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In search of the inner voice: a qualitative
exploration of the internalised use of
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imagery in the perception and
performance of music

Nicole Saintilan
University of Wollongong

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In Search of the Inner Voice:

***A Qualitative Exploration of the Internalised use of
Aural, Visual, Kinaesthetic, and Other Imagery in
the Perception and Performance of Music***

***Completed in fulfilment of requirements for the degree of
Doctor of Philosophy***

Nicole Saintilan BCA (Hons), M Mus, A Mus A, Grad Dip Ed

***Faculty of Education,
University of Wollongong***

2008

Statement of Sources

Apart from the acknowledged borrowings from other sources, the work in this thesis, to my knowledge, is original. No part of this thesis has been submitted to any other institution for academic credit.

Nicole Saintilan.

September, 2008

Style Guidelines

According to Departmental advice received, the Style Guidelines to be adopted for the presentation of this thesis were optional. Therefore, the guidelines of choice were those of the Publication Manual of the American Psychological Society (5th.ed.). Taken into account was the variation allowed by these guidelines (for material other than journal articles) that is not only permissible, but also desirable in the interests of clear communication.

Abstract

This study is about imagery, mostly sound imagery, but also a more complex set of imageries used by musicians in the perception and performance of music. Imagery is the internal representation of a stimulus, experienced in the presence or absence of that stimulus. Imagery may be of different types, such as visual (imagined seeing), auditory (imagined words or sounds), spatial (imagined distances or placement), or kinaesthetic (imagined movement). The thought processes that musicians use in this regard are not well-documented. This lack of knowledge contributes to the mystique that surrounds music literacy, a mystique that, in turn, does little to help student musicians develop useful strategies for performing and listening to music.

The aim of the study in the first instance was to find out what types of thought processes musicians actively employ during their work. The research expanded progressively to become an exploration of the psychological and physical tools musicians use when they perform and listen to music. The underlying premise was that there is an inner voice with multiple manifestations, and that musicians have the capacity to generate such internal imagery.

A review of the literature in this area showed the absence of a comprehensive description of the sounds that musicians are able to imagine in terms of range, speed, timbre, and complexity. Also lacking from the literature is a description of the differences in the *feel* of imagery, and the range of imagery skills that musicians combine when performing and listening to music. Thus the starting point for this thesis was the search for an *inner voice*.

The research centred on a series of questionnaires and interviews with 10 experienced musicians over a 12-month period. In the course of these interviews the musicians were asked to comment on their imagery during different musical experiences such as thinking, listening, score reading, and performance. Their written and spoken answers were collated and compared to search for similarities and differences. The investigation became a sequential and in-depth search, as participant responses raised more and more issues and areas for enquiry. Research Questions were developed progressively, subsequent to the initial two-part theory having been operationalized. This stated that (a) the musician-participants would be able to generate the impression of sound internally (i.e., *inner sing*), and (b) they would agree that there is more than one type of sound imagery.

Although unable to generalise results due to the limitations inherent in research of this nature, the findings shed new light on previous inconsistencies in the literature, provide new knowledge and conceptualisations, clarify terminology, and have implications for the teaching of music in its various forms. The two main findings to emerge from the study are that musicians are likely to employ a variety of imagery types when they work and that they do so in significantly different and individual styles. The results demonstrate that the musicians relied on a wide variety of imagery, including imagery of movement and sound as well as visual imagery of instruments, hands, written music, and analytical representations of the music. The results further revealed the wide range of terminology used when musicians talk about their inner musical worlds. Where

one musician may inner sing music, another may *inner hear* or *inner perform*, and the next may do something entirely different.

These findings lead to several conclusions. It is incorrect to assume that any two musicians will think the same thoughts or use the same imagery when they hear or perform a piece of music. Moreover, differences that professional musicians display when imagining music may well be evident in students. Expecting students to conform to one way or another when listening, performing, or thinking about music may be unrealistic or damaging. In gaining a more precise understanding of the inner voice of musicians, it becomes possible to set clear goals for the teaching of hitherto hidden skills. An accentuated awareness of individual differences in this regard holds within it the exciting prospect of full potential being reached by student musicians.

Table of Contents

	page
Statement of Sources	ii
Style Guidelines	iii
Abstract	iv
Acknowledgements	xvii
Preface	xviii

Chapter One – Introduction

1.1 Imagery for the Perception and Performance of Music	1
1.2 The Study	1
1.2.1 The initial research question	3
1.2.2 Origins	3
1.2.3 Delving into the underlying process	5
1.3 What Sort of Evidence Might be Gathered?	8
1.4 Terminology	9
1.5 Summary of Chapters	11

Chapter Two – Literature Review

2.1 Auditory Imagery	14
2.1.1 Definition	14
2.1.2 The history of the study of auditory imagery	15
2.1.3 What does auditory imagery sound like?	16

2.1.4 What does auditory imagery feel like?	18
2.1.5 How is auditory imagery learnt?	21
2.2 What is Auditory Imagery Used For?	22
2.2.1 Speaking	23
2.2.2 Performing	24
2.2.3 Reading	25
2.2.4 Listening	26
2.2.4.1 Externalist theories	26
2.2.4.2 Internalist theories	27
2.2.4.3 Streaming	31
2.2.5 Internal repetition for perception	34
2.3 Motor Activity Theory	37
2.3.1 Leontyev (1981)	37
2.3.2 Sokolov (1972)	38
2.4 A Multilayered Personal Approach	40
2.4.1 Performance imagery	41
2.4.2 Inner hearing	45
2.4.3 Visual imagery	46
2.4.4 Rhythmic imagery	47
2.4.5 Emotional imagery	48
2.5 Conclusion	49

Chapter Three – Methodology

3.1 Background to Methodology	51
3.1.1 Summary statements	51

3.1.2 Propositions	52
3.1.3 Research questions	54
3.2 Methodology	55
3.2.1 Research Design	55
3.2.2 Participants	57
3.2.3 Procedure	59
3.2.4 Materials	60
3.2.4.1 Questionnaires	63
3.2.4.2 Interviews	68
3.2.5 Data Analysis	68
3.3 Explorative Research Questions	68

Chapter Four – Results (1)

4.1 Questionnaire One: Inner Singing – Part One	70
4.1.1 Aims	70
4.1.2 Underlying assumptions	70
4.1.3 Results	71
4.1.3.1 Inner singing and sound	71
4.1.3.2 Inner singing and movement	77
4.1.4 Conclusions	79
4.2 Questionnaire Two: Inner Singing – Part Two	80
4.2.1 Aims	80
4.2.2 Theoretical underpinnings	81
4.2.3 Underlying assumptions	86
4.2.4 Results	88

4.2.4.1 Inner singing and breathing	88
4.2.4.2 Linking the internal and external voice	92
4.2.4.3 Inner singing and tempo	99
4.2.4.4 Inner singing and timbre	105
4.2.5 Conclusions	110

Chapter Five – Results (2)

Questionnaire Three: Listening and the Inner Voice	112
5.1 Aims	112
5.2 Theoretical Underpinnings	113
5.3 Underlying Assumptions	115
5.4 Results	116
5.4.1 Listening one: Slow melody line	117
5.4.2 Listening two: Fast melody line	122
5.4.3 Listening three: Polyphonic music	127
5.4.4 Listening four: New music	132
5.4.5 Listening five: German lieder	137
5.5 Conclusions	139

Chapter Six – Results (3)

Questionnaire Four: Music Reading and the Inner Voice	142
6.1 Aims	142
6.2 Theoretical Underpinnings	142
6.3 Underlying Assumptions	143

6.4 Results	146
6.4.1 Item 1: Pulse imagery	146
6.4.2 Item 2: Counting	150
6.4.3 Items 3 and 4: Pitch imagery	152
6.4.4 Items 5 and 6: Kinaesthetic and visual imagery	155
6.4.5 Item 7: Chord imagery	159
6.5 Conclusions	161

Chapter Seven – Results (4)

Questionnaire Five: Music Performance and the Inner Voice	162
7.1 Aims	162
7.2 Theoretical Underpinnings	162
7.3 Underlying Assumptions	165
7.4 Results	166
7.4.1 Item 1: Playing by ear	166
7.4.2 Item 2: Transposing by ear	169
7.4.3 Item 3: Rhythmic variation	171
7.4.4 Item 4: Free improvisation	173
7.4.5 Item 5: Playing by memory	176
7.4.6 Item 6: Performance by reading	182
7.4.7 Item 7: Sight-reading	185
7.4.8 Item 8: Imagery for singing	189
7.5 Conclusions	193

Chapter Eight – Discussion and Conclusion	196
8.1 Summary of Research Questions and Related Findings	197
8.1.1 Terminology	197
8.1.2 Inner singing	197
8.1.3 Listening	199
8.1.4 Whole listening	200
8.1.5 Imagery for music reading	201
8.1.6 Imagery for music performance	203
8.2 Key Findings in Relation to Previous Literature	204
8.3 Emergent Concepts	207
8.4 Limitations	208
8.4.1 Qualitative methodology	208
8.4.2 Validity and reliability	209
8.4.3 Variables	210
8.5 Implications for Education	211
8.5.1 Ear training	212
8.5.2 Instrumental practice methods	215
8.6 Future Research	216
8.6.1 Children’s education	216
8.6.2 Society	218
8.7 Coda	220
References	221

Appendix A – Questionnaires

Questionnaire One: Inner Singing – Part One	234
Questionnaire Two: Inner Singing – Part Two	236
Questionnaire Three: Listening and the Inner Voice	239
Questionnaire Four: Music Reading and the Inner Voice	246
Questionnaire Five: Music Performance and the Inner Voice	251

Appendix B – Scores of Musical Works for Questionnaire Three

Albinoni – Adagio, from <i>Oboe Concerto in D Minor Op. 9, No. 2</i>	255
Vivaldi – Allegro Non Molto, from <i>Oboe Concerto in C Major RV 447</i>	259
Bach – Chaconne, from <i>Violin Partita No. 2 in D Minor BWV 1004</i>	266
Schultz – Night Flight, from “ <i>Mephisto</i> ”	267
Schumann – Ich Grolle Nicht, from <i>Dichterliebe Op 48</i>	273

List of Tables

Table 3.1. Participant Demographics	58
Table 3.2. Questionnaire Design and Rationale	61
Table 4.1. Responses to Inner Singing and Sound	72
Table 4.2. The Timbre of Inner Singing	75
Table 4.3. Responses to Inner Singing and Movement	78
Table 4.4. Responses for Inner Singing and Breathing	88
Table 4.5. Responses for Linking the Internal and External Voice	94
Table 4.6. Responses for Internal Pulse (Tempo)	99
Table 4.7. Activities for the Generation of Internal Pulse	101
Table 4.8. Responses for Changing the Timbre of Inner Singing	106
Table 5.1. Responses for Listening One: Slow Melody Line	119
Table 5.2. Responses for Listening Two: Fast Melody Line	124
Table 5.3. Responses for Listening Three: Polyphonic Music	128
Table 5.4. Responses for Listening Four: New Music	133
Table 5.5. Responses for Listening Five: German Lieder	138
Table 6.1. Responses for Pulse Imagery During Music Reading	148
Table 6.2. Responses for Counting During Music Reading	151
Table 6.3. Responses for Pitch Imagery During Music Reading	154
Table 6.4. Responses for Other Imagery During Music Reading	157
Table 6.5. Responses for Chord Imagery During Music Reading	160
Table 7.1. Information Given for Playing by Ear	167
Table 7.2. Information Given for Transposing by Ear	170
Table 7.3. Information Given for Creating a Rhythmic Variation	172

Table 7.4. Information Given for Free Improvisation	174
Table 7.5. Information Given for Playing by Memory	177
Table 7.6. Information Given for Performance by Reading	183
Table 7.7. Information Given for Sight-reading	186

List of Figures

Figure 4.1. Three-Step Model of Thought to External Speech	82
Figure 4.2. Three-Step Model of Perception	83
Figure 4.3. Three-Step Model of Musical Thought to External Sound	84
Figure 4.4. Three-Step Model of Perception and Production	96

Musical Example

Example 6.1. Mozart – Adagio No. 1 in D Minor (violin part)	147
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Preface

Driving in our car with the radio on, I asked my two sons what they imagined when they listened to music. They both imagined, in a visual way, the contour of the melody. My elder son reported imagining it as a continuous line graph, the younger imagined someone jumping up and down over the houses as the melody rose and fell.

A special moment; to glimpse the developing minds of children.

Chapter One - Introduction

1.1 Imagery for the Perception and Performance of Music

This thesis is about a variety of different imagery types used by musicians as they perform and listen to music. A cursory evaluation of the title might suggest that only the experience of imagined sound is relevant. However, the full complexity of the topic demands closer examination, as sound is only one of a number of ways that musicians imagine music. The current study was concerned with the voluntary thinking processes used by musicians. These are called *mind skills* and are usually the concern of educational psychologists. The research did not grow from the popular topic of involuntary musical imagery, sometimes known as *earworms* or *sticky tunes*.

1.2 The Study

The study came from a desire on the part of the author to know what mind skills musicians use when they listen to or play music, and, therefore, what skills would be worthy to develop in student musicians. This initial two-part research question was constructed because of an interest in music education and current educational philosophies. It was thought that an exploration of this question might help to better inform teaching practices in music performance. Mind skills or *tools of the mind* are controlled, self-generated types of thinking and imagining used in order to attend to, understand, and remember more efficiently (Bodrova & Leong, 2007; Vygotsky, 1934/1986). Two examples of mind skills are inner speech and mathematical visualisation.

A major focus of the study was that as mind skills are internal, they are difficult to identify and describe. Brain scans might show brain activity, but they do not show and describe mind skills. Therefore, it was decided that detailed discussions with a range of experienced musicians, about their thinking during specific performance and listening activities, might be the best way to shed light on this topic. As no previous studies were found that include discussions specifically concerning the mind skills that musicians use, it was difficult to form a picture as how best to embark on the present investigation. By way of an entrance into the subject, the theory and methodology from other studies of sound perception were reviewed. The most detailed studies on sound perception are those on speech perception, and in particular the use of the inner voice for speech perception. Hence, it was from this perspective that the research began.

Vygotskian theory (1934/1986) has described the power of an inner voice, which people use to organise, monitor, and control their actions, thoughts, and emotions. Initially, the aim of the present study was to find evidence that, in a similar way, musicians sing inside their heads as they perform and listen to music, and that this singing assists in organising their musical thoughts and actions. It was the assumption of the study that the inner voice can indeed sing; the inner voice can lie idle, sometimes prattle away with words, sometimes break into song, and often its owner is unaware that it is happening.

However, as the study progressed and the musicians explored their thinking, it became apparent that the inner voice was only one of a battery of mind skills that

musicians employ during their work. Nonetheless, the initial focus of interest – the jumping-off point – was inner singing.

1.2.1 The initial research question

A clear statement of the starting point for the study was the question: *Do musicians use their inner singing voice when they perform and listen to music?* Similar to using inner speech when thinking, it was thought that musicians might use their inner singing voice for musical thinking. The term *inner singing* is used to mean an active generation of internal sound, which may feel like singing but does not involve the generation of external sound. This question is worthwhile investigating, as it has not been asked before in available literature. Musicians have been aware of internal musical sound, but the scholarly literature has not linked inner singing to activities such as listening and performing.

1.2.2 Origins

The present interest in internal sound generation stems from the writer's previous research in the area of perception and memory of music. The idea formed gradually and progressively over the course of a number of theses, research papers, and teaching experiences. In the first instance, an Honours thesis studied the appropriation of indigenous Australian culture by early twentieth century Australian composers (Saintilan, 1990). Appropriation involves the borrowing and reinterpretation of an artefact, with a result that the function and form of the original is significantly altered. Early twentieth century Australian composers reinterpreted indigenous music and culture (borrowing the original material from

ethnographic texts) and presented them in an Europeanised form. However, it became apparent during the course of the study that the original material the composers had appropriated may not have been completely authentic.

This led the author to complete a Masters thesis where the original ethnological transcriptions were studied (Saintilan, 1993). The ethnographic texts, from which the composers borrowed, were the exploration journals of the eighteenth and nineteenth century English and French voyages to the Pacific and of the Australian overland explorations of the nineteenth century. These meticulously written journals included notations of indigenous music placed alongside scientific drawings of flora and fauna, as a kind of scientific travel diary. It was the intent of early ethnographers to preserve copies of indigenous music through notation; however, for various reasons, the notations they made arguably bore a far stronger resemblance to the music of their own culture than to the music they were trying to represent.

Through this study it was seen that early ethnologists seemed unable to present transcriptions of indigenous Australian music without changing the music to fit into a European paradigm. It has been argued (Cook, 1998) that all notation fails to represent a musical performance, and that the only real representation is the original performance. However, the early studies of indigenous Australian music were particularly amiss. In which part of the process of hearing, perceiving, remembering, and notating did the music become Europeanised? Why were the ethnographers unable to perceive and present correctly the sounds of a different culture?

These unanswered questions led to studies of cultural psychology, and in particular, the idea that individuals learn to function in their societies. Individuals may be born with the ability to hear, but recognition and knowledge of sound is learnt through interaction with society (Cole, 1996). According to these theories, the early ethnographers were unable to recognise and represent indigenous Australian music correctly, as they had not developed relevant knowledge appropriate to that culture. That leading musicians and ethnographers of the eighteenth and nineteenth century could not understand sounds of a different culture, demonstrated the very important point: music recognition is not a naturally occurring ability, but one that is developed by interaction within a society.

1.2.3 Delving into the underlying process

When trying to discover the process by which music is understood and remembered, it would seem reasonable to compare it to the process used to understand other sounds. Speech perception studies show that repetition of speech by the inner voice (along with other thinking skills) is used for recognition and memory of speech. This led to the idea of inner repetition for recognition and memory of sounds. One way to repeat music internally is through inner singing.

Most children are born able to hear, and they may be able to mimic simple sounds by themselves. However, understanding the sound and understanding its perceptual meaning in the way that their society demands means attaching

significance to it. Clarke (2005) described the primary function of auditory perception as “to discover what sounds are the sounds *of*, and what to do about them” (p. 3). For example, the recognition of a sound might need a visual image of the object causing the sound, a name for the object, perhaps knowledge of how the object works, and a decision of what to do about the sound. In the case of complex sounds, one might be able to hear them, but remembering them in a detailed way might take recognition of the timbre, pulse, rhythm, articulation, pitch, harmony, form, or other features of the sound.

How is this type of sound recognition taught? By looking at speech recognition studies, it can be seen that language is taught externally first; it is modelled and corrected through social interaction (Vygotsky, 1934/1986). At some stage in the learners’ development, they are able to cease using an external form of the skill and can choose to use it internally as a mind skill (Bodrova & Leong, 2007; Vygotsky, 1934/1986).

Mind skills as taught by a particular society to their members are, by their very nature, culturally specific. With language, the listener may be able to hear a sound and also mimic it, but it is the added knowledge about the sound that makes it specific to a culture. In terms of music learning, an unsupervised child may discover pitch on a xylophone. However, the society that made the xylophone will tune it in a particular way. Thus, the child will discover pitch as appropriate to his or her culture. The child is enculturated by using tools that their society provides. This type of enculturation begins very early in life with lullabies and play songs (Unyk, Trehub, Trainor, & Schellenberg, 1992).

Through learning the music of their own culture, the ethnographers had learnt mind skills that would help them quickly understand European music. However, a different set of skills would be needed to understand music of a different culture.

The mistakes the nineteenth century ethnographers made would seem plausible if they used inner repetition (through inner singing) in an attempt to understand indigenous music. The way they sang the music internally would have been informed by their previous training and performing experiences and, therefore, would have had European characteristics. If they had only been taught to sing in a tempered scale (12 notes to an octave) then their internal singing would have been performed in this way. Any microtonal singing by the original musicians may have been ironed out as the ethnographer attempted to mimic the performance. The ethnographer might also have been trying to feel a regular beat and rhythm in the music. If the ethnographer had only been taught to feel a limited number of time signatures and rhythms, he would have approached his inner performance with only these rhythmic possibilities in mind.

The act of notation may also have contributed to removing information from the original, as the small range of available symbols may not have been adequate to portray the complexity and subtleties of the music. However, it seems that the ethnographers were not aware of the incongruity of adding superfluous information such as time signatures and bar lines; this shows that the perception of the music was formed through the use of European musical structures. Time signatures and major or minor keys might help listeners quickly understand and

remember European music, but forcing indigenous music to fit these parameters profoundly changes and misunderstands the original.

The step from these questions to the current study came about through involvement in the education of music performers. A large part of modern music teaching practice involves teacher demonstration followed by student imitation. Students learning in this way would use the same process as the ethnographers; listening, perceiving, remembering, and reproducing. It seems that the mind skills needed to do this are not well-understood, commonly discussed, or taught, and instead students are left to succeed by trial and error. When students have problems in this process, is it possible to describe mind skills that will help them? To do this, it would be necessary to have a detailed picture of what successful musicians do in order to perceive and remember the constituent parts of a complicated musical environment.

It was this final step that led to the formation of the current and broader research questions: Can it be proven that inner singing is used to listen, perceive, remember, and perform music? Further, if inner singing is used for listening and performance, might it not also be useful in music reading? The objective, therefore, was to clearly state if the 10 musician-participants thought they used inner singing in a range of musical activities.

1.3 What Sort of Evidence Might be Gathered?

In one respect, although brain scans cannot lie or distort, they do not really provide the information that was needed for this study, namely, a description of

the mind skills that musicians use in their work, to help themselves understand, remember, and perform music. As the research came from an Education background, behind the propositions and research questions lay the applied and practical notion that information gathered could be useful in helping student musicians. The study set out to estimate, explore and describe the thinking and imagining of 10 experienced musicians, as they completed activities relevant to their work, descriptions of which might be useful to student musicians attempting those same activities. Such a purpose dictates the use of a qualitative method of data collection: that combines free-flowing interviews with specifically direct and detailed questioning to establish (a) levels of agreement/disagreement with the ideas presented by the researcher, and (b) the extent of individual difference among participants. A further description of the research design is set out in 1.5.

1.4 Terminology

Research in this area is frustrated by the wide variety of terminology in use. A number of researchers from different backgrounds have approached the area simultaneously and, therefore, the existing terminology is reflective of its diverse and fractured research history. A search of the literature on internal sound revealed more than 60 terms, many commonly found, which include: acoustic image, acoustic picture, acoustic memory, articulatory rehearsal, audiation, auditory after-effects, auditory imagery, auralisation, backward messaging, brain-worms, covert rehearsal, ear-worms, echoic memory, endogenous sound, hearing eye, image hearing, imaginary voice, imagined music, implicit humming mediation, inner ear, inner hearing, inner singing, inner sound, inner voice,

invisible voice, involuntary musical imagery, last song syndrome, maintenance rehearsal, mental humming, mental imagery, mental rehearsal, mind's ear, mind's voice, musical image repetition, music imagery, musical imagery, musical hallucinations, non-audible singing, notational audiation, picturing sound, pitch maintenance, pitch recall, pitch residue, pitch retention, rote rehearsal, seeing ear, sensory memory, shadowing, silent singing, singing in your head, song on the brain, sound imagery, subauditory singing, subvocalisation, subvocal rehearsal, subvocal singing, tonal rehearsal component, trace effect, tune in the head, tune on the brain, and quasi-hearing.

The sheer volume of terminology for this phenomenon implies two important things. Firstly, that research in this area has not had the benefit of existing as a discipline in its own right; while researchers from divergent disciplines continue to rediscover and redefine the topic, the theory and terminology cannot settle. Secondly, with such a miscellany of terms it may be that more than one type of experience is being described. However frustrating this accumulation of terminology seems, it does provide some insight; for each term provides a small definition, a reflection of how an individual felt, heard, or produced internal sound and chose to describe it. For example, researchers have described the skill as a type of hearing (inner hearing, quasi-hearing), or singing (inner singing, subvocal singing), or humming (mental humming, humbugs). Still others have described the process as visualising (seeing ear, picturing sound). In terms of where the sound comes from, researchers have presented a range of ideas. Some thought it could be the mind (mental imagery), the brain (tune on the brain), or the head (singing in your head). Others thought the ears were responsible

(backward messaging, inner ear), or the voice (inner voice, subauditory singing). In terms of function, there are those who thought inner sound was a memory of a sound (echoic memory, pitch retention, last song syndrome), or that it was used for thinking (mind's voice). Practical uses for inner sound can be seen through the suggestion that it is used for rehearsing (tonal rehearsal component, covert rehearsal), reading music (notational audiation), or listening (shadowing). Some writers have thought it was involuntary (musical hallucinations, sticky tunes, involuntary musical imagery), or a result of recently vanished sensory stimulus (auditory after-effects, pitch residue, trace effect), or as a voluntary mind skill (audiation).

As the current study grew from research on inner speech, the terminology chosen at the beginning of the study reflects this. The terms inner singing and subvocal singing (internal sound combined with a singing movement) and also the terms auditory imagery and sound imagery (internal sound) have been used as a starting point. It was thought that these terms would be understood by the participant musicians, and that the suitability of these words could be explored as the study progressed.

1.5 Summary of Chapters

In form and nature the current project can best be described as a journey of discovery; the ending place of this thesis could not have been imagined at the start. With each research step taken and each chapter written, the research evolved and moved steadily into uncharted territory. So that while the ending

statements of the thesis do answer the research question, they do so in a way that was not possible to predict.

The thesis begins with the very clear research question: Can it be proven that inner singing is used to listen, perceive, remember, and perform music? A review of literature (Chapter Two) delves into the areas of sound perception, educational psychology, cultural psychology, and music psychology. Theories regarding music perception are discussed along with literature on imagery.

Chapter Three includes a set of statements based on findings from the review of literature, which led to a set of propositions and a broader set of research questions. Here the use of an evolving form of data collection is outlined. The study is based on the results of five questionnaires; the results from the first questionnaire were used to devise the second questionnaire, and so on. The first two questionnaires were concerned with inner singing and other types of internal sound production. The third questionnaire asked musicians if they used their inner singing during listening. The fourth questionnaire dealt with music reading, and the fifth dealt with performing. The results from this research are set out in Chapters Four to Seven.

Chapter Eight presents the final discussion. It includes statements of findings in relation to the broader research questions. As the project was undertaken from the perspective of educational research, some implications for music education are included and ideas for future research are proposed. Finally, previously

uncharted ideas are charted and presented as emergent concepts in the hope that they will provide a foundation for future studies in this area.

Chapter Two - Literature Review

2.1 Auditory Imagery

2.1.1 Definition

There is an extensive but unsettled terminology in the literature on auditory imagery, with the result that two seemingly dissimilar studies may present the same ideas, or the opposite, with the same terminology meaning very different things. For example, the term *inner ear* used in medical studies will mean the fluid-filled section of the ear, which includes the cochlea, used for balance and the transduction of sound waves into electrical signals. Used in studies on perception, inner ear will mean the imagined hearing of music. It is beyond the scope of this thesis to discuss the range of terminology used in the relevant literature. Therefore, the research intent, rather than the literal terminology, of the literature is examined in the present chapter.

The term *auditory imagery* has been used in this thesis as an umbrella term; it is assumed that there will be a range of skills that can loosely be described this way. Auditory imagery includes speech sounds as well as other sounds such as environmental and musical sounds (Godøy & Jørgensen, 2001). A definition of the term auditory imagery has been provided by Intons-Peterson (1992), who made the distinction between a self-generated sound and the presence of a sound due to the unconscious process of hearing and claimed that auditory imagery happens in the absence of external sound, being:

the introspective persistence of an auditory experience, including one constructed from components drawn from long-term memory in the absence of direct sensory instigation of that experience. This definition is intended to exclude auditory after effects, which result from just vanished auditory stimulus. (p. 46)

Godøy and Jørgensen (2001) argued that a definition of auditory imagery should show the relationship between external sound and imagery:

It is also clear that in an ordinary listening situation, the memory of what has been heard as well as the expectation of what is to come, play an integral role in the process of any 'primary' perception of musical sound ... [also] elements of music imagery 'present' in an ordinary ... performance situation (e.g., the improviser has an image of what he/she has just played and what to play next.). (p. vii)

Therefore, a definition of auditory imagery is a self-generated internal sound which is not the direct effect of stimulation by an exterior sound source, but which may co-exist with that exterior sound.

2.1.2 History of the study of auditory imagery

The history of the study of auditory imagery is covered in articles by Bailes (2002), Brodsky, Henik, Rubinstein, and Zorman (2003), De Cheveigné (2004), Godøy and Jørgensen (2001), Intons-Peterson (1992), and Pierce (1999). The majority of the research on auditory imagery has been concerned with the internal, self-generated sound and act of speech known widely as inner speech (Alain, 2005; Baddeley & Salame, 1982; Berk, 1994; Mackay, 1992; Medina &

Rubio, 2004; Smith, 1992; Sokolov, 1972; Vygotsky, 1934/1986; Walliczek, Kraft, Szu-Chen Jou, Schultz, & Waibel, 2006). Research has also been concerned with the link between inner speech and inner singing (Deutsch, 1999; Logie & Edworthy, 1986; Pechmann & Mohr, 1992; Reisberg, 1992).

Other research has concentrated on aspects of music imagery alone (Bailes, 2002; Crowder & Pitt, 1992; Godøy & Jørgensen, 2001; Hespos, 1989; Intons-Peterson, 1992). There has also been a surge of interest in neuro-imaging studies that show which parts of the brain are being used when people imagine music (Meister et al., 2004; Peretz & Zatorre, 2004).

2.1.3 What does auditory imagery sound like?

Auditory imagery has been shown to happen in real time; it can have pitch, tempo, and harmony (Baddeley, 1996; Brodsky et al., 2003; Halpern, 1992; Intons-Peterson, 1992). Auditory imagery can be faster and can have a greater range than external singing or playing (Mackay, 1992; Teplov as cited in Sokolov, 1972). Less is known about timbre and volume in auditory imagery. Bailes (2002) showed that melody and lyrics are more vivid than other elements such as expression, dynamics, and timbre. Others have argued that dynamics and timbre may only be an aspect of auditory imagery when it is required by a specific task (Crowder & Pitt, 1992; Intons-Peterson, 1992). Very little is known about imagery of articulation and attack (such as slurs, staccato, and accents).

Listening to external music will always happen in real time. A significant aspect of auditory imagery is that it can be imagined *in time* or *outside time*. It is possible to re-hear or re-play fragments of music in slow motion, fast forward, or all at once (that is, in a synoptic way). It is also possible to imagine “zooming in on detail” (Schneider & Godøy, 2001, p. 22). Thus, the speed in which music is imagined can easily ignore real time constraints, because it is not dependant on breath control, bow length, hand span, finger speed, or any other physical limitation of performance.

Auditory imagery can be used to predict what is likely to happen next in music; it has a *feel forward* ability sometimes described as *anticipation* (Brodsky et al., 2003; Godøy & Jørgensen, 2001; Hansen, 2005). The feel forward aspect of auditory imagery is experienced in performing as well as listening situations (Kvifte, 2001). When improvising, musicians might remember the music they have played, but also be able to hear the music that they are going to play. When listening to familiar or even unfamiliar music, the listener might be able to anticipate what is about to happen.

One type of musical imagery is inner singing: “The inner voice can speak and it can sing or hum” (Altenmüller & Bangert, n.d., p. 7). Inner singing is the experience of inner sound, combined with movements of singing. Collyer (2004) stated that “singing silently differed from vocalised singing only in that the vocal folds were open so they did not vibrate in the airstream” (p. 64). Movements during inner singing may range from small involuntary movements of the larynx, to a full singing performance (i.e., without sound).

Some types of auditory imagery do not sound like inner singing. Smith, Reisberg, and Wilson (1992) have argued that there must be a different type of imagery for imagining sounds which cannot be sung, such as instrumental timbres: “It seems unlikely that subjects are able to subvocalise the relevant timbres” (p. 102). Also, inner singing might only allow for one note at a time to be sung; however, it is possible to imagine chords and multipart music. Teplov referred to Stump and Abraham, who claimed that:

One can imagine with complete clarity passages of such virtuosity as would be impossible for one either to sing or play ... It is possible to imagine multi-voiced (both homophonic and polyphonic) music while only one voice can be reproduced by inner singing. (Teplov as cited in Sokolov, 1972, p. 51)

Therefore, according to the literature it seems likely that there is more than one style, type, or way of producing auditory imagery.

2.1.4 What does auditory imagery feel like?

Some studies have described auditory imagery as spontaneous and uncontrolled (Halpern, 2003; Jorgensen & Binsted, 2005; Sacks, 2007; Warner & Aziz, 2005). It can also be self-generated (Bailes, 2002; Deutsch, 1982; Jorgensen & Binsted, 2005; Sacks, 2007; Smith, 1992; Sokolov, 1972). The amount of control an individual has over their auditory imagery may be due to their education, training, or health. At one end of the spectrum, young children (Medina & Rubio,

2004), schizophrenic (Smith, 1992), or elderly patients (Warner & Aziz, 2005) may have very little control over their auditory imagery. A continual and uncontrolled experience of auditory imagery may be distressing for some people (Warner & Aziz, 2005). Sacks (2007) observed that sometimes “normal musical imagery crosses a line and becomes, so to speak, pathological, as when a certain fragment of music repeats itself incessantly, sometimes maddeningly, for days on end” (p. 41). At the other end of the spectrum, music schools may train their students to have fine and accurate control over their musical imagination (Bailes, 2002; Hansen, 2005; Kvifte, 2001; Schneider & Godøy, 2001).

It is possible to hear as well as feel auditory imagery: “Short-term auditory memory is not necessarily unitary and ... at least two codes appear to be used, acoustic and articulatory” (Logie & Edworthy, 1986, p. 36). During inner singing and inner speech, movement of the larynx and mouth can be felt. Because of this movement, inner singing has been described as a composite mental-physical activity. Collyer (2004) described three forms of music: an intellectualised or mental form of music; inner singing as a mid-way (mental-physical) form; and external singing as a physical or kinaesthetised form. “Mind-body unity” is another description of the same idea (Reybrouck, 2001, p. 120). Reybrouck suggested a reason for the co-activation of sound and movement is that auditory imagery is often accompanied by motor imagery of the action that would be needed to perform sound (p. 120).

The physical aspects of inner singing are well-documented in the literature. When someone imagines words through inner speech, the motor cortex of the

brain sends messages (electromyograms) to the mouth and throat, which sometimes result in small movements (Godøy & Jørgensen, 2001; Jørgensen & Binsted, 2005; Mackay, 1992; Smith, 1992; Sokolov, 1972; Walliczek et al., 2006). However, different people display different levels of motor excitability in their speech musculature. Some may have more involuntary movement in their mouth and throat than others (Medina & Rubio, 2004; Sokolov, 1972). This could mean that some are more aware of the feeling of inner speech or inner singing than others. Also, it has not been proven, in all cases, that internal speech has accompanying vocal movements; there may be quite significant differences between one person and the next in this respect. This may explain the differences in the way people describe auditory imagery.

Evidence of the link between internal sound and throat movement has been found in brain scans, which show that during music imagining, the motor cortex and the supplementary motor area are active (Mikumo as cited in Brodsky et al., 2003; Reybrouck, 2001; Zatorre, Halpern, Perry, Meyer, & Evans, 1996). Activation of the supplementary motor area (SMA) is thought to be due to movement attached to inner singing: “SMA activation seems to reflect motor planning associated with a subvocal singing or humming strategy” (Zatorre & Halpern, 1999, p. 703). Electrophysiological studies on the throat and mouth have shown that there is a greater nerve transmission rate in the area of the larynx during inner speech (Sokolov, 1972). Similar results have been shown in studies on hallucination; participants displayed larynx and tongue activity when they imagined voices (Smith, 1992).

Reasons for highly personalised descriptions of the way auditory imagery sounds and feels may be that: people have differing amounts of control over their auditory imagery; there may be different types of auditory imagery; different types of auditory imagery may sound and feel different; and, there may be differences in the degree of associated physical movement from person to person.

2.1.5 How is auditory imagery learnt?

For a young child, the world is first explored through the senses. As the child learns to speak, she can use words to express her thoughts. When language skills and capacity to think become more refined, the child no longer needs to announce all her thoughts aloud, but can instead talk silently to herself.

Initially the child learns to apprehend the surrounding world by means of various visual, tactile, auditory, and other impressions. As the child masters speech, he develops the capacity to arrest his movements and begins to express his thoughts in words (the reflex is now confined to the muscles of speech only). Subsequently inhibition may spread to the external expression of words as well and what is left is but dumb speech, accompanied by soundless movements of tongue movements within the oral cavity. (Sechenov as cited in Sokolov, 1972, p. 4)

The decrease of external speech is not only due to the age of a person, but to their level of education. However, during problem-solving, when challenged by a task, a person's thinking may need to employ external activities such as diagrammatic representation or speaking.

Our experimental results indicate the function of egocentric speech is similar to that of inner speech: It does not merely accompany the child's activity; it serves mental orientation, conscious understanding; it helps in overcoming difficulties; it is speech for oneself, intimately and usefully connected with the child's thinking. ... Our hypothesis ... explains the function and development of egocentric speech and, in particular, its sudden increase when the child faces difficulties that demand consciousness and reflection. (Vygotsky, 1934/1986, p. 228)

Externalisation depends on the complexity of the activity and the thinking skills of the person (Berk, 1994; Medina & Rubio, 2004; Sokolov, 1972).

2.2 What is Auditory Imagery Used For?

It may be that auditory imagery is used for a range of tasks including thinking, memorisation, reading, writing, and speech perception and production (Brotsky et al., 2003; Sokolov, 1972). In music, inner sound might be used for reading, composing, anticipation of sound, and listening (Bailes, 2002; Godøy & Jørgensen, 2001; Holahan, Saunders, & Goldberg, 2000). According to Kvifte (2001) and Miklaszewski (2004) it may also be used for performing.

Therefore, it can be seen that auditory imagery is used in the processes of listening, communicating, reading, writing, thinking, and memory. These areas are now summarised in terms of the relevant literature. As this study deals with the day-to-day work of 10 music performers, the area of music reading was relevant to the study but the area of music writing, or composing, was not.

2.2.1 Speaking

Through the process of interiorisation, it can be seen that speech and inner speech are linked. Inner speech had been described as a replacement of external speech; however, Vygotsky (1934/1986) claimed the relationship between the two was not a simple act of replacement. According to Vygotsky, a way to imagine the relationship between thought and speech was as two sets with a common subset: “Schematically, we may imagine thought and speech as two intersecting circles. In their overlapping parts, thought and speech coincide to produce what is called verbal thought” (p. 88).

Speech might exist in thought, but in this state it can be fragmentary and combined with other types of imagery (Sokolov, 1972, p 71). Verbal thought, inner speech, or inner articulated speech might be a way to convert thought into speech. To speak externally, a person needs to choose words that will adequately describe the content of their thought. Mackay (1992, p. 123) called this the *generative component* of inner speech. Therefore, the generation of speech can be seen as a three-step process where thought is transformed into inner speech which can then be spoken. If inner speech is used for providing a structure for external speech, inner singing might do the same thing for external music making.

