Articulations of Trace: Analogue-Digital Conversion in The Age of Transversal Reproduction

Gregory J. Hughes
University of Wollongong

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Articulations of Trace: Analogue-Digital Conversion in The Age of Transversal Reproduction

Gregory J. Hughes

Supervisors:
Dr. Jon Cockburn
Dr. Susan Ballard

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The University of Wollongong
School of the Arts, English and Media
Faculty of Law, Humanities and the Arts

March 2018
ABSTRACT

Media increasingly screens itself. To extend the understanding of our media-ontic world, we need to observe inside, behind, and through the medium’s surface effects. The trace of a medium, if followed between the poles of immutable representation and unstable mutable symbolic work, becomes of interest as medium in itself. This thesis highlights articulations of ‘trace’ that traverse assemblages of analogue-digital media couched in network culture and asks: How does the trace of a medium survive transversal analogue-digital media assemblage and what qualities of the trace hold potential in thinking about media cultures and practice? The answer presented here rests on the development of a concept of ‘analogue-trace,’ which is a concept built upon a combination of theories in the writings of Walter Benjamin and various authors on media archaeology and cultural techniques, the ‘deconstructionist’ philosophy of Jacques Derrida and Bruno Latour’s ‘circulating reference’ in Actor Network Theory. Images and diagrams are addressed as articulations of the trace throughout the thesis. The key focus is how an investigation of ‘analogue-trace’ as cultural technique informs a media archaeology of the analogue-digital converter (A/DC). The A/DC facilitates three main forms of material-symbolic trace and these are analogue-digital affordance, analogue-digital feedback as an interdependence, and signal ‘distortion’ from reproducing ‘nothing.’ Thus, the thesis uses a broad media archaeological method associated with creative practice and critique, suggesting that, as an operator in an analogue-digital assemblage, the trace is a useful pointer helping to ‘make visible’ and unbox the hidden operations of media technologies that are at work inscribing the ‘analogue-trace’.
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9. CONCLUSION

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1. INTRODUCTION

Figure 1.1 Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*, visualising the overarching thesis structure, chapter positions and the path of the trace in the discussion to follow.
The trace is appearance of a nearness, however far removed the thing that left it behind may be. The aura is appearance of a distance, however close the thing that calls it forth. In the trace, we gain possession of the thing; in the aura, it takes possession of us. (Benjamin [1927-1940] 2002, p.447)

1.1 A Speculative Manifesto to Start
The trace, when applied to media, is vital in bringing an absent means, mode or thing closer, while paradoxically pushing it farther away. The present study is centred on a trace, or the tracing, of transmitted operators through analogue and digital media in reproduction. Inscriptive registrations as characteristic traces of analogue media, both symbolic and physical, in assemblage with the digital, are indicators of the uses and movement of media, as well as of wider cultural implications. If there is movement, a trace can be found; if a trace is left, the trace itself is not deterministic and does not discriminate. The trace works across signification, materialities, immaterialities, dualities, dialectics, arenas, disciplines and institutions. Equally, the trace can work across matter, signal, sign, medium, content and meaning. The trace holds input and output across linear and non-linear structures of media theory and practice in its ability to mark and highlight the concrete, stable, ephemeral and temporal but also the hidden, broken and unstable. To trace is to conduct a process of evidence, indication, trajectory, indexation and mapping across time and space. The trace is at once method, analysis and result. The trace is a point of connection and disconnection in continuity amongst media assemblages, systems and transversal practices. The trace is the presence of absence and absence of
presence. Hence, the medium, in digital network culture activity and within an era of inscriptive media, is made available to us in its traceability.

1.2 Tracing the Trace: Thesis Overview
The symbolic work performed by specific media from the advent of inscriptive media through to mechanical reproduction, processes of computation and networked communications, has become increasingly fragmented, layered or hidden from human comprehension and perception. Hardware and software are equally guilty. For example, micro integrated circuits as actants are usually black-boxed in hardware, only to be accessed via an interface; their size is hidden and their functions resist contemplation in the exchange of signification via the abstraction of their concrete operational qualities. In software, examples include artificial intelligence, facial recognition or image search algorithms that effectively allow images to ‘see for themselves’ across immense networked archives, altogether removing dimensions of concrete representation or sender-receiver protocol from the human experience. Media increasingly ‘screen’ themselves, they show and ‘hide,’ and if we want to keep a closer eye on what technical media do, then for the benefits of theorisation and better understanding of our media-ontic world, we need to observe inside, behind, and through media surface effects. The approach taken by this thesis is to let media tell their own story via their trace.

The trace of a medium, if followed from the inside to the outside of its casing, and anywhere in between the poles of immutable representation and unstable mutable symbolic work, should be a medium of interest itself. This thesis highlights and
articulates the ‘trace’ that traverses assemblages of analogue-digital media couched in network culture. Informed by ‘technical media’ themselves and modes of theoretical enquiry that point toward thinking about media ‘with media,’ this study reviews how the trace of media and that which it captures are articulated and presented. Consequently, this thesis asks: *How does the trace of a medium survive transversal analogue-digital media assemblage and what qualities of its survival hold potential for thinking about media cultures and practice?* The response to these questions is a synthesis of theory that centres back onto the trace itself and leads to the generation of a media archaeology of the analogue-to-digital (A/D) convertor through which the thesis investigates trace as cultural technique.

The thesis (Fig.1.1) begins at the ‘concrete trace’ introduced via Walter Benjamin’s modes of the ‘dialectical image’ (Benjamin [1927-1940] 2002; Buck-Morss 1989). At this moment in the thesis, the anti-allegory a medium and its trace can perform in relation to spatial and temporal mediation, image codes, reproduction and the dialectic binary ‘trace and aura’ are key focus points. The thesis moves Benjamin’s trace, from the age of mechanical reproduction, toward a discussion of its viability as a mode of media inquiry in digital network culture of the early 21st century. Consequently, Benjamin’s trace is moved toward a ‘transversal trace’ found in a contextual combination of Kristoffer Gansing’s (2011; 2013, pp.267-72) distillation of ‘transversality’ in network culture media practice as ‘generic transversal media archaeology’ and Matthew Kirschenbaum’s ‘forensic trace’ (2008) registered on the physical surface of digital storage. This meeting of context, theory and a defined analogue-digital materiality critiques the potential of the trace as couched in media
archaeology’s ‘medium-specificity’ (Parikka 2012, pp.84-9). However, the transversal trace suggests a struggle between two realms of symbolic work—broken or hidden forms of trace and immutable forms of trace. Therefore, as both a contemplation of method and an observed state of trace, the transversal trace is split into two considerations, and then re-joined through a consideration of cultural techniques (Siegert 2013; 2015a). Unavoidably, this split leads also to Jacques Derrida’s trace ([1967] 1997) which is acknowledged through a discussion of broken and hidden symbolic work. Likewise, when addressing the trace’s immutable symbolic work, Bruno Latour’s concept of ‘circulating reference’ (1999, pp.24-79), which draws on his framing of Actor-Network Theory (ANT) within the field of science studies, is referenced and discussed via a detailed review of key concepts in ANT as they pertain to the symbolic work of media and their use in practice. Following on from a cautious merger (located somewhere between Derrida-Latour), the trace is discussed as operative in both ‘dual’ and ‘dialectical’ processual ways. This consideration allows the term and concept coined for this thesis, ‘analogue-trace,’ to take form: referring to an immediate bringing together of matter, medium, and representation, while highlighting the instabilities of such networks. Dual operations across the friction of symbolic and physically technical re/production, inherent in network culture, point to analogue-trace as a Benjaminian but also a post-structuralist concept indebted to the writings of Derrida. However, to better address the post-hermeneutic basis of cultural techniques, Latour’s ‘circulating reference’ is used to strengthen the application of a dual and dialectic ‘analogue-trace’ that can approach media archaeology. Ultimately, the goal is to identify a method to articulate the trace, as a technological inscription and as a wider societal and cultural mode of symbolic work (and back again if
required). In doing so, the aim is to remain faithful to a non-linear spatial and temporal transversality across media-oriented actor-networks. However, in approaching the transversal this thesis does not give over to strict or terminal ‘undecidabilities’ or to a ‘non-dialectic’ in regard to the transformations of media and/or the transformations in communication they perform.

Case studies, often captured in image and diagram, are addressed throughout the thesis. However, medium-specificity, as a basis, leads to a combination of media archaeology, ‘media archaeography’ (Ernst 2013, pp.55-73) and ‘cultural techniques’ (Siegert 2013; 2015a) with the architecture and symbolic work of integrated Analogue/Digital signal converter circuits (A/DCs). A/D converters are identified as a ‘crux’ technical medium for network culture and are the key case study in the thesis. The media archaeology of A/DCs conducted here starts chronologically with the invention of the semiconductor-based transistor and moves on to the observation and discussion of an array of signal processing traces. These traces include circuit architectures, patents and signal processing formulae but also the artefacts left within, fabricated and/or omitted in media as a consequence of A/DC transmission and signal duplication. In approaching and throughout this media archaeology, the ‘analogue-trace,’ as a symbolic-material concept, is emphasised and discussed. In short, while a media archaeology of A/DCs is performed, unavoidably, a second media archaeology of analogue-digital trace and ‘analogue-trace’ is also performed. Consequently, the investigation identifies and discusses multiple forms of material-symbolic work done by the A/DC, including digital affordance as the preparation of analogue signals for digitisation, and integrated
A/DC feedback as an interdependence of both realms, as well as a contributor to signal ‘distortion’ circuit architectures and designs, schematics, and patents.

The thesis conclusion links the operational qualities of A/DCs and their articulations of the trace, especially distortion, to the wider theorisations and applications of the trace presented throughout the thesis. The key case study of the thesis as a whole is the A/DC as a material actant that both traces and forms new traces of its own. As a result, the thesis argues that to trace the trace means to follow unfolding events of re/production—artefact and practice as material-symbolic work—which highlight trace’s potential as a “basal cultural technique” (Siegert 2013, p.61) in digital network culture. Speaking about cultural techniques, Bernhard Siegert suggests that in digital symbolic work there is a “short circuit between the imaginary and the real” (2015a, p.205), that requires a “filtering” of signs (2015a, p.32; 2015b, para.121) from signal-noise networks rather than a semiotics ingrained in iconography. Ultimately, the thesis argues for the trace as a cultural technique that filters signal-signs as ‘distortion’ from signal and supposed non-signal binaries—a kind of bridge or door (Simmel [1909] 1994; Siegert 2015a) for feedback between content and non-content based approaches to media: the trace of a medium marks content and the trace of content marks the medium. The thesis identifies recursive dealings with the trace in both highly theoretical and medium-specific ways, enforcing the trace as a cultural technique. Additionally, in both its theoretical and methodological considerations, based on the trace of a medium, the thesis points toward broader media archaeological motives in creative practice and critique and suggests that, as an operator in analogue-digital assemblage, the trace, as observed and outlaid, is a highly useful pointer to ‘make
visible’ and unbox the operations of media and their use in the ‘analogue-trace’ nexus. This is as much about the trace of residual media as it is a search for active articulations of the trace as a concept and mode of affordance in practice.

1.3 Key Words and Concerns: A Few Clarifications
Keywords and concepts are defined in the unfolding of the thesis proper. However, a ‘brief’ summary of definitions at the outset may help to establish the scope of the thesis. This move is not intended to close off potential connections, constellations or networks developed throughout the argument to follow, but instead identify boundaries to these terms, their intended use and, as the thesis continues, what has become of their meaning. The following list of terms is presented in a glossary style format by order of relevance.

Medium, media or mediums: Medium-specificity as described by Jussi Parikka (2012, pp.84-9) and media archaeology as informed by Ernst (2013) suggest media enquiry can be based on, or start at the site of, or inside, media devices, mechanisms or operational processes. The different readings found in the doubling of meaning between the words media (broadcast, or ‘the’ media) and media (the channel through which material events occur) are critical to the trajectory of this thesis. Yet the opening discussion on Walter Benjamin’s analysis of mechanical reproduction as ‘mass production’ implies ‘the media’ inference of the term. The difference between medium and its plural (also) ‘media’ is open for interpretive differentiation throughout. These discussions of media-specificity are extended in Chapter 7, ‘Analogue-trace: A/D Converter, Media Archaeology and Cultural Techniques’ and
Chapter 2, ‘Concrete Trace: A Benjaminian Foundation of Trace.’ In some instances a hierarchical approach is intended. For example, a simple electric circuit can include wire as a medium for current flow or signal transmission, additional components to control signal between the circuit source and return accumulate to form a collection of ‘media’; and then the time-critical operation and cultural use of the assembled object/s become a ‘media’ network. Sybille Krämer (2006, p.106), for example, reflects on Friedrich A. Kittler’s ([1985] 1990; [1986] 1999) use of the term ‘media’, saying:

Media are practices that use strategies of spatialization to enable one to manipulate the order of things that progress in time. Such means of time axis manipulation are only possible when the things that occupy a place in time and space are not only seen as singular events but as reproducible data. Such production sites of data are ‘discourse networks’. Discourse networks are media in the broader sense: they form networks of technological and institutional elements.

Reinforcing Krämer’s view of Kittler’s ‘mediality’ are Geoffrey Winthrop-Young and Michael Wutz (1999) who, in their ‘Translators’ Introduction’ to Kittler’s *Gramophone, Film, Typewriter* ([1986] 1999), emphasise the intrinsic nature of media, rather than their social use, as an arena of study (p.xiv). In short, contained within the word ‘media’ is the notion of media or mediums telling their own story via their mediality. This approach speaks to the concrete mediality of media, as opposed to media’s role in social or cultural analysis and is the way the word will be used in this thesis.
What makes ‘media’ in this context? As an example, the material characteristics of a channel and the time critical processes of transmission and storage can be identified in practice or process allowing the media’s system of action to become a medium. This reading is also central to studies in cultural techniques (kulturtechniken), and for good reason, because “‘media’ are first and foremost cultural techniques that allow one to select, store, and produce data and signals” (Krämer 2006, p.93). The theory of cultural techniques focuses on intermediaries and mediums that potentially connect the dual production of concepts and concrete operations. The 21st century theory of cultural techniques began as an ontological extension of 19th century agricultural planning, and environmental engineering, in combination with a questioning of a determinist strand in late 20th century new media technologies. Or, as Winthrop-Young (2013, pp.4-7) puts it, cultural techniques is the result of the need for users to learn techniques to survive obsolescence. Cultural techniques, as a mode of media study or an approach to a specific medium, is a post-hermeneutic extension of German media theory. It considers the interplay of the material/physically concrete and the symbolic in the ‘processual’ chains of operations ‘and’ techniques, human and non-human, that unfold before and after the use of specific media (Siegert 2015a, p.13). The concept is extremely close to Latour’s Actor Network Theory (Siegert 2012, p.9; 2015b), but has a media-oriented slant with archival and media-archaeological motives that move toward the unfolding of referential operations that form a medium, including the feedback loop of material symbolic meaning, consequential action and culture. In other words, cultural techniques is an alternative to or extension of traditional media-oriented semiotics, whilst being historical in approach, and offers a:
media-ontological set of tools designed to unravel cultural techniques as material actions, skills, perceptions, and representations. Histories of knowledge, science and media are understood not through semiotic reading of texts but as complex spatial and temporal knowledge systems. The epistemological is entwined with the ontological. Cultural techniques are completely material: understanding them requires that we pay attention to everything from the characteristics of the inscription surface (what kind of paper used) to the wider spatial and temporal infrastructures. (Parikka 2013, p.154)

Bernhard Siegert (2013; 2015a) has been pivotal in bringing cultural techniques to non-German audiences by drawing on readings of Kittler’s work. However, Siegert’s (2013; 2015a) contribution should not be “reduced to an afterglow of Kittler” (Parikka 2013, p.148), and is recognised as unique in translations and interviews by Winthrop-Young (Siegert 2015a; 2015b) with support from Parikka (2013). Siegert’s definition of cultural techniques entails a useful genealogy of ‘media’ becoming understood as cultural techniques (2013, pp.3-11), and grounds this thesis’ affinities in what can be loosely described as ‘German media theory’. Siegert says:

German media theory shifted the focus from the representation of meaning to the conditions of representation, from semantics to the exterior and material conditions that constitute semantics. Media therefore was not only an alternative frame of reference for philosophy and literature but also an attempt to overcome French theory’s fixation on discourse by turning it from its philosophical or archaeological head on to its historical and technological feet. (2013, p.3)
Strangely, the material turn Siegert describes enabled thinking ‘with’ or observing media to also move toward affinities with another branch of French theory—Actor-Network Theory (ANT), as coined by Bruno Latour (Siegert 2013, p.6). Within the context of ANT, Latour offers definitions of media-related concepts that are also central to media as cultural techniques. For example, two key words in his lexicon are ‘mediation’ and ‘intermediary,’ defined in dialectical operation, as follows:

The term ‘mediation,’ in contrast with ‘intermediary,’ means an event or an actor that cannot be exactly defined by its input and its output. If an intermediary is fully defined by what causes it, a mediation always exceeds its condition. The real difference is not between realists and relativists, sociologists and philosophers, but between those who recognise in the many entanglements of practice mere intermediaries and those who recognize mediations. (Latour 1999, p.307, asterisks removed)

In the spirit of Latour’s wider explications of ANT, an emphasis on ‘practice’ allows the definition of media, as mediators or actors in mediation, to be stripped of fixed signifiers or any association with neatly defined institutional labels and contexts. Media are instead identifiable, observed, traced or defined only when active in actor-networks, in that they “transform, translate, distort, and modify the meaning or the elements they are supposed to carry” (Latour 2005, p.39). Siegert extends both Kittler and Latour to suggest we think of media as material-semiotic objects or operations that are “preceded by a reference to interruption, difference, [and] deviation” (2015a, p.21). Similar in description to Serres’ concept of the parasite ([1980] 2007) in communication, Siegert proposes that media can be generatively deterministic—the
basis of situation and relations. In other words, humans are not the only instigators of meaning and relations; media as non-human actors create situations, relations, context and conceptualisations for us or with us, enabling and forming distinctions in meaning through the processes of media actants becoming actors (Latour 1996, p.373).

It is important to note that the present thesis came to studies in cultural techniques after a review of Benjamin, Derrida, Latour and then the field of media archaeology. Furthermore, studies in cultural techniques offered pragmatic and elegant summations of media, and approaches to media. Ultimately, the thesis moves toward a reading of media as cultural techniques and explores processual or operational understandings of media. If this thesis offers anything to the concept of media, it is that the trace, as concept and material thing, at the site of exchange between material objects and symbolic work, is important to an informed approach to mediality and/or cultural techniques.

**Technical media:** As a side note to ‘media,’ the use of ‘technical media’ has significance, as Parikka points out:

[T]echnical media are media of mathematical codes, and in their execution they become processes defined by patterns of signals unfolding in time. They also become frequencies instead of beings, quantities instead of qualities, and functions instead of attributes. (Parikka in Ernst 2013, p.18)

This perspective on media follows the Shannon-Weaver model of communication (Shannon & Weaver 1963) and declares that the technical channel of communication
is at the centre of media and media “are now conceptualized as code-generating interfaces between the real that cannot be symbolized and cultural orders” (Siegert 2015a, p.21). Yet technical media are not always seen to be defined by computation or ‘the digital.’ Instead, Siegert notes (as translated by Kromhout 2014, para.5, italics in original): “technical media are an episode of the digital and the analog, of the era of graphé [of inscription].” Notably, these notions of code generation are not limited to alpha-numerical systems of writing, and nor should they be defined chronologically by the formalisation of signal processing, such as Shannon’s (1948), as they hinge on recursive relationships with material carriers that can become channels (Siegert 2015a, p.10). Modes of inscription, and consequently trace, as they pertain to temporal and spatial differences in signal processing, are or become central to technical media.

