill that continues to demand practice and effort.

### **5.3.2 Processing verbal instructions**

Processing complex verbal instructions is another point of difficulty that has arisen in Rhoda and Steve's life together.

R: There are certain [things] that I find difficult. ... if somebody interferes with me while I'm trying to absorb information, or too many verbal instructions at once. (Interview)

Rhoda and Steve described a self-devised scenario that illustrated differences in the way they think. The scenario was a route, known to both of them, that was described to her, verbally, by Steve. The test was to see whether Rhoda could mentally construct the route. They concluded that, as long as she mentally navigated by roads and landmarks she had previously experienced in real life, she was able to mentally construct the route and follow directions. However, if Steve gave verbal instructions using landmarks, as soon as she moved off the previously experienced route, she was unable to mentally navigate, and experienced a sense of 'being lost'. In this case, she required the concrete support of a map.

R: ...if somebody says, 'Oh, you go left. You go right and then you...' I say, 'Don't. Just give me a map. Tell me where it is on the map and I'll find it.' (Interview)

This account is in accord with the research on cued and uncued recall (free recall) that found 'contrasts between intact cued recall and impaired free recall and recognition in autism' (Ben Shalom, 2003, p. 1129). Rhoda's previous experience possibly acts as an internal cueing system, but when it comes to mentalising novel material from verbal instructions, she is unable to do this.

The timeframe required to process instructions is a critical factor for Rhoda's thinking processes. For example, she enjoys knitting and chooses complex knitting projects. In the case of complex knitting instructions, they are written, not spoken, which allows Rhoda to process them in her own time, whereas performing a task within a timeframe according to another person's expectations, under the processing time-pressure of speech, is very difficult.

Res: So, from the map, or whether it's a knitting book, or watching someone else, in your own time you are able to go through the steps and process it but in somebody else's timeframe, you can't. Would that be right?

R: I think that's an excellent way of putting it. Someone else's timeframe, what they expect. (Interview)

### 5.3.3 Dyslexia

Rhoda has eye-tracking problems suggestive of dyslexia, which is grouped with dyscalculia under 'Specific learning Disorder' in the *DSM-V* (APA, 2013), a possibility she and Steve had not considered in the context of the issues they raised in their interviews, even though she was diagnosed with dyslexia as a child.

R: ... my eyes, I have trouble, now this is another learning difficulty, tracking along a line. ... I did have a good arithmetic teacher in school. I was very good at algebra and geometry but in arithmetic I'd get every answer wrong. Why? I was dyslexic. I always got my methods 100% right, so I'd get 95% for an arithmetic test. [The teacher] was very kind because, had she just gone on the correct answer, I would have failed it every time. ... the numerical answer was wrong.

Res: Because you were reading the numbers in the wrong order?

R: Yes, because sometimes I'd say the numbers back to myself and I'd reverse them. I tend to reverse things. I tend to say left when I mean right. Even though I know left is left, and it drives my partner mad because, when we're driving, [I'll] say, 'Go left. No, sorry, I mean right.' (Interview)

While Rhoda spoke about her dyslexia as though it was in the past, the current problems with sight-singing highlighted by Steve suggested that she continues to have difficulty with eye tracking and discrimination of musical notation on paper (that is, not being able to distinguish between a note on a line and a note in a space).

S: So notation, unfortunately, there's no escape. Rhoda deals with it in a sort of flexible pictorial way of watching the rise and fall of those little black blobs ... if there is a mistake, I have to say, 'that was note 2 in the scale' and Rhoda has to somehow at that stage look at that blob and ... that blob has to be recognised somehow as the pitch of the 2nd degree in the scale. (Interview)

R: ... it's a problem in that I never learnt music officially until I was 14 and I learnt guitar, which is a completely different thing [to sight-singing] because that was kinetic and, if I saw the notes, my fingers would go to them automatically. Plus, I could also hear what was coming next so I'm good at pitching within a harmonic framework and I can anticipate, I can improvise and I can even compose. But the thing is that, if I'm reading something from scratch, it's very easy for me to make a mistake because sometimes it will be a very quick guess and be correct within the harmonic structure but won't be the right note ... because sometimes my eyes skitter, especially if I go on to a new line. (Interview)

The term 'skitter' was employed extensively by both Steve and Rhoda as a pseudo-technical term: their explanation for her cognitive processing differences being that Rhoda's brain 'skitters'. Steve likened a 'brain skitter' to a *petite mal* epileptic seizure and hypothesised that skitters are a 'lag', where there's a mismatch in integration of information processing in the brain between the left and right hemispheres. Apart from attributing the brain skitters to the left-brained/right-brained neuromyth (Pasquinelli, 2012), Steve's processing integration explanation is supported by the literature (Brandwein, *et al.*, 2013). Rhoda reported being diagnosed with dyslexia as a child: it is possible that sensory integration problems continue to affect her visual processing and are most noticeable when sight-singing from musical notation on paper under the pressure of performance timing and rhythm constraints.

### 5.3.4 Handwriting vs. drawing

The contrast between Rhoda's handwriting skill at school, which was poor, and her drawing skill, which was excellent, poses a conundrum: she expressed bewilderment about her apparently conflicting abilities. Being left-handed and moving her hand across the wet ink during handwriting was a problem.

R: I had awful trouble [especially with handwriting]. First of all I was left-handed. We used ink pens in those days, so oh! my book was covered with blots and then I'd tear pages out ... I was just so dissatisfied, and yet I could draw. Now, that's the weird thing and I could print well ... I could draw people and I used to look at the other kids [at school] and think, 'Why are they doing stick figures? Can't they see what they seeing?'

Res: That is a big conundrum isn't it? The fact that handwriting is almost universally a problem, translating the language into figures, into letters and numbers is a problem but many [people with] Aspergers ... draw so beautifully and so well and with such control. ...

R: ... I've been to art school so I know about drawing and I was drawing since I was about three or four, but the way that I draw, I don't need to block out things. I'll start in the corner and if somebody says, 'Can you draw a picture of me?' I'll start off and, you

know, I'll just go da-da-da, and just gradually do it. Whereas other people need to block out the shapes ... and I'll think, 'Why?' (Interview)

The theory of weak central coherence in autism suggests that, when she is drawing, enhanced perceptual functioning and reduced top-down modulation of perception allow Rhoda to accurately represent what she literally perceives, as a drawing, without labelling or categorising. She is most likely not interpreting the elements in the drawing as objects in relationship to each other (an example of top-down modulation) so there is no need to block out those elements before filling in the detail; she is simply representing what she perceives. Stephen Wiltshire, an artist with autism ([www.stephenwiltshire.co.uk](http://www.stephenwiltshire.co.uk)), is renowned for the same capacity to draw without significant blocking; in his case, immense city landscapes drawn from memory.

The act of handwriting, in contrast, requires representational mental manipulation of symbols (letters, words) if the words are to be written as language, rather than as a verbatim representation of the way the letters and words appear and are perceived at that moment. A useful metaphor to describe this distinction is the digitisation of text through scanning: a page of text can either be scanned as a graphic or it can be interpreted as text. If recognised as text (Optical Character Recognition—OCR) then the text characters can be edited (manipulated as independent symbols); if recognised as a graphic, the entire block of text is a single item and the text represented by the graphic cannot be edited, being, in fact, a picture of text. During handwriting, the mental manipulation of letters and words for meaning, rather than reproduction, adds a layer of cognitive processing requiring top-down modulation. Alternately, if handwriting at school was, for Rhoda, the literal reproduction of letters and words without interpretation, as if they were a drawing, this could be understood as problematic due to hand position and left-handedness, while attempting to conform to the handwriting techniques being taught. In this case, her attempts to faithfully reproduce the text (style, font, line weight) in a school exercise book using ink resulted in frustration.

Motor skills, which are frequently poorly developed in ASD (Meyer & Minshew, 2002), present an obstacle in handwriting but appear to present no problem when the artistically gifted individual with AS is drawing. Layered over the constraints of conforming to the physical handwriting techniques being taught, in cognitive terms, when the person is drawing from life or a visual memory, they are representing what

they literally see, but when they are engaged in handwriting, they are representing language. For ‘picture thinkers’ such as Rhoda, the symbolic representation of language arguably requires translation from a visual mode of thought, increasing cognitive load and interfering with handwriting ability.

### 5.3.5 The use of scaffolds: Top-down modulation

Rhoda’s partner, Steve, gave a detailed explanation of the differences in cognitive function between themselves that he has observed during their years of working together on music performance.

S: We conjectured that Rhoda’s left and right brain were working in a different phase ... she thought differently and she learnt differently and she saw things differently. ... Rhoda picked up other instruments with me and we learnt them and performed them. But there were always discontinuities and I could tell that things were different from an average able student, and Rhoda is ... an intuitive, very natural musician. [But] I was seeing and hearing these problems in getting some of the basics of music into [her] head and as a language. There were problems in picking it up. It wasn’t ‘til Rhoda said, ‘I can’t see the lines,’ and ‘Stop calling [the notes of the scale by] numbers. It’s one more thing to learn. ... Don’t try to put another process in the path to block getting to something, which is unnecessary and confusing.’ (Interview)

The sol-fa notation system is a scaffolding technique used in music teaching. Each note in the scale is sung using a syllable (*doh, ray, me, fah, soh, lah, te, doh*). The strength of the sol-fa system is that it facilitates the teaching, on any instrument, of pitch, intervals, and transposition into different key signatures, using the voice. Steve’s attempts to use an adaptation of sol-fa by singing numbers instead of sounds (*doh* = 1, *ray* = 2), while he and Rhoda practised sight-singing (singing from the musical notation of music not previously learnt), highlighted the differences in their cognitive processing style. Even **naming** the notes of the scale (A, B, C, D, E, F, G) was a distraction for Rhoda. She stated that she needed to hear the raw data of the musical sound (simulated through singing nonsense sounds) in order to learn a piece.

S: The **sound** is, to Rhoda, the final result. ‘Why learn numbers when I go, ‘La-da-dum-da-dum?’’ (sings) ‘Why learn letters? I can see the blobs.’ ‘Dum-ba-bum-ba-bum.’ (sings) ‘Why go 3 levels away?’ (Interview)

For Rhoda, the scaffold itself becomes a barrier, not a facilitator, of learning. Scaffolds allow generalisability but Rhoda is unable to utilise the scaffold and needs to learn each instance separately.

### 5.3.6 Learning via rote memory

Prior to engaging in sight-reading activities with Steve, Rhoda performed music entirely from memory.

S: ... previously all Rhoda's music was 100% memory. She has a very, very good memory.

Res: So we're talking rote memory here ...

S: Yes, yes. There would not be any notation anywhere. It's learnt from sounds, goes into [her] head and, 30 verses of the folksong, watertight memory, all [the] verses and the tune and, when it locks on, it lasts for multi-decades.

Res: It's the perfect skill set for a street troubadour.

S: Exactly. And that's why we have done this very same thing. (Interview)

Working from strong rote memory (a function of the semantic memory system) as a musician, having learnt a piece of music through auditory and tactile processing, Rhoda avoided the effects of her 'brain skitters' until she was challenged by Steve to sight-sing polyphonic music (multiple melodic parts that work against each other rather than a single melody with a harmonic structure), where predictability of the melody line was low and reading musical notation was required. This task exposed her processing weaknesses.

## 5.4 Cognitive profile: Processing style

Aspects of Rhoda's mental processing style and memory that illuminate her cognitive profile are examined here.

### 5.4.1 Sensory sensitivities and phobias

Rhoda described phobias triggered by the way certain objects appear to her: for example, a leaf damaged by a leaf miner (Figure 5.2).



Figure 5.2 Leaf damaged by leaf miners (the larvae of insects)<sup>3</sup>

Other triggers were: the shape of a monkey's skull; old-fashioned cage-type elevators, where the chains and pulleys are visible; and, salt shakers. Rhoda and Steve shared their attempts to make sense of the phobias.

R: I [had] a lot of phobias and sensitivities. Very strange phobias, like things I didn't like the look of, shapes. ... for instance, a monkey's skull. ... the shape of it, ... it had to be from the side-on, would absolutely terrify me. I only got over it when I was about 33 and even [now] I still don't like it very much. ... apparently one day I didn't like the look of the salt cellars and I'd hide my ... face so I didn't look at it and my parents would say, 'Oh yeah, another one of your madnesses' ... (Interview)

Steve's explanation for Rhoda's sensitivities implied that Rhoda has a 'normal' visual representation of an object and that deviance from that picture causes horror.

S: Certain items, skulls and things, ... are related to some shape of something which is normal but they upset her because of their deformation, turning the expected, and something which can be seen with ease, into something which is objectionable, ... a bastardisation, a horrific mutation ... The deformation of the human form into a mindless, sightless, ghost form, a sort of variation on the human ... the medical aberrations cabinet at the hospital, at the museum. (Rhoda speaks in background.) As Rhoda said, '*The Cabinet of Dr Caligari*'. (Interview)

*The Cabinet of Dr Caligari* (Wiene, 1920) is a silent horror film about a sideshow carnival act with a murderous 'somnambulist' who predicts the future. The character of Dr Caligari is a carnival showman, who displays the sleeping fortune-teller in a coffin-like cabinet to paying visitors. The visitors respond in horror at the body in the cabinet, which is apparently neither alive nor dead.

Whereas Temple Grandin described extreme sensitivity to the way things feel on her skin, Rhoda described sensitivity to the way certain shapes appear to her vision, which

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<sup>3</sup> Photo reproduced under GNU Free Documentation License. Description: Leaf mining in the *Lonicera periclymenum* leaf (Diptera). Author: Krzysztof Ziarek. accessed 15/10/2013. URL: [http://commons.wikimedia.org/wiki/File:Lonicera\\_leaf\\_miner\\_kz.jpg](http://commons.wikimedia.org/wiki/File:Lonicera_leaf_miner_kz.jpg).

evokes feelings of horror, as illustrated in the film. Steve's explanation of deviance from a remembered 'norm' implies that Rhoda has a 'prototype', an abstracted summary representation of an object (Klinger & Dawson, 2001), that she uses to identify objects, whereas it is more likely that, as a bottom-up processor, she has not abstracted prototypes of objects but recalls objects by remembering each instance of an object she has seen.

... it has been reported that in ASD the categorization of objects is in particular compromised when it has to be done on the basis of abstract object prototypes (Klinger and Dawson, 2001; Minshew *et al.*, 2002). This is in line with an anecdotal account by Temple Grandin (who has ASD), who described her tendency to remember all specific exemplars of a category rather than rely on a more generalized concept of those exemplars (Grandin, 1995). (Burnett & Jellema, 2013, p. 213)

Other reports have confirmed that individuals with autism have difficulty with prototype formation (Gastgeb, 2010; Gastgeb, *et al.*, 2012; Meyer & Minshew, 2002; Williams, D. L. & Minshew, 2010). Rhoda stated that the monkey skull evokes horror only if it is viewed from the side, not because it **is** a monkey skull. This phobic phenomenon is more likely to be a low-level perceptual processing problem, similar to Temple Grandin's aversive response to the light touch of certain fabrics on her skin. In the absence of well-developed emotional regulation, which is a top-down process, unregulated emotional states are triggered by certain perceptual stimuli. Why some shapes and not others? Why the monkey skull from the side and not from the front or back? Further research on enhanced perceptual functioning would be indicated to identify, if possible, the mechanism behind triggers and responses for individuals such as Rhoda.

An interpretation of the phobic phenomenon in Rhoda's case is that, accompanied by poorly regulated emotion: (a) she can only conceptualise single items as she is a detail-focused processor relying on semantic and perceptual memory to make sense of the world; (b) therefore, like a page of text scanned as a single graphic instead of OCR text, she cannot mentally represent concepts into their component parts for problem-solving; and (c) working with single-item memory (Section 4.4.1) for objects only leaves a binary choice, good or bad, right or wrong (for example, a leaf with leaf miner damage has lost its 'leaf-ness'; the essence of its identity as belonging to the leaf category). Further research would be of interest as to whether Rhoda is able to accept new

categories, such as ‘leaves damaged by leaf miners’, through compensatory learning, and whether this would assist with regulation of her sense of horror.

Certain sounds, also, are, or have been, a trigger for Rhoda’s fear response: sirens; sound effects on radio plays in the 1950s; and, the sound of a Jew’s harp being played by the maid next door in her childhood home in South Africa.

R: ... I’d never heard that sound [of a Jew’s harp] before and it absolutely terrified me. I went under the bed, I blocked my ears, I couldn’t stand it and you know I’d even hear it from the bedroom and that was about five rooms away. She was in a flat next door, I would still hear it and my hearing’s extremely good ... (Interview)

Rhoda’s auditory sensitivity has contributed to her phobias. Phobias have impacted upon her choice of career as she planned to study anthropology but found looking at skulls too frightening. Her comments about sensory sensitivities and their contribution to her phobias illuminate the process of ‘meltdowns’ in children with AS that find aspects of the school environment very frightening.

#### **5.4.2 Executive control of attention and ‘filtering’ sound**

Despite the fact that Rhoda said she has a very analytical mind, her concept of ‘analysis’ appears to match the notion of single-item memory rather than the ability to: deconstruct a phenomenon into its component parts; consider the parts and their relationship to the whole; and, reassemble the whole, while maintaining the integrity of the phenomenon. With reference to this, it was of interest to know whether Rhoda, as a musician, has the capacity to move her attention between the different elements of massed sound, for example, the performance of a symphony, or whether she processes the sound as a single item, a whole. The ability to filter sound would commonly be considered a necessary skill for a musician. The research literature on executive control of attention in autism (an executive function), which includes the ability to filter sound in order to attend to salient sounds, suggests that Rhoda would have difficulty with this task and be more likely to perceive the massed sound of an orchestra as a single stimulus. Filtering sensory input requires executive control of attention, akin to ‘set shifting’ or ‘cognitive flexibility’, and demonstrates impairment in ASD (Tsatsanis, 2004; Van Eylen, *et al.*, 2011). The capacity to filter sensory input is a point of difference between giftedness and twice-exceptionality, according to Jensen’s description of gifted individuals.

Generally, the gifted has the ability to acquire new and complex information more rapidly than their average-ability peers in situations involving simple acquisition. Multiple studies have shown a stronger focus ability in those with higher IQ, suggesting an ability to filter out distractions. Higher-ability people's effectiveness in controlling attention and gating sensory information seems to be a critical factor. It differentiates and identifies those individuals with complex cognitive abilities. (Jensen, 2008, p. 391)

‘Gating sensory information’ is a characteristic of giftedness that does not apply in Rhoda’s case, Gifted individuals with AS may present an exception to Jensen’s proposition.

Steve confirmed that Rhoda does indeed have difficulty filtering the sound of music performances and noted that she is entirely unable to do it with **recorded** sound, due to insufficient fidelity. Even for live performances, Rhoda’s natural way of processing the sound is as a whole: as a single unit of sound.

S: So you could trace the trumpet in the top, you could hear the clarinet in the middle and the trombone ... but ... Rhoda assembles the unified whole. It will be like a big organ which goes ‘Blah’ (makes sound) like that. And the whole sound is chords and harmonics in a big whole, but the strands, even though they might be a bit visible, they’re not wondrously clear. ... So it’s a different way of perceiving music. It’s more holistic ... (Interview)

By contrast, in a **live** performance, Rhoda later stated that she has acquired limited ability to move her attention from instrument to instrument through effortful control. However, when conversational language is involved, she experiences sensory overload and has to reduce sensory input by putting her hands over her ears. (Steve used the phrase ‘acoustic masking’ to describe the situation where multiple sounds require filtering in order to attend to salient information.)

S: Acoustic masking is devastating for Rhoda. This means that a conversation of two people is okay. Three people in a room conversing starts to get a worry. Three, four, there’s problems. A party with all these conversations going, it’s the delineation and the focus on one thread within that mess. Remember I talked about the orchestra, which is a whole? It’s the same thing. [She] can’t pick up the line. So acoustic masking within multi[ple] conversations simultaneously is very, very, very difficult. (Interview)

When language is an element of the environment, such as in a room where conversations are taking place, sensory issues quickly become overwhelming for Rhoda and she does not have the capacity to control her attention in order to attend to one conversation, while screening out others.

### **5.4.3 Serial processing**

Rhoda and Steve both expressed their passion for simpler styles of music. (Early music is much simpler in form than the music of later historical periods, such as the Classical and Romantic periods, when increasingly larger ensembles produced ‘fatter’ sounds.) This preference suggests that the historically more recent styles of music may present a challenge to Rhoda’s auditory processing. In particular, Rhoda and Steve love polyphonic music, where two or more melodies ‘compete’ against each other, in contrast to musical styles that employ harmonic structures. It is suggested by Rhoda’s narrative that her love of polyphonic music plays to her cognitive strengths in serial processing (thinking in a linear fashion rather than ‘simultaneous processing’—see Section 4.4.4) and, indeed, polyphony, with each performer’s focus on a single melody line, provides a wonderful metaphor for the serial-processing cognitive style of gifted individuals with AS.

### **5.4.4 Auditory processing**

Rhoda’s auditory processing shows distinctive characteristics in line with the research on information processing in AS. She has a prodigious auditory memory and performs long pieces from memory. Her principal means of learning new music is by hearing and memorising. She mostly processes ensemble music (for example, chamber group or orchestral music) as though it were a single sensory input but has learnt, with effort, to move her attention from the whole to a single instrument in a live performance: for example, with visual support and auditory memory of the sound of an oboe, in a live performance Rhoda can pick out the oboe part, overcoming the limitations of single-item processing. She is unable to filter sounds in the same way when watching television or listening to a recording on sound equipment, as she apparently needs the richer visual and auditory cues of live music performance. When spoken language is involved, cognitive load is much greater and Rhoda finds conversation hard when more than one person is speaking: she lacks the cognitive capacity to spontaneously narrow her focus to the speaker of interest.

### 5.4.5 Visual processing

Like Kahla, Rhoda described her thinking in visual, eidetic terms: using the terms ‘movie’, ‘recording’ and ‘playback’. A difference in visual processing was the first clue that led Rhoda and Steve to investigate, and ultimately receive, Rhoda’s diagnosis of AS.

S: ... as we got to know each other in the early days and we were working on music together, it wasn’t ‘til she ... said, ‘I think very differently from other people. ... I see things in pictures, or in movies’, and then dear Temple Grandin’s similar statement, which happened in a documentary and I picked it up and that was the beginning of ... denouement’. (Interview)

In fact, Rhoda gave the impression that she has a very similar visual cognitive style to Temple Grandin, as portrayed in the movie *Temple* (Monger & Johnson, 2010), with the slight exception that she appears to be the kind of visual thinker who is, in Grandin’s terms, a visual-spatial or ‘pattern thinker’ (Grandin & Panek, 2013, p. 140).

As in Kahla’s case, Rhoda described her autobiographical memories as ‘recordings’ that are played back.

R: ...the kind of memory which I have ... is very good, because it’s a little bit like reeling back information, almost like a tape recorder. So that really gave me good advantage ... I used to remember 24 verses of a folk song after singing it twice, things like that. I don’t think I could do that now because my mind is cluttered and full of rubbish but when I was 15, yes, I could do that kind of thing.

Res: So you’re saying that your memory records things that you’re interested in as though it was a video camera?

R: Yes, yes, that’s right, and also if ... something really bad has happened, I’ll relive it. I’ll go over it again and again. [My psychologist] says I’m like a person with post traumatic stress syndrome. It’s an advantage to have a memory like this but it’s also a disadvantage. (Interview)

As with Kahla’s case, caution needs to be exercised in regard to her use of the term ‘reliving’. Rhoda stated elsewhere, ‘to remember it, I have to [play the recording]’, indicating a noetic, rather than autonoetic, state of consciousness.

## 5.5 **Cognitive profile: Memory**

During their interviews, Rhoda and Steve remarked that ‘kinetic’ or ‘tactile’ memory plays a major role in the expert performance of instrumental music. Tulving’s human learning and memory systems framework (Figure 4.3) facilitates an explanation of Rhoda’s success and giftedness as a musician, artist and draftsman. Tactile or kinetic memory is a reference to procedural memory, where automaticity is achieved through practice and repetition, just as a touch-typist types words automatically without requiring conscious effort to select each letter correctly.

Rhoda’s learning requirement for music to be learnt through bottom-up processing, rather than through the use of scaffolding systems like sol-fa (top-down processing), is indicative of enhanced perceptual functioning operating in conjunction with prodigious rote memory. Rhoda’s narrative is suggestive of superior semantic, perceptual and procedural processing coupled with diminished episodic thinking. Rhoda’s autobiographical memories were not as extensive or descriptive as Kahla’s so it is difficult to further evaluate her reliance upon episodic thinking. Her personal history was told from a first-person perspective but this aspect of her account was not explored during the interview as Rhoda and Steve had a set agenda for the topics they wanted to talk about. Indicators of first-person stance for autobiographical events, in some instances, may be the product of mental and verbal rehearsal, rather than evidence of episodic functioning.

Within the framework of Tulving’s human learning and memory systems, Rhoda’s case displays: increased reliance on procedural memory for music learning; enhanced perceptual processing demonstrated by artistic representations (drawing, musical performance); difficulties with language processing; and, likely superior visual symbolic representation. It is also possible that Rhoda has an extensive mental capacity for word memory, although this may function in a compensatory way, as suggested by Grandin (2006; 2013), Koshino *et al.*, (2005) and Williams and Minshew (2010), which allows her to enjoy reading. Dyslexia affects her eye tracking from left to right and from line to line when reading musical notation. Her challenges are exposed during sight reading, which is a complex function requiring sensory integration of stimuli under time pressure in multiple modalities: visual, auditory and tactile.

## 5.6 *Philosophical questions*

As for the other cases in this thesis, higher-order issues emerging from the case will be addressed using Lincoln and Guba's (2013) framework of the four philosophical questions, which are interpreted as issues of reality, knowledge, methodology, identity and value.

### 5.6.1 **What does Rhoda mean by 'logic'?**

The methodological question, 'How does one go about acquiring knowledge?', arose in Rhoda's case through her references to the notion of 'logic'. Anecdotally, most individuals with AS will claim to be logical in their thinking, where logic and emotion are held to be mutually exclusive, and have difficulty understanding the complexities of other people's behaviours and thinking. The characters of Mr Spock and Data from the television series *Star Trek* are commonly held heroes, of, for example, Temple Grandin (Sacks, 1995), for their logical thought and lack of emotion. Rhoda described herself as logical in the way she learns new skills and information, and she reported frustration with her students' failure to employ logic in their learning. Her claim to be a logical, analytical thinker raised the question of what she meant by 'logical', contrasted with her perception of her students' as 'illogical'.

It is reasoned that rule-based categorisation (Perkins, *et al.*, 2006) is an example of the phenomenon Rhoda referred to as 'logic' in learning. Rhoda's superior semantic processing with minimal top-down modulation means that her thinking can be described as 'black and white' or 'concrete' thinking (DeLong, 1992; Meyer & Minshew, 2002; Newman, *et al.*, 2010). A characteristic of this cognitive style is superiority at labelling, sorting, classification and rule-based categorisation with reduced reliance on abstract schemas (top-down processing). In the researcher's experience, it is often accompanied by poor understanding of other people's lack of 'logic' in failing to adhere to the same rules and categories.

Rhoda's definition of Asperger thinking is centred on the notion of logic.

Res: What would you say the essence of the Asperger mind is?

R: I would say very logical and not tolerating a lot of extra information. (Interview)

‘Not tolerating a lot of extra information’ appears to indicate the requirement of a clearly defined, narrow frame of reference for the logic to operate effectively. To use Grandin’s example of the categorisation of ‘dogs’ via a series of rules (Gastgeb, 2010; Grandin, 2006; Klinger & Dawson, 2001): dogs have four legs; fur; they bark; they are bigger than cats. The implied frame of reference in Grandin’s account is every instance of dogs she has known, stored in memory as a series of images or movies. Broader thinking and experience, including other people’s ways of thinking about dogs, would, therefore, present challenges to the learned, rule-based logic. If the rule is, for example, that dogs are bigger than cats, based on every remembered instance of dogs and cats previously encountered (rather than abstract prototypes), seeing an adult chihuahua for the first time is likely to result in an incorrect categorisation: ‘that’s not a dog’.

Rhoda reported that she had great difficulty in tolerating some of the learning behaviours of her adult students that, to her, are illogical; for instance, her students’ failure to rigorously apply the rules she taught them for naming computer files for use in websites, where the application of rules is a requirement. Following the step-by-step instructions of a knitting pattern was the example she gave of her own use of logic in learning.

Res: So when you say [as a child] you were good at teaching yourself, how do you think you did that?

R: Oh, it would be pictures in a book or something like that. It would be instructions and pictures. If it came to something like crocheting and learning a new stitch, it would be lots of visuals and verbal things in point form. **Everything would have to be succinct and logical, not verbal, as in sentences.** Long sentences and unnecessary words [don’t] work for me. (Interview) [Emphasis added]

Individuals with AS have difficulty comprehending complex verbal instructions (Saalasti, *et al.*, 2008). Where there are complex instructions in a task (as previously noted in Section 5.3.2), the application of simple rule-based principles of labelling and categorising breaks down, hence Rhoda’s preference for simple, dot-point instructions.

In addition, except for the most basic tasks (for example, labelling an object), in semantic processing there is a process of mental manipulation, once a single-item concept or rule-based category is established. Boucher described how ‘JS’ builds factual knowledge by using ‘logical’ formulaic processes based on concepts that have been established by rule-based categorisation.

However, JS's factual knowledge is acquired in ways that differ, at least in part, from more typical processes of knowledge acquisition. JS points out that, *in the absence of episodic and event memory*, he must derive factual knowledge in one of two ways. The first way in which JS establishes factual knowledge in semantic memory is to derive it from percepts and single-item concepts by linking together arguments and predicates (JS's terms): e.g. 'cats' + 'eat' + 'fish'; 'chillis' + 'are' + 'hot'; 'global warming' + 'results from' + 'CO<sub>2</sub> emissions'. These propositional facts are then reinforced and stabilized in semantic memory via internalized verbal rehearsal. JS reports that he has good perceptual memory for single items. However, these may be complex: he describes 'single items' in terms of a snapshot, rather than in terms of isolated items. (Boucher, 2007, p. 258) [*Italics added*]

Boucher notes that JS's cognitive strategies are a means of compensating for under-functioning episodic memory processes, where typically developing individuals are more likely to learn equivalent knowledge spontaneously through personal experience.

... ordinary people ... extract a great deal of information and knowledge effortlessly and unconsciously from events and episodes. If, for example, the ordinary person drives into an unfamiliar shopping centre on successive Friday nights and on each occasion find the car park full, they are likely to register unconsciously that 'the car park is usually full on Friday nights'. ... Although registered without conscious effort, such information is subsequently available as factual declarative knowledge derived from episodic memory, even long after the actual episodes from which the information was derived have been forgotten. JS cannot derive factual knowledge from events in this effortless way. Instead, if he wants to learn from personally experienced events, he has either to memorize conversations that occurred (or, for example, the content of a lecture he heard at a conference); or formulate a verbal account of the event and rehearse it ... (Boucher, 2007, p. 258)

Interpreting Boucher's explanation within the framework of Tulving's memory systems, in the cases of JS and Rhoda, it is reasoned that observations of the way other people derive knowledge from experience would be considered 'illogical' because: (a) the observed learning would not conform to rule-based categorising and the formulaic processing of semantic memory; and, (b) the operation of episodic memory and personal experience in that act of learning would be opaque to the individuals with AS.

Therefore, it could be the case that what Rhoda means by 'logic' is that the task or material to be learnt is **already** inherently structured in a way the individual with AS can understand: it conforms to known rules and categories so that a concrete, externally-oriented thinking style is accommodated. However, for learners who are abstract thinkers and are factoring a broader frame of reference into their thinking (for example, their personal experience), the application of simple rules and categories may be unsatisfactory for their approach to a learning task. From the perspective of the

individual with AS, the abstract thinker would likely appear to be illogical, due to what is **not** perceived by the individual with AS.

In summary, it is reasoned that rule-based categorising and formulaic manipulation, which are characteristics of semantic processing unmodulated by personal experience, are perceived as ‘logical thinking’ by Rhoda. A pedagogical insight that emerges from this discussion of logic in AS is that the desirable ‘logic’ needed to facilitate learning in a student with AS is most likely to be simply the inherent, concrete structures and concepts that accommodate concrete thinking, in contrast to the detailed, conceptual explanations intended to help students build their own complex knowledge constructions.

### **5.6.2 Identity**

Unlike Kahla’s narrative, Rhoda’s narrative is mostly neutral in its indications of first-person *vs.* third-person observational stance. However, she made an explicit self-reflective identity statement, so there is, at least, slight evidence for self-referential processing.

R: I don't think I'm a teacher. I might know things but it's not really me. (Interview)

One of the few other identity statements Rhoda made was couched in terms of her perception, rather than in self-referencing terms, seemingly indicating a greater reliance on perceptual memory for identity, rather than semantic and episodic memories.

Res: ... what do you understand by your ‘mind’?

R: Oh, it's, mostly it's me, as I am. Um yeah, I think that's, I mean it's a whole conglomeration of things but it's me, basically, as I perceive things. (Interview)

Like Kahla, Rhoda likens her memory to a recording that requires time to playback to the appropriate place, in contrast to the spontaneous nature of episodic memory retrieval via mental time travel. However, Rhoda’s narrative doesn’t overtly display the characteristics of a third-person observational stance as did Kahla’s. This may be due to memories being rehearsed and retold in the style of episodic memories in a compensatory way, as noted in JS’s case (Boucher, 2007).

## 5.7 *Pedagogical insights*

From Rhoda's case, the following observations can be made regarding the complexity of Rhoda's cognitive style.

- (a) Despite her high levels of giftedness in the creative arts, when the element of language is a layered component of a task, Rhoda operates at a disadvantage.
- (b) Rhoda has high levels of skill in drawing and artistic representation but poor handwriting. Motor control issues are recognised as playing a part but it is proposed that this is not a sufficient explanation for the conundrum of excellent drawing skills alongside poor handwriting: instead, the processing load induced by language is a significant factor (see previous item).
- (c) Rhoda has excellent auditory processing for memorising and performing certain styles of music (early music and polyphony; linear melody lines; long folksongs requiring strong rote memory) but distinguishing the sounds of individual instruments from the whole in an ensemble is difficult, and is only possible from a live performance, otherwise she interprets the sound of an ensemble as a single stimulus. She has problems with a basic musical skill but excels in some types of complex musical performance.
- (d) Rhoda's perception is affected by dyslexia when reading from paper, however, visual processing and memorisation of scenes, pictures, patterns, puzzles, and word recognition (possibly with each word as a single item rather than decoded) is excellent.

Insights for teachers reflecting upon the implications of Rhoda's case for teaching and learning include: (a) the need for teachers to be mindful of the potential interference of a learning disorder; (b) the need to modify expectations of the timeframe required for a task, due to increased cognitive processing demands; (c) the high-levels of 'self-learning' that may occur when obstacles to learning are removed, as when Rhoda was absent from school due to illness; (d) the notion that teacher-provided scaffolds may be a distraction that increase load and decrease learning; and, (e) the importance of positive feedback and recognition of strengths for emotional well-being.

## 5.8 Conclusion

In both visual and auditory processing, when language comes into the mix, Rhoda's cognitive processing load increases dramatically, supporting the notion that she is a visual thinker translating between visual mental representations and language. Complex verbal instructions, both written and spoken, are difficult for Rhoda to process, particularly under time constraints (such as in a classroom learning situation or practising a piece of music with another musician). Instrumental music and music sung without words do not present the same challenges. Rhoda is most likely to be the type of picture thinker that Temple Grandin calls a 'pattern thinker' (Grandin & Panek, 2013, p. 205) or 'spatial visualizer' (p. 155). She has a prodigious memory for words and sounds, however she most likely processes an incoming visual stimulus or incoming auditory stimulus as a single unit. Through trial and error, she has found a visual scaffold that assists with overcoming the limitations of reading music notation under performance pressure (software that scrolls music manuscript and an animated cursor that points to the place) but has found that traditional language-based, music-teaching scaffolds, such as sol-fa or counting, interfere with her learning and performance.

Within the Human Learning and Memory Systems framework (Schacter & Tulving, 1994), Rhoda most likely: has enhanced perceptual functioning which is, however, disrupted under certain circumstances by dyslexia; has superior semantic processing and memory; is natively a picture thinker rather than a verbal thinker; is reliant on rule-based categorisation for simple concept identification (bottom-up processing); and, has decreased reliance on episodic memory and abstract reasoning (top-down processing). Rhoda's cognitive style of serial processing, allied with enhanced perception and excellent semantic memory, ideally positions her for her interests in early music, such as folk songs that would once have been sung by wandering troubadours.

## Chapter 6 Case 3 ‘Colin’

The third case study is centred on a 57 year old male, ‘Colin’, who has a life partner ‘Wendy’. Colin and Wendy had been together for 14 years at the time of the interviews in 2011. Colin is a professional photographer and writer of considerable reputation. Colin is also a semi-professional musician and has had extensive involvement in media, advertising, entertainment and publishing in Australia for several decades. In addition to photography, Colin creates artistic images through painting. Wendy trained as a teacher so her insights into Colin’s thinking and learning were of special interest for that reason. Wendy initiated the contact with the researcher and stated that she and Colin had often discussed the different ways of thinking of each and were interested in contributing to research, hoping to gain understanding into those differences. Since the interviews, there has been prolonged engagement with Colin and Wendy, at their initiative, via email messages that have been included in the data for Case 3.

The interviews took place at Colin and Wendy’s home. Each elected not to be present during the other’s interview and asked not to see transcripts of the interviews. Colin’s interview was conducted over two hours while Wendy left the house and walked their dog. A phone call to Wendy at the conclusion of the first interview recalled her and, while waiting for her to return, Colin displayed some of his photographs and artworks. This part of the dialogue was not captured on the recording as it was unanticipated and involved moving around their house to see the displayed artworks and photos. During Wendy’s interview, Colin worked elsewhere in the house but once or twice walked through the room where the interview was being conducted. Nonetheless, Wendy was candid in the interview, even sharing references from her private journal. Much of the data given by Wendy falls outside the research questions of this study, however, her evidence is significant for corroboration of Colin’s narrative and for insights into his learning and memory.

Colin was born in India and, like Rhoda, experienced frequent, dislocating moves as a child, all before the age of twelve: India, the United Kingdom, the Middle East, Eastern Europe, Europe, Asia and, finally, Australia. He described himself as a loner and much younger than his older sister and brother. His father, whom he recently discovered worked in international intelligence, was a distant, critical figure in Colin’s life but Colin experienced a measure of closeness with his mother. Colin was given his first

camera at the age of seven and had a photo published from his first reel of twelve exposures: he had taken a photo of his neighbour working at her desk because the light was interesting, which she then used as the author photo on the cover of the book that she was writing.

C: It was a simple yet eloquent image of her sitting at her writing desk lit by a shaft of warm afternoon sunlight streaming in through her office windows (this was purely by chance more than good planning – I had spent so much of the day running around with my camera that by the time I got to her house the light just happened to be in the perfect spot). Still, it was my first published shot and I'd only had a camera for less than 24 hours; not bad for a 7 year old. But then, I had learnt so much simply by looking at all those wonderful photos in *LIFE* magazine for years. (Email)

Colin does not believe that any of his immediate family members have AS, however, he noted eccentricity and autistic traits within members of his wider family circle. His father's brother was the creator of iconic children's animated television characters in the UK and his cousin, the same uncle's son, was said to have 'a blank spot on the brain'.