2.2.2 Performing

The three-step model might also be applied to the activity of musical performance. This idea played an important role in the evolving conceptualisation of the present thesis (see in particular Chapter Four). Miklaszewski (2004) argued that memorisation of music was achieved through mental representation of the sound of the music. The musician memorises the sound of the piece, and during the performance they experience the sound internally before it is played: “Competent performance is impossible without having audiatonal experience of music prior to its execution on the instrument. In this case audiation is a term analogous to a performance plan” (Miklaszewski, 2004, p. 31). However, some musicians may not be aware of the duality of sound production. They may not be aware of the internal version because the external version blocks it out: “Playing on a silent keyboard clearly requires musical imagery, though not necessarily to a greater extent than normal performance does; the imagery may just be more conscious in the absence of heard sound” (Repp, 2001, p. 186).

An article by Collyer (2004) advised singers to alternate between listening to the internal and external singing voices. The singer should model their external singing on the internal voice. “The approach feeds from the longstanding tradition of imitation but is based on the singer’s own voice and self-concept of that voice” (Collyer, p. 66). Alternating in this way might be necessary if the performer is unable to hear the internal voice above the external. The inside time and outside time aspects of auditory imagery may be useful in conditions such as improvisation where the performer can fast forward if needed: “The improviser

has an image of what he/she has just played and what to play next” (Godøy & Jørgensen, 2001, p. ix).

Several authors have tested these ideas, proving that the internal and external speaking voices are difficult to separate. Verbal thinking, or inner voice tasks, can be disrupted by speaking or external voice activities (Deutsch, 1982; Logie & Edworthy, 1986; Pechmann & Mohr, 1992); for instance, when participants were asked to use their external voices to repeat an irrelevant word, while trying to complete a verbal thinking task. As the inner voice provided structure for the repetition of the irrelevant word, it was, therefore, not free for the verbal thinking task.

Verbal hallucination is imagining voices using inner speech. This type of imagining can be made difficult if the external voice is used for another activity such as naming objects. The inner voice needs to provide structure for external speaking, so it is not free to imagine other inner speech. Verbal hallucination in schizophrenics can be stopped in this way (Smith, 1992, p. 164).

2.2.3 Reading

Musicians might also use auditory imagery in the process of reading and writing music. However, as this thesis is concerned with the working processes of performers rather than composers, only the reading condition was relevant. A few articles have dealt with auditory imagery during score reading. Some researchers have suggested that internal sound was purposefully generated during the reading of notation (Gabrielsson, 1999; Halpern, 2003; Odam, 1995;

Wöllner, Halfpenny, Ho, & Kurosawa, 2003). Others have suggested that it could be spontaneous: “Music imagery ... triggered by reading the graphic representation of music (music notation)” (Brodsky et al., 2003, p. 602). When learning a new piece of music there are at least two ways to build up a picture of the music in the performer’s mind; by listening to a recording of the work, or by reading the music. Bailes (2002) put forward the idea that reading the score allows for greater flexibility of interpretation, in contrast to the rigidity of a recorded version of the piece. The role of auditory imagery in the process of reading music remains open to conjecture and further investigation.

2.2.4 Listening

Current theories on listening and perceiving are mostly concerned with speech perception; however, perception of speech and music are very similar. De Cheveigné (2004, 2005) summarised past and current theories of hearing and pitch perception, dividing them into so-called *externalist* and *internalist* theories.

2.2.4.1 Externalist theories

The externalist theory of perception claims that perception happens when stimulants from the outside world affect a person (Békésy, 1960; Helmholtz, 1875; Sloboda, 1985; Wilson, 1986). This is called a *sensory driven* model (Bigand & Tillmann, 2005) or a *psychoacoustical model* (Hubbard & Stoeckig, 1992). The human brain alone cannot understand sound waves, it needs ears to transform these waves into electrical signals. During the journey through the cochlea, the waves are turned into electrical messages and sent to the brain. In

the brain the electrical messages are perceived as sound. The exact way this is done is still subject to debate (Weinberger, 1999) and is beyond the scope of this thesis. However, theorists seem to agree that the same pitch frequency is always sent to the same place in the brain. Externalists argue that the brain learns to recognise pitch because of where the signals are received in the brain (De Cheveigné, 2005).

Sound waves, however, are complicated patterns of vibrations; each note produced on an instrument will set off a fundamental vibration, but also a complicated set of smaller vibrations (De Cheveigné, 2005; Pierce, 1999; Sloboda, 1985). The cochlea in the ear works as a spectrum analyser; it analyses the complex harmonic sounds that are present in a single pitch (Rasch & Plomp, 1999; Schneider, 2001, p. 102). *Hearing out* the harmonics is possible with training (Pierce); however, Plack, Oxenham, Fay, and Popper (2005) claimed that, although the cochlea does its work and sends information regarding multiple pitch material to the brain, the note is usually perceived as having a single sound. Thurlow (1963) suggested that listeners have a choice in the way they perceive a sound stimulus. This idea does not cancel out externalist theories, but does take into account the actions, choice, and skill of the listener. It proposes that the next step along the continuum of the hearing, perception, and memory of auditory events is personal choice.

2.2.4.2 Internalist theories

Internalist theories build on the externalist concepts. Internalists claim there is more to the perceptual process than passive reception. They claim that perception

requires an additional step. Perception is a process where a person creates understanding in the presence of a stimulus:

Like his externalist predecessor he assumes that perception can be understood in terms of what stimuli do to the organism. What in fact is required is an understanding of what the organism does to the stimuli. Perception and hallucination should not be thought of as passive, receptive process, but as an active constructive process. (Savage as cited in Smith, 1992, p. 280)

The surrounding environment is understood through the use of the senses. The senses turn stimuli such as sound waves, light waves, and heat into electrical signals for the central nervous system and brain. The process of understanding or ignoring those electrical signals is the basis of the internalist theory for perception (Sokolov, 1972).

Internalists argue that perception is not something the brain gets from the world, rather, perception is something the brain produces in response to the world. At any one time the senses change a barrage of information into signals for the brain. The person picks and chooses from this sensory information that is briefly held in a sensory store. *Trace effect*, *memory trace*, or *echoic memory* are terms that describe the presence of electrical and chemical signals in the nervous system due to unconscious processing by the senses (Baddeley, 1996; Sokolov, 1972). Electrical signals sent from the senses decay quickly so that a person is able to stay continually up-to-date about the surrounding environment. The decay of sensory input takes about 2 to 4 seconds (Kalakoski, 2001, p. 47).

Internalist perception theory argues that in order to pick out and retain a stimulant from the environment, a matching internal copy of it needs to be made. In terms of sound stimuli, the ears of a listener will turn every sound wave present in the environment into an electrical signal. A system of internal repetition moves the stimulus from the sensory store to the working memory (Baddeley, 1996; Sokolov, 1972). The “copy” may or may not be a correct representation of the original.

Participants may make mistakes when generating a copy of a stimulant. This has been shown by the experiment where the lowest frequency of a note is removed, and the remaining frequencies are played. In most cases the listener still perceives the lowest pitch. Schneider (2001, p. 112) suggested that the cochlea still does its work correctly, but the listener employs some other decision-making process. Godøy and Jørgensen (2001, p. 3) claimed that a simplified version of the sound stimulus is imagined. One way to do this is by finding a note that fits through “humming subvocally”, even though the hummed note is not actually present (Thurlow, 1963, p. 469).

Internal repetition, in this way, is called *simultaneous reproduction*, *echolalia*, or *co-enouncing*. In order to perceive sounds, one must be able to co-enounce (almost simultaneously) with the sounds as they happen in the environment. In terms of speech perception, listening to speech is not just listening, because “to a certain extent we, as it were, talk together with the speaker” (Blonskii as cited in Sokolov, 1972, p. 49). This would explain why, in some cases, the motor cortex, throat, and mouth muscles are used during speech perception.

The generation of sound imagery during listening has been explained as a process of perception:

It may seem contradictory that one may listen to (hear) music and at the same time audiate that music. The fact is that as one listens to music, he is aurally perceiving sound the moment that it is heard. It is not until a moment or so after the sound is heard that he audiates and gives meaning to that sound as he is aurally perceiving additional sounds that follow in music.

(Gordon as cited in Miklaszewski, 2004, p. 31)

In a sound environment, a listener is able to choose from a wide range of sound stimuli. Listeners are not able to consciously attend to every aspect of an auditory scene, instead they attend to one aspect at a time (Moore, 1989). Co-enouncing helps to distribute attention. In order to focus on and retain a particular sound from the array offered, individuals must isolate the sound and move a copy of it into their working memory. The way they do this is through internal matching. The external sound is matched by an internally generated sound. The brain can either generate a matching image of the stimulus and move this information into the working memory or ignore the signal so that the trace is lost to the person (Sokolov, 1972).

In speech perception, listeners can choose to co-enounce with the speaker or do something else with their inner voice; the result is *distributing attention* or *selective attending* (Sokolov, 1972). In music perception, mimicking is described

as subvocal rehearsal or inner singing: “If subjects are asked to retain the pitch of a particular tone for some time, they usually report afterwards that they internally rehearsed the tone” (Pechmann & Mohr, 1992, p. 315).

2.2.4.3 Streaming

After distributing attention to a particular sound source, the listener must then engage in the process of streaming. Streaming is more than just selecting one sound in an environment. Streaming is linking the chosen sounds to form a continuous thread through time. The listeners not only have to process a sound as it happens, but they must link it to sounds before and after, to make sense of the complete sound. The listener, therefore, has to be able to identify a sound in the environment and also be able to track the sound as it changes because of circumstances. This is a process called *sound streaming* (Levitin, 2006; Schneider & Godøy, 2001; Sloboda, 1985) or *auditory scene analysis* (Bregman, 1999). Streaming is done by pitch, timbre, location of sound, and dynamic level and is outside the listener’s conscious control (Bregman, 1999; Deutsch, 1982); and for this reason the process is known as *primitive* (Alain, 2005, p. 14). After the initial streaming process, voluntary attention is used to choose which stream to attend to (Alain, 2005; Deutsch, 1982). Sound streaming in speech perception is the process of following one voice and linking the words together to understand the complete statement. To cite a commonly used explanation – at a cocktail party, one particular conversation can be focused on, but the listener can quickly switch to another conversation if it is of more interest.

Inner speech is used in speech perception to initially match and understand the speech sounds heard, to fix these words in the memory, and to relate and make sense of different parts of what is being said. The inner voice repeats the perceptual information for as long as is needed for the task to be completed (Pechmann & Mohr, 1992).

Reybrouck (2001) commented on the *reproductive* and *schematizing* functions of imagery. The reproductive function of imagery allows the listener to track an auditory event through time (to form auditory streams). Schematizing allows the listener to take the sound out of context and form opinions about it. Therefore, the inner voice is used in real time to track a stimulus, but it can be used outside time to re-play and examine auditory events.

In polyphonic music, streaming would be attending to one voice to a greater extent than the others. However, the listener can quickly scan through the texture to decide on which auditory stream to attend (Deutsch, 1982). The way composers write music may direct listeners to the most important line. Using the highest, loudest, or most distinctive sounding instrument, for an important line, will draw the attention of a listener. Introducing change against a stationary background or staggering important entries will also draw attention. This is known as an *orienting response* (Sloboda, 1985), which Moore (1989) described as “of practical value since events of significance in the world are usually associated with a change of some kind. Sensitivity to change provides a way of directing the attention to new and potentially important events” (p. 251).

There are some types of music textures where formation of streams is not so clear-cut. Deutsch (1982) wrote about *fission* where at high speed a rapidly alternating pattern of high and low notes is broken up into two streams. The opposite phenomena is *temporal coherence* (Deutsch). For an alternating sequence to have temporal coherence (or to be perceived as a single stream), a slower tempo is needed. Deutsch also claimed that fission is more likely to happen when a participant becomes familiar with the musical excerpt. The forming of streams is not a one-way process; the composer or performer may intend one stream to stand out above the others (Sloboda, 1985); however, it is the listener who will decide on what to attend (Moore, 1989).

Inner speech is used to voluntarily focus on one sound stimulus above another. By choosing which source to process, the listener is also choosing which sources not to process. They are not blocking sounds so much as not processing those sounds. The ears still turn vibrations into electrical signals for the brain and nervous system, however by not repeating them, they are lost within seconds, and the listener will have limited memory of them (Deutsch, 1982). Dean and Bailes (2007) described the phenomena of *habituation*, where a listener becomes so familiar with a continuous sound, that he or she stops processing it. Only when the sound abruptly stops or changes intensity does the listener switch attention to take notice. Listeners are, therefore, able to select what they will hear and what they will ignore.

Listening to two verbal streams at once is very difficult. As Durlach (2005) pointed out, “the human system is severely limited with respect to memory

(storage) capabilities ... and with respect to information input capacity (as exemplified by the extreme difficulty one has comprehending more than two simultaneous speech sources” (p. 223). The individual must choose which is the most important or rewarding auditory stream and co-enounce with that one, thereby successfully ignoring the other.

Multitracking or performing two internal tasks at the same time is possible if participants have the intent, and are relaxed, able, and fast enough to make use of micropauses in the first activity to switch to the second. The ability to do this indicates that the inner voice must be faster than the external voice and must be able to abbreviate or simplify (Sokolov, 1972). It is apparent that streaming skills are pertinent also in music perception.

2.2.5 Internal repetition for perception

It may be that internal repetition is needed for every perceptive process. If an internal copy is not made, the sensory stimulus may be lost within seconds. Finke (1985) wrote a review of 160 articles that linked visual imagery to perception. He claimed they fit into three broad theoretical approaches. Structural theories claim it is a quirk of nature that perception and imagery use the same neural pathways. Functional theories claim imagery is a tool for comparison and recognition. Interactive theorists think that perception is achieved through appropriate visualisation (Finke, 1985; Kosslyn as cited in Schneider, 2001). In the present thesis, it is argued that the interactive theory is

the one that most closely describes the process of music perception and performance.

If perception of the world happens through an internal representation of stimulus, then a person's perception of the world will be based on their individual ability to imagine correctly the constituent parts of an experience. A person can only gain correct knowledge of the world if able to internally represent what is really in the world (Reybrouck, 2001). Perception can be thought of as a personal construction of images and interpretations of the world: "We make the world we experience" (Reybrouck, p. 118).

Perception is based on a person's ability to internally represent a stimulus (Reybrouck, 2001). Some people, through experience or training, may be more able to internally represent an external stimulus and hence, they will have a fuller understanding of the event. Building perceptions is mostly a subconscious process (Levitin, 2006). However, when individuals meet the level of their ability in terms of incoming perceptual information, they will need to consciously work hard to build correct perceptions.

A number of experiments have been carried out to see if the inner voice is used for perception. Verbal thinking tasks can be disrupted with listening (Kalakoski, 2001; Smith et al., 1992; Sokolov, 1972). The participants either had to use their inner voices for thinking or for co-enouncing during listening. They found they could not do more than one activity. Tests by Logie and Edworthy (1986) showed that perception of melodic material can be disrupted by secondary tasks

involving the inner voice. Participants were asked to compare two melodies for similarity or difference while completing one of three secondary tasks (speaking, reading, and a visual matching). The results showed that the inner voice was used for speaking and reading and so was unavailable for processing music, while the visual matching task did not affect the music perception task. In contrast, some studies have shown that listeners can somehow manage to make pitch judgements while completing other verbal activities (Kalakoski). In a series of tests, Sokolov tried to disrupt perception by simultaneous thinking activity. He found that although participants felt they understood what was being said, they were unable to remember or make sense of the whole text if they were not allowed to repeat it internally. They suffered what he described as an *instantaneous amnesia*.

If speech imagery is used to co-enounce during speech perception then evidence of this should be found in electro-physical tests. Smith (1992) cited studies that showed that participants display the same amount of electro-physical activity in their larynx when imagining voices as when they listen to speech: “Across all subjects, the percentage of reported hallucinations that was coincident with higher vocal EMG (46%) was no greater than when subjects listened to tape recorded statements” (p. 163). Further, if people use their inner singing voice to mimic music as they listen, then evidence of imagery during listening tasks might be found in brain scans. Evidence has been found that the same parts of the brain are used for imagining melodies and listening to melodies (Brodsky et al., 2003; Halpern, 2003; Peretz & Zatorre, 2004; Schneider & Godøy, 2001).

2.3 Motor Activity Theory

The idea of repetition and activity for perception was first presented by Russian psychologists in motor activity theory (Leontyev, 1981; Sokolov, 1972). This theory has been controversial and has only recently gained support (Mackay, 1992; Schneider & Godøy, 2001), because although brain imaging techniques have proved there is activity during perception, other tests have shown that it may be a covert or imagined type of activity (Reybrouck, 2001). Motor activity theory argues that in order to perceive, a person must perform a motor activity of some sort in response to a stimulus. Leontyev (1981) suggested that “the structure of sensory process must also include motor acts with proprioceptive signalling” (p. 140).

2.3.1 Leontyev (1981)

Leontyev claimed that perception is not a passive process, that humans are not born able to understand the sounds in their environment. He claimed that at birth a child is only a “candidate for humanity”, unable to become human in isolation (Leontyev, 1981, p. 135). In relation to aural development, this means that although humans are born with the ability to hear, their perception of pitch is not innate but is formed during their life as they learn to live in society.

Leontyev attempted to prove that there is no gene that makes people either good or bad at perceiving pitch. He wanted to prove that people are not born with the ability to perceive pitch, and the way he did this was to teach people how to do so. He showed that a group of tone-deaf people could be taught to make

acceptable decisions about pitch. They were trained to match their singing voices with an external sound source, so that they could feel the difference in the position of their larynx as they sang different notes and were thus able to use the terms *higher* and *lower* to describe pitch.

Leontyev's work set out to suggest that perceiving pitch can depend on the activity of the listener. His experiments indicated that motor action, such as singing, gives the person a way to feel the difference between sounds of different frequency. He proposed that the next step for these participants would be to internalise their singing. Leontyev recognised that inner singing would also involve movement of the larynx and so the participants would be able to feel these small movements and make acceptable judgements about pitch. He used the term *motor isomorphism* to describe the physical similarities of movement between external and internal singing: "The next step ... in training tonal hearing is to distinguish pitch without loud singing, silently, and when the sounds being perceived lie outside the subject's singing range" (p. 143). It can be seen, therefore, that Leontyev's next step for perception of pitch was to phase out the external singing and use instead the imagery of this activity.

2.3.2 Sokolov (1972)

Sokolov also claimed that the inner voice was used for music perception. He described a study by Ovchinnikova, which set out to test if participants could make judgements about pitch while they were singing an unrelated note:

This technique has produced great difficulties only with those subjects who usually make use of intonation [singing] in comparing the pitch of sounds; it had no effect whatever on pitch discrimination in subjects who possessed either a very bad or a very good sense of pitch. The latter result seems to be due to the fact that subjects with very bad pitch discrimination never resort to singing the tones, with the result that their evaluation of sounds in terms of pitch was bad in all cases; in subjects with good pitch discrimination, however, the vocal acts were automated to such a great extent, even prior to experiment, that kinaesthetic signals could operate in a contracted form so that vocal interferences were unable to exert any noticeable inhibitory effect on the process of pitch analysis. (Sokolov, 1972, p. 56)

This study showed a continuum where those with poor pitch sense never use singing as a means of pitch perception, whereas people with moderate skills need to use external singing for pitch perception, and others with good pitch skills may be able to multitrack during this task. It also showed once more that the inner voice and the external voice are linked during production of speech.

Motor activity theory arguably provides evidence that perception is not a passive process. The activity of a person directly affects the way they perceive a stimulus. However, it may be that the activity can be internal. The “act” that the person performs may simply be the generation of imagery, and the imagery may be of any kind (motor, auditory, or visual).

2.4 A Multilayered Personal Approach

Studies in the psychology of perception suggest that internal mimicking, representation, or recognition are all important for perception. However, the wide range of terminology used in the literature regarding auditory imagery suggests that there may be more than one way to achieve this. Inner singing may be only one type of musical imagery, which not everyone uses in all circumstances. There may be many different types of imagery that are used for different situations. Differences in a person's ability to construct imagery, or preferences for a particular type of imagery, may mean that one person's imagery for a situation will be quite different from the next.

Schneider and Godøy (2001, p. 21) claimed that musical imagery is a composite or "impure" phenomenon as it is made up of a combination of imageries. Inner sound often has associated vocal movement (as has been seen in inner singing), or it can often be coupled with other types of imagined movement and visual images. Godøy (2001, p. 241) argued that a fusion of auditory imagery, movement imagery, and visual imagery can be understood as instances of cross-modality. O'Shea (2005) also argued this point observing that "perceptions are the brain's educated guesses about what the combined senses are telling it, and as such they will almost always depend on interactions between different modalities" (p. 64).

In terms of music perception and performance, musicians may have a multi-layered memory of a piece of music. They may have an auditory memory of the sound and a motor image of how to play the piece on their instrument, a

visual memory of the instrument, the music notation, or the structure of the music (Kalakoski, 2001, p. 44). Musical imagery, therefore, may be any imagery required to perceive or perform music, be it auditory, kinaesthetic, visual, emotional, or something else. The multidimensional nature of musical imagery was noted by Godøy and Jørgensen (2001):

Musical sound 'in itself' may be considered 'impure' in the sense that musical imagery seems in many situations to be accompanied by, or even inseparable from images of source, of sound-generation, or the environment, as well as various images of 'meaning,' such as emotional content or highly extramusical associations. (p. x)

2.4.1 Performance imagery

If inner singing is imagined sound accompanied by larynx movement, then inner sound accompanied by hand movement might be *inner performing*. These types of imageries may be triggered by request. Asking a participant to inner sing or sing in your head may result in the experience of a different type of imagery than if the participant was asked to imagine performing or inner perform.

There are many reports in the literature of musicians experiencing imaginary hand movement when imagining sound. Some studies suggest they are fused to the extent that sound imagery may trigger movement in hands or throat, and in reverse, movement of hands or larynx may trigger sound imagery (Altenmüller & Bangert, n.d.; Brodsky, Kessler, Rubinstein, Ginsborg, & Henik, 2008; Schneider & Godøy, 2001). Musicians will often use this link to strengthen auditory imagery (Meister et al., 2004; Teplov as cited in Sokolov, 1972;

Wöllner et al., 2003). Odam (1995) described the link between hand movement and imagined sound, and its use by musicians in compositional activities:

Student candidates in formal harmony examinations could often be observed “playing” on an imaginary keyboard on the exam room desk in order to solve the best part-writing in the set task, because they had learnt the procedures as movements and overall shapes. ... Such students had learnt to create an aural perception of appropriate sounds internally through movement. (p 14)

Linking sound and movement in this way has been called *guided imagery*, *stimulus support* or *motor-aided perception* (Altenmüller & Bangert, n.d.; Godøy, 2001). In a similar way that inner speech is sometimes called subvocal speech, hand movement or imagined hand movement has been called *submotoric tinkling* (Altenmüller & Bangert). Many musicians, especially those who improvise, claim a memory of music will be a memory of the movements needed to play the piece. “Anyone familiar with improvisation knows how much is determined by movement patterns” (Gabrielsson, 1999, p. 504).

Just as brain imaging studies (e.g., Reybrouck, 2001; Zatorre & Halpern, 1999) have tried to show that motor areas of the brain are active during imagined singing, there have been similar studies for hand movement during imagined performance. Studies have compared the neural structure used for imagery of performance and actual performance and found that the same parts of the brain were used for both. However, during the actual performance the use of these areas was more intense. According to Meister et al. (2004) “significantly greater fMRI activation of the areas was seen” (p. 227).

Theorists argue that the process of learning to produce sound on an instrument will mean that imagery of sound will have an ecological constraint (Godøy, 2001). Knowledge of where the sound is coming from, and how it is made, is an important part of understanding the sound, and this will not be jettisoned during listening or thinking about sound. Due to ecological constraints, expert musicians will have different knowledge than musically naïve people and therefore will generate different types of imagery during perception (Schneider & Godøy, 2001). This will also be the case when musicians read music, and is known as *music-learning coupling* (Brodsky et al., 2008, p. 443). Years of learning an instrument will result in musicians experiencing imagery of sound and an imagery of playing as they read notation.

Hence, when considering the mental representation of music notation, perhaps more than anything else a reliance on manual motor imagery is inevitable because of the closely knit cognitive relationship between reading music and the associated manual gestures imprinted in the minds of music readers by having a music instrument in hand throughout a life time of music development. (Brodsky et al., 2008, p. 437)

It may be almost impossible to separate imagined motor activity from sound imagery. Learning to play an instrument changes the way the brain responds to stimulus (Baker, 2001; Odam, 1995). After learning an instrument, the parts of the brain that are responsible for auditory processing are used in tandem with those responsible for the fine motor movements of playing. This happens when the musician is playing or only listening:

The work of Bangert, Parlitz, and Altenmüller – presented at the 1999 Conference on Musical Imagery in Oslo ... shows that for pianists with as little as five weeks of training, cortical structures for auditory and sensorimotor aspects of keyboard performance are always activated together, regardless of whether the musician is actually playing or simply listening. (Baker, 2001, p. 253)

Even when musicians have had their arms amputated, they are still able to feel finger movement while imagining or listening to music. This is known as *phantom limb* and is a result of internal movement imagery (Sacks, 2007). The person will not be able to undertake the actual movement physically, but this does not mean that the brain cannot generate the image.

The experience of inner performance will not preclude the experience of other types of imagery; for example, inner singing and inner performance can be experienced simultaneously (Brodsky et al., 2008). The preference for a particular type of imagery might depend on the musician's past experiences. Different musical experiences and training will result in the musician's brain growing in a particular way. Dowling (1999) gave the example that string players develop the area of the brain responsible for motor movement of the left hand to a greater extent than other people:

This sensorimotor learning undoubtedly has consequences for brain development, as illustrated by [the] demonstration of the enhanced allocation of cortical representation to fingers of the left hand in string players, especially those who begin study of the instrument before the age of 12. (Elbert et al. as cited in Dowling, 1999, p. 604)

Musicians encounter a wide variety of musical experiences throughout their years of learning and performing. Their childhood experiences may include singing, dancing, and learning a second or third instrument. All of these activities will cause the musician to discover and practice mind skills unique to that activity or instrument. A preference for one type of imagery developed through involvement in a particular activity might transfer to other activities and, therefore, each individual musician will develop a unique blend of skills.

2.4.2 Inner hearing

Using inner singing for perception of sound may mean that the listener is streaming in environments that do not need to be streamed. In the case of a complicated musical soundscape, the listener may choose to stream or not. At a cocktail party, if listeners wish to stream to understand a conversation, they would use inner speech to achieve this. However, listening to the complete sound of a cocktail party (the murmur of numerous concurrent conversation) may involve a different type of matching or repetition.

The whole sound environment, in music, does not need to be streamed if the listener wishes to listen to the complete sound. Also, in music, the many lines (streams) are designed to fit together: “In most contrapuntal music, however, the various lines are not independent. They are constructed with skill and care to be related to one another” (Sloboda, 1985, p. 167). But when listeners do not wish to stream, what imagery do they use? It is not possible to inner speak the sound

of 20 conversations, yet it is possible to imagine its sound. Also it is not possible to inner sing chords and highly virtuosic music, but musicians are able to imagine this (Teplov as cited in Sokolov, 1972). A different type of internal representation might be necessary for processing these kinds of sounds. The terms inner ear and inner voice are sometimes described in the literature as different processes, and are perhaps used for different types of imagery (Bailes, 2002; Kalakoski, 2001). Inner ear and inner hearing are terms that are widely used in the literature to mean the generation of internal sound without the associated feeling of singing (Smith et al., 1992).

Inner hearing might be a skill that is used when the need for a wider type of listening is necessary. It might also be used for imagining sounds that cannot be sung, for example, instrument timbre or environmental sounds (Bailes, 2002). It may be a type of imagery that exists by itself, or perhaps it is accompanied by other types of imagery not traditionally thought of as musical imagery.

2.4.3 Visual imagery

Just as imagery of sound can be linked to imagery of movement, the former may also be linked to visual imagery. The visual imagery may be of various kinds, for example, sound is often accompanied by images of the source that made it.

A serendipitous finding in this work was the common reports that participants reported seeing the images in addition to hearing them. In fact for some stimuli such as pop-corn popping, many participants said they had to “see” the popcorn before they heard it. (Intons-Peterson, 1992, p. 50)

When listening to or performing music, an image of the instrument making the sound often accompanies the sound imagery. The technique and movement needed to produce the sound may also be “seen” (Godøy & Jørgensen, 2001). “I have only to think of a particular mazurka and the mazurka will start playing in my mind. I not only ‘hear’ the music, but I ‘see’ my hands on the keyboard before me, and ‘feel’ them playing the piece” (Sacks, 2007, p. 31).

Imagery involved when performing and thinking about music may include analytical diagrams of music structure. “To understand a musical stimulus, listeners may form an image which acts as a simplified model of the stimulus” (Schneider, 2001, p. 96). This type of analytical perception is often taught in musicianship aural classes and is helpful for musicians not only in listening situations, but also so that they can develop a greater understanding of the music they perform. By seeing the whole piece and how the parts fit together, they are more able to present a logical interpretation. These visual images are not of the notation; they may be instead graphic or diagrammatic representations of the structure of the piece. In this way the whole piece can be seen at once (Kvifte, 2001). Musicians may also imagine notation while they are listening or imagining music: “He also said that when he heard music he saw the music notation, as though hovering above his head” (Sacks, 2007, p. 262).

2.4.4 Rhythmic imagery

Musicians must have the ability to generate and maintain a steady tempo, or pulse, in the music that they perform. They must be able to set a tempo and then

fit the rhythm of the piece within this structure, either counting the beats of long notes or dividing the pulse for short notes. Failure to maintain a tempo would result in the performer not being able to perform music as part of a group.

Authors have pointed out that perception and production of pulse in music was connected with movement (Clarke, 1999). It may be that perception and production of pulse in music is done with movement imagery of tapping or breathing rather than inner sound.

2.4.5 Emotional imagery

That music can convey emotion or meaning has been a highly debated topic in music philosophy (Budd, 1985; Dowling, 1999; Grew, Nagel, Kopiez, & Altenmüller, 2007; Juslin & Sloboda, 2001; Miell, MacDonald, & Hargreaves, 2005; Miklaszewski, 2004; Raffman, 1993; Schubert, 1996, 2004; Sloboda, 1985, 2005). The use of emotional imagery during performance has been described as an “extramusical template” (Sloboda as cited in Woody, 2006, p. 127). Emotional imagery can be used as a mnemonic aid so that performers are able to quickly apply a set of performance techniques to their playing: “The expressive performance details related to timing, dynamics, and articulation, which otherwise would be too memory-intensive, are made more manageable by using extramusical analogies (e.g. gesture, feeling)”. (Woody, 2006, p. 127) However, Woody warned that teachers can often confuse their students by teaching expressive performance in this way, unless the analogy is coupled with an aural modelling of the music (2006, p. 126).

Studies by Adachi and Trehub (1998 & 2004) have shown that singers use a range of techniques to express emotion during performance, including facial expression, body gestures and some musical devices such as tempo. Their work showed that audiences can sometimes interpret these cues although sometimes not. Performers may imagine emotion when they are performing, and they may try to communicate this through articulation in their playing, facial expressions, and body movement. However, in perception, it is the listener who constructs the perception. If there is an emotional response present in the perception, it is self-constructed by the listener:

Common to these examples is the notion that music does not create emotion; rather it allows a person access to the experience of emotions that are somehow already ‘on the agenda’ for that person, but not fully apprehended or dealt with. (Sloboda, 2005, p. 204)

This construction of perception would also be the case for other synaesthetic experiences (such as seeing colour) when imagining or hearing music. The highly individualised accounts of colour seem to confirm this point, as Dixon Ward (1999) stated: “Unfortunately, however, the colours associated with a particular tone differ drastically from individual to individual” (p. 286).

2.5 Conclusion

The available literature provided a rich resource for understanding some current theories of perception and ideas about music imagery. The literature provided information on perceptual theory, namely, that internalist theory does not negate externalist theory but rather extends it, and that motor activity theory might be a

preliminary version of internalist theory. The process of perception might require the internal representation of a stimulus using imagery such as inner speech or visual imagery. Other types of imagery used in perception might be imagined hearing, emotion, or movement, and sometimes combinations of these. The literature also showed that musicians use a wide range of terminology to describe their inner sound worlds and suggested that perhaps this is due to differences in the way they combine or experience imageries.

Gaps in the literature included a comprehensive description of the sounds that musicians can imagine, in terms of range, speed, timbre, and complexity. Also identified as missing from the literature was discussion of different types of imagery and when they are used. The most notable absence in the literature was writings about the use of imagery during the performance of music. Armed with a current (developing) theory of perception and a knowledge of these gaps in the literature, a methodology for the present study was able to be formulated.

Chapter Three - Methodology

3.1 Background to Methodology

3.1.1 Summary statements

To summarise thus far, the literature review provided a considerable amount of information; it defined some terminology, outlined a theory for perception, and raised the possibility that there might be more than one type of imagery needed for musical activity. The following statements about the topic of inner singing and its role in the perception and production of music have been formed in response to the literature review and fit into the four broad areas of perception, inner speech, inner singing, and imagery.

- ***Perception*** Perceptions are something that individuals create in response to signals received from the senses. Perceptions can be multimodal, existing in a variety of forms such as auditory, visual, emotional, kinaesthetic, or a mixture of any of these.
- ***Inner Speech*** Inner speech is used for building speech perceptions. The incoming sound stimulus is repeated by the inner voice. Through this process the person is able to check the perception for similarity with the original and match the perception with concepts from the memory. The perception is also checked for congruency with the surrounding verbal information.

- ***Inner Singing*** It has not been shown clearly in the literature that inner singing is used for building music perceptions. However, it has been shown that external singing can help individuals make distinctions between notes of different pitch. By singing the notes externally, participants can feel the muscles of their larynx lifting and falling and are, therefore, more able to recognise pitch change. In this process, the auditory information gained by singing would be used to check for similarity (between the heard note and the sung note), and the kinaesthetic information from the change in larynx position would be used for informing choices about verbal descriptions (higher or lower) for the notes.
- ***Imagery*** While the review of literature did show that the inner voice was important for these processes, it also showed that there might be a range of ways that musicians achieve these outcomes. Visual imagery and imagery of movement might be examples of mind skills musicians use in place of inner singing. Therefore, the mind skills that musicians use may be more diverse than had been assumed in the original research question.

3.1.2 Propositions

In response to these statements, a set of propositions was drawn up. These three propositions contained new ideas that provided the foundation for the study.

- Inner singing may be used for perception as musicians may sing internally while they listen to music. However, inner singing may only allow for one note at a time to be sung and, in this case, it may be an unsuitable type of internal representation for listening to chords or multipart music. Musicians may use processes such as streaming to cope with complex sound environments, or they may be able to reproduce them internally using a different method.
- Musicians may mimic their inner singing (that is, their internalised memory of the music) on their instruments to reproduce it externally. However, it may be that the memory or internal representation of the music can exist in forms other than inner singing. There may be musicians who use imagery of hand movement in place of inner singing; this might be called inner performance.
- Inner singing is a bipartite activity, involving the imagery of sound and some throat and mouth movement. However, it may be that some musicians do not use inner singing and instead use other processes that do not involve actual movement, such as visual imagery of notation, imagery of hearing, or imagery of performance. In this case, it may be that inner singing becomes part of a larger range of activities better known more generally as *imagery*.

3.1.3 Research questions

In general terms, the purpose of this study was to explore the range of psychological and associated physical tools that musicians use when they perform and listen to music. The statements and propositions, drawn in response to the literature review, informed an even wider range of research questions, which aimed to describe specific mind skills used by musicians in their work:

1. *What is inner singing?*
2. *Can musicians sing internally (in their heads)?*
3. *What is inner singing used for?*
4. *What does inner singing sound like?*
5. *What does inner singing feel like?*
6. *Are there different types of internal sound?*

Questions about music listening were also formulated:

7. *Do musicians sing internally as they listen to music?*
8. *Do musicians use processes such as streaming to help with complex sound environments?*
9. *Do musicians have a choice in how they listen to a musical texture, or does this have more to do with stream prominence used by composers?*

Additionally, questions about music performance were developed:

10. *Do musicians sing internally as they score read?*
11. *Do musicians have other techniques for helping themselves to hear music internally as they score read, such as feeling the rhythm and visualising hand placement?*

12. Do musicians sing internally as they perform music?

13. How is imagery used in a range of musical performance activities?

3.2 Methodology

3.2.1 Research Design

The choice of research design for this study can be most closely aligned to the Modified Analytic Induction (MAI) approach, as outlined in Bogdan and Biklen (1998, pp. 63-66) where the researcher starts with a research question, prepositional statements (underlying assumptions), and an emerging theory. The theory and explanation is modified as cases that do not fit are encountered. The strategy of the method is to conduct interviews until no participant is found who does not fit the theory; however, some researchers set out to study a limited population and report on this only. The theory is modified until it appears to have achieved stability.

The current research method differed from the MAI approach in a few ways. The initial research ideas were based on information constructed from a review of the literature. There were definite gaps and discrepancies in the literature that the study attempted to address, and this shaped the research questions and prepositional statements (underlying assumptions). Because of the specific and detailed nature of the research questions, the study made use of forced-choice questionnaires as a tool of research. The interviews that followed the administration of questionnaires were open-ended and free-flowing discussions.

However, the use of questionnaires takes the research out of the realm of pure qualitative research and crosses over into a quantitative method.

As with the MAI approach, it was the case in this study that for each participant who did not fit the emerging theory, the theory was modified to fit them. However, there was not an active desire to find cases that did not fit. Instead, from the outset, a certain number of interviews were envisaged, and the study was a description of these particular interviews.

The research design incorporated the progressive administration of five questionnaires and five interviews over a period of time, with the addition of email follow-up correspondence. The design underwent a number of changes during the course of the study, initially in line with the construction of an expanded theory on the basis of the literature review. Further developments emerged as the study progressed and reflected the increasingly apparent individual differences in thought processes as described by each of the musicians. These differences called for a high degree of flexibility and preparedness on the part of the researcher to let the data speak for itself and set the further inquiry. Thus the design of research process could also be described as progressive or evolving as information gained from responses to the first questionnaire and interview informed the design of the second questionnaire, and so on throughout the project.

Prior to data collection, the questionnaires were sketched out and the research project submitted for approval by the University of Wollongong's Ethics

Committee. The participants for the study were given an information sheet about the project and were also asked to sign a consent form.

The actual fieldwork was intended for a 6-month period and started in the second half of 2006. Scheduling time for interviews was difficult, as the musicians were busy working, teaching, and most had families. Restricted access to the musicians because of their busy lives meant that by the end of 2006, some case studies had almost concluded, while others had barely started. The project was extended for an extra 6 months into 2007. The staggered progress of participants also meant it was often the case that musicians who had finished the study needed to be recontacted if some new idea was thrown up by one of the later participants. As a result, there was much more email correspondence than was originally anticipated.