**Trace:** The trace is considered from the outset to be a material ‘thing’: a registration in the inscription and substrates of media in reproduction. As a concrete material ‘thing’, though, the trace is mischievous as it is never a ‘being’ or whole ‘thing’ (as that which is among other ‘things’), or a complete construct as the result of symbolic, mechanical or electrical abstraction. In the games trace plays between notions of ‘presence’ and ‘absence’, in both the re/production of material evidence and the connections and complications it has in relation to semiotic exchange, the trace resists being strictly defined. In her ‘Afterword: Media Archaeology and Re-presencing the Past’ (2011), for Huhtamo and Parikka’s compendium *Media Archaeology: Approaches, Applications, and Implications*, Vivian Sobchack elegantly identifies a critical theme in media archaeology in which the
trace is at home. The theme is the discourse on ‘presence’ and the reactivation of the trace as “presence in absence” (2011 pp.323-30), and that which can be “re-presenced” (2011 p.323). Sobchack makes connections to trace that work as a foundation for the term as used in this thesis. Trace via presence has two extremes, at one is the concrete trace—including “performative acts” or the “here and now” of “material fragments”—and at the other extreme the “trace pierces an uncanny hole in quotidian temporality (and comprehension)” (Sobchack 2011, p.324, italics in original). Sobchack points to Benjamin’s use of trace to bring both extremes together, saying:

Although the metonymic fragments and traces of the past do not transport the past directly to the present, in their presence they do numinously reverberate with its absence. Thus, at both ends of the discourse of presence—real, if partial, presence or illusory presence effect, existential encounter or its posthumous aftershock—the previously overlooked and unthought metonymic fragment or trace provokes intense awareness not only of an irrecoverable larger absence (conceived as ‘the past’) but also of an existentially present ‘otherness’ (recognized as a difference located in, yet distinguishable and distant from, the order of things that constitutes the everyday world we live intimately as ‘the present’). (2011, p.326)

The theme of the trace in media archaeology as presented by Sobchack (2011) is of particular use to this thesis. By drawing on the trace as outlaid and observed by Derrida ([1967] 1997) and Latour (1986; 1999) the media-specificity of the trace is prioritised and the two extremes of presence in dialectical tension with absence are explored. The form of media archaeology conducted here is interested not so much in
re-presenting ‘uncanny’ media artefacts from the past, but rather in exploring the role the trace plays in such a dialectic. The emphasis is on a trace-based mode of media-archaeological practice that focuses on extending the trace beyond its place as a mere fragment in symbolic orders.

Trace is both a noun and a verb and the *Oxford English Dictionary* (OED Online 2017a) highlights the diversity of the word: ‘the trace’ may invoke measurement, a trail left by animal or human on a path or course, a former presence, a mark or impression, a figure drawn, the inscription of a self-recording instrument, or even the ‘trace routine’ or program of software development testing/results. These meanings have a tangible, evidence or forensic basis in substratum or substrate. However, the dictionary also highlights the trace in science as “a quantity so minute as to be inferred but not actually measured” (OED Online 2017a), as in ‘trace elements.’ Additionally, once the move is made to linguistics “null elements” and “non-material indication” (OED Online 2017a) are implied in notions of signs and marks. ‘To trace’ as an action, inclusive of ‘tracing’ or ‘a tracing’, is defined via reference to ‘following,’ to “tread the trace” (OED Online 2017a), to measure or to request information as investigation, and the like. Evidently, the game of absence and presence is always already embedded in the English word.

The translation of the word ‘trace’ from German also brings with it significant resonances relevant for this thesis. Buck-Morss (1989, p.211) and Miriam Bratu Hansen (2008, p.340) highlight the capitalised German word ‘Spur’ as an equivalent to ‘trace.’ Interestingly though, ‘Spur’ is a feminine noun where ‘the trace’ is
referred to as ‘die Spur’ and only has a plural counterpart, ‘die Spuren,’ with no obvious verb for the action of ‘tracing’ (DWDS 2017). In German the meanings of trace centre around the trace as a thing found, as in an ‘impression’ or ‘the track’ of something that leads to following via a trace left in other things. Equally, as Howard Carpendale’s circa 1975 hit song *Deine Spuren im Sand* (*Your Trace in the Sand*) reminds us, a trace is left as a mark or owned as ‘Deine Spur’ (your trace). Such a foundation has less emphasis on a projectional or planning trace, or processual ‘tracing,’ such as an architect’s blueprints or the making of inscriptions in recording for results or to be followed. The movement from the owned, singular thingness of the trace to the processural action of the trace that is found in these linguistic understandings is at the core of this thesis.

**Analogue-trace:** Analogue-trace is the key concept coined by this thesis. In chemistry, for example, an analogue or ‘structural analogy’ is a molecular form based on or having structural similarities to another molecular form, despite their chemical potentials showing extreme difference when measured or ‘traced’ (Nikolova & Jaworska 2003). The identification of chemical ‘analogues’ in practice can be described as ‘analogue traces.’ Additionally, and somewhat fittingly, in printed circuit board design the conductive tracks between component points are commonly referred to as traces. The setting of these in the physical design of a circuit can also be referred to as analogue traces. Analogue-trace, though, as shaped in this thesis, is set in a realm between the material and symbolic sides of technical media, associated with the inscriptive and formal scaling and manipulation of signals in the movement from concrete trace to analogue representation and then digitisation.
Symbolic work: Reproduction, Re-production, Representation and Reference:

Serres says: “What is work? Undoubtedly, it is a struggle against noise. … To work is to sort. Maxwell’s demon is unavoidable, just like the parasite. Alas, they are twins’ perhaps” ([1980] 2007, p.86). James Clerk Maxwell’s (1872) thermodynamics thought exercise, dubbed Maxwell’s demon or ‘the demon at the door,’ in early cybernetics is a fitting metaphor for the work the trace is observed to do in this thesis. The demon is a hypothetical finite being given just enough information to sort fast from slow molecules to control temperature difference and entropy. Like the demon, it is proposed the trace performs work for us to sort the symbolic and material signals as a mediating third, distinguishing symbolic action from noise.

‘Symbolic work’ is a concept borrowed from Macho’s (2013) use of the term. However, Siegert’s (2015a, pp.11-13) critique of Macho (2013) is preloaded into the term for use in this thesis. In defining cultural techniques Macho (2013, p.30), says: “The term does not encompass all the techniques a culture has at its disposal, but strictly those techniques that make symbolic work possible”. Macho is placing an ontological order on cultural techniques and in doing so similarly positions symbolic work, the reasoning suggesting symbolic work is not possible without the use of specific techniques. Macho continues:

Human cultures, however, are not simply composites of these multiple techniques, but evolve out of their symbolism. This symbolic work endows all
other activities with their specific meaning; it gives order to the world and enables
cultures to develop self-reflexive concepts. … Cultural techniques differ from all
other techniques through their potential self-referentiality, a pragmatics of
recursion. … One can only calculate and measure with reference to calculation and
measurement. And one can of course write about writing, sing about singing, and
read about reading. On the other hand, it is impossible to thematize fire while
making a fire, just as it is impossible to thematize field tilling while tilling a field,
cooking while cooking, and hunting while hunting. We may talk about recipes or
hunting practices, represent a fire in pictorial or dramatic form, or sketch a new
building, but in order to do so we need to avail ourselves of the techniques of
symbolic work, which is to say, we are not making a fire, hunting, cooking, or
building at that very moment (p.31, italics added).

Siegert (2015a, pp.11-13) argues against Macho (2013) reducing cultural techniques
to only “second-order techniques … of self-reflection, identify formation and
identification” (p.31) that enable symbolic work. For Siegert “it is problematic to base
an understanding of cultural techniques on static concepts of technologies and
symbolic work;” instead these should be replaced with an emphasis on “chains of
operations and techniques” with an emphasis on the “processual rather than
ontological definition” of symbolic orders (2015a, p.13). Ultimately, this allows
cultural techniques ‘and’ symbolic work to be witnessed and described from a
primary array of non-human actions and actors as in “how things/signifiers can exist
because of the interchange of materials/information across the ever-emergent
boundaries by which they differentiate themselves from the surrounding
medium/channel” (2015a, p.13). This is exactly why the present thesis enlists Latour

“[S]ymbolic concentrations” (Macho 2013, p.31) should be given the possibility to be found via speculative and then distinguishable operations of symbolic work as ‘found’ in networks, including the non-human actors of cultural techniques. Media are actors beyond or in spite of themselves and condition (rather than determine), not only kinds of labour but, meaning and social realities, as cultural techniques—technical and symbolic artefacts, processes, operations, and practices. Obviously, they perform symbolic work for us, however, this work does not need to be exaggerated to exotic modes of autonomous cyber-physical production as ‘work’. Media perform or disrupt symbolic work, whether we order symbolic action for ontological argument or not, communicating themselves via the trace of their operations. Yes, we can elevate the act of symbolic work to a self-referential order like being able to write about writing but the trace of writing’s channels can also perform symbolic work (the material characteristics of the actor network in action), even if noisy and fragmented, because the trace is inherently self-referential. This is why ‘symbolic work’ as a recurrent term in the present thesis has been adopted for continued use and its use acknowledges Macho (2013) as a primary definition in addition to Siegert’s (2015a, pp.11-13) problematisation of the term. This counterintuitive use of the term is not intended to put words in the mouth of Siegert, so to speak, in utilising the term from Macho or with inferences in this thesis. Symbolic work as utilised in this thesis is a term to label any action, actor, or fragment thereof, that contributes to the processes, operation and practice of
meaning-making, and meaning exchange between signals and symbols, from frequencies of electron flow or the microscopic registrations of data to wider cultural conceptualisations or images. Like Macho (2013) indicates, this can include the ordering and theorisation of the symbolic, as cultural techniques, or signs such as in the semiology/semiotics of Ferdinand de Saussure’s sign-signifier-signified linguistic taxonomy (Saussure [1916] 1983) or later structuralism such as Jacques Lacan’s ([1966] 2004) ‘The Symbolic’ in tension, via absence and presence, with ‘The Real’ in signification. However, the emphasis for ‘symbolic work’ in this thesis is not intended to be a catch-all term for anything to do with signs or symbols, or a substitute for cultural techniques, it is Siegert’s cultural techniques approach that shines through the use of the term: “the ontological distinction between symbols (as defined by logic) and signals (as defined by communications engineering) is replaced by the practical problem of distinguishing between them” (2015a, p.15). Ultimately, the scope for this thesis is to navigate the supposed distinctions of the analogue and digital, as signals and symbols, via the symbolic work of the trace of each. Thus, ‘symbolic work’ is adopted as a label for action between channels, signals and symbols, not just self-referential symbolic orders.

Symbolic work in **reproduction** is explored via Benjamin as a starting point for the thesis. But the thesis rapidly picks up on how signal processing, as both recording and reproduction, performs symbolic work. For example, Ernst explains that the invention and process of recording audio with an analogue phonographic device switches the emphasis from the need for “vocal-alphabetic code” in communication exchange to “an electromagnetic flux of electrons” forming “a different regime of signals operating
as a substratum of cultural semiotics” (2013, pp.60-1). Symbolic signs as signals are formed, set in the “close reading of the literal ‘wiring’ of the recording machine, of its voice coil and the other techno-logical ingredients” (2013, pp.60-1). Ernst also highlights a role the trace of a medium can play in this realm of symbolic work across time, absence and presence, analogue and digital. In identifying a process of “digital restoration of gramophonic artifacts” (2013, pp.65-7), from wax cylinder archives, a kind of symbolic work in analogue-digital preservation is recognised. Ernst says: “we can listen to these recordings and hear almost exactly the same quality of sound as in the moment of recording” with a “media-archaeological operation of reading the inscribed traces” pinpointed as key to the symbolic work of the A/D conversion process (2013, p.66). Through this process media perform symbolic work when they “trigger media memory according to nonhistorical laws of their own” (2013, p.66). These modes of symbolic work form a technological ‘image,’ annexing iconography, set in a realm of ‘evidenced-based’ and medium-specific processual and recursive findings in relationships with media theory. The motif is implied throughout the thesis, especially from Benjamin through to Kirschenbaum (2008), media archaeology and cultural techniques. The use of re/production in the thesis, then, adds to this grounding of reproduction by highlighting the ambiguity between reproduction and production, or the impossibility of ‘production.’ In approaching media and symbolic work as cultural techniques, with all the distinction making processual operations they entail, this thesis finds it hard to approach production as separate from reproduction. Ultimately, there is no network of production without a trace, without a reproduced or recorded trace. Consequently, when discussing typical modes of cultural output that entail ‘production,’ such as the fashioning of raw materials or commodities for ‘consumption,’ or creative output in graphic, audio or film production, and when a
medium-oriented focus is needed, ‘re/production’ is used.

What of **representation and reference**? For this thesis, representation, as approached from a ‘philosophy of mind’ that associates representation with modes of internal or intellectual representation, or prioritised ‘internal referents’ from structuralist semiotics, is of less interest than representation as observation, description and measurement. The focus is on what can be tentatively described as ‘external’ material symbolic work, as approached via media, including the additional movement away from the ‘mind’ in a distancing from or position outside hermeneutics, the logos, speech and text, as basal to modes of theorisation and symbolic expression. In many ways, ‘representation’ as treated herein is another word for symbolic work, at its core something (like an inscription), some process, or some network envelope standing in for another or an ‘other.’ The basis for this perspective is set at a reading of ‘**reference**’ provided by Latour and again does not point to neat labels for objects but rather to networks or actors, relative to reference. Latour says: “‘Reference’ does not designate an external referent that will be meaningless (that is, literally without means to achieve its movement), but the quality of the chain of transformation, the viability of its circulation” (1999, p.310). This definition is key to Latour’s concept of ‘circulating reference’ and consequently to the present thesis.

Concerning the path shown for symbolic work, in the thesis diagram (Fig.1.1) and overall, ‘symbolic work’ can and should include activity that does not quite make it to resolved sign, signifier or signified yet is an ‘articulated’ actor or actant in the processes of symbolic work. The trace is an obvious contender in this mix. Broken or hidden symbolic work is seen as active but not fully resolved signification conducting
some kind of activity toward the forming of symbols, images or conceptualisations even if they are never reached. Symbolic work has some part in the forming of distinctions and differentiations that produce or aid in the re/production of meaning, whether mediating actors like channel, signal, noise or parasite, and the important modes of recursive practice or concrete functions, such as interruption, disruption, error, deconstruction or distortion, that they maintain. Symbolic work is what cultural techniques perform in order to pre-form or re-form the codification of meaning, as Cornelia Vismann points out: “Cultural techniques define the agency of media and things” (2013, p.83), before stating that: “If media theory were, or had, a grammar, that agency would find its expression in objects claiming the grammatical subject position and cultural techniques standing in for verbs” (2013, p.83). If ‘verbs’ are described most basically as ‘doing words,’ then to contribute to symbolic work is to do something. In ANT, this doing means being an actor or actant in action within a network, whatever and where-ever that doing may be found. As Vismann also reminds us, “all cultural techniques maintain or establish some form of connection to the symbolic order” (2013, p.83). This connection certainly does not need to be strict, clean-cut or performed on behalf of well-behaved subjects or mapped structures; perhaps all the better and more re/productive if it is not. For this thesis, then, trace is both ‘grammatical subject’ and verb, or a ‘mediator’ as opposed to ‘intermediary’ between the two; hence its point of interest and perhaps difference.

**Analogue-digital:** This thesis does not employ a clear distinction between the analogue and the digital, as is commonly understood via an analogue/digital binary, to be confused with material/immaterial binaries, or labels such as hardware/software. Analogue does not equal physical. While the word may be more at home in the
physical realms of technical media and inscription it is also a mode of symbolic
work. In this scenario, analogue representation, recording or reproduction is always
already a kind of ‘analogy’ or copy just as much as its counterpart, ‘the digital,’ can be
perceived. Both systems, analogue and digital, elevate material, practice and
operation to networks of symbolic work and this is the site of distinctions. However,
as the discussion of transversal practice in network culture and then trace will
reinforce, via A/D converter integrated circuit architectures, it is also the site of
actor-networks that are proposed to show that analogue and digital are always
already continuously interwoven and oscillating systems of symbolic work.
Analogue and digital are both dual ‘and’ dialectic, hence the conjoined, ‘analogue-
digital’ term throughout the thesis.

**Dual ‘and’ Dialectic:** At its most basic ‘dual’ refers to two systems formed and
performing in parallel—separate and kept that way by generic modes of cultural
practice—and the ‘dialectic’ is a means to label the material, symbolic work and
practices of supposed parallel systems being connected or crossed in transversal
practice. Dual demands less deflection in intended meaning than the weighted, classic
and perhaps ancient ‘dialectic.’ Dual is positioned via Gansing’s reflection on Laruelle
([1986] 2010; [2008] 2011) to suggest that generic network practices, while inherently
transversal, are media-archeologically “unilateral” and “dual yet not dialectic”
(Gansing 2013, p.275) when it comes to relations of old and new, or analogue and
digital readings of media (these pairs are not considered synonymous). Ernst reinforces
the dual notion by highlighting differences in archival structures, suggesting there “has
always been data circulation between the needs of an inquiring present and the archival
documents; only online does this circulation become a closed circuit” (2013, p.100). Thus, unless concerted effort is made to ‘write out’ online archival material to non-online systems of transmission and/or storage, two broad archive systems, defined by ‘temporality’ and the ‘generic,’ appear to exist in parallel.

The intended use of the words **dialectic** and **dialectical** cannot be avoided, especially when starting with Benjamin’s dialectical image and its proximity to Marxist notions of ‘dialectical materialism.’ However, the term is simply too weighted, as an objector medium of philosophy, to be tackled without pointlessly bloating the thesis overall. It should be recognised that defining dialectic or dialectical is not the key focus of this thesis, especially in terms of mapping a dialectical method to be applied as a ‘methodology.’ Instead, the terms dialectic or dialectical are used to point at observations on media networks in action—do the actors within perform dialectically? A general appraisal of this approach will be outlined before moving onto the discussion of Benjamin and media.

The study’s use of ‘dialectics’ is not set in strict ‘thesis versus antithesis’ modes of back-and-forth debate. Nor is it set in a background of in-depth study in philosophical process. Ultimate truth, or synthesis as a better third, arrived at by two ‘humans’ in argument, a notion that we may associate with classical philosophy (Maybee 2016), is not the outcome being pursued in this thesis. On the contrary, the model of procedure is one that instils the notion of actors in ‘conversation’ as a mode of dialectics in action. According to Lunenfeld (2001, pp.xvii-xviii), the German philosophers George Wilhelm Friedrich Hegel (1770-1831) and Karl Marx (1818-1883) were prominent in extending dialectics to specific ‘subject and matter’—for Hegel it was how the
supposed opposites of philosophy feed into each other as a kind of transcendence through dialectics and for Marx it was more about the ‘physical’ notions of economics in play with the movements of history. The label ‘dialectical materialism’ is commonly applied to Marx (Heim 2001, p.26), along with his ‘historical materialism,’ as a theory on the rise and fall of society centred around modes of production, class struggle and divisions of Labour (Wolff 2017). These study areas are large but do not concern the core of this thesis. Yet Benjamin’s proximity to Marx, both historically and concerning the ‘dialectical’ as a key word here, requires some acknowledgement of differentiation between the two thinkers. In fact, Benjamin’s own attempts at differentiation caused some tension with peers and is noted. For example, Theodor W. Adorno (1903-1969) tried to impose, from his Marx-inspired ‘negative dialectics,’ an underlying ‘element’ of ‘human labour’ on Benjamin’s notion of trace (MB Hansen 2008, p.346). The concept of the traces of the labour in things was refuted by Benjamin with a recognition of trace and aura as “not sedimented labor alone” (Buck-Morss 1979, p.293). Benjamin instead examines trace as a material thing, by centering his thoughts on the aptly named dialectical image (Buck-Morss 1989). Karl Ivan Solibakke describes Benjamin’s dialectical image method well, suggesting:

[H]is dialectical method blends the imagistic and the textual into the presence of the now. For in resuscitating both the topographical and topological traces embedded in cultural artifacts Benjamin exposes his present to rigorous scrutiny. Above all, he envisions a gap in time that superimposes past and present upon one another. The historical layers within that interstice mirror the vulnerability of metropolitan experience, pitting ephemeral revelations against linear notions of collective advancement. (Solibakke 2009, p.154)
This dialectical method is indebted to an emphasis on image mediation and re/production. For example, Osborne & Charles (2015, para.73) argue that Benjamin was concerned with placing “the ‘static’ temporality of the image” in conversation with wider cultural readings and the implications of written history. In this sense, the mediation of facts, as a counter to Adorno, can become dialectical and consequently theoretical (Buck-Morss 1989, p.205).