C: They used to tie him up by his reins to the radiator so he wouldn't run around the house and he'd just sit there rocking, backwards and forwards. I used to get like that sometimes when I'd get really stressed out and I used to think, 'I kinda relate to him in a way.' Really nice guy, turned out he's a really chronic Asperger but, without any formal training, ... he works for the [museum name] as an illustrator of birds and his job was to turn every single bird that they had in their collection into an illustration for a book on birds. (Interview)

Colin was formally diagnosed with AS as an adult some years prior to the interview, following a long period of mental health treatment for depression, through the intervention of a colleague whose son had been diagnosed with AS.

## **6.1 School experience**

Colin's education was extremely disrupted by his family's moves from country to country and he ultimately left school early, aged fifteen. He found school very stressful and never felt he fitted in.

C: Yeah, never liked school, always had a miserable time at school. A lot of the time I put it down to bad teachers, but also increasing awareness from about the age of about 6 or 7 that I just was not part of the human race. Just didn't fit in. I never felt normal, ever. (Interview)

His narrative of his school experience has several defining features: the mismatch between his cognitive profile and the learning environment that was provided; bullying;

his struggle with any learning task that involved written or spoken language; and, his intuitive grasp of many tasks without being able to articulate his thinking, which resulted in him being described as ‘lazy’ and ‘a shonk’. Colin was told during school that his IQ had been tested at 163 and he was selected to attend a school for the gifted. He reported that his father ‘flatly refused because it was going to cost him money and my father would much prefer to spend money on a bottle of brandy than sending me to a private school’ (Interview). His school experience, during which he was regarded as gifted with behavioural problems, has contributed to his conflict over the value of his intellect, and impacted upon his identity. Colin’s narrative, along with those of Kahla and Rhoda, encompasses the sub-textual question; ‘Am I smart, or am I dumb?’

Although very unhappy at school, Colin remembers one teacher as the single example of a teacher from whom he was able to learn.

C: Except for one teacher in high school, a guy called [name] ... and he was the best teacher I could have ever had, he taught us history, because he was nuts. He’d walk into the classroom with a sheet wrapped around himself. He’d been down the bottom of the school playground, he’d got some ivy and made himself a laurel wreath out of it and he’d storm into the classroom holding his books like the 10 Commandments and he’d say ‘Boys, today we’re gonna learn about Julius Caesar!’ crash [slamming books on desk] and he’d say, ‘OK, it’s the Vietnam War but ... it’s not the Vietnam War, it’s the Civil War in Rome. What’s the difference here? Oh, one’s got a media and one hasn’t.’ And suddenly he had us. (Interview)

This teacher’s externally oriented methods included dramatic and visual strategies, combined with oral story-telling: techniques that reduce the load on abstract reasoning and top-down information processing. Wendy noted that students like Colin should be regarded ‘almost like ESL [English as a Second Language] children’ (Interview).

W: ... because they can’t handle too many people, too much stimulus, they can’t seem to block, they can’t seem to stop other sounds and concentrate on what they’re meant to be doing. They find the teaching methods themselves really boring, he [Colin] found that so unstimulating just to stand there and listen to a teacher with a blackboard, so they need lots more interactive things for sure ... (Interview)

Colin stated that he found the ‘teacher with a blackboard’ methods employed in art classes so stressful that he would skip lessons and accept the punishment, indicating not just boredom, but also significant stress. He described the ‘traditional’ pedagogical style and the associated explanations, methods and frameworks as ‘crap’.

It will be argued later in this case, that, although clearly being a gifted individual with AS like Kahla and Rhoda, Colin has significant cognitive profile differences from them. While, along with Colin, they displayed enhanced perceptual processing, Kahla and Rhoda recounted more memories with semantic-memory features than Colin. With reduced capacity to explicitly process language (a function of semantic memory), the mismatch between the lockstep, teacher-centred teaching methods that Colin experienced and his capacity to learn is understandable, since those teaching methods depend on the student's capacity in language processing and abstract reasoning. Abstract thinking is a function of the episodic memory system, which is mediated via the semantic memory system, according to Tulving's original description (Schacter & Tulving, 1994), and Colin's narrative is consistent with diminished features of both semantic and episodic thinking (explicit) and increased reliance on perceptual and procedural processing (implicit). Colin, therefore, appears to be very reliant on visual imagery, perceptual processing and procedural memory and this will be further discussed in Sections 6.5 and 6.6.

## **6.2      *A sense of difference, alienation and isolation***

A deep sense of alienation from family, peers and society runs throughout Colin's narrative. He described trauma, depression and, like Rhoda, prolonged experience of treatment for mental illness. Prior to his diagnosis of AS, he attributed his sense of alienation to multiple causes: his unusual family background; a minor head injury as a child; and, unquestionably significant trauma. In particular, when he was nineteen, he lived with his girlfriend, who died suddenly and unexpectedly in their bed the morning after their first Christmas together.

C: I didn't know that she was bulimic. But when they came to investigate why she died, they found all these hundreds of empty bottles of *Ford Pills* under the house. You know Ford diet pills? Evidently her kidneys had collapsed during the night and she died. I woke up. It was about half past six, quarter to seven, and the clock radio was on and it was John Lennon singing 'So This is Christmas'. There was some guy mowing his lawn. Suddenly, all this reality around me and yet, she was dead 20 minutes later. The ambulance guys arrived and, I mean, I can still visualise all of this absolutely, almost down to how high the length the grass was. ... I became quite suicidal and ended up being put into [a psychiatric clinic] and then I spent six months at [another psychiatric clinic], and that isolated me for about 19 years ... It was like the last straw because, again, I'd always had this feeling that there was something wrong with me, the sense of isolation. (Interview)

Further trauma was experienced at the sudden death of a mentor in the entertainment industry, who was like a ‘substitute father’, and at the abrupt death of a beloved pet dog. Prolonged emotional upheaval following trauma that reinforces his sense of alienation is a thread through Colin’s account.

In considering Colin’s sense of being different, it is tempting to conclude that he does not need or desire validation from others as, in his narrative, he was sometimes dismissive of others and appeared very self-focused. However, from prolonged engagement with the researcher, it is evident that he greatly values the example, opinion and feedback of a significant few, including his partner (corroborated by her), as being essential for his well-being, and views it as important for him to contribute to their well-being.

C: Support. I think that’s why Wendy and I have been together so long. She knows how to give support – not that I need much as I never have relied on it from others, but what she does provide is of enormous help to my sense of self-esteem and general well-being. I also think it’s very important for Aspies to have someone to love. Joseph Campbell said ... ‘it is not important how many people love us, but it is important for us to be able to love someone back.’ (Email)

The air of self-absorption expressed in Colin’s account, considered separately from other autistic features, raises the issue of distinguishing between AS and other disorders. This line of inquiry is addressed briefly here for two reasons: in order to gain insight into the nature of Colin’s experienced sense of difference; and, because this issue is consistently raised by life partners attending *ASPIA* meetings and workshops (Grigg, 2013). The following passage provides an opportunity to consider this issue.

C: I got my call-up paper (Vietnam conscription) and that was the weird thing, cause I thought, ‘There’s no way I’m going’. The Whitlam Government got in in December and [girlfriend’s name] died on the Boxing Day and I said, ‘**Great, somebody had to die and it wasn’t me.**’ Cause I said, ‘If I go, I’m dying. I know that.’ Cause I’m not smart enough to be a soldier, you know what I mean. You put me on the front line, I’d do something stupid because I’d forget where I am and that’s what happens. (Interview) [emphasis added]

Without specific insight into Asperger cognition, Colin’s attitude to the death of his girlfriend appears callous in the extreme (see bold text). How can this feature of Colin’s case best be understood? Is this statement pointing to an anti-social personality disorder of some kind in which social isolation may be a choice; or does he desire a sense of belonging and is frustrated by its lack?

To understand the issues presented here that are representative of Colin's thinking processes, it is important to factor in the style and purpose of his utterance. First, the purpose of the utterance was to make a number of points about the Vietnam war and mass media following his description of the history teacher who used dramatic techniques in his teaching. Secondly, this long monologue, of which the above is a small excerpt, is an instance of 'associative thinking', as described in Case 1 (Section 4.7.2). The path of association from one point to another, paraphrased, is: Colin's history teacher; dramatic teaching techniques were effective; learning about the civil war in Rome by comparing it with the Vietnam War; the change to the conduct of war due to the influence of the media, starting with the Vietnam war; the subsequent conscription of some of Colin's peers; Colin receiving his own call-up papers; the death of his girlfriend at that time; his conviction that he would be killed if he went to Vietnam because he'd 'do something stupid'; Bert Stern, an American photographer for *Life Magazine*, who wanted to photograph Vietnam but was constrained by the military due to potential impact of photos depicting Vietnam as a beautiful country; identifying with Bert Stern in wanting to photograph beauty, not war; not wanting to come home from Vietnam in a body bag; karma; being born in India; a Buddhist pilgrimage with his carer at age 5; and so on for several more ideas, finishing with 'looking at shapes and things [that] started to have meaning and significance' (Interview), which was intended as a description of his visual processing style. The single, linear track of thinking that moves from idea to idea in Colin's mind, as he speaks, briefly touches on his girlfriend's death but in a way that shows his intention was most likely not callous. Instead it is an associated idea with the recount of his Vietnam war conscription. That is, the idea of death provides the association with the next thought and pervades the following points of war, death and karma.

This utterance illustrates one of the significant social issues faced by individuals with AS that contributes to social isolation: the message received by another person may not be in line with the intention of the utterance. The broader issue of intentionality in autism has been discussed in relationship to theory of mind (Hill & Bird, 2006; Perkins, *et al.*, 2006) and inter-subjectivity (Hobson & Lee, 1999; Solomon, *et al.*, 2011) and, even though definitions vary, Williams' discussion, 'The development of situated social understanding' (Williams, E., 2004, p. 720), shows a likely connection between intentionality in autism to 'intentionality' as characterised within phenomenology

(Berndtsson, Claesson, Friberg & Öhlén, 2007; Larkin, *et al.*, 2011). The relevance to this analysis is that Colin's utterance 'Great, somebody had to die and it wasn't me' (it was his girlfriend), interpreted in the light of his behaviour in speaking through a long chain of linearly associated ideas, set against the poor likelihood that he would have any idea of how his statement might sound to the listener, resulted in a self-focused statement that could be interpreted by a casual listener to imply a different disorder, such as narcissistic personality disorder (APA, 2013). Anecdotally, and in the researcher's own partner support experience, this is a significant issue for families and partners of individuals with AS, with the self-focused behaviours of individuals with AS appearing narcissistic to others (Goulston, 2009; Holmes, 2013; Jacobsen, 2003), and evocative of the question, 'Is it Asperger syndrome or is it narcissism?' However, Colin's self-deprecating approach to his considerable achievements; his lack of ambition and monetary pursuits; his delight at the unconditional acceptance of his dogs; his positive relationships with his partner and mentors; and, the sense of alienation he described as his lived experience; seem to indicate a longing for acceptance and support the expert diagnosis of AS.

As for Kahla and Rhoda, the diagnosis of AS for Colin, when it eventually was given, provided great relief and the beginning of building a new understanding of self and the world.

W: ...[the] psychologist who he felt comfortable with... finally said, 'I think he might be Asperger,' and Colin said the (snaps fingers) light bulb came on and it made perfect sense to him [and] that's [when] all the things that he felt different about all his life from everybody made sense. It all clicked into place. (Interview)

The diagnosis did not resolve any of the personal or social difficulties experienced by Colin but provided the means to reinterpret his experience in the light of new knowledge. Despite his earlier life being characterised by dislocation, trauma and depression, he has found a measure of self-acceptance facilitated by his diagnosis, which has provided him with an explanatory framework through which he has been able to reinterpret his experiences of alienation and isolation. It is evident that Colin has a deep longing for acceptance, although he may have paradoxical criteria for what constitutes acceptance, so the measure of acceptance and belonging that he has attained is hard-won.

### 6.3 *Language*

Like Rhoda, Colin is an artist with superior visual perception and processing, except where language is concerned. Colin is a semi-professional guitarist who cannot read music. He learns to play or sing music through auditory processing: he listens between one and three times to a piece he is learning, and then is able to 'play from ear' after one or two plays-through. He is a professional writer with an extensive publication list but cannot spell very well.

C: I've written over 60 articles for photography magazines. I've written two books on photography. Mark Twain said, 'I have no respect for a man who can only spell a word one way,' (Laughs) cause he was a bad speller. (Interview)

C: I spelt something one day and [my colleague] said, 'You know, it might actually be easier if you just fell across the keyboard occasionally. You might hit the right combination.' (Laughs) (Interview)

Colin does not seem to have learnt compensatory mental strategies for spelling but manages by using spellcheck extensively and relying on the assistance of his partner and editors. Although Colin reads widely, it is difficult to fathom how he elicits meaning from text. Wendy discussed his reading problems in the following terms.

W: He still asks me to spell words for him ... He gets letters around the wrong way, he cannot look at a word as a whole and know what that word says. He'll spell things on our chalkboard ... they're always misspelt for the shopping list, for example. So nothing's retained, his brain just doesn't do what we do ... He can read but there's words that he might have seen once or twice but he will not recognise them again. He just he cannot get it and he can't sound it out. ... No sight recognition. His phonetics is shocking. ...

Res: So how does he decode a word then if he's got no phonetics, no sight [recognition]?

W: He doesn't. ... He'll substitute something, perhaps, which is what you're meant to do when you learn to read but he doesn't quite understand exactly what that word might mean. He might not get the meaning and that's the block. (Interview)

Wendy indicated that Colin's excellent visual processing in relationship to objects does not apply to language.

W: He has told me that he sees in pictures. ... and that's the problem with the written word, he doesn't see that as a picture. It doesn't have the right meaning. (Interview)

Wendy, utilising her teaching background, had considered compensatory strategies for word learning.

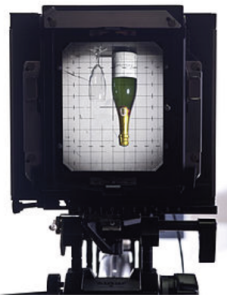
W: It's interesting because he's so visual, being a photographer, it made perfect sense to me that he would therefore be able to just photographic[ally] take a photo of the word and be able to respell, but he can't. ... with letters, he can't do it. He can do it with the world. (Interview)

Colin's dyslexia severely disrupts his visual processing of text. With apparently limited success in the acquisition of compensatory strategies, it is a matter of surmise as to how he derives meaning through reading, perhaps 'intuitively' garnering meaning from context clues and relying on his own perception to construct meaning. This obscurity points to Colin's interesting stance with regard to knowledge (Section 6.7.5).

Colin's dyslexia was identified at an early age and profoundly contributed to his learning and behaviour problems in school. It is interesting to note that, like Rhoda, Colin is left-handed and is unable to see the words as he writes. As a visual processor, this would make consolidation of the shape and detail of words for sight recognition very difficult. Now he is an adult, it seems inappropriate to describe Colin as having 'left/right confusion', as might be a typical description in a school report, because, in fields apart from reading and writing, it could be regarded as a superiority, that is, lack of encumbrance by mental issues of directionality. The following email communication illuminates this perspective.

C: I had a bit of an insight into my view of the world the other night, it came about by accident when I was talking to [Wendy] and flippantly said I was always like something out of left field and immediately gestured with my right hand to the 'left field'. [Wendy] cracked up laughing. At first I didn't know what she was laughing at. When she told me, I got this flash that has been bugging me for years. I suddenly worked out I live in a mirror world in my head. I used to draw pictures when I was a kid that were completely reversed from the reality I was in. Left was right and right was left. Just like looking in a mirror. I have never had a problem reading printer's typeset – all letters reversed and upside down. Same with when I used to shoot advertising shots on a big format camera with a ground glass viewing screen and the image was reversed and upside down too. I never had a problem telling my assistant which way to move a product as I just knew without thinking how to work in a reversed way. I can even write backwards pretty easily too, like Da Vinci did. It's actually easier to spell correctly too as I can see the letters as they appear and not being covered up when I write normally. (I'm left handed by the way.) (Email)

He sent the following image, embedded in the last email, to illustrate the way that certain cameras mirror-reverse images.



*(This is the view through the back of a large format studio camera.)*

**Figure 6.1 Studio camera © Guillaume Piolle / CC-BY-3.0**

In Colin's case, superior ability in visuo-spatial processing can be attributed to enhanced perceptual functioning without top-down modulation from either semantic or episodic processing. As a non-verbal processor, or 'picture thinker', directional issues in language processing are problematic but, in other areas, lack of directional constraint confers unusual accomplishments: his visual processing is not restricted by explicit notions of left and right, or top and bottom, and this is an advantage in his field of photography. The theory of central coherence, as described by Happé (1994), is suggestive of low level processing in Colin's case with little modulation by either semantic or episodic processing.

## **6.4 Learning**

Several times, Colin described himself as never having **consciously** learnt anything.

C: I'm a bit of a freak, I suppose. I can't think of anything I've ever **consciously** been taught, at school or anywhere but I play guitar semi-professionally, I played in a band at school. ... I can't read music, I just play. ... Same with painting. I've never been given a formal lesson in painting but I paint and I love to paint but I haven't got enough room to do it all. Same with photography. Once I worked out [the] basic things about the shutter speed and the F stop and the filmstrip. Once I'd worked out those three things, that was it, I was away. ... I can do any of them well enough to make a living out of. (Interview) [emphasis added]

So the question raised for this study is, 'How does Colin learn?' He clearly **does** learn and acquire new skills and has achieved high-level mastery in his professional life, attested to by the wide-spread use of his photographs in publications and the media. Colin implied that his learning is so quick it is as if there is no requirement to think effortfully or explicitly. Wendy corroborated the rapidity of his learning, saying; 'It's almost like it's instantaneous.'

W: How does he learn? I think he just makes connections without even thinking through the different parts of it. He seems to go from beginning to end in a nanosecond. (Interview)

W: It's almost like a natural gift that he has that he can just work something out straight [away], and if he needs to make something, he just looks at, or he'll just design something, he'll just sketch what he wants, he knows what he wants. ... So he just cuts straight through 'all the crap,' as he calls it, and does a good job. [laughs] (Interview)

Colin has a very quick method of grasping how to achieve a task, apparently without conscious reflection, so that he seems to feel that learning is obvious and effortless and therefore achievements are not a matter for pride. He has a tendency to attribute his personal achievements, such as taking a widely admired photograph, to a supernatural element: a force beyond himself. His description of his writing process is illustrative of this.

Res: Tell me what the process is inside your head and your body as you're sitting at your computer and you're typing words ... [are words] an obstacle of some kind that you've to get past ... or does it just flow out and you worry about it later?

C: No, once I get ... that first line, the first paragraph that I want for an article, bang! That's it, I'm on to it and I don't worry about the spelling. ...

Res: ... is the language just there and flowing or are you seeing pictures of the words?

C: No, it's just flowing ... it's this stream of eloquence [that] just comes along. It's like when I worked on a book ... based on a true story about a guy who was adrift on the icebergs for a few years, and it was almost in places like **automatic writing** cause I would write something that **I had absolutely no knowledge at all of** and I'd think, 'Shit', and this is in the days before the internet, I'd think, 'Ooh, better go down to the library and find out if that's true,' and I would and it would take me half a day to find out something I'd written like that was actually true. I'd say, 'Oh, OK. That is true. Good.' (Interview) [emphasis added]

The phrase 'almost ... like automatic writing' is an example of Colin's tendency to ascribe his knowledge to the supernatural. To him, he is drawing upon knowledge he is unaware of and it is as if it comes from outside himself. Because he is not aware of consciously thinking or learning and, at school, could not describe his learning processes, he was accused of being lazy and a 'shonk'.

C: I'm really not aware of thinking, 'Now, if I get a spirit level and do that to that, that's gonna make that.' ... I really cannot explain it but it's sort of like, 'Well, if yellow and red make orange, then those two wires connect into that and that should work.' That's kinda how my brain works ...

Res: So you're getting the answer without actually having the working out.

C: Yeah! That's what I always got failed at exams at school on! I could get the answers but I could never show the working out, so they'd fail me. That's exactly right.

Res: Accused of cheating?

C: No, never! Accused of being lazy ... being a shonk! (Interview)

Colin's attempt to explain his thinking process, while doing a creative manual task, employed the metaphor of mixing colours, and is reminiscent of JS's formulaic approach to memory (Section 5.6.1). The formulaic utterance above ('if yellow and red make orange, then...') is the closest Colin came to articulating any kind of conscious awareness of his thinking or learning processes.

It might be argued from the statement, 'I actually get the feeling that I have never had a conscious thought in my life' (Interview), that Colin simply lacks the vocabulary to describe his thinking or that he is unable to employ metacognitive vocabulary accurately. However, his 'stream of eloquence' demonstrates that he commands considerable vocabulary and he can, in his writing, frame his own perspective for an audience (for an example, see Section 6.7.1). The problem appears not to be lack of vocabulary but one of accurately matching the vocabulary to the mental experience: he clearly **does** have conscious thoughts but does not equate them with learning or creativity. Rather than lacking the vocabulary to articulate his mental experiences, it may be **knowledge** of the mental experience that is lacking, which is an instance of a 'theory of **own** mind' problem: therefore, his perception is that he has never had to consciously learn anything. Not knowing the knowledge that is in his own mind, Colin looks to external explanations. Attribution is a function of source memory, which is part of the episodic memory system. If this interpretation is accurate, it lends weight to the notion of Colin's greater reliance upon implicit (non-declarative) thinking and memory processes rather than explicit (declarative).

## **6.5 Cognitive profile: Processing style**

Wendy noted that Colin's mind is very quick, 'jam-packed full of facts' (Interview), and she used the term 'self-directed learning' to describe the only method by which he learns. She described him as a 'high-level thinker' but this appears to refer to the rapidity of his thought processes combined with minimal reflective thinking rather than

strong abstract reasoning and a top-down processing approach. Without conscious reflection on Colin's part, the cognitive phenomenon being described is a bottom-up approach, unencumbered by abstract reasoning and mental schemas: of being completely 'in the moment'. Indeed, it is postulated that knowledge of mental schemas constitutes 'the crap' of Colin's narrative. The phenomenon being described by Colin is therefore most likely to be 'raw', enhanced perception and strong procedural memory, fortified by robust priming (Baddeley, 1994), with minimal top-down modulation from semantic and episodic processing. If this is the case, Colin is reliant upon implicit processing and memory systems with very little explicit processing. His learning is chiefly procedural and perceptual; non-declarative rather than declarative. He doesn't use words to process or learn but he is able to construct knowledge through writing and creation of artistic works. His learning is implicit, **therefore his learning processes are opaque to him.**

Colin is a highly verbal person in his output, spoken and written, but is most likely not a verbal thinker. He thinks in pictures and has been fascinated by shapes, patterns and light since he was very young. Colin's enhanced perceptual functioning is accompanied by sensory sensitivities, particularly visual: for example, the inability to tolerate fluorescent light at 50 hz. This makes it difficult for him to go to shopping centres because he 'can see the flicker like a strobe light' (Email). He also wrote that he can 'detect the slightest movement, especially in my peripheral vision' (Email). The cognitive profile he presents stands in contrast to Kahla's and Rhoda's, who both described thinking processes characteristic of enhanced perceptual processing with superior semantic memory. Colin's cognitive profile has characteristics of enhanced perceptual processing with possibly diminished semantic characteristics. As a visual thinker, it is most likely that he is translating from visual representation to and from language when he speaks and writes. His speech, while being rapid and forceful, contained many hesitations and repetitions, and shows evidence of deictic shifting problems, indicated by pronoun reversal or misuse (Mizuno, *et al.*, 2011; Perkins, *et al.*, 2006). His monologues were marked by associated ideas, moving in a linear fashion, from one topic to another without reference to the original topic.

Externally oriented thinking characteristics are subtly evident in Colin's narrative in contrast to their more obvious presence in the narratives of Kahla and Rhoda. Colin

explained that meaning for him is associated with passion and ‘being in the moment’, rather than being invested in objects. However, the artefacts he produces are very meaningful to him as external representations of the memory of producing them: the artistic beauty of the artefact, which is so important to an audience, appears to be less important to Colin than the artefact as a ‘holder’ of the memory of its moment of creation. This shift of emphasis from Kahla’s and Rhoda’s profile is consistent with greater reliance on the implicit processes associated with raw experience (perceptual functioning) and less reliance on semantic-style mental representation.

## **6.6 Cognitive profile: Memory**

A really interesting feature of Colin’s account was the assertion that he has some kind of ‘psychic thing’, which allows him to know in advance that a photo opportunity is about to take place: it is to this ‘psychic’ ability that he attributes his success as a wildlife photographer. Colin described this phenomenon in a number of different ways. He used the term ‘synchronicity’, which is drawn from a literary reference to the ‘Chapel Perilous’ from Wagner’s opera ‘Parsifal’ based upon the Holy Grail quest: these references imply supernatural assistance to accomplish an epic quest. The notion of psychic ability or supernatural intervention extends beyond Colin’s creativity into other areas of his life.

C: ... the psychic thing, I’d just get a feeling sometimes that something’s happened, or something’s gonna happen, and pretty much it does. But I can’t explain to you what that is. (Interview)

During a correspondence with the researcher discussing the nature of his visual thinking, Colin accepted the idea that he is a pattern thinker (in Temple Grandin’s terms) and used the word ‘serendipity’ in a similar way to ‘synchronicity’ and ‘psychic’.

C: ... when I’m photographing, I start to see shapes and patterns that others don’t see until I show them the photo later. They might only be small things but they add up in a visual way that lends power or emphasis to a shot. It all makes sense visually to me. I’ll send you a couple of examples where this has happened and as usual, quite spontaneously. I think for an Aspie like me my favourite word has to be Serendipity. (Email)

As a gifted photographer, the art of capturing great images is served by the rapid evaluation and extraordinary visual acuity of Colin’s quick mind, which he attributes to being ‘psychic’. Within the Human Learning and Memory Systems framework, this

‘psychic’ phenomenon could be interpreted as evidence of a deficit in source memory and theory of mind, thus creating attribution problems. Source memory, a function of the episodic memory system, encodes emotion, location and subjective time of personally experienced events. There are indications of deictic shifting problems in Colin’s narrative and, given the assumption that he is not actually psychic, there may be temporal shifting problems as well. If this is the case, it would mean that Colin would have difficulty **assigning correct temporal attribution for the knowledge of a recalled event**: that is, does his knowledge of an event become explicit **before** or **after** the event? The ‘psychic’ phenomenon becomes subject to explanation when considered alongside: high self-efficacy beliefs in his capacity to capture excellent images; enhanced perceptual and procedural memory, which allow Colin to perceive and respond to patterns and shapes, without conscious thought, that others cannot; and, temporal misattribution of the knowledge of an event. This would indicate diminished source memory coupled with enhanced function of implicit memory systems. However, mitigating against this explanation is Wendy’s conviction that Colin has genuine psychic ability.

Wendy confirmed that Colin has excellent rote memory, which is in line with Kahla’s and Rhoda’s memory profiles. ‘Once you tell him something he remembers **everything** ... incredible memory’ (Interview), indicating an active semantic memory system with the concrete-thinking characteristics previously discussed.

W: It is jam-packed full of facts, full of self-taught knowledge, it’s full of a lot of stereotypes, he’s pretty black and white in his thinking. I can see his mind’s thinking all the time and he’s very quick with a response ... (Interview)

Colin also referred to his memory in terms that indicate strong rote memory.

C: Now what bothers me is how can I learn something as complex as [a complicated song] and remember it note for note? Once learnt, I never seem to forget a song. I also know about 230 songs I can play by heart ... yet I can’t spell to save my life. (Email)

One recalled memory in Colin’s narrative has episodic characteristics but memories of this nature are fleeting. The recovery of this memory appears to be an unfamiliar experience for him and was triggered by smell and touch.

C: ... what I can get sometimes, I had it the other day in the garden, I walked out there and there was just a puff of breeze that was warm ... and instead of being a cold wind it

was this hot wind coming in from the west. There was a certain moment where it brushed up against me and it took me right back to Christmas Day 1965 in the driveway of my house in Woodland St B— [suburb name] talking to Mrs G— and it was like everything suddenly went BOOM! I thought, ‘Where the hell did that come from?’ And it was just so vivid. I’ve had it other times too when I’ve smelt something. I’ve caught a whiff of something and it’s taken me right back somewhere completely all-encasing. ... it’s really hard to explain, I might just be like we are in this situation now and suddenly a memory will go clunk [makes noise] out of left field and I’ll go, ‘Oh shit! I just remembered something,’ that I thought I’d completely forgotten all about and it’s like something’s fallen out of one of the folders in my brain and just gone, ‘Oops sorry,’ and before I can really grab hold of it something comes along and goes whoosh [makes sound like ‘ssvfit!’] and scoops it back up and I go, ‘Hang on! I was trying to remember that.’ (Interview)

There is a sense of discomfort, even alarm, associated with this kind of instantaneous memory recovery. Colin appears to be describing a rare experience of autonoetic awareness (mental time travel), which, for him, is very disconcerting.

## **6.7      *Philosophical questions***

In Colin’s narrative, the theme of identity dominates. Lincoln and Guba’s (2013) philosophical questions were applied to the issue of identity to frame the following associations: ontological—the reality of self, epistemological—knowledge of self, methodological—‘How do I find or experience my self?’, axiological—the value of the self; and provided the framework for a deeper-level consideration of Colin’s data. At this point, the same framework was then applied to the other cases in this research. The philosophical questions for this case are described and discussed under the following headings, which were suggested by the data: creativity and giftedness; animals; fictional characters and fantasy; ‘I have always felt like a fraud’; knowledge and the knower; and, values.

### **6.7.1      Creativity and giftedness: The antidote to alienation**

With the photographic artefacts he discussed and shared, Colin placed higher value on the experience of taking a photo than the resulting product, but the photo is most likely a key to recovering the memory of the experience. He described one of his wildlife encounters in a magazine article, accompanied by a photo.

C: You’re in a Zen-like zone, focused in more ways than one. That is, until some thing or someone reminds you you’re about to die a needlessly horrible death. (Draft article, written and photographed by the participant, in an unidentified wildlife magazine)



**Figure 6.2 Photo accompanying the draft of a wildlife magazine article about a face-to-face encounter with water buffalo in a remote part of the Northern Territory of Australia. Reproduced by kind permission of ‘Colin’**

For the purposes of this research, Colin’s use of the term ‘zen’ is equated with Csikszentmihalyi’s concept of ‘flow’ (Csikszentmihalyi, 1990; Nakamura & Csikszentmihalyi, 2005).

A person in flow is completely focused. There is no space in consciousness for distracting thoughts, irrelevant feelings ... Self-consciousness disappears, yet one feels stronger than usual. The sense of time is distorted; hours seem to pass by in minutes. When a person’s entire being is stretched in the full functioning of body and mind, whatever one does becomes worth doing for its own sake. (Csikszentmihalyi, 1996, p. 71, cited in Vialle, Lysaght & Verenikina, 2005a, p. 217)

The ‘disappearing self-consciousness’ (Csikszentmihalyi, 1990, p. 71) of the state of flow, while pleasurable for all individuals, echoes Colin’s general lack, or rejection, of explicit self-conscious awareness, so it is perhaps then that Colin’s sense of his self is strongest. Colin indicated that this state is at the heart of his creativity: he actively pursues such experiences in his wildlife photography and understands his giftedness in its light. A wildlife photographer’s conscious, effortful calculation of lighting requirements for a photo would be considered ‘crap’ in Colin’s terms, when, for him, this is a matter of ‘zen’. Other words he utilised to expand on this idea were ‘serendipity’ and ‘synchronicity’, meaning that he doesn’t consciously think about when to press the camera shutter, his body just seems to know. This photo of a nesting osprey in Western Australia was the focus of a discussion about ‘being in the moment’.



Figure 6.3 Nesting osprey. Reproduced by kind permission of 'Colin'

The researcher queried how he was able to capture the osprey at a moment when its silhouette, rotated 90° clockwise, was mirrored in the cloud formation above it.

C: When I was in Broome last time I got these great shots of osprey and there's only two breeding pair left in England and there's not many left in Australia. Every time we go down the South Coast or anywhere on the coast I always see eagles and I always get to photograph them and the other day there were whales leaping out of the water and I was getting lots of shots of that. So it's, I don't know, it's this thing.

Res: Is that what you mean by 'synchronicity'?

C: Yeah. I just happen to be in the right place at the right time. Bang! (snaps fingers) There they are for me and that is always a great thing ... I'll say to myself, 'Gee, I hope I see such and such,' and within half an hour or so, [I do]. Like, here's a classic, I was at Little Garie Beach about a month ago or a little bit longer, and I was taking some great shots and I suddenly got the feeling I was being watched and I turned around and there was this gorgeous and rather rare large black swamp wallaby. Never seen one. It looked like a kangaroo that was wearing a fur coat, they are **gorgeous**. ... And so the two of us just sat there for about 15 mins and just had this non-verbal interaction which was lovely and it let me take lots of pictures ... I love those moments where they are not scared of me and I'm not doing anything to make them scared. I'm never [more] at my happiest than when I'm at that moment. It's just a wonderful feeling, cause it's not about who I am or what I do or what my socio-economic grouping is it's, 'OK, I'll accept you if you accept me.' (Interview)

There are clear elements of identity and belonging in Colin's description of his wildlife encounters. As with Kahla and her animal encounters, Colin experiences unconditional acceptance and belonging in such moments, while with people he may be the object of jealousy for the ease with which he produces such high-in-demand images.

W: ... one [of his photographic mates] admitted how jealous he was of him, but Colin doesn't have a jealous bone in his body and he could never understand why people were a

bit narky towards him. He thought it was because he had Aspergers ... but they would say, 'No, it was because you were just so amazing, your lighting.' (Interview)

Professional jealousy aside, Colin's implicit knowledge ideally equips him to take photos that require split-second timing. Consciously, he is simply prepared and waiting. Then, when the moment is right, his finger presses the shutter as though acting by itself.

C: ... in motion picture you've got 25 frames a second to capture a moment. In photography you've got 125<sup>th</sup> of a second to capture the moment or less. You've got to sum up an entire emotional attitude, everything there is about that photograph that makes it work, in a split second, and as I used to say to myself, 'If I see it, I've missed it,' because that means that the [SLR camera's] mirror wasn't up out of the way. ... but I've never had to say to myself, 'Get in the moment,' I've always been in the moment which is why I think that I've never really had a conscious thought. I mean I've had conscious thoughts like, 'I'm hungry, I'll make lunch,' but I'm talking more about [creativity]. (Interview)

Colin's creative genius appears to be heavily reliant on implicit processing with very little conscious thought. This cognitive profile gives him a speed and perceptual advantage that results in world-class wildlife shots. Although he also has done studio photography, he is extremely passionate about wildlife photography and his encounters with wild animals, which endow him with a sense of unconditional acceptance and belonging.

### **6.7.2 Animals: A path to acceptance and belonging**

Colin experiences a sense of peace and self-acceptance through contact with animals that is otherwise elusive. His encounters with wildlife in the course of his photography are deeply meaningful to him. Domestic animals also provide a stabilising influence and play a key role in Colin's life in providing a sense of unconditional acceptance that assists with emotion regulation and social anxiety.

C: ... [we] went to a friend's wedding not that long ago, last time we went out anywhere big and, as soon as we got there, I sat in the car and literally said, 'I don't want to go in. I don't want to go in. I don't want to go in. I really don't want to be here.' And so we sort of wandered over and there was a few drinks going on and so forth and I saw a horse in a field so I immediately made a bee line for the fence and the horse came over and I stood there with the horse for about 5-10 minutes and the horse just calmed me down, then I was fine. I just needed something that I could interact with that was going to be non-threatening and I always find an animal is that ground for me. (Interview)

The couple has had two pet dogs that have played an important role in Colin's life, giving him unconditional acceptance. The death of one of the dogs was an abrupt and traumatic experience. Wendy recounted the impact of 'Skye' upon Colin.

W: He still will cry about beautiful Skye. ...she gave him unconditional love so that's what he really leans towards. (Interview)

Whereas many individuals love their pets, Colin and Wendy's dogs seem to play a more pivotal role in Colin's life, being a primary means to experience a sense of personal acceptance and belonging.

### 6.7.3 Fictional characters and fantasy

During the interview, Colin spoke about a number of fictional characters he identified with, the first being the film character 'Walter Mitty' (McLeod, 1947; Stiller, 2013). He explained that, in the past, he relied upon fantasy for identity and social cues, and experienced a blurring of reality and fantasy, in the absence of a securely developing identity.

C: I thought, 'Well hang on. All these psychologists I've been to see can't work out what's wrong with me so there's got to be something pretty serious here.' And I used to sometimes think, 'What am I? Am I schizophrenic? What am I?' My father used to call me a 'Walter Mitty' ... [There was] also ... a film called 'Billy Liar', which is basically the way I used to deal ... with a lot of my internal problems as a kid, the loneliness and all the problems I had, place myself in fantastic situations. ... In a perfect world where I'm in control. ... I've been doing that since I was five, going off in my own world. (Interview)

C: I was, and still am, a Walter Mitty kind of character. It was, is, and will always be, the perfect antidote to stressful or uncomfortable situations. It's such a relief to be able to just nip off down the yellow brick road of my imagination into a fantasy world where I am the one in control. Being able to escape inside my head without any outward signs to those around me that I had racked off was one of the best tricks I ever developed. I was the ultimate day dreamer. Classic dissociative child stuff. I was just protecting myself from my all-too-often awkward relationship with this odd little world we call Planet Earth. (Email)

In addition to fictional characters, Colin indicated that he employed radio and films for social scripts for events, in lieu of role models.

C: ... ideal situations that I've seen in films ... because of the way my life was structured, I didn't have role models outside of my mum and dad. My dad wasn't a particularly good role model and mum was a nice lady, she was not really that bright but she was good. So my role models became Saturday at the movies. I could escape into that world ... I didn't

have television as a kid. I only had radio so I was a great mimic. I could mimic, I can still do it today, I can mimic all sorts of things that I want. (Interview)

Colin's account was peppered with references to fictional characters that he used to illustrate a point about himself: for example, 'Zaphod Beeblebrox', a character from Douglas Adam's *Hitch Hiker's Guide to the Galaxy* (Adams, D., 1979) series.

C: I think that [Douglas Adam's] definition of Zaphod Beeblebrox, the guy with two heads (snaps fingers), perfect Asperger, you know, the logical and the irrational. Having two heads is perfect: pop one up, put one down.

Res: [But] the irresolvable conflicts internally that sets up...

C: Absolutely. (Interview)

'Marvin, the depressed robot', was also mentioned, quoting the line, 'I get a migraine thinking down to your level'. Colin not only identifies with the characters, but also with the author, Douglas Adams: his humorous ideas and eccentricities. Writer and comedian Spike Milligan was also mentioned in this context and there was discussion about the eccentricities of these men as his 'heroes', their lives and creativity. Indeed, a major strand in Colin's account was the 'hero narrative', particularly through references to: Parsifal and the Chapel Perilous; and, Joseph Campbell and his book *The Hero with a Thousand Faces* (1949), reportedly used by film-maker George Lucas (Lucas, 1977) as the 'blueprint for all of *Star Wars*, classic Greek tragedy' (Interview). Colin perceives his life in similar terms as being on a creative quest or epic journey, facing overwhelming challenges, with the struggle to find meaning and purpose in suffering without knowing the ultimate end of the journey; whether tragic or triumphant.