3.2.2 Participants

The 10 participants included three violinists (Vln 1, Vln 2, Vln 3), two cellists (Vcl 1, Vcl 2), two pianists (Pft 1, Pft 2), a clarinettist (Cl), a horn player (FH), and a mezzo soprano (MS). There were four males and six females, with ages ranging from approximately 30 to 60 years. There was an intent to create a gender balance but no intention to study gender differences. The participants were healthy members of the community, and highly trained musicians, well into their careers. To preserve anonymity and respect privacy of participants, more explicit demographic detail is not shown here. Recruitment by personal approach led to a snow-ball effect. It was anticipated that there would be considerable interest in the study and this proved correct. It attracted teachers and parents who

have students or children at the beginner musician stage. Reflecting on the workings of their own minds held promise of creating a greater understanding of what is needed to tutor student musicians.

Table 3.1.

Participant Demographics

Abbreviation	Main Instrument	Gender
Vln 1	Violin	Female
Vln 2	Violin	Male
Vln 3	Violin	Female
Vcl 1	Cello	Female
Vcl 2	Cello	Female
Pft 1	Piano	Male
Pft 2	Piano	Female
Cl	Clarinet	Male
MS	Mezzo Soprano	Female
FH	French Horn	Male

Originally, the intention was to use musicians such as pianists and string players who had formed trios and quartets and worked in the Sydney and Illawarra area. String players and pianists were considered because of the specific techniques of their instruments. References in the literature had suggested that the inner voice could be disrupted by suppressing the movement of a person's lips and tongue (Bailes, 2002; Brodsky et al., 2008; Hespos, 1989; Smith, 1992). By choosing

instrumentalists such as string players and pianists, it was first thought this problem could be avoided. Nevertheless, the conclusion was reached that, were the previous claims in the literature to prove correct concerning the inner voice of brass players, wind players, and singers, it remained important to know whether or not these instrumentalists could generate internal sound.

Criteria for inclusion in the research were that participants should be musicians who (a) had acquired the necessary skills to work confidently and to teach in an area of music performance, and (b) were able to commit to the substantial number of hours it would take to complete the five questionnaires, five interviews, and additional email correspondence. Because the project unexpectedly stretched out over a whole year, some musicians who were initially happy to commit, found that their circumstances changed. Three musicians dropped out of the project. However replacements were readily found, leaving the final $N=10$.

3.2.3 Procedure

Data collection required the participants to complete questionnaires, participate in musical activities, make written descriptions of the thought processes that occurred during the activity, and participate in interviews. The participants were asked to complete practical activities, such as listening to excerpts of real music performances, score reading, performing music that they already knew, and sight-reading of music that was written for their instrument. After the musicians completed each questionnaire, they were interviewed about any ideas, questions, or concerns they had about the topic. Written notes were made during the course

of each interview, and further email correspondence was utilised by the researcher where necessary.

The questionnaires were designed to be taken home and filled out in the musicians' own time (approximately 15 to 60 minutes per questionnaire). Most musicians chose to work this way, the only exception being for the third questionnaire on listening, where some musicians preferred to combine the questionnaire, listening process, and interview, discussing each excerpt as soon as it had been played. In general, the interviews were held in a place convenient to both researcher and participant and took place as soon as possible after the completion of the questionnaire.

3.2.4 Materials

The materials involved a series of questionnaires, administered by the researcher, followed by an interview. The questionnaires dealt with the areas of inner singing, listening, reading, and performance, as outlined in Table 3.1, which summarises key features of each of the questionnaires and the associated research objectives. Moreover, the assumption that the original research question may have been too narrow proved correct, and this had implications for Questionnaires Two to Five. Sticking to the original research questions (even when modified to suit the individual instrumentalists) would have been to ignore the valuable information that the participants were able to give.

Table 3.2.

Questionnaire Design and Rationale

Questionnaire	Database	Research questions
1 Inner singing: Part one	Descriptions of inner singing; its sound, feel, and range.	1. What is inner singing? 2. Can musicians sing internally (in their heads)? 5. What does inner singing feel like? 6. Are there different types of inner sound?
2 Inner singing: Part two	Descriptions of inner sound during external sound production, such as whistling, singing, and playing an instrument.	3. What is inner singing used for? 4. What does inner singing sound like?
3 Listening	Descriptions of inner sound during music listening.	7. Do musicians sing internally as they listen to music? 8. Do musicians use processes such as streaming to help with complex sound environments? 9. Do musicians have a choice in how they listen to a musical texture?
4 Music reading	Descriptions of inner sound and other imagery during score reading.	10. Do musicians sing internally as they score read? 11. Do musicians have other techniques for helping themselves to hear music internally as they score read, such as feeling the rhythm and visualising hand placement?
5 Performing	Descriptions of the production of imagery during different performance activities, such as playing by ear, by memory, improvising, and sight reading.	12. Do musicians sing internally as they perform music? 13. How is imagery used in a range of musical performance activities?

The individuality of the musicians meant that by the end of the process their questionnaires contained general but also individualised questions. For example, there were questions about the inner hearing of multipart playing for the pianists, and questions about hand imagery and instrument imagery for the string players. These types of questions were not relevant for the mezzo soprano who instead had questions about text and theatre. Each questionnaire, therefore, had a set of standard questions, but also some additional questions based on the individual's previous answers or individual specifics of their instrument or genre.

As already mentioned, Questionnaires Two to Five were designed to a large extent on the basis of participant responses to each survey and relevant theory. Thus, the results served the dual purpose of testing ideas and as a source of information on which to build further investigation. The questionnaires were designed in response to (a) the information gained from the previous questionnaire, (b) a follow-up interview, and (c) further reflection on underlying theory. This meant that each questionnaire took on a life of its own, acquiring aims and hypotheses. As can be seen in Appendix A, each questionnaire consisted of a series of items and subitems. The following section provides a broad overview of each of the questionnaires and their development. A more detailed record of this development is to be found in Chapters Four to Seven, which present the overall results in terms of emerging aims and conclusions.

3.2.4.1 Questionnaires

Questionnaire One: Inner singing – Part One

The first questionnaire was designed as a “tick-the-box *Yes/No*” type questionnaire. It introduced terminology and concepts such as inner singing, subvocal singing, and sound imagery with a series of items and subitems. It also asked musicians about the sound, feel, and range of their inner voice and invited them to add their own comments.

Questionnaire Two: Inner singing – Part Two

The second questionnaire followed a similar design to Questionnaire One and further discussed the physiology of inner singing. The interest was in the relationship between mouth and throat movement, breathing, air pressure, and inner sound. This questionnaire also aimed to find out if the musicians thought that they sang in their heads as they played. The musicians were asked to sing, whistle, and play scales to try to notice if there was an internal as well as external sound. The second questionnaire also asked if the inner voice was able to produce for other musical qualities such as pulse, timbre, and articulation, or if other internal representations were used for this.

Questionnaire Three: Listening and the Inner Voice

The third questionnaire was concerned with how the musicians listened to music. The musicians were played five excerpts of music. They were not given scores to

read and were also asked not to read the questionnaire paper while listening. It was thought the process of reading could interfere with the workings of the inner voice. (Scores of these excerpts are included in Appendix B). Each excerpt was chosen because it provided a different texture or style of music.

The slow movement of an oboe concerto (Albinoni – Adagio, from *Oboe Concerto in D Minor Op. 9, No. 2*) was given as the first listening example, because it has a prominent solo line. Of all the instruments used in Western concert music, the oboe is arguably the one that sounds most like the human voice and, therefore, may be something that the musicians would easily be able to mimic. It was thought that the intention of the composer and performers of this piece was to draw attention to the solo oboe line and that any streaming choices made by the listeners would reflect this.

The fast movement from an oboe concerto (Vivaldi – Allegro Non Molto, from *Oboe Concerto in C Major RV 447*) was chosen as another listening example, because it contains fast melodic lines. If inner singing is used as a tool for perception and memory, then it is possible that the listeners would have to mimic this very fast playing with their inner voices. However, the review of literature showed that the inner voice can work quickly by taking short cuts. The aim was to describe what sort of short cuts the inner voice might use when listening to extremely fast music.

A chaconne (Bach – Chaconne, from *Violin Partita No. 2 in D Minor BWV 1004*) in a transcribed form played on solo viola was chosen as an example of

listening that contains multipart textures and chords. According to the literature, chords are outside the range of inner singing. The aim, therefore, was to describe how musicians could form an internal representation of this type of material.

A modern piece (Schultz – Night Flight, from “*Mephisto*”) was chosen for two reasons. Firstly, it was unlikely that any of the musicians had previously heard it, which means the process of perception rather than that of memory was being examined. Also, the piece is quite wild and contains fragmented melodic lines, which make streaming difficult. In this case, would the musicians stream, or would they do something else?

A piece of vocal music (Schumann – “Ich Grolle Nicht,” from *Dichterliebe* Op 48) was the last listening task. The literature review showed that presentation of speech was able to disrupt perception of music. In this case, however, the speech was part of the musical texture. Would the listeners be drawn to speech, or could they process the speech as part of the whole soundscape. Also, how would they cope with a foreign language?

The listening experiences presented here were not outside the musicians’ normal range of activities. Somehow they are able to perceive complicated sound environments such as these, and the aim of the questionnaire was to collect a series of in-depth descriptions of how it was done.

Questionnaire Four: Music Reading and the Inner Voice

The fourth questionnaire dealt with silent reading, again with a series of tick-the-box items and subitems. The musicians were asked to read a piece of music without the help of their instrument. There have been conflicting views in the literature about this process, with some authors describing the hearing of music during reading as spontaneous, and others suggesting that it was an experience that was actively generated by musicians.

The challenge for this exercise was that the music given out needed to be something that the musicians had not heard or played before, and also be at a challenging but comfortable level of their reading ability. Therefore, the only suitable people to choose the examples were the musicians themselves. However, it was thought that if the range of music was too diverse, then the range of skills used would reflect this and would make drawing useful comparisons difficult. With these constraints in mind, the parts of a string trio (Mozart – Adagio No. 1 in D Minor, from *Sechs langsame Sätze und dreistimmig Fugen* KV404a) were given out as a reading example. However, the musicians were also encouraged to choose their own examples if they thought the task was too far removed from a relevant score reading activity. Most musicians chose to use the treble or bass part of the Mozart string trio. However, the pianists chose their own pieces, and the singer chose to use the score of an opera she was about to learn.

The participants were asked to read the score silently (without playing the music on an instrument). They were then asked to comment on any imagery they experienced or generated to help them complete this activity. There were no right

or wrong answers. The questionnaire was broken up into groups of items dealing with pulse setting, counting, pitch, linked imagery, chords, and text imagery.

Questionnaire Five: Music Performance and the Inner Voice

By the time the fifth questionnaire was designed it had become apparent that the ways of working for these 10 musicians were distinctly individual, and that the formula of tick-the-box questionnaires was potentially inadequate. Consequently, the last questionnaire was designed in a more open style, where the musicians were encouraged to give explanations and descriptions of processes rather than answering questions. The musicians needed to play their instruments to complete the questionnaire; they were asked to work through a number of exercises such as sight-reading, improvising, playing by memory and by ear, and to describe any imagery used while performing in these ways. The performing activities were not difficult and were designed not to place the musicians in a stressful situation. The participants were not audio- or video-taped during the activities, as it was thought that it might be counterproductive if they took more notice of their playing than their thinking. The participants were told that the interest was in their ways of working and thinking not their standard of playing, and that there were no right or wrong answers, but only self-reflections. Most of the musicians decided to work on the questionnaire in their own time and then explain their answers in the interviews following.

3.2.4.2 Interviews

Each questionnaire was followed by an interview which served to clarify the meaning of the musicians' answers. Interviews were free-flowing and were based on the thoughts that the musicians had about the questionnaires. It became apparent to the researcher that some participants preferred the interview stage to the questionnaire stage, as their verbal answers were detailed and lengthy in comparison to their sometimes monosyllabic written answers. During the interviews, the musicians were encouraged to describe their individual processes verbally and did so confidently. By the end of the data-gathering procedure, it was felt that the musicians had given a lot of time to the research, and that their descriptions of their ways of working had been dealt with thoroughly.

3.2.5 Data Analysis

The written and spoken answers and comments that each of the musicians gave were analysed and compared to search for similarities and differences. The *Yes* and *No* answers were collated in tables, which appear in the results chapters (Chapters Four to Seven). All of the information gained from the 10 musicians has been included in the thesis. Some of the comments have been interpreted, but the original comments are included in their full form.

3.3 Explorative Research Questions

Due to the progressive nature of the investigation into the inner voice of musicians, a series of preliminary, explorative, and working ideas were formulated and put to the test via the questionnaires and interviews. These

research questions are detailed in Chapters Four to Seven. In broad terms, the overall idea to emerge was that:

A complex set of imageries (particularly with regard to auditory imagery) are used, in individualistic ways, in the perception and performance of music by the musician-participants, the complexity having been further compounded in the past by a labyrinth of terminology in the literature and in practice.

Chapter Four - Results (1)

4.1 Questionnaire One: Inner Singing – Part One

The first questionnaire dealt with a two-part investigation into the phenomenon of inner singing. Part One sought a description of the participant's experience of the sound, feel, and range of inner singing. Part Two went a step further to discover to what extent, if any, participant musicians use inner sound and/or inner singing to structure their external musical activities.

4.1.1 Aims

Questionnaire One introduced the topic of music imagery to the participants and reflected the study's basic aims, namely, to see if music imagery was a common ability among musicians and to describe what it sounded and felt like. It was important to clarify the meaning of the term inner voice by including a range of comparable terms, especially where these are already in use or at least familiar to musicians taking part in the survey. For instance, as previously noted, the term inner voice is used to represent the production of internal musical sound. It embraces terminology sometimes used by musicians such as inner singing, subvocal singing, singing in your head, auditory imagery, and sound imagery.

4.1.2 Underlying Assumptions

It was thought that the musician-participants would be able to generate the impression of sound internally (i.e., inner sing), and that they would agree that there is more than one type of sound imagery. For example, the sound of the

pitch A440 can be sung internally or externally. The complex and momentary sound of shattering glass is not something that can be sung either way yet it can be imagined. For this to be so, there must be some other way of producing sound imagery apart from inner singing.

4.1.3 Results

The responses to Questionnaire One are presented under the two main headings of “Inner singing and sound” and “Inner singing and movement.” Full details of the questionnaire appear in Appendix A.

4.1.3.1 Inner singing and sound

Table 4.1 shows the collated answers to Questionnaire Items 1, 2, 3, 4, and 5 (and their subitems), which deal with sound imagery, common abilities, range, and timbre. Scanning down a column shows each musician’s individual answers, reading across a row shows the range of participant answers for each item. The nature of the answers given was fairly consistent across participants, except in the case of Item 4 which investigated the sound of the inner voice. Given that sound imagery is not talked about or taught in any systematic way, it was reassuring that the participants understood what the researcher meant by the term singing in your head.

Table 4.1.

Responses to Inner Singing and Sound

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
1.1 Can you sing in your head?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.2 Can you sing a scale in your head?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.3 Can you sing a simple nursery rhyme with words in your head?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. Are you ever aware of singing subvocally by accident?	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
3. Can your inner voice reach higher and lower than your actual singing voice?	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓
4.1 Does your inner voice sound like your own singing voice?	✗	✓	✓	✓	✗	✗	✗	✓	✓	✓
4.2 Does it sound like other instruments?	✓/ ✗	✗	✓	✓	✓	✗	✓	✓	✗	✗
5. Can you imagine other sounds like a train whistle, the screech of car tyres?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ✓/✗ = Both *Yes* and *No* response given, with an explanation subsequently at interview stage.

The aim of Subitem 1.1 was to establish if musicians thought sound imagery was a common experience. The answers here were uniform and very definite. All the musicians were aware of inner sound and of its use. Indeed, Vln 2 in particular was relieved to find out that other people experienced inner speech and singing too. Subitem 1.2 aimed to see if inner singing was self-generated and controllable. It seems that all of the participants had control over their music imaging. That is, it was not an involuntary experience, in the way that “tune on the brain” experiences are often described. All of the musicians in the study were able to start and stop their inner singing at will. Subitem 1.3 showed that all of the participants were able to imagine a melody line in combination with words. None of the participants expressed any concern about the idea of this type of imagery being compared with singing; that is, the experience of inner singing was felt to be a kind of imaginary singing.

Much of the literature on sound imagery concentrates on uncontrolled experiences (Bailes, 2002). This type of imagined sound is often described as ear worms or tune on the brain and is similar to daydreaming (that is, uncontrolled imagery). Item 2 of this survey sought to discover if the participants had been aware of this type of involuntary experience; hence the use of the term *accidental* in this question to denote an inadvertent or unplanned mental activity. The uniformity of the answers shows that the generation of sound imagery can be an uncontrolled activity. Although Cl answered *No*, in discussion he pointed out that it was a lack of awareness of the activity, rather than the actual absence of the activity that caused his negative response. It is worth noting here that none of the participants commented on the terms inner singing or subvocal singing. Later

on, as will be reported, they became concerned with using the right terminology to describe their individual styles of inner sound production.

The aim of Item 3 was to discover if the musician's inner voice has a greater range than their external voice. This might be a significant aspect of the musical imagination given that the normal range of a human voice is only approximately one and a half octaves. For example, styles of music composition would probably be quite different if composers were unable to imagine music outside of the one and a half octaves that they were individually able to sing. Nine of the 10 musicians said that they could sing subvocally higher and lower than their actual external voice range. MS thought her inner voice had a cut-off point similar to her external voice. It may be that she gave this answer because of the way the item was phrased. As a singer, it may be that the use of the term subvocal voice meant that she generated internal sound imagery in a specific and applied way, namely, that she did not just imagine sound, but also imagined performance. In this case, the imagery she generated may have had an ecological constraint – the memory of actual performance – and this is why she experienced a cut-off point. Had the term *imagination* been substituted for subvocal voice she may have responded differently. Nonetheless, what can be seen in Table 4.1 is that, when the term subvocal singing is used, MS understands her experience of internal sound in a unique way in comparison to the other participants in the study.

The aim of Subitem 4.1 was to see what musicians thought their inner voice sounded like. A little more than half of the musicians surveyed thought that their inner singing sounded like their own voice. Vcl 2 remarked that her inner singing

did not sound like her own singing voice and noted that this was because she thought her inner singing sounded better than her own singing voice. Despite considerable skill at music performance, quite a few of the participants thought their external singing was technically very poor, or as one participant described it, “a money back experience”. Item 4.2 asked the musicians if their inner singing sounded like an instrument. A little more than half of the musicians agreed that their inner singing sounded like an instrument rather than their own singing, but this created a disparity; one would have expected the answers to Item 4.2 to mirror Item 4.1. A further break down of these results is shown in Table 4.2.

Table 4.2.

The Timbre of Inner Singing

What does your inner singing sound like?	<i>N</i>	Musician-participants
Your own voice	3	Vln 2, MS, FH
An instrument	1	Pft 2
Neither voice or instrument	2	Pft 1, Vln 1
Both voice and instrument	4	Vln 3, Vcl 1, Vcl 2, Cl

The two participants who chose “neither voice or instrument” both thought that their inner singing sounded pure and “devoid of timbre”. Vln 1, however, could consciously make it sound like a violin, if she was imagining violin repertoire. Those who answered both “voice and instrument” seemed to have no trouble changing the timbre of their inner singing.

The aim of Item 5 in this preliminary questionnaire was to allow for a difference between the terms inner singing and sound imagery to emerge. The difference is,

perhaps, that inner singing is a controlled, self-generated applied musical imagery that may sound to the participant like singing and also produce some imagined or subconscious movement in the vocal chords or mouth, whereas general sound imagery (including the internal construction or recollection of environmental sounds that are not primarily musical in intent) involves a much larger range of imaginative behaviours and may not have a physical manifestation in the vocal apparatus. All participants were able to imagine sounds such as a waterfall and a train whistle. There were no adverse comments on the use of the term sound imagery; indeed the musicians seemed to be happy that this type of imagery existed. CI agreed that there was more than one type of auditory imaging. He described two distinct types. The first type was an “active singing type”, where he could sing melody lines, scales, and songs with words in his head. He felt accompanying physical movement in the upper soft palate and sinus. The second type was a “picturing the sound”, which he felt was not just a passive form of the first type but was a different skill. He explained the differences between the two:

With inner singing, I can sing only one note at a time. With sound imagery, I am able to imagine more than one note at the same time. Whole chords and orchestral textures are possible here. It is not possible to inner sing one note and imagine another one at the same time, because the inner singing blocks any other type of sound.

All the musicians interviewed were able to experience sound imagery. They described it as a self-generated experience of imagining. Mostly the experience was controlled; however, sometimes they noticed that they were generating sound imagery by accident. The musicians seemed to experience differences in

sound imagery when it came to timbre as the sonic character of the imagery seemed to be unique to each musician. Some musicians described their inner singing as similar to their own voices, and for that reason their imagery must be uniquely their own. Other musicians described their inner sound as similar to the instrument they play, which makes their inner sound specific (for example, the imagery of a cellist will sound different to that of a pianist). It seems then, that all musicians interviewed can experience sound imagery, but the nature of the imagery may be unique to that person.

4.1.3.2 Inner singing and movement

Subitems 6.1 to 6.4 dealt with the idea of movement of the articulatory system during inner singing. Research by Russian theorists such as Leontyev (1981) and Sokolov (1972, pp. 43-45) on motor activity and sound perception, led the researcher to question the musicians about associated movement of the throat or mouth musculature during sound imagery. Item 6 explored these types of movements. The participants were asked to inner sing very high and very low notes. They were asked to comment on any sensations or movement in various parts of the throat and head.

Table 4.3.

Responses to Inner Singing and Movement

				Musician-participants									
				Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
Prompt				1	2	3	1	2	1	2			
6.1	Did	you	feel	✓	✓	✓	✓	✓	✗	✗	✓	✗	✓
sensation in the front of your face (upper soft palate / sinus)?													
6.2	Did	you	feel	✓	✓	✓	✓	✓	✗	✗	✗	✓	✓
sensation in the throat (larynx)?													
6.3	Did	you	feel	✓	✓	✓	✓	✗	✗	✓	✗	✓	✗
sensation in the ears (middle ear)?													
6.4	Did	you	feel	✓	✓	✓	✓	✗	✗	✗	✗	✓	✗
sensation in the mouth (tongue)?													

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response.

The results shown in Table 4.3 indicate that some musicians did experience the sensation of movement during the exercise, and some musicians did not. This may be due to differences in the way the musicians imagined the sound. If the musicians imagined singing the sound, the process of imaginary singing might have meant that they experienced movement in their throats and mouths. If the musicians imagined hearing the sound, then there may have been no movement. If they imagined playing the sound then they may have experienced, or imagined, hand movement.

The manner in which the questions in Item 6 were phrased could lead some musicians to imagine singing rather than playing and this may be why so many

of them did experience vocal movement (real or imagined). Interestingly, although the ratio of answers to Subitems 6.1 to 6.4 were mostly six to four, it was not the same participants who answered *No* in each item. Some musicians were experiencing much more movement and sensation than others. Only Pft 1 experienced no vocal sensation when imagining sound. The degree to which the participants felt movement may have more to do with individual styles of music imaging. It may be possible to get more conclusive findings in this area with the use of physiological tests of the vocal apparatus to assess involuntary and controlled movements that may accompany relevant musical activities and sonic imaginative behaviours. However, such testing lies beyond the scope of the current study.

4.1.4 Conclusions

The aims of the first questionnaire were to see if inner singing is a common ability among musicians, to describe what inner singing sounds and feels like, and to compare different types of sound imagery. Overall, the questionnaire raised some interesting points. *The assumption, that all participating musicians would be able to generate internal sound, was correct. However, it seems that the sound they generated, in terms of timbre and feeling, was unique to each individual.*

The first questionnaire showed that the inner voice does not sound the same for all musicians. Some musicians claimed their inner sound was devoid of timbre, while others said that it sounded like their own voice, or an instrument, or both.

Also the generation of inner sound does not physically feel the same for everybody. Some musicians experienced movement in their throat and mouth and also associated sensations in the sinus and middle ear, whereas others felt a combination of these or even no physical sensation at all.

The musicians did agree that there were different types of sound imagery and were able to give quite detailed descriptions of both. Perhaps *difference* was the most important theme to emerge, and it may be that because of this, the terminology used becomes increasingly important. When asked to inner sing or sing subvocally, some musicians experience vocal imagery or real movement. When asked to imagine sounds (Item 5), the musicians might have experienced a different kind of imagery, which did not involve vocally linked activity. Use of specific terminology may make musicians choose a particular type or combination of imageries. Had the instrumentalists been asked to inner perform, instead of inner sing, they may not have experienced kinaesthetic vocal imagery or activity. Instead, they may have experienced a different range of imageries, possibly with finger, hand, or arm movement. The responses to items on timbre and terminology seemed to warrant further study; this led to a second questionnaire being designed.

4.2 Questionnaire Two: Inner Singing - Part Two

4.2.1 Aims

The first questionnaire allowed the researcher to begin preliminary discussions with the participants. It was designed to be a quick process, introducing some

terminology and concepts involved in the study. At the conclusion of the first questionnaire, it was decided that a more in-depth discussion of musical imagery was needed to further clarify ideas. Thus, the aims of the second questionnaire were to define inner singing in relation to other types of imagery and to describe the relationship between imagery and external musical activity. The second questionnaire also dealt with the concept of pulse, a term which means the regular, reoccurring emphasis of a fixed interval of time. This further cluster of aims was to discover if (a) the musicians could produce a sensation of pulse internally, and (b) if so, whether this was a function of the inner voice or of a different activity altogether. Further discussions about timbre were also included. The following conceptualisations underpinned the development of Questionnaire Two.

4.2.2 Theoretical underpinnings

Research on the inner voice has shown that inner speech, when used in thought, can be fragmentary and is often combined with other types of imageries: “reduced verbal statements sometimes combined with graphic images” (Sokolov, 1972, p 71). A thought may have visual, spatial, kinaesthetic, haptic, auditory, verbal, or emotional content. However, when finding form externally, this multimodality needs to be stripped down. To express a thought verbally, words need to be chosen that adequately describe the thought in all its complexity. This task is a function of the inner voice and can often become the difficult or arduous word-searching that happens just before the right word and phrase is found.

This idea can be represented in a diagram which shows three steps (see Figure 4.1). The first step is the generation of thought which might consist of many different types of imagery. The next step of the process is to choose words (in the inner voice) that best convey these thoughts. The third step is external enunciation of these words. The second and third steps can happen almost simultaneously, so that once the right verbal formation is found (or articulated in the inner voice) it is also expressed externally.

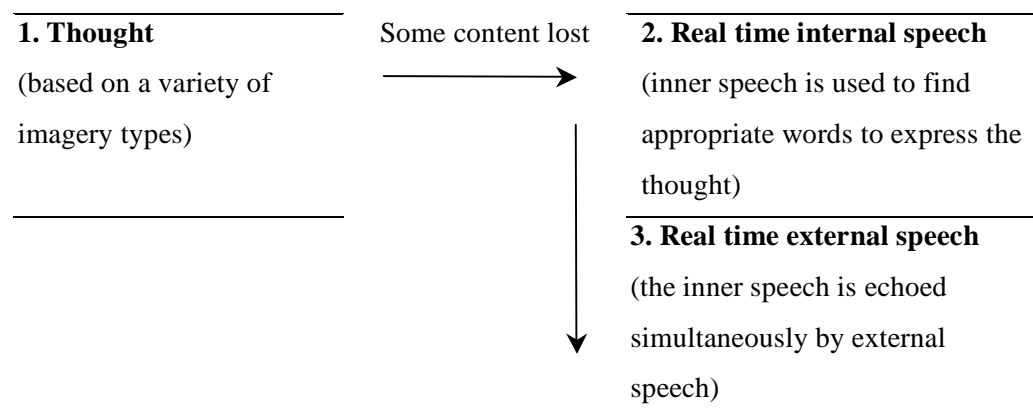


Figure 4.1. Three-step model of thought to external speech

This three-step process often feels laborious, as the thought that is formed in the mind can be fleeting and might employ a variety of imagery that the inner voice needs to find words to adequately express. Conversely, the link between the internal and external voice should be produced in real time, replicate exactly, and happen almost simultaneously. As the participant speaks, their external voice speaks in unison, or slightly behind, their internal voice.

Further to the diagram shown in Figure 4.1, it could be that perception and production of speech use the same intermediate step. Production means

generation of language to convey thought. Perception might use the reverse system. Studies on inner speech (see Sokolov, 1972, p. 102) have argued that in order to focus on and retain a particular sound experienced in their environment, the listener needs to actively engage with it. The listener must isolate the sound and move it into their working memory. Sokolov claimed that the way listeners did this was through a process of internal matching. The external sound is matched by an internally generated sound from the memory store. The internal sound is created using the inner voice (see Figure 4.2).

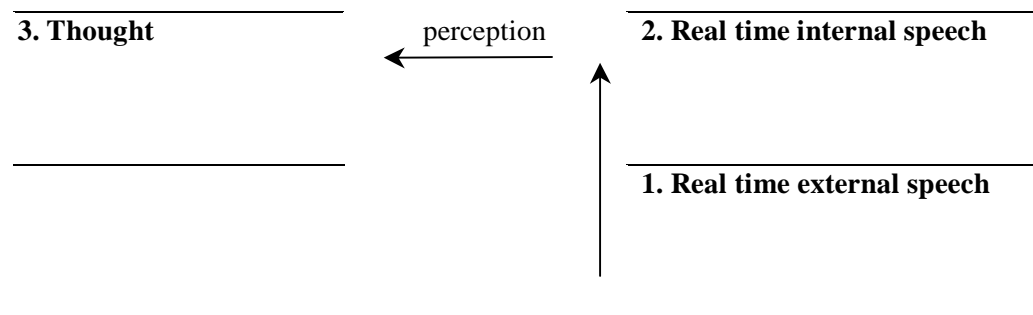


Figure 4.2. Three-step model of perception

It would appear that this three-step model might be applied to inner singing. Musical thought could be translated into internal and external singing. In this process, it may be that some aspects such as timbre, texture, and harmony may be lost in the process. Also, the conversion to inner singing would mean that the sound would have to be produced in real time, whereas this limitation may not apply to musical thought.

Although musicians may be aware of internal and external singing, they may not notice that both occur simultaneously, as the external sound might block out the

sound of the internal voice. Further to this, there may be a three-step process between musical thought, real time imagery (such as inner singing), and playing an instrument. Again, musicians may be unaware of this link, as the sound of the instrument may block out the experience of the internal sound.

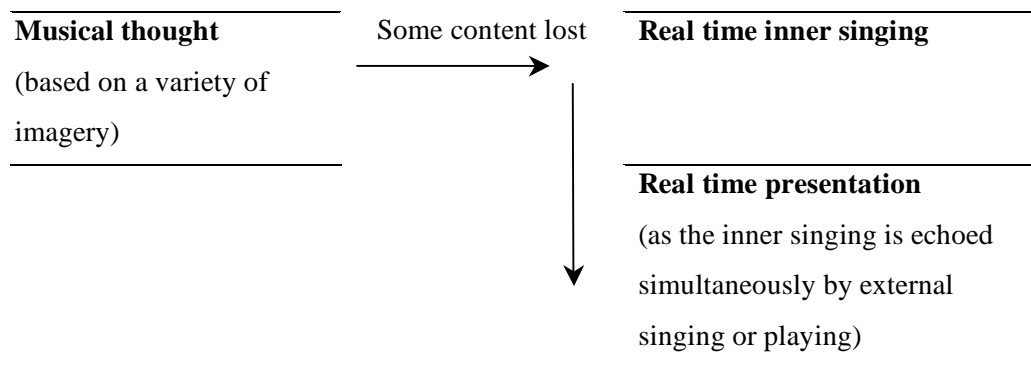


Figure 4.3. Three-step model of musical thought to external sound

It could also be possible that some musicians do not transfer musical thought into inner singing; they may instead transfer musical thought into inner performance, and this may involve imagery of playing rather than singing. This concept was outlined by Teplov (as cited in Sokolov, 1972), when he proposed that vocal chords or fingers may be important in inner musical perception. “Movements of vocal chords or fingers play an important part in inner musical perception. There may be musicians who do not use these movements for perception” (p. 51).

If some musicians do not use inner singing to perceive pitch, then they may not use inner singing to generate it. In these situations, it may be that other internal processes form the link between musical thought and external production. The Teplov quote is significant, because it highlights three possible scenarios for musical perception: (a) Perception or generation of sound using the inner voice

as a tool – the muscular memory of the larynx is linked with an internally generated sound; (b) perception or generation of sound using finger movement as a tool – the muscular memory of the fingers or hand is linked with an internally generated sound; and (c) perception of sound without either of these prompts.

It is postulated here that through external singing, musicians become familiar with the way it feels to sing a particular pitch. It may be that this kinaesthetic imagery becomes associated with the inner sound imagery that the musician is able to produce. In the same manner, the act of repetition of the physical actions needed in playing an instrument may mean that instrumentalists get used to the feeling of where a pitch fits on their instrument. It could be that, when perceiving music, they may be able to feel the difference between pitches by an imagined or real movement of the hand. Also, perhaps this movement can be used again, so that when the musician is trying to generate an external sound vocally, the movement of fingers or the hand may help them obtain the correct pitch.

The third of Teplov's points needs some clarification. If some musicians do not generate or perceive pitch aided by kinaesthetic imagery, perhaps some other sort of memory or imagery is involved. Pitch sometimes acquires a visual position on an instrument. For example, some pianists might hear a pitch and be able to visualise where it belongs on a keyboard. It may be possible to reverse this so that, when the musician is trying to generate an external sound, visualising the notes on a keyboard may help. Musicians also get used to reading music, and visualisation of written music may be helpful in generation of sound imagery.

There may be a variety of ways for musicians to perceive and generate pitch, and inner singing with its associated throat movement may be only one of these.

It has been seen that muscle movement can be used as a tool for measuring pitch. Pitch can be measured by the feeling of the stretch of a larynx or a hand muscle, the distance of which is monitored by internal sound generation. This works well for pitch perception, but is this the best system for production and perception of pulse? It was predicted that pulse generation would also follow the three-step model of thought to external production, except that the intermediate step may not be inner singing.

4.2.3 Underlying Assumptions

On the basis of the foregoing conceptualisations triggered by responses to Questionnaire One, it was thought that the difference between inner singing and other types of sound imagery was that inner singing is sound imagery fused with the kinaesthetic imagery of singing performance (throat movement and breath control). Thus, inner singing is distinct from the sound imagery of inner hearing, which may not have any associated kinaesthetic imagery. The second questionnaire addressed the following four ideas.

1. *There is a link between inner sound and throat movement.* The idea underlying Questionnaire Two, Subitems 1.1 to 1.4, was that there would be a link between breath, throat movement, and inner singing (but only for those who thought that the internal sound generation they experienced could be described as inner singing).

2. *There may be a three-step process between musical thought and external sound production, with inner singing as the transitional step.* The formulation of Items 2 to 4 and their subitems was that there may be a three-step process between musical thought and external sound production, with inner singing as the transitional step; however, this may not occur for all musicians. The external sound production types were whistling, singing, and playing.
3. *Pulse production may not be a function of the inner voice.* Subitems 5.1 and 5.2 dealt with rhythm and pulse as a function of the inner voice. The musicians were asked about pulse setting, what it felt like, and how they maintained it. It was hoped that musicians would be able to describe if pulse is a function of the inner voice or if it is produced and maintained in some other way.
4. *Participants are either unable to imagine timbre or they use imagery other than inner singing to achieve it.* Subitems 6.1 and 6.2 dealt with terminology as the researcher wanted to discuss terms such as musical thought, sound imagery, subvocal singing, inner singing, and inner hearing. It was thought that asking the participants to undertake a task that was somewhat outside the scope of inner singing (such as imagining timbre) might prompt them into making clarifying distinctions in terminology in describing their inner sound production.

4.2.4 Results

The results show that each participant worked in a unique way. The answers that the musicians gave illustrate that even when they perform the same music, they may not be thinking the same thoughts or working in the same ways psychologically or even kinaesthetically. The differences expressed in ways of thinking about sound were quite surprising, especially in the discussions about pulse.

4.2.4.1 Inner singing and breathing

The aim of Subitems 1.1 to 1.4 was to explore the link between internal sound and breathing. Table 4.4 shows the collated responses.

Table 4.4.

Responses for Inner Singing and Breathing

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
1.1 Can you inner sing a note on an out breath?	✓/✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.2 Can you inner sing a note on an in breath?	✓/✗	✓	✓	✓	✗	✓	✓	✓	✓	✓
1.3 If you change breath directions while inner singing a note, is there a gap?	✗	✓	✓	✓	✗	✗	✓	✓	✗	✓
1.4 Can you inner sing a note without breathing at all?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note. Key to symbols: ✓ = Yes response; ✗ = No response; ✓/✗ = Both Yes and No response given, with an explanation subsequently at interview stage.

Subitem 1.1 asked the musicians if they could inner sing a note on an out breath. Vln 1 answered *Yes* and *No* to the first two subitems, as she made the distinction between the type of sound imagery she was using and inner singing. She thought that the terms inner singing and subvocal singing did not describe her inner sound production and preferred the term inner hearing:

- If subvocally means internally, yes [I can sing on an in and out breath]. I'm not sure if it is as accurate as I *hear* internally and I have the tendency to breathe as I feel the phrasing or bowing. (Vln 1)

It is not that Vln 1 cannot sing internally; she just described the term subvocal singing as not an accurate description of what she does. Inner singing implies the added element of singing imagery with larynx movement. In the absence of this imagery, this violinist feels that the term inner hearing better describes features of her internal sound production. The statement that Vln 1 made: "I have the tendency to breathe as I feel the phrasing or bowing", suggests that this musician imagines bowing movement as she imagines sound. Perhaps this musician inner performs rather than inner sings.

Subitem 1.2 asked participants if they could sing a note internally on an "in breath". Vcl 2 had some interesting thoughts on this item. In the questionnaire, she indicated that she could not sing a note on an in breath. Perhaps it was not that she could not, but instead she used the in breath as a gap between the phrases, such as a wind player or singer might do. When this was suggested to her, she commented that when she tried to imagine sound while breathing in it changed the tone:

- It changes the tone of the subvocal singing (rather like a harmonica wheeze!). It just seems more natural to sing on the out breath and use the in breaths to breathe and yes, for phrasing too. (Vcl 2)

It can be seen that, in the case of Vcl 2, the inner sound that is being generated is very similar to external singing. In this case the term inner singing seems to be very accurate.

The researcher wondered how important breath pressure was for inner singing. It is noticeable that in external singing, when the breath direction is reversed, there is a brief gap in the tone of the note as well as a change in timbre. The sound gap is made because at that precise moment there is no air pushing through the vocal chords and hence they cannot vibrate. This is similar to the gap made by a bow change for a string player where the bow for a brief moment is not pulling at the string and the vibration of the string momentarily ceases. The author queried whether a breathing gap had any effect on the production of inner sound. It seems for six musicians that it did. The string players commented on the breath being used as similar to that of bowing:

- I have a tendency to breathe with the phrasing/bowing. (Vln 1)
- The gap was miniscule (reminiscent of a bow change). (Vln 3)

What is interesting is that some people heard a gap at all. The next subitem tried to establish the extent to which breath control is related to inner singing. The researcher asked if the musicians could sing subvocally without breathing at all (briefly). Even though Vln 1 found this uncomfortable, the uniformity of the

answers to this subitem seems to be important. All the musicians could do this, which shows that while musicians feel their breathing is related to their inner singing, they are still able to imagine sound without it.