Informed by Benjamin as a starting point, this thesis aims to observe media in recursive conversation via their materiality. It is through dialectical action that media become culturally ‘concrete.’ This site of mediality is not simply a domain of physical channels and signal manipulation techniques; there is perpetual dialectical negotiation, but also the distinctions and difference generated by the symbolic work performed by media inevitably have wider cultural implications. Winthrop-Young and Wutz bring Benjamin and Kittler together via dialectical materialism, suggesting:

Kittler espouses a type of technomaterialism that, albeit only on a formal level, bears some resemblance to Marxism’s historical and dialectical materialism. Out of the dialectical exchange between the media-technological ‘base’ and the discursive ‘superstructure’ arise conflicts and tensions that sooner or later result in transformations at the level of media. (1999, p.xxxv)

Following this statement, Winthrop-Young and Wutz give an example of the cultural interplay of techniques and symbolic work, itself a dialectic, in the movement from the printed book to cinematographic technology. Via a dialectics of media, ‘reference,’
as defined by Latour, has its chains of transformation and viability of circulation tested (Latour 1999, p.310). In this regard, Ernst (2013) brings us closer to the media of contemporary digital network culture and their dialectical potential. The symbolic work of analogue media, physical recording devices of inscription, phonograph and wax, cinemograph and film, ‘register’ time via their trace. However, Ernst reminds us that this fixing, this reference, is altered and suggests:

> It is only with the digital computer that the symbolic regime dialectically returns, this time in a genuinely dynamic mode (which differentiates implementation of software from the traditional Gutenberg galaxy): algorithmic time and operative diagrams. (Ernst 2013, p.30, italics in original)

The challenge set by digitisation is time. Time’s effect on the dialectics of media renders it mutable in digital network culture. Overall, the definition of ‘dialectical’ employed in this thesis is of the moment when two or more actors or ‘actor-network envelopes’ come together and are witnessed as one in the output of a techno-logic, concept or theory. In this, the witnessed ‘conversation’, the shared connection, communication or system contradictions, as well as the conflicts of media components, in assemblage and/or wider cultural influences of practice, are important.

**Assemblage:** Assemblage is used to discuss the alignment of components in ‘integrated circuits,’ a bringing together of medium types as channels, signals or their architectures—networks of found or built mediums. In this vein, assemblage can be as simple as one media artefact—Ernst describes a photograph as “an assemblage of optical signals” (2013, p.47)—or much more complicated ‘transversal’ objects such as
Parikka identifies via Fuller (2005):

In short, if you want to understand an arrangement, such as a media technological assemblage, look at its relations and compositions. … Objects are far from inert ‘things’ but instead consist of various dimensions of relationality. Relationality is here less a matter of communicating content than a weaving in and out of scales and incorporating them into its assemblage. (Parikka 2011b, p.40)

In addition, ‘assemblage’, as used throughout the thesis, also takes into account Adriana de Souza e Silva’s notion of ‘hybrid space’, a space “built by the connection of mobility and communication and materialized by social networks developed simultaneously in physical and digital spaces” (2007, p.761). Ultimately, the term ‘assemblage’ has been chosen for the exploration of the analogue-digital circumstance and its relevance to network culture’s negotiation of analogue media and physical space.

**Affordance:** In this thesis affordance is a turn of phrase that points to what the trace offers for further investigation, discussion and case study exemplification—its potential or possible value. However, the specific use of the term **analogue affordance**, in chapter 8.2, ‘A/DC-D/AC: Feedback, Analogue Affordance and Distortion’, warrants some clarification and is identified and observed in (1) the trace of signal pre-processing offered by a medium for conversion; and, (2) the trace of conversion such as parasitic signal feedback, interruption, interference, disruption, loss, error, decay and corruption. The emphasis from the outset of the thesis is an interest in signal and reproduction anomalies, such as those just listed, that can be
grouped under the umbrella of signal distortion as the trace of media reproduction in action. These indicators of reproduction could be considered modes of ‘affordance’ in analysis but the weight of the word from fields of design or human-computer interaction study is not intended. Counterintuitively, analogue affordance is also a digital signal processing affordance, as distortion, in A/D conversion—the design of analogue (electrical) signal manipulation is conditioned to reduce digital distortion in signal processing for improved conversion. In this sense, conversion is defined by feedback between two systems of reproduction and labels such as analogue or digital affordance are inconclusive and should meld to represent processes of conversion—the affordance of distortion in conversion. Importantly, the thesis does not point toward affordance in association with practices of user experience design such as the development of graphical user interface design patterns (for example, as an application of Gibson’s [1966] 1983; [1979] 2014 and Norman’s [1988] 2013 coinage and use of the term). Instead, this thesis moves toward a focus on the observation of measurement and signal manipulation in the operations of media themselves, or their impact on signals when assembled for conversion. Where possible, the study of the trace at this point is intentionally positioned aside psychological, phenomenological or physiological notions of the user experience. This position is not a tactic to avoid the human side of ‘affordance’ in human-to-human or human-media-human interaction but rather the emphasis is on medium-to-medium affordance—what does one technical medium afford another in processes and environments of media assemblage and conversion? The ‘and then?’ or ‘what after?’ process of user experience data collection is beyond the scope of the present thesis. This position is a grounding for the present study and discussion of trace findings developed throughout point to the employment of a cultural techniques
approach to media. Cultural techniques could be argued to share interests with studies of affordance. However, to suggest speculatively, cultural techniques might align better with ‘the distortion of affordance’ in how media share the production of meaning and experience with human subjects. Such tangents are also beyond the scope of study here.

Network Culture: Network culture is used as a context for inquiry in Chapter 3, ‘Network Culture: Toward a Transversal Trace,’ where the term is a platform for unfolding Gansing’s (2011; 2013, pp.267-72) distillation of ‘transversality’ in network culture media practices as a ‘generic transversal media archaeology’. However, Tiziana Terranova’s (2004) book Network Culture: Politics for the Information Age is acknowledged as the primary source of the term used throughout this thesis. Network culture is a name cautiously given to contemporary global culture by Terranova, informed by the complexities of “interconnectedness,” rather than a desire to “think of cultural formations as distinct entities” (p.2) or to coin a reductive catch-all term. Network culture is an ambitious term for a culture of local to a global scale, however, Terranova reminds us of the “multiplicity of communication channels” and the “meshwork of overlapping cultural formations” that inform a “single informational milieu” (pp.1-2). The term is in no way a neat name for one stable concept. Terranova provides a key definition, saying:

[N]etwork culture is inseparable both from a kind of network physics (that is physical processes of differentiation and convergence, emergence and capture,
openness and closure, and coding and overcoding) and a network politics (implying the existence of an active engagement with the dynamics of information flows). (p.4, italics in original)

This dynamic, between physical infrastructure and its politics, is supported by Terranova’s mapping of key “transformations, not simply as technologies but also as concepts, techniques and milieus” (p.5, italics in original) concerning: information; the architecture of the Internet; digital economies; the problem of control in modes of network culture distribution; and, the political considerations of such modes within an informational milieu.

Gansing elaborates on Terranova’s (2004) network culture to suggest a contemporary culture identified by “a performative and processual form of capitalism” adding to a network culture defined by only “technological conditions and their relation to politics of cultural production” (2013, p.43). Importantly, via Thrift (2005; 2008), Gansing (2013) points to cultural reflexivity, saying:

reflexivity is not in itself a liberating kind of revealing of the mechanisms behind the digital economy and culture. The production of reflexivity has already become a part of the process of capitalist circulation, itself now a processual, yet also material network culture increasingly intertwined with subjects. (p.43)
Ultimately, Gansing’s (2013) discussion of Terranova (2004) in combination with others (discussed in Chapter 3 proper) allows him to highlight the ‘contradictory features’ of a network culture materiality as a theme in defining network culture or a network culture approach. This perspective is an alternative to media study interested in specific or unified media, or a unified medium, and its political relations (p.52). Of most value to this thesis is the characteristic of network culture highlighted by Gansing emerging from the themes of ‘contradiction,’ the ‘performative,’ the ‘processual,’ and points beyond cultural reflexivity to “a cultural production of ‘feedback’ where the past, through digitisation, is increasingly important to the production of contemporary culture” (p.44). Gansing’s mapping of network culture, an extension of Terranova’s, is valuable to considerations of the trace and analogue-digital signal ‘conversion’ as a contemporary cultural context for the present thesis—a network culture “where old and new media forms co-exist and continuously re-shape each other” (p.60).

**Tracing the trace, not a theory of trace:**

*The (pure) trace is differance.* It does not depend on any sensible plenitude, audible or visible, phonic or graphic. It is, on the contrary, the condition of such a plenitude. (Derrida, ([1967] 1997, p.62, italics in original)

The reader is asked to recognise that the individual articulations of the trace and relative theorists explored within this thesis form a complex discussion, but no
ultimate theory of the trace is intended in the synthesis, or is there an inference of reconciliation of the theoretical viewpoints canvassed. There is, however, a desire to offer thematic openings for the potential alignment of philosophies rather than form a unified, prescriptive or reductive synthesis of theories. Each key theorist featured is discussed via their own articulation of the trace. These are often in contradiction, and this contradiction and the very difficulty of *tracing the trace*, is the core concern of this thesis. A thematic literature review of the trace occurs across the scope of the whole thesis. The emphasis is on the ‘observation’ of both the trace and the trace in action, as a tracing of the trace, not as an assumption of a unified theory of trace. Intentionally, articulations of the trace are grouped and considered via a cultural techniques approach to media (Siegert 2015a, p.15). Although such a taxonomy may seem counterintuitive it is in the spirit of the multiple theories employed (ANT, medium-specificity in modes of media archaeology and cultural techniques) to witness actors or actants that influence or form media networks as a platform for inquiry. For this thesis, such an approach includes synthesis (symbolic, conceptual or virtual) articulations of the trace as well as more easily witnessed media processes, operations and networks or ecologies thereof. Paradoxically, the emphasis on the ‘observation’ and mapping of the trace in covering such territory raises problems (at least for the intentions of this study) when the unobservable, the invisible or the supposedly purely virtual characteristics of some articulations of the trace are put under the lens. How can you track nothing, the other, the absent? Importantly, the trace, for this thesis, is not a catch-all for observing empirical evidence in supporting the unified ‘presence’ of media and their operations, instead it seeks absent actors through the material trace of others. Of course, there is an inherent contradiction within the trace itself as it constantly negotiates the presence and absence of
signification and actors in a given network and this thesis’s emphasis on a material or concrete trace runs the risk of seeding tensions that are not intended.

As a reminder, and to summarise early on, the four primary informants of the trace and their key texts in this thesis are Benjamin ([1927-1940] 2002; including Buck-Morss’s reading of Benjamin, 1989), Derrida ([1967] 1997), Kirschenbaum (2008), and Latour (1999, pp.24-79). Kirschenbaum and Latour emphasise observation of the trace as a material object or substrate impression. In Kirschenbaum, the trace is formal and forensic, yet clearly based in the physical analogue and digital trace of individualisation in computer hard drives. In Latour, the trace is not used as a specific theory or concept but is an action for following “immutable mobiles” (1999, p.307), themselves a form of material inscriptive trace, in following modes of reference transformation and translation through actor networks. These two theorists and their trace neatly fit into the thesis’s overall theme of ‘immutable symbolic work’—in which signal and symbol are more easily discernible.

Concerning Benjamin and Derrida, their use is more complex than Kirschenbaum and Latour. Both are prominent figures of extensive literary canons and their importance in this thesis is found in their departure from neat material findings of the trace. In Benjamin ([1927-1940] 2002; Buck-Morss 1989), the trace is found in material objects and their substrates. From this material platform expands a ‘collective unconscious’ phenomenological reading or psychoanalysis of mass culture through notions such as the ‘wish image’ (Benjamin [1935] 2008, pp.97-8) or the ‘dream image’ ([1927-1940] 2002, p.10, 462-4). These are concepts that point to the “Dream World of Mass Culture” as articulated in Buck-Morss (1989, pp.252-86), where
informed by Surrealism and, for example, a synthesis of Proust, Bergson, and Freud (Benjamin [1939] 2007, p.160), the material or ‘concrete’ trace becomes only part of a wider theory or method. Benjamin’s wider engagement with culture employs readings of more symbolic or virtual iterations of the trace as a relationship between material ‘and’ collective social or political memory (although their concreteness is understood to be sought after for the social and political understanding of a history-media nexus). For example, mental images as ‘memory-traces’ or ‘involuntary memories’ in ‘On Some Motifs in Baudelaire’ ([1939] 2007) points to a philosophy of mind and the modes of phenomenology and psychoanalysis employed by Benjamin. However, in this thesis, there is an intentional overemphasis on the ‘concrete’ trace—the fossils and the interior of the arcades, the surface, the imprints and substrates of objects as dialectical image. For example, contemplating the dialectical image in Benjamin from basal levels, such as from a pictorial perspective in Chapter 2.2 ‘Towards Trace: Pictures, Images, Time and Space’ does not intend to reduce or deface Benjamin’s view to one of material historical experience formed through pictures. Likewise, it is not the intention to allege obsolescence or understate mental images, collective memory, and memory-traces. The overemphasis on the concrete is a methodological manoeuvre to unfold the potential of a particular nuance of Benjamin’s trace; the physically tangible stuff of media practices, as a platform for wider analysis—the absence and presence of material signals, the ‘stuff’ of signs, and how this stuff points to the symbolic to inform the trace in network culture.

The use of Derrida’s trace ([1967] 1997) requires clarification as it involves taking onboard a vast critique of prominent philosophers in the history of metaphysics, which in Derrida ([1967] 1997) is succinctly the “science of presence” (Spivak 1997,
p.xxi), the main target of his ‘deconstruction’. Additionally, for this thesis Derrida’s trace is a filtrate or residue of the continual shifting of meaning in modes of communication (any language, knowledge transfer, transmission or exchange) and is itself realised by its circumstance, having no unconditional truth or transcendental origin in meaning—it is a non-concept and more a strategy in his philosophy. Thus, a quick definition for clarity at the outset is self-referentially problematic. That said, preliminary clarification is warranted for the clarity of the thesis.

As a starting point, Spivak (1997, p.xvii) notes that Derrida’s trace extends Heidegger’s practice of placing a word ‘under erasure’ to suggest presence cannot be articulated. Instead, Derrida’s trace is “the mark of the absence of a presence, an always already absent present, of the lack at the origin that is the condition of thought and experience” (p.xvii). From this succinct position we can highlight the three key interrelated points of interest concerning Derrida’s trace for this thesis: (1) it destabilises systems of signification by problematising notions of origin in meaning (“the lack at the origin”); (2) as a mechanism to continually put words or concepts and their meaning ‘under erasure’ via deferral and différance, preloading the play between the trace of signs, as the standout or only possible feature of any system of language (“an always already absent present”); and (3) the inclusion of the basal units, techniques and medium of writing in this play of traces (a critical component of

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1 Derrida suggests there can be no transcendental origin of presence, no proper representation of an origin, no unimpeded signification of a signified, of which philosophies of metaphysics rely so heavily, because any origin is itself a representation. For example, see Derrida ([1967] 1997, pp.36-7).
2 Difference and différance, Derrida’s iteration of the word. The manipulated word cannot be distinguished through French pronunciation from its source. By example, it highlights a difference in meaning as the trace of writing and is also an act of differing. For example, in addition to use in Of Grammatology ([1967] 1997), see Derrida’s introduction in Margins of Philosophy ([1972] 1982a) and discussion of the term in interview (1991, p.98).
3 It is acknowledged that the work of Emmanuel Levinas concerning the trace and notions of ‘the Other’—external to one’s self, the unknowable alterity, an absent Otherness—forms Derrida’s trace. Derrida describes the influence on his trace as a: “relationship to the illeity as to the alterity of a past that never was and can never be lived in the originary or modified form of presence” ([1967] 1997, p.70).
the “condition of thought and experience”\textsuperscript{4}. All three point to the need to perpetually read and ‘write back in’ the absent or quasi-residual actors, as the trace, self-referentially into systems of communication.

There are two main concerns regarding the use of Derrida’s trace that need clarification and justification. Firstly, in Derrida ([1967] 1997) “arche-trace” and “arche-writing” are used to show there is no use of language or language that, while we may be able to follow a pathway to track back through a text to a point, allows us to witness a transcendental, empirical or non-trace origin of a concept (p.61). This argument is made via the trace while allowing the impossible concept of the arche-trace to be present. For example, Derrida says:

\begin{quote}
[T]he value of the transcendental arche … must make its necessity felt before letting itself be erased. The concept of arche-trace must comply with both that necessity and that erasure. It is in fact contradictory and not acceptable within the logic of identity. The trace is not only the disappearance of origin—within the discourse that we sustain and according to the path that we follow it means that the origin did not even disappear, that it was never constituted except reciprocally by a nonorigin, the trace, which thus becomes the origin of the origin. ([1967] 1997, p.61)
\end{quote}

The above quote is couched in a discussion of Husserlian metaphysics where Derrida is suggesting transcendental origin is not a thing that exists, it is never wholly present, impossible. There is no origin. Yet, to wrangle such thinking, reference must be made

\textsuperscript{4} See Derrida ([1967] 1997, pp.70-71) regarding the movement of signification as the trace: from before memory through to writing (“inscribed or not”), to “the living and its other and of the inside to the outside: spacing”.

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to an arche-trace—“one must indeed speak of an originary trace or arche-trace” (p.61). If this groundlessness to absolute signification is inferred otherwise throughout this thesis, the inference is not intended to counter the ‘impossible’ origin outlaid here, it simply seeks to ‘play’ with it.

The impossibility of origin via Derrida’s trace and arche-trace is acknowledged as precise in his philosophy yet becomes expansive in this thesis when pointing it at media assemblage and analogue-digital conversion—in witnessing or putting them under erasure. Indeed, it is suggested at the end of Chapter 6, ‘Analogue-Trace: Immutable Deconstruction? Deconstruction Immutable?’ that Derrida’s trace can become methodologically terminal. For one, deconstruction is not a methodology. But also, because the play of vanishing signs/ traces at the margins of language struggle to guide ‘this’ investigation. However, this thesis speaks to the temperament of ‘play’ in affirmation via the trace (Spivak 1997, p.xiii; Derrida [1967] 1997, p.71) and upholds Derrida’s trace as expansive for the better, if taken to contexts other than his own engagement with the language of metaphysics, to put the signification of signal processing under erasure. Additionally, a Derridean impossibility of origin could be strictly applied to exemplification in this thesis. For example, Figures 4.2 and 4.3, in Chapter 4, ‘Broken/Hidden Symbolic Work: Derrida’s Trace’, feature the filmic analogue-digital production techniques of Rodriguez and Tarantino’s Planet Terror (2007) motion picture, and it is suggested that neither an analogue nor digital origin of re/production can be witnessed. Yes, a pathway of production techniques could be tracked back to a point. However, within the bounds of film production and viewer consumption both the analogue and digital are under erasure in assemblage and conversion, always already absent in presence, analogue ‘and’ digital as a “trace-
structure” that questions a “presence-structure” (Spivak 1997, pp.xvii-xviii, p.liii, p.lxix). Here the material trace of supposedly distinct media forms questions the use and signification of self-referential media referents and thus highlights a trace-structure in the mode of communication. References to reaching an origin of production become a game of semantics as the notion of origin is only present to be spoken of in discussion—an impossible point of reference if we are strictly Derridean about it.

Secondly, like the use of Benjamin, it should be noted that an overemphasis on the material qualities of media is intentional in this media study. The concern is over-inflating or misrepresenting Derrida’s focus on writing as somehow privileging writing over speech. Of Grammatology is certainly a discussion of writing, what it is, its limits and its contemporary importance ([1967] 1997, pp.3-5). Suggestions, herein, of Derrida ([1967] 1997) upholding writing over speech point to it simply being focused on and mentioned more throughout his text. Writing is more important in the argument, for argument’s sake, as the mode of language maintained by metaphysics for offering some form of supreme or absolute signification (p.93). Derrida is read as cutting through such a privileging of pure or empirical signification, not maintaining it. However, through Derrida, this thesis intentionally emphasises the medium of writing via its material ground and finite units, for example, the ‘grammè’ or ‘grapheme’ ([1967] 1997, p.9, 46). It is acknowledged that this focus is what Derrida might call “writing in the narrow sense” ([1967] 1997, p.74), or, “graphic notation on tangible material” (Spivak p.lxix). Derrida’s project and ‘writing’ is, of necessity, much broader. Reflecting on Of Grammatology Derrida ([1972] 1982b) says the text: “is not a defence and illustration of grammatology. And even less a
rehabilitation of what has always been called writing. It is not a question of returning to writing its rights, its superiority or its dignity” (p.12). Counterintuitively, *Of Grammatology* is “a question about the necessity of a science of writing” (p.13), a problematisation not a definition or answer. Hence, writing as a specific concept for glyphs on a graphic support ‘in the narrow sense’ becomes something much broader when ‘under eraser’. Spivak explains:

> Something that carries within itself the trace of a perennial alterity: the structure of the psyche, the structure of the sign. To this structure Derrida gives the name ‘writing.’ … ‘Writing,’ then, is the name of the structure always already inhabited by the trace. This is a broader concept than the empirical concept of writing, which denotes an intelligible system of notations on a material substance. (p.xxxix)

‘Writing’ then, becomes a name for Derrida’s “entire structure of investigation” (p.lxix). Other modes of language that display a trace-structure of the sign can come into play, including communication and modes of reading outside a speech-writing (in the narrow sense) nexus, such as the visual arts (Derrida 1994, p.13) and, provisionally for this thesis, the analogue-digital nexus (in the narrow, general and trace-structure sense), to point to sites of *différance* and deferral in analogue-digital signal conversion—the analogue ‘and’ the digital perpetually under erasure. Ultimately, for this thesis, a Derridean trace speaks to the absent residual trace of analogue-digital conversion that cannot be fully identified, have its own identity signified, and, is never wholly present. The use of the trace is more a strategy in pointing to the absent in a system of reproduction. For example, the distortion caused
by the reproduction of nothing (the absent ‘other’ or the non-origin) in the reproduction of a signal in analogue-digital conversion.
2. CONCRETE TRACE: A BENJAMINIAN FOUNDATION OF TRACE

![Diagram](image)

*Figure 2.1* Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*, visualising the overarching thesis path and current chapter position to the reader. This chapter is set at the entry point of ‘Concrete Trace.’
Figure 2.2 Passage du Caire, a photograph by Germaine Krull (1928) kept in Benjamin’s archive showing the vernacular and deteriorating surface of a 1930s Paris arcade.