#### **6.7.4 'I have always felt like a fraud'**

Shortly after beginning to date Wendy, he announced to her that 'I've got the characteristics of a serial killer', and now appreciates that this was not an appropriate way to describe himself to a new girlfriend. Even into his adulthood, he felt that he was a 'fraud' or a 'freak': a fraud because he seemed to be able to effortlessly do that which took others years to master and a freak because he felt so different to others. The impact upon his identity can be seen in the following quote, which describes a time in his thirties when he had a breakdown in the middle of a photographic shoot and abruptly left for Bali.

C: When I got back to Sydney, I shut the studio down, sold everything off and put myself in the care of a psychologist for a few months and tried to rebuild myself as I wanted to be, not as everyone else wanted me to be. The whole time I was running my studio and having to sell, sell, sell, I felt I was living a terrible lie – that I was a fraud. I have always felt like a fraud, simply because I seem to be able to do things effortlessly that most people say takes years to learn. I never asked to be creative and I sometimes wish I wasn't. Life would be so much simpler and perhaps a happier experience if I wasn't so driven by this bloody Asp[ie] [AS] demon. (Email)

In later adulthood, Colin appears to have adopted more positive role models that have aided him in his professional and personal life. He identified himself with Bert Stern, 'the great America photographer' and also with a well-known member of the Australian entertainment industry, who mentored him and whom he described as a 'substitute father'.

#### **6.7.5 Knowledge and the knower**

Colin stated, 'I don't know how to paint ... I don't know how to do it' (Interview). He claimed that writing a book was like 'automatic writing' as he was writing details he 'didn't know', which turned out to be accurate when he checked the facts in a library. Colin's cognitive profile of greater reliance upon procedural and perceptual memory, with reduced reliance on semantic and episodic memory, assists with understanding his beliefs regarding supernatural elements being involved in his creativity. He may not be able to attribute his own semantic knowledge due to reduced awareness of his own mental states and tends to attribute his accomplishments, at least in part, to a spiritual dimension external to himself. His use of terms such as 'psychic' and 'synchronicity', and allusions to 'entering the Chapel Perilous', are the evidence for this interpretation. This tendency to ascribe inspiration to supernatural intervention aligns with the notion of externally oriented thinking in autism (Section 4.8.5).

In terms of Tulving's memory systems approach, Colin appears to be describing strong reliance on implicit memory systems including the function of priming (Baddeley, 1994; Poirier & Martin, 2008), resulting in knowledge whose origins are opaque to him, which may also involve temporal misattribution (that is, did the knowledge of an event come before, or after, the event?). Feedback from others about the genius of his work, combined with low self-esteem and a distinctive memory profile, may be the contributing factors that have led him to believe there is some form of supernatural intervention that confers upon him the fantastic images he produces. Colin's narrative

invites speculation as to whether his experience reveals the nature of genius: does the extraordinary operation of implicit memory-processing constitute genius of a certain kind, unencumbered by top-down mental processes? There is some research evidence on savantism that lends weight to the view that it does (Motttron, *et al.*, 2006).

Colin's view of the nature of knowledge is, inevitably, skewed by his beliefs based on his own experience. It follows that implicit knowledge and skills, in combination with reduced explicit understanding, will instill a distinctive view of the nature of knowledge. Knowledge and skills that he possesses, he is inclined to attribute, at least in part, to an external source, rather than to an explicit learning process. For some, 'inspiration' may be a more satisfactory term than 'supernatural' for the process he described: however, Colin resolves his epistemic uncertainty by external attribution to the supernatural.

#### **6.7.6 Values**

Colin has a strong sense of what he values and despises: that which is despised is labelled 'crap'; that which is valuable is associated with passion, 'flow', and meaning-making. To him, the production of creative artefacts (photographic images, artworks, music performances) is 'authentic' if produced in a state of flow; inauthentic if produced in a state of conscious self-reflection or by following a formula. Authenticity is associated with a lack of explicit reflection apart from a consideration of that which is true and beautiful.

C: Now there's a funny sense of security when you're looking at the world through a camera lens. There's no sense of fear, no sense of impending danger, nothing, just the shot you're trying for no matter how foolhardy. (Undated draft of wildlife magazine article by Colin)

Being a photographer is associated with a sense of destiny: 'I think I was always destined to be a photographer' (Email); and, in finding meaning through the passion of producing images and writing that others also find meaningful, Colin has learnt to build a sense of identity and meaning in his life.

Colin's core belief statement is 'if you follow your bliss, all else follows' (Interview), meaning that to follow one's passion is, in his view, the highest expression of humanity. For Colin, passion and meaning-making are inseparable. This is the major insight he offered into his giftedness and the understanding he draws upon for his identity. Passion

is, for him, associated with a lack of conscious reflection, with tasks accomplished by ‘being in the moment’ rather than through consciously acquired learning.

## **6.8 Conclusion**

Colin’s case represents an educational paradox: a published author who has profound spelling and reading difficulties but produces highly valued written manuscripts. While sharing general cognitive characteristics with Kahla and Rhoda, he presents a slightly different cognitive profile: in Colin’s case, during learning and creative production, there appears to be minimal explicit processing and memory. There is increased reliance on implicit, bottom-up, holistic processing of extraordinarily enhanced perceptual and procedural processing. Verbal explanations and top-down understanding for learning purposes tended to be discounted, whereas being ‘in the moment’ is valued. The tendency to ascribe his abilities to supernatural intervention could be the outcome of temporal misattribution of knowledge of events and poor theory of own mind capacity, although it is difficult to account for Colin’s partner’s reinforcement of the notion of his psychic ability. This implicit profile of holistic processing and memory could be described as ‘presemantic’ (Markowitsch & Staniloiu, 2011; Schacter & Tulving, 1994), as it does not rely on symbolic representation or explicit memory of personal experience and stands in contrast to the cognitive profile of Kahla and Rhoda, whose memory and learning profile, as described by themselves, relied heavily on semantic-style explicit thinking (although, their narratives also indicated enhanced perceptual functioning). However, it should be noted that Colin’s key informant highlighted his prodigious rote memory, indicating strong semantic processes, which, combined with probable poor theory of own mind and source memory for attribution, illuminates his account of his memory and learning. Colin’s narrative indicates serious disruption to the formation of his identity during his childhood and adolescence that continued into adulthood, however, in his fifties, he has been able to formulate a stronger identity narrative on the basis of his diagnosis of AS.

## Chapter 7 Case 4 ‘Nadia’

Nadia is a young woman who was 18 years old at the time of the interview. She was still attending school and was studying a half load of subjects for the high school leaving qualification (the New South Wales *Higher School Certificate*, known as the ‘HSC’); her final year of high school was conducted over two years with three subjects being studied each year, instead of six over one year. Nadia was accompanied to the interview by her mother, Lydia, who had proposed their participation in the research via a personal contact, although the researcher had not met either woman previously. Nadia’s case is of interest because of her proximity to her school experience, unlike the other four cases, where memories of their school experience were moderated by the long time period since.

The two interviews were conducted on a single occasion at the researcher’s home. Each interviewee elected to wait in another part of the house during the other’s interview but there was some checking of facts and discussion between interviews. As with the other interviews, these interviews were recorded and transcribed, with the data being coded in *NVivo*.

The key informant, Lydia, indicated that Nadia has two siblings, both of whom are some years older. The second sibling is a young adult male, whom Lydia described as being almost non-verbal during childhood and intensely shy and withdrawn. In hindsight, she feels he would have qualified for a diagnosis of ASD. While Lydia described his current progress as a successful electrical apprentice, there were, as she recounted, clear, pervasive autistic traits evident throughout his childhood. As a young adult, he had found satisfaction in working on lifts (elevators) in high-rise buildings but, having mastered this field towards the end of his apprenticeship, he was looking for new challenges and considering an electrical engineering degree. As for each of the other four cases in this doctoral study, indications of the broader family phenotype are apparent in Nadia’s case.

One thing that was clear from both Lydia’s and Nadia’s accounts is the extensive and successful advocacy by Lydia and her husband in realistically addressing Nadia’s social, communication and educational needs, perhaps based on their negative prior experience with Nadia’s older sibling. Nadia’s case appears to demonstrate the value of expert,

prolonged, targeted interventions and successful advocacy. She was diagnosed with AS at the age of twelve after an extensive period of bullying and disruption to her primary schooling. Since that time, she received regular social skills training, emotion management coaching, and school accommodations. The social skills training and emotion management coaching were provided by a practice of psychologists who specialise in AS: in fact, it transpired that it was the same group that provided Kahla's coaching.

## **7.1 School experience**

Following her difficult experiences in upper primary school that led to her diagnosis of AS, Nadia attended a Catholic girls' high school catering for Years 7 to 10 and then, along with her cohort, transferred to a co-educational senior high school at another campus. Lydia indicated that the support and accommodations received at the school from Years 7 to 10 were outstanding, with the school arranging for Nadia's teachers' attendance at training sessions each year, provided by Nadia's psychologists. This training was tailored to professional development of teachers so they could provide an educational environment that would support Nadia's learning and development and indicates a high level of commitment by the school to cater for Nadia as an individual. The senior high school was viewed by her mother as not being as proactively supportive of Nadia as the junior high school, however, Nadia continued to receive extensive accommodations for learning and assessment that enhanced her participation and contribution to the school.

An example of the strategies employed, as designed by the psychologist in consultation with Nadia and her teachers to assist with stress and emotion management in class, was a green piece of cardboard (green as a representation for 'go' as in traffic lights) that she could hold up momentarily to the teacher, which then entitled her to leave without further talking. This strategy was utilised to address Nadia's history of meltdowns in the classroom, which had occurred due to her rising frustration at not being able to understand the teacher's expectations or instructions. The goal was to facilitate Nadia's implementation of self-calming techniques **before** she had a meltdown: the school allowed her to leave the room and spend time outside or in the quiet space of the library until she was able to self-regulate her emotional state. This strategy first required Nadia to be taught painstakingly how to recognise and respond to her own emotional states.

Nadia reported that, as time progressed, she had decreasing need to resort to this green card strategy.

When she was younger, Nadia reported that she coped with the stress of being at school by constant reading. Every opportunity was employed in reading and this minimised the requirement to interact socially with her peers. In more recent times, Nadia has actively cultivated a social group of other students whom she considers ‘outsiders’.

N: ... I went around and grabbed all the ‘oddities’ and put them together and we made this huge group.

Res: How many people in that group?

N: There’s about 13.

Res: All at school or in other places?

N: That’s my school group ... Most of my out-of-school friends are neurotypical because they were from before this school but these friends, a lot of them are odd, oddities, weird, different, slightly abnormal and we have a saying that we’re the normal ones and nobody else is. Because we understand each other and nobody else does. And it’s fun because we’ll do something that we understand is acceptable for our group and everybody will be like, ‘What the...?’ (Interview)

She now finds social acceptance with her ‘tribe’ and does not appear to be troubled by the necessity of moving between year cohorts for different subjects as she undertakes her alternative study pathway. The school has apparently been successful in engendering a culture of acceptance among the students as well as the staff.

N: ... All the teachers are very observant. They will understand and accept that I am not going to be neurotypical, I’m going to be different and it’s going to be a bit harder on me and it’s a very good school because they all understand and accept it. ... Yeah, even the students, once it’s explained to them, even they understand and sometimes point out to me [when] I’m getting stressed. Last year when I was doing English, I used to sit next to a girl and I got stressed at one point and she goes, ‘Nadia, use your green slip,’ and I’m like, ‘Right, thanks,’ got up and went out. She stopped me from having a major meltdown at that point. (Interview)

Nadia and Lydia both indicated high levels of satisfaction with the support they received from the school and expressed that the overwhelming majority of teachers were understanding and supportive. However, there were two instances recounted where Nadia found it difficult to learn: the first was with a teacher who had a heavy accent. Nadia finds it demanding to interpret what her teachers are saying and, in one

class, this process was made even more complex by the teacher's accent. Nadia lacked the capacity to adapt and 'went from being an A student to being a D student' (Lydia: interview). The second instance was when the class had a particular substitute teacher. Lydia felt that the teacher was very rigid and did not believe that Nadia had a disability, or that she should receive accommodations. The school responded by ensuring that that particular teacher was assigned to other classes.

L: But [the school leaders] were fantastic ... they really tried to work to find teachers that she got on well with and that she had a bonding with and they kept giving her the same teachers after that. (Interview)

Despite overall happiness with the level of understanding and accommodations Nadia was receiving, Lydia indicated her frustration with teachers who do not understand the communication problems that are an element of AS.

L: She has such a hard time sometimes understanding the little bits in between what a person's saying, that it really has a massive impact on how she's learning. ... If the homework or the assignment isn't specific in what it wants, and I mean 100% specific, she'll go off on a tangent that has nothing to really do with what they want in the end. And she gets so angry and frustrated because they didn't write exactly what they wanted. (Interview)

Lydia's statement, 'She has such a hard time ... understanding the little bits in between what a person's saying' is a reference to sub-text in the teachers' verbal (written and oral) instructions. Such things as meaning derived from: previously established expectations; prior knowledge; and, gestures; those elements of language that enhance meaning, where such meaning is not communicated via words. Lydia stressed that the wording of assignments, text displayed during lessons and the teacher's verbal instructions, should all take into account Nadia's need for literal, direct language and explicit explanation of ideas. Teachers being aware, or not aware, of the nature of the communication issues inherent in AS is a critical component of a successful learning environment for Nadia.

Nadia receives assessment accommodations for formal examinations; extra time and a room by herself with a supervisor. She was diagnosed with dyspraxia, which, for the purposes of this study, is understood to be canvassed in the autism literature as 'proprioceptive' problems (Francis, 2005; Kushki, Chau & Anagnostou, 2011; Paton, *et al.*, 2012), and sometimes struggles with the cognitive and physical tasks of writing

under time pressure, so her teachers have, where appropriate, allowed her to demonstrate her learning by doing *viva voce* assessment tasks instead of in-class written assessments.

N: Sometimes, like recently, I haven't been able to write it down. I can't get the information from my brain to my hand. So I sat down with the teacher and they've recorded it and I've answered the question verbally. (Interview)

Facilitating alternative forms of assessment is another indication of a school that has strongly invested in creating a learning environment that enhances Nadia's opportunities to learn. Nadia has been able to pursue her love of writing, drama and fashion through her school studies: she shared with the researcher photos of fashion outfits she had made, modelled by her friends, and a copy of the stage play she was writing as a major work for her HSC Drama course. These artefacts show clear evidence of a keen and questing intellect, an eccentric sense of humour, and individualistic artistic ideas.

## **7.2      *A sense of difference, alienation and isolation***

Nadia speaks in terms that indicate a deep sense of difference and alienation.

N: [Neurotypicals are] like an alien race to me. It's the little green men. They look humanoid but they're different. It's like I was a little green man and I was on a completely other planet and sometimes it's still like I have green showing through. Sometimes it's like, 'You [neurotypicals] are so weird,' and it turns out it's me being weird.' (Interview)

She is, however, anything but resigned, and proactively cultivates other people who are the 'oddities'. She tends to celebrate her differences, based on the understanding she has gained through extensive interventions and the support of a family who value her as a person.

N: Sometimes I feel like an alien. My friend has this book ... and it says 9 [out of 10] child[ren] will be a horrible little monster, one was abducted by aliens. And my friend and I turned to each other and went, 'We were abducted by aliens!' cause we're one of those 10 that is completely different to everybody else. And I like to think I'm completely and absolutely different. There is nobody else like me. And that's a good thing because there's no criteria for me to live by so I can think how I want, speak how I want and I don't really mind now how people interact with me. Cause I know with my social training what not to do and that's the only thing I need to know, is what **not** to do. (Interview)

Although Nadia's utterance has an air of nonchalance, it is clear that she cares deeply about social interaction with people she likes and her mother confirmed that this is the case. Nadia is an example of a well-coached young adult with realistic aspirations and hard-won social knowledge. Knowing what **not** to do or say in social situations has allowed her to gain confidence. Within the framework of support provided by the school, the psychologists and her family, she enjoys and values a measure of social interaction, relying heavily (and apparently successfully, at least from her own perspective) on her social training. However, her overall direction in life is still guided by the desire for minimal social demands.

N: I guess, my ideal life would be in a library with very little interaction with the outside world. Everybody else would rather go to 'schoolies' [a week-long party attended by students after completing their HSC]. I guess, I'm just completely different. (Interview)

Excellent coaching has enabled Nadia to develop substantial social skills and enjoyment from social interaction, however, this is compensatory, not corrective. She is strongly aware of her differences from the 'mainstream' (Nadia's term) and is proud of her individuality.

### **7.3      *Language***

Nadia is highly verbal and had precocious language development. Lydia stated that Nadia began to speak confidently around 9 months of age and was speaking in full, carefully enunciated sentences at 18 months. Nadia is fluent and comfortable with spoken language, is a voracious reader, and loves to write. During her relatively short monologues, there were signs that she has attained a level of mental self-discipline that overcomes any tendency toward purely associative thinking, as described by Temple Grandin (Section 4.7.2) and demonstrated in Colin's case (Section 6.2), where one idea leads to the next without any reference back to the original utterance or topic. In the following utterance about her love of dance (she has learnt to dance in many different styles) and the role of emotion in dance, Nadia demonstrated the capacity to fluidly maintain and elaborate the central idea of the utterance, developing her argument as she speaks and reaching a coherent conclusion.

N: Now that I've learnt from [my psychologist] all these ways that people interact, how to pinpoint an emotion that I would have accidentally thought was another, I am becoming even more in love with dancing because I can actually feel it. Every dance is something that I can feel and imagine. Kind of like when I read a book, I don't see the words after

about a page, I see images as if it's a movie in my head. Sometimes I'll become so absorbed in the book that it's all that exist[s] until I stop reading. With dance it's similar. Once I'm on stage, it's the only thing that exists at that point in time. And I don't have to think about anything confusing about the way people are going to interpret it because they can interpret how they want. It's just liberating. (Laughs) (Interview)

As she appears to have developed a measure of central coherence in speech through explicit learning, this raises the question of whether coherence learnt at such an early stage of maturation (between the ages of twelve and eighteen in Nadia's case) impacts upon the neural networks that support top-down thinking: in other words, is Nadia's capacity to demonstrate coherence in her speech purely reflective of compensatory learning or has it also had an influence on her neural development? Further research is needed. On another level of meaning, this utterance is interesting for the window it provides into Nadia's awareness of her own mental states, attention, 'flow', and awareness of other people's perspectives.

It is difficult to posit whether Nadia is natively a verbal thinker: she certainly did not appear to be translating between thought and speech like Colin and Rhoda; although, like the other cases, she described her thinking in terms of pictures and movies. Her speech during the interview appeared to act as a tool for her thinking as she constructed ideas through passages of fluent speech.

Res: What's the difference for you between autism and Asperger's syndrome?

N: Autism is a brick wall where Asperger's is a glass wall. Asperger's you can already see though, you can already punch through holes and sometimes fix some problems. But with autism, it's more so that there're a few bricks missing but most of the wall's there and you need help.

Res: Is that your idea or have you heard that from someone?

N: I just made that up on the spot. (Interview)

This statement about autism and AS may represent fluid production of ideas through the medium of speech or, alternately, it may represent an attribution problem: attributing an idea to herself in the moment. However, Nadia's speech gave the impression of being constructive talk, possibly representing externalised thought-processing, while Colin's and Rhoda's speech left the impression of a verbal struggle to articulate thinking, with their speech representing the output of the struggle rather than being an intrinsic part of the process of thinking. Perhaps Nadia is natively processing thought using a

combination of verbal and visual processing, although no evidence from the research literature with which to support this statement was discovered. The style of Nadia's speech shared more with Kahla's than Colin's or Rhoda's: however, Kahla was very specific in describing the way she thinks in visual terms so there appears to be more evidence for visual processing in her case. Kahla's utterances were very well-constructed and delivered, as though rehearsed, while Nadia's speech appeared more spontaneous. This poses the query, worthy of further research, whether Nadia's compensatory learning, which began so early in her maturation, may have influenced the development of her cognitive processing style. Other explanations are possible: for example, heterogeneity between cases; the possible mildness of Nadia's AS; her stage of development; and so on.

As mentioned above, Nadia loves reading but, unlike Rhoda and Colin, she is only interested in reading fictional literature. She reads fantasy literature, which she consciously uses as a form of escape to help her tolerate social situations. Reading fiction also appears to act as a way of accruing social scripts or playing out possible social scenarios in Nadia's imagination with her focus being 'What if...?'

Res: What are your favourite topics for books?

N: Fantasy, sometimes with a mix of reality in it. Basically, ones that I know could never really happen; with magic or futuristic science that probably would never really work; medieval times which I've never experienced. I like to, when I read a book, become part of a world or go to a place I've never experienced.

Res: Is that still for escape or is there some other attraction?

N: I guess it's kind of escape but I don't want to read information on a real place because **it's** happened: it's got certain guidelines and therefore I wouldn't be able to imagine much different. But if I read something about the round table with King Arthur and Merlin and magic and stuff, I can make up a million storylines in my head. ... Once I've read a book I want to be able to imagine situations that didn't happen. I want to imagine a life for these characters that never happened in the book. But if I read about King Henry VIII, his life has already been lived. Everybody knows everything about it.

Res: It's not going to change.

N: It's not going to change. So how could I make that character or that person do something that I know they probably would never have done? ...

Res: So you like to ask the question 'What if?' for yourself?

N: Yeah, that's kind of my favourite question when I read a book. What if this happened, would this character have been different? If that person never died would everything have changed? So I like to take one thing and change it and change the whole storyline. (Interview)

Nadia's central focus in her reading and writing is on fictional characters and their behaviours. This focus appears to afford her the imaginative capacity to play out alternate behaviours and events in a safe way, providing the environment and narrative structure that enable her to rehearse alternatives. Non-fictional accounts, for her, are **too** structured and leave no room for this process.

Nadia, like Kahla and Colin, loves to write and she develops her thinking through writing. Whereas the purpose of Colin's writing was chiefly descriptive (wildlife encounters, photographic techniques), Nadia's writing appears to serve another, distinctive purpose; that is, the study of people in order to accrue social skills that facilitate her interaction with her environment (Section 4.8.4). The unfinished play that Nadia was writing for her HSC Drama major work is a very revealing artefact. It is based around three pairs of characters: one of each pair is a famous person in history, suspected of having AS, who is contrasted with a present-day, mute, autistic-savant, child-self version of themselves. Nadia described her characters in the following way.

N: My script ... is basically about six main characters. Three of them are based on real lives: Einstein, Leonardo da Vinci and Beethoven. I know that Einstein was probably autistic but I made him an Asperger character. These three characters have Asperger's ... and I've put them in an Asperger context, how they interact with the world, in that setting of their time; because they didn't have any help, they didn't have any diagnosis for it. Then I've got three characters, ... they're younger versions and they've also got very severe autism and it's how the modern world interacts with them ... To tie it together, I've got the three from the past in the afterlife playing a poker game and inbetween every few scenes, they discuss what's going on, how it's affected them and how it's affecting their younger *doppelgängers*, ... three [autistic savant] characters. (Interview)

Having established the contrasts in temporal context and cognitive profile between the three pairs, Nadia uses her play as a medium to work through issues of acceptance and rejection of AS and autism.

N: There's a mother figure and she plays a part in both times. She's the mother of one child, Beethoven. Beethoven and his *doppelgänger* version, his name's Brian, and in the path with Beethoven, she is very confused, disoriented. Why is my son so different? Why? ... but, with the modern version of it with this child called Brian, she's accepted it, she's comfortable with it and there's a line in my script that she declares that it is her 'normal' now, with this autistic child. ... But there are other characters that reject the

autism or Aspergers. There's characters that misinterpret what's going on, there's some characters that try to accept it but are only half way there. (Interview)

Nadia has written her stage play with the purpose of educating the audience about the value of human genius, whether in the form of AS, or autistic savantism. The conversations between the characters in the play perform the function of addressing Nadia's reality and exploring the question 'What if?' in a similar way to her explicit purpose for reading fictional literature. This is an enlightened and intelligent utilisation of reading and writing for social problem-solving and demonstrates Nadia's commitment to working proactively to achieve social competence and a sense of belonging. There are certainly elements of enjoyment in Nadia's discussion of her favourite books but the task-oriented aspects of her reading and writing dominated her account.

#### **7.4 Learning**

From Nadia's narrative, it is apparent that, like Kahla, she proactively studies people, even though she may be unaware of doing this. It appears that this study of people provides her with social scripts and ways of functioning that have allowed her to achieve success in her own terms. This is a form of learning that she is highly motivated to undertake and, as previously described, she uses drama, dance and writing to play out and rehearse emotional and social scenarios. Nadia has learnt compensatory strategies that support her social and academic learning. For instance, she is poorly motivated to learn maths and anything to do with numbers but highly motivated to learn through language and in areas of special interest (fashion, dance). So, in lieu of executive function processes, she employs explicitly learned rationales provided by her mother, teachers and psychologists, in order to tolerate maths classes, where she has low motivation to learn.

With strong semantic memory, it is easy for Nadia to learn using semantic processes such as repetition, re-stating in different words, visual processing, and so on, and she reported that her teachers encourage her to utilise these strategies.

Res: What would you say that you need in order to learn successfully?

N: It's good to try different ways to approach the situation. Sometimes ... repetitions [are] needed, sometimes it's a different way of thinking. I learn things a lot through visual images, little doodles in the borders of my books so I can remember. Sometimes I need a

way to remember like a rhyme. Sometimes I just learn it straight away. ... Usually trying a different approach often works and that approach can often be manipulated to other situations.

Res: What do you mean by that?

N: During drama you learn rhymes to remember how to move a certain way ... In ancient history there was a certain war that it's very hard for people to remember it, so my teacher decided to create a rhyme for it and everybody remembers it. Especially somebody like me, I can repeat it word for word. (Interview)

Nadia has been taught to vary her mental approaches to learning, which indicates that she has formed some compensatory metacognitive strategies, including the use of mnemonic devices. She may also have built some basic understanding about appropriately generalising a strategy to another context ('that approach can often be manipulated to other situations'). If this is the case, it is indicative of some extremely successful coaching strategies, as difficulties of generalising learning for individuals with AS are well-established in the literature (Klinger & Dawson, 2001; Loth, Gomez & Happé, 2011; Minshew, *et al.*, 2002; Williams, E., 2004).

Through dance, Nadia has learnt much about emotion. The attraction of dance for her is its structure and scripted-ness.

Res: So what do you love about dance?

N: Probably how it's so predictable. You learn steps then somebody tells you how to do the steps. They tell you when to do it, where to do it and all I have to do is do it. (Interview)

The highly structured and explicit nature of dance training accommodates Nadia's learning needs. She had recently discovered that teaching dance is an entirely different proposition, introducing elements of unpredictability.

N: I am now learning to teach [dance] with my sister and it's the most confusing, scary thing I've done in a few years. Because I don't know how somebody's going to react to what I tell them to do. But for my whole life I've loved dancing especially when I'm the one doing the moving. I love it that I can just move my body and interpret an emotion that I used to have no clue what I was doing to. I could dance an angry dance and I knew anger. I could dance a happy dance and I knew happiness but they would tell me a few steps to a certain piece of music and it would be an emotion that I didn't understand but **I still loved it because I could for a moment pretend I felt it.** (Interview) [Emphasis added]

While acknowledging that she does not necessarily feel the emotion (see emphasis), dance has been a medium through which Nadia has learnt to further differentiate between emotions. Dance could be said to be an external representation, through movement, of emotion, which has made it an ideal training ground for Nadia. It is also likely that dance training has assisted in rehabilitating her proprioceptive problems.

Lydia's perspective on Nadia's learning revolved around the success or failure of teachers provided by the school and their capacity to facilitate Nadia's learning. Her summation supports the merit of 'cherry-picking' (for the origin of this idea, see Humphrey & Lewis, 2008) teachers for students with AS and is a partial re-statement of the educational problem that initiated the current study.

L: We'll find that the teachers that are really great with [Nadia] are the ones that will tell her the way she understands it. The ones that don't understand her at all, she struggles with continuously because I don't think they can talk to her on the same wavelength ... (Interview)

Nadia's learning capacities would appear to have been greatly extended through the intervention of explicit coaching, school accommodations and the advocacy of a family committed to providing her with optimal outcomes. She employs many compensatory strategies that benefit her learning and she displayed high self-efficacy beliefs in her capacity to learn subjects in which she is interested.

## **7.5 Cognitive profile: Processing style**

Nadia's cognitive style is characterised by cognitive inflexibility: problems in being able to 'set-shift' (Van Eylen, *et al.*, 2011, p. 1390), or mentally 'change gears', in order to get past a blockage in thinking. She provided a succinct example of this problem.

N: I often have to do my exams alone in solitary [solitude] because external annoyances will distract me and I'll forget. Whereas somebody [else] goes, 'OK, I'm going to write this,' and then they forget something half way, they'll go to the next part, I can't do it. I hit a brick wall and I'm stuck and it often results in me having a stress attack or having to completely remove myself from the situation. (Interview)

Cognitive inflexibility in AS is subsumed under executive function in the theoretical framework and is associated with sensory sensitivities, difficulty with filtering out extraneous sensory information, perseveration, and distress. Explicitly learned compensatory strategies appear to have enabled Nadia to identify her mental state, at

least in retrospect, in this context. Examination accommodations provided by her school were an effective means of addressing the problem with regard to timed assessments.

Nadia is hyper-verbal, with early complex language development, in contrast to her brother, who had high tested IQ and was almost non-verbal in his early childhood. Nadia's use of speech as a vehicle for her thinking demonstrates strong verbal reasoning, however, she identified herself as a picture thinker with strong visual processing. During a discussion of books that had been turned into popular movies, such as *The Lion, the Witch and the Wardrobe* (Lewis, 1950), Nadia described her processing and her memory recall in terms of a movie that she watches and can control, as if on a DVD player.

Res: What happens if you tell me the story [of a book you've read or a movie you've watched] – what's happening in your mind?

N: I remember flickers of the movie, pieces.

Res: Do you mean the real movie or the movie that was in your head when you read the book?

N: Both, both. If it wasn't a movie, I'd remember the movie in my head, how I imagined it and sometimes there might be something slightly different from the book that I remember but it's basically the same. But if I've seen a movie, I often see the moving images, the pictures, in my head, like a flashback, and it's kind of how it works in my brain. (Interview)

Nadia referred to imagination to describe the act of visualising a story: here, imagination is equated with working memory. Movies she has seen in real life she recalls as 'flashbacks' but she prefers to read the books first and imagine the story for herself, even becoming incensed at what she regards as poor movie interpretations of some of her favourite books. Although imagining the narrative of a book being played out as a movie is not indicative of a particular visual style associated only with AS, the indications are that Nadia's processing style is predominantly visual, supplemented by high verbal reasoning skills. This interpretation is supported by her 'documentary' (Newman, *et al.*, 2010, p. 269) verbatim recounts of personal memories from early childhood (Section 7.6) and many visual processing references, in the absence of recalled memories with a 'sense of self-involvement' (Boucher, 2007, p. 261).

It is difficult to be as conclusive in Nadia's case as for the other cases as her reflections on her own thinking were minimal and tended to be stated in terms of metaphors, actual events, or strategies she had learnt through coaching: indicative of an externally oriented thinking style. The same was true for Lydia's account as she focused on recounting events rather than offering descriptions and interpretations of Nadia's thinking. The participants in the other cases of this study, perhaps as a result of their greater maturity, were able to provide more developed descriptions and interpretations of their thinking. Nadia's use of metaphors was descriptively rich but caution was applied in the analysis of this case because of lack of further explanation, whereas metaphors used by the other participants were subjected to discussion and clarification.

## **7.6 Cognitive profile: Memory**

In line with her visual processing style, Nadia spoke about her memory using metaphoric terms that indicated a visual memory style. The researcher reflected these terms back to Nadia for elaborative purposes but there was only one direct reference to the internal characteristics of her memory.

Res: Is that like pressing the recorder on the DVD player again when you do that?

N: It's kind of like one of those old movies where there's bits of fuzz in between, some bits are a bit hazy and then there's some really bright clarity pieces and that's kinda like how my mind is. All the boring stuff is fuzzed out but all the important facts are still clear or only a little bit hazy. (Interview)

Anecdotally, some individuals with AS may claim that they remember **every** detail of their life as if it were video-recorded and available for playback at any time. (This assertion emerged from a presentation on memory given to a group of high-functioning individuals with AS by the researcher in March 2013.) It is reasoned that this claim may be the result of a form of mind-blindness where the individual is blind to their own capacity to forget: put simply, they 'don't know what they don't know' or, with reduced theory of mind, they cannot imagine themselves having a mental state that is different from their current 'knowing' mental state. In contrast, Nadia's statement above encapsulates some understanding of the capacity to forget, stated in visual terms: 'all the boring stuff is fuzzed out'; with 'important' and 'boring' indicating salience or lack of it.

Lydia claimed that Nadia's long-term memory stretches back to infancy and this was confirmed by Nadia.

L: Memory like an elephant. She can remember when she was tiny ... really little. (Interview)

To clarify what age Lydia meant by 'tiny', she indicated at another point that Nadia's memories stretch back to when Nadia was two. Nadia's way of recalling the early memories is by giving verbatim recounts of what was said at the time, or by describing other details, such as the clothes that were worn.

L: She'll remember stuff that's not important, ... she'll remember everyday conversations. 'No you didn't, Mum. You said 'blah, blah, blah,' ... and specifically no changing of the words that you said.

Res: So, verbatim.

L: Yeah, so you can't lie and say you said something else. (Interview)

Like Kahla, the operation of childhood amnesia is significantly and atypically reduced and Nadia's personal memories are characterised by verbatim semantic-memory-style recounts. Unlike Kahla, the early memories described were identified only with Nadia's development of speech, whereas Kahla also described memories that appear to be pre-verbal.

Lydia asserted that Nadia has extraordinary rote memory and Nadia's report indicates the explicit use of mnemonic rote memory techniques in her learning. While the use of mnemonics is a powerful and effective learning technique highly suitable for Nadia, this memory style has limitations that significantly affect learning: conceptual understanding built upon facts and general knowledge committed to rote memory are, by nature, inflexible: conceptual frameworks based on abstract reasoning are, by nature, generalisable to other contexts (Klinger & Dawson, 2001). Reliance upon rote memory accompanied by cognitive inflexibility poses the following pedagogical problem. School knowledge curricula are usually enacted by building conceptual understanding over time in ways appropriate to age and development. This means that explanations given in Year 7 (where the students are aged twelve or thirteen), for example, on the geography topic of 'tidal wetlands', will be less sophisticated than the explanations given in Year 11 or 12 (senior high school). Rote memory characterised by cognitive

inflexibility may cause the effect, over time, that colloquially is known as ‘the whiteboard effect’: a metaphor for cognitive inflexibility in long-term memory in AS. The whiteboard effect refers to the notion of permanent marker pen, which cannot be erased, being used on a whiteboard: that is, the first version of a new idea or piece of information that is planted and retained in the memory of an individual with AS will be very resistant to change and development. Therefore, the development of more sophisticated understanding over time through the curriculum may be problematic for learners with a memory profile similar to Nadia’s. This issue is highlighted in the following description by Lydia of a dispute with a teacher over a senior school assignment on tidal wetlands.

L: ... and [Nadia] didn’t explain the first bit [in her assignment] which a Grade 2 person would explain what a wetland is or a sand dune was, it’s ‘sand pulled up from bleh bleh bleh’. She didn’t do that opening little bit because it’s assumed knowledge. ... and in [the] HSC they’re just going to know that already, and then she didn’t do it, she lost points, she got cranky. Now don’t say things you don’t mean because they are going to remember it word for word ... and like 5 years later they’ll remember it word for word. (Interview)

At some point prior to this assignment, Nadia was told by her geography teacher about ‘assumed knowledge’ and, it seems, encouraged to move beyond basic knowledge about tidal wetlands. She interpreted this to mean that she didn’t need to give basic definitions in an important assignment, lost marks as a result and felt this was very unfair. The teacher’s first explanation may have been given with the intention of helping Nadia produce better assignments but Nadia has possibly applied this explanation to a different context inappropriately, demonstrating the perseverative effect of cognitive inflexibility and its impact on learning. While this is illustrated through a very specific example in Nadia’s case, it is proposed that this same effect will impact upon learning through the ‘spiral curriculum’ (Bakhurst & Shanker, 2001): over the years of education, as topics are revisited with the goal of deepening understanding, earlier, simpler, memorised explanations may be resistant to development and incorrect understanding will be resistant to correction. The literal interpretation of teachers’ language and explanations from past learning, faithfully remembered by rote, may cause problems in the more complex learning contexts of senior high school and this was certainly indicated, to some degree, in Nadia’s case. Therefore, for students like Nadia, teachers may need to persist in gentle correction and repetition of new ideas in a way that would be unsuitable for other students.

## **7.7 Philosophical questions**

Consideration of the themes within the framework of the four philosophical questions (Lincoln & Guba, 2013) are addressed under the following headings of: identity; knowledge and the knower; and, ‘Am I smart, or am I dumb?’

### **7.7.1 Identity**

Nadia sees herself as different but seems to feel a sense of distinction in her difference that might be termed ‘Aspie pride’. With her diagnosis and extensive interventions, she expressed a sense of identity based around her perceived difference. Her narrative contrasted her sense of rejection by ‘the mainstream’ with a sense of acceptance and finding her ‘tribe’, which, at school, was her social group called the ‘Oddities’. The contrast between acceptance and rejection is one of the major themes enacted in her HSC Drama major work, the script for a stage play with three autistic characters, each of whom has two states: a socially ‘accepted’ gifted version and a ‘rejected’ autistic-savant version. Her play, at one level, can be interpreted as a means of working through the issues of acceptance and rejection, with the goal being to normalise difference. Nadia’s self-narrative is evident in the following statement.

N: Sometimes, I’ll have to do something different. Sometimes, I won’t be able to do something that other people can. Sometimes, the way something affects me won’t affect another person. And I had to accept that, understand that, and I accepted it and understood it really easily because I wanted a reason. I wanted a reason to understand so I could look at how to fix it. It wasn’t exactly, like, broken, it was just cracked. [Laughs] I had a slight crack in me that needs to be fixed but I wasn’t falling apart. I find it sad that some people refuse to accept that they have a problem that they will never be able to completely cure. Just because it’s a disability in one area doesn’t mean it’s horrid. ... When I found out [I had AS], I was relieved, I guess. Even though I was young, I was relieved that I wasn’t a freak, I wasn’t broken, I wasn’t defective ... that it wasn’t only me. I go to a group ... to meet others with problems similar, and sometimes more extensive, than mine ... they’re so much like me and so different. And yet, when I meet neurotypical people, they’re so different to me and yet there’s only a few things that are like me. (Interview)

Nadia demonstrates resilience based on her framework of understanding about her differences. She elsewhere described having AS as ‘a bump in the road’ that she has learnt to navigate around and, without minimising the impact of disability, displays an energetic passion for meeting her challenges, changing societal attitudes around her and supporting others.