The findings for this set of questions are that only 1 of 10 musicians did not think the terms subvocal singing or inner singing accurately described her internal sound generation. She preferred the term inner hearing, even though when she was inner hearing she breathed with the phrases. Her imagery may have been linked to her breathing; however, there was something about the term inner singing that she did not like. Possibly this was absence of movement in the vocal chords, or that this musician imagines bowing movement while hearing internal sound. Inner hearing or inner performing describes this musician's imagery more accurately than inner singing.

Musicians can inner sing on either an in or an out breath. Some musicians made no distinction between the two, using in and out breaths like up and down bows in string playing. Other musicians tended to breathe the way a wind player or singer might, by using the in breath for breathing and phrasing and the out breath for singing. Musicians do take notice of their breathing in sound imagery, but breath pressure is not important. All musicians claimed that they could inner sing with no breath pressure coming through the larynx.

In summary, there is a link between inner singing and throat movement for those 9 musicians, who agreed that a type of internal sound generation they experienced could be described as inner singing.

4.2.4.2 Linking the internal and external voice

Items 2 to 4 with their subitems asked musicians to try to separate their internal and external voices and comment on any links. The researcher felt that if the two voices happened simultaneously, possibly the internal voice would be ignored. A question that would make musicians take notice of the role of the inner voice would be needed. The gradual elimination of one of the voices, during a singing or performing exercise, might mean that musicians would be able to comment on any relation between the two.

This set of items was in three parts: whistling, singing, and playing. (See Table 4.5 for a summary of responses). Whistling was chosen as the first activity, as the vibration is not made with the larynx but by air being forced over the tip of the tongue and through the lips. Therefore, the larynx might not be needed when producing sound by whistling. However, the musicians may notice that they still feel movement in their larynx. The researcher assumed this was because the subvocal voice was working at the same time the whistling was occurring. Alternatively, due to the sound of the whistling, it may be that the musicians are unable to hear the sound of the inner voice. The challenge was, therefore, to set an easy whistling activity and then to reduce the external sound to an inaudible level, to see if the sound of the internal voice could be heard.

The musicians were asked to whistle a scale. Halfway through the scale they were asked to decrease the volume of the whistling until there was no sound and then increase back to the original volume. They were asked if, during the silent

time, they heard the missing music internally. If the musicians were able to notice that their inner voices continued to sound when the whistling became inaudible, they might be able to detect that the inner voice is always there. However, if there was no sound when the whistling dropped out, then perhaps the inner voice does not sing in conjunction with the whistling. The participants were asked if they thought that they might sing in their heads at the same time as they are whistling. The exercise was repeated twice, the first time with singing, and then with playing (the musicians were asked to play their own instruments).

All of the musicians heard the missing music in their heads. Vcl 2 raised an interesting point when she commented that:

- Whistling is really hard for me and was higher pitched than my singing until I practiced a bit and then it got easier to sing the missing bits internally.

It can be seen from this point that Vcl 2 assumes that the internal singing and the external sound should match in pitch. Perhaps she could hear a discrepancy throughout the entire scale, or perhaps she just noticed a drop in pitch when her inner voice became audible. Also, it is interesting to note which voice was at fault here, the inner voice or the whistling. It has been seen with this particular participant that she feels her inner voice is far better than her external singing. Perhaps in this case her inner voice was right or closer to the original musical thought than the whistling. Perhaps this is how musicians know when they are playing out of tune, because there is a discrepancy between the inner sound (the most desired pitch in any situation) and the externally produced sound.

Table 4.5.

Responses for Linking the Internal and External Voice

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
2.1 Whistling: Did you hear the missing music in your head?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2.2 Do you think you sing in your head at the same time as you are whistling?	✓	✓	✓	✓	✓	✓	✗	✓	✓	✗
3.1 Singing: Did you hear the missing music?	✓/ ✗	✓	✓	✓	✓	✓	✗	✓	✓	✓
3.2 Do you think you sing in your head at the same time as you are singing?	✗	✓	✓	✓	✓	✓	✗	✓	✓	✓
4.1 Playing: Did you hear the missing music?	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
4.2 Do you think you sing in your head at the same time as you are playing?	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ✓/✗ = Both *Yes* and *No* response given, with an explanation subsequently at interview stage.

This could also be how musicians know if someone else is playing out of tune. They will be able to think of the best pitch choice for the situation, taking into account the surrounding musical texture (the notes before, during, and those likely to come after), and they will articulate these in their inner voice. When the external sound source fails to match this, the musician knows that an intonation

error has occurred. It is, therefore, important to know if the musicians thought the sound only appeared when their whistling stopped to fill in the gap, or if the inner singing was constant throughout the exercise. If the inner singing was constant throughout the exercise, the musicians would have a capacity to check for intonation mistakes using this model.

Eight of the 10 musicians thought the internal singing happened at the same time as they were whistling. This becomes very important, because it means that the inner voice can be used to structure production of external sound. FH marked *No* but wrote beside it “probably do”, because he was not absolutely sure that he did sing at the same time as he was whistling. It can be seen in Table 4.5 that he was sure that his inner voice was singing while he was singing externally and also while he was playing his instrument.

Although Pft 2 answered that she heard the missing music while she was not whistling, she still answered that she does not think she sings subvocally at the same time as she is whistling. Pft 2 relies more on finger movement than larynx movement, stating that:

- I feel finger movement rather than hear and visualize a piano keyboard. (Pft 2)

Pft 2 feels she has developed a muscular memory used for perception and generation of music, which has nothing to do with larynx position or internal singing. Pft 2 made the comment that: “*I feel . . .* rather than *hear*”. This means

an alteration to the three-step system of musical thought to external sound production for this musician. This alternative is illustrated in Figure 4.4.

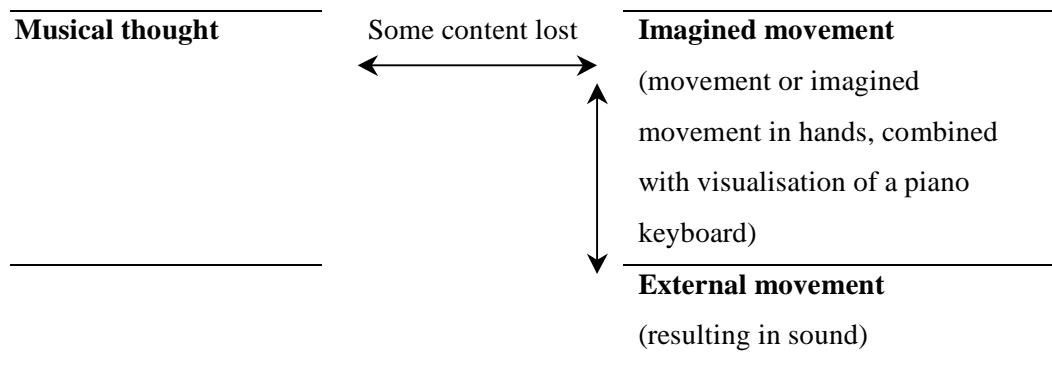


Figure 4.4. Three-step model of perception and production

Presumably while Pft 2 was whistling, she was feeling movement in her fingers and imagining a scale pattern on a keyboard. When the whistling became inaudible she kept track of the scale through the feeling in her fingers, and this was guided by the internal visualization of the scale pattern in her mind. It can be seen in Table 4.5 that Pft 2 felt this was the way she approached all three exercises in this section.

The exercise was repeated again with external singing replacing the whistling. The researcher thought that by singing aloud and then dropping the external voice out gradually the participants might become aware of the larynx continuing to work in the silent time. However, Vln 1 found (in a similar way to Vcl 2 in the whistling exercise) that the external sound source was not what she expected:

- Singing out loud is an instant distraction for me. (Vln 1)

For this reason, she was unable to say whether she sang internally at the same time as she sang externally.

The researcher expected Item 3 and its subitems to be more complicated for the participants to answer. They were asked if they thought they sang in their heads at the same time as singing externally. Given that the inner and external voices are sharing the same equipment (larynx) and the sounds they are producing are in some cases very similar, it might be quite hard to distinguish the two. Most musicians did think they sang internally while they sang externally, but some commented on the difficulty.

- Possibly – but the inner sound is drowned out by the actual sound. (Pft 1)
- Probably but my voice covers it up. (Vcl 2)

The exercise was repeated again; this time the external sound source was the musician playing their own instrument. All of the musicians were able to do this and hear the internal music in the silence (apart from Pft 2 who might use a different imagery in the intermediate step). This time there were no discrepancies reported between the internal and external sound, as these musicians are able to play with impeccable intonation on their instruments.

Most musicians also agreed that they sang in their heads while they played their instruments. MS (who played piano for this exercise) was very certain in her response:

- I definitely sing internally all the time. (MS)

Pft 1 did feel that he sang in his head while he played, as external singing was sometimes utilized in his practice:

- Here I can comment: possibly yes, because when there is a hard bit, or a page turn, I vocalize what I can not realize physically without further practice. (Pft 1)

The findings from this set of items were that most musicians felt that they sang in their heads while they produced an external source of music. The musicians expected that the internal and external sound sources would be the same in pitch and happen simultaneously. Some musicians commented that it was difficult to hear the inner voice while singing, whistling, or playing, because the external sound source covered it up. Two musicians expressed problems with the intonation differences between the internal and external voice. This was registered as out-of-tune performing. The internal sound source seemed to be the one that musicians felt represented their intention. It is the external sound that musicians target when there is a discrepancy in pitch between the voices. This might be because of the inadequacies in motor skills of the performer, for example, larynx movement or breath control in singing, or lip, tongue, or breath control in whistling. Pft 2 does not use internal singing to structure her external music making. She seems to rely more on visual imagery of the piano keyboard and musical notation, and movement imagery of the hand, as a mediating step.

To summarise the findings, it seems musicians are aware that inner singing is a step between musical thought and external sound production.

4.2.4.3 Inner singing and tempo

The researcher was interested to know how musicians think about pulse and rhythm. Is pulse thought, sung, or felt? Is it sung in the inner voice or is it felt in the tap of a foot? Are pitch and pulse linked or can they be separated? Early childhood education theorists, such as Kodály, Orff, and Jacques-Dalcroze, used motor movements to teach pulse and rhythm. Children are taught to feel pulse through gross motor movements (skipping, marching, or running) and rhythm through the fine motor movements (of speech, tongue movements, and breath pulses). Given that these educational systems are quite successful for teaching young children about rhythm and pulse, it is interesting to see if musicians use similar methods to perceive and generate pulse and rhythm, namely, gross motor movement for pulse and fine movement for rhythmic subdivisions of the pulse. Table 4.6 shows the musicians' answers concerning internal pulse setting.

Table 4.6.

Responses for Internal Pulse (Tempo)

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
5.1 Can you set a pulse (tempo) in your mind?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response.

All the musicians were able to set a pulse in their minds proving that pulse can be internally generated. As well as being able to tap a foot, click fingers, or clap hands (external replication of a pulse), these musicians were also able to feel a pulse internally.

Subitem 5.2 asked the musicians to describe what the pulse felt like. The variety of responses to this subitem was unexpected. What was most astonishing is that some of these musicians perform together in quartets and larger ensembles. One would assume that musicians sitting together and performing highly complicated music, and being able to pick a tempo to within a fraction of a second of each other, would involve feeling and thinking about tempo in the same way. This was not so. Each musician seemed to have a highly individualistic way of feeling pulse. This can be seen in the following comments:

- Like a conductor, I feel it near my heart, which initiates a whole body response, a whole body movement that is hard to maintain sitting down. (Vln 1)
- I think it is an inner voice (larynx) movement. Also sometimes I visualise a conducting movement, which often converts to a hand movement. (Vln 2)
- It feels like waves from one side of the roof of my mouth to the other side, resembling an old metronome. (Vln 3)
- I feel the pulse in my head and hands. Mostly it is in my finger point. It must be an imagined movement as there is no outwardly visible movement. (Vcl 1)
- I can use a heartbeat feeling or I can inner sing like a metronome ‘tock.’ (Vcl 2)
- It is attached to whatever melody/piece I’m thinking of. I am inner singing, I suppose, the music as a whole. I certainly never hear pulse without a pitch

attached. I inner sing the opening bar or whatever bars will set the tempo for the entire piece. (Pft 1)

- It is a tongue and slight head movement. (Pft 2)
- It does not feel like anything, it sounds like ‘da.’ (Cl)
- I tend to set the pulse by counting rhythmically in my head. (MS)
- It feels like a separate heart beat. (FH)

Even by placing the data into a table (Table 4.7) that expresses the similarities of views about internal rhythm, it can be seen that musicians are surprisingly individual in the way they experience an internal sense of pulse.

Table 4.7.

Activities for Generation of Internal Pulse

An internal rhythmical pulse feels like:	<i>N</i>	Musician-participants
1. It is a whole body movement	1	Vln 1
2. I visualise a conducting movement	2	Vln 1, Vln 2
3. I feel it in my finger point	1	Vcl 1
4. It is a slight head movement	3	Vcl 1, Pft 2, Pft 1
5. It feels like an extra heart beat	3	Vln 1, Vcl 2, FH
6. I hear it like a word “tock”, “da”	2	Vcl 2, Cl
7. I use rhythmical counting	1	MS
8. I feel on the roof of my mouth	1	Vln 3
9. I feel it in my tongue	1	Pft 2
10. It is a breath or larynx pulse	1	Vln 2
11. It is always attached to music	1	Pft 1

What can be seen is that both body movement and speech are used for setting pulse. Where body movement is used, the musicians described it as an imagined movement. Where speech is used, the musicians described it as a sound. It can also be seen that the musicians have developed a variety of ways to feel pulse and rhythm and often use them in combination. Most of the musicians were able to separate pulse from pitch and describe the feeling of it. Only Pft 1 described singing the music as a whole and could not imagine pulse or rhythm without pitch.

In jazz music performance, tapping a foot (to maintain the pulse) is acceptable practice; it shows an awareness of the beat and a desire to experience it. Indeed, even wilder movements are performed by rock musicians; however, this may have more to do with dance and body movement as a source of communication and expression (Davidson, 2002, p.148). Body movements in classical music making are accepted when they are used for expression, achieving a range of dynamics and musical communication with the audience and other performers (Davidson & Correia, 2002, p. 243). However, prominent tapping of feet is generally regarded as unacceptable. When motor activities become internalised, it is because the person has acquired a high degree of fluency and ease in the activity and no longer needs the security of a highly visible and forceful sensory movement. As soon as the musician becomes challenged by the activity (that is, the degree of difficulty matches or exceeds the person's level of capability), the internalised activity needs to become external again (Medina & Rubio, 2004). When a classically trained musician starts tapping their foot on stage, it shows

that they are at the limit of their technical ability and for this reason the movement is unacceptable. However, foot tapping and leg bouncing are not the only activities that are frowned upon in classical music-making. It seems anything but an internalised perception of the pulse is seen to be slightly embarrassing:

- I did find however that my head wanted to move – and did (discreetly, I hope) to anticipate climaxes or rhythmic patterns. Even in the pieces I did not know at all. I also have the tendency to want to move my arms like a conductor. (Pft 1)

Music teachers often tell their students they must not tap their feet or bounce their heads. However, it is only the student's desire to engage with the music by setting or perceiving a constant tempo that makes them do this. The variety of ways in which the participant musicians felt an inner experience of tempo might be a result of trying to fit within the acceptable boundaries of movement allowed by their peers. The whole body movement experienced by Vln 1 is often displayed by performers. It translates into a lively and acceptable style of dance-like performance where the musician is allowed to sway and move with the rhythm. Perhaps the communicative expressiveness of this movement makes it seem acceptable. Yet interestingly, while this is a far more extreme motor action than toe tapping, it seems to be an acceptable type of movement for classical concert music-making. Those musicians who felt like they wanted to move their arms like a conductor might be experiencing a smaller, more controlled version of the whole body movement. Perhaps Vcl 1, who felt the pulse in her hands and

finger point, could have internalised this movement to an even greater degree.

She hints at this when she says that:

- It must be an imagined movement as there is not outwardly visible movement.

(Vcl 1)

Vcl 1 also was aware of a slight head movement, which both the pianists felt as well. This is an interesting similarity as all three have to play sitting down and have both hands occupied; Vcl 1 (a cellist) has to use both her legs to hold the instrument in position, and the pianists use their feet for the piano pedals. Any tapping or bumping of legs or feet may disturb the stability of the tone quality. Therefore, the only thing left to safely move is the upper body or head. Also, the way musicians generate pulse in performance is to lean more heavily on the instrument during the accented note. This would involve an upper body push for all three seated musicians. Perhaps this movement in turn becomes the way that they create and feel pulse.

The extra heartbeat experienced by Vln 1, Vcl 2, and FH was not what the researcher was expecting. Most other motor activities can be controlled or generated, but humans do not have control over their heartbeat (even if it is an extra one). When questioned about this, FH responded that it definitely was not a breath pulse.

It can be seen that some musicians feel the pulse with the inner voice: “I can sing it like a metronome tick”, or “It sounds like da”, or “I set the rhythm by counting

rhythmically in my head”. These are all results of using the inner voice to articulate a pulse. Using the mouth or tongue movement might be a smaller version of this. The “waves from one side of the roof of my mouth to the other side, resembling an old metronome” experienced by Vln 3, might be something she developed through years of practice watching a clockwork metronome. Perhaps this became an extension of her inner voice combined with a visual imagery of metronome movement.

The third idea was supported, in that there seems to be a variety of ways that musicians feel pulse, including physical movement and sound imagery. The movement can be of any acceptable type and can be external or internalised. Internalised movement is imagining the feeling of the movement but showing no actual signs of movement. Some musicians use internal sound generation to hear pulse internally. They do this with inner speech by imagining counting or other sounds and also with inner singing or inner hearing by imagining the piece as a whole.

4.2.4.4 Inner singing and timbre

Item 6 dealt with the imagery associated with timbre. If inner singing is one type of sound imagery, perhaps imagining timbre is another. The item tries to discover if the musicians thought imagining timbre was a separate skill or related to the way they used their vocal apparatus.

Table 4.8.

Responses for Changing the Timbre of Inner Singing

Item	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
6.1 Can you change the timbre of your subvocal singing?	✗	✗	✓	✓	✓	✓	✓	✓	✗	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response.

Subitem 6.1 asked musicians if they could inner sing a note and then change the timbre to an oboe sound. The verbal responses to this item were varied. The three participants who thought they could not change the sound said either that their inner singing was usually pure and devoid of timbre or that it always sounded like their own voice or instrument.

- I hear sound without instrument/timbre, it's a pure sound. (Vln 1)
- My inner voice is always vocal sounds. (Vln 2)
- I think my inner voice is quite neutral. I don't hear specific instruments, except perhaps piano. I think the percussive sound of the piano makes it easier for me to imagine. (MS)

Vln 1 added that the exception to this is when she imagines violin music and in this case she experiences a violin sound and associated movement imagery:

- My inner voice is sound free of association with an instrument with the exception of violin repertoire. In this case the link between sound and the violin is strengthened as I feel impulses in my hands as if I'm playing. (Vln1)

Some musicians were able to imagine timbre, however, the methods of achieving this were varied. Two musicians thought they tried to imagine the timbre by altering the way they sang:

- When trying to do this, my tongue tightened. Perhaps I was trying to sing a more nasal sound to imitate the sound of an oboe. (Vcl 1)
- I needed to breathe differently. (Pft 2)

Visual imagery might have also been used to cope with this request as one musician commented:

- I ended up with a visual image of someone playing the oboe. (Vln 3)

Those who definitely could imagine timbre argued that it was a separate skill. They described inner singing as a vocally related activity resulting in a bland sound. The production of timbre required other processes which included imagination.

- If I just imagine a pitch, then it is a very bland sound. This is not the same thing as thinking of an instrument timbre. (Cl)
- I can do the whole orchestra. It is a combination of sensation and imagination. (Vcl 2)
- Imagining timbre takes mental effort. (FH)
- I never really hear timbre unless I'm thinking specifically about which instrument or vocal part I'm reading. It's a deliberate act, I think. (Pft 1)

It seems that most musicians agree that imagining timbre is not a normal attribute of their inner singing. Indeed, some musicians said their inner singing had no timbre. Others said that imagining timbre involved visual imagery or changing the inner singing to mimic an instrumental sound such as the nasal quality of the oboe, while others said that imagining timbre was a completely separate skill.

Subitem 6.2 asked the musicians if they thought there was a difference between inner singing and musical imagery. The musicians described inner singing as a useful but narrowly defined skill. It is sound imagery that is produced through a conscious internal singing action. In this activity only pitch is produced and then usually only one pitch at a time. It has some associated larynx movement which helps musicians feel the difference in pitch and contour. However, as sounds become more complicated (for instance, more than one note at a time, sounds of complex timbre, or sounds with no discernable pitch), musicians find that inner singing is not useful. Vln 2 commented on this:

- I think the difference between inner singing and sound imagery is related to the complexity of the sound being imagined. For example the screeching of car tyres has a discernable pitch and therefore I can sing it. The shattering of glass is a more complex set of sounds, which I cannot sing in my inner voice.

Some of the musicians commented that in the case of complex sounds a different type of imagery was needed. They described this as sound imagery or inner hearing. In this case, there was no movement in the larynx and it did not feel anything like singing. The sound was just imagined or heard:

- Inner singing is making a sound, sound imagery is hearing. (CI)
- I think I probably imagine more than I sing, if singing is defined as a subvocal activity involving the movement of the vocal apparatus. (Pft 1)

Some musicians thought they could combine the two types of imagery to produce sounds with specific timbres. FH commented that the sound imagery “is like a separate layer once removed from the inner singing”, but MS thought sound imagery involved much more than inner singing:

- I suppose I think of inner singing as something specific that I use as a technical support, whereas musical imagery is how I imagine communicating the piece as a whole. (MS)

Perhaps in this situation, MS was using the term musical imagery to include ideas on form, dynamics, expression, and emotion.

The musicians are quite aware of differences between the various types of sound imagery they employ, but among themselves they do not agree on terminology. Inner singing seems to be an activity that is useful for generating pitch and has associated vocal movement; inner hearing is sound generation without vocal movement, whereas sound imagery is useful for generating more complicated sounds or musical ideas including timbre and environmental sounds.

In terms of the fourth idea either the musicians participants did not imagine timbre, or they used inner hearing, sound imagery, or other types of visual and kinaesthetic imagery to achieve it.

4.2.5 Conclusions

The musicians in this study all experience internal sound imagery. Some of the musicians were happy to describe their sound imagery as inner singing, in a similar fashion to describing their inner language dialogue as an inner voice. For these musicians, the inner voice is a combination of sound imagery and kinaesthetic imagery or real movement (larynx and breath). When musicians do not experience fusion of sound and kinaesthetic imagery, they are more likely to describe their sound imagery as inner hearing. The musicians are also aware of the difference between inner singing and other types of sound imagery. They describe inner singing as useful for generating pitch, but not for generating more complicated sounds and musical ideas.

Musicians also develop a unique blend of internal and external activities to generate and perceive pulse. Acceptable movements for classical musicians seem to be those that are internal, necessary for making music, or communicating musical ideas. Tapping a foot, bouncing a knee, or counting aloud show that the musician is stressed and, therefore, this becomes an unacceptable movement. It is acceptable for a musician to employ a motor movement to keep time when their ability is stretched, but it must be internal or one that is commonly used for expression or communication of music such as dance-like swaying or conducting.

As already noted, there is a wide range of terms used to describe sound imagery; in part the terminology for sound imagery is probably so unsettled, because inner sound feels and sounds differently for everyone, and depends on the unique

blend of imageries they choose to use. Issues raised in this second survey provided the foundation for further investigation, as is presented in the following chapters.

Chapter Five – Results (2)

Questionnaire Three: Music Listening and the Inner Voice

5.1 Aims

At this further advanced point of the study the research took a different turn. The previous two questionnaires expounded on a central proposition of the thesis, that is, a model for articulating musical ideas based on internalised imagery. Here the question is asked: What if this model could work in reverse? Could this research actually have practical ramifications for the way that the participants listen to music? Therefore, the aim of this third questionnaire was to examine if musicians employ imagery when they listen to music.

It was seen from Questionnaire Two that musicians thought they used imagery to structure their production of external sound. The researcher was attempting to discover if the musicians thought that the three-step model could work in reverse, namely, that internal imagery would be generated and used to understand an external sound source. This further research was based on the premise that imagery would be an intermediate step between external sound and thought.

The starting point of the enquiry for the third questionnaire was that (a) in order to actively engage with the music, the musicians would have to create imagery of it, and (b) one type of imagery used for perception of music is inner singing.

5.2 Theoretical Underpinnings

If only one note at a time can be sung internally, then listening to music would become complicated when more than one note is presented at any one time. Returning to the cocktail party effect as an example, it is possible to hear the sound of 20 conversations at once, but it is not possible to understand 20 conversations at once (Moore, 1989). To listen to a conversation, some internal processing needs to take place. With speech processing, this is by internal repetition and matching of repeated words with concepts from the memory. Repetition of this sort involves isolating one conversation above the others and then linking the words of this conversation into a stream. Streaming is done through visual cues, volume, and timbre analysis (Deutsch, 1982). A sound stream is formed and then analysed.

Literally applying the cocktail party effect in relation to music listening is spurious, as 20 different pieces of music are not presented at the same time. However, even in one piece of music, the sound environment becomes complicated when more than one sound happens at a time. The notes are designed to fit together to create a new whole, but at times this whole can be very complicated. How does the listener cope with this complexity? Is the whole environment processed or does the listener choose a component of it? Is the sound environment divided up into streams, as in language, and one stream understood, or can the sound of a complex musical environment be processed as a whole?

Perhaps the answer lies partially with styles of music composition. Composers have always been concerned about how their audiences listen to their work. Often they will write a piece, trying to direct attention towards a particular part of the sound texture. Composers will make one line more prominent than another in order to direct the audience's attention. A composer may compose a melody adhering to rules for creating a sound stream. The timbre and rhythm will remain consistent, the movement will be logical and display note movement that can be linked into one stream, and the melodic line will be distinguishable even though it is embedded as part of the musical texture. Harmonic activity does not adhere to the rules for sound streaming. However, it may be that as listeners become used to hearing the combination of certain notes, they will be able to process complex harmonic combinations as wholes (by recognizing the sound patterns of harmonic movement). Any sound in the environment comprises a number of separate sound waves, and listeners become used to processing these sounds as a whole.

It is the job of the performer to realise compositional intention. "Bringing out the melody" is one of the main objectives of performing practice in conventional Western classical music. A lot of early piano teaching is based on trying to establish where the melody is and how to find the balance between this and the other lines. In the orchestral context, it is the role of the conductor to establish this balance. In some polyphonic music, it becomes the job of the performer to shape the surrounding material into streams. In such cases, there are two or more equally important lines, and this is how the sound environment can become very complicated.

It seems, therefore, that to varying extents composers design their works with the listener in mind. Where something in the music becomes important, the composer will attempt to draw the listener's attention towards it. Performers will try to realise the composer's intentions by shaping the material into well-connected phrases. However, a listener's perception of a piece may be beyond the control of the composer and performer.

In a complex sound environment, who decides what the audience listens to? Despite the intentions of the composer and performers, it may be up to the choice of the listener as to what they will listen to in a performance. Are they breaking the sound environment up into streams and, in this case, to which will they attend and why? How do they make their choice? Perhaps in the case of a very complex and novel sound environment the audience tries not to process the individual streams, but instead listens to the sound of the complex whole. Given these choices affecting perception, it could well be that each member of the audience hears a different version of the piece.

5.3 Underlying Assumptions

Researchers of language perception have claimed that internal repetition of words is necessary to move the words into the short-term memory (Sokolov, 1972). This internal movement sometimes becomes extremely fast and automated to such a high degree that it is hardly noticeable. Based on this idea, the listening questionnaire was designed to explore the following assumptions

specifically related to musical perception, using the musical excerpts described fully in Chapter Three and Appendix B.

1. Similar to language perception, musicians might sing internally in order to perceive music.
2. Inner singing usually allows for one line only to be sung. Some sort of sound streaming might occur because of this limitation.
3. In a complex sound environment, humans have the capacity to distribute all their attention to one stream thereby blocking out other events. This is called *attention distribution*.
4. In a complex sound environment, humans have the capacity to follow one stream, but also be alert and aware of other events.
5. It is possible to be alert and attentive to the whole sound environment rather than focus on any one part in particular.
6. The percentage of attention given to any one part in an auditory environment is governed by personal choice of the listener.
7. Other forms of imagery might be used for perception of sound, such as kinaesthetic imagery (hand movement), word imagery, or visual imagery.

5.4 Results

Whereas the results of the two previous questionnaires had only hinted at differences between the participants in the internal processing of sound, it was in this listening questionnaire that differences became very obvious.

5.4.1 Listening one: Slow melody line

The purpose of the musical extract with a slow melody line was to see if the participants sang internally when listening to music. A particularly slow, lyrical piece was chosen: the *Adagio* from the *Oboe Concerto in D minor* by Albinoni (See Appendix B). It was thought that the slowness of the melodic line might allow the participants to have time to notice their inner singing. A Baroque piece was chosen, as most musicians are familiar with the style of the music and are able to anticipate harmonic movement and stylistic conventions. A concerto was chosen, as in this genre the melodic line of the soloist usually stands out from the accompanying texture in terms of dynamics and also timbre. The musicians would have a fair idea of what the next note could be at any given time and also would understand the harmonic language. Oboe as a solo instrument was chosen, as it is this instrument along with some string instruments, which most resembles the human voice. Therefore slowness, clarity of texture, familiarity of genre, and voice likeness were chosen as a starting point for listening activities.

It was thought that musicians would inner sing on the first hearing, and that they would sing the line to which the composer and performer drew attention. In this case, the solo oboe line would stand out from the accompanying texture. The performing group would be trying to make the oboe line prominent, as this is a characteristic of the concerto genre. Another way to attract a listener's attention is through *difference* or *change*. It is a feature of the Baroque concerto grosso that solo sections are interspersed with tutti sections. The playing of the soloist gains importance and attention as they enter at points where the musical texture changes dramatically.

It was also assumed that the musicians would be instinctively assessing the attributes of the performance; for example, by expecting the soloist to apply ornamentation (trills and other fast decorations of the melodic line) in a Baroque style and by making judgements about the success of this application. To do this, they would have to distribute a large percentage of their attention towards the line of the soloist. The results can be seen in Table 5.1.

Only 8 out of the 10 interviewed musicians agreed that they were singing internally in the first listening extract. The interesting point here is that even though Vln 2, Vcl 2, and MS did not know the piece, they felt they were singing on the first hearing. This makes inner singing for perception likely, as their inner singing was not just a memory of the piece or a co-performance. They were using their voices as a way to track the music. How is this possible if they do not know what is going to happen next? If the inner voice *shadows* sound then it must be able to move very quickly and be just fractionally behind. To move this quickly the inner voice must be very fast or the musician must be able to anticipate what the music is about to do. MS hints at this when saying: “I knew the style”. Inner singing could, therefore, feel automatic and simultaneous if a musician knows through experience what is likely to happen next.

Table 5.1.

Responses for Listening One: Slow Melody Line

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
1.1 I knew this piece	✓	✗	✓	✓	①	✓	✗	✓	①	✓
	Vaguely (Vcl 2)									
	I knew the style (MS)									
1.2 I sang on the first hearing	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓
1.3 I sang the oboe part	✗	✗	✓	✓	①	✓	✗	✗	✓	①
	Sometimes (Vcl 2)									
	On and off and commented on vibrato (FH)									
1.4 I also / sang with the	①	①	①	①	①	①	✗	✗	①	①
	Violin and made internal observations (Vln 1)									
	Violin (Vln 2)									
	Violin, I am familiar with this line (Vln 3)									
	Whoever had the melody (Vcl 1)									
	Melody or cello or viola (Vcl 2)									
	Harmony (Pft 1)									
	Accompaniment (MS)									
	Different strings at different times (FH)									
1.5 I sang the ornamentation	✗	✗	✓	✓	✓	✓	✗	✗	✓	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ① = Written answers were given on the questionnaire form and are included on the table.

Another interesting point is that these musicians seemed to be singing different things. Some are inner singing with the soloist, even though there are no oboe players among them (apart from Cl who is able to play bassoon and oboe as a second and third instrument). Some sang with the instrument they play, the three violinists sang with the violin line and Vcl 2 sang the bass line. FH flipped from

one line to the other depending on what interested him at the time. Pft 1 was interested in the harmony, and MS and Vcl 1 seemed to track whoever had the melody at the time. Interestingly, MS said she was able to sing both the melody and the accompaniment in her head at the same time:

- I automatically began to sing in my head as soon as the music started. I very strongly followed and sang with the oboe. I often was singing both the melody and accompaniment simultaneously in my head. (MS)

The six musicians who thought they sang internally with the oboe part were also the six that thought they sang the ornamentation. Perhaps this meant that they distributed greater attention towards the oboe line and, therefore, were able to notice the ornamentation. It must also mean that their inner voices are able to move quickly and easily.

Two musicians said they did not inner sing with the music. Pft 2 and Cl both said inner singing was not something they did when they listened to music. Cl described his thoughts during listening as “thinking about the structure of the music (solos tutti, chord progressions) and stylistic things such as articulation and the style of the soloist’s playing”. These thoughts were involuntary and did not happen all the time. They were recognitions as he absorbed the music:

- Most of the time I am just listening which is not the same as singing. When I do sing along with the music in my head I feel I am listening to less of the music. When I do sing I am shadowing a particular part. I would only do this if I wanted to notice more about that part for some particular reason. You can compare it to visual perception. Say you are perceiving a game of soccer. You can be in the game and have an intense knowledge of your own part, or you can

be watching the game and seeing the entire game, taking notice of everyone's progress. (Cl)

It can be seen that for this musician, streaming and inner singing are devices that can be used for tracking one particular instrumental part. However, in this case he did not employ this kind of imagery and instead was trying to approach the music as a whole. A significant comment that this musician made was that in place of inner singing he used inner speech. He was making comments to himself about the structure of the piece, the length of the opening tutti, and the harmonic material. As well, he commented internally about the oboist's style of playing.

Pft 2 also did not think she used inner singing when listening to music. She described her listening as being more like feeling than listening and commented that she tends to:

- track the music on a mental stave, think of chord structures, and feel movement in my fingers. My "dictation" must be very slightly behind what I am hearing as this process also occurs with previously unheard music.

It can be seen that unlike Cl, Pft 2 rarely sings internally. Her imagery in response to music is not auditory. Instead she experiences visual imagery by seeing notes appearing on a stave. She also feels movement in her hands. Whereas some musicians would hear sound and feel movement in their larynx, this musician sees notation and feels movement in her hands.

From the responses to this extract much evidence emerges, including support for the following ideas.

1. It is possible to inner sing with music that has not been heard before.
2. When inner singing is used, usually only one voice is attended.
3. Inner singing is a useful device for paying attention to one instrumental line in a complex texture, but perhaps less of the sound environment can be accessed in this way.
4. When sound streaming does occur, musicians will not necessarily choose the same line.
5. Often the listener will choose the melody line (this is probably what the composer and performer intended them to take notice of).
6. Sometimes personal choice determines which line the listener is interested in, and often they will choose the instrument (or register) that they are most familiar with.
7. Musicians are able to flick quickly from one line to another.
8. Inner voices must be able to move fast in order to mirror complex ornamentation.
9. Not all musicians use sound streaming when listening to music. It is possible to listen to the whole sound environment, however, it may be that a different type of imagery is necessary for this.
10. Some musicians use hand movement (or imagery of hand movement) to help with music perception.

5.4.2 Listening two: Fast melody line

The fast melody line extract was chosen to test the speed of subvocal singing. The Allegro (fast) movement of a Vivaldi oboe concerto was chosen (see Appendix B). In this particular performance the scale passages performed by the

oboist move extremely fast (estimated at semiquavers at a crotchet = 184). Also, the range of the oboe is quite high (higher than a soprano can sing). The reason for choosing a solo instrument which is able to play outside the capacity and range of the human voice (that is, faster and higher) was to see if the inner singing voice is able to match these extremes.

It was seen in the first listening example that Cl and Pft 2 thought that the imagery they used when listening to music could not be described as inner singing. Cl described his style of listening as accessing the whole sound texture and using verbal commentary to remember aspects of it. Pft 2 thought that her style of listening included imagining notation of the music and feeling hand movement. Both musician-participants returned their questionnaire forms with only the first item completed, but did include written comments for the other items. The absence of their *Yes/No* responses are indicated on Table 5.2 with a dash.

Another two of the musicians, who said they sang internally in the first listening example, did not inner sing in this exercise. Vln 1 thought that she may have sung internally during the first listening extract because she knew the piece. In the second extract she did not know the piece, but instead “listened and absorbed” the music. She commented that she did not experience visual imagery, but she was aware of hand placement:

- I do not visualise staves or beams or fingerboard, I am always aware of where my hand would need to be to produce the music. (Vln 1)

MS also described her listening experience as “listening very intently, but that was all”. This means that only 6 out of the 10 musicians thought they used inner singing during listening example number two. Of those 6, the way they used their voices seems fairly consistent.

Table 5.2.

Responses for Listening Two: Fast Melody Line

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
2.1 I sang the fast bits	✗	①	✓	✓	✓	✓	–	–	✗	✓
I sang the fast bits and tracked the bass line (Vln 2)										
2.2 In the fast bits I glissando-ed along the melody line	✗	✓	①	✓	✓	✓	–	–	✗	✗
I noticed my breaths became slower (Vln 3)										
2.3 This music was beyond the range of my natural singing voice	✓	✓	✓	✓	✓	✓	–	–	✓	✓
2.4 My subvocal voice was able to reach high	✗	✓	✓	✓	✓	✓	–	–	✗	✓
2.5 I transposed to suit my voice type	✗	✗	✗	✗	✗	✗	–	–	✗	✗
2.6 My subvocal voice is more agile than my natural singing voice	✗	✓	✓	✓	✓	✓	–	–	✗	✓

Note. Key to symbols: ✓ = Yes response; ✗ = No response; ① = Written answers were given on the questionnaire form and are included on the table; – = Item not completed.

Given that the main focus of the test was on voice virtuosity, it is interesting to see that with the extreme speed of the oboe in this extract, most inner voices were challenged. Only FH could clearly articulate internally every note that the

oboe played. The other musicians thought that their inner voices had to cheat by glissando-ing along or ironing out the melody line. Vcl 1 commented that, even though she could hear every note that the oboe played, she was aware that her inner voice was doing something slightly different. If the singing that these musicians did during the fast passages in this listening were to be notated, it would look more like a flowing line graph than individual notes on a manuscript.

Even though the musicians had to sing slightly differently to cope with the speed of the piece, it can be seen that they could cope with the register. All the singing musicians said that their internal voices were able to cope with the high notes of the oboe. It can, therefore, be assumed that the inner voice can reach higher than the external voice or that it is able to transpose easily. Given that none of the musicians ticked “I transposed to suit my voice type,” it can be assumed that the inner voice can reach this high. All the six singing musicians agreed that their inner voices were more agile than their external voices.