Figure 2.3 Advertising image for Victor Talking Machine Co. by Underwood & Underwood in Talking Machine World (1915), showing a Landay franchise shop front featuring the Victrola machine.

Figure 2.4 Website image from ikeahackers.net by Maximilian (2012) showing Ikea furniture DIY customisation for under bed long play vinyl record storage.

Figure 2.5 Website image from playbar.com.au (2016) showing DIY ‘milk crate’ long play vinyl record storage.
Figure 2.6 Website image from musicfarmers.com (2016) showing storage/display of vinyl to customers via, amongst other store features, genre and alphabetical presentation.

Figure 2.7 Screen grab from Spotify music streaming software (2016) showing a track playlist generator based on categories of mood.
The trace is appearance of a nearness, however far removed the thing that left it behind may be. The aura is appearance of a distance, however close the thing that calls it forth. In the trace, we gain possession of the thing; in the aura, it takes possession of us. (Benjamin [1927-1940] 2002, p.447)

2.1 Why Benjamin?
An initial observation of the above images (Fig.2.2 to Fig.2.7) highlights the spread of vinyl record and phonograph paraphernalia which, aside from wax or vinyl recordings themselves, leave a physical and/or cultural imprint. The images hint at the qualities and behaviours invested in display spaces, sites, and storage, that in one broad stroke manifest a concrete trace associated with the medium of recorded audio. The trace featured in these examples draws on an approach to media informed by the observational and archival techniques of German-Jewish thinker, literary critic, philosopher and avid culture-technology writer Walter Benjamin (1892–1940). Benjamin’s approach to media forms provides a starting point to explore the many facets and fragilities of ‘trace’ as a physical thing and concept. In Passage du Caire (Fig.2.2), a photograph by Germaine Krull located in Benjamin’s archive, we see captured the seemingly vernacular and deteriorating surface of a 1930s Paris arcade. The photograph is representative of key themes in Benjamin’s The Arcades Project ([1927-1940] 2002); it functions as “a kind of casing” for “historical clues, with an objective meaning” (Buck-Morss 1989, p.66). Benjamin “regarded arcades and private interiors as corresponding spatial formations” (eds Marx et al. 2015, para.5 of chap.11). These spatial formations, such as arrangements of signage, display windows and cabinets, including the “imprint of objects particularly visible in the plush of bourgeois interiors or the velvet lining of their casings” (Buck-Morss 1989, p.211),
provided Benjamin with a means to document and expose cultural and political activities: from the interconnectedness of the finite details of production and consumption to technological change and development.

Keeping Benjamin’s influence in mind, we can go a little further back in time and away from Benjamin’s fascist-torn European context to New York in 1915. The magazine advertisement from *Talking Machine World* (Fig.2.3) features a then new Victor Talking Machine Co. product and a photograph of the Landay franchise shop front. The *Library of Congress ‘National Jukebox’* archive (Library of Congress n.d) contains the Victor Talking Machine company’s directive on advertising and shop display requirements to target elite or upper-class audiences, those who could afford their product. The directive insisted that the top of the line Victrola machine should be the focus and that the presentation should not convey “gaudiness and show” but rather “elegance was emphasised” (Library of Congress n.d). Likewise, the Victrola and associated records were presented “as fine musical instruments and worthy additions to the most elegant of home living rooms and parlors” (Library of Congress n.d), worthy of an equal position in the same category of lifestyle commodity as the piano or pianola. In 1915, the scenario in New York was starkly different to the cluttered bourgeois interiors of Berlin and Paris analysed by Benjamin: these collections, casings and clutter pointed to a kind of fossilised or stagnated mode of consumption in denial of development and change (eds Marx et al. 2015, fig.11.15 in chap.11; Benjamin [1927-1940] 2002, p.540).
In the early 21st century, a revamped do-it-yourself (DIY) or ‘independent’ trend in record storage and display became the focus of attention (Fig.2.4 to Fig.2.6). The record player, as musical instrument and innovative domestic technological acquisition has been overtaken by the digital revolution in audio-visual recording, storage and playback. The record player takes a back seat in comparison to the treatment of vinyl collections, as artefacts, in shop and home interiors. For example, in an Ikea shelving ‘hack’ that combines bed and storage (Fig.2.4), the object conveys the absurdity of the collector’s dedication to a medium, one that begs for a Benjamini analysis, as does the classic DIY milk crate vinyl storage solution (Fig.2.5). Independent record stores also exemplify this quality, such as Music Farmers in Wollongong, Australia (Fig.2.6), where the target audience is no longer the upper-class owners of ‘parlours’ in New York, but rather music and analogue medium enthusiasts, or ‘hipsters’ (Urban Dictionary 2007), in a regional Australian city. In such stores, records are presented alphabetically, by genre and/or ‘condition,’ allowing consumers to manually browse ‘albums’ in a quasi-archive that is organised for commercial purposes and the activities of customers searching for qualities of recorded ‘trace’ in the vinyl they desire.

What makes the ‘trace’ of recorded audio more appealing for critique in the DIY scenario? Is it that, when compared to the likes of Spotify’s Mood playlist (Fig.2.7), the online service exists in the same audio recording nexus as the vinyl pressing, and the record disc, its sleeve and collection storage offer physical traces? Physical traces that capture, in a relatively more emphatic and concrete manner, a time signature of the item’s history as authentic and commodified object. The vinyl pressing as recorded
audio, as content, competes with processes of digital representation hidden behind the interface and GUI screen. The record store and private interior collection display have morphed into user generated playlists and/or software algorithm track selections, such as listening by ‘mood,’ combined with hard drive or cloud storage. This comparison illustrates a critical concern when approaching digital media in a network culture. When examined through Benjamin’s concrete trace, digital media in network culture alter the qualities and value of the trace.

In this study, the key terms and concepts taken from Benjamin’s texts, ‘The Work of Art in The Age of Mechanical Reproduction’ ([1936] 2008), ‘The Author as Producer’ ([1934] 2007) and The Arcades Project ([1927-1940] 2002), are not a means of entry into a political debate on the position of media in a globalised network. Yet the struggle Benjamin faced, as a German-Jewish citizen in Europe during the rise of the Nazi regime, are obviously ingrained in the tone and motives of his discourse and this is acknowledged. However, of interest is Benjamin’s position, in the 1930s, in the continuing forum of Marxist arguments on class distinction and dialectical materialism, that extended to media use positioned in the tensions between the proletariat and the bourgeois. The proletariat and the bourgeois function like separate theoretical demographics throughout his body of work with each allowed a distinct relationship to and interpretation of media’s collective influence. Benjamin understands the proletariat as lower level labour wage earners, on a sliding capitalist scale. The proletariat, for Benjamin, are revolutionary agents acting against fascist forces; they are the subjugated hard working lower echelon of the public, championed
as educated in the revolutionary potential of media. The bourgeoisie, on the other hand, Benjamin reads as a complacent middle class, a less subjected public who, in their comfort, are blinded to the footwork of collective change. Benjamin’s tone toward the bourgeoisie is negative to the extent that he treats their consumption and use of media artefacts as a fossilisation of media consumption.

Figure 2.8 Angelus Novas (New Angel), an oil transfer and watercolor on paper drawing by Paul Klee (1920), now held in the Israel Museum Jerusalem, showing the central figure that Benjamin referred to as the ‘angel of history.’

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5 For example, see Buck-Morss’ reference to “proletarian revolution” (1989, p.64) and Jennings’s summation of Benjamin’s Anschauungsunterricht as a media-oriented pedagogy (2008a, pp.12-13).
6 Benjamin’s positioning of the bourgeois will come into play later in the investigation of his method of trace. Bourgeois inabilities to accommodate modern change, couched in a dialectic of natural history, their ownership of arcades in Paris, living quarters and paraphernalia within, become the target of a profound palaeontology. See Buck-Morss (1989, pp.58-77).
Benjamin’s political agenda is also of interest when framing a perspective on how history is recorded. For example, in ‘Theses on the Philosophy of History’, one of his last texts, Benjamin ([1940] 2007) positions among references to the challenge of “historical materialists” ([1940] 2007, p.254) to fight “class struggles” ([1940] 2007, p.254), history written by the “ruling classes” ([1940] 2007, p.255) and fascism ([1940] 2007, p.257), a description of Paul Klee’s drawing entitled Angelus Novas (New Angel) (Fig.2.8). In 1921, Benjamin purchased the artwork and dubbed it the ‘angel of history’ (Benjamin [1940] 2007, p.257), describing the angel as facing the past with his back to the future, distracted by debris of a past catastrophic event. The material of distraction from the past repeats and accumulates as a force to be fought against and filtered to avoid blind progress ([1940] 2007, pp.257-8). Benjamin’s view suggests caution before a blind progress without significant change, as this is the violent dangerous fuel for collective stagnation and fascism: a common thread in Benjamin’s work. Benjamin’s reading of Klee’s Angelus Novas hints at his broader interpretation of time and history, less politically fuelled, where past and present collide in the form of small fleeting artefacts and moments. Max Pensky (2004, p.193) suggests these artefacts are dialectical images: “things that one ‘encounters’ in the linguistic sediment of the material culture of the nineteenth century. They are the perceptible ‘ur-phenomena’ of history, heterogeneous moments of truth,” the ‘ur’ in the compound word meaning the most basic, elemental or archetypal form or phenomenon that can be observed. Benjamin’s charge to himself as a kind of method is to:
carry over the principle of montage into history. That is, to assemble large-scale constructions out of the smallest and most precisely cut components. Indeed, to discover in the analysis of the small individual moments the crystal of the total event. ([1927-1940] 2002, p.461)

The purpose of the present study is to focus on the shifting weight of contemporary representational/reproductive technologies in relation to the symbolic or representational work of the trace. The beauty of Benjamin’s key concepts of ‘dialectical image’, ‘aura’ and ‘trace’ and their tangents is that they stand as variables that remain relevant to media practice today. Benjamin observed and described the superstructure, in the Marxist sense, of human progress. For example, Benjamin highlights a shift in “human sense perception” relative to media across time ([1936] 2007, p.224). Benjamin alters position and concepts from a focus on painting to the mass accessibility of photography and film in the 1930s, a shift in focus that continues to the present day. For example, Benjamin’s dialectical image, as mapped by Susan Buck-Morss (1989), can be applied to the distinction between physical (analogue) media and the supposed immateriality of digital media. Benjamin’s aura, for instance, is a concept flexible enough to apply to the difference between consumers’ uses of their vinyl collections and their uses of MP3 or streamed music collections today, where data meets the user in the place they happen to be. Equally it can be applied to the movement of personal computers from fixed desktop locations to the mobility of smart phones and complementary network structures. Additionally, Benjamin’s desire for synchronicity, between technology and reproduced artwork, applied to a political take on increasing audience accessibility and shifting sensitivities in consumption, or “simultaneous collective reception” as highlighted by Michael W. Jennings (2008a,
p.15), can also function in the critique of networked mediation. As a concept in media theory, Benjamin’s observation of the potential for mass audiencing is an important critical archetype. The archetype is useful in engaging with the democratic capacity of the Internet as an image archive formed on the shifting foundations of contemporary creative production and consumption such as copyright, expertise, exchange and value. The state of networked creative production and consumption, via reproduction, leans heavily on the Benjaminian concepts discussed here. However, as worn as these concepts may be in media theory, they are central luminaries in contemplating a contemporary construction of media-oriented trace.

Howard Eiland, the translator of Benjamin’s *The Arcades Project*, suggests that a “collective redemption of lost time, of the times embedded in the spaces of things” (Benjamin [1927-1940] 2002, p.xii) informs the structure and contents of Benjamin’s unfinished project. The observation, when applied to Benjamin’s reflection on the tension between trace and aura, in the introductory quote to this thesis, supplies a fitting connection to the complexity of the trace in a contemporary media space. The ‘times’ are not simply embedded in past media but, as fragments, are plucked and remixed amid the immediacy of digital network culture and the supposed destabilisation of expertise, ownership and commercial power. Finding trace in the physical and symbolic qualities of a particular medium across creative production gets trickier the easier it becomes to access and manipulate media past and present via networked means of re/production. If the trace is a concrete physical reflection of a medium or a medium’s use and value across time, the concreteness of the trace
in such an application is destabilised by the material qualities of digital mediation and network functionality.

2.2 Towards Trace: Pictures, Images, Time and Space
Jennings pinpoints a fundamental purpose among Benjamin’s concerns in The Arcades Project, focusing on the way that Benjamin describes the project as a means to “root out every trace of ‘development’ from the image of history” (Benjamin in Jennings 2008a, pp.16-17). Jennings continues by highlighting Benjamin’s unique focus on the present as informed by resonant cultural forms of the past, stating that:

The resolutely historical nature of Benjamin’s project is driven thus not by any antiquarian interest in cultural forms of past epochs, but by the conviction that any meaningful apprehension of the present day is radically contingent upon our ability to read the constellations that arise from elements of a past that is synchronous with our own time and its representative cultural forms. (2008a, pp.16-17)

Benjamin’s ambition to trace all developments in image apprehension was too grand a scheme ever to be completed (perhaps its point was to never be complete). However, a foundation and a purpose for the trace were formed. Relative to the trace, there are key terms in Benjamin’s writing that need to be highlighted when approaching media at play and across time. As the “image of history” statement indicates, Benjamin places importance on the use and development of media as the transmitter of images across time and space. Buck-Morss notes the weight Benjamin places on the complexities of the dialectical image (1989, p.67), reminding us that: “He [Benjamin] compels us to
search for images of sociohistorical reality that are key to unlocking the meaning of his commentary” (1989, p.x). Buck-Morss also highlights Benjamin’s interest in “the interpretive power of images that make conceptual points concretely, with reference to the world outside the text” (1989, p.6). Following Buck-Morss’ interpretation of Benjamin, we can begin to identify a key component in Benjamin’s method as a tracing of mediated society grounded in the archiving of images that consider a material-based production of meaning in addition to the symbolic. But what is meant by ‘image’ in this context? It is possible that some ambiguity is warranted when addressing Buck-Morss’ rendering of Benjamin’s use of ‘image’. We are moved to make image-based connections to the operations of society outside the medium of text, but the umbrella of ‘image’ is broad in meaning. Should we be simply looking for pictures or wider assemblages of mediated symbolic perception as image? A combination of the two, pictures and mediated perception, is warranted in forming one’s own constellation of dialectical image fragments and requires further explanation.

An answer to this question may be provided by turning to WJT Mitchell’s (1994) distinction between picture and image, in the analysis of the verbal and pictorial divide, in representation. Mitchell notes the distinction separating picture and image, referring to:

the difference between a constructed concrete object or ensemble (frame, support, materials, pigments, facture) and the virtual, phenomenal appearance that it provides for a beholder; the difference between a deliberate act of representation (‘to picture or depict’) and a less voluntary, perhaps even passive or automatic act (‘to image or imagine’); the difference between a specific kind of visual representation (the
‘pictorial’ image) and the whole realm of iconicity (verbal, acoustic, mental images). (1994, p.4n, italics in original)

The claim being made is that Benjamin’s ‘image’ includes the pictorial and the image in the “realm of iconicity”, as set out above by Mitchell (1994, p.4n). The pictorial-image combination is demonstrated in Benjamin’s focus on a photograph’s reception across time. As Jennings (2008b) points out, the ambiguity between a photograph’s production and its reception is contained in what Benjamin ([1931] 2008, p.279) describes in ‘Little History of Photography’ as “image worlds”. These image-worlds are Benjamin’s recognition that there exists something “inevitably subjective” in photographic images “but our perception of them is conditioned by something objective” (Jennings 2008b, p.264). Notably, the objective conditioning qualities of ‘image-worlds’ are a fixing of the image in time by the codes of the photographic apparatus in relation with supposedly “magic” or more subjective image perception (Benjamin [1931] 2008, pp.279-86), the awareness and difference between the two being a “thoroughly historical variable” for Benjamin ([1931] 2008, p.279). Jennings (2008b, p.264) says: “the image-world emerges as a place in every photograph which encodes not just the specific character of a past moment … but also ‘the future’”. Furthermore, in Benjamin’s 1936 ‘Work of Art’ essay, we read his observations on the medium of film when contrasting the process and product of the painter as against those of the cinematographer. The cinematographer’s output is pictorial action framed by the media apparatus that cuts and mixes the unfolding representations on view. The process and outcome of image production are determined by the affordance of the media “apparatus” at hand. Benjamin, for instance, notes that: “The painter’s is a total image, whereas that of the cinematographer is piecemeal, its manifold parts being
assembled according to a new law” ([1936] 2008, p.35). In the process of film making, images are assembled into a form often addressing an overall abstract idea or narrative that the medium offers up by running in time and motion. Consequently, ‘picture’ can be read as a concrete starting point, in proximity to the physicality of a medium, that unfolds and assembles ‘image’ via a medium’s qualities and culturally encoded reception across time.

In his exposé for *The Arcades Project* entitled ‘Paris, The Capital of The Nineteenth Century,’ Benjamin also draws attention to the wider virtual iconicity of the image via the term “wish images.” In highlighting the operations behind modernist industrial development and production, represented by the Paris arcades, he states:

Corresponding to the form of the new means of production … are images in the collective consciousness in which the new is permeated with the old. These images are wish images; in them the collective seeks both to overcome and to transfigure the immaturity of the social product and the inadequacies in the social organisation of production. (1935 2008, pp.97-8)

Buck-Morss notes that Benjamin’s wish image, in the collective unconscious, is “a dialectic between utopian imagination and the new technological potential” (1989, p.56). Benjamin’s use of image, whatever the topology, refers to a medium’s development, position and affordance across time. The “image-world” considers the past via pictures as intermediary to the future. The cinematographer’s image slices time, just as the wish image plays across the old and the new in technological or industrial development. A more recent example of reflection on media, time and space
reinforces the importance of such an approach. In exploring the medium of the book
as an extension of memory, Florian Brody sums up media’s use relative to time:

> Time is as much a human convention as it is a condition of existence. Every ‘user’
of time perceives it on an individual level that is in turn informed by social and
cultural conditioning. The way we define the concepts of past, present, and future
(and even the unidirectionality of time) are reflected in all media and, furthermore,
are actually enforced by the way we use media. It is precisely because time and space
are the cornerstones by which we define our environments that they are central
categories within any discourse about media. (1999, p.139)

Benjamin was obviously sensitive to such an understanding and placed similar
emphasis not only on media use but also on the associations of its development in
relation to changes in modes of collective perception. Benjamin holds that change is
tied to the central role of a medium in conditioning perception across time:

> Just as the entire mode of existence of human collectives changes over long historical periods, so too does their mode of perception. The way in which human perception is organised—the medium in which it occurs—is conditioned not only by nature but by history. ([1936] 2008, p.23, italics in original)

The political agency that Benjamin associates with reproductive media and its ability
to reflect back onto a collective audience their values informs ‘The Work of Art’ essay
([1936] 2008, pp.19-55). Benjamin’s approach exemplifies a focus on cultural change
identifiable as a consequence of media development and image transmission, relative to time and place.

Figure 2.9 Web page screen grab composition by Greg Hughes (2017) featuring work by Max Brückner (1900) on publicdomainreview.org and reverse Google image search via images.google.com.au using Escher’s Stars (1948). The composition shows a kind of algorithmic mode of archive access concerning geometric forms that is comparable to Jennings’ interpretation of Benjamin’s methods.