Nadia has future plans. She has a part-time job after school shelving books in the local library and her goal is to be a librarian. The quiet environment, muted social interactions and focus on literature is a safe, comfortable place where she has the potential to thrive. Forming clear, future, realistic life goals is an area of difficulty for individuals with AS as this operation, known as ‘prospection’, shares a neural network with episodic memory (Spreng, Mar & Kim, 2009). The conclusion to be drawn is that, through compensatory pathways discovered via extensive intervention and support, Nadia has overcome many of the hurdles faced by young people with AS: including the over-representation of gifted students in school drop-out rates (Jensen, 2008; Peterson, 2009).

In speaking about her likes and dislikes, Nadia said, ‘I like to keep true with what I **know**’ (Interview), and, in saying this, she appears to benchmark her sense of self against factual knowledge. There is an undercurrent of identity formation that has been mapped to factual knowledge (the realm of semantic memory); rather than to personal experience (the realm of episodic memory), supported by factual knowledge. There is also a sense of confidence in ‘what I know’ and pride in her identity. The level of support and intervention that Nadia has received appears to have been efficacious in helping her develop external representations of identity: odd, eccentric; valued by self and others; social interaction (the ‘Oddities’); gifted (writer, fashion-designer); and, with future plans (librarian).

### 7.7.2 Knowledge and the knower

When specifically asked about how she learns and the conditions that impede or enhance her learning, Nadia commented ‘I need to keep with what I know’ (Interview), indicating a measure of general uncertainty in the reliability of knowledge and this is reminiscent of Kahla’s narrative.

N: I guess the way I think is normally completely the opposite of most people. I don’t want to say ‘narrow’ **but I need to keep with what I know**. I like to learn but I won’t talk about it till I’ve learnt it.

Res: Oh, that’s interesting! So while you’re learning something...

N: I’ll talk about what I’ve learnt but not what I’m going to learn. Because I have no information on it. (Interview) [Emphasis added]

Whereas Kahla's account indicated her continual trial-and-error methods for testing the reliability of knowledge, Nadia appeared more reserved and chooses to wait until she achieves a sense of completeness before she acts upon knowledge. While their responses are different, this highlights the background of uncertainty that exists for both Nadia and Kahla in their learning: to establish that which is real, true and reliable. From their learning narratives, it appears that Nadia and Kahla are engaged in a quest for epistemic certainty that is more difficult because of their cognitive style (this proposition also applies to Rhoda's and Colin's cases). It is a struggle for them to incorporate new knowledge into their constructed understanding of the world.

Approaches to explicitly learned knowledge, such as Kahla's and Nadia's, stand alongside the traits of 'social naivety' (Hedgcock, 2010; Humphrey & Lewis, 2008), where individuals with AS have a tendency to accept socially transmitted knowledge as true without subjecting the information to any form of reliability testing, thereby becoming a target for bullying and manipulation (Attwood, 2008; Bradshaw, 2013). These epistemic polarities indicate the challenge of constructing reliable knowledge frameworks with the cognitive profile of AS, where abstract reasoning (top-down processing) is diminished. Yet, such knowledge construction is central to educational endeavour in schools in Australia, where rote-learned, fact-based knowledge is assigned a lower value.

### **7.7.3 Am I smart, or am I dumb?**

Just as in Kahla's, Rhoda's and Colin's cases, the same core question of self-worth, 'Am I smart, or am I dumb?', is enacted in Nadia's account. One of the ways this question is expressed is through the characters in Nadia's play.

N: ... in the scene that I've already written, [one of my autistic characters is] playing piano and he refuses to acknowledge anybody else until he's finished the tune. An elderly man comes on[stage] and basically insults him, saying that he's dumb, he can't have a conversation, why bother? (Interview)

Nadia appears to be utilising avatars to act out representations of central questions in her life, including the question of worth, through the medium of her stage play. The adult-genius and the autistic-child characters are representations of the same people: one is the 'smart self' (in the eyes of society) and the other is the 'dumb self' or autistic self. The conclusion reached by Nadia is summarised in the following statement.

N: ... these autistic kids aren't dumb or retarded. They're learning, breathing, emotional characters. ... my mum told me ... that a woman said that autistic kids have no empathy, and it's not true. (Interview)

In relationship to herself, Nadia indicated that she had been called 'dumb', but was dismissive because this was said by 'idiots, bullies'. Instead, she based her reasoning on academic testing and exam results. The following passage demonstrates the verbal reasoning Nadia applied as she worked through issues of self-worth.

N: I'm intelligent but not brainy, intelligent for my age, I've been told. I understand things that other people don't but that's because I've learnt it. I go to a psychologist, she explains life. I go to dance and I've tried nearly every style. I read a thousand books. So, I see things from so many different angles that I can understand it. I am not extremely brilliant ... but, then again, I'm not dumb. I know the basics to sometimes quite a high level compared to other people but sometimes they know heaps more than I do. ... I guess I am about average in some things, above average in others. The best way to say that is my reading skills on one of my ... end-of-term reports ... were above the charts, I was one of the best readers in my school. But my spelling and grammar [result] was one of the worst. So just because I'm good at one thing doesn't mean I'm brilliant and if I'm bad at one thing doesn't mean I'm dumb. (Interview)

The question of self-worth ('Am I smart, or am I dumb?') demonstrates, for Nadia, the difficulty of resolving Lincoln and Guba's methodological and axiological questions: 'How does one go about acquiring knowledge?' and, 'Of all the knowledge available to me, which is the most valuable...?' (2013, p. 37). As she debated with herself, Nadia reached a hesitant conclusion: 'but, then again, I'm not dumb', based on external representations of academic worth, in place of internal self-references and identity.

## **7.8 Conclusion**

Nadia has had an exemplary background of support and intervention since her diagnosis of AS, aged twelve. She is well-schooled in social skills, emotion management and compensatory learning strategies. Her verbal skills are a great asset and she has worked hard to achieve competence in social interactions through explicit coaching, such as being taught that a conversation between two people is like a game of ping-pong (table tennis), with the 'ball' being passed back and forth. Nadia relies on metaphors as an aid to her own understanding and the articulation of self-generated metaphors as external representations of mental ideas is common throughout Nadia's speech.

In her interview, Nadia gave the impression of youthful energy and hopefulness, coupled with a realistic view of her capacities. She has a determination to proactively address issues that arise. This is summarised in the opening statement of Lydia's interview, which was conducted immediately after Nadia's.

Res [speaking to Lydia about Nadia]: She shows a great energy. She called [AS] the 'bump in the road' and it was just a matter of finding a way around that particular bump and that shows a great energy in her spirit to accommodate the problem and she doesn't come across as being burdened. (Interview)

As Nadia has had so much successful intervention and helpful support, it raises the question of the impact this has had on her cognitive development during her adolescent years; that is, the extent to which Nadia is experiencing an altered developmental trajectory based on the expert, prolonged intervention and support she has received since diagnosis. There appears little doubt that Nadia is set up for a more fulfilled and self-aware adulthood than those experienced by Kahla, Rhoda and Colin.



## Chapter 8 Case 5 ‘Riley’

Case 5’s primary participant is ‘Riley’, a male in his 60s, who is married to ‘Renae’, the key informant. They have three adult children and a number of grandchildren. The relationships within the family are strong: between husband and wife; themselves and their children; and, themselves and their grandchildren. This family is distinctive among the cases for the longevity of the primary relationship: couples in the other cases had experienced the breakdown of life partnerships before settling into their current long-term relationship. At the time of the interviews in 2012, Riley was nearing the end of his career as a distinguished veterinary scientist specialising in particular diseases of certain animal species. He has an extensive list of publications in peer-reviewed research journals and has co-written a hefty reference book in a highly specialised knowledge domain. Riley does not have a formal diagnosis of AS, however, Renae is a special needs teacher, experienced in teaching children with AS and learning disorders. Through Renae’s professional experience, and from extended experience with their own children and grandchildren’s diagnosed conditions, they reached the conclusion in recent times that AS is the ‘bottom line’ condition in Riley’s case. As Riley’s professional career was drawing to a close, they felt there was then nothing to be gained by seeking a formal diagnosis. Both are extremely well-read and informed on many issues to do with disability and AS. Riley was formally diagnosed with dyslexia as a school student and recognises that he has a learning disorder. He is also colourblind in the pink region but has enhanced green perception. He suffers from chronic pain stemming from severe injury in early childhood in a serious car accident.

Renae is justifiably proud of Riley’s achievements but is also a knowledgeable realist. Her understanding and support appears to have contributed enormously to Riley’s capacity to participate socially and professionally, and to have the strong family life they have built together. Their story might be a rarity as individuals with AS with successful long-term life partnerships and strong relationships are not well-represented within the research literature, nor is there much known about factors contributing to such success where so many fail. Renae and Riley’s narrative is inspirational: this is not to minimise the challenges and difficulties they face but is a testament to their determination and resourcefulness in meeting and navigating the obstacles attributable to AS. Renae spoke of Riley’s achievements with admiration.

Renae: ...for me, I see a man with incredible courage to just keep going, you know, six years, or five years of university, I don't know how he did it. I watched him with his Masters and his Fellowship and Membership and PhD ... (Interview)

Courage was required because of the mountainous obstacles of language and social cognition. Given Riley's achievements, his cognitive profile and learning are of great interest to this study.

The key participant interview was conducted at the participants' home, followed two months later by the primary participant interview, which was conducted at the researcher's home. The delay was due to ill-health, family and housing issues. After Riley's interview, he sent an email to the researcher with further information that he wished to be included in the data. Riley and Renae requested a copy of the interview transcripts so their interviews were transcribed as a priority. They also requested another meeting and this was arranged in order to deliver the transcripts. It took place at the participants' home and, at the same time, there was an impromptu consultation, which, being unanticipated, was not recorded: the content consisted of queries about diagnosis and behaviours but did not contribute new data.

Riley and Renae have a grandson with a diagnosis of ADHD and sensory sensitivities. Gastrointestinal problems are experienced by a number of family members. Their then-infant son, now a successful aero engineer working in the United States, had severe proprioceptive problems in infancy that responded well to targeted interventions throughout childhood and adolescence. Riley recognised that he had the same problems as those being addressed in his son but chronic pain prevented him from undertaking similar interventions. Renae now recognises traces of the broader phenotype in their own family and in Riley's biological family. Renae stated that Riley's parents were distant and he spent a lot of time alone growing up. His siblings were older and not closely involved with him apart from his middle sister's 'emotional abuse'. Although no-one in the family has been formally diagnosed with AS, there are patterns of giftedness, high achievement and related conditions such as dyslexia, proprioceptive problems and ADHD. Riley and Renae's assertion that he has AS was accepted and many characteristics were evident throughout the data collection process without contradictory evidence being detected.

## 8.1 *School experience*

Riley was able to recount many memories of school experience, although he does not claim to remember **every** autobiographical experience in the way claimed by Kahla. He struggled at school with handwriting legibility and language tasks but excelled in tasks using numbers. He has extraordinary mental calculation ability and Renae testified that she has no need of an electronic calculator in the house as she can read out a list of amounts and Riley can tell her the total. Riley experienced bullying at school and at home. He recalls being tested in primary school for selection for a school for gifted learners but was told by his mother that he had ‘failed’.

R: In Year 4 at primary school, two of us were sent to a test centre: I presume this was the result of some sort of IQ test I can vaguely remember doing ... I remember the interview with the headmaster about some of it afterwards, even to words and phrases used: I insisted on [saying] ‘Is-land’ ... Later I was told by mum that I had failed because my writing was so bad: if I had passed it would have let me into an accelerated learning stream in a school for the gifted. Since then, we have uncovered numerous instances in the family of white lies to cover not being allowed to go off and do other things a little different, so I suspect I may have got in but they would not allow me to participate. (Email)

Feedback that Riley received at secondary school confirmed his giftedness.

R: I remember an interview with the careers teacher at school in Year 11 ... and he was reading my report card ... all I remember was that he read ‘mathematics – says “extraordinarily gifted”’, and he then looked at my report card just after I had come first in the latest set of tests for Maths 1 and Maths 2, and he let out an exclamation. (Email)

Riley received a scholarship that allowed him to attend a selective secondary agricultural school. Although he was not formally accelerated, he matriculated to university at the youngish age of seventeen and received a scholarship that allowed him to attend.

## 8.2 *Handedness*

The issue of handedness was raised independently by both Renae and Riley. Renae believes Riley is left-handed but Riley spoke of himself as right-handed or ambidextrous, which is an advantage in his profession as intricate surgical procedures, such as tying sutures on tiny animals, have to be performed with either hand, independently of the other. As the incidence of left-handedness was so prominent in the cases of this doctoral research, a brief literature review was conducted that confirmed

the higher incidence of left-handedness and lateralisation problems in autism and AS (Gillberg, 1983; Hauck & Dewey, 2001; Markoulakis, Scharoun, Bryden & Fletcher, 2012). Speaking of interventions for proprioceptive problems for their son when he was an infant, Renae said:

Renae: The diagnosis provided for [our son] was that he's left-handed, and by the way, I think Riley should have been left-handed but wasn't permitted to be, because he does a lot of things with his left hand. But with [our son], what the [therapist] did was gave him exercises to do extremely slowly that allowed the infant reflexes to move out and the adult ones to come in. (Interview)

Renae stated that their son reported significant improvements in dyslexia symptoms following proprioceptive interventions throughout childhood and adolescence. Once this option became known to them, Riley was unable to participate in similar interventions because of a back injury accompanied by chronic pain, so this avenue of potential assistance was not available to him.

Riley's ambiguous hand-preference is an advantage in surgical procedures.

R: Well, I was probably a left-hander when I started but I can remember being hit over the knuckles with a ruler. I still do quite a lot of things left-handed but partly that's as, learning surgery, if you're right-handed you had to learn to do things left-handed, so we had to shave left-handed, had to tie knots left-handed. We used to practise that on the train on the way in. We had pieces of string and [practised tying] a knot single-handed left-handed, so you could do everything. (Interview)

However, Renae indicated that Riley has motor coordination issues that are a concern.

Renae: [Riley] has the tension, he should have been a left-hander [but he's] had to be a right-hander. ... So that opened up this can of worms, I think. ... he'd been forced to be right-handed and I think he's actually a left-hander ... So he has a lot of those sort of motor issues. (Interview)

Riley considers himself to be a right-handed person who sometimes does tasks with his left hand but Renae views him as having motor problems that are compounded by his being forced into right-handedness.

### **8.3      *A sense of difference, alienation and isolation***

Riley's narrative builds on the theme of alienation in the previous cases. Being told by significant people in his life that his perception is wrong has caused him to question his own experience and, along with Colin, his sanity.

R: I'm also colourblind ... I remember [my] mother-in-law say[ing], 'But what **colour** do you see in that?' And I said, 'But that's the colour I see'. That's it. That's what all my life I've called pink, or red, or whatever. People who are colourblind have a different profile of colours and they can see some patterns easier than others, and being told, 'No, that is **not** what you should be seeing.' This **is** what I see.

Res: When the world tells you, 'That's not what you should be seeing', what's going on inside your head and your heart at that point?

R: Am I crazy? (Very quiet voice) ... What is wrong with me? Why am I stuck with this? It's not an antagonism or rebellion [against other people], it's very inward focused. What's wrong with **me**? (Interview)

Invalidation of one's own experience by other people is a source of the philosophical problems already noted. The conflict between Riley's experience and what other people tell him he should be experiencing causes him to question his experienced reality, his relationship with knowledge, and the value of his experience and knowledge. In Riley's approach to learning and knowledge, he is methodical and evidence-based to extremes, regardless of the subject or context. Renae related, for instance, that, when his daughter asked him if he knew about a certain topic she was about to teach as a school music teacher, he responded by working through the night to compile an extensively detailed catalogue of information and resources, even though she was casually asking for a brief amount of information. This is Riley's usual approach: indeed, a number of excellent resources and the offer of more were supplied to the researcher following the interview. This is perhaps a perseverative over-response to the philosophical problems (Section 8.13), reinforced by many instances of invalidation of his perception and experience throughout his life, which contribute to his sense of difference.

#### **8.4      *Giving and receiving social cues***

Renae and Riley's relationship includes the giving and receiving of social cues. Renae seems to have an unlimited capacity to support Riley in this way and Riley is grateful for these cues. In her interview, Renae's description of Riley's perseverative monologues on factual topics indicates how the giving of social cues operates between them.

Renae: You usually get quite a detailed [monologue], which socially can be quite impacting because people don't necessarily want to know everything about Sibelius or the common flu or whatever it is that they've asked him about. ... I've had to say, 'Okay darling, maybe next time you don't need to give **that** much detail because people just

want a little bit of information.’ [Riley:] ‘Oh really? They’re not interested in the whole lot?’ [Renae:] ‘No. They just want a **little** bit.’ (Interview)

Following a social outing, Riley and Renae may review the event in order to clarify social meaning and behaviours, including Renae indicating appropriate social event scripts for Riley to consider using in the future. This process appears to occur without any sense of control or power difference between them; rather, it is the giving and receiving of information with the purpose of supporting the other’s well-being and it is an opportunity for Renae to act as a ‘sounding board’ for Riley to make sense of social interactions for himself. Such conversations between them appear to act as a natural learning opportunity.

## 8.5 *Non-verbal language and social insight*

Riley is aware of his lack of social insight and self-consciously works to interpret non-verbal cues. He finds the use of telephones difficult for this reason and avoids them if possible.

R: Phone conversations – these scare the willies out of me; talking to people face to face is bad enough, but over a phone ... all the non-verbal cues are gone. These confuse me at the best of times, but in this situation they are not even there. The hardest thing I have to deal with. I will avoid even simple [phone calls], or at least procrastinate a lot. (Email)

Social conventions that accompany such social interactions are problematic for him.

R: ... like talking to people on telephones. When I’ve finished talking to my wife and kids, I hang up. I don’t say goodbye or anything, I just stop. And conversations, ... I don’t know, I can’t read into them. I miss cues that people give. I find it really difficult to read between the lines. (Interview)

Poor reading of non-verbal cues, along with reduced theory of mind capacity, has resulted in Riley not being able to complete pastoral care training in his church.

R: I did a pastoral training course which I failed because I could not read people. They would present their stories and [we would] share with them and I would just go totally blank. ... I found it **extremely** difficult because you had to think about what other people were saying and empathise with them and help them to develop what they were saying and come through to a solution and all that sort of thing and I just couldn’t get it. (Interview)

Riley demonstrated awareness of his lack of insight, as did Nadia (Case 4). It is suggested that this could be the result of respectful, thoughtful feedback given to him by

his wife, which has resulted in him possessing greater compensatory awareness than was demonstrated by Rhoda (Case 2) and Colin (Case 3). Nadia appears to have acquired this awareness through feedback from her mother and coaching by psychologists. Nadia's and Riley's awareness contrasts with Rhoda's and Colin's, whose accounts had undertones of puzzlement or bewilderment about many aspects of social cognition, whereas Kahla's account (Case 1) had a measure of this kind of social awareness but she seems to have developed it largely through hostile social encounters and the support of psychologists rather than a close family member. The difference between the compensatory awareness of the individuals appears to support the value of a trusted mentor, friend or family member as a key strategy for life-long, compensatory learning of social skills.

## **8.6 Social conversations and thinking**

From many references throughout the data, the researcher gained a sense of the mountainous obstacle that language represents for Riley. He explained that his difficulty with social communication and interaction is a result of his way of processing language and ideas from conversation. He has to 'correct' the form of other people's language **and** the content of their speech before he can understand the words that are said and process them for meaning. This makes participation in conversations frustrating and inefficient. Speaking of a professional conversation with colleagues in a social setting, Riley explained this process.

R: I'm reconstructing their English as well, and critiqu[ing] the construction of their sentences and everything as well as the information.

Res: Right. So once you've heard what they have to say, ... you've reconstructed or translated it into something that makes sense, proper sense to you

R: and corrected

Res: yes, and then you're responding to your construction and translation. ...

R: and then the conversation moves off. (Interview)

In the time taken for the 'correction' process and for Riley to construct a response, the conversation topic has evolved, making it difficult for him to contribute. In addition to 'correcting' the form of the language, he also has to 'correct' the information supplied by other people before he can process it.

R: When I was undertaking counselling by a pain psychologist, he had asked me to document my pain with maps: this I did in great detail; their maps were not correct (i.e. not fully inclusive, anatomically incomplete, etc.) so I made my own. He then stated very firmly that I was fixated on my pain. But he had told me to track it this way. I just got totally confused and bamboozled. What was I supposed to be doing? (Email)

This detail-focused way of processing language and meaning was interpreted by the psychologist as a ‘fixation’, whereas, for Riley, it is a process needed for him to be certain of meaning. The response of the psychologist became yet another invalidating experience that added to his sense of alienation.

## **8.7 Translation**

Riley agreed that the process that he described as ‘correcting’ was equivalent to a process of ‘translation’. In conversation, words and meaning are translated into a visual representation, described by Riley using terms such as ‘blocks’ or ‘skyscrapers’, which are then mentally manipulated visually. Whatever this process is, it is how Riley describes his native mode of thinking. Translating back into words is always difficult, sometimes impossible, and, during the interview, he frequently resorted to noises made with his tongue (transcribed as ‘splat’) and hand gestures in place of words, which were noted in the transcript where possible. There is a time lag while this three-step process of translation to and from visual representation takes place (see Figure 8.1). The time lag, itself, then further disrupts his participation in conversations because the flow of a conversation has moved along in the time taken to translate, and the opportunity to respond to an idea is lost.

The idea of ‘constructing skyscrapers’ was explored further in Riley’s interview because he referred to it a number of times and it appeared to represent his thinking process, which is visual, not verbal. The process he described also illuminates the lack of fluency in his speech throughout the interview. Renae explained that Riley’s process of learning new information requires him to undertake a lot of in-depth reading and thought before he can talk about the new ideas, so the process of articulating ideas is challenging, even without the time pressure of conversation. The previous utterance about Riley’s experience with the pain psychologist demonstrates that he also ‘corrects’ written material, so the translation process is not exclusive to speech or social situations. Learning about a new topic requires time to process and construct ‘skyscrapers’ to

represent and remember those ideas before Riley is able to articulate to others what he has been thinking about. The translation process he described is very tiring.

R: ... I can be in a conversation with people and not actually say anything but will be totally exhausted just from trying to keep up with the conversation. (Interview)

It is also very disruptive to his participation.

R: ... everyone assumes that I haven't had anything to contribute but by the time I've constructed my 'skyscraper', which is what I call it, the conversation's moved on, and it crumbles. (Interview)

Riley clarified that by 'skyscrapers' he meant the ideas and relationships that make up his thoughts.

R: [My colleagues] say something and so I work out what they're trying to say, because what they're trying to say is actually not what they're saying, or [not] in my head [anyway], and so I try to respond that that's what they're saying, therefore that needs this sort of response, that's how I should say that. And then a third person interjects and [I've\*] got to try and answer that one as well so [I\*] build another skyscraper here (indicates a space in the air). How [am I\*] going to respond to that one? And then they respond back and it's different, they've changed tack so [I've\*] got to start dismantling this [skyscraper] and suddenly [my\*] head is full of all these different responses and pseudo-responses, what I should have said ten conversations ago. And it just gets bigger and bigger. It explodes. (Interview – \*Inconsistent pronoun use has been corrected)

Translating words into 'skyscrapers', Riley's term for his visual thinking process, and then back into words requires a timeframe not conducive to participation in conversation, particularly in groups. Even in non-social situations, it can be seen from his description of 'constructing skyscrapers' that Riley's thinking process is more time-consuming when he needs to articulate his thoughts than for verbal thinkers. The process is, for him, exhausting. Although at the time of the interview this was not explored, presumably Riley's thinking is efficient and less effortful if he is not translating to and from words.

Riley's articulation of this process in these terms, with the accompanying cognitive burden, suggests that learners with AS who are non-verbal thinkers should be considered in the same light as second language speakers, as proposed by Wendy, the key informant for Case 3. Accommodations for teaching, learning and assessment should factor in the extra time required for these learners to demonstrate their learning authentically and accurately as they are clearly disadvantaged by timed assessments that

have been designed for individuals who do not have to undertake mental translation of some kind.

## 8.8 *Reading*

Riley is an avid reader and was said by Renae to ‘devour books’. However, the act of reading is significantly disrupted by dyslexia. Riley’s preferred reading material is non-fiction, with his favourite topic being animals. The exception is fictional representations that allow him to pursue his study of ‘how people tick’ (Riley: Interview). He reads novels to study human behaviour, with a similar intent to his study of animals, through the fictional novels of Jane Austen, or by watching movies of the novels. Jane Austen’s novels and movies, and others that are similar, appear to serve an important function for Riley. These novels make the thinking and morals of the characters explicit and align their thinking and morals with their behaviour. *The Count of Monte Christo* (Dumas & Coward, 2008) was cited as another favourite novel where there is ample opportunity to witness the development of the human characters within the story set over a long time period and to study the behaviour and interactions of the characters.

## 8.9 *Dyslexia*

Dyslexia causes severe disruption to Riley’s reading and stands in contrast to his expert capacity with mathematics, including his savant-like calculation ability. Riley described his experience of dyslexia in terms of the words and letters moving on the page, in a spiral, always in the same direction, which makes it difficult to differentiate the letters and words.

R: Occasionally [the words] flap all around the wrong way. ... [When] I’m reading, if I’m more stressed it’s always more of a problem and ... the whole of the page will jumble, literally in front of my eyes. ... and if I’m trying to read out loud ... [the words] move. They’re moving ... which makes it really complicated cause nothing’s still ... and [I\*] read a paragraph and think, ‘I haven’t got a clue what that said, because the words [are] all jumbled up, they don’t make any sense’. ...

Res: Just for the tape, you’re moving your hands around in a semi-

R: It’s spiralling in ... It’s always (gestures) ... clockwise. (Interview – \*Inconsistent pronoun use has been corrected)

Riley’s processing difficulty does not apply to numbers, which suggests that his visual thinking process encompasses numeric-symbolic thinking but not language. For

mathematical calculations, no translation process is required so his verbal response is very quick when he acts as a ‘human calculator’ for Renae’s shopping and finances. Unlike Colin, who was unable to describe his method for calculation, Riley is able to articulate his mathematical methods and processes. Renae attributes this capacity to his ability to work with patterns.

### **8.10      *Learning***

When writing about affordances and obstacles to learning, Riley stated that his physical location in the classroom or lecture hall may have been a significant factor in his ability to learn.

R: I can remember where I sat in various class rooms at school, primary and secondary, and also various lectures at uni. I had not seen a connection, but the classes at high school I did not do well at (i.e. just failed in mid year, just passed at end of year) were all with me in what I would now consider a ‘bad’ place: middle of back left quarter for Year [8], failed English and French; and for Year [9] mid right half, failed history ... had not connected these before. Maths in Year [11], I was in top 5, I was front right second table in on row of 6. (Email)

This supposition by Riley evokes the suspicion that he has a limited perceptual field: the optimal visual and auditory field for him was obtained by sitting at the right side of the room, towards the front. This appears to be an additional factor to the sensory sensitivities that also disrupted his learning.

Riley explained that an essential part of his learning process is to manage information through extensive note-taking. In his note-taking, he goes through the same ‘correction’ process as for spoken language. He does not transcribe verbatim because, from his perspective, the language needs to be corrected. Rather than the usual process of paraphrasing that is common to note-taking tasks, it seems that Riley requires **every** statement by a speaker, whether they are a lecturer, preacher or colleague, to assume a ‘correct’ form. As he is listening, his attention is on the ‘incorrect’ parts of the utterance and his focus is on correcting these with the corrected version being transcribed into notes for his memorisation. This is a detailed-processing approach to managing knowledge. The mental construction of ideas and development of conceptual understanding appears to take place at a later time, based on his notes, rather than in real time.

With the quantity of notes required to document the extensive reading that Riley conducts and the lectures or sermons he attends, memorisation is based on mental activities he described using the terms ‘indexing’, ‘categorising’, and ‘filing’.

R: So if I wanted to learn something now, I would probably get a book on it or start to read on it but it wouldn’t be one item, I go for collections. So I will read ten books and will try and understand it in a fair degree of depth. In the past, I kept a lot of card indexes with summaries. I would make notes. I would try and tie bits together. I ... search out books, pamphlets, ideas, discussions that are opposites so that there is a balance rather than just one side of something. And I would certainly catalogue it in my head. (Interview)

Riley’s mental catalogue is paralleled by his development of extensive physical filing systems at work. He employed his concrete filing system as a metaphor for his thinking and memory processes (Section 8.12.1): this highlighted a feature of Riley’s memory processes described in Boucher’s case study as ‘state dependency’ (Boucher, 2007, p. 256) (Section 8.12.4), which is an expression of an externally oriented thinking style that is an important feature of his learning.

While he was at school, Riley reports that he ‘would go to the library and read an encyclopaedia’ (Interview) but that he could also, as long as the classroom conditions were suitable, learn from teacher-directed classroom lessons (unlike Colin). He recounted his profile of success and failure across subject areas and over time.

R: When [the teachers] actually gave the work, mathematics was dead easy, maths, chemistry and physics and biology, you know anything like that, fine. History I found difficult. French I failed, because it’s words ... But I did advanced maths at one stage in school and I quit because the concept ... *i* the square root of -1, it allows you to solve the equations but it’s wrong, it’s nonsense because you can’t have a square root of -1. It will allow you to do the maths and that’s nice and I can do the maths but I have this philosophical conflict, the square root of minus one is actually nonsense so therefore everything else that derives from it, even though you can solve, is nonsense. That was the ... thing that really struck me. I was what, 16 at the time, 15. You can do it but it doesn’t make sense. Anyway, so I had a struggle with that. I never did very well at school; never did very well at university. I struggled all the way through. I could learn the work by very, very hard [work], by concentrated learning, by lots of notes, by lots of reiterating, by summarising things, I’ve still got the books where I summarised everything, and just rehashing it. But it was very hard all the way and if a subject didn’t actually make sense or didn’t hold together well by the presenters, I struggled with it all the way through. (Interview)

The need for knowledge to be ‘correct’, in his own terms, is apparent within this monologue and certain ‘philosophical conflicts’ presented an obstacle to Riley’s

participation in some forms of learning at school. The corrected knowledge appears to be a requirement in order for ideas to become amenable to his thinking processes and meaning-making, even where those ideas are theoretical mathematical notions. Those things that are not amenable to such processes are apparently excluded or avoided.

Riley's detailed approach to knowledge management has resulted in a thorough grasp of the research literature that is the basis for his professional practice. He contrasted his own comprehensive, perseverative, approach to learning with the apparently piecemeal approach employed by the young trainees he supervises.

R: ... [the young trainees are] smart, there's no question. They're smart and sharp as a tack. Whether they're any good or not is another matter. ... I spend a lot of time just trying to explain to our trainees the basics, the pathogenesis, what's actually happening at the base level. ... People reading it in a book, read the process and they know the end result or a couple of snippets along the way but they don't understand the whole process. (Interview)

Implicit in Riley's account is a lack of awareness of the value of learning processes other than his own detail-processing approach. He has a self-consciously systematic approach to learning: wide reading; comprehensive note-taking; and, an indexing and filing system, upon which he is heavily reliant. These essential learning aids constitute an externalised process to facilitate memory recall and, most likely, stand in place of mentalised abstract representations of knowledge.

## **8.11 Cognitive profile: Processing style**

Riley's processing style is documented under a number of separate headings covering sensory issues, attention, perseveration, perfectionism, his three-step thinking process, visual processing style, inner speech and mental rehearsal.

### **8.11.1 Enhanced perceptual functioning and sensory sensitivities**

Riley documented his difficulties with sound levels and gating auditory input when he is in a room where concurrent conversations are taking place. His descriptions of the impact caused by this difficulty are similar to those described by Colin and Rhoda.

R: If the room [is] very noisy, I am listening to this conversation, and others in immediate proximity, and even further afield, and the music ... can readily become a cacophony of sound and [I] cannot delineate any of it, let alone follow. (Email)

In his interview, Riley noted that if he is in a social setting and is overwhelmed, he will cover his head with his coat to dampen the sound.

R: ... what I want to do is just curl up in a ball and put a blanket over my head. I have done that in prayer meetings occasionally. We go to a pentecostal church. This [church] is fairly quiet but I've been in some very expressive and noisy prayer meetings and I just literally pull my coat over my head and (grunts), 'Shut up.' (Interview)

Colourblindness was an issue raised by both Riley and Renae that did not arise in the other four cases. The problem with colour extends to choosing clothes to wear each day so Renae has arranged matching sets of clothes that Riley does not vary.

Renae: He's also colourblind. ... I've said, 'Right, those trousers go with **that** shirt'. ... I can't get patterns that are too busy because they stress his mind. So checks that are reasonably big are fine. Stripes are fine but I have to be careful which colours they are because he's colourblind, red shades and green shades, so it's not a red-green, it's a shaded thing. So if I tell him that **that** pair of trousers goes with **that** shirt, they'll always go together even if I've got another pair of trousers and I can say to him, 'They'll go with that as well'. ... So you've got the added issue of not quite seeing the changes in colour which is great for work, for reading slides because he can actually see things that other people can't see. (Interview)

As in Kahla's and Colin's cases, it can be seen that enhanced perceptual functioning confers both advantages and disadvantages, depending on context. Riley's enhanced perception for shades of green, for patterns and for tiny changes in cells give him a perceptual advantage in the diagnosis of diseases but make it difficult for him to choose matching clothes. Renae is aware of Riley's visual sensitivities, demonstrated by her statement: 'I can't get patterns that are too busy because they stress his mind' (Interview).

Riley, an amateur musician, has a strong preference for instrumental music instead of music with lyrics as the words interfere with his cognitive processing, particularly if they are 'free-form version so the words don't rhyme or anything ...' (Interview). Instrumental music of particular genres is soothing and is used as a background while he is working or reading but the added component of language is sensually aggravating for him.

### **8.11.2 Attention and language processing**

From Riley's case, interpreted in the light of the literature, the relationship between language processing and poor executive control of attention can be seen, resulting in an

increased load on working memory. The implications of this insight are profound for classroom environments, where so much of the delivery of teaching and learning activities relies on the capacity of the student to attend to, and process, verbal information. Like Rhoda, Riley has a problem with selective attention and executive control of attention (Section 5.4.2), including controlling the track his thoughts are taking and resuming a thread after a distraction.

Rena: Often he loses where he's up to [in his work] and he'll have to re-track, even though it might be marked, he has lost the string [thread] ... in his head. (Interview)

In his language during the interview, he displayed associative thinking, in Temple Grandin's terms, to some extent but was able to keep himself on-track as he had prepared what he wanted to say and mentally rehearsed for the interview as if for a lecture he would deliver. Riley directly indicated his attentional difficulties in the following statement.

Res: I was just about to ask you about the noise [of a party] and noise-filtering.

R: It doesn't filter. ... selective attention, can't do it. Or if I can, it's so short and so exhausting. (Interview)

Closing his eyes is a strategy he consciously uses to help him focus on his thoughts.

R: I often shut my eyes, which I have been doing quite a lot in this discussion, in order to focus [on 'thoughts and concepts']. ... with conversations and other things, if there's loud music, it can be extremely 'ehh!' (sighs audibly) or in a room full of other conversations, I am trying to listen to the music and I am trying to listen to the other conversations and I'm trying to listen to the conversation I'm involved in. So suddenly I can be talking to you but someone's got a conversation going on here so I start constructing skyscrapers again relevant to that lot (gestures), I'm listening to the music and thinking, 'Well, that's nice. What's the pattern there?' (Interview)

The problem of poor executive control of attention has a profound affect on Riley's language processing and consequently on social interaction. This has also been reported in the literature: 'One of the most commonly reported auditory problems in individuals with autism is an inability to understand speech when background sounds are present' (Plaisted, *et al.*, 2003, p. 380). Iarocci, *et al.*, (2010) elaborated on this issue.

Plaisted and colleagues found that individuals with ASD have difficulty understanding speech embedded in background noise, due to a wide auditory filter that creates a greater susceptibility to interfering sounds during speech processing (Plaisted *et al.*, 2003). Thus a subgroup of persons with autism may have difficulty with both the auditory processing

of speech signals as well as the visual lip reading of speech in background noise. Alternatively, difficulties dividing attention between speech and non-speech noise may be integral to our understanding of communicative development in persons with ASD (Kenworthy et al., 2009). (Iarocci, *et al.*, 2010, p. 316)

Maintaining a single focus, requiring the filtering out of other sensory information, particularly background speech, is problematic for Riley and this can be understood as having an impact on working memory: the reduced ability to selectively attend when there are multiple inputs undermines information-processing efficiency. The load is further increased by the need to integrate non-verbal information, difficult for Riley in conversation with a single speaker such as the researcher but overwhelming in situations where there is background noise.

In summary, Riley has a problem attending to salient information in social settings and rigorously rehearses for expected social encounters, such as the research interview. He expends increased mental effort in order to participate in a conversation, even with a single speaker. Against a background of other speech, the task of interpreting and responding within a conversation can be overwhelming. The mental and physical exhaustion that results from social interaction was a major theme of Riley's account and is attributable to perceptual processing, attentional issues and language processing. Teachers of students with similar issues should be mindful of the increased effort required in order to process verbally delivered input, particularly against **any** background noise. A quiet classroom is, therefore, a pre-requisite for mental engagement for such students. Clear, slow speech and economy of words are likely to be more effective as a means of instruction for individuals with a cognitive profile similar to Riley's, rather than rapid, rich language.

### **8.11.3 Perseveration**

In Riley's case, there are some indications that perseveration applies to his thinking as well as behaviour and speech. Whereas perseveration is most often discussed within the research literature in relationship to behaviour (Frith, U., 2004) and speech (Perkins, *et al.*, 2006), thinking is also implicated: this suggestion is embedded in reports such as that by Landa and Goldberg (2005). The notion of perseverative patterns of thinking is supported by a recent research study that investigated the relationship between autobiographical memory in ASD, depression and ruminative thinking (Crane, Goddard

& Pring, 2013). Ruminative thinking is a real problem for Riley and contributes to his mental effort and exhaustion.

Res: Can I ask you about concepts? Renae said that you say that a concept will often go round and round in your head and it's like it's on a continuous loop. Does that mean anything to you? ... that's her interpretation. ...

R: Well, [the idea is] probably correct, so I'll just keep on wearing it out. I can't get off off off the loop. ... I can't stop it. The only way to stop it is to shut up. ... Otherwise it just keeps going around and around and around, I say the same thing four times. ... Then I can re-gather my thoughts and concepts and I often shut my eyes, which I have been doing quite a lot in this discussion, in order to focus. (Interview)

It may, therefore, be helpful in educational settings to consider perseverance not just in behavioural terms but also in cognitive terms. Students will require clear cues and assistance in moving their thoughts from one idea to another during the course of a day of instruction, particularly if there are no obvious external cues such as moving from room to room. Indeed, the need for preparation and clear cues is well understood in the classroom strategies employed by many teachers of students with AS, as evidenced by the plethora of commercially available visual aids for this purpose.

#### **8.11.4 Perfectionism**

Perfectionism is a trait commonly associated with AS (Cash, 1999; Konza, 2005) and, along with behaviour patterns such as hoarding, can be conceptualised in terms of perseverance.