MS did not agree that her internal voice was more agile than her external voice, but perhaps she had trained her inner voice to reflect the capabilities of her external voice:

- This music was beyond the range of my subvocal voice, perhaps the piece was too fast. I found that with this piece I hardly used my subvocal voice at all. Especially compared to the first piece which I had felt an immediate physical sensation in my throat. Instead I was listening very intently but that was all.

The comment from Vln 3 that her “breaths became slower (both inhaling and exhaling)” shows that her subvocal singing is a physical activity, and in her case

seems to be not just larynx and tongue movement. Perhaps she uses her breathing to shape her sung lines. Interestingly, she sings on both in and out breaths or otherwise she may have had to have long out breaths and extremely short in breaths. The comment from Vln 2 that he was able to sing the fast bits and “track the bass line” is similar to the comment by MS in the first listening example that she was able to “sing both the melody and accompaniment”.

From the responses to this extract shown in Table 5.2, the following observations can be made:

1. Six out of 10 interviewed musicians sang internally when listening.
2. Most inner voices were challenged at this fast speed.
3. The inner voice can use short cuts to cope with speed.
4. The inner voice is able to reach higher than the normal range of a human voice. It does not use transposition to cope.
5. One musician noticed her inner singing was linked to her breathing.
6. Some musicians chose to divide their attention between lines.
7. Some musicians did not sing internally.

At this stage, the musician-participants had agreed with the ideas raised in preliminary discussions. However, it seemed that they were able to offer more insight into the topic in terms of their individual styles of listening than had been expected.

5.4.3 Listening three: Polyphonic music

The third listening extract was chosen to see how the musicians coped with multiple lines. The first and second examples of music were from a concerto and, therefore, had a prominent solo line. The third example was chosen because a number of different lines were presented by one instrument. The piece was a Bach chaconne played on solo viola. The chaconne is an example of polyphonic music that often requires a solo performer to play two or more melodies simultaneously. The researcher was interested to see how the participants listened to multiple lines and chords. Did they follow all the lines, the line that the performer made prominent, the melody line (the composer's choice), or did they use their own personal choice when distributing their attention? The excerpt was also interesting because of the style of the performer's playing. The performer was technically flamboyant in the use of different types of bowing, thus creating interesting textures in the music. Also, the piece was played using a curved bow with a thumb lever. During chords the performer loosened the hair on the bow (with the thumb lever) and was, therefore, able to produce sustained four note chords. It was wondered if the musicians would represent these technical aspects internally.

What can be seen in Table 5.3 is that the musicians are very individualistic in their response to music listening. Seven of the musicians sang, or sang sometimes, while listening, and their singing showed many individual preferences. This was possibly because Bach's second and third lines are just as beautiful and engaging as the top line.

Table 5.3.

Responses for Listening Three: Polyphonic Music

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
3.1 I sang/sang sometimes	✗	✓	✓	✓	✓	✓	✗	✗	✓	✓
3.2 I sang the melody	–	✓	✗	①	①	✗	–	–	✗	①
	I can switch (Vcl 1)									
	Sometimes (Vcl 2)									
	Sometimes (FH)									
3.3 I sang the line that the performer made prominent	–	✓	✓	①	①	✓	–	–	✗	①
	Not necessarily. I sang the melodic line, but in the chords, I sang the middle line (Vcl 1)									
	Often, but also lots of the bass notes (Vcl 2)									
	Sometimes (FH)									
3.4 I sang the chords	–	①	①	①	✓	✓	–	–	①	①
	I sang the second note down (the resolving notes) (Vln 2)									
	I sang some harmony in the slower chord section (Vln 3)									
	I hear the repeated central note of the chords and bass of the chords more than the melody (Vcl 1)									
	Only the middle line (MS)									
	As a whole (FH)									
3.5 I arpeggiated the chords	–	①	✗	✓	✗	✗	–	–	✗	✗
	Only when the performer did (Vln 2)									
3.6 I sang the articulation (legato and staccato)	–	✓	①	✓	–	✓	–	–	✓	–
	The sensation in the roof of my mouth differs with the articulation type (Vln 3)									

Note. Key to symbols: ✓ = Yes response; ✗ = No response; ① = Written answers were given on the questionnaire form and are included on the table; – = Item not completed.

The listeners were aware that the performer was trying to bring out certain lines of the music, and they did sing with him, but they also chose to sing other lines as well. It is almost as if the musicians were perceiving the performance, but at the same time they were creating an alternative personalised performance of the piece. This is most evident in the way they approached the chordal sections where their singing seemed to mirror the roles they would perform when playing as an ensemble. The two cellists gravitated towards the bass line:

- I sang lots of the bass notes. (Vcl 2)
- I hear the repeated central note of the chords and bass of the chords more than the melody. The denser textured sounds in the chords make the viola sound “yummy,” otherwise the straight solo melody makes the viola sound light. In two part playing I hear the melody, but in chords I really hear the middle. (Vcl 1)

The violinists claimed to be singing the middle notes, with Vln 2 saying “I sang the second note down (the resolving notes)” and Vln 3 “I sang some harmony in the slower chord section”. Even MS who would naturally be singing the middle notes in a vocal ensemble claimed to be singing with the middle stream. She commented that in this piece “my subvocal singing was influenced by my voice type. In the chords I was drawn always to the middle voice and to the way it moved”.

The remaining two musicians thought they sang the chords. The researcher had assumed that, when confronted by chords, the participants would either pick one note of the chord to sing or would sing rapidly through all the notes (that is arpeggiate the notes) in order to perceive them. It seems that nobody used

arpeggiation as a way to perceive chords. Pft 1 and FH sang internally, the chords as a whole internally. Given that pianists are used to working with harmonic material, they may be more likely to recognise chords as a whole. FH felt that he was able to track a melody line, but he was also able to take in the whole chord by using imagery rather than inner singing. He agreed that it felt like a “pulling out” from tracking a line and instead felt like a wider type of listening.

It seems that the listeners were interested in the style of performance and followed the articulation choices of the performer. The inclusion of staccato (notes that are short and detached) and legato (played in a smooth style) in the inner singing of the listeners shows that the inner voice is very competent at reproducing sound. Vln 3 offered the information that “the sensation in the roof of my mouth differs with the articulation type”. This was such a provocative statement that the researcher asked other participants what they thought of the idea.

Vln 3 further clarified the statement and linked articulation to breathing: “Legato feels smooth, like one breath. Staccato creates a pulsing sensation on the roof of my mouth”. Most of the musicians agreed with this idea:

- I find that my whole body reacts differently also to staccato or legato inner singing. It must be having the same physical reaction it would have if singing out loud. (MS)
- Yes, very subtle, yet a different sensation – more around the tongue. (FH)
- Yes I agree. (Vcl 1)

- Only when I'm singing vocal sounds or words. (Vcl 2)

The comment of Vcl 2 is interesting, as it seems she uses two types of imagery. When she imagines vocal sounds, she feels movement or sensation in her mouth, but if she imagines other types of music she does not. Vln 1 also made the distinction between different types of sound imagery:

- I agree with this, if I am using my own inner voice rather than inner hearing.
(Vln 1)

Cl seems to only use sound imagery that does not rely on vocal movement. He has previously described this process as inner hearing.

- It does not feel. It seems to be in my head.

From the responses to this extract, the following observations can be drawn:

1. The listeners were aware of the main melody line of the music, but did not feel they had to sing with it.
2. The listeners were aware of the performer's intentions and often sang with him to perceive his interpretation of the music.
3. The listeners seemed to use personal choice when streaming. Five of the seven musicians said they were often singing with bass notes, or notes further down in the texture.
4. The streaming choices made by the listeners often resembled the register of the instruments that they play.

5. It seems that arpeggiation is not a device used to perceive chord structure.
The listeners either chose one note out of the chord to sing or perceived the chords as a whole.
6. The listeners who mimicked the articulation (the legato and staccato) of the performer, linked this ability to breath control.

5.4.4 Listening four: New music

Listening Four was Night Flight, the fourth movement from “*Mephisto*”, a work for a mixed ensemble of six instruments by Schultz. This contemporary extract was chosen as the musicians had not heard it before, and possibly did not know the style of the composer. It was assumed that they would not be able to anticipate the course of the music. It is extremely fast and quite wild as it opens with a frantic triplet figure that eventually stabilizes and continues as an underlying theme. The melody is fragmented and passed between instruments, so that the whole feeling of the work is of something that is only just hanging together. The researcher expected the following:

1. Those participants who usually sang for perception would continue to do so.
2. The participants would have difficulty forming instrumental streams as the instrumental parts were fragmented.
3. They would have to rely on something other than timbre analysis to form streams.
4. If listeners were able to mimic staccato and legato they might be able to mimic pizzicato and flutter tongue techniques.

Table 5.4.

Responses for Listening Four: New Music

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
4.1 I sang fragments	–	✓	✓	✓	✓	✓	–	–	✓	✓
4.2 I sang the melody	–	①	✗	✗	✗	✗	–	–	✗	–
	I didn't really try to identify a melody (Vln 2)									
4.3 I sang the most prominent bit	–	✓	✗	✓	①	✗	–	–	①	✗
	I mostly sang the repeated Ds (D flats?) (Vcl 2)									
	Yes the most obvious rhythmic pattern (MS)									
4.4 I flicked quickly between the instrumental lines	–	✓	✓	✓	✗	✓	–	–	✓	✓
4.5 I was able to colour my singing so it sounded like pizz. or flutter tongue	–	✗	✗	✓	✗	✗	–	–	✗	✓

Note. Key to symbols: ✓ = Yes response; ✗ = No response; ① = Written answers were given on the questionnaire form and are included on the table; – = Item not completed.

The same 7 (out of 10) musicians said that they sang internally during listening to this piece. This is interesting as it suggests there may be listening habits. Some musicians may always sing internally, while others may not. Some musicians may hardly ever sing internally, but occasionally use it as a tool to track a particular instrumental line. The reverse may be that some musicians may only occasionally stop singing, when they find a situation where it is not useful. It seems this piece created a situation for some musicians where inner singing was not useful. Vln 2 commented on reasons for singing or not singing:

- When singular/simple lines were apparent, I tended more to sing the line, when it became hectic I stepped out for a while.

When asked to clarify this point, he described it as a “pulling back” similar to getting out of a swimming pool when the play became too rough. This point was also raised in the second listening extract when MS said that although she did not sing subvocally, because the extract was too fast, she found she stepped in when it became predictable:

- I noticed that sometimes with the repeated patterns I would start subvocalising, but mostly there was no reaction.

FH’s reaction to the chords in the Bach chaconne was similar; he commented that he “pulled away” for a fuller perception of the music. This could be a similar concept to the “zooming in on detail” that Schneider and Gødoy (2001, p. 22) described.

Five of the listeners stated that they flicked quickly between instrumental lines. It could have been that the melodic lines were so fragmented that it was necessary to rapidly flick from one line to the next as a way of following which instrument was playing. Or it may have been that flicking between lines is a way of scanning the texture for something which is easy or enjoyable to follow.

In this extract, most of the listeners seemed to direct their attention towards the repeated triplets played by the violin at the start of the piece. This was the most predictable line in the texture, and it was the one theme or element that continued throughout the piece. The rhythmic figures take a while to settle; strongly

accented triplets in combination with the natural heaviness of the performer's down bows (on every second note) results in some ambiguity of rhythm. It was this instability that attracted the attention of the listeners. MS described a strong physical reaction to it:

- My body definitely reacted to the rhythmic pulse. I felt it especially in my head, neck, big toe, and right hand. I think I was trying to pick up accented beats and make sense of the timing.

In this case, it seems that reaction to the pulse or rhythm of the piece was not something that was in the subvocal voice, but rather pulse perception was a motor movement.

Although some musicians agreed that they could sing legato and staccato internally, they were not sure that their internal singing extended to pizzicato (plucking the string rather than bowing it) or flutter tongue (blowing a note over a rolled “r”). Only FH and Vcl 1 thought they were able to do this. Perhaps these sounds are more easily imagined than sung. MS did notice that she sang along with the glissandos of the clarinet part:

- I sang along especially the rhythmic stuff at the beginning and also the glissandos. I felt my voice doing a kind of siren-ing effect along with the music.

It can be seen from Table 5.4 that this composition challenged the inner singing voices of many of the musicians. It also challenged one musician who did not sing. Pft 2 had previously described her listening to music as “not hearing” but “feeling”. With the three previous listening extracts she visualised the music on a

internal stave, thought about the chord structures, and felt movement in her fingers. However, she found that for the Schultz piece, this did not happen:

- The only exception was the Schultz composition. My impressions were not as accurate and I tended to become immersed in the atmosphere of the music without the compulsion to analyse. (Pft 2)

Similar to the stepping out experienced by those musicians who usually sang internally while listening to music, it can be seen that this musician stepped out from feeling and visualising the music. It is interesting that she describes her responses to the music (that is visualising, thinking, and feeling) as analysis. The music seems to have been too fast, fragmented, and unpredictable for the musicians to be able to sing or perform internally, and instead they chose to listen to the sound of it rather than try to analyse.

From the responses to this extract, the following can be seen:

1. Musicians may develop styles of listening. Some may always approach a listening task by trying to sing internally.
2. Listeners might be able to scan through the texture rapidly looking for streams.
3. If the melody line is fragmented enough, listeners may find that inner singing (or inner performing) is not useful.
4. Inner singing may be a personal choice and even if people automatically do it, there might be times when they step out.
5. Stepping out may be used to rest, but also some musicians use it to achieve a more complete perception of the music.

6. Most musicians claim their inner voices cannot sing pizzicato and flutter tongue. Other types of imagery might be useful here.

5.4.5 Listening five: German lieder

The next listening extract presented to the musicians was the song by Schumann, *Ich Grolle Nicht*. From the review of literature, it has been seen that the inner voice is used for speech perception. In this extract it was assumed that the inner voice would be used to inner sing the melody; it was wondered if the addition of text would mean that the musicians would attempt to mimic the words.

Pft 1 and MS knew the song quite well, and both are capable German speakers. Therefore, their mirroring of the German lyrics is not as astonishing as the two non-German-speaking cellists, whose inner voices were virtuosic enough to sing the vocal line as well as mimic the German. (It can be seen in Table 5.5 that Vcl 1 was also visiting other lines as well). FH thought that although he did not consciously sing the German text, the timbre of the consonants was very clear and obvious. He thought the clarity of the consonants gave the music an added percussive effect, which was hard not to mimic. Two violinists did sing the vocal line but without mirroring the German language. For Vln 2, the inner singing sounded like an instrument playing the same line as the singer: “No, I sang like an instrument doubling the part”. This is an example of a musician being aware of his inner singing, so that he can hear the difference between the sound source and his internal representation of it.

Table 5.5.

Responses for Listening Five: German Lieder

Prompt	Musician-participants									
	Vln 1	Vln 2	Vln 3	Vcl 1	Vcl 2	Pft 1	Pft 2	Cl	MS	FH
5.1 I sang with the piano	–	①	✓	✓	✗	✓	–	–	✗	✓
	Sometimes when more prominent (Vln 2)									
5.2 I sang some harmony	–	①	✗	✓	✓	✓	–	–	✗	✓
	Bass line sometimes (Vln 2)									
5.3 I sang the vocal line	–	✓	✓	①	✓	✓	–	–	✓	✓
	I switch between the lines (Vcl 1)									
5.4 I sang along with the vocal line and mirrored the words	–	①	✗	✓	✓	✓	–	–	✓	①
	No, I sang like an instrument doubling the part (Vln 2)									
	Partially (FH)									

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ① = Written answers were given on the questionnaire form and are included on the table; – = Item not completed.

MS and Pft 1 commented that because they knew the piece so well, their inner singing became a co-performance. They sang the piece internally the way they thought it should be performed, rather than stay with the performer:

- Because I know this song, I tended to want to sing it using more legato than the recorded voice was using. This meant that I actually stopped mirroring his singing and adjusted to suit what I wanted to do. (MS)
- The baritone takes the low option at the climax, I sang the high version. (Pft 1)

From the responses to this extract the following can be seen:

1. Some listeners were able to mimic foreign languages internally.
2. It may be the timbral or percussive sounds of language that attract attention.
3. Some listeners were able to notice that their inner voices were producing the melody line without the text.
4. Some listeners described their inner singing as co-performing rather than perception.

5.5 Conclusions

The inner voice is more agile than the external voice. It was demonstrated in that the inner voice can track music playing at speeds approaching 736 notes per minute and will sometimes use short cuts to cope with speed in excess of this. The inner voice is able to reach higher than the normal range of a human voice and does not use transposition to cope with this. Some musicians in this study thought their breathing was linked to the phrasing of their internal singing, as they used breath pulses to mimic staccato and sang on long breaths to achieve a legato sound. Most musicians claimed their inner voices could not mimic pizzicato and flutter tongue. Some listeners were also able to mimic foreign languages.

Seven out of the 10 interviewed musicians sang internally when listening to music. The others chose not to sing. Reasons given for not singing were that other imagery was being used (visual imagery or kinaesthetic hand imagery) and also that less of the sound environment could be processed with inner singing. Of

those seven who did sing, it can be seen that they mostly sang, but occasionally dropped out when the lines became too frantic or fragmented.

When sound streaming does occur, musicians use personal choice as to which line to attend. In some of the extracts the listeners were aware of the main melody line of the music, but did not feel they had to sing with it. They were also aware of the performer's intentions and often sang with the solo line. However, quite often they chose their own line to sing with, thereby creating an alternative performance of the piece. Five of the musicians said that in a polyphonic texture they were often singing with bass notes or notes further down in the texture rather than the melody line. The streaming choices the musicians made closely resembled the register of the instruments they play. In some cases the musicians described their singing as co-performing, and this tended to be where they knew the piece very well and would have performed it differently to the recorded soloist.

It seems that arpeggiation is not a device used to perceive chord structure. The listeners in this study either chose one note out of the chord or perceived the chords as a whole. Those who perceived the chord as a whole did not use inner singing to do it.

Some musicians chose to divide their attention between lines either rapidly scanning between them in order to find something to sing with or singing one line while somehow tracking another. One musician described his listening as involving tracking by singing combined with periods of a more whole listening.

It is possible that by concentrating only on one line of music another can be blocked or partially ignored. This blocking may be caused by failure to repeat any of the sounds in the inner voice. Therefore, none of the sounds would move beyond the initial sensory signal and would be lost quickly. The blocking of streams may be unacceptable to some musicians in their listening, and so they try to access the sound environment as a whole by using different imagery. It may be that the three musicians who did not sing internally during this questionnaire were trying to perceive the sound environment in this way. These musicians described their listening as being still and calm and including internal commentary about chord progressions, structure, and stylistic characteristics. Possibly sound imagery is replaced by other kinds of imagery such as word imagery.

It seems that only 7 people out of 10 consistently sang internally when perceiving music. It may be that musicians get used to either singing internally or not singing internally when listening to music, so that one way or the other becomes a habit. The imagery that the musicians used could in some cases be described as inner singing, but they also experienced imagined hand movement, inner speech, inner hearing, and visualisation of notation.

Chapter Six – Results (3)

Questionnaire Four: Music Reading and the Inner Voice

6.1 Aims

The aim of Questionnaire Four was to find out what sorts of imagery musicians experience or employ when they read notated music. Score or music reading is a fundamental part of being a musician just as reading words is a key component of literacy. Researchers of language perception claim that when language text is read, the sound of the word is imagined in the reader's mind. It was wondered if, in a similar way, musicians might hear the sound of the notes that they read. This questionnaire was based on three aims:

1. To discover if musicians experience imagery in their minds when they score read. If they do then:
2. To describe if it is a planned and controlled generation of imagery, or if it is a involuntary experience. And:
3. To describe what imagery types are useful for reading music (e.g., auditory, kinaesthetic, or verbal).

6.2 Theoretical Underpinnings

The research up to this stage had concentrated on the generation of imagery in two contexts. Chapter Four dealt with the generation of imagery in the absence of any external stimulus. Participants were asked to generate musical imagery and to answer questions about how it sounded, looked, felt, or moved. Chapter

Five was concerned with imagery that was generated in response to an aural stimulus such as listening to music. The next step in this process was to see what sort of imagery was generated in response to the external stimulus of notated music. Notated music is a symbolic representation of sound consisting of written instructions that musicians read in order to produce a desired set of sounds. Generating internal sound in the process of score reading is difficult, as it involves interpreting a range of symbols to produce notes of correct pitch which fit correctly into time. During this exercise the musician might experience imagery of the sound of the music, imagery of the feeling of performing the music, visual imagery of the instrument which could produce the music, or visual imagery of themselves performing the music.

6.3 Underlying Assumptions

When listening to music, the musician-participants generated imagery in order to move the external sound source to their memory. It was assumed, in a similar way, that the musicians would generate sound imagery in response to notated music. If the musicians thought that the exercise produced a spontaneously uncontrolled sound imagery then they would have no need to consciously set up scaffolding for their perception. Instead, they might just answer that they heard the music without any other activity. *It was thought that this would not be the case, but rather, the musicians might choose a specific way to create the sound of the music in their minds, which would need a planned sequence of internal decisions, and imaginings.*

To set up scaffolding for imagery, musicians would have to actively make decisions about the rhythm and pulse of the piece, as this is an area where mistakes can occur. When young players make mistakes with rhythm, they are often told that it is because they are “not counting”. Given that most students can count to 4 or 6 quite easily, performance of rhythm may be more complicated than just literally counting. The reason experienced musicians are able to play rhythmically complex music together is that they share an agreement of the *pulse*. They need to keep track of the shared pulse, decide how many of those pulses to give each note, or recognise how to subdivide it correctly.

It was seen in Chapter Four that the musicians were very individualistic about the way they created pulse. It was mostly done through movement or movement imagery. It was assumed that when score reading, notes longer than a beat would be imagined by setting a pulse and then feeling a certain number of pulses for each note. Therefore, when score reading, it was anticipated that the musicians would set up a scaffold for imagining pulse and rhythm in the following three ways: (a) Set a pulse by movement or imagined movement, (b) count pulses for notes or rests which were longer than one beat, and (c) subdivide the pulse for shorter notes.

Scaffolding might also be used for generating pitch. Generation of this type of imagery in response to notation is difficult, as one slight mistake can mean the subsequent imagery is also wrong. Because of this, musicians might try to scaffold the imagery in some way. This can be done by choosing a scale or key area or setting a tonic note (the first note of the scale). By doing this, the

musician creates a reference point and is able to measure each pitch in relation to this point. Therefore, it was expected that when score reading, musicians would approach pitch by (a) placing their inner singing into a scale or key area, and (b) setting a tonic note.

Pitch names are a way of communicating about pitch and keeping track of where notes exist on an instrument. However, as the musicians may be counting in their heads, it may be that they are unable to say pitch names at the same time as they are saying numbers. Muscle memory of hand positions or larynx position might help with the generation of auditory information. The fusion of imagery (auditory and kinaesthetic) could make the capacity for imagining different elements of the music stronger. However, it may be that if kinaesthetic imagery is used, the imagery generated might be felt rather than heard. Therefore, it was assumed that when score reading, musicians may (a) not say the letter names of pitches, (b) use hand positions or larynx movement, and (c) recognise what performing the music feels like.

The generation of chord imagery (more than one pitch at a time) is also relevant. It was thought that, as the sounds became more complex, the musicians would not be able to use inner singing, as this type of imagining usually is only useful for one note at a time. The musicians would have to rely on other types of imagery or fusions of imagery to cope, such as (a) inner hearing (sound without larynx movement), (b) word imagery (chord names), or (c) kinaesthetic imagery of hand positions.

6.4 Results

The musician-participants were each given a piece of single line music; the slow movement of a Mozart string trio (see Ex. 6.1). They were given either the cello or the violin part depending on the range and clef of the instrument they play. This questionnaire tried to discover if the musicians actively use mind skills to generate an image of the music as they read through the score. Questions were asked about setting a tempo, feeling the pulse, counting the rhythm, saying the note names, singing the notes internally, or imagining performance. The questionnaire also touched on musical aspects of the piece, which were apparently outside the range of inner singing (for example, double stops, articulation, and dynamics). It was thought that the pianists who chose scores with complex harmonic material could answer a further set of questions about inner representation of this.

6.4.1 Item 1: Pulse imagery

Item 1 and its subitems asked musicians about pulse setting. The researcher assumed that a scaffold of an imaginary pulse would have to be set, so that the musicians could fit their rhythms successfully into the beat. This could feel like an internal pulse or an imaginary movement. As there is no need to internalise movement in score reading, the musicians may use real movement.

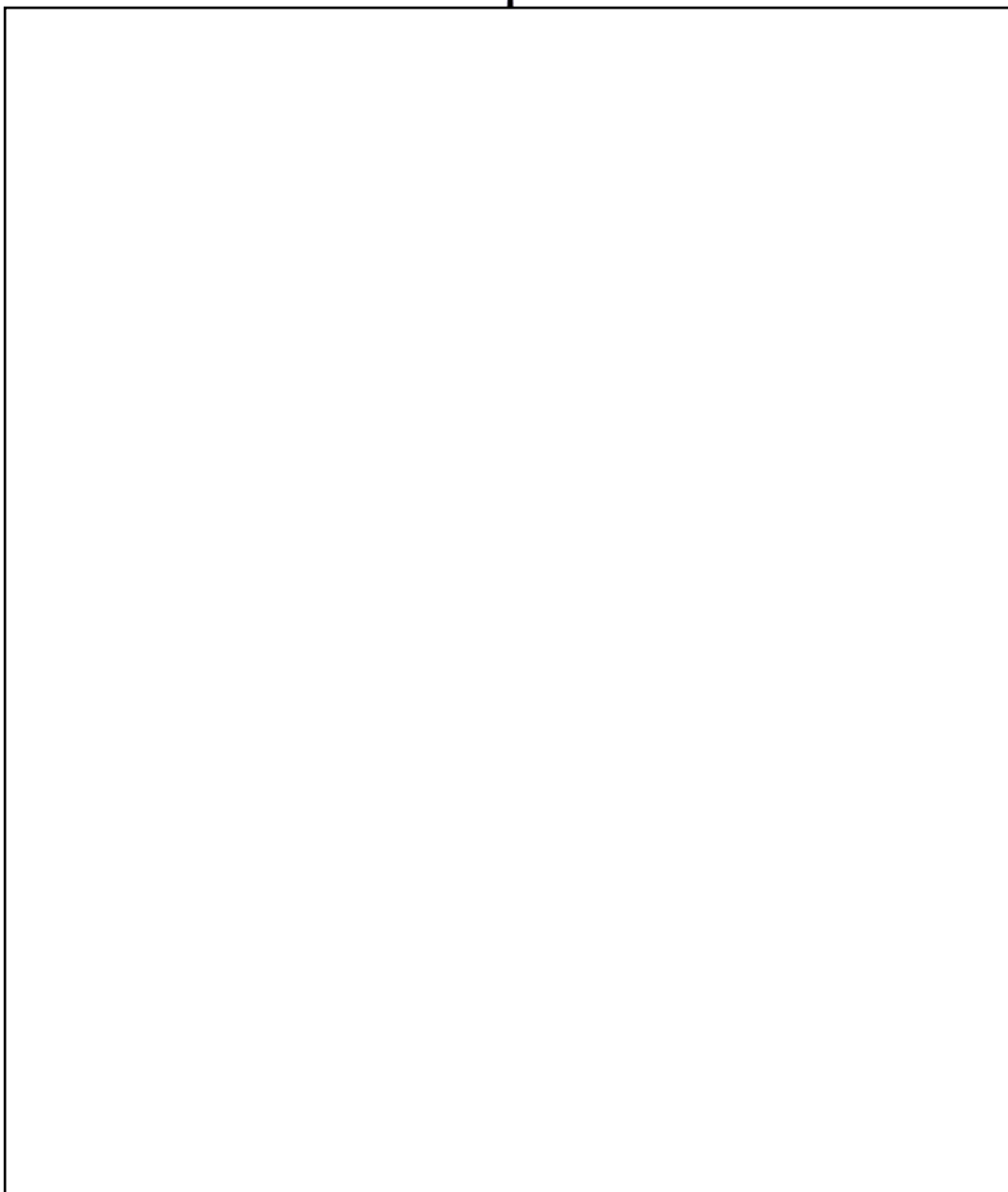
Example 6.1. Mozart – Adagio No. 1 in D Minor (violin part)

Sechs langsame Sätze und dreistimmige Fugen
für Violine, Viola und Baß (Violoncello)

Violine

Wolfgang Amadeus Mozart KV 404 a
herausgegeben von Johann Nepomuk David

I



Edition Breitkopf 5678

© 1938/1966 by Breitkopf & Härtel, Wiesbaden

Table 6.1.

Responses for Pulse Imagery During Music Reading

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
1.1 I When score reading I: pick a tempo	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1.2 Keep time by beating (toes, foot, leg, hands, head)	✓	✓	✓	✓	✗	✓	✗	✗	✓	✗
1.3 Keep time by inner pulsing (breath/larynx)	✗	✓	✓	✓	✓	✗	✗	✗	✗	✓
1.4 Maintain a steady tempo in some other way	✓	①	①	①	①	①	①	①	①	①
	Beating and counting (Vln 2)									
	Moving from side to side (Vln 3)									
	Sense of conducting, beating, bowing (Vcl 1)									
	More of a heart / diaphragm beat (Vcl 2)									
	Conducting (Pft 1)									
	Counting (Pft 2)									
	Imagine the music in my head (Cl)									
	Beat with toes and keep count in my head (MS)									
	Inner pulsing (breath) mixed with inner feeling (FH)									

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ① = Written answers were given on the questionnaire form and are included on the table.

It can be seen in Table 6.1 that all the musicians picked a tempo (or set a pulse) before or while they read the music. The uniformity of the answers shows that this was an important step to reading. None of the musicians claimed that the speed or tempo just appeared in their minds spontaneously. The musicians consciously generated the pulse or tempo framework of the piece before they

started. Although all the musicians did this, Pft 1 said that in score reading he felt there was no need to stick to the set tempo:

- I look at tempo marking, but I might slow down the tempo if there are lots of notes. The fact is that away from the instrument there is no imperative to keep time, so one can pause to analyse things more closely, particularly with complex works.

Once the tempo was set, most musicians tried to keep it constant throughout the reading by some sort of movement or imagery. Six of 10 chose to do this by an external movement or movement imagery. Vcl 1 commented that: “if it is a cello piece, I pretend to bow, but there is no movement”. This also shows a link between playing and perceiving rhythm. String players usually produce rhythm in their playing by bowing articulation. It can be seen that imagery of this movement is then used to reproduce rhythm and pulse in their imagery. Possibly it is similar with conducting, as conducting is used to communicate pulse through hand signals. Two musicians used this method to maintain pulse in their own internal imagery.

Four of the 10 musicians thought their pulse was related to their inner singing. They combined imaginary singing with a diaphragm push to produce a breath pulse. This could also be a real or imagined event, as Vcl 2 commented that it is “more of a diaphragm/heart beat”. FH thought that the pulse was an inner feeling, but he commented that when the music became too complicated he resorted to using external beating.

All of the musicians thought that setting a pulse, before beginning to score-read, was important. They maintained the pulse throughout the piece by real or imagined beating, pulsing internally, or combining any of these methods. Pft 2 did think she set a pulse, but did not do so through movement or internal pulsing. She described her inner pulse as internal counting.

6.4.2 Item 2: Counting

It was assumed that the musicians would count, as counting is an important self-monitoring mechanism. One of the first things students are taught about music is that they have to count the length of the notes and keep a tally of which beat of the bar they are up to. This helps when initially learning the piece, as keeping a tally of the number of beats in each bar is a way to check if the bar has been played correctly. However, the need to count may be affected by the degree of difficulty of the task and also the participant's degree of fluency in sight-reading. In Item 1, all the musicians said they set a pulse, but only two musicians said they produced and maintained the pulse through rhythmical counting. For the rest, counting was a separate activity to pulse setting. Given that counting is a self-checking mechanism, some musicians might find it unnecessary, if their fluency is beyond the technical challenges of the task. Therefore, it may be that some musicians count because they need to, or because it is a habit, and some may count in the difficult bits only or not at all.

Item 2 asked the musicians about their counting during score reading. Their answers illustrate that half the musicians in this sample did not count during the score reading exercise. This may have been because they did not need to. They

may have been so confident about the exercise that they did not need to self-monitor by counting. However, the musicians who were not counting, were mostly pulsing or beating (see Table 6.1). The only exception to this was Cl, who did pick a tempo at the start of the score reading exercise, but did not count, beat, or pulse to maintain the tempo.

Table 6.2.

Responses for Counting During Music Reading

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
2.1 I When score reading I count in my head	✗	✓	✗	✓	✗	✗	✓	✗	✓	✗
2.2 Count in my head while I keep a steady tempo with another part of my body	✗	✓	✗	✓	✗	✗	✗	✗	✓	✗
2.3 Count only on the long notes, repeated notes and rests	✗	✗	✗	✗	✓	✗	✗	✗	✗	✗

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response.

Vcl 2 did not count throughout the whole piece, but did count on long notes, repeated notes, and rests. This means that she did not feel the need to self-monitor for every bar of the piece, but occasionally she checked long or repeated notes. Four musicians claimed that they did count throughout the piece. It can be seen that three of these thought that they combined counting with the pulse setting (count in my head while I keep a steady tempo with another part of my

body). Therefore, they thought that counting was a separate skill to pulse maintenance, but the two could be used together.

The piece given out was written in slow 6/8 time, so the unit that the musicians would have pulsed to would have been quavers. The characteristic element of the piece was the complicated subdivisions of the quaver pulse (there were lots of semi-quavers and hemi-demi-semi quavers but very few sustained notes in the piece). In this example, the subdivisions were more prevalent than long notes. This might have been another reason that the musicians did not count. There was no need to count, but there was a need to subdivide. Counting would be useful in music where there are long sustained notes, repeated notes, or multiple bars of rests. However, the piece given to the musicians in this exercise was not of this nature. Therefore, in this instance, counting may not have been as important as techniques of subdivision.

6.4.3 Items 3 and 4: Pitch imagery

The researcher wondered if musicians thought they spontaneously heard the pitch imagery of notated music or if they had to take steps to consciously generate it. If the musicians thought they “heard” the music and did not have to do anything else, then it might be spontaneous. However, if the musicians had to set up a scaffold to help with their imagery generation, then it would not be spontaneous. There are various ways to set up an auditory scaffold. One way is to place the imagery into a scale or key area as this limits the number of pitch choices available by half, thereby reducing the number of wrong notes available. By placing the piece into a key area, the musicians would be able to anticipate

melodic and harmonic movement through their knowledge of style and appropriate pitch choice for the genre. Also, by setting a tonic note the musicians would create a reference point and would be able to measure each pitch in relation to this. If they made one mistake, the next pitch may not also be wrong, as long as they kept measuring each subsequent note by its relation to the tonic note.

The researcher wondered if pitch names were helpful in any way when score reading. Pitch names are useful in situations such as communicating about notes, finding notes on instruments, reading unusual clefs, or reading accidentals and key signatures, but perhaps they are not necessary for score reading. Items 4 and 5 dealt with pitch reading.

All the musicians described the imagery generated by reading the notated music as auditory (see Table 6.3). They could all hear imagined sound. However, it appears that this sound was not completely spontaneous, as each musician set up a scaffold for their imagery. Eight of the musicians thought about the key signature and scale area, thereby limiting the notes available to them. Those who did not notice the key did set a tonic note, thereby creating an anchor or point of reference.

Table 6.3.

Responses for Pitch Imagery During Music Reading

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
3.1 I When score reading I hear the music	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3.2 Think about the key, major/minor)	✓/ ✗	✓	✓	✓	✗	✓	✓	✓	✗	✓
3.3 Set a tonic note	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓
3.4 Sing the music internally	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓
4.1 Say the letter names of the notes in my head	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
4.2 Do not say the letter names even though I automatically know them	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.3 The letter name of the note flicks through my head if it is affected by the key signature or an accidental	✗	✗	✗	✗	✓	✗	✗	✗	✓	✗

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; ✓/✗ = Both *Yes* and *No* response given, with an explanation subsequently at interview stage.

None of the musicians thought they said the pitch names of the notes even though they automatically know them. Vcl 2 thought that she might say the letter names only when reading different clefs:

- Only when reading treble clef. When reading bass or tenor I feel the fingering of the cello and use no letter names.

Pft 1 thought that recognition of notes involves knowledge of the pitch names, stating that “it depends on complexity and tempo, but basically yes, if not for all notes, depending on piece”. Even though the musicians would know the pitch names of the notes instantly, it seems that this information was unnecessary for most when score reading. Only two musicians answered *Yes* for the last item, on whether the pitch name flicked through their head when it was affected by an accidental. It may be that the musicians are so automated in this area that they think in key areas and hand positions, rather than individual note names.

It seems that the musicians did consciously generate pitch imagery when reading notated music. The musicians placed their singing into a scale area or set a tonic note. It seems that once the key was set, they did not think about the key signature, nor did most of them think about the pitch names. The musicians did use kinaesthetic imagery (as can be seen with the comment “I feel the fingering of the cello”), to help with pitch generation.

6.4.4 Items 5 and 6: Kinaesthetic and visual imagery

Questionnaires for this study were based on the premise that musicians would generate internal imagery in a number of music making and perceiving situations. Based on the research of Leontyev (1981), it seemed that movement or action would be an important part of the perception of sound, and that larynx movement might be a major component of this. However, there were also references in the literature to different kinds of movement and also the absence of movement (Teplov as cited in Sokolov, 1972).

The researcher speculated as to whether it might be that initially the performance of musical elements creates a link between muscle movement and sound. Different kinds of performance would use different kinds of movement. As the musician becomes competent, both muscle movement and sound generation could become internalised and exist, in a linked state, in the imagination. This link could be re-used when perceiving sound. The researcher wondered if the musicians agreed that cross-modality references were occurring in their imagery. Item 5 aimed to find out if the musicians thought their internal sound generation was linked with imagery of hand movement. Item 6 explored the possibility that sound imagery may also be linked with visual imagery. MS was not interviewed for this section. However, it has been seen that she strongly relies on larynx movement and inner sound production in her pitch perception.

It can be seen in Table 6.4 that all of the string players agree that movement of their fingers, as though they were actually performing the piece, helped with the internal generation of pitch imagery. Perhaps this fusion is used to strengthen the image. Comments from the string players suggest that movement is imagined and spontaneously generated with inner sound. Pft 1 thought that movement imagery was not a tool that he used to generate pitch.

- Not really, but with piano scores I have a sense of which fingers, hand positions and techniques to use. When playing at sight, this thought transfers into action.

Pft 2 did think that hand position and finger movement helped her to hear sounds. It has been seen throughout the study that hand, rather than larynx movement, was more important for this musician. Pft 2 also commented that it

was a spontaneous movement that she did not have to think about, similar to not having to consciously think about walking. She made the comment:

- This all sounds very complex. I feel the notes with my fingers, count, and hear internally. Simple as that! (Pft 2)

Table 6.4.