‘Synchronicity’ is a key term in Benjamin’s consideration and tracing of media across time and space, and is highlighted by Jennings (2008a, pp.16-17). In ‘synchronicity’ can be found Benjamin’s dialectic image, such as Benjamin’s method of seeking the synchronous across time, as a means to finding echoes in the
technological development of media past that reverberate with the present. The goal of Benjamin’s method is to make present media and cultural renderings more legible, as Jennings (2008a, p.16) points out. As an algorithmic present-day illustration of such thinking, imagine if, instead of the complex custom archival techniques of legends, codes and diagrams used to map his *Arcades* fragments (eds Marx et al. 2015, chap.9), Benjamin had access to a reverse Google image search, using the service with an image file rather than text input. The composition of screen grabs (Fig.2.9) can be followed from left to right starting with the geometric models of Max Brückner (1900) found at the *Public Domain Review*, notably built on the influence of Escher’s 1948 *Stars* print. Next, *Stars* as an image file uploaded to a Google search produced the grid of results presented. The resulting montage has several causal connections, such as other works by Escher and appropriations; however, a similarity can be found with the images of geometric experimentation and alternative mediums also thrown up by the search service. Of course, the pre-composed autonomy of Google’s image recognition algorithms may render any hope of synchronicity in the strictest sense impossible, although the spirit of acausal findings is still possible despite the uncertainties of machine learning. Google’s Arts and Culture gallery collaboration and experiments (Google Arts & Culture 2013) and Deep Dreaming artificial intelligence (Mordvintsev, Olah & Tyka 2015) would be equally applicable here, as immense image archives from across the globe are filtered and brought together via machine learning and image similarity. Notably, though, just using and not understanding the qualities of Google software algorithms may rub against Benjamin’s insistence on a literacy of a medium’s influence.
Present day alignment to Benjamin aside, it is worth quoting at length directly from *The Arcades Project*, so as to draw out the divide between past and present when tracing media over time, as Benjamin states:

> It’s not that what is past casts light on what is present, or what is present its light on the past; rather, image is that wherein what has been comes together in a flash with the now to form a constellation. In other words, image is dialectics at a standstill. For while the relation of the present to the past is a purely temporal, continuous one, the relation of what-has-been to the now is dialectical: is not progression but image, suddenly emergent. ([1927-1940] 2002, p.462)

Tracing image via media over time, then, as based on Benjamin’s dialectic image, is not about the chronological mapping of events over a continuous spectrum or the desire to expose a kind of ‘universal history’ from chance connections. Rather, the process is akin to a quantisation of time, informed by media development and consequential image production and storage. A fitting parallel would be looking at media across time as analogue (linear, continuous or one-to-one) or digital (non-linear, divided or abstracted). The main point is that Benjamin’s tracing is not about following set or causally related paths, but rather about locating supportable relations or similar structures in the movement, production and retrieval (consumption, accessibility, archive) of image. Benjamin continues:

> These images are to be thought of entirely apart from the categories of the ‘human sciences,’ from so-called habitus, from style, and the like. For the historical index of images not only says that they belong to a particular time; it says above all, that they
attain to legibility only at a particular time. And, indeed, this acceding ‘to legibility’ constitutes a specific critical point in the movement at their interior. ([1927-1940] 2002, p.462)

Benjamin’s use of image at this stage brings clarity back to the reproduction of images across time. The clarity is found in an awareness of the unique operations of media and reproduction amongst the movement of image, not in current trends or styles. In fact, for Benjamin “material nature was ‘other’ than the subject, and this remained true no matter how much human labor had been invested in it” (Buck-Morss 1989, p.70). The clarity is also particular in a tracing via “historical index” where “the images produced in particular historical moments are related to images of prior epochs” (Jennings 2008a, p.16). Jennings also suggests that for Benjamin it is only this kind of knowledge, derived from such a synchronic outlook, that produces social change (2008a, p.15); as Benjamin notes:

Every present day is determined by the images that are synchronic with it: each ‘now’ is the now of a particular recognisability. … Only dialectical images are genuinely historic—that is, not archaic—images. The image that is read—which is to say, the image is the now of its recognizability—bears the highest degree the imprint of the perilous critical moment on which all reading is founded. (Benjamin [1927-1940] 2002, pp.462-3)

The present moment of an image then, does not depend on a linear trajectory of time or constructed narrative, but rather on a subversive resonance of that which is recognised in a present image from past image: including its means of production and consumption. At the point where recognisability comes into play, a knowledge of
image, media development and re/production would become essential to the legibility of a particular time period and its associated present media affordance. In this light Mitchell regards Benjamin’s dialectical image as associated with the concept of “metapictures” (1994, p.45). Metapictures are “pictures that refer to themselves or to other pictures, pictures that are used to show what a picture is” (1994, p.35). Metapictures demand a close reading of self-referential elements, including a play within the pictorial frame of composed content that instils ‘mutistable’ readings when viewed (1994, p.48). Additionally, for an image to function in this way, a reliance on external codes and contexts of mediated viewing behaviour is highlighted by the image’s content and its production. Mitchell goes on to describe how metapictures “reflect on the intersections of visuality, language, and similitude, where they engage in speculation and theorisation on their own nature and history” (1994, p.82). Mitchell’s concept drifts close to Benjamin’s dialectic image: connection is found within an image at a meeting point of self-referential content, including past associated images and the image’s means of production. All the while, this site is dependent on the visual literacy associated with an image’s context and readability.

Photomontage, for Benjamin, exemplified a medium of dialectical image production. Buck-Morss notes that Benjamin’s interest in the technique and form that were technologically and theoretically progressive in his time was due to his interest in how media construction “interrupts the context into which it is inserted” and thus “counteracts illusion” (Benjamin in Buck-Morss 1989, p.67). This interest is not only evident in engagement with graphic montage produced at the time, but also informs the approach and structure of Benjamin’s entire project (Buck-Morss 1989, p.67).
Benjamin asks and answers: “in what way is it possible to conjoin a heightened graphicness … to the realisation of the Marxist method? The first stage … will be to carry over the principle of montage into history” (Benjamin [1927-1940] 2002, p.461). *The Arcades Project* and photomontage resonate with the functions described of Mitchell’s metapictures.

*Figure 2.10* Adolf der Übermensch: Schluckt Gold und redet Blech (*Adolf The Superman: Swallows Gold and Spouts Tin*), a photomontage by John Heartfield (1932) originally published as a cover for *Die Arbeiter-Illustrierte Zeitung* (*Workers’ Illustrated Magazine or AIZ*).

*Figure 2.11* Magazine cover for/by *Adbusters* (#127, September/October 2016) showing the magazine’s product barcode as a trace of the medium at a point of intervention on the symbolic work of the image.

The point being made is that the qualities of image production, and consequentially the means of re-production and consumption, offer a space for an active trace to be found—a trace of the medium found at the sites of intervention on the medium, image codes and content that support the image. For example, the cover of the culture jam magazine *Adbusters* (Fig.2.11), featuring a detoured image of Donald Trump as an
early 21st century Adolf Hitler, is in the spirit of John Heartfield’s 1932 *Adolf The Superman: Swallows Gold and Spouts Tin* a famous *AIZ Magazine* cover photomontage (Fig.2.10). These figures resonate with image codes used by Heartfield to comment on the influence of German Natural History on political and social prejudice. For example, the use of Darwinism to affirm a higher class or more evolved people as a dangerous pseudo-science that mixes nature or natural history with social or political history (Buck-Morss 1989, pp. 58-64). The point here is not the context but a nuance in Benjamin’s view of history as a dialectical image method, found in such images, that highlights the importance of a material trace. Benjamin met Heartfield in Paris and knew his work well and Buck-Morss introduces a discussion of Heartfield’s work with an explanation that points to Benjamin’s dialectical image method by stating:

The method relies on juxtaposing binary pairs of linguistic signs from the language code (here history/nature), and, in the process of applying these signs to material referents, crossing the switches. The critical power of this maneuver depends on both the code, wherein meaning arises from binaries of signifier/signifieds independent of the referents, and the referents, the materially existing objects, which do not submit to language signs meekly, but have the semantic strength to set the signs into question. (Buck-Morss 1989, p.60-1)

On the *Adbusters* cover, the barcode placed on Trump’s face (Fig.2.11) ‘is’ the magazine’s functional product code. In becoming an element of the image, the barcode becomes a form of self-referential material intervention, criticising the referent that is Trump’s face and the politics he represents with the imposition of
Hitler’s moustache. Working from the elements within the picture only, this play of references could be seen as mostly semiotic, having references to Heartfield’s original image, Hitler, Trump’s capitalist status and politics, and a comment on consumerism too. Yet, as a material trace of a wider system of reproduction the barcode flips Trump to a product of capitalism, and not only in reference. In addition, for the Trump image it is not only the use of photomontage elements informed by the language of natural science flipped onto the upper echelons of the Nazi regime but also a distribution system of product identification and individualisation that his face will physically have to endure—repeated shuffling in the shelves of the print warehouse or magazine store and the rub and beam of the barcode scanner across his deep-etched head. This means of intervention, the barcode as an example of the trace, shows the value of the trace in and analysis of media production and consumption, lifting us from, yet connecting us to, the picture plane—a crux connection point between pictures and broader dialectical image. At this stage, we have been hovering around a perspective informed by media artefacts and their content. Yet Benjamin’s dialectical image can take us much further regarding the material trace of media.
2.3 Trace Fossils

Figure 2.12 Dinosaur Stampede, Lark Quarry, Winton, a photograph by Julia Harris for ABC Local (2011) featuring dinosaur footprints preserved in stone, Queensland, Australia.

Figure 2.13 Photograph by Greg Hughes (2017) showing the physical variations between the inside design of retail box packaging for the iPhone 4s, 6 and 7.
What do the fossils of a dinosaur stampede (Fig.2.12) and the packaging of iPhones (Fig.2.13) have in common? Trace fossils! Also known as impression fossils. Benjamin allows us to observe the latter, forgoing chronicled time, with the modes of enquiry that would be typically applied to the former as a kind of iPhone palaeontology. The fossilised tracks of dinosaurs are located at Lark Quarry Conservation Park, Queensland, Australia (Fig.2.12). The location hosts thousands of footprints representing numerous species once thought to indicate a stampede. It could be said that an ‘aura,’ as conceived by Benjamin, has manifest from the discovery of these trace fossils. The fossils have become a site of significance: heritage listed, fenced off, advertised like a theme park as the ‘Dinosaur Stampede National Monument’ and hotly debated, scientifically and colloquially, as to whether the impressions are evidence of a stampede at all. However, recent research (Romilio, Tucker & Salisbury 2013) examines in great detail the characteristics and direction of footprint impacts in the majority of preserved impressions, arguing that they indicate that the ancient creatures were in a semi-buoyant state swimming in shallow water. From the fossils and the realisation that these dinosaurs could and did swim or wade, the researchers were led to consider, in addition to animal behaviour, the environment; namely, the “variable subaqueous conditions” and “current flow” evident at the location and time (Romilio, Tucker & Salisbury 2013, p.102). Simply put, in this scenario, trace offers an objective indication of subject size, behaviour and environment, while the hype of institutionalised ritualisation associated with fossils, as trace, results in a kind of general aura. This aura, with all the complexities of cultural and symbolic sedimentation, shares an intricate and fluid relationship with the trace.
The retail packaging of different generations of iPhones (Fig.2.13) also acts like a type of trace fossil. If the trap of time is allowed to be put aside for the purpose of observation and analysis, a cultural and symbolic critique can be taken up in place of palaeontology to address the concrete impressions of media use and production. The image presented (Fig.2.13) contains retail packaging for three iPhone models: the 4s, the 6 and the 7. The structure of box board and form of supporting internal material give an immediate indication of device size and shape. However, more interestingly, observing the change in substrate, internal packing and structure from left to right highlights design and production behaviours with a basis in economic and environmental considerations. The glossy plastic inserts common to earlier models are not present in the iPhone 7 model with instructions and accessories not being hidden under an additional layer. The plastic inlay has been deleted altogether and a paper or fibre-based composite utilised, objectively showing significant change in the packaging design process, amount and type of material used. These packaging observations indicate specific consideration of environmental impact in Apple’s design behaviours. The trace from a collection of artefacts themselves forgoes company and consumer hype such as speculative Apple product ‘leaks’ and opinions on internal company changes (for example, Price 2017). Additionally, such analysis may also avoid reliance on the potential bias of a company’s own claims:

U.S. retail packaging of iPhone 7 contains 84 percent less plastic than the previous-generation iPhone packaging and contains 60 percent recycled content. In addition, the packaging fibers are made from sustainably managed forests, bamboo, and waste sugarcane. (Apple Inc. 2016, p.3)
The comparison of dinosaur tracks and iPhone packaging as trace may seem a strange example; however, comparing the trace or dinosaur’s footprint impressions to present day production and consumption allows an objective or concrete analysis to begin in an otherwise complex and noisy program. But these comparisons are only partially illustrative of one of Benjamin’s original methods that is open for further review.

To build a theory of media trace or tracing, commencing with Benjamin, is to ask what defines his categories of tracing. Initially an answer would be that a dialectic image and synchronicity are foundation and umbrella to Benjamin’s theory of media trace. Other possibilities exist, but are dependent on the operation of subject and context as an act of general tracing in discourse and reflection; for example, the causal links of the standard narrative in detective stories. Throughout Benjamin’s work, no specific set-out methodology is to be found, only the dialectic of trace and aura in *The Arcades Project* fragment used for the introduction to this chapter and repeated here:

> The trace is appearance of a nearness, however far removed the thing that left it behind may be. The aura is appearance of a distance, however close the thing that calls it forth. In the trace, we gain possession of the thing; in the aura, it takes possession of us. (Benjamin [1927-1940] 2002, p.447)

Benjamin offers an operational logic between trace and aura concerning ‘distance’ against the appearance of an object, but little detail concerning the potential of ‘possessing’ and applying a concrete trace to media-founded cultural enquiry. MB Hansen (2008) positions a concern for potentially misreading Benjamin’s trace in a footnote to her reading of Benjamin’s aura. MB Hansen attributes Benjamin’s trace to
two examples that are similar to the pictorial and image-based considerations already listed. MB Hansen’s examples are derived from the qualities of media artefacts proper ‘and’ the wider abstraction of image as reflected in a time or era; she says:

Trace (Spur) is one of those concepts in Benjamin that have antithetical meanings depending on the constellation in which they are deployed; it is rejected as the fetishizing signature of the bourgeois interior in his advocacy of the new “‘culture of glass’” in ‘Experience and Poverty’ (1933), … but valorized as a mark of an epic culture—and its implied renewal in modern literature and film—that links art with material production and tactical, habitual perception; see Benjamin, ‘The Storyteller’ (1936). (2008, p.340)

The meaning of trace for Benjamin is thus problematic, especially when attempting to define trace across his literary output. At the very least, in line with MB Hansen (2008) and discussion so far, we can pin the trace to the concrete qualities of a medium and the cultural manifestations that unfold from a medium’s material trace. It is suggested that the trace, when considered as a method, is not a holder of meaning with a strict definition, but rather a process. Trace is a noun when a mark or a sign and a verb when a practical process or manoeuvre. Derrida’s use of trace, to be explored further in Chapter 4, instils difference and defies certainty before notions of origin in the exchange of meaning. Derrida aside, the more useful thing to do, in the present

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7 The idea extracted from Benjamin here aligns with a recent repurposing of 19th century agricultural theorisation known as cultural techniques, to be engaged with in Chapter 7 and 8 of this thesis. Cultural techniques, as an approach to the critique of media or a specific medium, is a post-hermeneutic extension of German media theory that considers interplay of both the material concrete and the symbolic in the observation, documentation and critique of chains of operations (human and non-human) that unfold from the use of specific media. The concept, it is suggested, is extremely close to Actor Network Theory; however, it has a media-oriented slant toward the ‘historical’ unfolding of operations with archival and media archaeology motives. See Siegert (2013; 2015a), Parikka (2013) and the Cultural Techniques special issue of _Theory, Culture & Society_ (2013, Vol.3, No.6). It is suggested that Benjamin, only lightly referenced amongst cultural techniques theorists, is foundational to its motives—an important consideration in reading media historically and epistemologically beyond ‘the text.’
trajectory of this study, is to highlight an example of Benjamin’s ‘process’ of trace closer to the material surface of media. Such an example would offer a method (rather than a methodology) for this discussion. Core to this procedure or method is to ask, how does Benjamin’s trace sit in dialectical tension with his concept of aura?

Buck-Morss (1989), in her extensive overview of *The Arcades Project*, not only breaks analysis up into temporal and spatial approaches to Benjamin’s work, but also argues that the dialectical image is key to Benjamin’s method. Buck-Morss’ commentary is comprehensive and convincing. Buck-Morss supplements *The Arcades Project* and, where fragments of the original text are provided, gives a structure and context that adds coherence to the primary document. In the combination of Benjamin’s original and Buck-Morss’ reflections we begin an analysis of the trace under the umbrella of dialectical image, noting:

> how Benjamin viewed the world of industrial objects as fossils, as the trace of living history that can be read from the surfaces of the surviving objects, and introduces the significance of visual ‘concreteness.’ (Buck-Morss 1989, p.56)

Buck-Morss goes on to highlight Benjamin’s use of trace via a diagrammatic structure that maps and lays out what is for her the taxonomy of Benjamin’s dialectical image (Fig.2.14). Buck-Morss’ argument also functions as a map for the overall arcade project, in which, in late 1930s Paris, the commodity is the token centre point of the dialectical image (1989, p.211).
The categories surrounding commodity, as an intersecting centre-point in Buck-Morss’ diagram of Benjamin’s foci, notably include “natural history: fossil (trace)”, of which Buck-Morss states:

[T]he *fossil* names the commodity in the discourse of ur-history, as the visible remains of the ‘ur-phenomena.’ … Benjamin sustains the physiognomy of the fossil in the idea of the ‘trace’ (*Spur*), … the imprint of objects particularly visible in the plush of bourgeois interiors or the velvet lining of their casings. (1989, p.211, italics in original)

In Benjamin’s time the notion of a ‘new’ history prevailed, brought on by the hope instilled in technological development (Buck-Morss 1989, p.64). However, Benjamin
subverted that idea, as Buck-Morss explains, by noting a Marxist tension that informed propositions of progress:

Extreme optimism concerning the promise of the ‘new’ nature of technology, and total pessimism concerning the course of history, which without proletarian revolution would never leave the stage of prehistory. (1989, p.64)

Conventional studies of natural history, biology, palaeontology and the like separate the past into various manageable epochs and eras. In other words, using natural history as an analogy, modernity was viewed as the beginning of a new past with a renewed human position in the world built on the spectacle or illusions constructed by capitalist production and technology of the commodity, where anything prior was “prehistory” (Marx in Buck-Morss 1989, p.64). However, Benjamin, as interpreted by Buck-Morss, toys with the prefix “ur” to counter the modernist myth. In The Arcades Project, Buck-Morss argues, Benjamin creates a “montage of nature and history” (1989, p.64), where the new is subverted by a conception of the “historical origins of the present,” in which:

Natural history becomes ur-history. Its goal is not only to polemicize against the still-barbaric level of the modern age, but … to disclose the essence of the ‘new nature’ as even more transient, more fleeting than the old. Natural history as ur-history meant bourgeois prehistory as prehistoric. (Buck-Morss 1989, p. 64)

Buck-Morss holds that Benjamin observed a traceable recent-present ‘natural,’ which echoes the dialectical image, already outlined, that sidesteps the linear continuum of media time and space. Benjamin also cuts through constructed notions of history via
his ur-history, questioning verifiability and treating bourgeois objects and commodities as primitive (or not modern at all), yet still informative as reflections on development. As Buck-Morss explains:

Benjamin identifies only what is new in history as prehistoric. The conception is dialectical. There is no biological or ontological ‘primitiveness’ that defies historical transformation. (1989, p.68)

Benjamin is sounding a warning addressed to the ‘new’ as an acceptance of an all-encompassing continuous flow of time, inclusive of human activity and its other, in his reflections. Supposed interventions to restructure time, in Benjamin, read as perceptions that the traceable (the origin) can cut through. It is a question of how time is ‘read’ not restructured. The crux of the argument rests on a sensibility as to how an object is followed across time. In the trace, there is the ‘possibility’ of verifiability as an artefact.