R: I tend to create extensive collections of things and I just added to my parasite collection today (laughs) cause that's what I do. I ... often find that is an obsessive thing and it just creeps in and I don't realise it's happening until it is well down the track and it's 'Okay, I've got to stop', otherwise I'll just keep adding more. They're all interesting, and all different variations on the theme but I'll just keep adding. ... [I tell myself that I've] got to stop because this is crazy, it's got a life of its own and it will drive me. (Interview)

As Riley described it, his 'obsessive' collecting habits revolve around a need for completeness in his areas of special interest. There seems to be a polarised belief (that is, 'either/or') underlying this behaviour that the collection, information or knowledge is not reliable unless it is 'complete'. The flaw in operating out of this belief is that most collections, whether they are of music CDs or knowledge about a topic, can never be complete, and therefore the notion of 'completion' is elusive. The black-and-white

belief in the notion of ‘completion’ does not allow for other possibilities and is possibly the ‘drive’ Riley referred to that gives the act of collecting a sense of urgency or compulsion. Such collections also may be acting as an external representation of knowledge or even identity. If this suggestion is accurate, it would assist understanding of the personal hurt that is caused if someone other than the individual themselves throws out, or even re-arranges, a collection, as depicted so poignantly in the movie *Mozart and the Whale* (Bass, 2001), when the main character’s girlfriend, Isabelle, tidies up his collections of newspapers and Donald’s furious response is, ‘You stole my life!’ This movie was submitted by Riley as an artefact for his case as it portrays aspects of his experience he found difficult to articulate, including the scenes depicting compulsive collecting.

Riley acknowledged that his perfectionism is a positive trait in his work, where he has collected information fastidiously, but a negative trait in other areas of his life, leading to task-avoidance.

R: Now some of those things come back to perfectionist streaks. If I have a new task to do and if I think I can master it, I will pursue it. If I know it is going to be difficult or if I think I will not be able to do it perfectly—I have it up on my wall that ‘perfection is the enemy of excellence’, so I know my weakness—... if I don’t think I can do it perfectly, I will not do it at all. And I will do anything to avoid it. (Interview)

Riley tries to challenge himself to attempt activities that he avoids. The example he gave was learning to fly a remote-control helicopter he was given as a gift. He described such challenges as ‘dragons in the basement’.

R: ... there are lots of things in my life that are like that: dragons in the basement.

Res: So your life is a constant series of self-challenges to overcome obstacles.

R: Repeatedly. Probably daily. ... it’s exhausting. I mean I’ve used that word on numerous occasions today ... but it actually is. There is no other way, other than running away from it and if I run away from it today it’s still going to be there tomorrow. If I challenge it today there’ll be different one tomorrow. There’s no letup. There is no letup. (Interview)

Perfectionism is another characteristic of Riley’s thinking that contributes to his sense of exhaustion.

### 8.11.5 Three-step thinking process

Information-processing load is evident in Riley's account. He is mentally working very hard despite having considerable intellectual capacity, as demonstrated by his career achievements, and yet the 'nuts and bolts' of daily functioning are, for him, infused with anxiety, effort and exhaustion. The burden on his working memory can be described as a compilation of: enhanced perception combined with inefficient filtering of sensory input; poor attentional control; language processing difficulties; and, the need to 'translate' between his native mode of thought, which is visual, and language. In order to explore this sense of exhaustion further, a detailed discussion of Riley's thinking processes ensued.

Res: [referring to participation in conversations and attending church meetings] Is it the 'barrage of sound' that is the problem or is it that you're having to work so hard? ... where you're talking about skyscrapers, are you having to translate from what other people say into the 'right' way of saying it and then respond to that? So you're going through a three-step process?

R: Oh yes. I'm reconstructing their English as well, and critique[ing] the construction of their sentences as well as the information. ...

Res: ... is that also happening to you when you're not actually in conversation but you're in a situation where you're thinking?

R: Oh, yeah. (Interview)

To participate in a conversation, or when reading a book, Riley described a three-step cognitive process: translation from language; conceptual thinking ('constructing skyscrapers'); and, translation back to language. This three-step process is illustrated in Figure 8.1.

Res: I'm interested in what I'm calling 'translation' [and] you're calling 'correcting' ... [an utterance has] passed your screening test so you go straight to constructing the skyscraper and the skyscraper is about the ideas?

R: Yes. That's my analogy of it ... the skyscraper is big and it's complex and it's all the other things and it takes time, and by the time it gets to the third floor it's 'Splat' (makes a noise and a gesture to indicate a big construction).

Res: So the skyscraper is a mental construction of ideas?

R: Mm, mm, and it will often give rise to other ones, and other bits will flow out from that which really have nothing to do with that.

Res: Is there a problem when you've got other bits flowing out of your skyscraper? How do you stick with the main idea? Do you bother sticking with the main idea or do you just let it go?

R: Sometimes it just disappears ... it gets left behind. I'm off on a tangent somewhere else and that becomes very embarrassing because ... I'll come out with this ('splat' noise) and no one knows the connections and they don't know that this is the fourth idea in a line that I've had. I know them all and I'll sort of blurt out something and they all look at me. ...

Res: Are you using extra mental resources then in order to do that screening process, when you decide **not** to respond out loud? So that's another layer of mental effort?

R: Mm, it's absolutely exhausting to say nothing. (Interview)

Both the 'barrage of sound', which is how Riley described sensory input in a room with other people, and the 'correcting' process load up working memory, which causes a delay in his responses in conversation and make it 'absolutely exhausting to say nothing'.

A significant feature of this account is that, discounting the 'translation' steps, Riley's thought takes place in a non-verbal way, apparently through visual processing. This is assumed to be his 'native' mode of thought. The necessity of dealing with other people via language requires a translation process from, and to, language. The presumption here is that, where Riley does not have to interact with other people, his thought processes would be much more streamlined and efficient within the 'native' visual processing mode. However, under the time pressure of social situations (for example, listening to a sermon or participating in a conversation with colleagues or friends), he is going through a three-step thinking process: 1) 'Correcting' or 'translating' the language used by others; 2) Constructing 'skyscrapers', his native mode of thinking and processing meaning; and, 3) Mentally translating his thoughts back into language so that he can give voice to his thoughts.

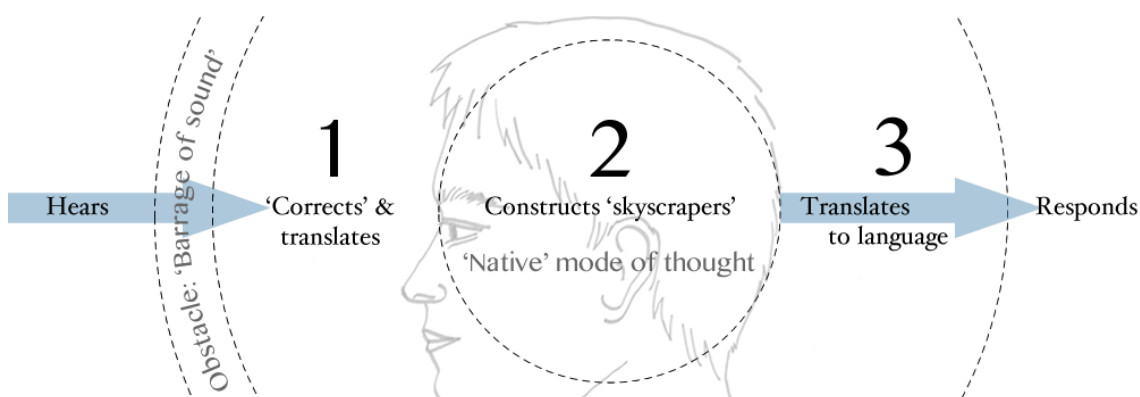


Figure 8.1 Language and thinking in Case 5

The mental demands of this process upon thinking and learning are considerable and supply an explanation for the delays and hesitations in Riley's speech in the interview. He agreed that he was working very hard mentally and needed extra time to respond compared to other people. This insight reinforces the proposition of this thesis that individuals with a similar cognitive profile to Riley are learners situated within a minority 'cognitive culture' and, if this is the case, then they should be given comparable considerations to second-language speakers: for example, with regard to time constraints (extra time or untimed assessments) and learning environment (reducing social cognition demands during learning by, for instance, assigning solo tasks instead of group work).

#### 8.11.6 Visual processing style

During the interview, sometimes there was a delay in responding to the researcher's question that Riley indicated was the time required for him to locate and play back the correct 'video' before recovering the memory. In an email sent as a follow-up to the interview, Riley described his 'field of view' for his autobiographical memories. Although he indicated that the 'video' is **not** replayed verbatim, he uses visual terms, with an observational stance, to describe memories for personal experience, rather than speaking in terms indicating mental time travel. The following email excerpt is reproduced as it was written, in truncated note form.

R: Video in my head or spirit is not re-play: it is re-worked to some degree. Mostly from left 07:30 looking forward over my head as quadrant at angle of 30° to ground plane; less frequently from right; rarely from above behind as sector at about 60° looking close in front. Recent interview visit with you is from right looking forward in quadrant to left from about 4:30, but you were at about 1:00, so just on the edge. And I cannot change it. These are never from front looking back on myself. Facial features of others not clear, although I know who they are. (Email)

The significance of the actual field of view, described with degrees and elevation, is beyond the capacity of this research to interpret but may be of interest to others with expertise in this area.

In describing notions involving relationships, such as his family, Riley spoke with many hesitations, appearing to hunt for the correct word and frequently resorted to gestures and noises made with his tongue in place of words.

Res: It looks like you're drawing a family tree in the air there with your hands, so that's how you think about it?

R: Yeah. And even my own [family], you know, Renae's there, and T— and the kids are all independent and they're all separate, they've got kids, they're all inter-related but they're separate. Yeah, I just thought that was normal. Anyway. Okay. (Laughs) Yes, this sort of, I, I, I don't like to do a lot of things with my hands but I end up doing it with my hands because I can then, as you said, the family tree, I can create it and then, 'Splat' (makes noise with tongue) and then suddenly I can visualise it. (Interview)

The task of describing conceptual relationships within the family required Riley to gesture as though forming a family tree in the air: he said this allowed him to visualise it as he struggled to articulate the relationships. Throughout the interview, which was nearly two hours long, he resorted many times to such gestures and tongue noises, which appeared to function as visual strategies in place of expressing those ideas in words.

An aspect of Riley's visual processing relates to his colourblindness. He described how his colourblindness, and that of his colleague, afforded them the capacity to see detail and patterns in stained cells on a microscope slide that others cannot detect. Together they published a major work of histopathology in which a slight change to the colour tints of the illustrations by an editor created a significant problem.

R: A friend and I published a colour atlas ... [of histopathology] ... we're both colourblind in the same areas and so we perceived things and saw things similarly and ... after the second galley proof from the printer, they put a scientific editor on it and he changed the tints to make them more acceptable to everyone else and we both went off and [were] cross about this. That's when we both discovered we're colourblind in the same area, because we see the colours and the hues and the changes differently. ... The pinks are the areas where we have difficulties, we can't distinguish so many pinks as other people ... but the strengths are around the greens. ... Well, they tend to put a lot of [unknown technical term] pink stain on everything, so everything's pink, and it's a fairly intense pink so that's fine, we can all see that ... but the other subtle changes happen [in the] greens. ... What I've noticed with the trainees that I have is they miss patterns. So

you look over the tissue and say, ‘See that, there’s a pattern here, there’s necrosis there and there’s changes here and some things over there. ... [I tell them] ‘You’ve just gone over a field and it’s actually got an inclusion body in it.’ [The trainees say] ‘What!? No. Where do you see that?’ And I [say], ‘Saw it as we went over it. We scooted over it,’ but I can see it.

Res: So by ‘patterns’, do you mean the texture of what they’re actually seeing on the slide?

R: Mmm, the texture, the colours, the arrangements of things at a minute level and I will see often will see bacteria or parasites or protozoa or something or inclusion bodies. Partly that’s experience ... but, even with colleagues that have equivalent experience, I’ll often pick things up much before they do. (Interview)

Riley’s enhanced visual functioning in perceiving miniscule patterns and irregularities in cells confers giftedness in the diagnosis of diseases in his field and aligns with the detail-focus processing of AS.

#### **8.11.7 Inner speech and mental rehearsal**

There appears to be very little internal verbal dialogue in Riley’s cognition. His descriptions of his thinking and memory processes revolved around visual thinking strategies instead of verbal. He explained that the visual construction of ideas has ‘snippets of dialogue’ within it but the majority of his own conceptual thinking was described as ‘blocks of concept’, which he also named ‘skyscrapers’. Interestingly, Kahla also used similar terms to describe aspects of her cognition: ‘block of memory’ (Section 4.7.2); ‘block of speech’ (Section 4.7.5); and, she spoke of retrieving a ‘block’ (Section 4.7.5). The mental rehearsal that Riley described consisted of rehearsing possible alternate behaviours and planning a script as a guide for him to follow in his speech. These are rote memory strategies and not necessarily evidence of inner speech as a mode of thought. The ‘snippets of dialogue’ are possibly further rote-remembered elements within his mental rehearsal.

Res: ... What I’m interested in is the idea of an internal dialogue in your mind ... say, rehearsing for today, did that involve a dialogue in your head? What were you actually doing in that rehearsal?

R: There are snippets of dialogue, yes. But largely ideas, concepts, block, blocks of (makes ‘splat’ noise) concepts.

Res: What is a ‘block of concept’?

R: Well it’s just a block of concept, well you know this is...

Res: You're seeing a block, idea of some kind in your head?

R: Yeah. Well, like the skyscraper thing ... so that was just sort of ('splat' noise), that's there, um, the conversations and the constructions, the rehearsals, that's there. ...

Res: So there's like a mental mind map in your head with...

R: Yes. Things that we want to address and talk about. (Interview)

Moving beyond Riley's explanations that involved gestures and noises, a 'mental mind map' of ideas was the closest agreed phrase to describe his natural way of thinking.

Even though he is a visual, possibly pattern thinker (in Temple Grandin's terms), Riley mentioned that he gave himself a 'talking to', by which he meant that he mentally delivered a lecture-like speech to himself with the purpose of exhorting himself to attempt a task he was avoiding. This might be construed as an internal dialogue representative of inner speech according to Vygotsky's original description (Vygotsky, 1962). The experimental and theoretical literature is divided on whether inner speech is diminished in individuals with autism and AS (Hurlburt, *et al.*, 1994; Whitehouse, Maybery & Durkin, 2006; Williams, D., 2010; Williams, D., Happé, *et al.*, 2008; Williams, D. M. & Jarrold, 2010). Williams, *et al.*, (2008) provide an interesting discussion on 'the verbal recoding of visual information' (p. 56). In contrast to previous studies, they found intact inner speech in autism and AS, however, their experimental conditions tested children only and a later analysis of the same data modified these findings to suggest a more complex relationship between the use of inner speech and autism (Williams, D. M. & Jarrold, 2010). Studies with adults over a wider range of conditions are needed. Distinguishing between what this doctoral study describes as the 'native mode of thought', which in Riley's case appears to be non-verbal, and the use of a 'talking to' as a self-talk script, are features of Case 5 that contribute to the debate. The 'talking-to' may be following a verbal script adopted, for instance, from his spouse and could represent an event script rather than true inner speech that indicates a verbal thought-processing style.

## **8.12 Cognitive profile: Memory**

Significant emergent themes of memory in Riley's case are presented here and, as with the other cases, should be considered against the backdrop of the memory and autism literature.

### 8.12.1 Semantic-style memory and temporality

Riley recounted that his memories are filed away in a ‘mental filing cabinet’. To retrieve a memory, even an autobiographical memory, he mentally runs a ‘video’ of himself opening the mental filing cabinet and pulling out the file containing the memory. Many memories are time-stamped.

R: When Renae and I went for counselling at one stage ... the counsellor said ... ‘You have a filing cabinet and everything in your life is filed away in a filing cabinet and you can open the drawer and pull it out and it’s the third one back and you can remember the event.’ ... Because, even just talking about that, ... I [can] see myself with a bank of filing cabinets pulling the things out and saying, ‘This happened on the 11th of January 1976,’ or whatever. Happened at 3 o’clock in the afternoon. Cause I can do that. ...

Res: So your memories are time-stamped?

R: Yeah. Morning, afternoon and evening: certainly within a couple of hours of when they happened. (Interview)

Salience, for Riley, is determined by the amount of detail attached to an event or piece of information: more associated factual detail results in greater likelihood that a memory will be available for retrieval from his mental filing cabinet. For autobiographical memories, Riley did not express any language indicating mental time travel or subjective temporal elements. The measured-time ‘time stamp’ that he ‘sees’ on the mental file as he retrieves a memory is rote-remembered, factual knowledge about the event or information and is therefore an act of noetic consciousness indicating semantic-memory recall.

### 8.12.2 Autobiographical memories

Autobiographical memories are replayed as videos in Riley’s mind with his ‘present-self’ as an observer. These memories exhibit a lack of emotional content, even for traumatic, remembered incidents. Other contextual elements of autobiographical memories are sometimes present, but in a limited way.

R: I can remember vividly some birthdays: 21 (me, mum and dad and a single cup cake), 40, 50, 60, (I only have pictures of the 60th, none from the others so remembrance not dependent upon those) ... I can remember lots of [childhood] playtimes by myself, making my own castles out of wood, even to the music that was playing at the time. However, [the] detail of grass under [my] feet whilst playing is rare, although walking through the bush alone, the trees and branches and tufts of grass and the water are real clear, and what I did or [what] happened to me. But almost no sound, no smell. And

usually alone. Very clear now even as I type. Mostly just the event itself. Little of the emotional stuff that accompanied whatever was going on. (Email)

Unlike the previously noted anecdotal reports arising from a presentation delivered to a group of adults with AS, indicating verbatim rather than episodic autobiographical memories, Riley does not claim to have comprehensive visual memories of his childhood autobiographical experiences. He had recently been shown some childhood family photographs by a sibling, of which he had no memory so he is factually aware of gaps in his autobiographical memories.

### **8.12.3 Rote memory**

Riley displays evidence of a powerful rote memory capacity. This is a feature of his professional life that has contributed to an excellent reputation in his field; a claim that is supported by an extensive academic publication list.

R: I gave a presentation to the [name] club in the UK which is probably the most prestigious in Europe. You have to give your presentation, by invitation, not allowed any notes, you just had to know it 'off pat' and then when you've finished, they bombard you with questions. So I gave my presentation and there were almost no questions, negligible, nothing of any substance afterwards because I'd been thorough, covered all the known options ... But the other thing was when I did my Fellowship exams, so that's four years of intense study, [I] did all the written ones and then the oral or the vivas that go with it ... when I'd finished and I got up and walked out, they had an observer there from the college, and before I'd shut the door he said, 'I've never seen a performance like that before, in any of the disciplines'. ... It still blows me away because I was doing what I was supposed to do. (Interview)

Powerful rote memory is a feature of cognition that is highly prized in many professions: for example, pilots, who must perform rigorous, extensive procedures under pressure; surgeons, who must remember procedures learnt from textbooks and observation, and adhere closely to detail in the replication of those procedures; and, actors and barristers, who need to reproduce long, complex, technically detailed speeches principally from memory. In the current school climate in Australia, rote-memory capacity is not highly valued except in fields such as music and drama performance, therefore, it behoves teachers, who are steeped in active learning pedagogy, to remember that students who do not respond well to active learning strategies at school may nonetheless enjoy future success in professions that value powerful rote-memory capacity.

#### 8.12.4 State-dependent memory

The ‘mental filing cabinet’ metaphor previously referred to is reflective of Riley’s use of extensive physical filing systems, both at home and at work, using a complex indexing system. Although his filing system is comprehensively indexed and cross-referenced, the physical location of the files within a cabinet and the location of the cabinet itself are critical features of Riley’s memory system. If a filing cabinet is moved, the whole system breaks down: it takes him a long time to accommodate any physical change.

R: At work I had to vacate my office and the stuff is still all currently in storage and it causes me much grief and anxiety but I have 24 four-drawer filing cabinets of stuff filed away. It’s all catalogued and indexed and I know where everything is within those drawers. ...

Res: Right, so to cross-reference you duplicate the copies and file [them both]? ... Then you’re remembering their actual position, the look of them in the cabinet, in the drawer?

R: Yeah. I know it’s [for example] third folder in, and that one is the tenth one in. ...

Res: ... When [your filing cabinets] come out [of storage], if they got put in your office by mistake in the wrong order, would that muck everything up?

R: Ooh, yeah. (Interview)

The move to digitisation strategies of knowledge management within his workplace was a major source of stress for Riley. Digitisation of information removes the concrete, physical triggers that are a key element of his retrieval strategies, for which he has been renown. Riley’s memory system for encoding and retrieval is highly state-dependent, therefore, changes of context are extremely disruptive. The notion of state-dependent memory is explicated in the case study of ‘JS’, who is a researcher diagnosed with AS (Boucher, 2007). Boucher reported how JS is unable to voluntarily remember how to navigate locations such as Heathrow airport, despite having been there many times. His memory is prompted by the physical state of being at, for example, the baggage reclaim area and this cues his memory of previous visits. At each stage of his journey, the process is repeated. In this formulaic manner, JS is able to navigate through the airport and to his destination without being able to freely recall how to do it.

In addition to Riley’s method of filing information, his recovery of some autobiographical memories, like JS, displays a high degree of state-dependency.

R: Until I was [aged] eleven, we were in a house in [suburb name]. It's still standing. I've been back and parked out the front of that house a couple of times. The house from there, from [age] twelve till twenty, is empty, is demolished. It's now replaced by a suburban sprawl. I don't want to go back there. I've driven past a couple of times. It's gone.

Res: By going and parking out the front, is that helping you access memories in the same way? And now you can't do that?

R: With that one that's gone, it's gone. ... It's definitely not pleasant because I can remember, ah, you know, it's where I learned to ride a horse and all sorts of things like that. It could bring me to tears very quickly. I'm not going to get angry about it but, but I am quite stressed just talking about it. ... And seeing the photos is not enough. I can see the photos of the house and I took them and I know the house is there and that's the car I drove and there's the dog and all the other things. But it's not the same. (Interview)

Riley expressed deep distress at the demolition of the home of his adolescence as its physical presence was necessary in order for him to experience those emotional memories in a way that was meaningful to him and, from time to time, he liked to visit the house and sit outside in his car to recover those memories. When asked about whether photographs are an aid to memory recovery, he indicated that photographs do **not** help with the recovery of emotion-laden autobiographical memories. However, he appears to have no problem remembering significant details related to his work, captured on photographs. Photographs related to professional matters that do not contain personal emotional memories **are** useful in recovering memories.

R: When I was doing my exams, because they'd accumulated the best photos that were available, they trotted out quite a few of my own photos and threw them back at me and so I told them where we'd taken it and the histories of the animals and all that. Just from the photos (snaps fingers), it's enough to give quite a lot of information. (Interview)

Therefore, for Riley, photographs act as a successful memory trigger for factual information but, for certain personal memories, they are insufficient. Personal, emotion-laden memories appear to be state-dependent: that is, they require the physical presence of the object (or for him to be in a physical location) in order for him to experience the memory in any way that is meaningful to him, demonstrating a higher reliance on state-dependency than is typical. This feature of Riley's autobiographical memory highlights the potential importance of external objects for key areas of memory and identity: that is, **emotions** experienced at the memory's source are mediated by the physical state of an object, whereas **factual**, time-stamped information about events is easily retrieved mentally through the use of visual strategies, such as the 'mental filing cabinet'. The state-dependency of such memories for Riley is contrasted with the capacity for mental

time travel in typically developing individuals, who experience emotional memories effortlessly through the mechanism of auto-noetic consciousness. Although a level of state-dependency operates for all individuals, Riley's autobiographical memories in this instance are unusually state-dependent: he can think factually about the memories but is unable to experience them in a meaningful way. Figure 4.5 illustrates the relationship between source memory, auto-noetic, and noetic consciousness: auto-noetic consciousness is the 'hallmark' of episodic memory (Bowler, *et al.*, 2000, p. 295) and stands in contrast to the 'noetic' form of human consciousness that is the hallmark of semantic memory retrieval. Riley has noetic awareness but lacks auto-noetic awareness, thereby increasing the state-dependency of his autobiographical memories.

Riley's externally oriented memory profile is consistent with the stronger semantic memory and diminished episodic memory of the other cases in this doctoral study. His account of autobiographical memories that are dependent upon a physical state contributes to descriptions of state-dependency as outlined by Boucher (2007). Furthermore, the notion of state-dependency of personal memories sheds light on the issue of hoarding behaviours in AS. The catastrophic impact of the changed state of personal possessions was portrayed within the movie *Mozart and the Whale* (Bass, 2001) (Section 8.11.4). One of the propositions of this doctoral thesis is that moving or removing personal possessions may be an assault to an individual's identity because of the changed state of an object that constitutes an external representation of identity. This is apparent in Riley's case as demonstrated by the grief associated with his filing cabinets being moved in and out of storage and the loss of his adolescent home. Boucher's account of the state-dependency of personal memories in JS's case highlights this key characteristic of memory in Riley's case.

### **8.12.5 Childhood amnesia and source attribution**

Riley described his memories of the serious car accident that happened when he was three years old. The entire sequence is encoded as a 'video' that he replays in his mind. Riley's stance within the following utterance shifts between observer and protagonist.

R: I was in a severe car accident when I was [aged] three. I can replay that in my head. I can replay that right now. But it's me on the [median strip of the road] with all the people around me and the camera is out here (indicates to the left or the right slightly above eye level with his hand) and I know that is false because I'm not out there, I'm down here. So why am I looking at the crowd around the car and the smash? So that's a reconstruction

and it's not the real thing and I know it's not but it's playing now because I've mentioned it. And so I know that that one is a reconstruction and it's false but it's well-entrenched.

Res: So [do you have] first-hand memories from three, from this car accident?

R: No, I can't remember it. Well, I **can** remember the ride in the ambulance ... and the anaesthesia and being locked in the room with the boogie man because I wouldn't eat my eggs and all that sort of stuff ... and your parents came to visit you once on Sunday afternoons for an hour. I remember getting a [toy] car once. My sister tells me that my parents used to hear me screaming and they'd all be crying out in the grounds and not allowed to come in. ... I know I was in and out [of hospital] for about 6 months. (Interview)

Employing Tulving's distinction between 'remember' (autonoetic consciousness) and 'know' responses (noetic consciousness) (Tulving, 1989), Riley's description is a curious mixture of 'remember' responses (the ride in the ambulance, the anaesthesia, being locked in a cupboard at the hospital) and 'know' responses. He calls the 'know' responses a reconstruction. There is an attribution problem apparent in the statement: 'So why am *I* looking at the crowd around the car and the smash?' At this point he is confusing the 'camera's' observational perspective of a 'known' act of recall with his first-hand experience. Using the term 'construction' to describe this kind of memory has validity as it is an act of recall that has been visually encoded in his memory based on other people's narratives of the event. However, interestingly, Riley voluntarily attributed some external sources (for instance, his sister) for this compiled memory even though the entire sequence is encoded and retrieved as a 'video' (semantic-type memory) rather than through an act of mental time travel that affords source attribution (episodic-type memory). It is reasoned that this event was such a defining event in Riley's childhood that family members have contributed to his reconstruction of the event in discussions over the years and it has been repeatedly mentally rehearsed. This extensive rehearsal has perhaps allowed Riley to mentally shift between a first-person and an observational stance in his recount of the memory and has conferred limited attribution capacity, although some attribution confusion remains.

The analysis of this passage initially focused on childhood amnesia, however, it is difficult to draw conclusions relating to lack of childhood amnesia as, unlike Kahla's and Nadia's early memories, Riley's recalled early memories were infused with trauma and are clearly subject to other people's contributions. Activation of the amygdala and the release of stress hormone boost the retention of traumatic experiences in long-term

memory (Cahill, 2008) and the contribution of family members to the construction of the memory needs to be accounted for. In his interview, Riley did not recount many personal memories of childhood that were not associated with the accident, however, the passage was included for its additional illumination of the nature of Riley's autobiographical memory, rather than as evidence for diminished childhood amnesia.

### **8.13      *Philosophical questions***

The philosophical issues in Riley's case are considered under the headings of: identity; knowledge and the knower; acquiring knowledge; and, value.

#### **8.13.1      Identity**

As in the other four cases, Riley's sense of difference and alienation cause him to question his identity so that he asks himself questions such as, 'What's wrong with me?' and, 'Am I crazy?' He does not appear to have arrived at a sense of resolution or positive self-acceptance and his narrative has a negative flavour similar to Rhoda's. This is contrasted with Nadia's sense of acceptance and celebration of her difference, Kahla's hard-won self-acceptance in adulthood and Colin's begrudging self-acceptance since his diagnosis of AS.

There are two features of Riley's narrative that distinguish his account from the other cases with regard to his sense of self: his solid and enduring relationship with his spouse, Renae, who he has been with since young adulthood; and, his strong belief system. Both of these factors appear to ground him and provide a stable environment within which he functions and manages his perceived differences. Riley's church environment provides a strong, supportive social milieu for him where he experiences acceptance, although sensory issues that arise within that environment are challenging. Within his family (spouse, three children and grandchildren), he experiences acceptance and validation of his identity as a gifted individual with AS. His wife, particularly, acts as a 'knowledgeable mirror', reflecting self-knowledge back to him and assisting him to interpret his experiences within the framework of her professional understanding. His strong belief system, coupled with solid, committed, family relationships, could be credited with facilitating a successful lifestyle of career, family and interests, while he also manages the challenges of AS and significant health issues.

### 8.13.2 Knowledge and the knower

The epistemological problem is restated here as the question, ‘How can I **know** what is true?’: that is, Riley’s relationship with knowledge and the issue of trustworthiness of that knowledge. He has dedicated a lot of time and effort in his life researching and accruing reliable knowledge. Management of the accrued knowledge is clearly an important element in Riley’s account. In his profession, he was, prior to digitisation, valued for his memory, knowledge and skill: particularly his capacity to retrieve relevant and comprehensive research materials from his extensive filing system for use in his own and his colleagues’ publishing, teaching and research. The workplace demand for digitisation of these resources has undermined this aspect of his identity and he stated that he had strong feelings of sadness and stress as a result. At the time of his interview, his filing cabinets were in the process of being put into storage and he now experiences intolerance from younger colleagues who are technology-reliant. This is associated with a sense of angst over the loss of perceived personal value.

R: Today, Friday, [I] was told when I arrived at work that I had too much stuff in my office, this is what I was able to salvage from the previous move and de-bulk ... and I had to remove a lot of it, today. Broke my heart. Something deep within cried out. Grief, yes. Perhaps even something more than that. A defining event. My style of knowledge accumulation and dispensing and use being eroded and rejected and thus I feel out of control as well as rejected and/or not needed or not wanted or not accepted as a totality – they need me because I am knowledgeable and committed, but they want me in their mould – or something like that. A very, very sad day. (Email)

Riley experienced the move to digitisation and the attitudes of his colleagues towards his traditional methods of knowledge management as an assault on his identity. Where, previously, his colleagues have reflected admiration for his memory and knowledge-management capacity, they now reflect impatience with his rigidity in wanting to persist with the methods that have been successful throughout his career. For his part, Riley is critical of the digitisation process as he feels that important information will be lost or overlooked through electronic search techniques that avoid the need for the individual to be directly familiar with every aspect of a body of literature. He seems to associate digitised knowledge with lack of trustworthiness and interprets his colleagues’ attitude as diminishing the value of **all** reliable knowledge. This is unsurprising since Riley’s thinking, memory and learning relies heavily on the concrete and literal aspects of memory. Riley has focused his life and sense of self around mastery of defined bodies

of knowledge upon which he can rely: factual and evidence-based. Changing knowledge management methodologies represent a challenge to his sense of self.

### **8.13.3 Acquiring knowledge**

The methodological question, ‘How does one go about acquiring knowledge?’, is easily answered in Riley’s case as he explained his learning process in detail. He uses the research process to acquire factual knowledge like a ‘sponge’ (Renae: Interview), reads as much as possible, takes extensive notes about what he has read, files and indexes the notes with cross-references. This process applies to special interests and his professional life. It also impacts on his interactions with other people as he enjoys supplying family, friends and colleagues with material on their topics of interest. Indeed, following his interview, Riley supplied the researcher with a bundle of resources (articles and movies) as an act of support for the research: these were accepted as artefacts for his case. In this way, shared knowledge acts as a relationship ‘bridge’ for Riley to other people. Riley positioned himself as a very active learner utilising research methods for every area of his life, including a study of ‘what makes people tick’ (Interview) through books and movies in order to facilitate his social interactions.

### **8.13.4 Value**

Regarding the axiological identity question ‘Am I valuable or not?’, Riley has received equivocal messages throughout his life. At work, he was formerly valued but now feels profoundly devalued due to the changing methods of knowledge management and learning in the workplace. His school and university experiences contrasted with his parents’ apparent lack of support and have contributed to his ambivalent sense of personal worth: instances of feedback by teachers and advisors that communicated admiration for his intelligence and career preferences conflicted with received messages from his family, who did not support his eligibility for selective (gifted) education or his career choice. A sense of distance, even disinterest, by his parents and siblings is evident in his account. Even though Riley’s wife and family now reflect to him his value in a much more positive way, this does not seem to have overwritten the messages of his early family life. Like Rhoda, Colin, Nadia, and Kahla, the question of self-worth is an area of great uncertainty for Riley.

## **8.14 Conclusion**

An uneven cognitive profile is apparent in Riley's case, with language representing a profound challenge to his thinking, memory and learning. Externally oriented strategies are evident in his account through his descriptions of memory, which draw extensively upon concrete metaphors. His personal, emotional memories display an unusual degree of state-dependency compared to typically developing individuals. Heterogeneity among the cognitive profiles of the five cases is apparent: for instance, Riley retains very limited early childhood memories while Kahla claims to remember most things about her infancy.

Riley's mental processes have been described in this doctoral thesis as a three-step process of 'translation' between language and visual mode of thought. This process is further complicated by the challenge of enhanced perceptual function combined with poor executive control of attention, meaning that, like Rhoda and Colin, he has difficulty gating or filtering sensory information particularly when language is involved, such as when attending to a conversation against a background of other conversations. Engaging in the mental translation necessary for social participation is, for Riley, exhausting. Riley's 'compensatory' form of thinking creates a processing time lag that affects his participation in conversation and the way he conducts his learning. As a result of his thinking style, he employs a process-oriented, perseverative approach to manage personal knowledge and finds it difficult to understand the learning of individuals with a different approach.

Riley's memory style has been advantageous in previous work environments where the development of physical filing systems allowed him to rote-remember huge quantities of data via visually representing the physical act of retrieving the data: by picturing himself retrieving a particular file from its place in the filing system, he could recall the contents of the file (or personal event), including the date and time of many memories in the form of a time-stamp on the 'file'. Therefore, his physical filing system supported and reflected his mental storage and retrieval system. With the move to digitisation of knowledge in his professional life, he finds himself greatly disadvantaged because the externally oriented memory methods, for which he was renown, are no longer helpful. He experiences this as a loss of personal worth and an assault on his identity.

Riley's cognitive profile, as was also evident in the other cases, demonstrates increased reliance on semantic-style memory strategies with reduced reliance on episodic strategies. Learning through the use of explicit research methods is Riley's *modus operandi* for work, social and personal matters. However, strong family relationships and religious beliefs appear to be a key factor contributing to Riley's overall success, rather than compensatory learning alone. The factors that contribute to, and are hallmarks of, the success of a long-term life partnership between an individual with AS and a TD individual in the face of obstacles that overwhelm so many such relationships, would be a topic of great interest for future research using an IPA research design.



## Part C

Part C is the final section of the thesis and includes Chapters 9 and 10. Chapter 9, 'Discussion & Findings': discusses the key components of the conceptual framework, the Thinking, Memory and Learning Framework (TML), that is the theoretical output of this study; employs the TML to frame a discussion of the emergent themes; and, proposes a representation of the cognitive profile of the five cases in the light of the conceptual framework. Chapter 10, 'Conclusion', draws the thesis to a close. Chapter 10: discusses the super-ordinate theme, 'Knowledge and the knower'; addresses the research question and sub-questions; offers pedagogical insights based on the findings of this research; and, poses questions and directions for future research.



## Chapter 9 Discussion & Findings

Essential elements of the conceptual framework that is the output of this doctoral study are presented at the beginning of this chapter. The conceptual framework is presented in full in Appendix C. The themes emerging from the case studies are discussed in light of the conceptual framework, which is further utilised to characterise the cognitive profiles of the five primary participants.

### 9.1 *Conceptual framework*

As this doctoral study presents a new perspective, utilising first-hand accounts of thinking and learning by individuals with AS, it sought to ‘map the landscape’ of the participants’ experience within the parameters set by the research questions. The conceptual framework, the ‘Thinking, Memory and Learning Framework’ (TML) is one of the practical outcomes of this doctoral study: it is a series of diagrams and explanations, with literature references, to be utilised for professional development (PD) presentations. The TML framework:

- (a) draws the cross-disciplinary research literature together to allow insights from other disciplines to be available to an educational audience (teachers, parents, individuals with AS, life partners);
- (b) is a professional development tool for communicating conceptual understanding to teachers and other stakeholders in order to address the educational problem that initiated this doctoral study;
- (c) is a summary of the literature reviews conducted in response to the call for firsthand accounts of ‘Mind’ from individuals with autism (Gardiner, 2008) (Figure 1.4);
- (d) facilitates a means to describe and compare the cognitive profiles of the cases in this doctoral research in a way that is helpful to stakeholders for a consideration of the cognitive profile of their student, family member or self with AS; and,
- (e) is a useful framework for the consideration of questions for future educational research.

The TML began, early in the study, as an attempt to compile the relevant literature for the purpose of PD presentations to teachers. However, the act of making sense of the cross-disciplinary literature seemed, of itself, to represent knowledge construction. The development of the TML was, therefore, driven by the desire to bring to light important concepts that are familiar within the research but not yet readily available to teachers across disciplinary boundaries. Yet such concepts have an important bearing on the provision of learning environments for gifted students with AS: for example, the concept of ‘theory of mind’ (ToM) is closely aligned with the concept of ‘metacognition’ as generally understood by teachers, particularly teachers of gifted learners, and yet ToM was not a familiar concept for many teachers in the local educational environment. The researcher’s relief at finding even a single reference, Neihart (2000) in the case of metacognition, to confirm a seemingly obvious relationship, was great. So it was valuable through the course of this study to continually ‘map’ conceptual ideas from the different bodies of literature against each other in order to see what insights this would produce, and how it might expedite explanations to teachers, parents, adults with AS and life partners. The process is an obvious ‘fit’ with the theory development activity of collective case studies, according to Punch (2009), which allows for the possibility of some measure of generalisability.

### 9.1.1 Thinking, memory and learning

To represent the relationship between thinking, memory and learning from the literature, the following word algorithm was constructed:

$$\text{Information processing} + \text{Memory} = \text{Learning}$$

This can be expanded to:

Information processing (*i.e.* thinking) in working memory + successful encoding, storage and retrieval in long-term memory = learning (*i.e.* acquisition of knowledge, understanding and skills).

Effortful thinking takes place in working memory, which is time limited. If anything of that thinking is encoded in long-term memory for future retrieval, the form of the thinking will determine the memory system deployed: for example, the memory resulting from personal experience will be handled by episodic memory and symbolic encoding will be handled by semantic memory. However, an instance of thinking or

learning does not naturally conform to one memory system: the memory systems work together during encoding to, and retrieval from, working memory.