Responses for Other Imagery During Music Reading

Prompt	Musician-participants									
	Vln 1	Vln 2	Vln 3	Vcl 1	Vcl 2	Pft 1	Pft 2	Cl	MS	FH
5. Find it easier to hear/sing the note if I move my fingers like I am actually performing the music	✓ ①	✓ ①	✓ ①	✓	✓ ①	✗	✓ ①	✗	–	✗
	This happens spontaneously (Vln 1)									
	It is a spontaneous imaginary feeling, of what it would feel like to play it (Vln 2)									
	The movement is very subtle, more like a playing in the fingertips rather than an actual movement (Vln 3)									
	I don't need to move them but feel the fingering / position internally too (Vcl 2)									
	I feel the notes with my fingers (Pft 2)									
6. Get a visual image of how the musical excerpt would fit on my instrument	✓	✓	✓	✓	–	✓	✓	✗	–	✗

Note. Key to symbols: ✓ = Yes response; ✗ = No response; ① = Written answers were given on the questionnaire form and are included on the table; – = Item not completed.

Cl and FH did not think that they felt finger movement when they thought of pitch. It may be that this has to do with the physical nature of their instruments. With string instruments and piano, a particular place on the instrument will always produce a particular pitch. However, this is not the case with brass and

woodwind instruments. In brass playing, many notes may be produced from one fingering pattern. In this case the different notes would be produced by lip tension. In woodwind playing the overtone or upper octave may mean that finger position may not have the same firm attachment to pitch.

The placement of notes on string and keyboard instruments is visually obvious. String and keyboard players get used to seeing the way their hands move from place to place on their instrument. They develop a visual knowledge of each piece learnt. The musicians would know which finger to use, but they also know the visual position of this note on their instrument. In score reading, it may be that the fusion of visual and auditory imagery will also be present. It can be seen in Table 6.4 that most of the string players and both pianists experienced visual imagery of their instruments and how the piece would fit on it. In commenting that this was a spontaneous reaction to reading music, Vln 1 said: “it happens spontaneously if the music is within my technical skill level”. Possibly the brass and woodwind players did not experience this due to the physical character of their instruments.

The string players and pianists seemed to be very aware of linked imagery. They noted that when score reading, they experienced spontaneous visual and kinaesthetic imagery. The string players and Pft 2 commented that hand movement, in particular, could be used to strengthen their auditory imagery. It was not so for the woodwind and brass player, who did not experience these sensory fusions.

6.4.5 Item 7: Chord imagery

In certain situations, inner singing, with its added kinaesthetic movement imagery, is very useful for some musicians. When trying to establish the difference between two pitches, a participant can subvocally sing both notes and feel the difference because of muscle movement in the larynx. However, this movement imagery, while adding definition and firmness to the imagery of a single pitch may inhibit the participant from being able to imagine more than one note at a time. In situations where musicians are required to imagine more than one note at a time, other imagery might be more helpful.

Table 6.5 shows what happened when the musicians in the study were asked to read chords and dyads. Most musicians thought that they were able to hear both notes. The first two violinists thought they sang the top note and imagined the lower note. Vln 1 commented that “this sometimes this happens if [the chord is] difficult and I would need to practice”. This shows the musicians are aware of two types of imagery; the upper note is an inner singing, but the lower note is just sound by itself. The rest of the string players thought they were able to sing both notes internally. Vcl 1 commented that “when doing double stops I image hear both notes, and sing both notes in the head as an interval. I hear them together at once and have no need to separate them”. The words “image hear” and “sing in my head” may be a clue to this performer’s ability to produce both notes at once. Perhaps she is hearing rather than singing. That she described it as happening in her head rather than her throat may mean that she has dropped inner singing in favour of just an imagined hearing of the sound.

Table 6.5.

Responses for Chord Imagery During Music Reading

Prompt	Musician-participants									
	Vln	Vln	Vln	Vcl	Vcl	Pft	Pft	Cl	MS	FH
	1	2	3	1	2	1	2			
7.1 When score reading I hear/ imagine the chord	✓	✗	✓	✓	✓	✓	✓	✓	–	✓
7.2 I sing the top note and imagine the other one	✓	✓	✗	✗	✗	✗	✗	✗	–	✗
7.3 I sing both notes internally	✗	✗	✓	✓	✓	✗	✗	✗	–	✗
7.4 I arpeggiate through the chord	✗	✗	✗	✗	✗	✗	✗	✗	–	✓

Note. Key to symbols: ✓ = *Yes* response; ✗ = *No* response; – = Item not completed.

The researcher assumed that some of the musicians may arpeggiate through the chords to perceive each note individually. It seems only FH did this, but not for the example given:

- I did hear the chords for this piece, but I do not always. I do often arpeggiate through the chords.

Two other musicians used word imagery of chord labels or names.

- I read the harmonies which helps hear the music. (Cl)
- I look at the bass often to establish harmonic progression as well. Try to imagine/hear as much as possible - easier with piano and solo vocal scores. I try to read vertically as much as possible. (Pft 1)

It seems that musicians are able to imagine more than one note at a time, but it may be that this cannot be accomplished by inner singing. The imagery that was used was inner singing combined with inner hearing and word imagery of chord labels.

6.5 Conclusions

As assumed, it has been seen that internal imagery is used when musicians score read. It seems that the imagery is consciously generated and may be of a variety of types. All of the musicians consciously generated a pulse or tempo for their reading. They maintained the pulse throughout the piece by real or imagined beating, pulsing internally, imagined counting, or combining any of these methods. They combined pulse setting with counting or with subdivision skills. Whether they count or subdivide may depend on the type of music that they are reading.

The musicians consciously generated pitch imagery when score reading. They placed their singing into a scale area or set a tonic note. They also used kinaesthetic imagery of larynx or hand movement to help with pitch generation. Some musicians also experienced visual imagery of note placement on an instrument. These musicians are able to imagine more than one note at a time, but they may not be able to use inner singing to accomplish it. More useful imagery for chord generation might be inner hearing, word imagery, or hand imagery.

Chapter Seven – Results (4)

Questionnaire Five: Music Performance and the Inner Voice

7.1 Aims

The first four questionnaires for this study dealt with imagery produced by musicians in a variety of situations and conditions. Some of those situations and conditions were: imagery produced by itself, imagery produced in response to sound, and imagery in response to written notation. Questionnaire Five focused on imagery that musicians produce when they perform music. The questionnaire was designed to test the following three aims:

1. To discover if musicians use imagery when they perform in specific applied activities. If they do, then:
2. To describe what types of imagery are used. And:
3. To discover how this imagery helps them to perform in these activities.

7.2 Theoretical Underpinnings

Musicians often have to call on a wide variety of skills in their work that extend beyond simple performance on their instrument or voice. For example, they are often asked to sight-read, play by memory, or improvise. The researcher wondered if these various types of applied and extended performance demands would mean that musicians had to use various types of thinking. The present research has shown that musicians use a range of thinking skills when listening

to and reading music, including imagery of sound and movement. The researcher wondered if these sorts of thinking skills would also be used when performing music.

The researcher was also aware that different people work in different ways, and wondered if during the same condition two musicians might employ different imagery to help them complete a task. Performing conditions examined in the fifth questionnaire included: playing by ear, transposing by ear, playing by memory, reading, sight-reading, and spontaneous composing.

Playing by ear is a skill that generally means playing a piece of music without looking at notation, or ever having seen the notation. It was assumed that playing by ear would involve generating imagery of the music and then copying this on an instrument. The use of the words *by ear* suggest that the imagery might be an internal sound. Similar to playing by ear is transposing by ear. This technique is necessary when musicians choose a different key in which to perform a piece (they can shift the piece into a higher or lower key to suit a situation). There may be a heightened sense of visual imagery (of the instrument or the musician's hands) if the performer has chosen a difficult key.

Improvising a rhythmic variation on a well-known tune may need the generation of an internal image and a external imitation of it, although, perhaps in this condition the performer would vary the external version slightly. Rhythmic variation might, therefore, need a separation of internal and external sound.

Free improvisation is spontaneously creating and performing a new piece of music. Musicians might be able to improvise by letting their fingers move randomly and then assessing the result. Another way might be to generate new internal imagery and mimic it. Free improvisation could be a combination of both; perhaps musicians create by trial, error, or accident, and then shape the result into something artistically pleasing.

When musicians perform, they sometimes read from music and sometimes play from information in their memory. The researcher wondered what happens in musicians' minds when they play from memory. Can they visualise the written music? Do they hear the sounds internally and copy this? Do they remember what hand movements to make, or remember the note patterns that the piece makes on their instrument? Do they rely on one of these memories only, or do they experience more than one?

Sight-reading occurs when musicians do not know how the piece of music sounds, nor have they previously seen the written score. Sight-reading might use the same processes as score reading (as discussed in the previous chapter); however, musicians might need to create internal imagery of the music (as with score reading) and then mimic this sound with sounds from their instrument.

For this part of the study, the Mezzo Soprano was given a slightly different questionnaire as it was clear that some of the items dealing with instrumental performance were not relevant to her. For example, playing by ear, for a singer, does not involve transferring what is in the inner voice to an instrument; it

involves the articulation of the inner voice with the external voice, a concept which has already been discussed in Chapter Four. However, there were questions that were relevant to MS, which were not really relevant to the other performers. The music that singers perform is often theatrically based and, therefore, singers have to act as well as sing. In this situation, the researcher wondered how the singer would be able to cope with thinking about counting, possible foreign language texts, and acting, all at the same time.

7.3 Underlying Assumptions

1. When playing by ear, musicians might create internal imagery of the music and match this with sound from their instruments.
2. When transposing by ear, musicians might need to imagining things such as key signatures, hand positions, and intervallic structure.
3. During rhythmic improvisation, a separation of internal and external sound may be necessary.
4. In a free improvisation task, musicians might compose with their inner voice or they might let their fingers lead.
5. During performance by memory, a range of visualisation skills might be necessary.
6. Kinaesthetic imagery might be important for well known music.
7. During sight-reading, musicians might read the notation, generating an internal version of the music before mimicking this with their instruments.
8. Singers might have to imagine counting and text at the same time.

7.4 Results

The questionnaire was set out slightly differently to the previous questionnaires. The researcher had been aware that the tick-the-box multiple-choice style was addressing the things that the researcher thought were important. It had been shown that on some occasions this was remarkably different to what other musicians thought was important. This was highlighted by a comment from CI:

- I have tried to be honest but sometimes it is difficult to describe what one does. Many of these questions are about what you do. I think these work because of what you don't do – be quiet and still so you can hear.

The individuality of the ways of working seemed to be an important theme, and the researcher thought this would show itself again in the performance study. Therefore, this questionnaire was designed in an open style, where written descriptions would give the participants an opportunity to express their individual views. There were seven items. Participants needed to read the directions, play their instrument, and then decide what sorts of imagery they experienced or generated to help them with their performance.

7.4.1 Item 1: Playing by ear

The musicians were asked to choose a nursery rhyme that they had not played before and play it by ear. In the absence of notated music, they were simply asked to begin playing the piece of their choice in any way that they could. They were asked to describe how they thought they did this and whether or not they

employed visual imagery (such as imagining the music in a notated form). Further, they were asked if they used any internalised sound imagery (such as inner singing or hearing), or any inner speech or semantic concept formulations about chord or note names.

Table 7.1.

Information Given for Playing by Ear

Musician- participant	Response
Vln 1	I am easily able to do this. I hear internally and instinctively my hands respond.
Vln 2	Auditory, hearing the notes coming up in my head, then - visual, where my fingers had to go on the finger-board (mostly) and a little on the stave. No chord or note names.
Vln 3	Subvocal singing and visual imagery (but not of a stave per se), more of a continuous line that moves up and down according to pitch. Although after reading this suggestion, it occurs.
Vcl 1	Sing the words in my head, which automatically provides the melody.
Vcl 2	My inner voice is measuring the intervals so I'm aware of if the next note is a semitone or a third etc, and I also am just one note ahead in my inner singing.
Pft 1	If I sit down and play, say 'Twinkle, twinkle, little star', it sort of just happens. ... I may well have sung (subvocally, but without any muscular movement) the words.
Pft 2	I think I track the shape mentally, using finger movements.
Cl	I listen for the intervals.
FH	Imagining (inner speech) note names, then scale category.

As Table 7.1 indicates, Vln 1, Vln 3, Vcl 1, Vcl 2, and Pft 1, all felt that they heard the music internally. The inner voice would sing or hear the desired melody, and the musicians would try to mimic this sound on their instrument. Interestingly, Vcl 2 noticed that she sings ahead of her playing. Reading or hearing ahead is something that musicians call anticipation. Vcl 2 thought that she sang the next note in advance and worked out the interval between the currently played note and the next note. In this way, she would minimise the mistakes and there would be less feeling around for notes. The analysis of intervallic structure must happen very quickly, there must be an almost spontaneous recognition of intervals, otherwise the rhythm of the piece may be affected. Cl listened for intervals and FH also did something similar to this. He kept track of the melody by thinking in scale degrees and then relating this to the key area that he was in. This might involve inner speech or visualisation of numbers and alphabetical letters.

The visual imagery experienced by Vln 2 was of where his fingers needed to go on the instrument to produce the sound he wanted and also of what the notation would look like. Vln 3 also experienced visual imagery, not of notes on a manuscript but rather of a continuous line moving up and down like a line-graph. Pft 2 used visual imagery of the shape of the piece on the keyboard, stating that: “I track the shape mentally on the keyboard”. This is similar to Vln 2’s visual imagery of finger patterns. Perhaps it is the nature of these instruments that made visual and spatial imagery important. The melodic shape can be seen quite easily on a keyboard because of the layout of the piano, and finger patterns become important and obvious on string instruments.

In summary, this exercise produced a range of responses from the participants. Most musicians seemed to produce imagery by singing and then copied the internal sound with sound from their instruments. Some musicians listened for intervals and one imagined an accompanying graph of the melody line. Visual-spatial imagery of keyboards, and finger boards also, was important.

7.4.2 Item 2: Transposing by ear

The musicians were asked to choose a different key and play their nursery rhyme again. They were asked to comment on any visual imagery (hand positions or key signatures and notation), inner singing involved, or any other thoughts, movements, or imageries.

Much the same method was used here as for the first exercise. After choosing a different starting note, some musicians imagined the sound and mimicked the sound on their instruments (see Table 7.2). There was an interesting comment from Vln 3, who felt more pressure on the roof of her mouth (soft palate and sinus) as she imagined higher music.

Table 7.2.

Information Given for Transposing by Ear

Musician- participant	Response
Vln 1	I transpose the sound. I could visualise it on a score, unless the music was difficult. I wouldn't normally need this process for my own playing.
Vln 2	No notation or key-signatures. The first thing I did was sing it in my mind (inner singing). Once I heard it in my head I visualised fingers on the fingerboard. Interestingly my fingers sometimes just know where to go, even for notes I haven't really visualised properly yet.
Vln 3	No visual imagery this time but the sensations in the roof of my mouth moved higher on my palate (I had chosen a higher key than the original).
Vcl 1	Yes just sang it in a different key, selected first note and started.
Vcl 2	No it's the same in each key, although I'm aware fractionally after I play the note, of it being an accidental.
Pft 1	None whatsoever.
Pft 2	Tracking shape.
Cl	No.
FH	Thought about interval sequence, starting note and scale degrees.

The comment from Vcl 2, that she was aware after playing the note that it was affected by a sharp or flat, means that she did not structure her playing by thinking about key-signatures or notation. She may have again been working out the intervals instead of placing the piece in a key and using the accompanying key signature. However, after she had played each note, she recognised the placement and, therefore, the name of the note. This was also the case with Vln 2 who was surprised to find that his fingers “knew where to go” even if he had not properly visualised their position. FH thought about the key and the scale

degrees, similar to the last exercise, and Pft 2 used visual imagery of melodic shape on the keyboard.

There was not a whole lot of difference between these first two exercises. Participants just re-did the exercise but started on a different note. Mostly, they sang internally and let their fingers try to reproduce the sound.

7.4.3 Item 3: Rhythmic variation

The musicians were asked to improvise a rhythmic variation to their song. This means that they were expected to play their chosen nursery rhyme again, but this time instead of changing the pitches they would change the rhythm. They were asked what thoughts, movements or imageries they used to help them with this. The responses are shown in Table 7.3.

This was the first exercise in which Pft 2 used sound imagery. She is able to imagine the sound of the music in her mind, but mostly relies on the visual imagery of shape and movement when she plays or when she listens to music. In this exercise, she employed learnt “rhythmic patterns” in the improvisation. Perhaps the need to think about the original theme and also the new variation, at the same time, meant that she needed an extra type of imagery. The theme might have been sung in the mind while the variation was performed on the instrument.

Table 7.3.

Information Given for Creating a Rhythmic Variation

Musician- participant	Response
Vln 1	I feel the rhythmic changes, as I sing internally, in my right hand.
Vln 2	I don't think I visualised beaming. I think I was singing internally. Sometimes I visualised up bow and down bow symbols as I went along.
Vln 3	Again no visualisation initially, but on suggestion it is generated. Yes to subvocal singing. I also felt more prominence of rhythm in mouth and chest.
Vcl 1	No visualization, just more subvocal singing. I think this process is aided by the bow, easy to change rhythm.
Vcl 2	Some subvocal singing but it is all pretty spontaneous and I sometimes surprise myself with what comes out. This is probably why my improvisations can be either inspired or just clumsy and weird!
Pft 1	No visualization, but probably some subvocalisation. I scat sang [the song].
Pft 2	Maybe both: rhythmic patterns and subvocal singing.
Cl	No.
FH	Thought about rhythmic element relative to beat.

Vln 1 commented on body movement, saying that she sang internally but it was her right hand (that is, the bowing hand) which created the rhythmic variety: “I feel the rhythmic changes ... in my right hand”. Vcl 1 also used her bow hand to change the rhythm: “I think this process is aided by the bow”, and Vln 2 noticed that he visualised bowing symbols. However, the rhythmic variation that Vln 3 produced may have been aided by breath pulse or singing the variation in the

inner voice. This can be seen from the comment that she felt it in her mouth and chest. Other musicians may have let go of trying to structure the music. They may have let random movement or singing add variation. Vcl 2 hints at this when she says she is sometimes surprised at the music she produces.

Most of the participant musicians heard or sang the music internally and then applied learnt rhythmic patterns. Some musicians let their inner voice structure the rhythmic variation; however, other musicians separated their voices from the music they were producing. It seems too obvious to say that the rhythm was produced by movement, so perhaps it would be more correct to say that the musicians felt that the spontaneous body movement directed the rhythmic variation, rather than that the rhythmic variation was planned and articulated in their inner singing. This can be seen by the various comments made by the string players who thought that their bowing motion became important for this exercise. They sang the melody with their inner voices but the version they produced on their instruments included rhythmic variation articulated through bowing patterns. This voice separation must have also happened to the pianist who sang the lyrics and accompanied himself on the piano.

7.4.4 Item 4: Free improvisation

The next item asked the musicians to improvise their own melody. There were no limitations or guidelines as to what to play – they were simply asked to spontaneously compose on their instruments, and to describe thoughts or imageries they had during the exercise (see Table 7.4).

Table 7.4.

Information Given for Free Improvisation

Musician- participant	Response
Vln 1	I do not separate elements unless I am struggling. Voice (internal) and tactile response most often happens simultaneously. No imagery if improvisation is simple.
Vln 2	The main contributor (I think) was known patterns – just learnt over time, that I know work. The fingers led the way, but the inner voice was obvious at certain times, assisting with what came next (maybe when a new pattern was being introduced or working out an ending phrase.) Interestingly I started thinking about something else in my mind (work related) but I continued to make up the music at the same time and only realised I did this when I re-focused on the task.
Vln 3	I chose a visual image to focus on (waves at the beach) and created a melody from that. Subvocal singing was involved. The voice was dominant medium, the fingers minimal. The imagery was only of scene, not musically related.
Vcl 1	The fingers alone went off. No use of subvocal singing as nothing to scaffold on.
Vcl 2	I seem to improvise from note to note to, (sometimes using scale/arpeggio movement to get to the next note). I never noticed before that I was using subvocal singing when I play like this, but if I stop playing the imaginary voice is still right there on the next note. There is some imagination of what the fingers will feel like on the next note, especially if there is a big shift or change of position. No visuals though when I play.
Pft 1	Often fingers lead the way, or more particularly, hand positions and harmonic choices.
Pft 2	Fingers.
Cl	Like in jazz the melody is created from the store in memory.
FH	Sometimes note names led the way. When changing to a non-standard time cycle I needed to count or feel the groupings.

Some musicians thought their voices were still dominant (Vln 1, Vln 3, and Vcl 2). Although Vln 1 said she does not separate voice and fingers, she still thinks the voice is dominant. This can be seen from the use of the words “tactile response” describing her physical movement in response to her inner hearing. Vln 3’s voice was still very dominant and her fingers mimicked the internal sound. Vcl 2’s response was interesting as she not only “pre-hears” the next note, she “pre-feels” the next note in her hands. This means both the sound imagery and kinaesthetic imagery occur slightly ahead of the real sound and action.

Other musicians let their fingers or hands have more freedom (Vcl 1, Pft 1, and Pft 2). While these spontaneous movements probably mean that the musicians are creating something new – not just reproducing something in their auditory memory – it is likely that this type of improvisation might rely on muscle memory. This can be seen in comments made by musicians who thought they used the physical memory of patterns to help them (Pft 1, Vln 2, Vcl 2, and Cl). The musicians might well have a muscular memory of a particular chord progression or scale passage that has developed from years of repetition of standardised musical shapes (for example, from the practice and repetition of cadence progressions or the rote learning of scale forms). Vln 2 commented that although he used known scale patterns, he found that he needed his inner voice when he linked the patterns together.

When creating something, the new material would be self-monitored by the musician. The musician would have to listen and make decisions about the

sound. Some sort of corresponding imagery would have to occur for the musician to understand how to shape the music into a pleasing artistic statement.

One musician chose unrelated visual imagery, of a beach scene, and then based her improvising on trying to express aspects of that imagery, rather than any musical imagery such as singing or imagining chord progressions. This was unexpected, but shows that she was creatively using the memory of sounds, emotions, colours, and shapes to structure her improvisation.

In summary, some musicians let their inner voice structure their free improvisation. Hence, it may be possible to have spontaneous unstructured inner singing and mimic this externally on an instrument. Other musicians let their fingers lead, but they may have somehow been monitoring the results. A few musicians relied on a store of improvisatory figures such as chord progressions and scale passages. One musician used freely related visual imagery to structure and inspire the musical sound she was creating.

7.4.5 Item 5: Playing by memory

The musicians were asked to play a piece they had learnt by memory. They were asked to comment on their use of any visual imagery (such as notation, internal maps of form and structure, progressive maps of where the piece fits on their instrument), inner speech, inner singing, or kinesthetic imagery.

Table 7.5.

Information Given for Playing by Memory

Musician- participant	Response
Vln 1	My memory is layered. My most successful is free form where I live in several memory types for the duration of the piece – strongest is emotive /imagination. Next is hearing/internal singing. Most challenging to me is not to interrupt the natural links.
Vln 2	I played a piece I had learnt by memory for an exam – maybe 25 years ago. I didn't hear it (internally) except in places where I had trouble remembering, then I heard it in my head and could continue playing. Fundamentally my fingers knew what to do. I did think as I played as to what bowing techniques to use in the different sections.
Vln 3	No visual imagery. I did sing the piece internally and could feel a slight pulse in the fingers of my left hand before each note was played. Some dialogue about phrasing, on and off.
Vcl 1	Yes I can see the notation in my head but basically use subvocal singing the whole time.
Vcl 2	On well known pieces the muscle memory of the fingers and the remembered positions etc is much stronger than the internal singing, but if I stopped playing I could still hear the notes internally, also the timbre I wanted. Of course there is always internal commentary regarding the performance and whether it measures up to the intended outcome. That also happens when improvising. If I really get into the music the commentary is less but I still notice what is happening in term of quality etc.

Table 7.5 (*continued*).

Musician- participant	Response
Pft 1	I think for me the visual imagery is only summoned, if at all, when I have to remember a forgotten or uncertain particular pitch, chord, dynamic, rhythm, etc. What I imagine is tone colour, the sound, and technique required to produce the desired colour. Not sure I actually talk about it. I suppose I also have a map of form and structure but not sure how I read the map. There is surely muscular memory involved in performing something by memory – which explains why it is often more difficult to unlearn a mistaken note/passage/technique etc.
Pft 2	Visualise form, keys, and modulations. I have a mental image of the music. I rely on a photographic memory of the music (if memorising) and also the tracking ability.
Cl	No visual imagery. Combination of sound in the head and memory of finger patterns.
FH	Note names are talked through. Imagined the phrasing (sometimes note by note) before each note was played. For faster passages only referred to note names after making a mistake. Made suggestions about style whilst playing. Surprised at not visualising (to a conscious degree) a notation. My inner ear/voice/imagination worked with groups of pitches and rhythms.

As Table 7.5 shows, the musicians experienced a range of imagery in this task. Vln 1 expressed this idea by stating that her memory of a piece is layered. She feels her memory is more successful if she can work using a number of layers at the one time. The types of imagery that the musicians commented on were sound, visual, kinaesthetic, and inner speech.

There was a strong response for sound imagery being experienced. Playing by memory using sound imagery is a little bit like playing by ear, as the musicians

would be hearing or singing the music internally and matching this sound externally on their instruments. It seems a majority of the musicians play in this way:

- Next [strongest] is hearing /internal singing. (Vln 1)
- In places where I had trouble remembering ... I heard it in my head and could continue playing. (Vln 2)
- I did sing the piece internally. (Vln 3)
- [I] basically use subvocal singing the whole time. (Vcl 1)
- If I stopped playing I could still hear the notes internally. (Vcl 2)
- What I imagine is tone colour, the sound (Pft 1)
- Sound in the head.(Cl)
- My inner ear/voice/imagination worked with groups of pitches and rhythms. (FH)

Some musicians also commented on being able to imagine a sound with a particular tone colour. This musical imagery may have accompanying imagery of instrument technique, such as hand, body, or breath movement used to create the desired tone colour on the instrument:

- What I imagine is tone colour, the sound, and technique required to produce the desired colour. (Pft 1)
- I could still hear the notes internally and the timbre I wanted. (Vcl 2)

For some musicians the added kinaesthetic imagery (or muscle memory) meant that they were not just playing by ear. The memory of how it felt to play the piece added security to the performance:

- Fundamentally my fingers knew what to do. (Vln 2)

- [I] could feel a slight pulse in the fingers of my left hand before each note was played. (Vln 3)
- On well-known pieces the muscle memory of the fingers and the remembered positions ... is much stronger than the internal singing. (Vcl 2)
- There is surely muscular memory involved in performing something by memory – which explains why it is often more difficult to unlearn a mistaken note/passage/technique. (Pft 1)
- Memory of finger patterns. (Cl)

The musicians did comment about visual imagery – mostly of the notated music. This would be very important for guarding against memory lapses. To be able to see the notation and read it from the imagery of it would be very useful:

- Yes I can see the notation in my head. (Vcl 1)
- I think for me the visual imagery is only summoned, if at all, when I have to remember a forgotten or uncertain particular pitch, chord, dynamic, rhythm, etc. (Pft 1)
- I have a mental image of the music. I rely on a photographic memory of the music. (Pft 2)

Not many musicians mentioned spatial imagery. The difference between finger movement and spatial imagery is that one is movement and the other is position. One is imagery of the self and the other is imagery of the instrument. The shape of a piece on the piano remains the same no matter what fingers one chooses to use. However, musicians will spend a long time thinking about which fingering to use and will then learn this pattern. A combination of learnt fingering patterns and what the piece looks like on the instrument may help some musicians. Pft 2's

tracking ability might be spatial imagery – that is, how the piece fits on the instrument.

Often in music there are loops and repeated sections. Having an internal map of the piece, and keeping track of where you are during the performance, could be helpful during a memorised performance. Only two musicians commented on this. Perhaps the segments that the musicians chose to perform were not long or complicated enough to need this type of memory. It was the pianists who commented on this type of imagery. Perhaps they are aware of this type of imagery because the music they need to memorise is so complicated:

- I suppose I also have a map of form and structure but not sure how I read the map. (Pft 1)
- Visualise form, keys, and modulations. (Pft 2)

That music expresses any type of emotional content is debateable. However, musicians often try to mimic emotion. A human voice speaking without dynamic variation or phrasing emphasis would sound mechanical. Musicians add dynamics, phrasing, and articulation to their playing for expressive purposes. Vln 1 commented that: “the strongest is emotive/imagination”.

Asked whether the participants experienced inner speech to help with their thinking and actions during the performances, only three musicians thought they might make comments about their own playing:

- Some dialogue about phrasing, on and off. (Vln 3)
- Of course there is always internal commentary regarding the performance and whether it measures up to the intended outcome. (Vcl 2)

- The note names are talked through ... For the faster passages I only referred to note names after making a mistake. I made suggestions about style whilst playing. (FH)

When playing by memory the musician-participants frequently use more than one type of imagery and will often combine them. One musician described this as layered imagery. The most prevalent combinations of imagery seem to be aural and kinaesthetic. Also present is visualisation of notation and form. It is reasonable to conclude that musicians seem to develop their own unique combination of imageries to help themselves with memorisation.

7.4.6 Item 6: Performance by reading

In Item 6, the musicians were asked about what happened when they played their instruments while reading music. They were asked if they talked internally about note names, key signature, dynamics, expression instructions (such as common Italian words), or technique. (See Table 7.6)

Table 7.6.

Information Given for Performance by Reading

Musician- participant	Response
Vln 1	I sing internally and feel pulse while I play. Normally an effort in revisiting a piece is reminding the memory types to be playful not rigid.
Vln 2	No note names. I definitely sang my head and had the beat in my head (the beat could be felt in my throat – actually inner singing it). I didn't count, I just felt the beats like a metronome.
Vln 3	I sing subvocally and there is some talk about dynamics and phrasing. No counting though or other things mentioned.
Vcl 1	Just singing and counting in my head.
Vcl 2	Sometimes I talk to myself if I'm likely to forget the key signature etc or if I have to remember a tricky position change etc. If I know the piece really well then there is no comment and the symbols stay symbols and are not translated into words. I only count numbers if I'm really insecure or don't trust myself.
Pft 1	Sometimes, perhaps, and some subvocal singing (even vocal singing if there's a passage I have not yet mastered, or possibly at a page turn where at least one hand must leave the keyboard). I should count – though I have little trouble if I conduct a difficult passage, probably because the baton is incapable of producing pitch!
Pft 2	No to talk and singing. Yes to counting in the head.
Cl	No.
FH	I talk through things that I think are demanding. Easy parts don't require commentary though I still use the imaging of the music phrase. Difficult things - I comment on areas that need my concentration. Sometimes rhythmic groups if non-standard.

While reading music, some musicians were able to generate the desired sound internally. Though they had the score in front of them, it seems they still needed

to know what the music should sound like, and they used sound imagery to achieve this. The sound imagery may have been remembered if they knew the piece well or self-generated if they did not. They would compare the internal sound to the sound that they produced from their instruments to check for errors:

- I sing internally. (Vln 1)
- I definitely sang my head. (Vln 2)
- I sing subvocally. (Vln 3)
- Singing ... in my head. (Vcl 1)
- Some subvocal singing. (Pft 1)
- I still use the imaging of the music phrase. (FH)

Some of the musicians used imagery to structure their rhythmic interpretation. The imagery they needed possibly depended on the music they chose. If the music had lots of subdivisions, they may have imagined the pulse and fitted the subdivisions into the pulse. If the music had long notes or rests, or the musician did not trust themselves to put the right amount of beats in each bar, they may have counted:

- I ... feel pulse while I play. (Vln 1)
- I ... had the beat in my head (the beat could be felt in my throat – actually inner singing it). I didn't count, I just felt the beats like a metronome. (Vln 2)
- Counting in my head. (Vcl 1)
- I only count numbers if I'm really insecure or don't trust myself. (Vcl 2)
- Yes, to counting in the head. (Pft 2)

Examples of inner speech experienced by these musicians show they are reminding themselves of phrasing, dynamics, and key signatures:

- There is some talk about dynamics and phrasing. (Vln 3)
- Sometimes I talk to myself if I'm likely to forget the key signature etc or if I have to remember a tricky position change etc. (Vcl 2)
- I talk through things that I think are demanding. Easy parts don't require commentary. (FH)

Sound imagery was used by a number of musicians during this condition. Some musicians felt a pulse or counted, possibly depending on the type of music they chose to play. Inner speech was also present for some musicians during the reading exercise.

7.4.7 Item 7: Sight-reading

The sight-reading condition may have been similar to the score reading exercise that the musicians experienced in the previous chapter. It was seen that as musicians read music they generate imagery, so that they know what the piece would sound or feel like when played. In this instance, however, they would have had to mimic the internal imagery on their instrument. The activity given was: "Please sight-read a piece. Was there any visual imagery (of your instrument in your mind)? Any internal singing? Do you hear/sing ahead (fast forward or rewind as you play). How important is counting?" (See Table 7.7)

Table 7.7.

Information Given for Sight-reading

Musician- participant	Response
Vln 1	My errors for rhythm are more frequent than pitch. My focus on pitch is so high because it is a critical factor in tone. Rhythmic fluency is often interrupted for focus being elsewhere.
Vln 2	Before I even picked up my instrument, I heard the first few bars in my head – both the rhythm and the basic tune. I noted the <i>Adagio</i> , key signature, timings, and dynamics. Then I started playing. I look about 1 bar ahead as I play and refer periodically back to the key signature. I have the beat in my head, I sing in my head as I go, and think of finger placement.
Vln 3	Subvocal singing was used. Mistakes: pitch clashes with the subvocal version, rhythm mistakes also clash, they feel wrong when played.
Vcl 1	Yes, just contour of note direction, i.e. melody up/down, definitely have to organise rhythm in head and count. Look at key signature, visualise stretch back 1 st finger on A string to play B flat. Sing melodic line as I read, so hear any mistakes as a miss-match between sound and subvocal sound in head.
Vcl 2	–
Pft 1	No keyboard imagery, but some subvocal singing, I suspect. I was conscious of chord/note names, sound quality, dynamics, tempo, but counting took, as usual second priority, as I checked dissonant chords. I also caught myself mentally assessing style.
Pft 2	Regarding a mistake – I know how the note should sound. Reading shapes is important for me.
Cl	Unless very complicated (and that depends on which instrument I'm playing) [I read] the notation in the piece in much the same way as reading a book.
FH	All seemed similar to above. Key and time noted to start with.

Vln 1's comparison of pitch to tone means she is listening for intonation based on sympathetic vibration, rather than just matching the note with one sung or heard in the mind. Intonation choices on string instruments can be made through tone colour as well as pitch. Each note will have a correct spot or node, so that when it is played there will be sympathetic vibrations from the other strings. This will result in a hollow, clear, and resonant sound.

Vln 3 felt that she could judge the correctness of pitch according to how well it matched the internal note stating that "the pitch clashes with the subvocal version". Vcl 1 also thought that she measured pitch in this way and said "I sing the melodic line as I read, so that I hear any mistakes as a mismatch between the sound and the subvocal sound in my head". Pft 2 said that when judging if a note has the correct pitch or not, she "knows how the note should sound". This could mean that she has the correct sound of the note in her mind, and she judges the external note against this.

Vln 3 claimed she has an internal kinaesthetic imagery for rhythm. This sometimes clashes with the actual external movement, so that "rhythm mistakes also clash, they feel wrong when played". Vcl 1 thought she had to set up a counting framework. She had to decide how fast the pulse was going to be and then scan through the music looking at the types of subdivisions and long notes that were going to occur. She commented that "I definitely have to organise the rhythm in my head and count".

Vln 2 set up a scaffold for the piece, he made a decision on how fast the pulse would be, how loudly he would play the notes, and which notes were likely to be used in the piece, explaining that “I noted the *Adagio*, key signature, timings, and dynamics”. As he played, he imagined the piece by inner singing and visualising finger placement, stating “I have the beat in my head, I sing in my head as I go, and think of finger placement”. Vcl 1 also thought about spatial imagery before she began to sight-read. She noticed the key signature and thought about where the notes in that key belonged on the cello fingerboard. Her steps were to “look at key signature, visualise stretch back 1st finger on A string to play B flat”. She also scanned through the contour of the melody. Perhaps this happened to see how high it went, so she could make a decision about the positions needed. Pft 2 also thought about the shape that the piece would make on her instrument and stated that “reading shapes is important for me”. Some musicians talked to themselves about note names, chord names, and style. Pft 1 thought he may have sung or heard the music internally; however, he also talked about chords.

It seems that a range of imagery was used when sight-reading on instruments. Some of the musician-participants used sound imagery to assess pitch. If there was a mismatch they changed the external sound to match the internal one. One string player judged the accuracy of her intonation by using sympathetic vibration and, therefore, must have some internal imagery of the desired timbre and its resonance. Three musicians commented on placement imagery; that is of where the notes belong on their instrument. One also looked at contour – the shape of the piece and how the piece would fit spatially on her instrument. Some of the musicians also set up systems for counting. One musician stated that

incorrect external rhythms clashed with what she knew the piece should feel like. Therefore, it clashed with her internal kinaesthetic imagery. Others counted to self-monitor while some musicians used inner speech to talk themselves through the exercise.

7.4.8 Item 8: Imagery for singing

It was thought that many of the performance conditions would not be relevant to the Mezzo Soprano. Questions about hand position and visual maps of note placement on instruments were not relevant. Separating the instrument from the musician seemed to be artificial. There were, however, other aspects of performance that were very relevant to her. Research by Ginsborg (2004) pointed out that singers have the added complexity of having to memorise large portions of text. Memorisation is especially important for singers; for example, in opera the use of printed music spoils the theatrical aspect of the performance and in song the presence of music arguably interrupts the connection between singing and audience even more so than for an instrumentalist. It was wondered how MS thought she was able to memorise so much music and text, especially as the text may often be in a foreign language. Also, would singing words mean that she was unable to count or talk to herself during the performance? Added to this is that the singer often has to act, which may involve a combination of spontaneous and planned movement, working with props, and interacting physically with other performers.

When asked about the memorisation of text, melody, and form, MS pointed out that in much music the text determines the structure of the piece. Having two

internal maps, one of form and another of text, is often unnecessary as the text provides the form and structure. If MS can remember the text then she already has the form. Likewise, the melody is learnt with the text. So it is not necessary to think of these things individually, as they are linked in reality and also in the imagination. For this singer, thinking of the words provides the melody and also the structure of the piece:

- Words and melody are strongly linked. So strongly in fact that sometimes unless I think the melody I can't remember words. I think as a singer the text also determines the form and structure of the piece so this is the main scaffolding that I use for memorization. With more tricky rhythms or if I have to come in tricky places, I tend to memorise the counting and concentrate on that rather than singing along in my head with whatever else is going on. I feel it is too dangerous to do that.