The trace’s affordance alternates with complexities of meaning and symbolic loading. Complexity also informs the other elements of the dialectical image, as mapped by Buck-Morss (1989, p.211). There is no absolute truth or origin to the trace in reproductive technologies, especially film, but the simple movement of recent media origins separates the trace from influential context and the limits of chronological narrative bounded by phenomenological constraint. As Buck-Morss asserts, Benjamin held that “there was no absolute, categorical distinction between technology and nature” (1989, p.68), in so much as technology, like nature, was “socially and historically produced” (1989, p.68), yet:
material nature was ‘other’ than the subject, and this remained true no matter how much human labor had been invested in it. Yet modernity marked a radical break in its form. The paradox was that predicates usually attributed to the old, organic nature—productivity and transitoriness as well as decay and extinction—when used to describe the inorganic ‘new nature’ that was the product of industrialism, named precisely what was radically new about it. (Buck-Morss 1989, p.70, italics in original)

The rapid shifts in time or perceptions of time, influenced by development that accelerated industrial decay, inform Benjamin’s trace as: “for the first time, the most recent past becomes distant” (Benjamin in Buck-Morss 1989, p.65). The notion is exemplified in the 21st century by Jennifer Gabrys (2011) in Digital Rubbish: A Natural History of Electronics, who targets the materiality of digital culture via Benjamin’s method. Gabrys suggests that Benjamin “reflected on the progress narratives that were woven through Victorian natural histories (and economics) and effectively inverted these progress narratives in order to demonstrate the contingency and transience of commodity worlds” (2011, p.6). The fallout of media obsolescence provides increasingly ‘recent’ decay and extinction—a basal substrate of electronic waste for ‘trace fossils’ to be found and from which cultural activity or operations can be observed. Parikka highlights Gabrys’ use of Benjamin in the chapter introduction to ‘Fossil Futures’ in A Geology of Media and reiterates that Gabrys aims “to understand the material imaginary of commodity culture” via Benjamin (2015a, p.115). A link to the potential of Benjamin’s dialectic image, or perhaps more specifically to his concept of ‘wish images’ as the ‘imaginary,’ is held here. With a

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8 In palaeontology a trace fossil is subsidiary proof of the past aside the actual fossilised remains of an organism. Trace fossils indicate actions and behaviours more than origin and identification.
base in the material properties and collective perception offered by a medium, the wish image exposes the “inadequacies in the social organisation of production” (Benjamin [1935] 2008, pp.97-8). In this case, there is a wish image exposing environmental consequence via the material trace of digital culture.

Similarly, the sense perception fallout of network culture media exchange can be better accessed via Benjamin’s inversion of natural history. Erika Kerruish, when discussing Benjamin’s work in the context of contemporary notions of hyperaesthetics, notes the contemporary value of Benjamin’s conflation of nature and technology:

Refusing an opposition between nature and technology allows Benjamin to develop a critical response suitable for engaging with the technology-saturated twenty-first century, one that is not the isolated practice of an individual distanced from shared sensory experience, but one that addresses the collective, embodied and situated experience of technology. (2012, para.18)

Benjamin founds a definition of material trace set in the potential of the seemingly redundant or obsolete preserved matter of technological development and communication. His method, accessed via the trace, gives permission to treat present media as immediately ‘distant’ in terms of connotations drawn from Ichnology, Palaeoanthropology, Archaeology and Geology and applied to media. “[T]oday arcades dot the metropolitan landscape like caves containing the fossil remains of a vanished monster: the consumer of the pre-imperial era of capitalism, the last dinosaur of Europe” (Benjamin [1927-1940] 2002, p.540). Benjamin’s take on time and media,
as characteristic of modernism’s natural history, is, according to Buck-Morss, linked to the trace as preserved material, items testifying to the trajectory of the bourgeois:

[T]he interiors of bourgeois dwellings were ‘a kind of casing,’ in which the bourgeois individual as a ‘collector’ of objects was embedded with all his appurtenances, ‘attending to his traces as nature attends to dead fauna embedded in granite. . . ’ [T]he fossilized commodity remains are not merely ‘failed material.’ . . . [A]s traces of prior life, they are historical clues, with an objective meaning . . . Benjamin perceived historical nature as an expression of truth’s essential transitoriness in its contradictory extremes—as extinction and death on the one hand, and as creative potential and the possibility for change on the other. (Buck-Morss 1989, p.66)

Figure 2.15 A photograph by Benjamin’s friend Sasha Stone (n.d), held in Benjamin’s archive, showing the plush furnishings and cluttered interior of a bourgeois apartment.
The inability of the bourgeoisie to accommodate the flux of development, couched in a dialectic of natural history, change versus stasis, their ownership of arcades and dwellings in Paris, and cluttered paraphernalia within, is exemplified by a photograph held in Benjamin’s archive and taken by his friend Sasha Stone (Fig.2.15). The image becomes the target of Benjamin’s fossil hunt of the past in the present:

On the walls of these caverns their immemorial flora, the commodity, luxuriates and enters, like cancerous tissue, into the most irregular combinations. A world of secret affinities opens up within: palm tree and feather duster, hairdryer and Venus de Milo, prostheses and letter-writing manuals. The odalisque lies in wait next to the inkwell, and priestesses raise high the vessels into which we drop cigarette butts as incense offerings. (Benjamin [1927-1940] 2002, p.540)

Buck-Morss notes that in this orientation of the trace, the commodity object and the evidence of its absent-presence becomes “particularly visible in the plush of bourgeois interiors or the velvet lining of their casings” (1989, p.211). Such trace is found in the ‘object’ encapsulating the ‘trace,’ much like the sandstone substrate of a trace fossil of a once living organism’s footprints or iPhone retail packaging (Fig.2.12 and Fig.2.13). The site enables the reflective affordance of commodities to be found aside themselves or their remains, evident in the trace left in the dusty dishevelled mannequins and store display shelves of Benjamin’s 19th century arcades. In these arcades, sites of fossilised modernity, the trace is “read from the surfaces of the surviving objects, and introduces the significance of visual ‘concreteness’” (Buck-Morss 1989, p.56).
2.4 Concrete Trace

A key aspect of Benjamin’s method of trace, as highlighted by Buck-Morss, is the importance of “visual ‘concreteness’” found in the dialectical image. Buck-Morss observes that Benjamin’s dialectic image is informed by its quality as “ur-phenomenon ... in which the origins of the present could be found” (1989, p.71) The ur-phenomenon brings Benjamin into close proximity with networks of action that are explored in Latour’s actor-network theory (ANT) and associated science studies: theories that address the interlinked working of the trace (to be explored in Chapter 5). It should also be noted that the category of ur-phenomenon is not necessarily Benjamin’s in origin, yet Buck-Morss links it to Benjamin via discussion of the science-oriented observations of naturalist morphology by Johann Wolfgang von Goethe (German philosopher: 1749-1832). In Goethe’s work, scientific practice did not associate with
“cognitive abstraction” but rather “irreducible observation” where “objective laws and regularities of living organisms were graphically visible in their structural forms” (Buck-Morss 1989, p.71) as objective and verifiable ur-form (1989, p.77). Buck-Morss points to the way that Benjamin takes this concept quite unaltered from Goethe’s approach to the natural sciences and applies it to his observations of history (1989, p.73). In Buck-Morss’ estimation, Benjamin’s trace images become:

the concrete, ‘small, particular moments’ in which the ‘total historical event’ was to be discovered … the ‘perceptible ur-phenomenon’ … in which the origins of the present could be found. (1989, p.71)

These “small particular moments” of “ur-form” trace build a total image or event (1989, p.77). The activity happens as alternative to, or before, cognitive considerations of subjective symbolism and meaning exchange. For example, thousands of Atari game cartridges, including still sealed retail packaging (Fig.2.16), from production in the 1980s were discovered and exhumed in 2014, following a build-up of speculation and conspiracy theories about the dumping site (Kohler 2014). The find is a concrete trace, a moment of ‘ur-form,’ dating from the then fledgling gaming platform, that now manifests as a symbol for a bigger picture, one of material considerations and the dark side of media ecologies, including e-waste and corporate manoeuvres during an industry downturn.

In the category of concrete trace is another important variant in addition to trace fossils and themes of exhumation but aligned with moments of ‘ur-form’ and ‘ur-phenomena.’ Warwick Mules notes a similar distinction in Benjamin’s thinking, between symbol
and a more concrete “experienced matter,” and does so via Benjamin’s exploration of the ‘mark’ (2007, para.7). Benjamin’s 1917 piece ‘On Painting, or Signs and Marks’ ([1917] 2008) is used by Mules to highlight the mark as a space in mediation between medium and sign. Mules defines Benjamin’s concept of the mark:

> The mark emerges from the medium on which the sign is printed or inscribed—a surging forth that persists and endures. This is not dead inert material, but rather a materiality that carries life itself, as experienced matter (that is, material capable of bearing experience). (2007, para.7)

For Mules, the mark “becomes the barely visible trace of a disjunction between being and tekhnē; evidence of the continual yet self-defeating struggle by technology to overcome the separation of experience from its origin” (2007, para.9, italics in original). The mark, like the trace, can sit prior to the unstable referential meaning of signs. As a site between medium and content, Benjamin’s mark, as highlighted by Mules, is a lingering layer of mediation between a material origin and symbolic effect that unavoidably imposes a distance between signifier and signified, or origin and experience, in processes of media reproduction—the trace of the medium standing in reserve and ready to surge forth. Inscriptive medium types suit this perspective and we are reminded of the microscopic registrations and misregistrations in a substrate, traces critical to their operation and characteristics. Digital compact disc (CD) pits (Fig.2.17) and vinyl grooves (Fig.2.18) examined via a scanning electron

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9 Mules aligns Benjamin’s critique of a technologically mediated world with Heidegger’s ‘The Question Concerning Technology’ ([1954] 1977) and key term ‘tekhnē’ or ‘technē’ (Mules 2007, para.2). Technē is the etymologically Greek source of technology and a means for Heidegger to seek the ‘essence’ of technology beyond a means-to-an-end reading of craftsmanship or instrumentality. Via pre-Socratic considerations of causality, Heidegger asks us to instead think of technology as a process of poetic potentiality and revealing or bringing-forth in understanding the world. For further alignment of Benjamin and Heidegger relative to technology see Cooper (2002).
microscope show a hidden fragility and concrete trace as the imperfections and interference on the registered mark’s substrate.

*Figure 2.17* Scanning electron microscope image of digital compact disc registration pits by Chris Supranowitz, Institute of Optics, University of Rochester, showing dust and cracks in substrate.

*Figure 2.18* Scanning electron microscope image of vinyl grooves by Chris Supranowitz, Institute of Optics, University of Rochester, showing dust and imperfections in substrate registration.

The trace and mark (Mules 2007) coincide here with media concreteness (Buck-Morss 1989, p.56), where medium or material concreteness is considered as distinct from notions of digital immateriality. Mules suggests the mark ‘is’ a “material tracing of a struggle to make the original show itself” (2007, para.20). The two concepts overlap—to leave a mark is to leave a trace and to leave a trace is to leave a mark. Both can operate as ur-phenomenon and ur-form.

The trace in Benjamin’s dialectical image targets wider contextual considerations of media production via a concrete material self-reflexive trace of a recent past. Benjamin’s trace forms a site of investigation at the site and surface of media alongside subjectivity, signification and connotation. The trace is to be found in the media
artefact itself, the mechanism, the specific media device (technology) or the imprint media leaves in a supporting substrate, and holds the means to discover and document token media use and qualities across time. Such a non-linear understanding of the trace highlights the treatment of time and space in media production and reception (such as the degradation of film stock, the trace of multiple runs through the projecting apparatus). Qualities of re/production, indicators of difference and change conversely all become indicators of what remains. The trace also holds potential to highlight political, cultural and social structures that have influenced or been influenced by a particular medium (for example, the stasis of bourgeois consumption in their affordance of the trace).

2.5 Trace and Aura
In the text used to introduce this chapter, Buck-Morss (1989) does not specifically focus on the aura, or its logical or dialectical position opposite: the trace. To address the tension between trace and aura, shifting from the quotation to media, we need to return to the aura as described in ‘The Work of Art in The Age of Mechanical Reproduction’, Benjamin’s 1936 essay. In ‘The Work of Art’ Benjamin positions the trace in direct relationship to the aura and its effect. But the aura also functions as a traceable operative and as a historic variable in changes of media, as Benjamin suggests: “if changes in the medium of present-day perception can be understood as a decay of aura, it is possible to demonstrate the social determinants of the decay” ([1936] 2008, p.23). Benjamin begins ‘The Work of Art’ by distinguishing the concepts he is about to introduce from a “Fascist sense” of conventional aesthetic codes:
It would therefore be wrong to underestimate the value of such theses as a weapon. They brush aside a number of outmoded concepts, such as creativity and genius, eternal value and mystery – concepts whose uncontrolled (and at present almost uncontrollable) application would lead to a processing of data in the Fascist sense. ([1936] 2007, p.218)

Remembering the context in which Benjamin wrote, we can straight away sense his focus on defining and defending the essentials of a progressive and critically self-conscious creative production. Benjamin was compelled to interject against the totalitarianism of his time, on behalf of producers of creative content. The concepts Benjamin defined or extended, his resistance to Fascism, capitalism and corporate exploitation, are still applicable. The context of Benjamin’s key concepts, trace and aura, allows us to better position systems of concrete trace within network culture and digital reproduction, pointing to media critique that is wary of dominant commercial linear operations of technological development and consumption.

The aura is touched on in his earlier works and becomes central to ‘The Work of Art.’ Benjamin’s simplest definition is given when he pulls the concept away from the connotations of reproduction and relates it to nature:

What, then, is the aura? A strange tissue of space and time: the unique apparition of a distance, however near it may be. … To follow with the eye—while resting on a summer afternoon—a mountain range on the horizon or a branch that casts its

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shadow on the beholder is to breathe the aura of those mountains, of that branch.  
([1936] 2008, p.23)

As a definition, the statement above may be somewhat misleading and is certainly esoteric compared to the concrete definitions of the trace sought to this point. MB Hansen highlights the more common misleading understanding of the term “as an elusive phenomenal substance, ether, or halo that surrounds a person or object of perception” (2008, p.340). This popular take on aura is one that Benjamin may have been setting out to avoid or subvert. However, in a general sense, the aura is simply the qualitative feeling of awe inspired by a unique entity and the customs that support it, whether it is an object, artwork, photograph, music, performance, film or nature. Graeme Gilloch succinctly extracts Benjamin’s concept of aura, replacing magical halos and a breathable entity with more tangible makings for media critique, stating:

Aura is the particular power which an image or object has by virtue of its singularity, authenticity … to stimulate in the spectator or listener a sense of reverence and wonder. (2002, p.182)

In addition to the aura’s signature qualities of singularity and authenticity is the influence of a beholder’s mediated distance from an artefact. Jennings, in an editorial and translator’s endnote on the aura, adjoined to ‘The Work of Art’ essay, sums up this distancing, pointing out that:

At stake in Benjamin’s formulation is an interweaving not just of time and space …, literally ‘one-time appearance’—but of far and near, … suggesting both ‘a distance’
in space and time and ‘something remote,’ however near it (the distance, or distant thing, that appears) may be. (Jennings et al. in Benjamin [1936] 2008, p.43, n.5)

At this point we have an understanding of the aura that involves both time and space, but also the specific variable of distance imposed on an artefact via the systems and codes of its reproduction and consumption. Jennings provides a useful depiction of the aura’s dependence on mediated distance when considered via creative production. He suggests that:

this distance is not primarily a space between painting and spectator or between text and reader but the creation of a psychological inapproachability—an authority—claimed for the work on the basis of its position within a tradition. The distance that intrudes between work and viewer is most often, then, a temporal distance: auratic texts are sanctioned by their inclusion in a time-tested canon. (2008a, pp.14-15)

The next question to consider is, when and how does the aura enter the wider matrix of commodity via reproduction? In its more general understanding it is easy to relate Benjamin’s concept of aura to the heart of what motivates and stimulates creative production and consumption. However, Benjamin’s analysis of the shifting nature of the aura through history, relative to specific media, casts it, or the supposed removal of it from a particular medium, as a negative quality:

One might subsume the eliminated element in the term ‘aura’ and go on to say: that which withers in the age of mechanical reproduction is the aura of the work of art.
This is a symptomatic process whose significance points beyond the realm of art. ([1936] 2007, p.221)

Benjamin’s concept of aura, while it points beyond the realm of art, is at the same moment a condition of the realm of art and the art object as the product of a medium of representation couched in social content and relevance. Benjamin’s discussion of the aura is not a negative attack on a particular medium so much as an observation of a technological, social and cultural shift:

The uniqueness of a work is inseparable from its being imbedded in the fabric of tradition. … We know that the earliest art works originated in the service of a ritual—first the magical, then the religious kind. It is significant that the existence of the work of art with reference to its aura is never entirely separated from its ritual function. In other words, the unique value of the ‘authentic’ work of art has its basis in ritual, the location of its original use value. ([1936] 2007, p.223)

One of Benjamin’s key contributions to intellectual discourse on visual communications was to note that “original use value,” imbedded in the “cult value” of art, shifts under the impact of technical reproduction to “exhibition value” ([1936] 2007, p.225). The point here is that by 1936 a shift in the collective tradition and reception of ‘new media’ was well underway and Benjamin’s exploration of the aura’s relative shift was a means to highlight this change. There is a risk, however, that the potential of the aura as a means of continued contemporary media critique could be trapped and limited to a historical painting-photography-film contextual dichotomy.
Miriam Bratu Hansen explores the risk of marginalising the aura to Benjamin’s era of media development, suggesting that if we only accept the degradation of the aura across its shifts in mediation technology—for example, if it were applicable to the painting-photography-film paradigm of Benjamin’s era only—then it would be of little use today (2008, p.337). MB Hansen’s reading of the aura in Benjamin’s body of work, leads her to suggest that in his later works he allowed himself to “import fragments of the concept [aura]—secularized and modernized—into his efforts to reimagine experience under the conditions of technologically mediated culture” (2008, p.375). MB Hansen here, via Benjamin himself, gives permission for the aura to remain applicable to a changing mediascape. Likewise, Samuel Weber suggests that the aura persists in media reproduction, not as:

elimination but as alteration, which … turns out to repeat what aura always has been:
the singular leave-taking of the singular, whose singularity is no longer that of an original moment but of its posthumous aftershock. (1996, p.104-5)

In Benjamin’s essay, the aura shifts in status and alignment with the beginning of mass reproduction, its movement and alteration, which continues today in network cultures (to be discussed shortly). The aura in the era of mass production changed as art content began to be produced for mass consumption and as a self-referential exhibition value began to displace the art-work’s prior cult value:

By making many reproductions it substitutes a plurality of copies for a unique existence. And in permitting the reproduction to meet the beholder or listener in
his own particular situation, it reactivates the object reproduced. (Benjamin [1936] 2007, p.221)

Mechanical means of production—photography, film and phonographs—begin to force a shift in the use-value of creative content, production and consumption, corrupting conventional values of the aura as emblematic creative singularity:

For the first time in world history, mechanical reproduction emancipates the work of art from its parasitical dependence on ritual. To an ever greater degree the work of art reproduced becomes the work of art designed for reproducibility. … Its fitness for exhibition increased to such an extent that the quantitative shift between its two poles turned into a qualitative transformation of its nature. (Benjamin [1936] 2007, p.225)

The unique artwork becomes accessible to the masses, fragmented and malleable. It is now possible to reconfigure the original meaning and purpose of an object or artwork through its reproducibility. We can begin to see here how the concreteness of Benjamin’s trace moves in opposition to the aura as it is manipulated in such a context. At this point it is worth returning once again to the chapter’s introductory quote from The Arcades Project:

The trace is appearance of a nearness, however far removed the thing that left it behind may be. The aura is appearance of a distance, however close the thing that calls it forth. In the trace, we gain possession of the thing; in the aura, it takes possession of us. (Benjamin [1927-1940] 2002, p.447)
In the trace we have the concreteness of Benjamin’s natural history, as described by Buck-Morss (1989) when discussing his dialectical image. The ur-history, ur-phenomena and ur-form of recent media objects and their fossilisation give us an appearance of nearness, as an objective imprint as representation or reproduction. The aura, as read here (and as Buck-Morss acknowledges as a conceptual centre to Benjamin’s dialectical image), is on the side of the symbol, allegory and meaning exchange (Buck-Morss 1989, p.211). The tension imposed by the aura on the stability of the trace is a temporal qualitative force that highlights collective attraction toward “the sensation of an object unique to a specific time” (Kerruish 2012, para.8). The trace and the aura as dialectic across time and space coalesce in contemporary media, as quantitative and concrete materiality of the physical ‘and’ temporal qualitative difference informed by collective traditional response to technology. In Benjamin’s words: “In the trace, we gain possession of the thing; in the aura, it takes possession of us” ([1927-1940] 2002, p.447). This dialectic is a foundation for recent theories of transversal and transmaterial media engagement, also referred to as media archaeology, and is of relevance to the discussion that will follow.
The tension between trace and aura plays out in the ‘democratisation’ of media co-participation made possible by the intervention of technical media. An explicit example in the history of inscribable media is Edison’s phonograph (Fig.2.19). Promotion of the device highlighted home production comparable to records distributed commercially and the sharing of recorded ‘user-generated’ content. However, extending the scenario to networked creative production and consumption asks for an extension of Benjamin’s trace and aura dialectic, especially the mediated
distance between the supposed uniqueness, singularity and autonomy of digitised physical or analogue media artefacts and their aura. The impact of reproduction through analogue technologies also applies to networked digitisation, increasing the loss of aura and multiplying the increased accessibility of media and creative content. For example, accessibility to networked communication, user-friendly creative content manipulation software and open-source expertise witnesses the consumer increasingly capable of being the producer of creative content well beyond phonograph recordings. Our ability to copy and paste and take control of reproduction brings with it a massive loss of singularity or aura. Fittingly, as early as 1934, Benjamin, in his essay ‘The Author as Producer,’ championed a closing of the gap between producer and consumer:

The crucial point, therefore, is that a writer’s production must have the character of a model: it must be able to instruct other writers in their production and, secondly, it must be able to place an improved apparatus at their disposal. This apparatus will be the better, the more consumers it brings in contact with the production process – in short, the more readers or spectators it turns into collaborators ([1934] 2007, p.233).