Different types of thinking or reasoning are characteristic of particular long-term learning and memory systems. The characteristics of a type of thinking (for example, rote remembering) align with the characteristics of the long-term memory system in which it will be remembered (or not remembered). Based on the five human learning and memory systems illustrated in Figure 4.3, Figure 9.1 was created by moving working memory underneath the other four memory systems. Working memory is the interface with the long-term memory systems and is the location of information processing or ‘thinking’. From the literature, the characteristics of thinking that align with, or are ‘native’ to, each memory system are listed in columns within working memory: this produced the representation shown in Figure 9.1. The horizontal arrows in Figure 9.1 indicate contrasting thinking processes: for example, the ‘remember responses’ of episodic memory contrasted with the ‘know responses’ of semantic memory.

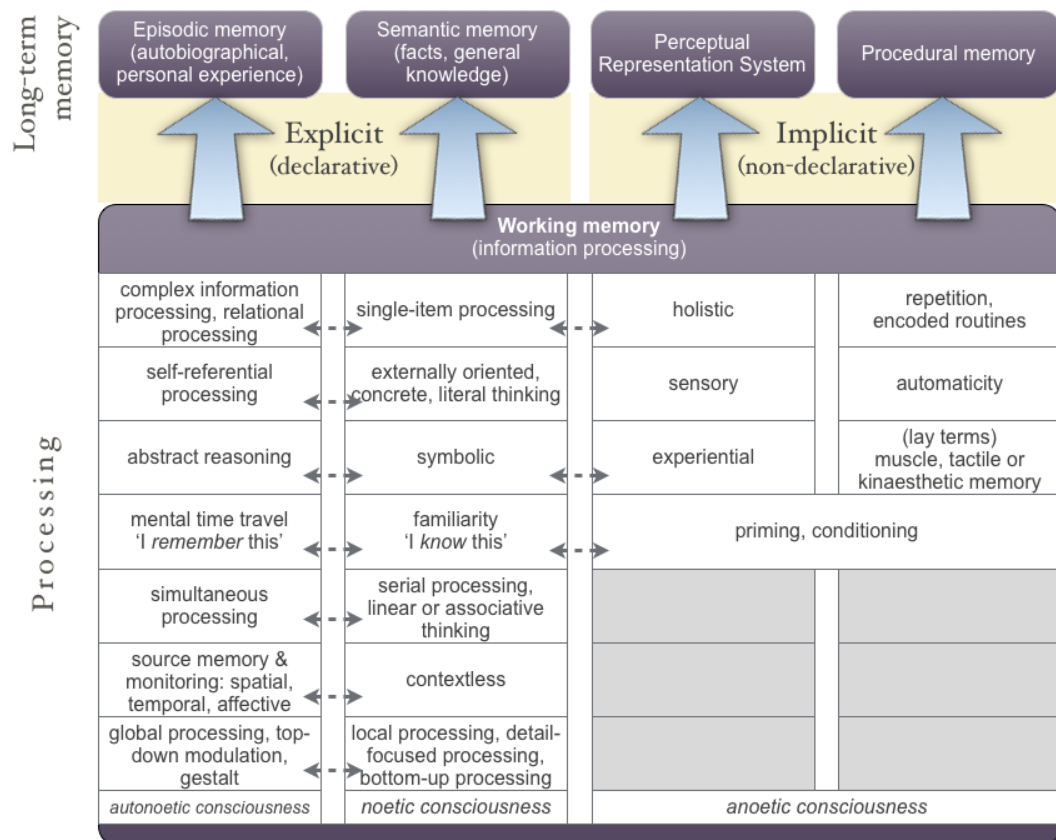


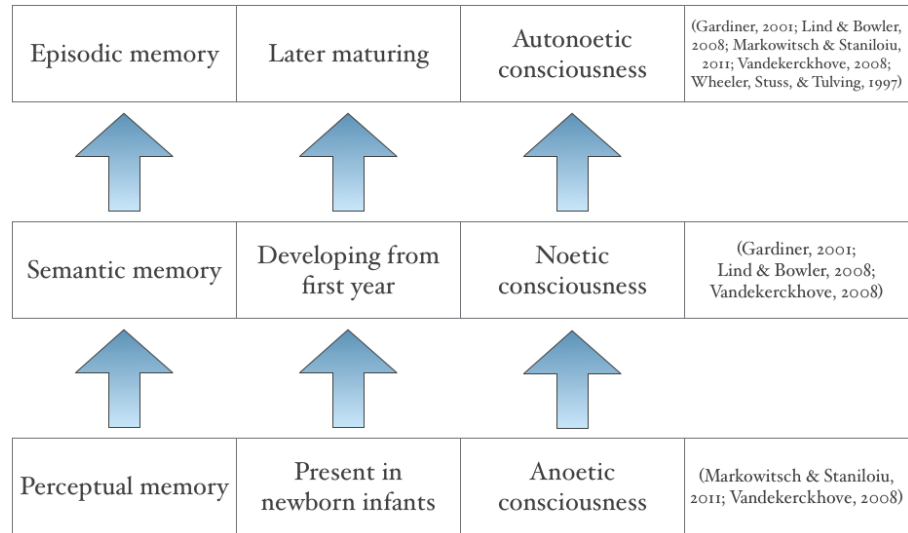
Figure 9.1 Characteristics of thinking associated with the learning and memory systems

The mapping process represented in Figure 9.1 is theoretical and indicative. It is useful for PD of educators and contributes to an understanding of the learning processes of the mind and brain. Amnesia studies have demonstrated that learning is severely compromised when there is damage to episodic memory as a result of brain injury (Tulving, 2002). As memory systems are discrete, yet work in harmony to encode and retrieve experience and knowledge, if there is damage or impairment to one system, it stands to reason that learning will be compromised or take on different characteristics: this is indeed the case with Tulving's participant 'K.C.'. It would be informative, but beyond the scope of this doctoral study, to compare the literature on further cases, such as Phineas Gage (Damasio, 1994), to see the impact on the learning characteristics of those individuals.

### 9.1.2 A learning hierarchy

There is a hierarchy **between** the learning and memory systems that is reflected **within** the mental activities that are native to each system. From an extended reading of the literature, it became apparent that terms such as 'bottom-up' and 'top-down', 'early developing' and 'later maturing', imply this hierarchy. Bloom's taxonomy of educational objectives in the cognitive domain (Bloom, 1974), commonly referred to as 'Bloom's hierarchy of thinking skills', has been critiqued for lack of evidence from learning research (Ritchhart, *et al.*, 2011). In contrast, the TML is an evidence-based hierarchical approach as it was constructed from a review of definitions and concepts from more than sixty research articles: the full list of references is provided in Appendix B as numbered footnotes and a reference list. Evidence for a hierarchy within long-term memory systems was presented in Section 4.4.8. Incidentally, although this framework is profoundly different from Bloom's taxonomy of thinking skills, it supports his notion of a hierarchy within cognitive activity and therefore conflicts with the view that 'the idea that thinking is sequential or hierarchical is problematic' (Ritchhart, *et al.*, 2011, p. 6).

Figure 9.2 (also Figure 4.8) shows the developmental order of the three memory systems of interest and the hierarchy in their associated forms of consciousness.

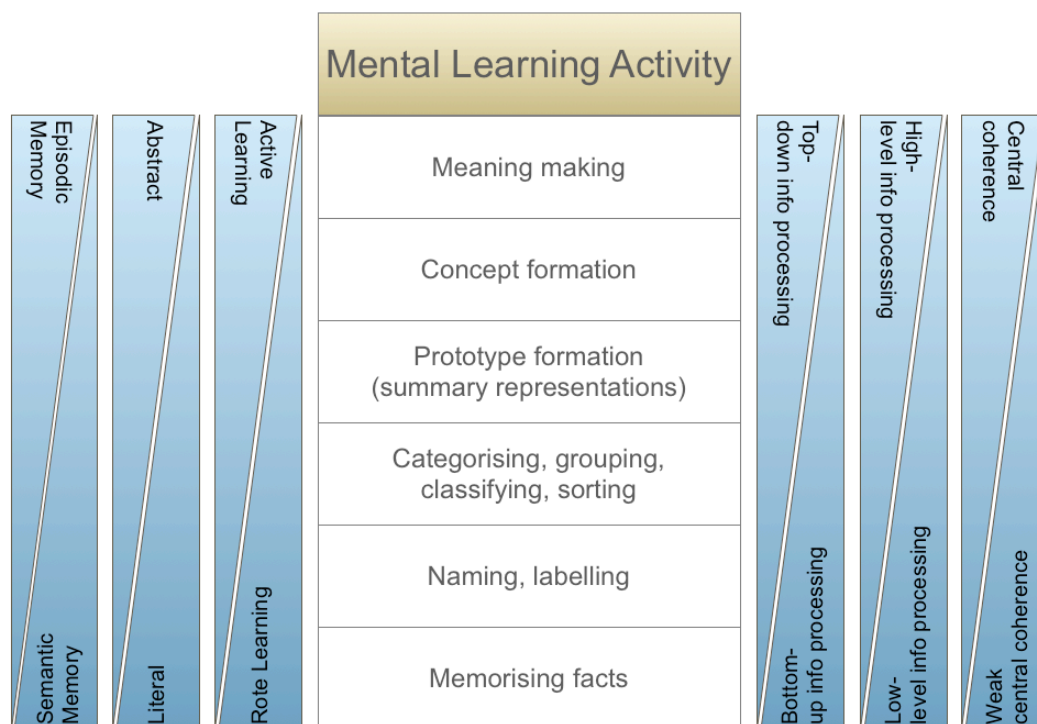


**Figure 9.2 Hierarchy of learning and memory systems and their associated forms of consciousness**

The hierarchy is indicated by the developmental progression of anoetic consciousness (raw sensory experience) to noetic consciousness (single-item symbolic representation) and, finally, to autonoetic consciousness (mental time travel). It is indicated, for example, by terms such as ‘top-down modulation’ vs. ‘bottom-up processing’, which are references to strong and weak central coherence. In line with the hierarchy **between** learning and memory systems, there is also a hierarchy **within** the corresponding mental activities: these are the activities and characteristics listed in Figure 9.1 as taking place in working memory, such as the progression from experiential (perceptual memory) to symbolic (semantic memory) to abstract (episodic memory).

### 9.1.3 ‘Learning Ladder’

The evidence for a hierarchy between different mental activities (see the table in Appendix B; see also Table 4.3) was distilled and the hierarchical ‘ladder’ of thinking and learning activities that resulted allows a series of inverse relationships pertaining to learning to become apparent, as shown in Figure 9.3. Memorising isolated facts relies on the single-item processing of semantic memory with each rung up the ladder drawing more upon episodic memory processes.



**Figure 9.3 Learning Ladder: inverse relationships**

As shown in Figure 9.3, memory for facts is reliant on semantic-memory representation, whereas formation of schemas and personal knowledge constructs (concept formation) are reliant on episodic thinking: conceptual relationships, simultaneous processing and memory binding are functions of episodic memory. Central coherence equates to a top-down processing style, whereas individuals with AS most likely have a bottom-up, or detailed-focus, processing style and therefore are said to have weak central coherence. A top-down processing style is represented by the top of the ladder: a bottom-up processing style is represented by the bottom of the ladder. Some writers refer to strong central coherence in terms of high-level information processing, meaning that increasingly sophisticated mental organising strategies, such as categories, prototypes and schemas, are employed in thinking, memory and learning: low-level information processing style refers to processing that is literal, tied to the ‘concrete’ and does not require the use of organising strategies.

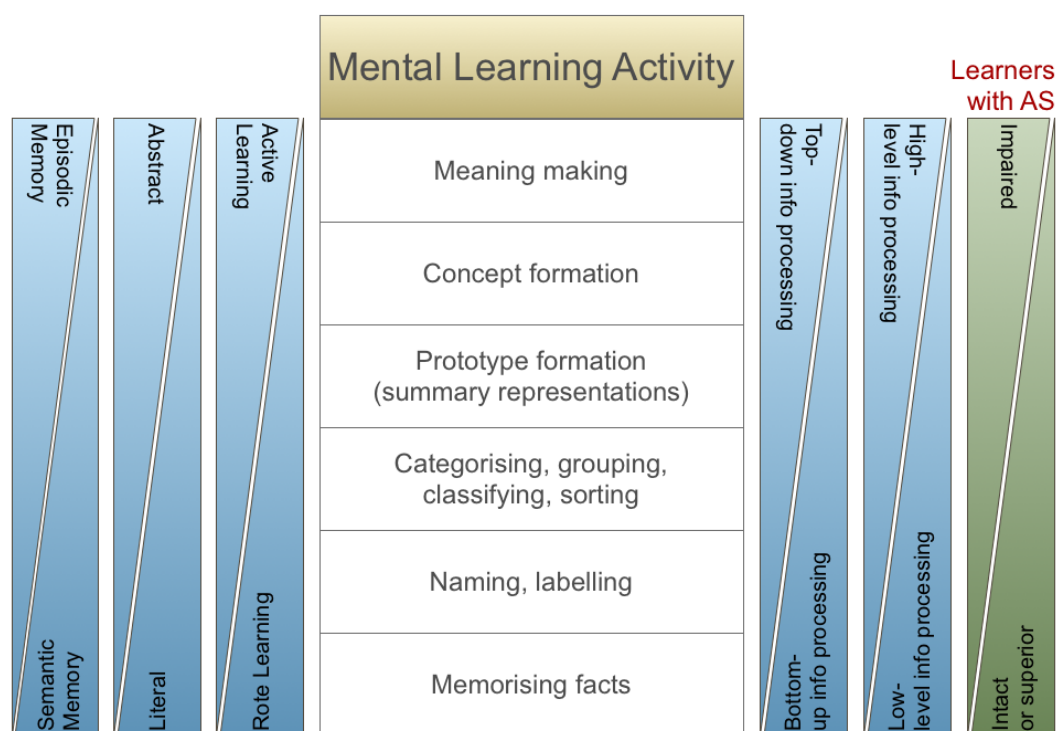
An instance of learning that employs mental activity from the bottom of the learning ladder is the recognition of the object in Figure 9.4 as familiar: this draws upon perceptual and semantic memory.



**Figure 9.4 Photograph of fruit: an orange. Used under licence**

Naming it as an ‘orange’ represents the application of language (a semantic system function) to the notion. Classifying an orange as ‘fruit’ requires the development of categories and the correct designation to a single category or multiple categories: for example, round objects, food, plants, orange-coloured objects. This is a low-level use of an organising strategy or a simple schema. Moving up the ladder in Figure 9.3, prototype development is a more sophisticated organising strategy involving the memorisation of a summary representation of a category, which may not be an actual instance, and comparing newly encountered instances with the prototype. This is an efficient deployment of memory compared to memorising **each** instance of **every** category. Concept development is a yet more efficient means of knowledge construction and relies more on abstract reasoning than the mental activities lower on the ladder. The highest rung of the ladder represents personal meaning-making incorporating the application of values, beliefs and worldview as part of personal knowledge construction. As long as an individual’s schemas and conceptual understanding are reliable (that is, they accurately represent reality), then abstraction higher up the ladder affords generalisability to new situations and circumstances that is not available to knowledge construction at the lower levels of the ladder.

In Figure 9.5, the Learning Ladder is employed to characterise the likely cognitive profile of gifted individuals with AS showing cognitive strengths and weaknesses that impact upon thinking and learning.



**Figure 9.5 Learning Ladder: inverse relationships showing likely cognitive strengths and weaknesses for gifted individuals with AS**

Figure 9.5 illustrates that a gifted learner with AS will, most likely, demonstrate a superior capacity in learning activities that require memory for discrete factual knowledge but once organising strategies such as prototype development or concept formation are required in order to mentally represent knowledge, then they will be increasingly challenged. The pedagogical implications of the Learning Ladder and its inverse relationships are discussed in Chapter 10.

The literature that was reviewed to construct the TML is listed in full in Appendix B and the complete set of diagrams and explanations that make up the TML is given in Appendix C.

## 9.2 *Emergent themes*

The TML serves as the theoretical framework for the interpretation of the five emergent themes, which are: Compensatory learning; Self-referential thinking vs. externally oriented thinking; Enhanced perceptual functioning and giftedness; Temporality; and, Language.

### 9.2.1 Compensatory learning

Compensatory learning is significant because it indicates how the primary participants have adapted to ‘fit’ an education system and culture evolved principally for typically developing individuals. One of the goals of the teacher PD activities of this doctoral study is that teachers will have the capacity to recognise, facilitate and reward the authentic learning of their students with AS, even when the learning is compensatory. It is proposed that teachers, as educational problem-solvers, should explore the learning needs of each individual student and, where there are learning blockages, facilitate compensatory pathways of learning, as demonstrated so clearly in Nadia’s case.

Evidence of compensatory learning was apparent within the accounts of the participants.

- (a) Through prolonged tutoring and careful explanations by her psychologists, Kahla learnt to overcome her usual way of talking, which was based on the belief that: (i) ‘You say everything you think’; and, (ii) ‘The more important something is, the louder it is said’, accompanied by larger gestures. From Kahla’s case, the lesson to be learnt is that compensatory learning may be needed to alter incorrect beliefs before more extensive learning can occur. The motivation to accept change was strong in Kahla’s case at this point in her life and she was able to learn the new principle, ‘You don’t have to say everything you think’, which has significantly enhanced her social interaction.
- (b) Kahla taught herself to recognise the faces of people she met socially by taking a mental photograph of the face and storing it effortfully in her visual memory. She practised retrieving the ‘photos’ and found that she had an increased capacity to recognise natural faces through this process. This was a specific instance of compensatory learning based on a premise that was personally meaningful to her: ‘Since I can remember faces from a magazine or television, can I learn to remember the faces of people I meet using a similar technique?’
- (c) Compensatory theory of mind to account for the behaviour of other people is expressed in Kahla’s narrative (Section 4.8.4).

K: You are right in thinking that I think a lot about how I and my sons think. I constantly evaluate and assess and pull apart our minds and events. At about age 4, I realised something was wrong, and by age 5 I was certain. It was then I began to study human

behaviour intently. Unfortunately, I also decided to study animal behaviour by reasoning that we are animals, and, for many years, applied what I had learned about cats, dogs and birds, to people, with dismal results. (Email)

- (d) The ‘study of people’ as a special interest was explicitly raised by Kahla and Riley and is an example of compensatory learning. Nadia’s play script and descriptions of her interactions with her peers at school indicated her close observation of people and attempts to make sense of human social interaction and behaviours. Riley said that he conducted his study of people through watching movies of period dramas from Victorian England, such as those based on Jane Austen’s books: the rules of social interaction and human behaviour are structured and explicit. Nadia experimented with human behaviour through her written play characters and, like Riley and Kahla, through reading fiction: her fantasy and fiction reading catered for her interest in studying behaviour and potential outcomes when unpredictable things happen. At a basic level, the study of people from television, movies and books provides potential social scripts but Kahla, Nadia and Riley appeared to be searching for knowledge beyond social scripts, desiring insight and understanding.
- (e) The effort of working with language through the research interview was a demanding task for Rhoda and Riley. Rhoda, like Temple Grandin, may be using language in a compensatory way, as illustrated by Figure 5.1, where an object is remembered symbolically and the word is remembered only by being visualised as attached to the object: rather than the word symbolically representing the object in memory. Wendy discussed the possibility that Colin might be able to mentally picture a word as a label attached to its object to overcome his spelling problem but, for him, this was not a useful strategy.
- (f) Nadia had received social coaching, from the same psychology practice attended by Kahla, regularly since she was 12 years old. She had embraced this learning as it smoothed her schooling and social life but she was aware that it was compensatory, not corrective, and was proud at being different from the ‘mainstream’. She, like Kahla, was extremely well spoken in her interview, with excellent diction, positive body gestures and well-regulated prosody. With the dual elements of strong motivation and excellent coaching, the compensatory learning of Kahla and Nadia in the area of speech and social interaction appeared to be profound.

- (g) Nadia's capacity to speak at length on a subject and give a coherent presentation contrasted with the associative speech of Colin. The structure and substance of one of Nadia's monologues demonstrated her capacity to keep her subject in mind, return to it, build on it and draw a conclusion. This raises the question as to whether this is a learned compensatory skill or whether, having had intervention since pre-adolescence, she has developed ways of thinking and speaking more characteristic of typically developing children. Being the youngest participant, who had received intense interventions over a long time, sets Nadia's case apart from the others.
- (h) Nadia had learnt to employ some simple metacognitive strategies in managing her learning at school, which indicates significant gains of mental control and self-reflection.
- (i) If the proposal of this thesis regarding 'native' modes of thought is accurate, then the use of language itself is a compensatory strategy for those participants who are not verbal thinkers: Rhoda, Colin and Riley.

Compensatory strategies are not as flexible as the competencies they are catering for.

One hallmark of compensation, unlike cognitive competence, is that it will be inconsistent across different situations. (Williams, D. M. & Bowler, 2014, p. 3)

Riley displayed a level of factual knowledge **about** himself (rather than 'self-knowledge') in his interview that he explained came from Renae in the form of a series of statements. Whereas Nadia has acquired dynamic compensatory skills that allow her to socially interact in a sophisticated way, for example, in giving a short, engaging, well-constructed, impromptu monologue on a topic of interest to her listeners, Riley's compensatory social learning had been reflected to him by Renae to make sense of a specific situation. Nadia's learning is a flexible skill that she can employ in many spheres of her life, while Riley's learning pertains to particular social situations and he remains reliant upon Renae for social cues in new situations. Therefore, from these cases, it appears that not all compensatory learning is equal. The nature of successful compensatory learning will be individual to each person, as is indicated by the heterogeneity of AS. Again, a hierarchy can be proposed, this time of the generalisability of learning: Nadia's speech construction skills have wider generalisability to other situations than Riley's learned feedback from his wife about a

particular social situation. From an educational perspective, it is desirable to facilitate the development of higher-order knowledge and skills as well as factual information and the distinction should be kept in mind by teachers.

Many authors refer to the compensatory learning of individuals with AS: for example, learning social ‘rules’ to compensate for lack of theory of mind. As noted earlier, compensatory learning is a ‘slow and painstaking learning process’ (Frith, U. & Happé, 1999, cited in Lind & Bowler, 2008, p. 178) and contributes to a different form of self-consciousness, founded on cognition that relies on external referents in place of self-referential processing.

### **9.2.2 Self-referential thinking vs. externally oriented thinking**

One of the major characteristics of thinking and learning in AS is the reliance on externally oriented thinking strategies. Self-referential thinking processes are diminished in AS and the flipside appears to be increased reliance on the external, concrete world, even for matters of personal experience and identity. Phenomena usually thought of as being internal to oneself were described by the primary participants as if external. Externally oriented thinking was expressed in the case studies in many ways.

- (a) Colin’s belief in a supernatural force that may be responsible for his giftedness indicates attribution of an internal reality to an external phenomenon.
- (b) Riley’s state-dependent emotional memories associated with his demolished family home are a demonstration of externally oriented thinking and align with the state-dependent, associative mental states ascribed to ‘JS’ (Boucher, 2007).
- (c) Riley related his difficulties at work when his filing cabinets were moved. His memory of what is in the filing cabinets is significantly dependent upon their location. When a filing cabinet is moved he is unable to remember its contents as effectively as before. This is a further expression of the state-dependency of his memory processes.
- (d) Kahla referred to her memory as though it was an external entity: either a twin or another identity. There was no threatening implication in this reference: it is as

though she cannot believe her good fortune to have so much, where she perceives others as having so little.

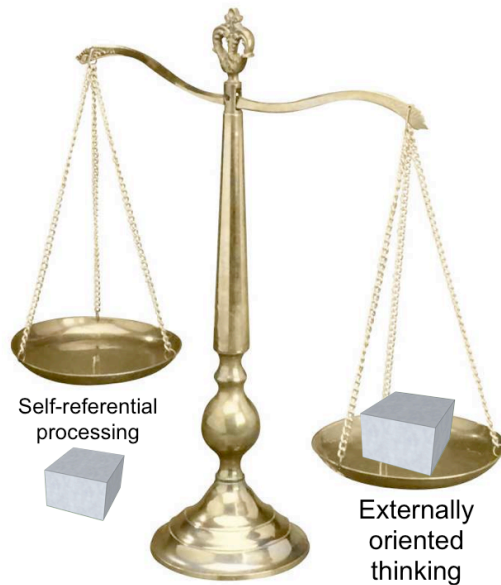
- (e) Rhoda stated that she relied on maps to navigate to a new location, even if only a short distance away. If Steve tries to explain a nearby location to her, she experiences a mental sense of being 'lost' the moment she attempts to imagine leaving a known location: she is unable to navigate using landmarks or verbal directions, even over a short distance. The rehearsal of having physically travelled every part of a route is required before she can imagine any variation to the route, indicating a reliance on concrete experience for mental manipulation.
- (f) The use of self-generated metaphors during interviews was a surprise finding that was particularly prominent in Kahla's, Nadia's and Riley's accounts. The metaphors accomplished the work of reifying abstract concepts, making it possible for them to be articulated. The use of metaphors in this way represents externally oriented thinking: external objects within the metaphors are employed to represent internal experience in place of direct descriptions of first-hand experience. Some of the metaphors employed by the participants are listed below.
  - (i) All the primary participants referred to their memory recovery using metaphoric terms such as: video; movie; tape; play; recorder; or, camera.
  - (ii) Kahla described her memory as a vast storehouse of information like a library.
  - (iii) Riley and Kahla both stated that their memories were like filing systems. Riley closely associated his memory to his physical filing cabinets at work and, when speaking of his memory, made references to indexing, cross-referencing, opening a filing cabinet drawer, pulling out a file and seeing a time stamp on the file.
  - (iv) Kahla described switching from a more recent memory state to an earlier infantile memory as being 'like when you hop into a bath', which is interesting for itself **and** because she is describing a mental activity rather than an object or fact.
  - (v) Kahla described her life as being like a circle, rather than a line, meaning that she feels very close to her infantile memories regardless of the passing of time, whereas she observes that others seem to move further away from their

memories as time passes and memories decay. Her memories, being arranged in a circle, are always fresh, no matter how distant they are in time.

- (vi) Rhoda offered *The Cabinet of Dr Caligari* as a metaphor for her horror of certain objects. She was able to communicate the factual information that she has a horror of certain objects but when she tried to communicate the emotional impact of her phobias, she instead offered the Dr Caligari reference, which her partner, Steve, explained.
- (vii) Riley described his study of how people ‘tick’, using a clockwork metaphor, evoking the allusion of a clock being taken apart.
- (viii) Colin used the metaphor of mixing colours to describe his thinking process: ‘if yellow and red make orange, then ...’
- (ix) Nadia spoke of AS as a ‘bump in the road’ and like there is a ‘glass wall between [me] and everybody else’.
- (x) Riley described his thinking processes as constructing ‘skyscrapers’ or building ‘blocks’ of thought. Kahla used similar terms, such as ‘block of speech’, ‘block of memory’ and retrieving a ‘block’.

Self-referential processing is portrayed in the neuroscience literature as an operation of episodic memory that confers a memory advantage, the self-referencing effect: that is, an event, skill or item of knowledge that has a personal meaning for the individual will be processed and remembered favourably compared to an event with which the individual has no personal connection. Teachers will recognise the outworking of this phenomenon in education as active learning, which is engaging and productive for learners compared to passive ‘book learning’ (the learning of material with low personal relevance for the learner). Individuals with AS do not benefit from the self-referencing effect to the same extent as TD individuals.

During the course of this doctoral study, an association was observed between self-referential processing and externally oriented thinking that is not clear in the literature: the phenomena of self-referential processing and externally oriented thinking appear to be complementary phenomena (Figure 9.6).



**Figure 9.6 Self-referential processing vs. externally oriented thinking<sup>4</sup>**

If, as the literature asserts is the case in autism, self-referential processing were absent or markedly diminished, on what, then, would an individual rely? The answer, in the case of AS, appears to be that external objects become invested with personal meaning, of which the individual themselves may be unaware, never having known any other state of being. Change, even a slight change, such as an object being moved, would change the ‘state’ of the object in the mental representation of the individual and could be significant and distressing to them.

Furthermore, self-referential processing is a building block for identity formation: being able to answer the question ‘Who am I?’ to one’s own satisfaction. Without self-referential processing, ‘Who am I?’ must be answered with reference to externalities. Therefore, any object that holds significance for an individual’s identity (these objects are dubbed ‘identity-holders’) would present a particular vulnerability for that person if the object were to be changed in any way (moved, broken, stolen) that results in their mental representation of the object no longer matching the object’s physical state: their mental representation, most likely, being visual and inflexible. If an object that is an identity-holder is changed, then the individual’s sense of self, invested in the object, has been breached.

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<sup>4</sup> [http://lostpedia.wikia.com/wiki/File:Scales\\_of\\_justice.jpg](http://lostpedia.wikia.com/wiki/File:Scales_of_justice.jpg) Cubes added to original  
Creative commons CC BY-NC-ND 2.5 <http://creativecommons.org/licenses/by-nc-nd/2.5/>

Venturing a step further, the life partner or parent, without knowing, may act as an ‘identity mirror’ for an individual with AS by reflecting back representations of the self. Perhaps a partner may even represent the ‘self’ to the individual with AS in the same way an object might be an ‘identity holder’. Therefore, one of the propositions emerging from this doctoral study is that the tendency to externally oriented thinking processes in place of self-referential processing suggests that **objects and even another person can represent the identity of an individual with AS, to that individual**. Change to the state of an object, or a person (for example, a change of hair style), may therefore have potentially catastrophic consequences for the individual with AS. Typically developing individuals are partly insured against this vulnerability by an internal sense of self, supported by the specialised neural network for self-referential processing that is underactive in individuals with AS.

### 9.2.3 Enhanced perceptual functioning and giftedness

Part-way through the data analysis and interpretation of Case 3 in the light of Tulving’s memory systems framework, it became evident that the explicit long-term memory systems of semantic and episodic memory were not sufficient to interpret some of the phenomena within Colin’s narrative. At this point, attention turned to the perceptual representation system (perceptual memory) and further reading uncovered the proposition of enhanced perceptual functioning in autism (Mottron, *et al.*, 2006). Colin’s existential descriptions of taking superb wildlife photos, such as the osprey in Figure 6.3, and his assertions that he had never **consciously** learnt anything (Section 6.4), pointed to mental experience that is either (or both): opaque to him due to an attribution problem; or, relies less on explicit memory processing and more on implicit memory processing (perceptual memory and procedural memory). The phenomenon of procedural memory was beyond the boundaries of this doctoral study but Colin’s narrative could be interpreted in the light of implicit memory processing, specifically enhanced perceptual functioning. In an earlier era, this form of memory was described as ‘unconscious’ or ‘subconscious’: within the current memory research, this form of memory is described as being characterised by anoetic consciousness or ‘without awareness’, and ‘non-declarative’, meaning that it cannot be spoken about.

The other cases were then reconsidered in the light of enhanced perceptual functioning and immediately it became clear that Kahla’s account of ‘dots’ and her enhanced colour

perception belonged in this category: Rhoda's artistic capacities and Riley's heightened perceptive ability to see minute indications of disease passed over by others are further evidence of enhanced perceptual functioning. An association with the superior gifts of the primary participants became apparent. From an educational perspective, this implies that gifted students with AS may be perceiving phenomena in the environment that are not commonly perceived by their teachers: Kahla's query about the researcher's 'colourblindness' is an example. Enhanced perceptual functioning is understood within the literature in relation to sensory sensitivities but recognition of the connection with giftedness within the educational literature is also needed. Teachers will, quite reasonably, discount things they themselves cannot perceive: the challenge for teachers arising from this association is how to recognise, facilitate and nurture their student's gifts when essential phenomena of the giftedness are beyond the teacher's perception.

#### **9.2.4 Temporality**

The differences in temporal processing and temporality in gifted students with AS, with the flow-on affect to theory of mind and episodic thinking, have a heavy impact on learning. Temporality is a function of episodic memory: its impairment has the result that a personal sense of the passing of time, of one's self as situated in time, and relative time judgements (such as 'before', 'after', 'a few days ago') will be impaired, apparently resulting in an increased reliance on the measured 'clock time' of semantic memory. Indeed, children with AS are described by their parents 'as living as if "time did not exist"' (Zukauskas, *et al.*, 2009, p. 85). The findings of Zukauskas, *et al.*, are supported by the case studies of this doctoral research, where the participants' utterances were concentrated into semantic-style, 'documentary' recounts of personal memories, accompanied by lack of recounts of personal experience indicating 'mental time travel'. Furthermore, the issue of identity formation is impacted by temporality as identity formation is founded upon a subjective sense of one's self in the past, one's self in the present and one's self in the future.

The issues concerning temporality noted within the cases of this doctoral study follow.

- (a) Temporality differences are indicated by the nature of personal memories from infancy (that is, the lack of childhood amnesia) in Kahla's and Nadia's accounts (Section 4.7.6 and Section 7.6). Kahla gave clear descriptions of her babyhood

memories as ‘watching’ or ‘playing’ a video tape. Loss of eidetic memories from infancy and the switch to mental time travel for personal memory recovery were not indicated in Kahla’s and Nadia’s accounts.

- (b) Riley’s ability to see a time-stamp on his recovered memories is an example of superior clock-time and calendar-time, the domain of semantic memory, and was accompanied by lack of subjective temporal terms, and hesitations in his speech when expressing temporal shifts (Section 8.12.1).
- (c) Riley’s account of his car accident at age three was given in language lacking problems of temporal-shifting and perspective-shifting (Section 8.12.5). It is most likely the case that this particular account is well-rehearsed, having been repeated by family members since childhood: whereas in other less-rehearsed segments in his interview, he struggled with the language required to indicate temporal shift, as well as pronoun usage to indicate changes in perspective.
- (d) With a diminished sense of subjective time to aid memory recovery, recovery of personal memories becomes reliant instead on external objects, locations and cues: for example, Riley’s struggle to recover emotional memories from his childhood home because the house had been demolished. This feature of memory in AS has been described as ‘state-dependency’ (Section 8.10 and 8.12.4).
- (e) The attribution of the source of knowledge (‘Did I say that or did someone else say it?’) relies, in part, on a personal subjective sense of time (‘Did I **think** that before or after I **heard** someone else say it?’) (Section 4.4.2). Colin tends to attribute his knowledge and skill to supernatural intervention instead of himself. Negative self-worth beliefs appear to foster the supernatural attribution although those negative beliefs are accompanied by high self-efficacy beliefs about his capacity as an artisan (Sections 6.6 and 6.7.5). The question of Colin’s lack of awareness of his own knowledge was canvassed in Chapter 6 from the perspective of temporal attribution: ‘Does his awareness of his knowledge of an event come **before** or **after** the event?’ Colin’s cognitive profile (see Figure 9.8) could be interpreted as conferring his knowledge, or noetic awareness, of an event (such as taking a brilliant wildlife photograph) before the event to after the event. In other words, he doesn’t ‘consciously’ think about taking the photograph until after it has been taken: the act

of planning and capturing the photograph has relied upon implicit memory processes instead. The phenomenon of ‘flow’ and the change to one’s personal sense of time experienced in ‘flow’ were noted in this context (Section 6.7.1).

- (f) Colin’s attribution to the supernatural, an external entity, suggests that the temporality issues in AS may contribute to the reliance upon external objects, locations and representations: this proposition contributes a fresh perspective on the phenomenon of externally oriented thinking in AS.
- (g) Nadia’s use of temporal shifting in her play script is interesting: she reifies the temporal shift of childhood to adulthood by having the child-self and the adult-self as separate characters in her play (Section 7.3). Rather than showing the characters’ incremental change over time, she has reified just two ‘now’ states. Her choice of this means of representation could be a characteristic of temporality issues in AS, as discussed by Zukauskas *et al.*, (2009).

In comparing features of Kahla’s recall of personal memories to Riley’s, temporal shifting issues in Kahla’s language may have been compensated for by her enormous expediency in language and a huge capacity to access her own semantic-style personal memories. To use a metaphor, it is as though she has a high-speed, high-resolution television studio at her disposal ready to replay any one of her vast library of ‘video recorded’ memories, while Riley’s ‘playback’ is achieved through a single video machine where time, experienced as hesitancy and repetition in his speech along with closing or covering his eyes, is required to select and play back the correct ‘tape’ in order to recall the memory. This hesitation may be compounded by the multiple demands of accessing the memory and then ‘translation’ of the memory into words for the interview: neither of these demands appeared to burden Kahla.

### **9.2.5 Language**

Kahla and Nadia, both hyperlexic, were the only participants who did not spontaneously offer the information that they struggled with conversation or handwriting. This appears to set them apart from the others: early language development and high levels of interaction with their mothers was noted in both these cases, in contrast to the other cases where the mothers were remote or absent during early childhood; and, both had benefitted from extended periods of social skills coaching. Rhoda, Colin and Riley are

challenged in any task where language is a requirement layered over other cognitive activity: handwriting, creative writing, spelling, spoken language (for example, pronoun use and deictic shifting problems), auditory processing of language, and conversation. Language difficulties and the impact upon their thinking and learning were a common thread in these three cases when recalling their school experiences. Language is further considered in the light of cognitive profiles later in this chapter (Section 9.3).

#### 9.2.5.1 *Dyslexia and dyscalculia*

Dyslexia was diagnosed in childhood in three cases, Rhoda, Colin and Riley, and there is a clear association in the narratives between the participants' experience of handedness and dyslexia: that is, they raised the issue of handedness unsolicited while describing their dyslexia. In addition, Kahla gave a clear description of dyscalculia (Section 4.2.2): her description of the experience of dyscalculia accorded with the other cases' descriptions of dyslexia. Numbers, or words, were described as sliding off the page, moving as if animated, rotating in a spiral, or moving in some way that made it very difficult for the eye to track and decode them. Rhoda also told how she read the digits of a number in the reverse order while at school, which led to calculation errors, even though she was very competent at mathematical processes. Rhoda spoke about her eyes and brain as having a 'skitter' that made it difficult to read music notation from one stave to the next: while Rhoda described the problem with musical notation as being in her own eyes and brain, Kahla, Colin and Riley spoke of the words or numbers as being animated.

#### 9.2.5.2 *Handedness*

All five cases were left-handed, with the exception of Riley, Case 5, who, in his wife's expert opinion, was coerced into right-handedness as a child. The significance of this was not noted until after data collection was finalised and handedness was not a factor in the research questions, so the high incidence of left-handedness is noted here for future studies. However, it is evident that lack of a strong preference for left or right-handedness translates to visual processing as well as behaviours and confers advantages: for Riley (Section 8.2), in surgery; for Colin (Section 6.3), in studio photography; and, Rhoda (Sections 5.3.3 and 5.3.4), in hand drawing 3D realisations from 2D plans; in being able to visualise and mentally rotate objects regardless of direction.

### 9.3 Cognitive profiles of cases

Against the backdrop of the TML framework and the emergent themes, the cognitive profile of the five case studies is now considered. The human learning and memory systems framework affords the opportunity to represent the cognitive profile of the primary participants as shown in Figures 9.7, 9.8 and 9.9. The characteristics of memory as described by the primary participants reflect their reduced reliance on episodic memory, accompanied by greater reliance on semantic memory, including semantic-memory style strategies (that is, eidetically recorded, third-person observational stance) for remembering personal experience, usually the domain of episodic memory. Profound superiorities in perceptual processing became evident that appear to be a key factor in the giftedness of the participants.

	Episodic	Semantic	Perceptual
Kahla			
Rhoda			
Colin			
Nadia			
Riley			
<b>Legend</b>	Weak	Strong	

**Figure 9.7 General cognitive profile of primary participants**

Figure 9.8 illustrates that, within the overall profile shared by the primary participants, Colin's profile can be distinguished from the others.