It would be easy to say that the presence of words supplies the rhythm. However, even though composers do try to set words as naturally as possible, they are still making art, and so the words are subjected to rhythmic treatment. Therefore, the musician still has to remember rhythm in some way. The researcher wondered how this was possible. If the singer was thinking words, how could she think different words or numbers at the same time? It may be that this is similar to music imaging where musicians can think of the sound of two or more notes at once. MS made the statement that "I tend to memorise the counting and concentrate on that rather than singing along in my head with whatever else is going on". This shows a kind of cognitive dissonance, where what is happening in the musician's mind does not mirror exactly what she is producing externally. She comments on this separation:

- I am not able to do this in all songs or all sections of songs that I sing especially when it gets very fast, but basically while I am singing the words my own voice, my brain is also counting at the same time, not just in the rests between the notes. It is not my main focus, just a background voice.

The singer was asked to perform a piece while reading the notated music of it. During this performance she did not need to count, as she knew the piece well. Instead she felt the piece in two pulses per bar and subdivided the notes into that structure:

- I definitely read the text first (which was in German), and then because I know the piece just followed the music as a crutch rather than because I needed it. The piece was in 6/8, but because I was aware of wanting to sing it in 2 rather than 6 I tried to keep the pulse of 2 going and just let the quavers trip lightly through. This I did in my head by slight emphasis on 1 and 2 each time. I didn't even think of looking at the key signature till I read it in your instructions. I guess because in the end without perfect pitch and because I know the song already and have sung it in a couple of different keys it makes no difference to me whether it is in D major or B major.

From the answers this musician gives, it seems that she often thinks about the words, which helps her remember the melody and the structure of the piece. Sometimes she feels the rhythm, or sometimes she counts in her head. In this case, there must be a separation of the internal and the external word. One would imagine this is only possible in slow-moving music.

It was wondered if the singer was able to make internal comments about technique, style, and performing practice, if her inner voice was already tied up with text and counting. She was asked how she thought about these things during performance:

- This is an incredibly difficult question to answer. I definitely count all the time in my head especially with difficult contemporary music. I think I use a mixture of feelings and visual images when it comes to interpretation, and talking myself through difficult passages or trying to pitch a note in my head from the accompaniment. I don't think I have ever properly analysed what it is that happens and when.

The other instrumentalists in the study were able to comment on intonation differences between their inner voice and their external playing. This was not something that the singer was able to experience. Her inner singing always has exactly the same pitch as her external singing. Instead she was asked to comment on how she could tell if someone else was making mistakes with their intonation. MS thinks she is able to judge when an intonation mistake has occurred by singing the right note for the situation internally and judging the other person's external note against this. She experiences a range of physiological reactions if there is a disparity between the voices:

- I definitely hear when something is not in tune and my entire body and throat reacts to try and get the note into tune. My eyebrows and cheek-bones lift if it is flat, I breathe in deeply through my nose and try desperately to lift my soft palette and sing the note in tune in my head as if that might help the other musician.

Item 8 provided a considerable amount of information about what the singer imagines when she performs. The text of a piece is important to this singer, as it becomes fused with the melodic line and provides insight into the form of the piece. In some cases she feels the rhythm so that she does not have to multitrack with the counting and text. Sometimes when she does need to count, she feels she is able to separate the internal and external voices to do this. MS is able to think about other things such as technique and interpretation in images other than words. She thinks she might use visual images and emotions to do this. She measures intonation by choosing the best possible note for the musical texture and sings this in her mind. In her own performance she would match this with her external singing voice. In other performances, she experiences physiological responses, which try to bend their external singing in to tune with her perceived best note.

7.5 Conclusions

The results from Questionnaire Five showed that most of the underlying assumptions for this section were correct. However, the degree of individual difference between players had not been anticipated, nor was the fact that a broader range of skills was displayed than originally thought.

In the playing by ear situation, most musicians seemed to produce imagery by inner hearing and singing and then copy this with sound from their instruments. However, some musicians listened for intervals, and one imagined an

accompanying graph of the melody line. One musician imagined the visual shape the piece made on a keyboard. There was not a whole lot of difference between the playing by ear and transposing by ear exercises. Participants just re-did the exercise but started on a different note. Mostly, they sang internally and let their fingers try to reproduce the sound.

In the rhythmic improvisation exercise, most of the musicians heard or sang the music internally and then applied learnt rhythmic patterns. Some musicians let their inner voice structure the rhythmic variation. Other musicians separated their internal and external voices; they sang the original melody internally and let their external playing include some sort of variation.

Some of the musician-participants let their inner voice structure their free improvisation. It may be possible to have spontaneous unstructured inner singing and to mimic this externally on an instrument. Other musicians let their fingers lead, but they may have been monitoring the results somehow. A few musicians relied on a store of appropriate improvisatory figures, such as chord progressions and scale passages. One musician used unrelated visual imagery to structure the sound she was creating.

When playing by memory musicians often use more than one type of imagery at a time. The most prevalent combinations of imagery seem to be aural and kinaesthetic imagery, but some musicians also use visualisation of notation and form.

The imagery that was present during the music reading task was internal hearing or inner singing. Some participants felt a pulse or counted, and inner speech was present for some musicians during this exercise. The musicians did not make much of a distinction between sight reading and normal reading. A range of imagery was used when sight-reading. Some musicians used inner singing or inner hearing to assess pitch. If there was a mismatch, they changed the external sound to match the internal sound. Two musicians commented on spatial imagery of how the notes fitted on their instrument. Musicians also set up systems for counting. Others used inner speech to talk themselves through the exercise.

Singers often have to deal with different technical demands during their performances. The text of a piece becomes important, as it is fused with the melody and provides the form of the piece. In some cases the singer feels the rhythm so that she does not always have to multitask with the counting and the delivery of the text; however, it is possible to multitask in this way. The singer interviewed for this study is able to think about other associated performance aspects, such as technique and interpretation in visual images or feelings.

Chapter Eight – Discussion and Conclusion

A central proposition of the present thesis has been that a complex set of imageries, and particularly auditory imagery, are used in the perception and performance of music by the 10 musician-participants. The findings are significant, as the results shed new light on inconsistencies that developed out of previous research in the field. The findings also provide new material in terms of conceptualisation and measurement technique and have serious implications for the teaching of music perception and performance.

The questionnaires and discussions with the musician-participants were successful as a unit of qualitative research in a number of ways. They facilitated discussion in an area that has not previously been well-documented and also provided descriptions and knowledge about the use and nature of imagery as experienced by musicians in their work. Further, the study has helped to clarify terminology representing the words that musicians use to describe their inner experience of sound and has demonstrated that musicians use a complex set of imageries to think about, perceive, and perform music. Prior to discussing results in relation to previous literature, the research questions with their findings are briefly summarised under the major headings of terminology, inner singing, listening, whole listening, and imagery for music performance.

8.1 Summary of Research Questions and Related Findings

8.1.1 Terminology

1. What is inner singing?

It was found that musicians use a range of terminology to describe their inner sound worlds. This terminology reflects the complex mix of imagery they are experiencing and, therefore, a blanket or umbrella term will not do justice to the individuality of their processes. Some musicians, who describe their generation of internal sound as *inner singing* or *subvocal singing*, experience a mix of auditory and kinaesthetic imagery which sounds and feels like singing. Others experience a mix of auditory and kinaesthetic imagery which sounds and feels like performing, and in this case perhaps the term *inner performing* would be better suited. Musicians are able to imagine a greater range of sounds if they use a mix of auditory and visual imagery; in this situation they use the term *inner hearing* or *picturing the sound*. Some musicians do not use auditory imagery to imagine music, relying instead on a mix of kinaesthetic, word, and visual imagery with equal success. The full expressive dimensions of music for performer and listener, although culturally specific, arguably go beyond the mere experience of sound and hence justify a clearer use of terms.

8.1.2 Inner singing

2. Can musicians sing internally (in their heads)?

All the musicians interviewed had an inner voice (that is, they could generate an internal experience of sound); they had control over starting and stopping the sound and could manipulate it to produce notes of different pitch and rhythm.

The study showed that most musicians thought that their inner voice was faster and more agile than their external voice and could reach higher and lower (had a greater range).

3. What is inner singing used for?

Musicians can use inner singing to generate internal sound for music thinking and memory. Inner singing is one mind skill that is available to musicians during listening and performing.

4. What does inner singing sound like?

In terms of timbre, the internal sound that the musicians generated was unique to each individual. To some it sounded like singing, to others it sounded like an instrument. Some musicians could make it sound like either singing or an instrument, and still others thought it had no timbre at all. The ability to imagine different instrumental timbres may depend on the type of imagery that is being employed, and perhaps this type of imagery is not best described as inner singing.

5. What does inner singing feel like?

If musicians are asked to inner sing, they experience movement in their throat and mouth, and also sensations in the sinus and middle-ear. However, not all musicians inner sing. Musicians who used the term inner hearing to describe their internal sound production experienced less movement and feeling in their speech musculature. Breath control was a feature that was important to those musicians who used inner singing. They used their breathing to shape the sound;

for example, breath pulses helped imagine staccato notes, and long breaths were used to imagine a smooth legato sound.

6. Are there different types of internal sound?

Musicians are able to give detailed descriptions of different types of internal sound. Inner singing is described as singing without producing external sound. It is useful for generating pitch, but not for generating complicated sounds and musical textures. When imagining harmony and whole soundscapes, the term inner hearing is sometimes used. Some musicians described the generation of internal sound as including visualisation of hand movement, and in this case possibly the term inner performing is appropriate. Sound imagery is a broader term used to describe the imagination of environmental sounds that cannot be readily sung or played.

8.1.3 Listening

7. Do musicians sing internally as they listen to music?

Of the musicians interviewed, 7 out of 10 generated imagery of sound as they listened to some extracts of music. The other musicians did not think inner singing or inner hearing was an accurate description of what they did when they listened to music.

8. Do musicians use processes such as streaming to help with complex sound environments?

The musicians who did sing internally during listening usually followed and mimicked one line of the music, in a process known as streaming.

9. *Do musicians have a choice in how they listen to a musical texture, or does this have more to do with stream prominence used by composers?*

The musicians were not concerned about the conventions of listening to the soloist. Rather, they used personal choice to scan through the musical texture to find something interesting or enjoyable with which to sing. With chordal sections, the musicians chose to sing one note out of the chord, but did not necessarily choose the highest. The streaming choices made by the musicians resembled the register of the instruments they play; however, they often visited other lines as well. The result of these streaming choices is that a group of listeners will construct multiple internal versions of the same piece.

In multipart music, the musicians were able to divide their attention between the lines by rapidly scanning between them in order to find something to sing with; otherwise, they used a different kind of listening to hear the whole texture or sang with one line and tracked another. When the music became too fast or fragmented, some musicians *stepped out*. During this time they describe their listening as *whole listening*. In whole listening the musicians felt they could hear more of the piece, but had less knowledge of the detail.

8.1.4 Whole listening

Musicians who used whole listening described their thinking as being still and calm and including internal commentary about chord progressions, structure, and

stylistic characteristics. The importance of this finding is that this would seem to prove that it is possible to perceive without co-enouncing. However, although the musicians were not mimicking the incoming perceptual information, they were still making a copy of it, although perhaps in an abbreviated or different way. Imagining words, diagrams, or visualising hand movement is still producing imagery of some kind. By changing the form of imagery (that is, changing the modality), the musicians felt they were able to access a wider view of the soundscape.

During the music listening exercises the external stimulus was auditory and most musicians chose to store the piece as an auditory impression; they could have sung parts of it at the end of listening (albeit one line only). Musicians who used whole listening stored the information in a different modality. One musician generated such a clear image of the notation of a previously unknown piece that after listening she could have written it down. Some listened and talked to themselves about form, chord names, keys, modulations, and stylistic characteristics. At the end of listening, they could discuss the structure of the piece and could have drawn analytical diagrams. Others listened and felt movement in their hands and knew how to play the music. For these musicians, successful perception and memory involved choosing the right modality in which to store information.

8.1.5 Imagery for music reading

10. Do musicians sing internally as they score read?

The hearing of music during score reading was not spontaneous and uncontrolled. The musicians in this study consciously worked to build an image of the music they were reading.

11. Do musicians have other techniques for helping themselves to hear music internally as they score read, such as feeling the rhythm and visualising hand placement?

All musicians interviewed for this study consciously generated imagery on a number of levels, in order to build an internal model of the piece they were reading. The musicians set a pulse or tempo during music reading, through real movement, imagery of movement, or imagery of repetitive sounds. The musicians then placed the notes into this pulse by subdividing for short notes or sustaining long notes or rests over a number of pulses. The musicians also consciously generated pitch imagery. They did this by working out which note of the music would be the tonic and then used their theoretical knowledge of scale degrees and intervals to produce the notes internally. Some musicians found that larynx or hand movement helped generate pitch imagery.

Reading music in this way is a skill that the musicians use to help themselves perform. The musician builds an internal model of the music on a number of levels and then mimics the model externally through performance. Musicians were also able to build internal models of music without the use of printed music, drawing material from their memory or spontaneously generating it.

8.1.6 Imagery for music performance

12. Do musicians sing internally as they perform music?

Musicians are able to create an internal model of music that they use to structure their performing. Inner singing can be used to create an auditory model. The musicians sing the music internally and then copy this sound on their instrument. Inner singing may be combined with other types of imagery such as imagery of pulse and movement. However, not all musicians use inner singing.

13. How is imagery used in a range of musical performance activities?

Several different types of performing were investigated in this study. All types of performance needed an internal image as a scaffold. When playing by ear, the musicians created an internal image of the music and copied this on their instruments. Examples of imagery were inner sound, or speech imagery of note names, scale degrees, and intervals. Some musicians used visual imagery such as a line graph of the melody contour or the visual shape the piece made on a keyboard.

In the rhythmic improvisation exercise, some musicians were able to separate their internal and external voices. They sang or heard the original melody internally and let their external playing include some sort of variation. This was particularly the case for some string players who could generate variation through different bow movement.

When asked to make up their own piece, some musicians let their inner voice improvise and copied this sound of their instruments. Other musicians let their

fingers lead. In both cases, the musicians would have had a model for their playing even if the model existed in a different modality such as words, movement, or an idea. This cross-modality can be seen with the few musicians who relied on a store of improvisatory figures, such as chord progressions and scale passages, and the one musician who used unrelated, personally meaningful visual imagery to structure the sound that she was creating. This was the only instance of metaphoric imagery in the study.

When playing by memory, musicians often use more than one type of imagery at a time. The most prevalent combinations of imagery for this exercise seemed to be firstly aural and movement imagery, and secondly visualisation of notation and form.

8.2 Key Findings in Relation to Previous Literature

The literature review of this study revealed a number of incompatible ideas. A significant outcome of the current research is that some of these inconsistencies can now be considered. The key findings of the study are now related to the previous literature.

The musicians in the present study had complete and accurate control over their music imaginings, in line with studies by Bailes (2002), Deutsch (1982), Jorgensen and Binsted (2005), Sacks (2007), Smith (1992), and Sokolov (1972). The musicians agreed with ideas put forward by Mackay (1992), that inner singing could travel faster and display a greater range than external singing or playing. They also agreed that the activity of inner singing has associated

movement in the speech musculature (Godøy & Jørgensen, 2001; Jørgensen & Binsted, 2005; Mackay, 1992; Smith, 1992; Sokolov, 1972; Walliczek et al., 2006). However, this study revealed that not all musicians inner sing. Some musicians imagine music in ways that could be described as inner hearing, inner performing, or inner seeing.

Teplov (as cited in Sokolov, 1972) and Smith et al. (1992) proposed that musical imagery might exist in different types. Out of the 60 terms that were found for musical imagery in the review of literature, the musicians interviewed for this study were happy to use the terms inner singing (subvocal singing), inner hearing, sound imagery, and picturing the sound to describe the generation of internal sound. They were also able to describe other types of imagery involved in music imaginings, such as visual imagery, spatial imagery, and kinaesthetic imagery.

Personal choice, experience, and skill are important in the process of listening. The musicians in this study would seem to support the internalist or interactive theory of perception that some kind of action is required for perception. However, this study found, contrary to the ideas of Leontyev (1981) and Sokolov (1972), that it is not physical action that is required, but rather the action of generating imagery. Inner singing was used for processes such as co-enouncing and streaming during listening. The musicians also displayed multitasking abilities that were proposed by Sokolov. Contrary to the ideas of Bregman (1999), Moore (1989), and Sokolov, some musicians found that streaming was unacceptable in specific instances, and instead preferred to listen to the sound of

the whole piece of music. A different kind of inner repetition was necessary for this type of listening.

Whole listening does not require the use of the inner singing voice as it relies on other types of imagery and imagery combinations, such as inner speaking, inner hearing, and visualisation of diagrams. The literature did hint that musical imagery might be a composite phenomenon (Schneider & Godøy, 2001). However, it did not reveal the extent of the multimodality.

The musicians in this study agreed with the findings of Gabrielsson (1999), Halpern (2003), and Wöllner et al. (2003) that musical imagery during silent score reading was purposefully generated. The imagery was multifaceted and, as Altenmüller & Bangert (n.d.) noted, movement of hands or larynx helped the production of internal sound. It was also noted in the literature that the generation of pulse might have more to do with movement imagery than the inner voice (Clarke, 1999), but the individuality of musicians in this respect was not fully appreciated.

It was noted in the review of literature that musical imagery might exist during music performance. However, musicians are unaware of this duality, as the external sound “blocks out” the inner sound (Repp, 2001). The musicians in this study agreed with this, but they added the proviso that the imagery did not need to be auditory.

A successful performance of music requires the musician to rely on the combination of several different senses. An action produced by muscle movement is seen visually and then heard aurally. In this way, the internal model for performance might also be multimodal, the most important characteristic not always being the most obvious one. For example, in the case of sound production, imagining the physical movement needed to produce the sound, instead of the actual sound, might be seen as an equally viable way to create the model.

8.3 Emergent Concepts

As well as defining terminology, clarifying ideas, and answering the research questions, the study produced findings substantial enough to warrant the development of a new set of concepts. The new concepts are as follows:

1. Different types of imagery are used when individual musicians listen to or perform music. It is equally viable to use movement or visual imagery in place of sound imagery when thinking about music.
2. Perceptions are based on the individual's ability to imagine the constituent parts of an experience. Further to this, two people may perceive correctly different aspects of the same experience, which will lead to two different but equally viable perceptions.
3. Exact internal repetition of a stimulus is not necessary for perception. However, some sort of internal imagery generation is usually employed.

When listening to music, incoming perceptual information can be stored in a variety of modalities or combination of modalities (e.g., sound images, visual images, words, or movement imagery).

4. Using an abbreviating form such as words or analytical diagrams may allow the listener to access a wider section of the sound environment, but perhaps less of the detail.
5. Musicians will choose a particular type of listening for a particular purpose. To have knowledge of technical execution, or expressive qualities of the playing of a particular instrumentalist, the musician might inner sing or inner perform. For a broader listening, musicians will employ different listening techniques.
6. When performing music, musicians create an internal image of the music, and then perform this externally. The image does not have to be auditory, it can be of any modality or combination of modalities.

8.4 Limitations

8.4.1 Qualitative methodology

Controversies in the field concern research methods, especially in a qualitative study, as the researcher's expectations can influence the results. It has been demonstrated that participants are quite able to work out the researcher's intention and the information given can be distorted because of this (Intons-

Peterson, 1983). However, the aim of the present research was to explore what musicians actively do or have control over doing internally. Their opinions and self-reflections were of genuine and vital importance. Thus, the qualitative method of data collection reflects the aim of the thesis. Moreover, the limitations of the study are inherent in its applied and community-based nature. Further constraints, in self-selection processes, were imposed by the reality of the data-gathering procedure. Time and commitment were of the essence.

Nevertheless, in spite of these limitations, the research does show in considerable detail the way 10 musicians approach their day-to-day work. Of major importance, the study revealed the unique and individual ways in which the musicians completed the tasks. A quantitative study would not have allowed extensive periods of interview time, and therefore, may not have uncovered the uniqueness of each musician. Nor would it have provided the wealth of verbal and written information that emerged. As well, a benchmark has been established for future research with the development of measures that are now available for emulation, replication, and application to other fields of enquiry.

8.4.2 Validity and reliability

Because of very busy lives, three musicians did withdraw from the study. However, as other musicians showed interest in the project, the opportunity to work with a range of instrumentalists presented itself. The original group consisted of eight string players and two pianists. The three string players who withdrew were replaced with a clarinettist, a horn player, and a mezzo soprano. It is possible that those musicians who continued in the study found it more

relevant than those who withdrew, producing a possible source of bias. However, those who continued with the study were also the ones who had differing points of view and were not afraid to share them (see the answers of violinist one, and the two pianists in Chapters Four to Seven).

Had it been the case that the findings, based on only a small number of participants with some withdrawals, showed that all musicians work in a similar manner, then there may have been cause for concern about bias. However, the present study clearly demonstrated remarkable individual differences between one musician's way of working and the next. The extent to which this individuality applies across the wider population and to other cultural settings awaits replication and further research. In fact, it would appear reasonable to propose that the individual differences might be further exacerbated under certain circumstances. However, the range of musician specializations used here supports the tentative conclusion drawn that the *uniqueness* of imagery is a phenomenon of particular note; apparently, even the replacement factor did not affect this outcome.

8.4.3 Variables

It may be that if musicians have learnt different instruments, then they may develop a preference for a particular type of imagery. Instrumentalists such as pianists, who can see patterns of hand movement, might require more visual imagery than instrumentalists such as horn players where much of the work is done with the mouth. If musicians develop different types of imagery because of

the instrument they play, then this could be a significant qualifying variable in the study.

However, in reality, most of the musician-participants play a second or third instrument and have sung in a choir or with their mother in their childhood. The rich tapestry of musical experiences that combine over decades of music learning to result in a well-trained musician are far too complex to unravel. Added to this are the different methods of their teachers, different learning styles, and the fact that some musicians compose, conduct, dance, act, or play different genres of music. Finding a group of musicians who do not display these types of differences is, in all likelihood, impossible.

8.5 Implications for Education

The musicians in the present study were chosen because they had all developed whatever skills are necessary to perform music. They can sit together performing complex rhythms over long periods of time and can choose notes that blend into the harmonic environment created by each other. They control their bodies to place sounds together, perfectly and beautifully, but have shown that the mind skills used to do this are remarkably individual. The differences that these musicians displayed in their internal thinking should ring alarm bells for music educators, who are teaching in the areas of ear training and instrumental practice.

8.5.1 Ear training

The review of literature in this study showed that the brain of a musician grows according to past activity (Baker, 2001). By the time an individual is competent enough to stand in front of a class and teach, they are likely to have experienced decades of growth in a unique way. Lanskey (2004) noted the prevalence of pianists and composers who design and teach music courses:

It is interesting to reflect on the extent to which conventional studies of music analysis or music criticism might be keyboard or composer biased. A brief analysis of the Music Studies staff at the Guildhall School, for example, demonstrates that in 2002 only two of approximately twenty part time staff in this area were not either keyboardists or composers. Even these two spent some post-graduate study time exploring elements of composition through the school's Performance Communication Skills course. (p. 13)

It is tempting to assume that a better model for teaching aural skills might involve class segregation according to instrument types, taught by specialists of that instrument. However, this study has demonstrated that, even among five string players, significant differences occur in listening styles.

An important starting point for music education is to acknowledge that there is likely to be more than one process for aural perception, and because of this, different but equally viable perceptions will be formed. It does not matter who teaches the aural class, as long as they understand and value these differences. Aural perception skills are not genetically endowed; music perception is an ability that is developed by purposeful interaction with the society and culture in which one lives. However, the complexity of each musician's background will

mean that the individual will have a unique set of skills with which to work. Perhaps it is the job of music educators to arm themselves and their students with a number of these tools, and not to be dismayed or impressed when students prefer one mind skill over another.

When designing aural courses, educators must look past their own ways of working, and also past the way they were taught. Educators must question “Why” when selecting class activities. What is the learning objective for the activity? What will the student be able to do as a result of the activity? How will this help the student as a musician? The primary function of the aural class should be to describe and give examples of a range of skills that can be used for music perception. Students need to know how these skills can be trained – that is, developed, exercised, and applied at the highest levels of attainment.

Examination of aural perception must not be biased and favour one type of music imagining over another. The point of examining and assessment is to encourage students to practice, learn, and develop in order to achieve at a higher level; the examining processes must be reflective of this rather than an obstacle to development. Examining needs to take into account individual achievement across a range of skills and that may well pose problems of assessment methodology.

Educators also need to understand the developmental aspects of mind skills. Often these skills start out as external responses to stimuli. The process of internalisation will take time and will depend on the student’s maturity and level

of education. For example, inner singing for perception as shown by Leontyev (1981) is a skill first taught through external singing. As students become competent, they will learn to interiorise. Not allowing young and inexperienced students to sing during aural perception exercises is showing ignorance of the developmental stages of this mind skill.

The same caution also applies to other types of imagery used for music processing. The problem with forming an understanding of music is that it is invisible. As Cook (1989) pointed out, “You can’t point to music, or grasp hold of it, because as soon as it has come into being it has already disappeared, swallowed up into silence, leaving no trace” (p. 52). But perhaps it does leave a trace; a small memory of muscle movement or visual image generated by the listener? Developing the accuracy and rigour of these responses should form the basis of aural skills programs. Young musicians whose skills are developing might need external models to see and feel music. Building blocks might show melodic contour better than notation. Children could use their hands to feel the contour of a melody and relate this to the feel of their larynx as it lifts and falls during singing.

Music educators need to understand that music perception can involve a variety of mind skills, producing different and equally viable perceptions of the same stimulus. They need to understand the nature of each skill and how to develop, exercise, and fairly assess its use. Developing age appropriate materials and curriculum resources for the various stages of aural training courses should always be a priority.

8.5.2 Instrumental practice methods

Practice routines for the majority of instrumental students are highly repetitive and concentrate on muscle and auditory memory. Numerous recent writings reveal that dystonia and repetitive strain injuries are a common problem for the developing musician (Andrews, 2005; Dawson, 2008; Horvath, 2006). The contribution that the present study makes is the discovery that muscle memory is only one of a number of imageries that the musician-participants use. Music students should take time out from their repetitive practicing to exercise some different types of thinking and mind skills. Developing multilayered imagery involves a different kind of practice; students could consider practicing without their instruments, in the following ways:

- Singing or hearing the piece internally when deciding on dynamics, phrasing, and speed changes.
- Imagining how it feels to play the piece, including visualising the correct fingerings.
- Imagining how the piece fits on the instrument. Learning the patterns that the music makes on the instrument because of keys and chord changes.
- Visualising the notation of the music.
- Visualising imagery of maps of form, structure, and dynamics. Being able to view the piece at a glance will help guard against memory lapses. It will also help students understand the form of the piece so that they are able to interpret and present the piece logically.

- Using emotional and metaphorical imagery for developing maps of the piece in terms of expression and communication.

Employing a practice routine that develops mind skills and the uses of different types of imagery could mean less repetitive strain injuries. Visualising on a number of levels will also mean that a detailed and thoughtful preparation of the piece has occurred.

8.6 Future research

A logical progression to the present research is to uncover the formative processes of various types of imagery. If inner singing is formed and exercised through external activity, teaching must take this into account. Inner speech has been an important part of educational research, with the result that teachers now understand the importance of private speech and encourage its use during problem-solving. Unfortunately, by way of example, young musicians are sometimes still being threatened with expulsion in musicianship examinations if they are unable to use their singing internally.

8.6.1 Children's education

This present study has shown what type of skills young musicians need to develop. Future research needs to uncover how these mind skills are developed. For instance, do they all need external practice before being interiorised? Are there learning experiences which will develop a child's ability to generate a specific type of imagery? Do certain curriculum materials encourage children to

use their multiple senses to experience a phenomenon before they are successfully able to imagine it? Are some types of imagery easier to develop than others? Do children of a certain age favour visual imagery over auditory or kinaesthetic imagery, which are perhaps difficult to develop and will become important to them later on? Research as to how children hear and imagine music might show the developmental progression of these mind skills.

Children's invented notations of music may be able to shed light in this area. Barrett (2001) has shown that notations made by young children employ a range of symbols to express music in a visual form. Barrett's case study of a 5-year-old, described the use of *representation of the instrument with modification* (2001, p. 42). This type of notation includes illustrations of an instrument to show which instrument to use and how many times to use it. The illustration is varied in size to show the amount of force needed when playing (dynamic needed). Barrett has also found evidence of *enactive representation* (p. 42). These notations illustrate the movement needed for performance, namely, straight lines for the scraping of a guiro and circles for the spinning of a cabasa. Enactive representation was more prevalent for instruments where a distinctive timbre could be achieved by playing the instrument in a particular way (p. 40). Speech sounds (onomatopoeia) were used to mimic timbre, and text became the focus point for vocal compositions (p. 42).

Barrett (2001) has shown that young children can experience a range of imagery types in response to music. The study showed evidence that children are able to build internal images of aspects such as dynamics, timbre, rhythm, instrument

shape, techniques of playing, text, and story lines. Often the various types of images were employed specifically to reflect the genre of a piece of music, but imagery types were also used in combination, expressing a multimodal image of the music in the child's mind.

The topic of children's imagery has potential to develop research in areas other than music. For instance, the study of the formative processes of visual imagery could have impact for the teaching of mathematical visualisation. Visual imagery is undoubtedly one of the most important features of mathematical thinking. As Palais (1999) has pointed out: "Mathematicians have always used their mind's eye to visualise the abstract objects and processes that arise in all branches of mathematical research" (p. 647). A study of the formative aspects of this type of imagery may be of benefit to teaching and learning in this area.

Relating the use of imagery to the learning and performing activities of young children may also explain why some methods of instruction are more rapidly successful than others. Music tuition methods such as those of Jaques-Dalcroze and Kodály combine singing, movement, and the use of visually straightforward instruments such as the xylophone. This multimodality might be important for stimulating the generation of musical imagery on a number of levels.

8.6.2 Society

At the broader level, themes from the current study could form the basis of further research in listening and perception. Imagery has been identified in the work of 10 musicians as they completed a range of musical activities, however, it

remains to be seen if these results can be reproduced over a larger population. Most of the imageries that the musicians generated were learnt from high-level participation in the activity. Kinaesthetic imagery such as hand movement was experienced, because the musicians had learnt and experienced the correct movements necessary to produce music. Visual imagery of instruments and notation were experienced, because they knew how to play instruments and how to read music. However, if a listener does not have this knowledge, what thought processes could they use when listening to music?

Could it be the case that non-musician adult listeners need the visual stimulus or emotive content provided by a story, in order to find their way into an unfamiliar piece of music? It is often the case that composers are asked to provide program notes for their new pieces. In this situation, a composer might make something up which may or may not have something to do with the piece. Even the act of naming a piece creates some sort of imagery. Music administrators and concert presenters feel that this is necessary to help audiences to find their way into the piece more easily. In the process of listening to new music, the audience might be wondering: “What is the piece about?” Is this really asking: “What should I imagine?” or “How should I imagine, when listening to this piece?” Does a title and program provide a basic way for the musically inexperienced person to listen to music? Do memories of other pieces and other stories affect the way a listener listens? This topic offers an exciting way forward in understanding what music means to us as individuals and as a society.

8.7 Coda

Those persons fortunate enough to receive the gift of a music education soon discover music is more than a pastime, leisure activity, ability, or career. Music is a lifelong passion, friend, and solace at times when nothing else can touch the soul. For this reason, for the power and worth of music, all children should be given the gift of music literacy. However, the divide still exists. Many children have been denied that gift through a lack of information on the nature of music skills and how to develop them. The process for gaining music literacy should be crystal clear, and this thesis has taken some steps towards achieving this goal.

References

- Adachi, M., & Trehub, S. (1998). Children's expression of emotion in song. *Psychology of Music* 26 (2), 133-153.
- Adachi, M., & Trehub, S. (2004). Perceiving emotion in children's songs across age and culture. *Japanese Psychological Research* 46 (4), 322-336.
- Alain, C. (2005). Speech separation: Further insights from recording of event-related brain potentials in humans. In P. Divenyi (Ed.), *Speech separation by humans and machines* (pp. 13-30). Boston: Kluwer Academic.
- Altenmüller, E., & Bangert, M. (n.d.). *Audio-sensory-motor integration as a prerequisite for musical expertise*. Unpublished manuscript, Institute of Music Physiology and Musician's Medicine, Hanover University of Music and Drama, Germany.
- Andrews, E. (2005). *Muscle management for musicians*. Lanham, MD: The Scarecrow Press.
- Baddeley, A. (1996). The fractionation of working memory. *Proceedings of the National Academy of Sciences, USA*, 93 (24), 13468-13472.
- Baddeley, A., & Salamé, P. (1982). Disruption of short-term memory by unattended speech: Implications for the structure of working memory. *Journal of Verbal Learning and Verbal Behaviour*, 21(2), 150-164.
- Bailes, F. (2002). *Musical imagery: Hearing and imaging music*, Unpublished doctoral dissertation, University of Sheffield, UK.

- Baker, J. (2001). The keyboard as basis for imagery of pitch relations. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 251-270). Lisse, The Netherlands: Swets & Zeitlinger.
- Barrett, M. (2001). Constructing a view of children's meaning-making as notators: A case-study of a five-year-old's descriptions and explanations of invented notations. *Research Studies in Music Education*, 16, 33-45.
- Békésy, G. (1960). *Experiments in hearing*. New York: McGraw-Hill.
- Berk, L. (1994). Why children talk to themselves. *Scientific American*, 271 (5), 78-83.
- Bigand, E., & Tillmann, B. (2005). Effects of context on the perception of pitch structures. In C. Plack, A. Oxenham, R. Fay, & M. Popper (Eds.), *The Springer Handbook of Auditory Research* (Vol. 24, pp. 306-352). New York: Springer Science & Business Media.
- Bogdan, R., & Biklen, S. (1998). *Qualitative research for education: An introduction to theory and methods* (3rd ed.). Needham Heights, MA: Allyn & Bacon.
- Bodrova, E., & Leong, D. (2007). *Tools of the mind: The Vygotskian approach to early childhood* (2nd ed.). Columbus, OH: Merrill/Prentice Hall.
- Bregman, A. (1999). *Auditory scene analysis: The perceptual organization of sound* (2nd ed.). Cambridge, MA: MIT Press.
- Brodsky, W., Henik, A., Rubinstein, B., & Zorman, M. (2003). Auditory imagery from musical notation in expert musicians. *Perception and Psychophysics*, 65 (4), 602-612.

- Brodsky, W., Kessler, Y., Rubinstein, B., Ginsborg, J., & Henik, A. (2008). The mental representation of music notation: Notational audiation. *Journal of Experimental Psychology: Human Perception and Performance*, 34 (2), 427-445.
- Budd, M. (1985). *Music and the emotions: The philosophical theories*. London: Routledge.
- Clarke, E. (1999). Rhythm and timing in music. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 473-500). San Diego, CA: Academic Press.
- Clarke, E. (2005). *Ways of listening: An ecological approach to the perception of musical meaning*. Oxford: Oxford University Press.
- Cole, M. (1996). *Cultural psychology: A once and future discipline*. Cambridge, MA: Belknap.
- Collyer, S. (2004). The sound in silence: Observations on silent singing as a practice technique. *Australian Voice*, 10, 64-69.
- Cook, N. (1998). *Music: A very short introduction*. Oxford: Oxford University Press.
- Crowder, R., & Pitt, M. (1992). Research on memory/imagery for musical timbre. In D. Reisberg (Ed.), *Auditory imagery* (pp. 29-45). Hillsdale, NJ: Lawrence Erlbaum.
- Davidson, J. (2002). Communicating with the body in performance. In J. Rink (Ed.), *Music Performance*. Cambridge: Cambridge University Press.
- Davidson, J. (Ed.). (2004). *The music practitioner: Research for the music performer, teacher, and listener*. Aldershot: Ashgate.

- Davidson, J., & Correia, J. (2002). Body movement. In R. Parncutt & G. McPherson (Eds.), *The science and psychology of music performance: Creative strategies for teaching and learning*. New York: Oxford University Press.
- Dawson, W. (2008). *Fit as a fiddle: The musicians guide to playing healthy*. Lanham, NY: National Association for Music Education.
- Dean, R., & Bailes, F. (2007). 'Human understanding' in imagining and organising sound: Some implications of John Locke's Essay for ecological, cognitive and embodied approaches to composition [Electronic version]. *Organised Sound*, 12 (1), 89-95.
- De Cheveigné, A. (2004). *Pitch perception models: A historical review*. Unpublished manuscript, CNRS-Ircam, Paris, France.
- De Cheveigné, A. (2005). Pitch perception models. In C. Plack, A. Oxenham, R. Fay, & M. Popper (Eds.), *The Springer Handbook of Auditory Research* (Vol. 24, pp. 169-234). New York: Springer Science & Business Media.
- Deutsch, D. (Ed.). (1982). *The psychology of music*. New York: Academic.
- Deutsch, D. (Ed.). (1999). *The psychology of music* (2nd ed.). San Diego, CA: Academic Press.
- Dixon Ward, W. (1999). Absolute pitch. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 265-298). San Diego, CA: Academic Press.
- Dowling, W. (1999). The development of music perception and cognition. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 603-626). San Diego, CA: Academic Press.

- Durlach, N. (2005). Source separation, localization, and comprehension in humans, machines, and human machine systems. In P. Divenyi (Ed.), *Speech separation by humans and machines* (pp. 221-243). Boston: Kluwer Academic.
- Finke, R. (1985). Theories relating mental imagery to perception. *Psychological Bulletin*, 98 (2), 236-259.
- Gabrielsson, A. (1999). Music performance. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 501- 602). San Diego, CA: Academic Press.
- Ginsborg, J. (2004). Singing by heart: Memorization strategies for the words and music of songs. In J. Davidson (Ed.), *The music practitioner: Research for the music performer, teacher, and listener* (pp. 149-160). Aldershot: Ashgate.
- Godøy, R. (2001). Imagined action, excitation, and resonance. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 237-250). Lisse, The Netherlands: Swets & Zeitlinger.
- Godøy, R., & Jørgensen, H. (Eds.), (2001). *Musical imagery*. Lisse, The Netherlands: Swets & Zeitlinger.
- Grew, O., Nagel, F., Kopiez, R., & Altenmüller, E. (2007). Listening to music as a re-creative process: Physiological, psychological, and psychoacoustical correlates of chills and strong emotions [Electronic version]. *Music Perception*, 24 (3), 297-312.
- Halpern, A. (1992). Musical aspects of auditory imagery. In D. Reisberg (Ed.), *Auditory imagery* (pp. 1-28). Hillsdale, NJ: Lawrence Erlbaum.

- Halpern, A. (2003). Cerebral substrates of musical imagery. In I. Peretz & R. Zatorre (Eds.), *The cognitive neuroscience of music* (pp. 217-230). Oxford: Oxford University Press.
- Hansen, B. (2005, February). *Strategies for teaching aural recognition*. Paper presented at the College Music Society, Pacific Northwest Chapter Conference. Retrieved July 8, 2008, from <http://www.hansenb.pdx.edu/pdf/auralskills.pdf>
- Helmholtz, H. (1875). *On the sensation of tone as a physiological basis for the theory of music*. London: Longmans.
- Hespos, S. (1989). *The characteristics of pitch, timbre, and loudness in auditory imagery*, Unpublished bachelor's thesis, Reed College, Portland, OR, USA.
- Holahan, J., Saunders, C., & Goldberg, M. (2000). Tonal cognition in pattern discrimination: Evidence from three populations. *Journal of Research in Music Education*, 48 (2), 162-177.
- Horvath, J. (2006). *Playing (less) hurt: An injury prevention guide for musician*. Kearney: Morris Publishing.
- Hubbard, T., & Stoeckig, K. (1992). The representation of pitch in musical images. In D. Reisberg (Ed.), *Auditory imagery* (pp. 199-236). Hillsdale, NJ: Lawrence Erlbaum.
- Intons-Peterson, M. (1983). Imagery paradigms: How vulnerable are they to experimenters' expectations? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 10, 699-715.