Over the years since Benjamin’s essay first appeared, the gap between producer of media content and its consumer has become increasingly smaller. Pit Schultz, in ‘The Producer as Power User’, introduces us to a definition of the contemporary proletariat as producer ‘and’ consumer, a position in which most of us would sit:

Within the circumstances of today’s media networks it is impossible to not produce. The classical dichotomy of production and consumption has been
melted down by the circuits of communication and given birth to what marketing calls the prosumer. Also known as power user, neither professional nor amateur, neither hobbyist nor self-employed, between sofa and kitchen table, sometimes expert, sometimes dilettante. (2005, p.111, italics in original)

The contemporary consumer/producer of networked media is embedded in a sharing ethos that reinforces proliferation of creative content while increasing our distance from an aura of singularity conventionally associated with original content and/or the site of exhibition-value (cinema, gallery, concert hall, theatre). Schultz expands upon the condition of our existence as participating producers:

The order which controls the life of the power user derives from a computerised form of self-discipline. In exchange for her submission she is granted access to the platforms of free exchange. Her daily routines are structured by networked environments, the rhythm of digital media such as mobile phones, news blogs, the permanent build-up of private archives. … The power user is a voluntary file clerk in the global open archives; her singularity is embedded into a truly encyclopaedic digital commons. … Riding the top of the gaussian curve of social consensus production, the power user … serves as a redirector, a filter, amplifier, repeater, reporter and commentator of actualities. Travelling possibility space, she is processing and commenting upon news, in collaboration with other power users, as a fabrication of facts, to cover the structural uncertainty of the media society, e.g. the social risk to fall off the edges or stay behind. She says; ‘I post so I am’, frequently actualising her binary existence by publishing and posting, so more links go to and from her name and address. The power user dreams
of the singularity of the author, which she gave up for a passion for engineering. (2005, p.115, italics in original)

The 21st century apparatus of reproduction is so accessible and user friendly that we are now, to differing extents, global collaborators in distancing ourselves from the autonomy and singularity traits of Benjamin’s aura. For example, the cartography heat map visualisation of Twitter hashtag ‘#OpeningCeremony’ for the 2016 Rio Olympics (Fig.2.20), by Twitterdata, shows the worldwide accessibility, interaction and delocalisation with and of a broadcast (reproduced) event. We now have the potential to bring any form of creative content, moment or event closer through its digital reproducibility and to filter, extend and manipulate its singularity and framing as a prosumer in networked media exchange.

![Figure 2.20 Screen grab from twitterdata.carto.com showing the intensity and location of the ‘#OpeningCeremony’ hashtag used live during the 2016 Rio Olympics opening ceremony.](image)

11 This example highlights a live event rather than a physical object. Understandably, the event can be experienced and read as intensely auratic given its global ritualistic value. However, the extreme example is used to emphasise the potential for a loss of aura in the ‘bringing closer’ of it via a network of inscriptive user generated reproductions (the trace of the event) in addition to more traditional modes of live broadcast. The example is not provided to understate the auratic potential of a globalised event.
Digital networked media exchange amplifies a shift in Benjamin’s concept of aura relative to media production and consumption. It could be assumed that the aura relative to the singularity of unique material artefacts or analogue media is no longer prominent, having given way to activity behind a myriad of transparent fixed and mobile screens. The aura can dangerously be reassessed at supposedly immaterial collective sites of networked digital communication, independent of specific media/medium traits. If this is the case, then the trace’s dialectic connection to the aura is at risk of being lost. If Benjamin’s dialectic of aura and trace is to be brought forward to meet networked communication then a shift in the trace must also be considered.

As a reminder, the fundamental elements of Benjamin’s dialectical image in Buck-Morss’s schema (Fig.2.14) include “ruin (allegory),” “fetish (phantasmagoria),” “wish image (symbol),” and “fossil (trace)”. The seemingly intangible qualities of digital network media—a great archive in the ‘cloud’—understandably align more to the first three with links to the materiality, or rather, immateriality of network culture media.

The concreteness of media substrate via “fossil (trace)” is at risk of being left aside.

2.6 Trace and Aura: Sites of Tension and Change
At one extreme of the aura’s shifting state relative to more recent digital networked exchange is Mark Hanson’s (2004) redeployment of Henri Bergson’s ideas of body, spirit and memory in new media. Bergson was a French philosopher active in the early twentieth century, and Benjamin ([1939] 2007, p.157) drew on Bergson’s image-based metaphysics, as set out by Bergson in Matter and Memory ([1896] 1978). M Hansen draws on both Benjamin (2004, pp.1-3, p. 231) and Bergson; however, he does not specifically connect Benjamin’s engagement with Bergson. In M Hansen’s approach
to a ‘philosophy’ of the digital, Bergson’s image-based philosophy is discussed relative to the levelling of media qualities by digital universalisation (an audio and a video file, for example, are supposedly indistinguishable in binary digital form). Determinants of media specifics are, according to M Hansen (2004), consequently and inescapably converted to the body and embodiment of information via centres of perception and reception image layer systems (for example, see p.22). In effect, the qualities of traceable media surface take a back seat, are bypassed, or are dominated by the body as the ultimate filter of content. Hanson suggests that contemporary digital awareness is an extension of Benjamin’s aura that can lead to a new singularity and return to aura. M Hansen’s analysis is heavily dependent on his reconsideration of Bergson:

If the hypostatization of the formal act of framing reality vacates the artwork of its Romantic trappings (specifically, its autonomy and its objective status as the bearer of truth or the idea), and if the shock-effect relocates the impact of the work squarely in the domain of experience, this is all in service of a redemption of embodied experience: a renewed investment of the body as a kind of converter of the general form of framing into rich, singular experience. One might even characterize this properly creative role accorded the body as the source for a new, more or less ubiquitous form of aura: the aura that belongs indelibly to this singular actualization of data in embodied experience. (2004, p.3, italics in original)

M Hansen argues that data is an “embodied” experience. He suggests that the aura is no longer associated with the cult-value or exhibition-value of an artwork or artefact but rather is a user-centred value. Similarly, Benjamin’s trace must face this model of
reception that seemingly forgoes the ‘concreteness’ of Benjamin’s original conception of trace and inscriptive media.

M Hansen (2004), as abridged here, is perhaps at a philosophical extreme of the movement away from digital re/production as terminally virtual or immaterial. Such a movement is broad, but has roots in three areas of concern in addition to embodiment. Firstly, the supposed universalisation or flattening of specific media qualities in their conversion to a digital data stream raises tension between symbolic mediation (human interpretation) and the physicality of communication storage/reproduction devices. These concerns are founded in the ‘media discourse analysis’ of Friedrich Kittler, where, in Gramophone, Film, Typewriter ([1986] 1999), we are asked to consider media and consequential cultural practices from the basal physical pointers of storage machines and their differing data channels. In this view, humanist symbolic exchange is grounded against systems of symbolic computation. Contrarily, Lev Manovich’s The Language of New Media (2001a), Post-media Aesthetics (2001b) and Software Takes Command (2013) champion universalisation in the glow of software’s potential to alter the state of specific media qualities. The problem with this viewpoint is that the specific qualities of a medium, which accommodate a concrete trace or mark, risk being dissolved, veiled or distanced by digital idealism from a basal level of inscription. Secondly, there is the question of the ephemeral effect of digital virtuality on matter dominated by the speed and exchange of information (Virilio 1998). This is a concern due to the supposed dominance of ‘fast information’ over the concrete physicality of the media substrate upon which the trace is dependent. Thirdly, and most importantly, there are the foundations of ‘affect’ as understood from the complex
rendering of mediated virtual experience by Brian Massumi (1998; 2002; 2008). Massumi details experiencing the virtual via ‘thinking-feelings’ beyond Cartesian dualism, mind and body, real and ideal, as well as beyond the triadic addition of the virtual, ultimately moving us beyond the reductive consideration of the analogue and digital simply reflected by the actual and virtual. He says:

The medium of the digital is possibility, not virtuality, and not even potential. Digital coding is possibilistic to the limit. … Nothing is more destructive for the thinking of the virtual than equating it with the digital. … The crucial point is that the digital is virtualized and potentialized only in its integrative circuiting with the analog, in the way in which it is integrated into the analog or integrates the analog into itself. (1998, pp.309-11)

The virtual is better considered, across both analogue and digital mediation, as “inaccessible to the senses” (1998, p.305) yet “sensation—always on arrival a transformative feeling of the outside, a feeling of thought—is the analog, matter in analog mode” (1998, p.307). In other words, an analogue of the outside world modulated in transposition, embodied or perceived just like the groove on a vinyl record is an analogue transformation of sound waves. The trace shows its potential to move across the inscriptive surface of media ‘and’ symbolic exchange. And, as M Hansen (2004) suggests, the trace can meet mind, body and embodiment as centres for auratic shift. However, Massumi does entertain the imaging or imagining of the virtual:

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12 Massumi leans on Deleuze and Guattari’s body of work here. Deleuze and Guattari are acknowledged along with Bergson. However, extension of discourse to include their body of work is beyond the scope of this study, as is the arena of affect theory. Instead, the trajectory of the trace as observed and described in action and practice, via Benjamin, at the point of media production and consumption is prioritised as sufficient in provisioning the present discussion.
Images of the virtual make the virtual appear, not in their content or structure, but in fleeting, in their sequencing or sampling. The appearance of the virtual is in the twists and folds of content, as it moves from one sampled structure to another. It is in the ins and outs of imagistic content or structure. (1998, p.305)

For Massumi, “[n]o one kind of image, let alone any one image, will do the trick” (1998, p.305) in making the virtual appear. The answer is instead in a multiplicity of images as offered by ‘topology’ and the constant transformation of images (1998, p.306). The trace, it would seem, as outlined already in the linear and non-linear function it has within and across images, their re/production, consumption, codification, tradition and context, also has the potential to work across the virtual (analogue and digital) as we “move from one sampled structure to another” relative to exchange, continuity and time. The trace, under such a lens, not only has potential in making the virtual appear—it is the presence of an absence—but allows us to follow and freeze-frame the trails of connection, continuity and movement between images and media forms through the “fleeting in their sequencing or sampling.” The trace is the go-between of images, connection points across their “ins and outs.” Under such consideration the trace gives permission to return to the medium and inscriptive surface as matter in media inquiry alongside the body. Perhaps, across the evolution of such language, the aura is the virtual and the trace the actual.
In ‘On Some Motifs in Baudelaire’ ([1939] 2007, pp.155-200), Benjamin once again draws on Bergson to engage the mechanical ‘shock’ effects of media and the integration of technology in a city living with a degradation of aura. Benjamin concludes the essay saying that Baudelaire, as his token flâneur and conduit for the qualities of modern city life, “indicated the price for which the sensation of the modern age may be had: the disintegration of aura in the experience of shock” ([1939] 2007, p.194). Shock in this sense is a process of, for example, the speed and hustle of dealing with traffic as a pedestrian—having to learn a technology of lights and signals to survive the speed of traffic leaves no option but to integrate shock into one’s experience ([1939] 2007, p.174). The beginning of narrative film production, depicting moments in the career of Georges Méliès (France: 1861-1938), is re-created in 2011 by Martin Scorsese in his film Hugo (Fig.2.21). Scorsese includes self-referential recognition by rescreening the brothers Auguste and Louis Lumière’s short L’arrivée d’un train en gare de La Ciotat (The Arrival of a Train at La Ciotat Station) (1896).
Scorsese (2011) shows the ‘shock’ effect of cinematography’s filmic illusion as experienced by the first-time audience grappling to come to grips with this new form of visual information and entertainment. The mechanical qualities of cuts and edits that comprise the film format developed by Georges Méliès take advantage of the shock snap of a camera’s shutter on the experience of the aura: “In a film, perception in the form of shocks was established as a formal principle. That which determines the rhythm of production on a conveyor belt is the basis of the rhythm of reception in the film” (Benjamin [1939] 2007, p.175). These technological experiences shock the aura out of a system of singular contemplation. Benjamin uses Bergson to detail the aura’s qualities relative to media, stating:

If we designate as aura the associations which, at home in the mémoire involontaire, tend to cluster around the object of a perception, then its analogue in the case of a utilitarian object is the experience which has left traces of the practiced hand. The techniques based on the use of the camera and of subsequent analogous mechanical devices extend the range of the mémoire volontaire; by means of these devices they make it possible for an event at any time to be permanently recorded in terms of sound and sight. Thus they represent important achievements of a society in which practice is in decline. ([1939] 2007, p.186, italics in original)

An object here can provide aura via the involuntary memories it conjures when contemplated: a space that accommodates contemplation of a traditionally crafted object and its obvious trace. However, when memories are intentionally recalled mechanical reproduction moves in to alter trace and aura to a position beyond
singularly crafted objects. Again, here we are reminded of the grand narrative of art that supports the cult-value aligned with the aura—“the philistine notion of ‘art’ in all its overweening obtuseness, a stranger to all technical considerations, which feels its end is nigh with the alarming appearance of the new technology” ([1931] 2008, p.275).

In mechanical reproduction the aura moves away from the serendipitous contemplation of an object and its ultimate creator. Benjamin suggests that “aura thus rests on the transposition of a response common in human relationships to the relationship between the inanimate or natural object and man” ([1939] 2007, p.188). We can find the aura via a returned gaze or story in an object—a reflection of tradition and history distanced from us by the object itself ([1939] 2007, p.188). Here we can associate the trace. The trace is tangible evidence of a story, a tradition or history and aura the power of distance imposed by the trace of the object, the object itself or its content. Neither the aura nor the trace is lost to mechanical reproduction though, only found elsewhere across time and the development of technology.

The photograph, in its ability to freeze time and aid intentional memory, opens the possibility of a returned gaze, in the act of the photographer’s eye, in capturing the photographer’s view and in the returned gaze of a photographed subject, as in a portrait. The process of photography can still accommodate the aura via association with cult-value, having the dual potential of aiding in both involuntary memory or imagination and intentional memory recall:
To perceive the aura of an object we look at means to invest it with the ability to look at us in return. This experience corresponds to the data of the *mémoire involontaire*. (These data, incidentally, are unique: they are lost to the memory that seeks to retain them. Thus they lend support to a concept of the aura that comprises the ‘unique manifestation of a distance.’ This designation has the advantage of clarifying the ceremonial character of the phenomenon. The essentially distant is the inapproachable: inapproachability is in fact a primary quality of the ceremonial image). (Benjamin [1939] 2007, p.188, italics in original)

Furthermore, it is again reproduction itself—the idea of image copies—that, in addition to shock, is the source of auratic degradation. More specifically, a desire for the aura or an attempt to create aura in production revolves around a play across time and the development of technology. In ‘Little History of Photography’, Benjamin highlights the aura as a “strange web of space and time: the unique appearance of a distance, no matter how close it may be” ([1931] 2008, p.285). Following on, he says that to bring things closer to us, or rather the masses, is just as passionate an inclination in our day as the overcoming of whatever is unique in every situation by means of its reproduction. Every day the need to possess the object, from the closest proximity, in a picture—or rather a copy—becomes more imperative. And the difference between the copy, which illustrated papers and newsreels keep in readiness, and the original picture is unmistakable. Uniqueness and duration are as intimately intertwined in the latter as are transience and reproducibility in the former … even the singular, the unique, is divested of its uniqueness—by means of its reproduction. ([1931] 2008, pp.285-86)
However, this notion does not stop a desire for the aura in production and consumption. Instead a balance is struck between the usability and the clarity of technological development (a collective taming of shock and reproduction) that results in the aura being attached to the desire for the trace of past media. Benjamin highlights the phenomenon in the technical and social development of photography:

After 1880, though, photographers made it their business to simulate the aura which had been banished from the picture with the suppression of darkness through faster lenses, exactly as it was being banished from reality by the deepening degeneration of the imperialist bourgeoisie. They saw it as their task to simulate this aura using all the arts of retouching, and especially the so-called gum print. ([1931] 2008, p.283)

The idea aligns with embedding an object in a tradition to target the aura, manifest by the mimicry of past techniques of reproduction and contextual content in the realm of new ones. Benjamin’s attitude toward such an approach to aura, in general here, reads as negative or inert in terms of collective progression (a desire for an emulated aura and trace). However, at this point today trace and aura come together in a unique way and underpin the relationship between digital and analogue reproduction. The addition, for example, of vinyl surface noise to digital audio production or the manufactured textures, dust and jitter of analogue film has culminated in the likes of one-button instantaneous nostalgia effects exemplified by smartphone applications such as Instagram.
Figure 2.22 Screen grab of Instagram’s iPhone application edit screen (2016) featuring a ‘selfie’ of the author with the additive/repeated use of the service’s filters, from ‘Clarendon’ through to ‘Lo-Fi,’ showing a manufactured or emulated trace of past photography techniques.

Instagram facilitates the ability to apply a quality of manufactured aura, via the emulated trace of past analogue photographic ‘filter’ processes, to an otherwise ‘digitally’ produced image (Fig.2.22). The popularity of such applications is proven by the high download rankings they obtain and their immense user-base if integrated
with social media engagement (Instagram hit 600 million active users in 2016). However, the phenomenon of applying analogue qualities within digital reproduction is not new. We have, if production time allowed, been able to achieve the same result via bitmap filters in desktop computer platforms for decades. Such image manipulation is a more manual digital process but is still removed from the original analogue one, although the process has now transformed into a commodity and a form of meta-photography with multiple levels of emulated trace and agency in both consumption and production contexts. Instant analogue qualities applied at the point of a smartphone camera click, while reminiscent of Polaroid cameras, are unique from digital image manipulation done at fixed workstations. The difference revolves around the combination of mobility, immediacy and proximity to social media distribution.