	Episodic	Semantic	Perceptual	
Kahla	WEAK	STRONG	ENHANCED	
Rhoda				
Colin				
Nadia				
Riley				
Legend	Weak	Less reliant	Strong	More reliant

**Figure 9.8 Cognitive profile: strengths and weaknesses**

Colin's profile has been represented differently in Figure 9.8, as displaying greater reliance on perceptual memory and less reliance on semantic memory, as his narrative pointed to greater implicit processing and reduced explicit processing.

To represent the cognitive profile of the primary participants alongside their contrasting language capacities, Figure 9.9 includes the apparent language facility of each participant, gauged through their recorded speech and written communication.

	Episodic	<div>Semantic</div> <div>Language</div>	Perceptual
Kahla	Weak	<div>Strong</div> <div>Strong</div>	Enhanced
Rhoda	Weak	<div>Strong</div> <div>Weak</div>	Enhanced
Colin	Weak	<div>Less reliant</div> <div>Weak</div>	Enhanced More reliant
Nadia	Weak	<div>Strong</div> <div>Strong</div>	Enhanced
Riley	Weak	<div>Strong</div> <div>Weak</div>	Enhanced

**Figure 9.9 Cognitive profile: language**

Language is a symbolic system in which two participants were fluent and three were not. Within the general cognitive profile (episodic—weak, semantic—strong, perception—enhanced) shared by the gifted participants with AS, there were differences. These within-group differences hold significant insights that impact the way each person

learns. Figure 9.9 demonstrates the similar profiles of Kahla and Nadia: both hyperlexic; both of whom appear to have external modes of thought via speech, that is, their speech acts as a ‘stream of consciousness’ for them; they know what they think by hearing themselves say it aloud; and, through the medium of (their own) speech, they manipulate their thoughts and arrive at conclusions. In addition, Kahla noted that by speaking aloud, the things she says are retained in memory. Rhoda and Riley have similar profiles to each other that are distinguishable from Kahla’s and Nadia’s. They struggle with all tasks involving language at any level and it is suggested that they are native picture-pattern thinkers (in Temple Grandin’s terms) and that their active, constructive modes of thought do not involve language and therefore require constant interpretation that imposes a heavy cognitive load wherever language is necessary (in reading, handwriting, conversation, and so on). Colin’s profile stands apart: he shares language issues with Rhoda and Riley but, overall, he appears to be less reliant on explicit semantic memory and more reliant on implicit memory.

Representing the cognitive profile of each participant in this way facilitates the generation of pedagogical insights for educators and aligns with the cognitive profile described here.

... blockage of the normative social adaptive trajectories will bias the child to forms of learning that are not grounded in social interaction: for example, preponderance of learning about the physical environment (*e.g.*, physical over social contingencies), rote speech over contextualized communication, hyperlexia over conceptual reading, and memorization of facts and information over episodic and personal information—all of which are features well noted in the later-life clinical expression of autism. (Jones, W. & Klin, 2009, p. 473)

However, as static diagrams, Figures 9.7, 9.8 and 9.9 do not capture the processing integration problems of the different sensual modalities and the cascading impact of poor integration upon higher-order processes such as language (Stevenson, *et al.*, 2014). Also not captured is the missing or reduced temporal processing and binding governing both sensory input and processing across memory systems (Brock, *et al.*, 2002).

## **9.4 Chapter conclusion**

This chapter discussed the key elements of the conceptual framework, the Thinking, Memory and Learning framework (TML), that was the theoretical development activity of this doctoral study: the complete framework is supplied in Appendices B and C. The

five themes that emerged from the case studies were then considered in the light of the TML and, finally, the cognitive profiles of the gifted participants with AS were represented, allowing some comparison. Pedagogical insights arising from this discussion and these findings are considered in Chapter 10.

## Chapter 10 Conclusion

This doctoral study has provided a preliminary phenomenological map of the broad landscape of human experience of thinking and learning in five gifted individuals with Asperger syndrome. Importance was placed on preserving the voice and intention of the participants, however, inexorably, the emergent themes led to life questions of knowledge and identity: ‘knowledge and the knower’ is designated as the super-ordinate theme for this study. The accounts of the primary participants about their learning indicated ontological, epistemological, methodological and axiological problems in relation to knowledge of the world and identity formation. Questions of existence that are challenging for all human beings are even more profoundly challenging when there are qualitative differences in cognitive profile: when the mechanism of knowing that humans employ to establish answers to life-questions functions differently. Tenets of human existence usually beyond question—‘*I know*’—are called into question when the means of knowing is altered and the dominant culture is mindblind to the difference in the few. In this chapter, the super-ordinate theme of ‘knowledge and the knower’ is discussed, the research questions posed in Chapter 3 are addressed, pedagogical insights arising from the findings are presented and questions for future research are posed.

### 10.1 *Knowledge and the knower*

The trustworthiness of one’s knowledge and its relation to identity formation is the point at which the primary participants of this doctoral study have experienced profound issues. Epistemic uncertainty has resulted from constant challenges throughout their lives to their perceived reality, both in their formative years and as adults. Tanweer, Rathbone and Souchay (2010) state that: ‘the integrity of autobiographical knowledge and the self is essential for normal functioning, as autobiographical knowledge is the knowledge base for the self’; and, ‘the relationship between self and memory [is viewed] as a reciprocal one’ (p. 901). Along with Lind and Bowler (2008), they noted that diminished auto-noetic consciousness in individuals with AS leads to a qualitatively different experience of identity.

Epistemic uncertainty is expressed in Kahla’s naïve assumptions about the reality of unicorns and the gods and goddesses of ancient myths, based on her reading about them in books. It is expressed in her adoption of personas from books, such as ‘Pollyanna’, in

her pursuit of a functioning identity that would confer social acceptance. It is expressed in Nadia's use of characters in her play script to wrestle with issues surrounding identity and social acceptance, factoring in autistic perspectives, in parallel with her own struggle for social and self-acceptance. It is expressed in what has been termed in this thesis 'the quest for epistemic certainty'. It exists covertly in the accounts of Rhoda, Colin and Riley: Riley's perseverative and pedantic indexing of knowledge before it is accessible to him for learning and his angst, 'What's wrong with **me**?'; Colin's belief in supernatural intervention to account for his exceptional gifts in wildlife photography and his view of himself as a 'freak' and a 'fraud'; and, Rhoda's dogmatic adherence to process-based, 'logical' thinking, where a narrow, clearly defined frame of reference is necessary in order to acquire knowledge.

### **10.1.1 Learning and knowledge**

In terms of the findings of this doctoral study and the literature that has been reviewed, it is asserted that learning can be defined as the acquisition and application of knowledge (whether learnt in the form of knowledge, understanding or skills) that is retained and accessible through the major systems of human learning and memory. Where one or more of those systems is compromised, learning will have qualitatively different characteristics. In the case of AS, robust findings have established a cognitive profile of diminished episodic memory with possibly superior semantic memory and enhanced perceptual memory.

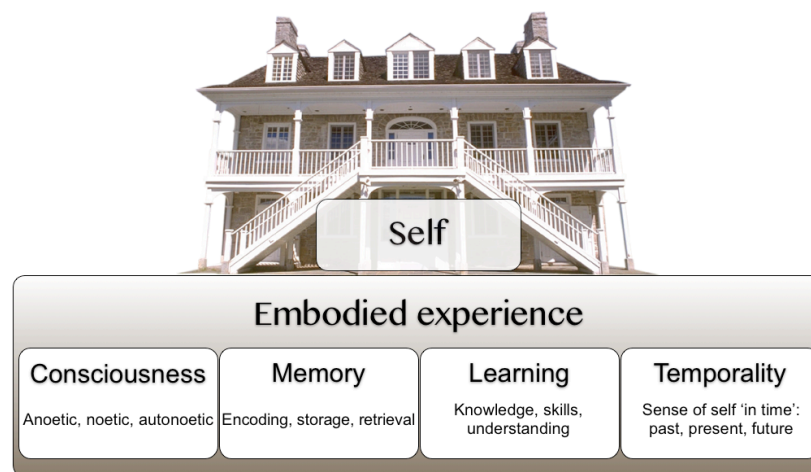
The TML framework (Appendix C) provides a new perspective on the phenomena of learning, knowledge and identity. The following propositional statements flow from the TML and the findings of this study.

- (a) Information processing + Memory = Learning
- (b) Learning is the acquisition of knowledge, skills and understanding, which is demonstrated by appropriate application to authentic, real-world situations.
- (c) Learning, knowledge and identity formation rely upon the human learning and memory systems, therefore: there is no learning without memory; and, there is no identity formation without memory.

- (d) 'Knowledge' (including skills and understanding) is the result of successful learning.
- (e) Compromise to one memory system will result in qualitative differences to learning, mental representation of knowledge, and identity formation.
- (f) In the absence of a robust internalised sense of self, external representations of knowledge and self are necessary.

### 10.1.2 Identity

An individual's identity is formed from personal, embodied experience, incorporating: consciousness (anoetic, noetic, autonoetic) over time (past, present, future), represented (encoded, stored, retrieved) within the human learning and memory systems and applied to the interpretation of one's past, application to one's present, and hope for one's future. To draw these elements together, Figure 10.1 represents the Self as a house sitting on its foundation, which is constructed from consciousness, memory, learning and temporality: according to the reviewed literature, these are formative elements for identity development.



**Figure 10.1 Identity.** Photo used and adapted under licence

The development of trustworthy knowledge, upon which to base one's sense of self, is problematic for individuals with AS as there is: diminished autonoetic consciousness; differences in autobiographical memory; altered learning characteristics; and, compromised temporality. Trustworthy knowledge will be biased away from the elements of identity formation within episodic memory and towards semantic-memory, eidetic-style ways of knowing. This conclusion supports the suggestion that identity formation is 'qualitatively different in individuals with ASD' (Lind & Bowler, 2008, p.

178) and clarifies the philosophical relationship between identity, learning and knowledge.

### 10.1.3 The philosophical questions

The narratives of the primary participants demonstrated that they have an ontological, epistemological, methodological and axiological problem, which is summarised here as the super-ordinate theme of ‘knowledge and the knower’. Lincoln and Guba’s (2013) philosophical questions were adapted in Table 10.1 to frame the issues of reality, identity, knowledge and worth and to propose preliminary statements, based on the research literature, to illuminate the nature of the life questions for the participants.

**Table 10.1 Lincoln and Guba’s philosophical questions adapted and rephrased**

1. The ontological question ‘What is there that can be known?’ Or, to rephrase the question, ‘What is the nature of reality?’	
<b>Rephrased question: What is real?</b> What is the nature of the participants’ beliefs about reality? How do they experience the reality of being themselves? How do they answer the question: Who am I?	<b>Some key points:</b> <ul style="list-style-type: none"> <li>• Participants’ inevitable framing of knowledge in terms of their cognitive profile</li> <li>• Reliance on literality and facticity for meaning-making <i>vs</i> abstraction and meta-representation</li> <li>• Enhanced perception and semantic-memory bias and biased away from episodic memory</li> <li>• Single perspective (AS) <i>vs.</i> multiple perspectives (TD)</li> </ul>
2. The epistemological question: ‘What is the nature of the relationship between the knower and the knowable?’	
<b>Rephrased question: What is true?</b> What is the nature of knowledge to the participants? What is the nature of knowledge of the self to the participants?	<b>Some key points:</b> <ul style="list-style-type: none"> <li>• Lack of awareness of own beliefs and knowledge (ToM)</li> <li>• Reduced capacity to account for multiple perspectives, others’ and own states of mind—across time (past, present, future)</li> <li>• Problems with attribution of knowledge</li> <li>• Problems with trustworthiness of knowledge: other people disagree with the knowledge that I believe is true: differences in perception, social understanding, emotion management</li> <li>• Development of identity biased towards implicit memory systems (anoetic consciousness) and semantic memory system representations (noetic consciousness); and away from episodic memory system representations (autonoetic consciousness)</li> <li>• Externally oriented representations of identity through objects, locations and people (e.g. life partners, not through relationship <i>per se</i> but as external representations of identity)</li> </ul>
3. The methodological question: ‘How does one go about acquiring knowledge?’	
<b>Rephrased question: How can I find out what is true?</b> Given their cognitive profile,	<b>Some key points:</b> <ul style="list-style-type: none"> <li>• Unable to autonoetically draw meaning out of autobiographical memories and personal experience through self-referential</li> </ul>

how have the participants' approached the acquisition of knowledge to answer the identity question: Who am I?	<p>processing, therefore approach search for identity as an object of (noetic) scientific study</p> <ul style="list-style-type: none"> <li>• Study of people may lead to strategy of mirroring expectations of people around them, e.g. 'masquerading' (Carrington &amp; Graham, 2001)</li> <li>• Adoption of identity roles or models from general fiction (Pollyanna) or fantasy (Mr Spock, Data).</li> </ul>
4. The axiological question: 'Of all the knowledge available to me, which is the most valuable, which is the most truthful, which is the most beautiful, which is the most life-enhancing?'	
<p><b>Rephrased question: Am I smart, or am I dumb?</b></p> <p>In the face of the previous philosophical questions, how have participants resolved the question of their own human value? Am I valuable?</p>	<p><b>Some key points:</b></p> <ul style="list-style-type: none"> <li>• Difficulty of arriving at a definitive answer</li> <li>• Internal conflict set up by ambivalent feedback of circumstances and other people</li> </ul>

## 10.2 *The research questions*

With the over-arching question 'How do gifted adults with Asperger syndrome think and learn?', this doctoral study investigated the accounts of learning from five gifted adults with AS, supported by key informant interviews and artefacts. To describe the complex answer to this research question, the TML conceptual framework was developed as an explanatory and theoretical framework for understanding the thinking and learning of gifted individuals with AS. The TML is documented in full in Appendices B and C. Outcomes of the research sub-questions are addressed in this section.

### 10.2.1 **Sub-question 1: Articulating thinking processes**

Can gifted individuals with AS describe how they think and learn? Given the ToM issues noted in the autism research literature, what means will they use to describe their thinking and learning?

The five primary participants in this research were very keen to make a contribution to this study despite the social and communicative challenges the interview situation posed. The interviews, in all cases, were much longer than anticipated but this was required for the participants and researcher to be satisfied that adequate ground had been covered. Some participants struggled to articulate their meaning in words over a sustained period of time (some interviews exceeded two hours and all exceeded one hour) and extra time was allowed to cater for this. Although an interview schedule was given to each

participant prior to the interview, the participant dictated the direction of the interview, to a large extent, to give ample opportunity for participants' experience to be expressed in their own words.

The participants were highly motivated and invested significant time and effort in order to make successful contributions to the research by articulating and communicating their mental experience. Some of the means used by participants to express cognitive experience were somewhat surprising, having not been first encountered in the background literature review. Deeper searches of the literature were required to build an understanding of these phenomena, which were: (a) the extensive use of self-generated metaphors to describe aspects of participants' thinking, memory and inner experience (Section 9.2.2f); and, (b) the descriptions of memory displaying lack of childhood amnesia (Section 4.7.6).

### **10.2.2 Sub-question 2: Cognitive profile**

Is there a distinct cognitive profile (information-processing style, memory, and learning) that emerges from the case studies of gifted individuals with AS?

The distinct cognitive profile of the five cases is discussed in detail in Section 9.3 *Cognitive profiles of cases* and illustrated by Figures 9.7, 9.8 and 9.9. In summary, the narratives of the five primary participants, informed by the research literature, indicated a distinct shared cognitive profile: diminished episodic memory accompanied by strong semantic memory with enhanced perceptual functioning. Within this overall profile, Colin's narrative appeared to indicate greater reliance on implicit processing (procedural and perceptual memory) and reduced reliance on explicit processing (semantic memory). A further variation between the cases was indicated by language, which is just one of hypothetically many symbolic systems. Two cases, Kahla and Nadia, were hyperlexic and appeared to be verbal thinkers while three cases, Rhoda, Colin and Riley, appeared to be 'translating' between language and their native symbolic ways of thinking.

### **10.2.3 Sub-question 3: Pedagogical insights**

What pedagogical insights emerge from the case studies?

The shared cognitive profile across the five cases promoted many pedagogical insights. These are canvassed, separately, in Section 10.3.

#### **10.2.4 Sub-question 4: Theory development**

Do neuroscience, autism and memory research inform educational theory development with respect to learning as it is understood by teachers? Can understandings of thinking, memory and learning from neuroscience and psychology be mapped to a framework that has meaning for teachers seeking to understand differences between the thinking, memory and learning of their typically developing students and their students with AS?

The cross-disciplinary areas of neuroscience and psychology have much to offer the development of learning theory. Over the six years of this study, wide reading of the research literature was conducted. The researcher's school environment for the first four years was the original field for the study and so her knowledge is benchmarked against pedagogical practice at that school at that time: mainstream teachers and pedagogical practice at the school had not yet been significantly impacted by the relevance of neuroscience research for learning. Pedagogical decision-making, which was based on psychological theories that pre-dated newer brain-imaging techniques that call those theories into question, was observed. This is not stated as a criticism, but a reflection of the professional need for a closing of the theory-praxis division. At the school, while engaged with the day-to-day necessities of providing a rigorous education and implementing sound learning theory in many areas, there was little room to reconsider over-arching issues of learning in the light of new research, and yet theoretical understanding about learning itself, to inform pedagogical practice in keeping with current research evidence, is a mission-critical priority for education generally, and for teachers particularly. The development of the TML as an explanatory framework for teacher professional development evolved to meet this need.

The TML has been road-tested with different audiences: feedback from those audiences demonstrates acceptance of the framework as a powerful tool for a consideration of learning and for comparative considerations of the different learning needs of TD students and gifted students with AS. The content matter of the TML is the core business of education and has the potential to contribute significantly to teachers' understanding of thinking and learning. The cross-disciplinary areas of neuroscience and psychology do indeed powerfully inform educational theories of learning and the TML was developed with the aim of applying this understanding to teaching practice and school culture through professional development. The TML is explicated in full in Appendix C.

### 10.3 *Pedagogical insights*

With knowledge of the mental processes of thinking, learning and memory that have been presented in this thesis, summarised in the TML framework, it is anticipated that educators will be able to better account for the individual learning characteristics of their gifted students with AS. In answer to research sub-question 3 (Section 10.2.3), major areas of insight arising from the findings of this doctoral study are presented here for consideration by teachers with the purpose of developing their existing frameworks of pedagogical understanding.

#### 10.3.1 **Language and different mental cultures**

The suggestion of ‘translation’ between the ‘native’ symbolic mode of thought and spoken/written language has been raised throughout this doctoral study: by the literature; within the narratives; and, directly by Wendy, Case 3’s key informant. A number of implications flow from this. Hyperlexia and strong verbal capacity indicate that Kahla and Nadia are either excellent ‘translators’ or they natively, at least in part, are verbal thinkers as well as visual: perhaps ‘bilingual’ (to extend the cultural metaphor). For ‘picture thinkers’ or thinkers in modes other than language, it appears most appropriate to consider those students as though they are second language speakers who are ‘translating’. Time allowed for learning activities, and expectations as to quantity and type of content covered, should be considered in setting achievable learning goals for each student. Further, this perspective **repositions teachers as cross-cultural interpreters of ideas and knowledge**.

#### 10.3.2 **Symbolic modes of thought other than language**

As ‘language translators’, Rhoda, Colin and Riley are at a disadvantage when articulating their own thought processes in words. However, their native modes of thinking, which can’t be described in words, do **not** indicate that an authentic symbolic system of thought is **not** operating. Support for this proposition from eminent quarters is provided by this reflection from Guba.

Years ago I read a book, whose author and title I have long forgotten ... that dealt with the question, ‘Can one think without using language to do it?’ The book consisted of a series of case studies intended to demonstrate that ‘language-less’ thought was possible. I was especially struck by the case of a British mathematician, who claimed that he thought not only without language but without the notational systems common to mathematicians.

Indeed, he argued, he developed his proofs at some inner level of mind that eschewed both words and symbols. But when the proof had to be written down so that it could be communicated to others, it ‘lost in the translation’; that is, it communicated only the surface of the thought and failed to communicate the deeper mental experience. There was much that remained behind, and it was that residue that subsumed much of the ‘beauty’ and ‘elegance’ of the formulation, and perhaps something of its meaning. (Egon G. Guba: My aim and hope, in Lincoln & Guba, 2013, p. 30)

The evidence for wonderful human thought processes is represented by the artefacts the primary participants have produced as a natural outflow of their thinking. Indeed, it is well recognised that AS can confer genius upon an individual as, freed from the constraints of top-down thinking, thinking ‘outside the square’ appears to be intuitive for individuals with AS: Albert Einstein and Temple Grandin are oft-quoted exemplars. However, modes of thought other than verbal and the easy-to-understand ‘thinking in pictures’ may be opaque to verbal-only thinkers.

### 10.3.3 Concepts and concept development

The cognitive profile of diminished episodic reasoning (indicating problems with abstract thinking) does not imply that learners with AS cannot learn concepts. Several authors distinguish between concept **identification** (or rule-learning that allows category identification: such as Temple Grandin’s dog example in Section 5.6.1) and concept **formation** (Gastgeb, *et al.*, 2012; Meyer & Minshew, 2002; Minshew, *et al.*, 2002). Concepts can be learnt as discrete items of knowledge by relying on semantic-style memory strategies, however, the **active personal construction of conceptual understanding** requires the use of abstract reasoning and organising strategies that are the domain of episodic thinking.

Many complex conceptual relationships can be represented visually: for instance, as a concept map that can be memorised and reproduced by an individual with strong visual processing and memory. However, the reproduction, application and generalisation of that knowledge will have different characteristics and be more limited because of the inflexible nature of the way the knowledge was learned. A memorised mind map that shows conceptual relationships is an instance of learning at the lower end of the ladder of mental activities (Figure 10.2). Concept **formation**, being a personal, trustworthy, generalisable act of learning leading to meaning-making, is located near the top of the ladder. This insight helps to explain the rigidity and inflexible thinking of gifted students with AS and highlights that the question for educators may not be ‘What does

my student know?’ but, rather, ‘*How* has my student learnt **that**?’ This approach is likely to give valuable insights to teachers of gifted students with AS on individual ways of thinking and learning.

### 10.3.4 The learning ladder

The ladder of mental learning activities with inverse relationships, repeated here as Figure 10.2, is the concluding point of this study’s investigation of thinking and learning.

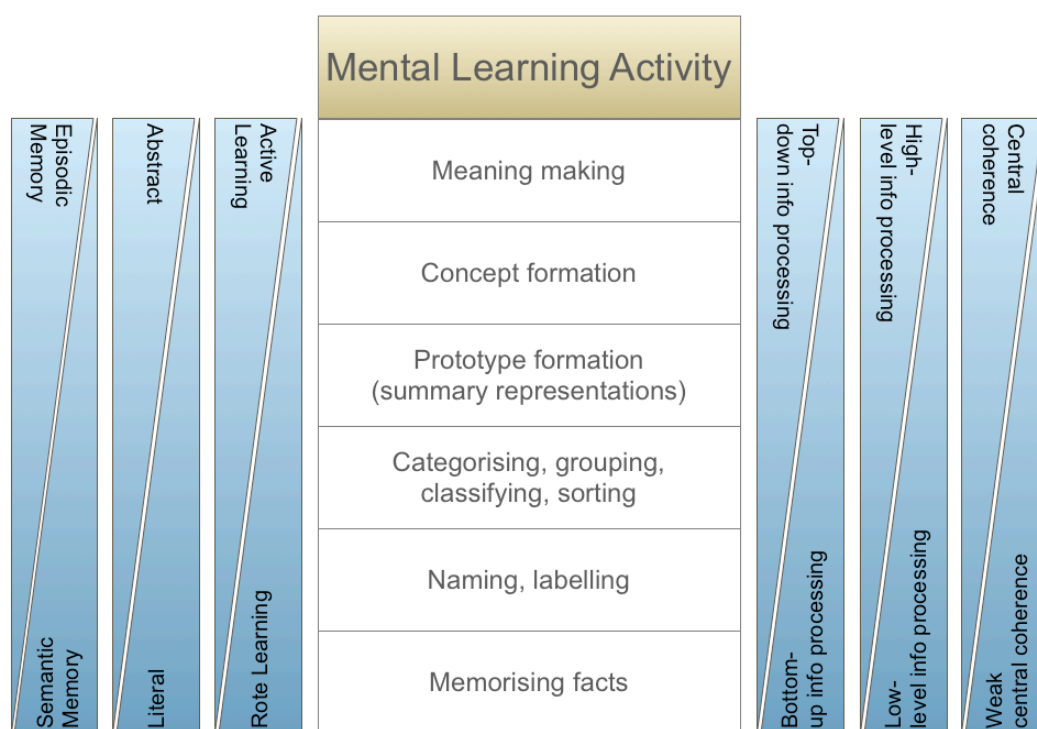


Figure 10.2 Learning Ladder: inverse relationships

Pedagogical insights arising from Figure 10.2 are:

- Within the hierarchy of mental activities, one or more of which will be employed in every lesson given by a teacher, activities focused at the bottom of the ladder will draw upon semantic memory more than episodic memory. Students with AS are likely to shine in these kinds of learning situations: for example, in biology lessons, remembering the facts about plant and animal species, naming and classifying them.
- Learning tasks focused on mental activities at the top of the ladder will greatly disadvantage students with AS and much greater scaffolding will be required for them to learn effectively: for example, a Year 9 English poetry lesson where the

students were instructed to write a ballad based on their own experience. Assuming that the features of a ballad were understood, then this task required the student to understand, construct and articulate a personal perspective employing complex language devices requiring meaning-making and conceptual understanding. This kind of abstract thought is the domain of episodic thinking and a student with AS is unlikely to have developed the neural networks required to think the way one must think if one is to write such a ballad. Therefore, an activity such as this would require extensive scaffolding.

- (c) The inverse relationship shown between literality and abstraction corresponds with the strong semantic and weak episodic memory profile. Literalism refers to an externally oriented focus and is also described in the literature using the terms ‘facticity’, ‘concrete thinking’ and ‘black-and-white thinking’. Therefore, learning environments that draw upon concrete materials and notions that can be represented concretely (for example, through visual diagrams) will assist learners with AS, whereas learning tasks that draw upon abstract notions without some form of concrete representation will most likely disadvantage learners with AS.
- (d) Rote learning of facts relies on semantic processing and is likely to be a strength in gifted students with AS.
- (e) Since students with AS do not benefit from self-referential processing to the same extent as typically developing students, active learning environments are most likely a less effective means of learning for students with AS. In addition, active learning activities may introduce factors that impede learning for these students, such as: successful completion of the task being dependent upon social interaction; or, environmental factors like noise levels that interfere with the student’s thinking and learning.

The other inverse relationships shown in Figure 10.2 relate to the literature on central coherence and information processing, with varying descriptions of the same phenomena: top-down processing *vs.* bottom-up processing; and, high-level information processing using organisational strategies (such as concept development) *vs.* low-level information processing. All the inverse relationships shown in Figure 10.2 correspond to the research on the mental learning activities in the learning ladder and indicate likely

strengths and weaknesses in the function of students with AS in lessons that require students to engage in those mental activities.

### **10.3.5 Teacher perceptual limitations**

Two of the questions raised by the findings of this thesis are:

- (a) Given the enhanced perceptual functioning that potentially confers giftedness upon students with AS, how do teachers create learning environments that foster such giftedness, elements of which may be beyond the teacher's own perception?
- (b) How should such work be assessed and evaluated?

In order to account for the cognitive profile of their gifted students with AS, teachers need to allow for the possibility that their own limitations may inhibit them from being able to **directly** appreciate their students' giftedness. Withholding judgement and conferring respect by learning from the student will be the most appropriate approach. This is an uncomfortable position for teachers to adopt, given that their professional standing positions them as the expert in the classroom, rather than the learner. A genuine commitment to lifelong learning by teachers is called for.

### **10.3.6 The value of rote memory**

It is timely for educators to re-evaluate the post-Bloom de-emphasis on rote learning and factual knowledge. The pendulum-swing towards placing value on active learning and conceptual understanding has unintentionally disadvantaged gifted learners with AS. In many occupations and professions beyond school, vast rote memory for facts remains a huge advantage: law, politics, the sciences, medicine, acting; occupations where the capacity for instant recall of factual information without reference to a book or digital device is valuable.

This thesis contends that the mental learning activities in the learning ladder are all legitimate learning activities that are valuable in their place, from rote learning to meaning making. The de-emphasis of one over another should not be dictated by educational trends but rather each kind of mental activity should be facilitated as a thinking skill to be used in appropriate situations for problem solving and navigation of one's world. Conceptual understanding, by its nature, is more generalisable than factual

knowledge and is certainly crucial for this reason, however, rote-learned knowledge also has a place of value within education that should not be overlooked.

### 10.3.7 Heuristics

This section concludes the pedagogical insights by distilling further ideas into heuristic form for teachers' consideration as a summary of key ideas from this thesis.

- (a) The mainstream curriculum and school environment was designed for students with typically developing cognitive profiles: students with AS have a different cognitive profile.
- (b) The diminution of episodic memory has negative implications for: learning through experience; identity formation; temporal judgments; source attribution of knowledge; and, memory retrieval through mental time travel. Teaching methods and learning activities that assume students' capacity in these areas are unlikely to be effective as the thinking and learning characteristics of students with AS have not been taken into account.
- (c) Gifted students with AS are using huge amounts of mental and emotional energy to compensate: socially, communicatively and in their learning. This feature of their learning should be recognised with accommodations such as extra time and favourable environments to facilitate their learning.
- (d) Students who natively think in symbolic modes other than language are mentally and emotionally working much harder than verbal thinkers in verbally mediated learning environments. Extra time and consideration should be factored in, as for second language speakers.
- (e) Gifted students with AS will most likely self-direct their learning for things they are interested in. Kahla's, Rhoda's and Riley's education was **enhanced** by extended periods of time (months) spent at home recuperating from illness and accident. During this time, they directed their own learning based on interest and self-motivation, and developed a lifelong love of learning.

- (f) Being **at** school presents perceptual, social, and communication challenges that are the main impediments to learning, rather than the intellectual learning process itself.
- (g) Providing an accommodating learning environment entails catering for the perceptual, social and communication challenges to allow gifted students with AS to capitalise on their intellectual strengths and be supported appropriately in their weaknesses.
- (h) Teachers can be considered as cross-cultural interpreters of ideas and learning as gifted students with AS, most likely, experience a different mental culture. In parallel with students experiencing education delivered in a language that is not their native language, it is appropriate that students with AS should be given accommodations for learning and assessment.
- (i) The most suitable teacher for a gifted student with AS is one who is proactively understanding and respectful of the student's capacities and needs, who maintains routine and consistency but retains the capacity for institutional flexibility when the student is effectively engaged in learning.
- (j) Students with AS are said to be 'mind blind' but schools that do not account for the different cognitive profile of students are themselves 'mind blind'.

#### **10.4      *Questions for future research***

An unresolved question arising from this doctoral study is the nature of the learning experienced by young people who have received a diagnosis and intervention early in their development. The case of Nadia, a young woman of 18 years and still at school at the time of her participation, poses this question. Nadia's capacity to engage in reciprocal, spoken interaction with the interviewer and to deliver a short, well-structured monologue of interest contrasts to the long, single-track, linear monologues of Colin and Riley. A feature of Nadia's case was the expert social and communication skills coaching she had received throughout her formative years.

The questions posed by Nadia's case are: 'Is the learning that Nadia demonstrated **compensatory** or **corrective**?'; 'Has Nadia's brain developed differently (along a more typical developmental path) as a result of the interventions during her formative years?';

or, ‘Is it simply the case that the combination of expert invention and her hyperlexia enabled her to demonstrate nuanced communication and thinking skills unusual in an individual with AS?’

## **10.5      *Informing future research***

This doctoral study informs future research by providing interpreted first-hand accounts of human lived experience as a wide frame of reference: a phenomenological ‘map of the landscape’ in the realm of cognition of gifted individuals experiencing AS. As an open-ended investigation of a phenomenon, the study covered a lot of ground and more questions were posed than answered (see, for example, Table 10.1). The metaphor of an explorer mapping unknown terrain as a first draft, perhaps not to a great degree of accuracy, comes to mind. Even so, the early map may be a valuable scaffold that points the way to the work needed in the future to fill in the detail. Quantitative studies, by their nature, focus an intense research ‘gaze’ on minute parts of the ‘pixelated landscape’. As Gardiner has suggested (see Section 3.2 and Figure 3.1), quantitative research studies may well be guided by the broader map of the landscape provided by studies such as this one so that overall direction and purpose of the research effort is situated within the scaffold of real-life human experience. Interestingly, building an understanding of broader human experience into a quantitative researcher’s awareness equates to incorporating a top-down view of the research endeavour itself to balance out the ‘bottom-up’, detail-focused processing of scientific research.

The unfolding conceptual understanding of what it is like to be autistic, first posited by Frith and Happé (1999), is of great interest to the individuals with AS in this study. The value to learners with AS of having teachers who share this understanding, even though the individuals themselves may be unable to reflect upon, or articulate characteristics of, their own thinking and learning, cannot be underestimated. Such teachers could be cherry-picked for mainstream classes with individuals with AS, a feature of Nadia’s schooling that she reported as highly effective. Teacher knowledge of the cognitive characteristics of AS is potentially of profound importance to students with AS.

Furthermore, as one pupil observed ...: ‘It is the teachers [that] are rubbish – they know about their subject but they know nothing about us with Asperger’s syndrome but then why should they – they’ve never been told – they’re not specially trained to deal with people with special needs’. (Humphrey & Lewis, 2008, p. 39)

The viewpoint expressed by this student was embedded in all five case studies of this doctoral study: none of the older four primary participants felt understood by their teachers, with only one or two exceptions. Nadia experienced greater acceptance and understanding from her teachers but described the trauma associated with having one substitute teacher who did not share this understanding. Therefore, with the low-resolution ‘pixelated’ view provided by this study comes the opportunity for future educational studies to ‘sharpen the view’, filling in the detail and making these insights available so that educators can work with, not against or in ignorance of, their learners’ cognitive strengths and weaknesses.

Arising from this doctoral study, some examples of possible future research directions are: (a) diminished episodic memory and the learning characteristics of individuals with AS with regard to temporality; (b) the role of a different sense of self-consciousness and identity, and its impact on learning; (c) the effect of increased understanding of cognitive learning characteristics by teachers upon student learning; (d) an examination of the proposal of ‘native’ modes of thought and the possible need by some learners to translate to and from language; (e) investigation of enhanced perceptual functioning and the triggers for phobias and meltdowns; (f) characteristics of long-term successful relationships between an NT partner and an individual with AS; and, (g) the high incidence of left-handedness among individuals with AS and the impact of this phenomenon on learning.

The massive research effort currently underway worldwide is well justified for the conceptual understanding it has already delivered in the decades since Lorna Wing first used the term ‘Asperger’s syndrome’ in 1981 and the publication of Frith’s translation of Hans Asperger’s work in 1991 (Happé, 1994). The five explanatory theories (see Figure 4.10): theory of mind; central coherence; executive function; amygdala theory; and, enhanced perceptual functioning; each represent a promising school of thought within the research community that is of potentially high value to education. Translating some of the value of that ongoing research effort into an amenable form for teacher professional development has been one of the challenges undertaken by this doctoral research, upon which future educational research could expand.

## **10.6 Conclusion**

This thesis contributes a new perspective to educational research through five phenomenological case studies utilising interpretative phenomenological analysis. The case studies were analysed in the light of an iterative literature review of neuroscience, autism and education research pertaining to thinking, memory and learning. The findings have relevance for all educators through the theory development of the Teaching, Memory and Learning Framework (TML) that was the theoretical output of the study. During the course of the study, the relevance of the content matter to parents, life partners and gifted individuals with AS was uncovered.

The study presents a series of challenges to educators.

- (a) How do we learn to value modes of thought other than our own?
- (b) How do we learn to respect and nurture the enhanced perception and giftedness of gifted individuals with AS when our own perception is more limited?
- (c) Without an understanding of the thinking and learning of gifted students with AS, assumptions about learning have been imposed upon our least cognitively flexible students, forcing them to adapt to learning environments constructed for TD learners. Where this is the case, those schools have a 'mindblind' pedagogical approach to the learning of those students. This study exposes the irony of our own mindblindness, while gifted students with AS have been characterised as mindblind. The challenge is to rectify this problem through a culture-shift within education, taking distinct cognitive profiles into account.
- (d) Our challenge is to side-step those educational trends that are not based on solid evidence and instead align our pedagogical practice with the robust findings of cross-disciplinary research pertaining to thinking and learning.
- (e) A further challenge is to enter into the mental world of our gifted students with AS and afford their learning the same consideration and respect that we confer upon TD students, based upon their cognitive profile: constructing teaching and learning environments that cater for all students' ways of learning.

The final word in this thesis is imparted to Oliver Sacks, commenting on Temple Grandin's own descriptions of her memory. Professor Sacks captures the many idiosyncrasies of the debate surrounding the qualitative characteristics of mental experience this thesis has attempted to describe and interpret: externally oriented thinking; eidetic imagery; visual processing; sensory integration; sense of self; perceptual processing; semantic memory; episodic memory; and, the different forms of consciousness, autonoetic, noetic and anoetic. Sacks commented:

The psychologist Frederic Bartlett writes of remembering as 'reconstruction', but for Temple (as for Stephen [Wiltshire]), seemingly, this does not occur, or occurs to a much smaller extent than usual. Nor is memory, for her, entirely internalized as part of the self - thus her frequent allusions to 'videotapes' and 'computer records', and other external forms of memory storage.

Temple's self-description here is intriguingly at odds with some of the current formulations of imagery and memory, as conceived by Damasio, Edelman, and others. Thus Damasio writes, in *Descartes' Error*:

Images are *not* stored as facsimile pictures of things, or events, or words, or sentences. The brain does not file Polaroid pictures of people, objects, landscapes; nor does it store audiotapes of music and speech; it does not store films of scenes in our lives. ... In brief, there seems to be no permanently held pictures of anything, even miniaturized, no microfiches or microfilms, no hard copies.

Yet this, Damasio emphasizes, 'must be reconciled with the sensation ... that we *can* conjure up' such reproductions or facsimile images. One must wonder, if this is the case, whether Temple – and also Franco and Stephen (and Luria's Mnemonist) – are merely, like the rest of us, susceptible to an *illusion* of reproduction, or whether in fact (as Jerome Bruner suggests) there may be in them **some failure of integration of perceptual systems with higher integrative ones, and with concepts of self, so that *relatively* unprocessed, uninterpreted, unrevised images persist.** (Sacks, 1995, p. 269) [emphasis added]

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## **Appendices**

Appendix A	Interview schedules and Ethics Approval
Appendix B	Hierarchy of thinking and learning activities in education: Literature review summary
Appendix C	The Thinking, Memory and Learning Framework (TML)

## Interview Schedule for Primary Participants

**Semi-structured interview:** Apart from the first question, questions are designed to elicit **personal narratives** containing relevant biographical data, experiences, reflections, memories, beliefs, opinions.