- Intons-Peterson, M. (1992). Components of auditory imagery. In D. Reisberg (Ed.), *Auditory imagery* (pp. 45-72). Hillsdale, NJ: Lawrence Erlbaum.
- Jorgensen, C., & Binsted, K. (2005, February). *Web browser control using EMG based sub-vocal speech recognition*. Paper presented at the 38th Hawaii International Conference on Systems Sciences, USA.
- Juslin, P., & Sloboda, J. (2001). *Music and emotion: Theory and research*. Oxford: Oxford University Press.
- Kalakoski, V. (2001). Musical imagery and working memory. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 43-56). Lisse, The Netherlands: Swets & Zeitlinger.
- Kvifte, T. (2001). Images of form: An example from Norwegian hardingfiddle music. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 219-236). Lisse, The Netherlands: Swets & Zeitlinger.
- Lansky, B. (2004). *Inside knowledge: Using the insights of music performance students as starting points for detailed repertoire reflection*. Unpublished manuscript.
- Leontyev, A. N. (1981). *Problems of the development of the mind*. Moscow: Progress Publications.
- Levitin, D. (2006). *This is your brain on music*. New York: Penguin.
- Logie, R., & Edworthy, J. (1986). Shared mechanisms in the processing of verbal and musical material. In D. Russell, D. Marks, & J. Richardson (Eds.), *Imagery 2: Proceedings of the 2nd International Imagery Conference* (pp. 33-37). Dunedin, New Zealand: Human Performance Associates.

- Mackay, D. (1992). Constraints on theories of inner speech. In D. Reisberg (Ed.), *Auditory imagery* (pp. 121-150). Hillsdale, NJ: Lawrence Erlbaum.
- Medina, J., & Rubio, D. (2004). *Self-regulation and mastering: Patterns in the development of private speech in illiterate adults*. Unpublished manuscript, dalarub@upo.es.
- Meister, I., Krings, T., Foltys, H., Boroojerdi, B., Müller, M., Töpper, R., & Thron, A. (2004). Playing the piano in the mind: An fMRI study on music imagery and performance in pianists. *Cognitive Brain Research*, 19, 219-228.
- Miell, D., MacDonald, R., & Hargreaves, D. (Eds.). (2005). *Musical communication*. Oxford: Oxford University Press.
- Miklaszewski, K. (2004). What and why do we need to know about music psychology research to improve music instrument teaching. In J. Davidson (Ed.), *The music practitioner: Research for the music performer, teacher, and listener* (pp. 27-36). Aldershot: Ashgate.
- Moore, B. (1989). *An introduction to the psychology of hearing*. London: Academic Press.
- Odam, G. (1995). *The sounding symbol: Music education in action*. Cheltenham, UK: Nelson Thornes.
- O'Shea, M. (2005). *The brain: A very short introduction*. London: Oxford University Press.
- Palais, R. (1999). The visualization of mathematics: Towards a mathematical exploratorium. *Notices of the Mathematical Association of America*, 46 (6), 647-658.

- Pechmann, T., & Mohr, G. (1992). Interference in memory for tonal pitch: Implications for a working memory model. *Memory and Cognition*, 20 (3), 313-320.
- Peretz, I., & Zatorre, R. (2004). *The cognitive neuroscience of music*. Oxford: Oxford University Press.
- Pierce, J. (1999). The nature of musical sound. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 1 - 24). San Diego, CA: Academic Press.
- Plack, C., Oxenham, A., Fay, R., & Popper, M. (2005). *The Springer Handbook of Auditory Research* (Vol. 24). New York: Springer Science & Business Media.
- Raffman, D. (1993). *Language, music, and mind*. Cambridge, MA: MIT Press.
- Rasch, R., & Plomp, R. (1999). The perception of musical tones. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 80 - 112). San Diego, CA: Academic Press.
- Reisberg, D. (Ed.). (1992). *Auditory imagery*. Hillsdale, NJ: Lawrence Erlbaum.
- Repp, B. (2001). Expressive timing in the mind's ear. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 185-200). Lisse, The Netherlands: Swets & Zeitlinger.
- Reybrouck, M. (2001). Musical imagery between sensory processing and ideomotor simulation. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 117-136). Lisse, The Netherlands: Swets & Zeitlinger.
- Sacks, O. (2007). *Musicophilia: Tales of music and the brain*. New York: Random.
- Saintilan, N. (1990). *The myth of the musical Jindyworobak: Some aspects of the appropriation of Aboriginal culture in the music of Clive Douglas and other*

- arts in Australia*. Unpublished honour's thesis, The University of Wollongong, Australia.
- Saintilan, N. (1993). "*Music if so it may be called:*" *Perception and response in the documentation of Aboriginal music in nineteenth century Australia*. Unpublished master's thesis, The University of New South Wales, Australia.
- Schneider, A. (2001). Complex inharmonic sounds, perceptual ambiguity, and musical imagery. In R. Godøy & H. Jørgensen (Eds.), *Musical imagery* (pp. 95-116). Lisse, The Netherlands: Swets & Zeitlinger.
- Schneider, A., & Godøy, R. (2001). Perspectives and challenges of musical imagery. In R. Godøy & H. Jørgensen (Eds.). *Musical imagery* (pp. 5-26). Lisse, The Netherlands: Swets & Zeitlinger.
- Schubert, E. (1996). Enjoyment of negative emotions in music: An associative network explanation. *Psychology of Music*, 24 (1), 18-28.
- Schubert, E. (2004, July). Emotion face: Prototype facial expression display of emotion in music. *Proceedings of ICAD 04*. Tenth Meeting of the International Conference on Auditory Display, Sydney, Australia.
- Sloboda, J. (1985). *The musical mind: The cognitive psychology of music*. Oxford: Clarendon Press.
- Sloboda, J. (2005). *Exploring the musical mind: Cognition, emotion, ability, function*. Oxford: Oxford University Press.
- Smith, D. (1992). The auditory hallucinations of schizophrenia. In D. Reisberg (Ed.), *Auditory imagery* (pp. 151-178). Hillsdale, NJ: Lawrence Erlbaum.

- Smith, D., Reisberg, D., & Wilson, M. (1992). Subvocalisation and auditory imagery: Interactions between the inner ear and inner voice. In D. Reisberg (Ed.), *Auditory imagery* (pp. 95-120). Hillsdale, NJ: Lawrence Erlbaum.
- Sokolov, A. (1972). *Inner speech and thought*. New York: Plenum Press.
- Thurlow, W. (1963). Perception of low auditory pitch: A multicue, mediation theory. *Psychological Review*, 70 (5), 461-470.
- Unyk, A., Trehub, S., Trainor, L., & Schellenberg, G. (1992). Lullabies and Simplicity: A cross-cultural perspective. *Psychology of Music*, 20, 15-28.
- Vygotsky, L. (1986). *Thought and language*. (A. Kozulin, Trans.). Cambridge, MA: MIT Press. (Original work published 1934)
- Walliczek, M., Kraft, F., Szu-Chen Jou, Schultz, T., & Waibel, A. (2006, September). *Sub-word unit based non-audible speech recognition using surface electromyography*. Paper presented at the Interspeech: International Conference on Spoken Language Processing, Pittsburgh, PA.
- Warner, N., & Aziz, V. (2005). Hymns and arias: Musical hallucinations in older people in Wales. *International Journal of Geriatric Psychiatry*, 20, 658-660.
- Weinberger, N. (1999). Music and the auditory system. In D. Deutsch (Ed.), *The psychology of music* (2nd ed., pp. 47-88). San Diego, CA: Academic Press.
- Wilson, F. (1986). *Tone deaf and all thumbs?* New York: Penguin.
- Woody, R. (2006). Musician's cognitive processing of imagery-based instructions for expressive performance. *Journal of Research in Music Education*, 54 (2), 125-137.

- Wöllner, C., Halfpenny, E., Ho, S., & Kurosawa, K. (2003). The effects of distracted inner hearing on sight reading. *Psychology of Music*, 31 (4), 377-389.
- Zatorre, R., & Halpern, A. (1999). When that tune runs through your head: A PET investigation of auditory imagery for familiar melodies. *Cerebral Cortex*, 9, 697-704.
- Zatorre, R., Halpern, A., Perry, P., Meyer, E., & Evans, A. (1996). Hearing in the mind's ear: A PET investigation of musical imagery and perception. *Journal of Cognitive Neuroscience*, 8, 29-46.

Appendix A – Questionnaires

Questionnaire One: Inner singing – Part One

Questionnaire Two: Inner singing – Part Two

Questionnaire Three: Listening and the Inner Voice

Questionnaire Four: Music Reading and the Inner Voice

Questionnaire Five: Music Performance and the Inner Voice

**Faculty of Education****Questionnaire One: Inner Singing – Part One**

Name: _____

The purpose of these preliminary questions is for the researcher and the musician to come to an agreement about the idea of internal singing and its associated terminology (inner singing, subvocal singing, subvocalize etc). There are no right or wrong answers.

		Yes	No
1.1	Can you sing in your head?		
1.2	Can you sing a scale in your head?		
1.3	Can you sing a simple nursery rhyme with words in your head?		

		Yes	No
2	Are you ever aware of singing subvocally by accident?		
3	Can your inner voice reach higher and lower than your actual singing voice?		
4.1	Does your inner singing sound like your own singing voice?		
4.2	Does it sound like other instruments?		
5	In terms of sound imagery, can you imagine other sounds like: a train whistle, a waterfall, the screech of car tyres?		
6.1	Imagine singing (subvocalize) very high and low notes "loudly." Did you feel any sensations in the front of your face (upper soft palate/sinus)?		
6.2	Did you feel any sensations or movement in your throat (larynx)?		
6.3	Did you feel any sensations in your ears (middle ear)?		
6.4	Did you feel any sensations in your mouth (tongue)?		

Please add any other comments:

**Faculty of Education****Questionnaire Two: Inner Singing – Part Two**

Name: _____

The purpose of this set of questions is to further understand the workings of the inner voice. There are no right or wrong answers.

		Yes	No
1.1	Can you inner sing a note on an out breath?		
1.2	Can you inner sing a note on an in breath?		
1.3	If you change breath directions while inner singing a note, is there a gap?		
1.4	Can you inner sing a note without breathing at all? (Perhaps just try this one really quickly).		

		Yes	No
2	Please whistle a scale. Halfway through, decrescendo until there is no sound, then crescendo back to the original volume.		
2.1	During the silent time, did you hear the missing music in your head?		
2.2	Do you think you sing in your head at the same time as you are whistling?		
3	Can you try the same thing but instead of whistling, can you sing the scale out loud?		
3.1	During the silent time, did you hear the missing music in your head?		
3.2	Do you think you sing in your head at the same time as you are singing out loud?		

4	Could you try this with your instrument? Play a scale. Halfway through, decrescendo until there is no sound, then crescendo.		
4.1	Did you hear the missing music?		
4.2	Do you think you sing internally while you are playing your instrument?		
5.1	Can you set a pulse (tempo) in your mind?		
5.2	What does the pulse feel like? How are you making it? Comment:		

6.1	Is it possible inner sing a note in your own voice, and then change the timbre to an oboe sound? Comment:		
6.2	Do you think there is a difference between inner singing and music imagery? Comment:		

7	One of the participants made the observation that different articulations such as legato and staccato, resulted in a different “sensation in the roof of the mouth.” Could you try inner singing a scale with the different articulations and comment on how it feels?		
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Please add any other comments:



Faculty of Education

Questionnaire Three: Listening and the Inner Voice

Name: _____

The primary goal of this research is to uncover how you think inner singing helps you with your work as a musician. This survey will ask you to reflect on what your inner voice does when you are listening. Do you use it when you listen to music or don't you? Is it important or isn't it?

The individuality of each of our minds and our ways of working and listening is important and for that reason try to make your responses as accurate and detailed as possible.

For the following six short excerpts, do you find your inner voice is engaged in any way?

- 1) Before listening to each extract read the list of descriptions.
- 2) Try to spend some time listening to each extract with your eyes closed. It is important not to read too much whilst you are listening, as the process of silent reading may interfere with the normal workings of your inner voice.
- 3) After each extract please stop the tape and re-read the descriptions, ticking the ones that are appropriate.
- 4) You can listen to the extracts as many times as you need.

- 5) There are no right or wrong answers and you can tick as boxes as you like.
- 6) Feel free to write your own statements or provide as much detail as you are happy to give.

1. Albinoni – Adagio from the *Oboe Concerto in D Minor*.

Oboe and Orchestra.

Descriptions:	Yes	No	Comments:
1.1 I knew this piece.			
1.2 I sang on the first hearing.			
1.3 I sang the oboe part.			
1.4 I also / sang with the-			
1.5 I sang the ornamentation.			

Other:

2. Vivaldi – Allegro from the *Oboe Concerto in C Major*.

Oboe and Orchestra.

Descriptions:	Yes	No	Comments:
2.1 I sang the fast bits.			
2.2 In the fast bits I glissando-ed along the melody line.			
2.3 This music was beyond the range of my natural singing voice.			
2.4 My subvocal voice was able to reach high.			
2.5 I transposed to suit my voice type.			
2.6 My subvocal voice is more agile than my natural singing voice.			

Other:

3. Bach – *Chaconne in D Minor*.

Solo Viola.

Descriptions:	Yes	No	Comments:
3.1 I sang/sang sometimes.			
3.2 I sang the melody.			
3.3 I sang the line that the performer made prominent.			
3.4 I sang the chords.			
3.5 I arpeggiated the chords.			
3.6 I sang the articulation (legato and staccato).			

Other:

4 . Schultz – Night Flight from “*Mephisto*”

Mixed Ensemble.

Descriptions:	Yes	No	Comments:
4.1 I sang fragments.			
4.2 I sang with the melody.			
4.3 I sang the most prominent bit.			
4.4 I flicked quickly between the instrumental lines.			
4.5 I was able to colour my singing so it sounded like pizz. or flutter tongue.			

Other:

5. Schumann – Ich Grolle Nicht from *Dichterliebe* Op 48.

Baritone and Piano.

Descriptions:	Yes	No	Comments:
5.1 I sang with the piano.			
5.2 I sang some harmony.			
5.3 I sang the vocal line.			
5.4 I sang along with the vocal line and mirrored the words. ¹			

Other:

¹ “Mirrored” suggests an imitation or reflection of the German text in the listener’s mind.

**Faculty of Education****Questionnaire Four: Music Reading and the Inner Voice**

Name: _____

The researcher is interested in what you feel is happening when you read music without the help of your instrument. There are no right or wrong answers. Can you read the following musical extracts silently and comment on what psychological and physiological devices you use to complete the task?

When score reading I:		Yes	No
1.1	Pick a tempo.		
1.2	Keep time by beating (toes, foot, leg, hands, head).		
1.3	Keep the tempo by inner pulsing (breath/larynx).		
1.4	Maintain a steady tempo in some other way.		

When score reading I:		Yes	No
2.1	Count in my head.		
2.2	Count in my head, while I keep a steady tempo, with another part of my body.		
2.3	Count only on the long notes, repeated notes and rests.		
3.1	Hear the music.		
3.2	Think about the key major/minor etc.		
3.3	Set a tonic note.		
3.4	Sing the music internally.		
4.1	Say the letter names of the notes in my head.		
4.2	Do not say the letter names even though I automatically know them.		
4.3	The letter name of a note flicks through my head if the note if it is affected by a key signature or an accidental.		
5	Find it easier to hear/sing the note if I move my fingers like I'm actually performing the music.		
6	Get a visual image of how the musical excerpt would fit on my instrument.		

When score reading I:

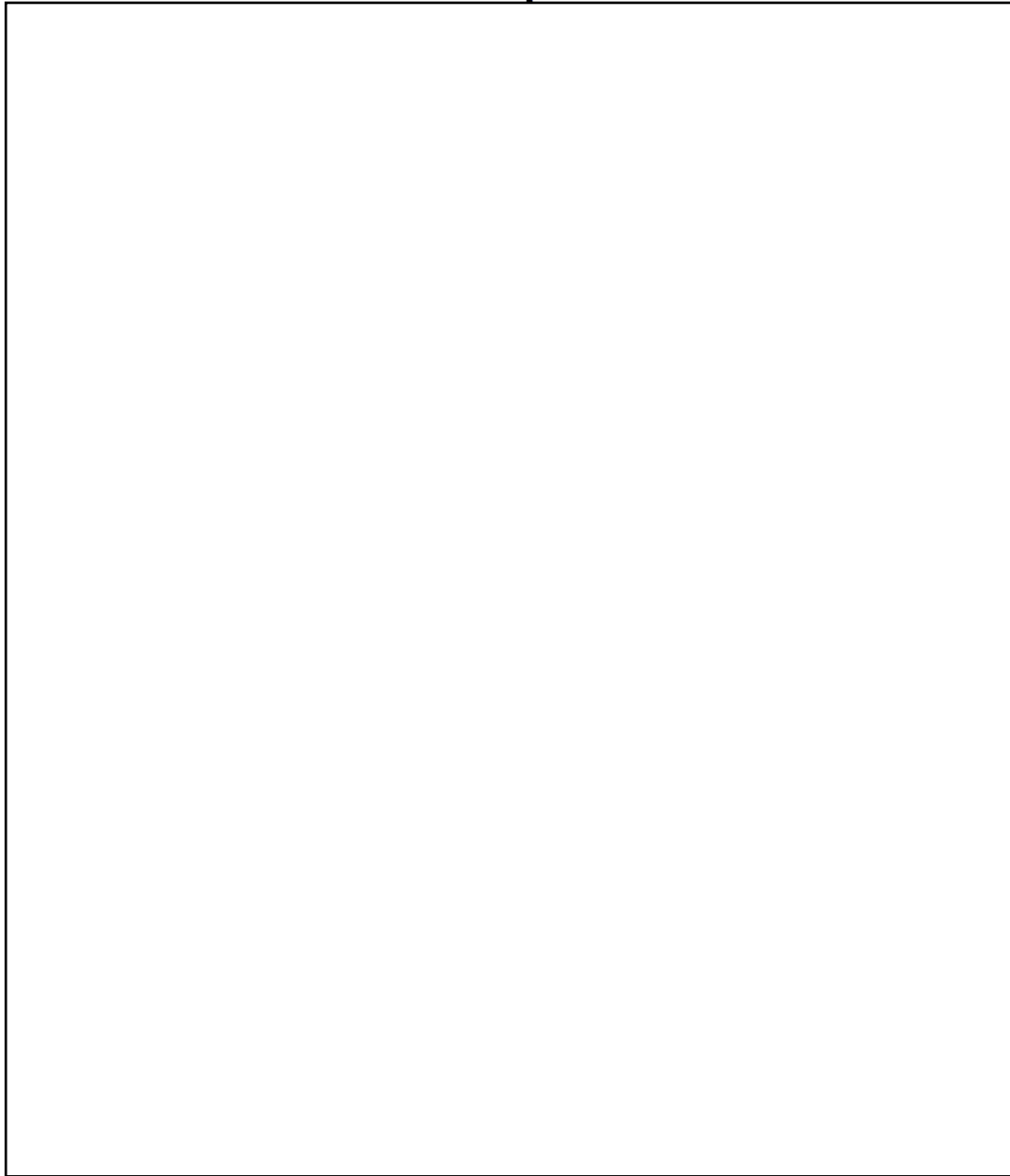
		Yes	No
7.1	I hear/imagine the chord.		
7.2	I sing the top note and imagine the other one.		
7.3	I sing both notes internally.		
7.4	I arpeggiate through the chord		

Please add any other comments:

Sechs langsame Sätze und dreistimmige Fugen für Violine, Viola und Baß (Violoncello)

Violine

Wolfgang Amadeus Mozart KV 404 a
herausgegeben von Johann Nepomuk David



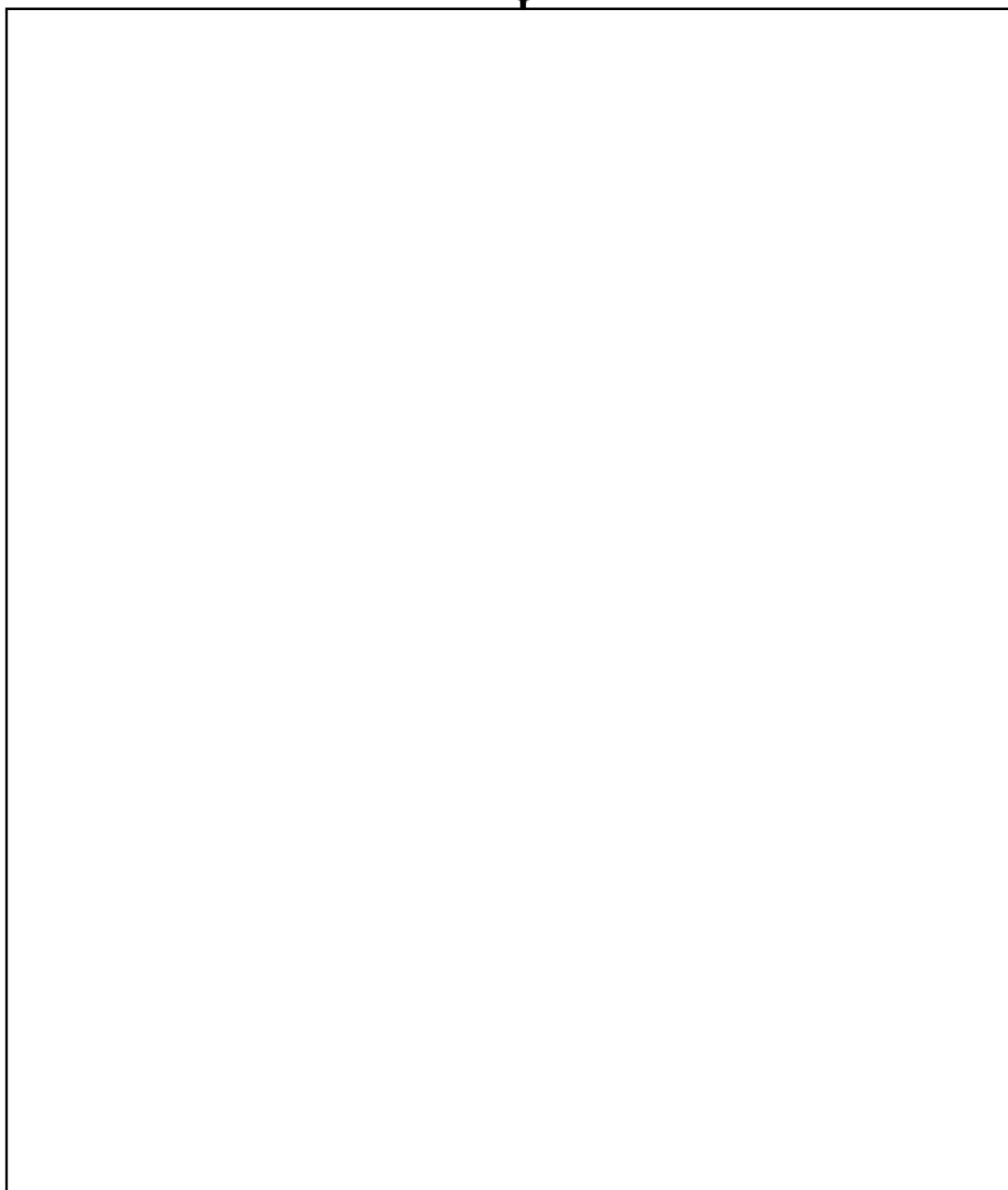
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Sechs langsame Sätze und dreistimmige Fugen
für Violine, Viola und Baß (Violoncello)

Violoncello

Wolfgang Amadeus Mozart KV 404 a
herausgegeben von Johann Nepomuk David



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Faculty of Education

Questionnaire Five: Music Performance and the Inner Voice

Name: _____

The researcher is interested in what you feel is happening inside your mind when you perform music. For each activity please comment on any visual imagery, sound imagery, inner speech, or inner singing that occurs. There are no right or wrong answers.

1. Playing by ear.

Please choose a nursery rhyme (that you haven't played before) and play it by ear. How are you able to do this? Did you employ visual imagery (such as imagining the music written down), any inner singing, or any other method?

Comment:

2. Transposing.

Choose a different key and play it again. Was there any visual imagery (key signatures and notation) or inner singing involved in this skill?

Comment:

3. Improvising.

Improvise a rhythmic variation to your nursery rhyme. Did you visualize notated rhythmic patterns? Did you sing subvocally?

Comment:

4. Free improvisation.

Improvise your own melody. How did you do this? Was there any imagery or inner singing involved in this skill? Which led the way, voice, fingers or imagery? Do they scaffold each other?

Comment:

5. Playing by memory.

Play a section of a piece that you have learnt by memory. Comment on any visual imagery (notation, internal maps of form and structure, progressive maps of where the piece fits on your instrument.) Did you sing the piece internally while you were playing? Do you talk to yourself about interpretation and technique?

Comment:

6. Reading

Play a piece that you have already learnt (please read the music while you are playing). Do you talk to yourself (note names, key signature, dynamics, Italian words, technique etc.) while you play? Do you sing subvocally? Do you count in your head?

Comment:

7. Sight reading.

Please sight read the following excerpt. Was there any visual imagery or subvocal singing involved in this skill? How can you tell when you have made a mistake (rhythm or pitch)?

Comment:

Please add any other comments:

Appendix B – Scores of Musical Works
for Questionnaire Three

Listening Example One: Albinoni – Adagio, from *Oboe Concerto in D Minor*
Op. 9, No. 2

Listening Example Two: Vivaldi – Allegro Non Molto, from *Oboe Concerto in C Major RV 447*

Listening Example Three: Bach – Chaconne, from *Violin Partita No. 2 in D Minor BWV 1004*

Listening Example Four: Schultz – Night Flight, from *Mephisto*

Listening Example Five: Schumann – Ich Grolle Nicht, from *Dichterliebe Op 48*

Albinoni, T. (1722). Adagio, from Oboe Concerto in D Minor Op. 9, No. 2.

Adagio

The musical score is presented in three systems, each containing five staves. The key signature is D minor (three flats) and the time signature is 3/4. The tempo is marked 'Adagio'. The score includes various musical notations such as eighth and sixteenth notes, rests, and dynamic markings like *(p)*, *(pp)*, *piano*, and *forte*. Fingerings are indicated by numbers 6 and 7 below the staves. A measure marked '10' is present in the second system.

First system of a musical score. It consists of five staves. The top staff has a melodic line with a fermata and a measure marked with a box containing the number 20. The second staff features a continuous sixteenth-note accompaniment, with the word *piano* written below it. The third and fourth staves contain chords and single notes, with *pp* markings. The bottom staff has a bass line with a 6/8 time signature and a 6/8 note value.

Second system of the musical score. It continues the five-staff arrangement. The top staff has a melodic line with a fermata and a measure marked with a box containing the number 21. The second staff continues the sixteenth-note accompaniment, with *mf* markings. The third and fourth staves contain chords and single notes, with *pp* markings. The bottom staff has a bass line with a 6/8 time signature and a 6/8 note value.

Third system of the musical score. It continues the five-staff arrangement. The top staff has a melodic line with a fermata and a measure marked with a box containing the number 30. The second staff continues the sixteenth-note accompaniment, with *pp* markings. The third and fourth staves contain chords and single notes, with *pp* markings. The bottom staff has a bass line with a 6/8 time signature and a 6/8 note value.

This page of musical notation consists of five systems of staves. The first system contains five staves with various musical notes and rests. The second system also contains five staves, with dynamic markings *f*, *mf*, and *pp* appearing. The third system contains five staves, with dynamic markings *forte* and *piano* appearing. The fourth system contains five staves, with dynamic markings *pp* and *forte* appearing. The fifth system contains five staves, with dynamic markings *pp* and *forte* appearing. The page is numbered 257 at the bottom right.

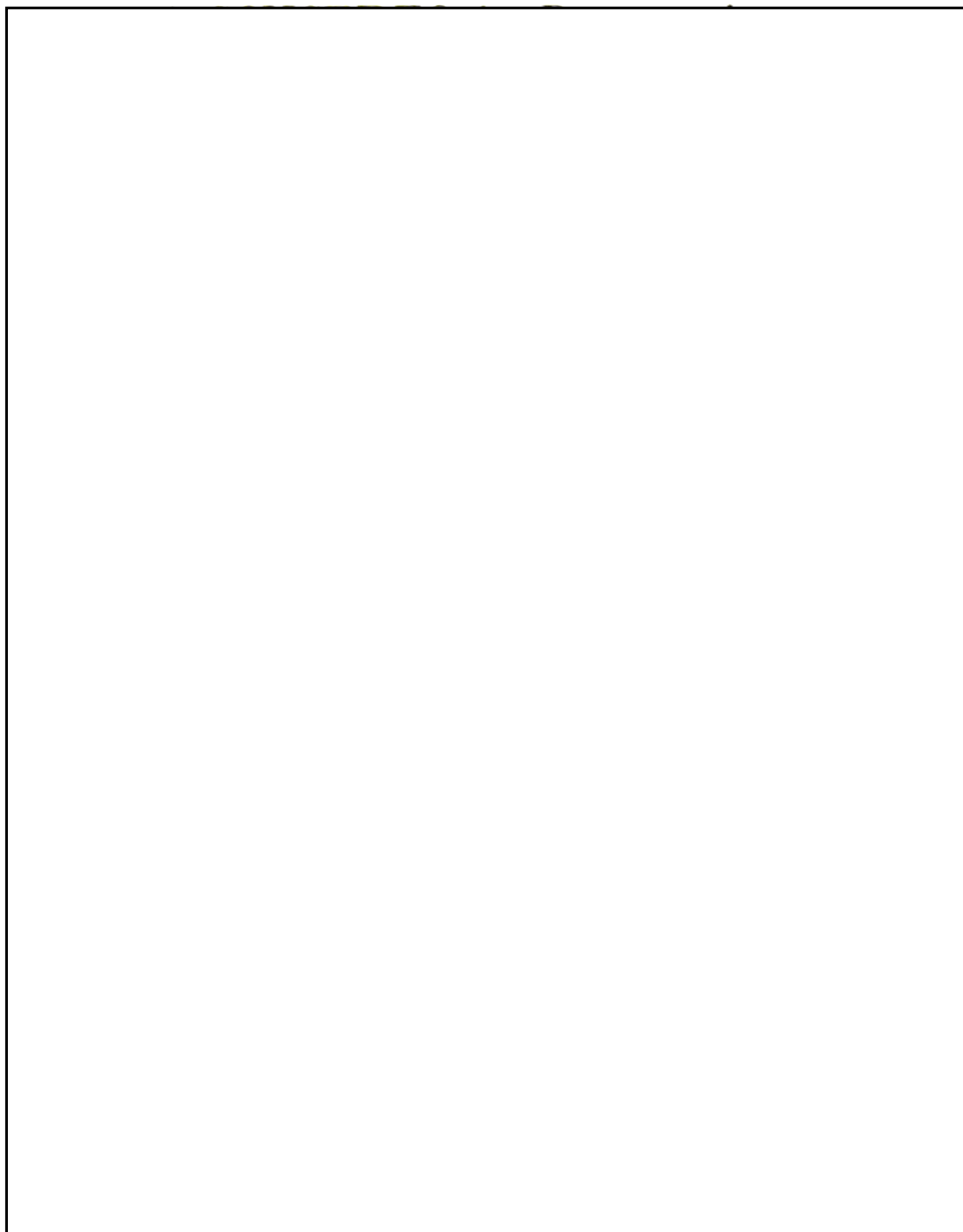
Musical score for a piano piece, featuring five staves (treble and bass clefs) and various musical notations including notes, rests, and dynamic markings.

The score is divided into three systems, each containing five staves. The first system includes a rehearsal mark [50] above the first staff. The second system includes a rehearsal mark [60] above the first staff. The third system includes a rehearsal mark [60] above the first staff.

Key musical elements and markings include:

- Dynamic markings:** *pp* (pianissimo) at the end of the first system, and *forte* (four times) in the second system.
- Rehearsal marks:** [50] and [60] are placed above the first staff of each system.
- Figured bass:** Numbers 6, 7, and 5 are written below the bass staff in the first system, and 7, 6, 7, 6, 7, 6, 5, 6 are written below the bass staff in the second system.
- Articulation:** Slurs and accents are used throughout the score to indicate phrasing and emphasis.
- Tempo/Character:** The score is written in a common time signature (C) and a key signature of one flat (B-flat).

Vivaldi, A. (c. 1720). Allegro Non Molto, from *Oboe Concerto in C Major RV*
447.



★) Riferendoci al concerto per Fagotto in Sol minore, Tomo 214°, avvertiamo che ci siamo andati sempre più formando la convinzione che nei concerti con uno strumento a fiato solista, questo non suonasse nei TUTTI. Invece Violini, Viole e Violoncelli solisti potevano rinforzare, nei TUTTI, le esigue file degli Archi.

G. RICORDI & C. Editori, MILANO.

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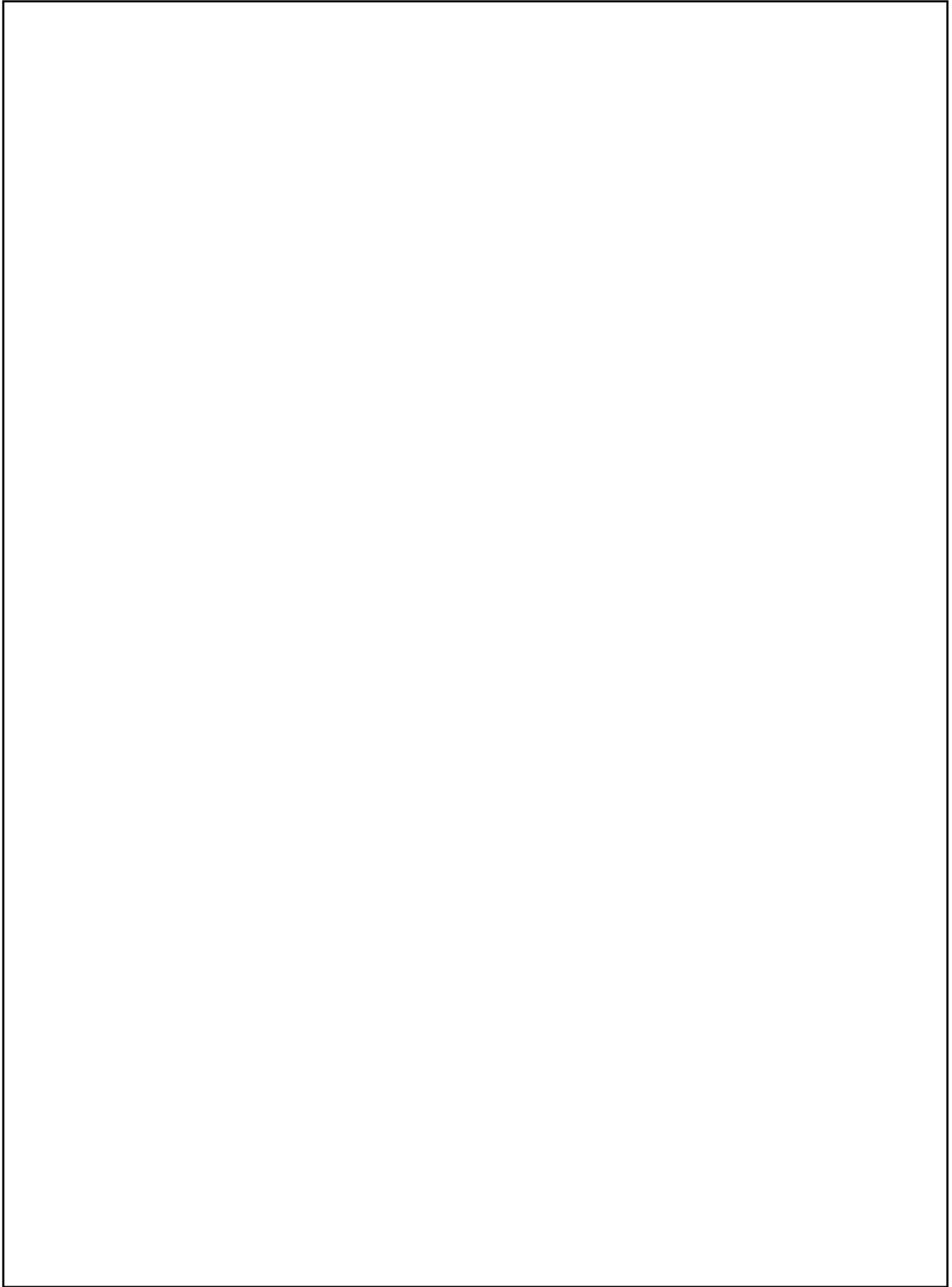
Bach, J. S. (1720). Chaconne, from *Violin Partita No. 2 in D Minor BWV 1004*.

5:

Ciaccona

the Manuscript:  ** In Manuscript: 

Schultz, A. (1990). Night Flight, from *Mephisto*.



VII.

Nicht zu schnell.
mf

Ich grolle nicht, und wenn das Herz _____ auch bricht.

E - wig verlor' - nes Lieb, e - wig verlor' - nes Lieb, — ich grol - le

nicht, ich grol - le nicht. Wie du auch strahlst in Di - a - man - teu - pracht, es fällt kein

Strahl in dei - nes Herzens Nacht, das weiss ich längst. _____

f ritard.

ritard.

The musical score is presented in four systems. Each system consists of a vocal line (treble clef) and a piano accompaniment (grand staff). The key signature is one sharp (F#), and the time signature is 4/4. The tempo/style marking at the beginning is 'Nicht zu schnell.' followed by the dynamic 'mf'. The lyrics are written in German and are placed below the vocal line. The piano accompaniment is characterized by a dense, rhythmic pattern of chords and sixteenth notes. The score includes various musical notations such as notes, rests, and dynamic markings. The lyrics are: 'Ich grolle nicht, und wenn das Herz _____ auch bricht. E - wig verlor' - nes Lieb, e - wig verlor' - nes Lieb, — ich grol - le nicht, ich grol - le nicht. Wie du auch strahlst in Di - a - man - teu - pracht, es fällt kein Strahl in dei - nes Herzens Nacht, das weiss ich längst. _____'. The score concludes with a 'ritard.' marking and a final chord.

f Ich grolle nicht, und wenn das Herz — auch bricht. *p* Ich sah dich ja im

Trau-me, und sah die Nacht in dei-nes Her - zens Rau-me, und sah die Schlang', die dir am Her - zen

cresc.

ritard. frisst, — ich sah, mein Lieb, wie sehr du e - lend bist. *f* Ich grolle nicht, ich grolle

ritard.

nicht.