1. Please tell me if there are other questions I should ask you to find out how you think and learn.
2. How did your diagnosis or suspicion of Asperger syndrome come about?
3. This study is investigating how people with Asperger syndrome learn. What are your thoughts about learning and Asperger syndrome?
4. Tell me about your 'mind'. Memory.
5. Do you learn in the same way as a person without Asperger syndrome?
6. Do you have a learning disability or disorder? (Diagnosed or suspected)
7. Are you gifted/intelligent/smart?
8. What are your gifts and areas of interest?
9. What are your memories of your school experience?
10. Did school recognise/foster/nurture your intelligence/giftedness?
11. Do you have particular learning needs or requirements?
12. When/how/where do you learn best?
13. What impedes your learning?
14. What do you think Asperger syndrome is?
15. How does having Asperger syndrome affect your life?
16. If you could go back in time, knowing what you know now, and speak to your school teachers and parents, what would you want them to know so they could make learning highly effective for you?
17. Do you have any other thoughts or reflections about Asperger's and learning which might contribute towards a better understanding of how people with Asperger syndrome learn?

**Thank you for your valuable contribution!**

## Interview Schedule for Key Informants

**Semi-structured interview:** Apart from the first question, questions are designed to elicit **personal narratives** containing relevant biographical data, experiences, reflections, memories, beliefs, opinions.

1. What is your relationship to the person with Asperger syndrome?

Husband    Wife            Partner    Mother    Father    Sibling    Friend

Other: \_\_\_\_\_

2. How did the diagnosis or suspicion of Asperger syndrome come about?
3. This study is investigating how people with Asperger syndrome learn. What are your thoughts about learning and Asperger syndrome?
4. Tell me about their 'mind'. Memory.
5. Do they learn in the same way as a person without Asperger syndrome?
6. Do they have a learning disability or disorder? (Diagnosed or suspected)
7. Are they gifted/intelligent/smart?
8. What are their gifts/areas of interest?
9. What are your memories of their school experience? [Establish age/stage of schooling for each reflection]
10. School issues and experiences, positive and negative
11. Did school recognise, foster or nurture their intelligence and gifts?
12. Do they have particular learning needs or requirements?
13. When, how and where do they learn best?
14. What impedes their learning?
15. What do you think Asperger syndrome is?
16. How does having Asperger syndrome affect their life?
17. If you could go back in time, knowing what you know now, what would you want school teachers to know so they could make learning highly effective for people with Asperger's?
18. Do you have any other thoughts or reflections about Asperger's and learning which might contribute towards a better understanding of how people with Asperger syndrome learn?

**Thank you for your valuable contribution!**



## CONFIRMATION OF APPROVAL

In reply please quote: ES:CJ: HE10/236

Further Enquiries Phone: 4221 4457

25 November 2010

Mrs Nola Norris  
11 Denbigh Place  
Harrington Park NSW 2567

Dear Mrs Norris

Thank you for your correspondence of 16 November 2010. I am pleased to advise that the the Human Research Ethics application listed below has been approved.

1. Please ensure that the information provided in your response to the initial review is included on the Participation Information Sheet:  
*"In the event that a participant experiences distress, a referral to an appropriate counsellor will be provided. In a school with a school counsellor where a young person becomes distressed, the participant will be referred to the school counsellor. In the case of an adult, the participant will be referred to an appropriate agency."*
2. Please forward a copy of the revised Participant Information Sheet to the Human Research Ethics Committee for our records.

Ethics Number: HE10/236  
Project Title: How do people with Asperger Syndrome learn?  
Name of Researchers: Mrs Nola Norris, Dr Roselyn Dixon, Dr Gordon Brown  
Approval Date: 23 November 2010  
Expiry Date: 22 November 2011

Please remember that the HREC has reviewed the research proposal for compliance with the *National Statement* and approval of this project is conditional upon your continuing compliance with this document. As evidence of continuing compliance, the Human Research Ethics Committee requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

You are also required to complete monitoring reports annually and at the end of your project. These reports are sent out approximately 6 weeks prior to the date your ethics approval expires, or can be downloaded from the web. The reports must be completed, signed by the appropriate Head of School, and returned to the Research Services Office prior to the expiry date.

Yours Sincerely,

PP

A/Professor Steven Roodenrys  
Chairperson Human Research Ethics Committee

Cc Dr Rose Dixon, Faculty of Education

**RENEWAL APPROVED**

In reply please quote: HE10/236

Further Enquiries Phone: 4221 3386

ES:MOT

10 November 2011

Mrs Nola Norris  
11 Denbigh Place  
HARRINGTON PARK NSW 2567

Dear Mrs Norris,

Thank you for submitting the progress report. I am pleased to advise that **renewal** of the following Human Research Ethics application has been **approved**.

Ethics Number: HE10/236  
Project Title: How do people with Asperger Syndrome learn?  
Researchers: Mrs Nola Norris, Dr Roselyn Dixon, Dr Gordon Brown  
Date Approved: 10 November 2011  
Renewed From: 23 November 2011  
New Expiry Date: 22 November 2012

Please note that approvals are granted for a twelve month period. Further extension will be considered on receipt of a progress report prior to expiry date.

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

Yours sincerely,

Associate Professor Sarah Ferber  
**Chair, UOW & ISLHD Health and Medical  
Human Research Ethics Committee**

cc: Dr Rose Dixon, Faculty of Education, Bldg 67.314

**RENEWAL APPROVAL**

**In reply please quote: HE10/236**

Further Enquiries Phone: 4221 3386

18 December 2012

Mrs Nola Norris  
11 Denbigh Place  
HARRINGTON PARK NSW 2567

Dear Mrs Norris

Thank you for submitting the progress report. I am pleased to advise that renewal of the following Human Research Ethics application has been approved. This certificate relates to the research protocol submitted in your original application and all approved amendments to date.

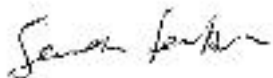
Ethics Number:	HE10/236
Project Title:	How do people with Asperger Syndrome learn?
Name of Researchers:	Mrs Nola Norris, Dr Roselyn Dixon, Dr Gordon Brown
Approved from:	23 November 2012
Expiry Date:	22 November 2013

Please note that approvals are granted for a twelve month period. Further extension will be considered on receipt of a progress report prior to expiry date.

This certificate relates to the research protocol submitted in your original application and all approved amendments to date. Please remember that in addition to completing an annual report the Human Research Ethics Committee also requires that researchers immediately report:

- proposed changes to the protocol including changes to investigators involved
- serious or unexpected adverse effects on participants
- unforeseen events that might affect continued ethical acceptability of the project.

Yours sincerely



Associate Professor Sarah Ferber  
Chair, UOW & ISLHD Health and Medical  
Human Research Ethics Committee

cc: Dr Rose Dixon, Faculty of Education, Bldg 67.314

**Appendix B: Hierarchy of thinking and learning activities in education: Literature review summary**

Type of thinking & learning activity	Type of knowledge	Description	Memory storage implications	AS vs TD	References
<i>Development of beliefs and values systems</i>	Philosophy	Beliefs as basis for understanding and interacting with one's world	Interaction with the world based on 'intuitive' world view.	AS may not be able to engage consciously in the same way as TD due to impaired complex information processing, reliance on semantic memory / literality / facticity.	1 2 3 4
<i>Self-referential processing Meaning making</i>	Autonoetic consciousness, source memory, prospective memory	World view: active, constructed knowledge of the world tested over time against experienced reality	Conceptual frameworks very efficient, incorporate experience, account for facts, strive for internal consistency, seat of learning, understanding.	Meaning-making in AS is impaired in favour of perceptual processing. Memory in AS impaired in relatively more complex high-level information processing, intact in less demanding cognitive processing tasks. Temporal concepts impaired in AS while clock & calendar time intact.	5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
<i>Concept formation Generativity (creativity)</i>	Conceptual understanding, generalisable knowledge	Relating ideas into a meaningful 'whole' or higher representation	Episodic memory encodes relationships & dynamic elements such as time & change, not possible in semantic memory. Ability to generalise adds layer of efficiency.	Problem in AS with concept formation, complex information processing, abstraction, organising strategies in learning. Weak central coherence in AS results in greater focus on detail without context. Central coherence equates to concept formation. Generating novel ideas is impaired, required for problem solving and schema formation. Capacity to generalise impaired in AS.	20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
<i>Prototype formation</i>	Pre-concept based on categorisation	Summary representation	Prototype formation memory-efficient as it avoids the need to memorise every instance or variation.	TD form prototypes for efficient memory encoding & retrieval. Prototype formation impaired in AS.	37 38 39 40 41 42 43 44 45
<i>Categorisation Grouping Classifying Sorting</i>	Active mental manipulation of ideas	Shared criteria	Indexing requires 'memory binding' or 'relational memory' and is more efficient than rote memory.	Binding is a process of episodic memory. AS most likely rote-remembers each instance and its grouping. TD most likely indexes by category criteria.	46 47 48 49 50 51 52 53 54 55 56 57 58
<i>Naming Labelling</i>	Language	Language contains/represents objects, ideas	AS's principal storage process may be visual ('eidetic') rather than language-based. Language processing affected in ASD.	Impaired language processing in AS, e.g. pronoun confusion, intentional cues, pragmatics, prosody.	59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84
<i>Rote learning</i>	Facts	Literal Concrete	Rote-learned facts stored in semantic memory.	Semantic memory intact or superior in AS. AS traits of literality, preference for sameness, state-dependent recall ('associative learning'), cued recall. AS preference for routine and rote-learned sequences.	85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105

**Abbreviations:** TD = typical development (neurotypical), AS = Asperger syndrome, ASD = Autism spectrum disorders, ToM = Theory of Mind

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## Appendix C: The Thinking, Memory and Learning Framework

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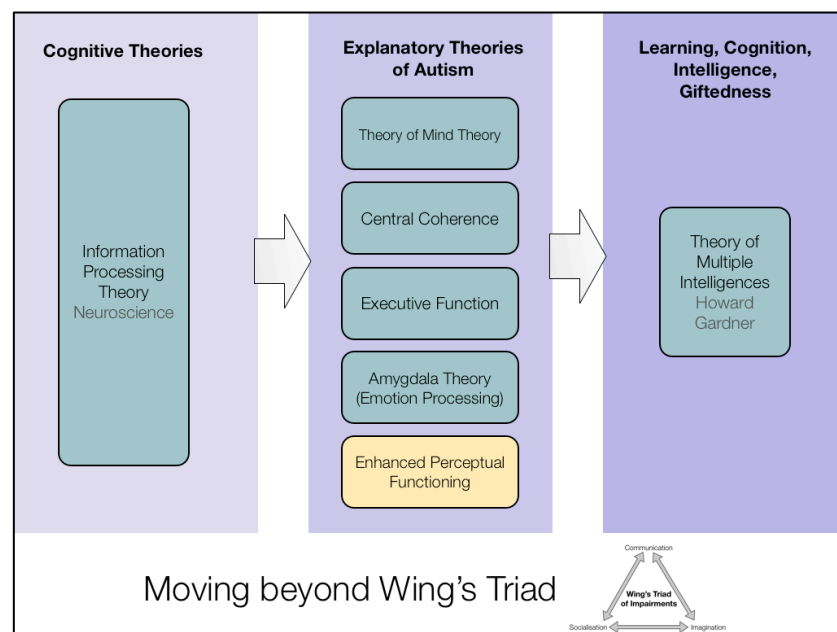


## The Thinking, Memory and Learning Framework (TML)

In this appendix, the conceptual framework—the ‘Thinking, Memory and Learning Framework’ (TML)—that is the theoretical output of this doctoral study, is presented in full. The TML is intended as a professional development (PD) package. The components of the TML have been ‘road-tested’ in PD sessions with stakeholder audiences, including teachers, family members and individuals with AS, throughout the study.

### *Theoretical framework*

From a phenomenological perspective, the starting point of the conceptual framework was the theoretical framework for this doctoral study, shown in Figure 1. The original version (Figure 2.6) did not capture all the nuances within the literature that are of value to an educational audience.



**Figure 1 Moving beyond Wing's Triad**

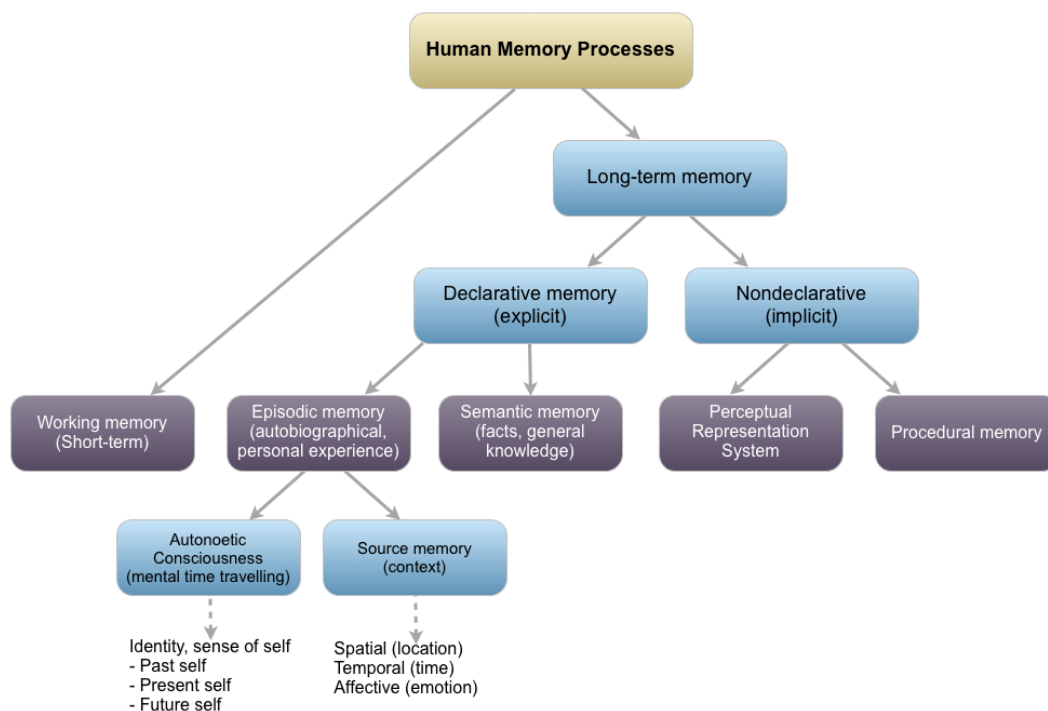
The addition of ‘Enhanced Perceptual Functioning’ to the explanatory theories in the theoretical framework (see also Figure 4.10) was indicated by the problem of locating the literature on the phenomenon of sensory sensitivities within the other theories: aspects of sensory sensitivities could be explained but there was not a complete and comfortable ‘fit’. With increased understanding of Tulving’s memory systems framework, accompanied by the discovery of the proposition of enhanced perceptual

functioning in autism (Motttron, Dawson, Soulières, Hubert & Burack, 2006), this problem was resolved and Enhanced Perceptual Functioning was added as the fifth explanatory theory.

Attempts to map more complex insights about thinking, memory and learning from the neuroscience and autism literature onto the theoretical framework were unproductive. This provided the impetus that led to the creation of further sections in the TML framework.

## Memory systems

Tulving's human learning and memory framework is the second component of the TML and provides the basis for an understanding of the research on memory in autism (see also Figures 1.5 and 4.3). It affords a consideration of the cognitive profile of the primary participants so that the cognitive profiles can be compared with each other and contrasted to typically developing individuals.



**Figure 2 Human learning and memory systems showing autooetic consciousness and source memory**

Autooetic consciousness, mental time travel, identity, temporality and source memory have been added to the memory framework in Figure 2 to reflect key elements of episodic memory that are impaired in AS.

## Mapping autism theories to memory systems

Based on a literature review, a conceptual map of key terms was compiled as a table. Originally presented as Table 4.3 in the thesis, the table is repeated here to show its location in the development of the TML framework.

**Table 1 Mapping autism theories to Tulving's memory systems**

Episodic memory	Semantic memory	Perceptual memory
<b>Type of consciousness</b>		
Autonoetic consciousness	Noetic consciousness	Anoetic consciousness
<b>Explanatory theories associated with this memory system</b>		
(Strong) Central coherence Executive function	Weak central coherence	Enhanced perceptual functioning
<b>Mental construct functions</b>		
Prototype formation Concept formation Meaning-making	Naming, labelling, classifying Simple category formation	
<b>Critical features</b>		
Source memory Temporal memory Prospective memory Relational memory Autobiographical memory Greater role of self-referential processing	Single-item memory Item-specific memory Symbolic systems e.g. language, mathematics, visual symbols Rote memory Associative thinking	Sensory processing Experiential
<b>Processes and descriptions associated with this memory system</b> <div> <div> <b>Top-down processing</b>            Other terms: Global processing, gestalt, high-level or complex information processing         </div> <div> <b>Bottom-up processing</b>            Other terms: detail-focused processing, local processing, low-level processing         </div> </div>		
Mental representation Top-down, global processing High-level processing Complex information processing Memory for personal experience Subjective Contextual (spatial, temporal, affective) Memory binding Abstract reasoning Organising strategies Interpretative, constructive Metacognitive	Mental representation Bottom-up, local, detail-focused or low-level processing Not contextual No memory binding Not interpretative Literal, concrete Object-focused	No mental representation Direct perception Low-level processing Raw experience Being 'in the moment' Registration of sensory input Sensory sensitivities in ASD

***A learning hierarchy***

A conceptual hierarchy became apparent from further extended reading of the literature. The extended body of literature was summarised into a table for ease of reference to confirm and support the emergent hierarchical relationships (see Table 2 on the following page). The full version of Table 2 is presented with footnoted references and a bibliography in Appendix B.

**Table 2 Hierarchy of thinking and learning activities in education**

Type of thinking & learning activity	Type of knowledge	Description	Memory storage implications	AS vs TD
<i>Development of beliefs and values systems</i>	Philosophy	Beliefs as basis for understanding and interacting with one's world	Interaction with the world based on 'intuitive' world view.	AS may not be able to engage consciously in the same way as TD due to impaired complex information processing, reliance on semantic memory / literacy / facticity.
<i>Self-referential processing Meaning making</i>	Autonoetic consciousness, source memory, prospective memory	World view: active, constructed knowledge of the world tested over time against experienced reality	Conceptual frameworks very efficient, incorporate experience, account for facts, strive for internal consistency, seat of learning, understanding.	Meaning-making in AS is impaired in favour of perceptual processing. Memory in AS impaired in relatively more complex high-level information processing, intact in less demanding cognitive processing tasks. Temporal concepts impaired in AS while clock & calendar time intact.
<i>Concept formation Generativity (creativity)</i>	Conceptual understanding, generalisable knowledge	Relating ideas into a meaningful 'whole' or higher representation	Episodic memory encodes relationships & dynamic elements such as time & change, not possible in semantic memory. Ability to generalise adds layer of efficiency.	Problem in AS with concept formation, complex information processing, abstraction, organising strategies in learning. Weak central coherence in AS results in greater focus on detail without context. Central coherence equates to concept formation. Generating novel ideas is impaired, required for problem solving and schema formation. Capacity to generalise impaired in AS.
<i>Prototype formation</i>	Pre-concept based on categorisation	Summary representation	Prototype formation memory-efficient as it avoids the need to memorise every instance or variation.	TD form prototypes for efficient memory encoding & retrieval. Prototype formation impaired in AS.
<i>Categorisation Grouping Classifying Sorting</i>	Active mental manipulation of ideas	Shared criteria	Indexing requires 'memory binding' or 'relational memory' and is more efficient than rote memory.	Binding is a process of episodic memory. AS most likely rote-remembers each instance and its grouping. TD most likely indexes by category criteria.
<i>Naming Labelling</i>	Language	Language contains/represents objects, ideas	AS's principal storage process may be visual ('eidetic') rather than language-based. Language processing affected in ASD.	Impaired language processing in AS, e.g. pronoun confusion, intentional cues, pragmatics, prosody.
<i>Rote learning</i>	Facts	Literal Concrete	Rote-learned facts stored in semantic memory.	Semantic memory intact or superior in AS. AS traits of literacy, preference for sameness, state-dependent recall ('associative learning'), cued recall. AS preference for routine and rote-learned sequences.

**Abbreviations:** TD = typical development (neurotypical), AS = Asperger syndrome, ASD = Autism spectrum disorders, ToM = Theory of Mind

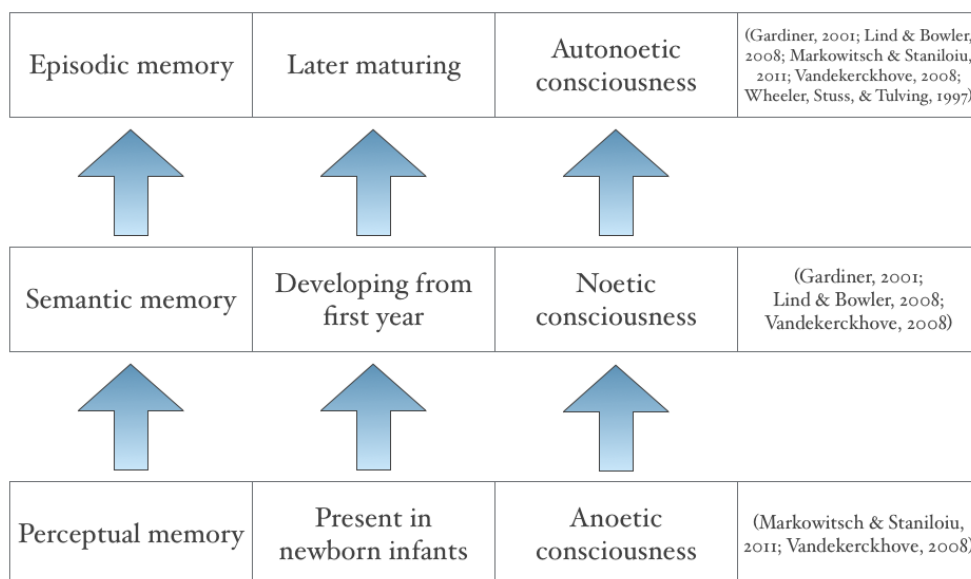
For the references associated with each category see Appendix B.

Figure 3 shows a simplified version of Table 2 that is suitable for teacher PD presentations: the blue arrows indicate later-developing memory systems.

Descriptive terms	Type of information processing or thinking	Memory System	Content	State of self awareness	Subjective characteristics of memory type	Indicative References
Declarative/ Conscious/ Explicit	Abstract thinking: includes ToM	Episodic Memory	Personal experience, context memories, source monitoring, relational memory, abstract representation	Autonoetic (self-knowing) consciousness 'remembering'	Personal involvement, mental 'time travelling'	Johnson & Chalfonte (1994); Lind & Bowler (2010); Minshew & Meyer (2002); Wheeler, Stuss, Tulving (1997).
	Concrete thinking	Semantic Memory	Facts, general knowledge, symbolic representation	Noetic (knowing) consciousness 'knowing'	Familiarity	Gardiner (2001); Lind & Bowler (2008); Vandekerckhove (2008).
Non-declarative/ Unconscious/ Implicit	Sensory input	Perceptual Representation System	Sensory experiences and input	Anoetic (unknowing) consciousness	Raw experience	Markowitsch & Staniloiu (2011); Vandekerckhove (2008).
	Encoded routines e.g. muscle memory	Procedural Memory	Automatised routines, motor-related skills	Anoetic (unknowing) consciousness	Competency in motor skills	Markowitsch & Staniloiu (2011); Vandekerckhove, 2008.

**Figure 3 Hierarchy within long-term memory systems**

Figure 4 (see also Figures 4.8 and 9.2) is a yet more simplified version of the hierarchy within the three memory systems of interest to this doctoral study: it shows the relationships between the memory systems and the three forms of consciousness. It also factors in the human developmental pathway and provides indicative references.



**Figure 4 Hierarchy of learning and memory systems and their associated forms of consciousness**

## Characteristics of thinking associated with learning and memory systems

The next development of the TML framework was to correlate literature references about characteristics of processing, which occurs in working memory, to the long-term memory systems. Figure 5 illustrates this. Working memory is the interface with each of the other memory systems (Baddeley, 1994; Markowitsch & Staniloiu, 2011), therefore, from its place in Figure 2, working memory was moved beneath the other four memory systems. Major characteristics of thinking that recurred in the literature were then mapped to the long-term memory system to which each characteristic aligns. This allows the characteristics of thinking and learning that will be compromised when one memory system is compromised (episodic memory in the case of AS) to become apparent.

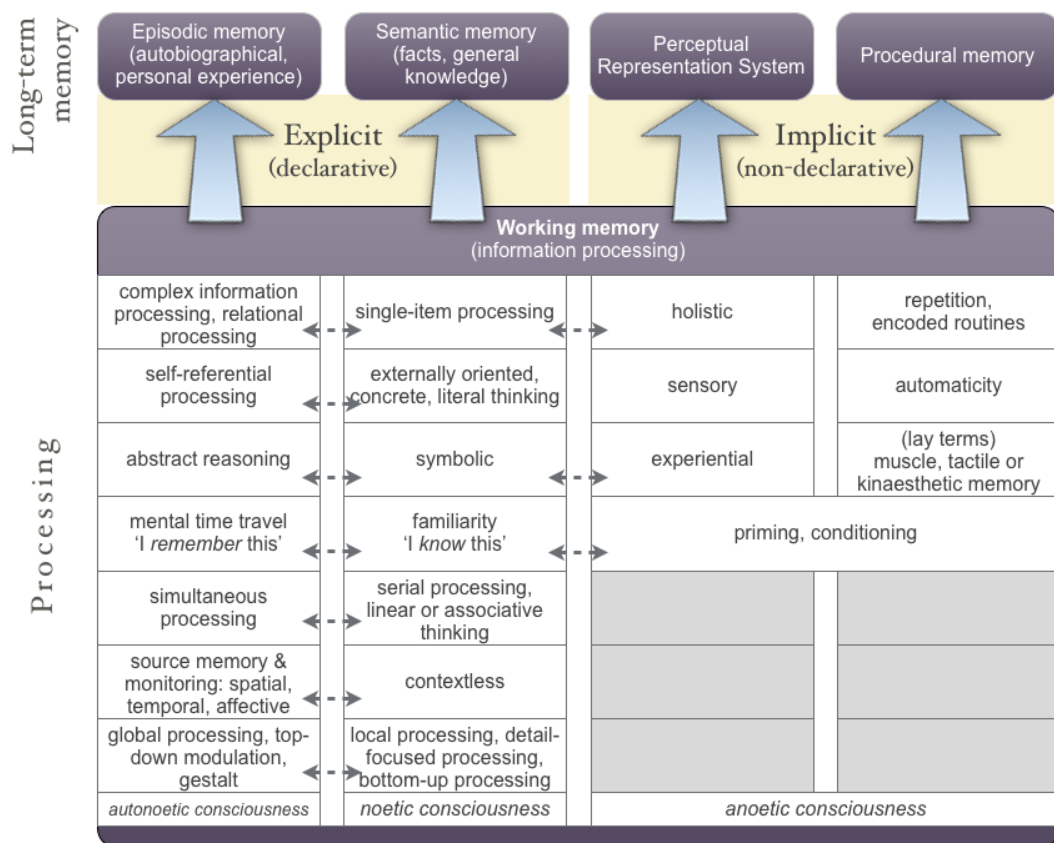


Figure 5 Characteristics of thinking associated with the learning and memory systems

Figure 5 was presented within the thesis as Figure 9.1.

## ‘Learning Ladder’

The hierarchy of thinking and learning activities listed in the first column of Table 2 was simplified: the hierarchical ‘ladder’ of mental activities allows a series of inverse relationships to become apparent. Figures 6 and 7 were presented in Chapters 9 and 10 in the thesis as Figures 9.3 and 9.5/10.2.

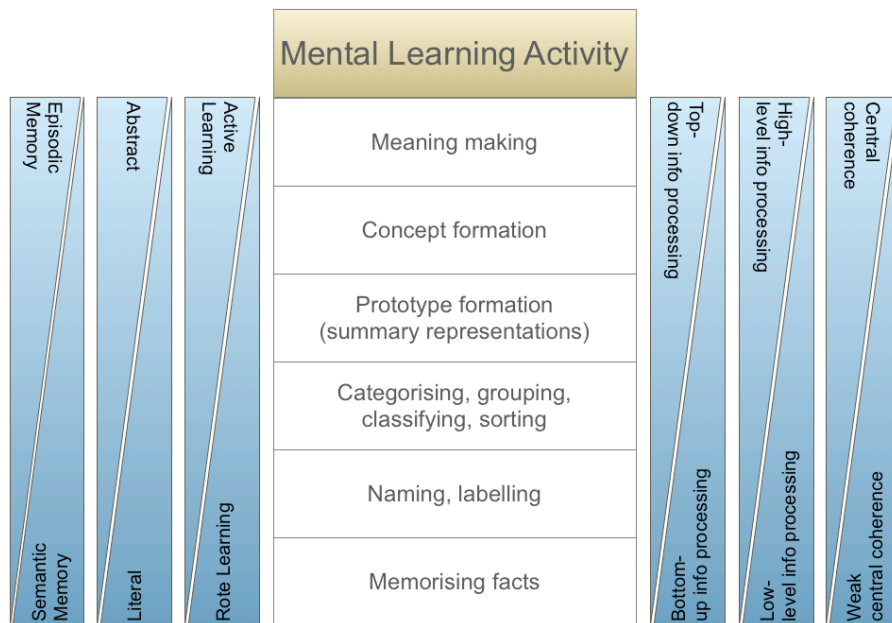


Figure 6 Learning Ladder: inverse relationships

Figure 7 adds the inverse relationship for learners with AS.

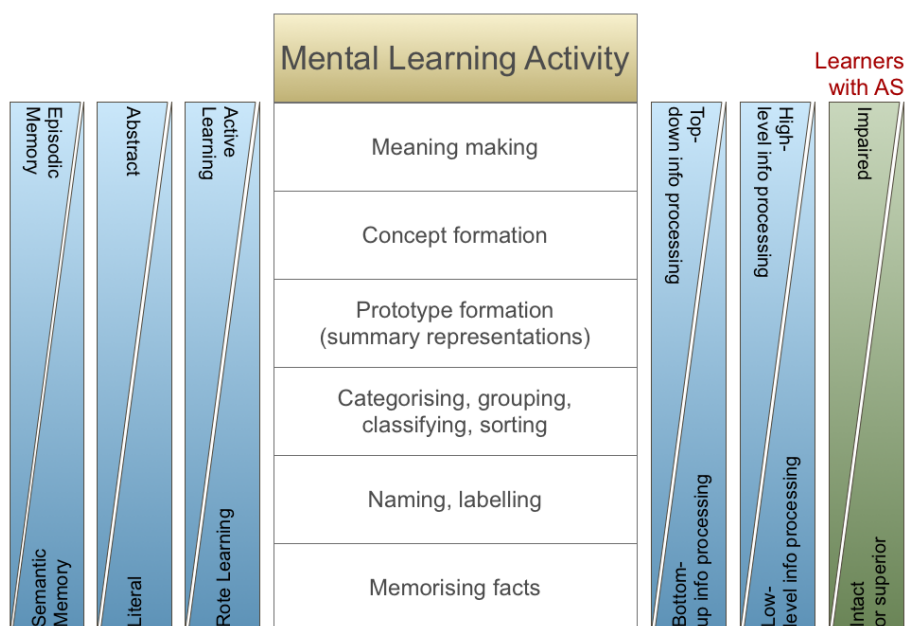
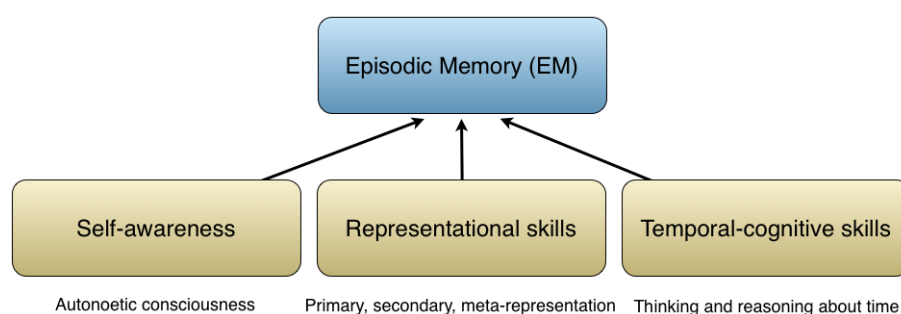


Figure 7 Learning Ladder: inverse relationships showing likely strengths and weaknesses for learners with AS

Figure 7 illustrates that a gifted learner with AS will, most likely, be disadvantaged when required to understand the relationship between facts or, further, to bind knowledge together to form concepts and construct meaning, while being unimpaired or superior at tasks reliant on rote memory or simple categorisation.

### ***Self-awareness and episodic memory***

To confirm the relationship within the research literature between identity, which is the super-ordinate theme of this doctoral research, and episodic memory, this final component of the conceptual framework is presented. The work of Lind and Bowler (2008) provided the conceptual link between memory, temporality, auto-noetic consciousness and identity formation: they showed that **the nature of identity formation in autism is affected by selective impairment of memory**. There are three prerequisites of episodic memory: self-awareness, representational skills and temporal-cognitive skills (Figure 8).



**Figure 8 Three prerequisites for the development of Episodic Memory**

Lind and Bowler employed Neisser's model (1988) of five forms of self-awareness and proposed the conceptual link between memory, temporality, auto-noetic consciousness and identity formation. Self-awareness refers to the concept of auto-noetic consciousness. Representational skills refer to the episodic representation of personal experience in memory (in contrast to symbolic representation in semantic memory). Temporal-cognitive skills refer to temporality (the subjective sense of time) which is the domain of episodic memory (in contrast to the calendar, or measured, time of semantic memory).

In autism, some forms of self-awareness are intact while others are impaired or delayed. Figure 9 illustrates the significance of temporality and auto-noetic consciousness to an understanding of memory and identity and the selective impairment of episodic memory (EM) in autism.

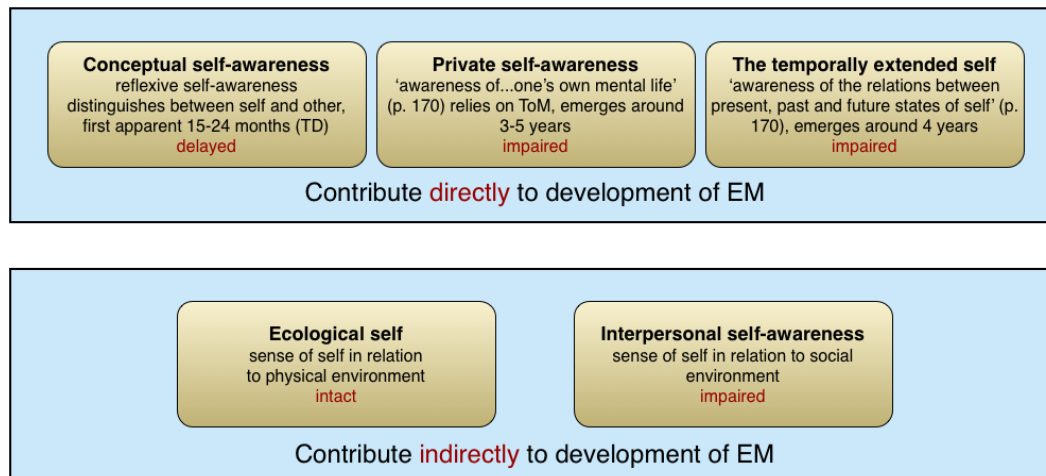
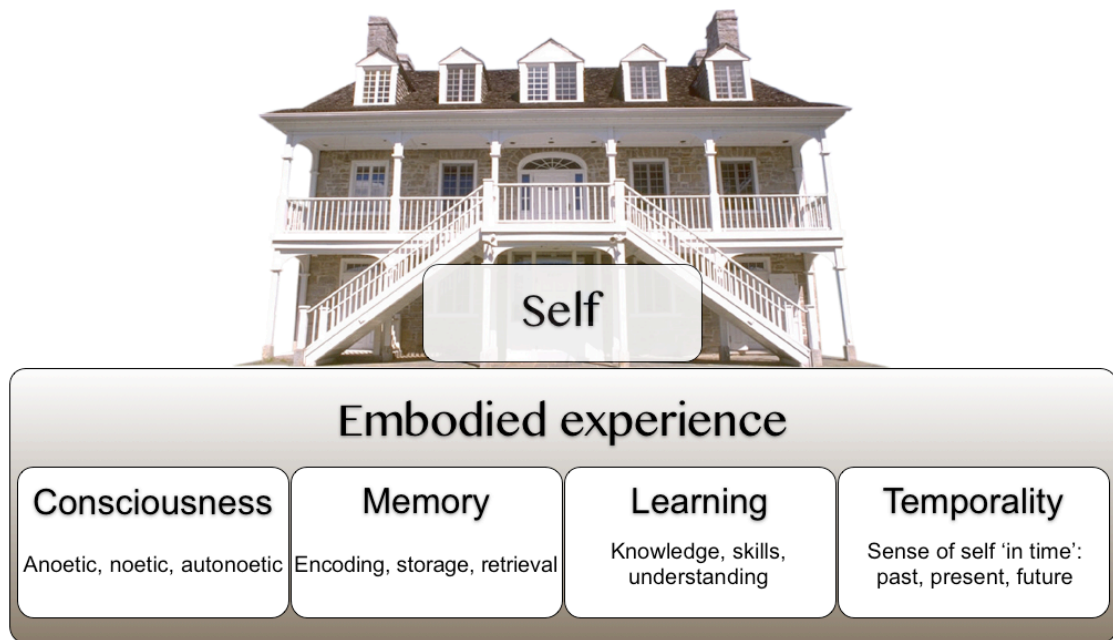


Figure 9 Five forms of self-awareness (Lind & Bowler, 2008)

The five forms of self-awareness provide a different perspective on key phenomena already discussed: 'conceptual self-awareness' can be understood as auto-noetic consciousness; 'private self-awareness' can be understood as theory of mind (ToM); the 'temporally extended self' can be understood as a personal sense of one's self in time, described as 'temporality' (Zukauskas, Sifton & Assumpcao Jr., 2009); the 'ecological self', said to be intact in autism, is an understanding of one's self in relation to the external environment; and, 'interpersonal self-awareness' refers to social-communication. Thus, many of the major phenomena of autism that have been discussed in this thesis are bound together with the development of personal identity: externally oriented focus; literality; impaired self-referential processing; theory of mind; central coherence; episodic memory; temporality; source attribution; semantic memory; and, perceptual memory.

### ***Identity: Knowledge and the knower***

The super-ordinate theme of identity and knowledge, 'Knowledge and the knower', is the finishing point in the interpretive journey of the case studies of this doctoral thesis. To draw together the elements that feed into the development of identity, Figure 10 depicts the Self as a house sitting on its foundation of embodied experience, which is constructed from consciousness, memory, learning and temporality, the formative elements for identity development. Figure 10 was discussed in Chapter 10 of the thesis (Figure 10.1).



**Figure 10 Identity.** Photo used and adapted under licence

As illustrated in Figure 10, an individual's identity is formed from personal, embodied experience, incorporating: consciousness (anoetic, noetic, autonoetic) over time (past, present, future), represented (encoded, stored, retrieved) within human learning and memory systems and applied to the interpretation of one's past, application to one's present, and hope for one's future.

## **Conclusion**

The diagrams and explanations presented in this appendix are the Thinking, Memory and Learning Framework that is the theoretical output of this doctoral research. The TML framework is intended for use in teacher professional development contexts but also has application for parents, life partners and individuals with AS to facilitate understanding of the cognitive profile of gifted individuals with AS.

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