Examples of a social media shift in the use-value of emulated photographic trace reminiscent of Benjamin’s early observations revolve around two main concerns: networked exchange value increases when filters are used and practices of their addition to images in turn are influenced by this increase. Firstly, Saeideh Bakhshi et al. conducted a large-scale data analysis of filter users to answer why they are added. Their relevant findings state:

Through quantitative analysis of mobile photos, we find that filtered photos attract more implicit usage as well as explicit action from viewers. Filtered photos are 21% more likely to be viewed and 45% more likely to receive comments, compared to non-filtered ones. Specifically, we find that filters that impose warm color temperature, boost contrast and increase exposure, are more likely to be noticed. (Bakhshi et.al. 2015)
Secondly, in addition to increased image exchange participation as a result of filters, Julian Stallabrass finds reasons for their use in practice concerning ‘selfies’: “Such accidental effects have been banished by sophisticated camera technology only to be reintroduced in simulated form” (2014, para.3). Additionally, the practice is combined with the speed of digital networked distribution. Instagram images “are low-resolution messages, to be glanced at rather than pored over. As with much digital culture, the experience is of rapid flow rather than contemplation” (2014, para.6). As compensation for a lack of aura due to a lack of contemplation time—perhaps a reaction to fast-media—the trace is grasped at ‘en masse’, Stallabrass continues:

Here is instead a popular urge to present the common and the mundane as wonderful using the photographic quirks, accidents and faults of the past. The look of the analogue snapshot – a discrete physical object that may fade and fray, be kept or lost, be framed, carried or stuck into an album – is knowingly and ironically invoked against the digital torrent into which images are continually thrown. (2014, para.7)

Subsequently, with Instagram, the trace mutates further finding additional value in combination with a desire for aura. Error or blemish in the subject is ironically covered with the simulated trace of past photographic technology—imperfection to cover imperfection in the face of sophisticated photographic perfection and simulated perfection such as airbrushing practices. Stallabrass elaborates:

Since so much Instagram activity is about self-presentation, a major advantage of simulated analogue faults is that they can be used to conceal faults in the subject,
when judged against today’s beauty standards. Warm-tinted film was, after all, originally designed to produce flattering skin tones. (2014, para.8)

All the while, behind the immediate past qualities of the photographic images produced by Instagram stands the trace of photographic tradition in practice—a history of technology and technique that accommodates the aura in the use of the application itself—bringing us again to the dialectic of aura and trace. As highlighted by Stallabrass, the name of the software application and filters within implies past positioning and nostalgia, for example, simply in the combination of ‘instamatic’ and ‘telegram’ to form ‘Instagram’ (2014, para.5) but as important is the lineage of mobile technology practices that support the software. Stallabrass finds a recent past for Instagram beyond photograph qualities in the ‘Lomo’ camera, which was a low-quality Russian amateur camera known for its unique qualities and low light performance that sparked a photographic movement in the late 1980s and 1990s. Stallabrass says the “technical oddities of the results were complemented by the Lomo shooting style. Photographers were urged to embrace chance and shoot from the hip: ‘Don’t Think.’” (2014, para.4). A trace of the Lomo technique and device is found in the point-and-click practice and output of Instagram and similar applications. These digital applications, summarised above, remind us of Benjamin’s concern for the aura manifest via the trace and its shift, post-Benjamin, into networked reproduction technology. The trace of the qualities of an analogue photograph along with photographic techniques that mimic earlier technical formats is used to increase social media image exchange as a kind of image authenticity.
In contemporary networked digital social media there are also examples of approaches that do not emulate older media processes but do align with the shift from Benjamin’s concepts of aura and trace as outlined to this point. Unlike the shock edits of film or the ease of an object’s reproduction via its photograph, where the wonder of one-off ritualistic or crafted artefacts is lost, a return to singularity can be found at the point of prosumer object production. 3-D printing, for example, enables one to bring an object closer to the point of immediate presence via open source design and DIY home production. The controversial subculture practice of 3-D gun printing as highlighted by wired.com (Greenberg 2014), for instance, enables the production and possession of firearms outside the control of legislated distribution. The object is not embedded
in or restricted (distanced) by a social or legal wall of tradition to instil aura in the beholder, if in fact a traditionally manufactured gun could be given a one-of-a-kind cult-value aura. Rather, the aura is combined with the trace of an object forming a different kind of aura-trace dialectic. The trace of a gun can be found in the shared open source gun design, the computer-aided design (CAD) file (Fig.2.23), and the digital metadata of the design that aids in the detective work of finding the said design. The trace, here, is not ‘left behind’ by an object but comes before it as projective or prior plan. The scenario involves an intentional trace, flipped or reversed in analytical and symbolic function from Benjamin’s conception of the concept, informed by a non-linear but also a future facing ‘angle of history’ (Fig.2.8) in the trail of digital networked exchange between design plan and production. Like mapping before expedition, the trace of an object can come before the object itself.

The yet-to-be 3-D printed gun has aura via its quality of distance from the prosumer, but also in a proximity to tangibility—the design plans are a trace and have aura relative to the object to be produced. However, once printed, according to Benjamin’s original dialectic, it would seem, the 3-D gun should lose its aura. The object no longer has the “appearance of a distance” as it is now physically present as a shared reproduction, although there is singular contemplative possession of a material object and we must remember that “aura is appearance of a distance, however close the thing that calls it forth” (Benjamin [1927-1940] 2002, p.447). The physical gun is as close as it can be; yet the aura could come from the prosumer’s unique inflections on the original design such as plastic type and colour choice or other modifications (unique material traces). The beholder is certainly more steeped in a
tradition of production, but is able to literally take possession of it and counter it to produce singular (customised) material objects as opposed to being limited to more exact mass-produced copies (Fig.2.24). The original meaning and purpose of an object is again reconfigured through its reproducibility—“the work of art reproduced becomes the work of art designed for reproducibility” (Benjamin [1936] 2007, p.225). Additionally, the tradition of law, in the case of firearms, always threatens to distance possession. The process moves the aura away from a distanced intangibility, digital immateriality, or virtuality and plants it back in the realm of physical hybrid analogue-digital reproduction and the trace of inscriptive media. The inert transparency of the screen, in digital networked exchange, is countered by the aura of the prosumer’s mastery of matter. Of course, mastery and the aura are always under threat by the ease of such reproduction. 3-D printing is a literal example of hybrid analogue and digital reproduction that makes Benjamin’s aura-trace dialectic more complex and worthy of reconsideration.

Figure 2.24 Image by ThreeD Ukulele of the prosumer customised 14 shot ‘Grizzly 2.0’ 3-D printed gun held by the gun maker known only as ‘Matthew’ online.
Benjamin’s aura-trace dialectic reminds us that the trace, like the aura, takes form beyond a general understanding of one-off objects and imprints of the craftsperson. The design and control of user experiences relative to the mass-produced treatment of content, through networks of production, can be examined in addition to the likes of 3-D printing. For example, through the mechanical format of newspaper re/production and consumption the trace is always at play in the design and experience of communication. Benjamin says:

If it were the intention of the press to have the reader assimilate the information it supplies as part of his own experience, it would not achieve its purpose. But its intention is just the opposite, and it is achieved: to isolate what happens from the realm in which it could affect the experience of the reader. ([1939] 2007, pp.158-59)

The newspaper format is brought into consideration as an important factor in the use of a medium to manipulate experience. The hierarchy of page order and content, as information design for example, including headlines and sub information, can prioritise one news story over another and influence the reading experience in addition to the editorial selection or omission of content. There is an “isolation of information from experience” ([1939] 2007, p.159) that resists singular unique embodied experience by imposing a way of reading on all readers. The practice of gaze plots and eye tracking quite literally provides a trace of page layout in this context. Eye tracking technology follows a user’s micro eye movements to provide a visualisation (Fig.2.25) of the path and eye dwell time of a reading experience.
This technique allows production decisions such as page advertisement positioning and the type and amount of imagery used. In this case, the trace of page layout and its design is as much a trace as the mark of a craftsperson in a one-off production, in that the page designer’s mark is left in the mass-re/produced product as a signature manipulation of page format. The understanding here is that there is always a system of trace at play that grinds against the fragility of the aura in popular collective media experience. And through the system, for example, a story’s journey through the likes of narration, newspaper and the sensation of film, is the hallmark of both the content’s and the format’s trace. Information is not stripped of the trace of a storyteller or the trace of a format of communication. It is the experience itself, the means of
consumption effected by the trace of technology, which alters the aura. The reader is not taking possession of a story’s content but rather bringing it closer via a medium’s trace: “In the trace, we gain possession of the thing; in the aura, it takes possession of us” ([1927-1940] 2002, p.447). The two are also dependent on one another in this scenario, or more specifically the aura is dependent on the trace, relative to the development of mediated experience. If “no breath of prehistory surrounds it: there is no aura” ([1939] 2007, p.185)—there is no aura without trace. Trace and aura culminate with dialectic function at the site of a medium’s collective auratic value across time. The ‘change’ in material format of technological re/production becomes central to the idea of the trace.

Mules highlights a material resilience associated with the trace in the face of digital reproduction. In Mules’ paper, ‘Aura as Productive Loss’ (2007), in a manner similar to Mark Hansen’s (2004), the problem of the trace is made more complex when processed through networked digitisation. The aura has a tendency to be couched in the realm of phantasmagoria, recalling Buck-Morss’s categories of dialectical image, but cannot forgo trace, he says:

Aura is reinvested in the body as an immediate experience of ‘being connected’ where the outside world seemingly dissolves in the presence of a far more enticing virtual world, full of new possibilities for interconnection. But the material world won’t go away. It persists as a stubborn residue, insisting that the body remain where it is: earthed in an historical milieu composed of the traces of outdated techniques and calculations that retain their power to affect contemporary life. (Mules 2007, para.20, italics in original)
Mules, as already mentioned, also proposes a media origin that bears a direct relationship to a refined concept of aura, via Benjamin’s concept of mark ([1917] 2008), that Mules argues opens up “space from within the immateriality of contemporary experience; to make contact with an ‘outside’ that is materially present as the yet-to-be realisation of some other form or mode” (2007, para.23). Similarly, the present study seeks to address this material turn by placing the concept of the trace, as weight, on the virtual or immaterial contemporary experience of media re/production and consumption—a media archaeology alternative to balance notions of absolute virtualisation or simulation in digitisation.

2.7 *Chapter Conclusion*

With two feet firmly planted on the ground, fingers on the keyboard and digital files inscribed in the binary on-off physicality of computation and the hard drive’s magnetic surface, it is reasonable to suggest that inscriptive media ‘and’ the symbolic operations of networked computation (as a source of virtual ideologies) are rendered traceable. In short, media activity and use can be empirically followed as a methodology, even across hybrid materialities or supposed immaterialities, with trace. The persistence of the concrete trace found in, or as substrate to, inscriptive technical media in a networked digital realm, central to this study’s trajectory, is the basis for such a suggestion.

The contemporary digital producer/consumer may move away from the aura of singularity (original artefact), in the attempt to bring closer the form that has been
mediated, while there is a corresponding turning or shift back to the original use-value of creative content and its trace. Often what is brought close by the digital producer/consumer is a digital fragment of an analogue original (of a material thing). At this point it is worth returning to Benjamin’s claim in respect to the attraction of reproduction:

It rests on two circumstances, both of which are related to the increasing significance of the masses in contemporary life. Namely, the desire of contemporary masses to bring things ‘closer’ spatially and humanly, which is just as ardent as their bent toward overcoming the uniqueness of every reality by accepting its reproduction. Every day the urge grows stronger to get hold of an object at very close range by way of its likeness, its reproduction. Unmistakably, reproduction as offered by picture magazines and newsreels differs from the image seen by the unarmed eye. Uniqueness and permanence are closely linked in the latter as are transitoriness and reproducibility in the former. To pry an object from its shell, to destroy its aura, is the mark of a perception whose ‘sense of universal equality of things’ has increased to such a degree that it extracts it even from the unique object by means of reproduction. ([1936] 2007, p.223)

The persistence of analogue reproduction, for instance, vinyl records and players, as stand-alone analogue systems and the simulated trace of analogue media qualities, in contemporary media production and consumption, despite the technological progress of digital alternatives, reflects back on Benjamin’s concept of auratic cult-value and emulated trace. Not in the religious or ceremonial sense, however, although for some consumers it may go that far, but in reaction to the ‘transitoriness’ of the mass and speed of networked digital reproduction. Analogue media can now represent “the
image seen by the unarmed eye” (Benjamin [1936] 2007, p.223). Counter to digital systems and output, analogue reproduction offers the possibility of “uniqueness and permanence” ([1936] 2007, p.223), the original, the autonomous, a reverential path, and consequently a manifestation similar to Benjamin’s aura. Benjamin’s trace, on the other hand, needs to be revisited and subsequently divided to function across both its concrete physical possibilities and the formal processes of symbolic networked digital computation, if it is to remain in a functional dialectic relationship with Benjamin’s aura.

The mimetic quality of analogue reproduction, such as the crackle of a vinyl record, the warmth of an electron tube or the crystal formation on a 35mm negative, is not only nostalgia, reverence or fetish when filtered through the work of Benjamin laid out here. Analogue reproduction can provide unique auratic matter through its singularity and historical stubbornness. Similarly, the recent-present history of analogue reproduction reads as if, to quote Benjamin, it is “imbedded in the fabric of tradition” ([1936] 2007, p.223), and its use is positioned similarly to the fossils of the bourgeois, “not merely ‘failed material.’ … [A]s traces of prior life, they are historical clues, with an objective meaning” (Buck-Morss 1989, p.66). The digital space analogue reproduction crosses requires that Benjamin’s trace, as a mechanism of media enquiry, be rendered more flexible so as to cope with its varied reproduced manifestations. Analogue reproduction is characterised, for example, in stand-alone reproductive (often playback) systems; the consumer’s vinyl collection kept exclusively for playing on analogue high-fidelity systems; resists the malleability and mobility of digitisation. Additionally, digitally emulated analogue qualities that resist medium authenticity and origin foster complex hybrid systems of re/production
and exchange of trace—a manufactured intentional trace as opposed to an accidental, found or consequential trace.

Consumers and producers of creative content are often accused of, at least in part, clinging to the properties or sensation of the aura. In 1936, Benjamin led us to consider the behaviour of the aura within a Marxist superstructure, and in contemporary networked digitisation we can find reification of the process in reactionary manifestations of the trace. Does the recouping and repositioning of analogue systems and emulated qualities, despite digital alternatives, point to a conceptualisation of the trace that is worthy of media inquiry in a digital network context? The ambiguity surrounding the concrete traceability of reproduction in a digital realm calls for the concept of trace to split in two at the point of analogue-digital and digital-analogue conversion, often an integrated circuit that converts continuous analogue signals to discrete digital samples or vice versa, forming a methodological divide. The divide is necessary in the need for a means to follow the linear and non-linear lineage of a medium’s trace over time and ‘transversal’ media forms.
3. NETWORK CULTURE: TOWARD A TRANSVERSAL TRACE

Figure 3.1 Trace: A Taxonomy of Enquiry. Diagram by Greg Hughes (2016). This chapter is set at the point of ‘Transversal Trace.’ At this position, articulations of the trace and supporting theories are examined in the context of network culture to suggest that the trace takes on a transversal function across broken and immutable symbolic work. Consequently, the chapter points toward a need for a split path of enquiry around technical media couched in network culture.
Figure 3.2 Intelity: #14, C-type matte photograph by Maximilian Tomozei (2015), showing a close-up view of a scratched and degraded electronic security chip. The piece highlights a transversal site between a physical trace and the trace of digital identity as stored in or via the chip.

Figure 3.3 oh!milgas, an audiovisual installation with a plexibox housed ant colony, turntables, audio, camera, monitor, variable dimensions, by Kuai Shen (2012). The work shows an example of transversal media practice as something more than ‘multi,’ ‘convergent’ or ‘mixed’ media in that new, bizarre or experimental channels of signal feedback between disparate spheres of communication are facilitated for new knowledge. In this case, nature and technology are ‘connected’ allowing feedback between ant colonies and a media artefact (turntable).
3.1 Trans?
The focus of this chapter concerns the transversal state of media in digital network culture. The chapter will outline what is meant by the ‘transversal,’ beyond its application as a metaphoric geometric concept. In doing so, this chapter will also map a contextual site of media practice that activates a reworking of the trace. The concept of ‘transversal’, as it relates to the assemblage of mediums, will be defined as a priority. Building on Benjamin’s concept of the trace as a mode of media inquiry applied to digital mediation, we need to examine the trace as active at points of
articulation in digitisation. In particular, what inscriptive media reproduction qualities alter and remain between the exchange of contemporary media artefacts and their use? The proposition is that the trace allows us to follow and capture or conversely disconnect a transversal relationship, in a context of transversal media production, cutting across the trajectory lines of otherwise separated, dual or non-discursive media paths. Organisation, intervention, connection or disruption of what alters and remains between the representational paths of contemporary media artefacts and their trace are brought into question when transversal intersections are formed or ruptured. The goal is to prioritise a ‘crossing’ of the layering, merging and networking of inscriptive media qualities and techniques to afford an examination of the trace as a medium of ‘transaction.’

The network culture oriented ‘transversal’ media theories and practices to be explored revolve around a combination of Kristoffer Gansing’s (2011; 2013) ‘transversality’ and Matthew Kirschenbaum’s (2008) take on trace relative to inscription, storage and ‘transmission.’ The work of both authors aligns with media archaeology as a part of a ‘trans’ lineage in media theory addressing differentiated morpheme combinations. A set of select examples includes Jay David Bolter & Diane Gromala’s (2003; 2000) myth of ‘transparency,’ where the interface is championed as a possible value-add intervention between user and content rather than something ultimately hidden by design to be successful. Additionally, the concept of ‘Transition’ (Thorburn & Jenkins 2003) as contemplation of media evolution as opposed to revolution, the old in the new, is a fitting example. Mitchell Whitelaw’s (2008; 2012) theory of ‘transmateriality’ as the contemplation of materiality or physicality of the digital and

Equally close to disciplines that analyze material (hardware) culture and to the Foucauldian notion of the ‘archive’ as the set of rules governing the range of what can be verbally, audiovisually, or alphanumerically expressed at all, media archaeology is both a method and an aesthetics of practicing media criticism, a kind of epistemological reverse engineering, and an awareness of moments when media themselves, not exclusively humans anymore, become active ‘archaeologists’ of knowledge. (2011, p.239)
There is a thread of concern with the physicality of media underpinning these listed concepts, and it is from such modes of observation that discussion emerges, reflecting the materiality of media change and development in the interconnection afforded by the trace and its substrate media forms.

What might articulations of the trace or a trace that affords an articulated and thus transversal medium look like? Maximilian Tomozei’s (2015) photograph *Intelity: #14* (Fig.3.2) captures an almost microscopic close-up perspective of a scratched and degraded electronic security chip, a device embedded in most bank and security cards today. As an additional play on notions of physical and digital identity the object is photographed using processes of analogue portraiture. Tomozei’s work highlights a transversal site between physical (or analogue) inscription and networked digital spheres of trace. Specifically, in this example the trace is present both as degradation and intervention with the material surface of the chip, an impression of the user’s unique physical treatment and storage of the artefact, and as a networked digital trace, such as financial records, location data, purchase habits and the like. Tomozei refers to the physical trace in the object captured by the photograph as “re-integrating the human aspect” (Tomozei 2015) back into digital identity. Of more value, from a ‘transversal’ media point of view, is that this ‘re-integration’ is the facilitation or articulation of a channel, at a critical site of trace, between physical and digital modes of symbolic work. The chip is an A/D converter in more ways than we might otherwise realise. Another example is the large format photography of Christoph Morlinghaus (Fig.3.4), that relies on a ‘long exposure’ analogue photographic process (Locke 2016) to capture and reveal the physical intricacies (concrete trace) of a digital signal.
processor, the Motorola 68030. The process and resultant objective image are powerful in their micro documentation of an intricately engineered artefact, but also afford a connection point between the trace of the photographic process utilised, the surface of the signal processor and the veiled means of digital signal processing within.

Examples of transversal media do not need to be tied to the surface of integrated circuits. Parikka (2011b) highlights a kind of transversal media practice that becomes a “practice as theory” (2011b, p.34) in the context of media art. Parikka (2011b, pp.34-46) suggests Fuller’s (2005) concept of ‘media ecologies’ is central to practice becoming theory. This transversal media practice is most evident where disparate medium channels are brought together for their potential facilitation of “methodologies and questions with which to try out what could act as a medium; what flows, what carries, what bends time and space” (Parikka 2011b, pp.45-6). In this sense, ‘transversal’ becomes a concern grounded in media theory and practice, but also inter- or trans-disciplinary practice-led research. Oh!m1gas by Kuai Shen (Fig.3.3) exemplifies transversal practice as research. The bio-audiovisual installation brings together an ant colony biosphere, cameras, monitors, microphones and turntables. Of most interest are the audible communication techniques of ants that are brought into proximity and feedback with that of phonograph record scratching: the two entities share similar audible characteristics. The assemblage opens up a feedback channel between media artefact and its trace, and the dynamics of the biosphere as the trace of ant colony behaviour. Transversal media practice in this regard exhibits an important difference from those of Tomozei (Fig.3.2) and Morlinghaus (Fig.3.4) and their examples of trace. The supporting framework employed here leans on an intentional
practice of intervention in the remixing of communication channels and their trace, while the others stem from the documentation or inclusion of an involuntary archival type of trace, a following of devices and culture. Both are important modes of transversal media assemblage in action, but their difference highlights a core challenge for the trace in network culture.

The ‘Trans’ issue of *The Fibreculture Journal* (2011) further legitimises a media ‘transfixation’ via the key complexities of media transduction, transversality, and transmateriality. As Murphie et al. (2011) point out:

> It is now perhaps a commonplace that digital, networked and informational media are extremely transient. They diversify in form and function at a dizzying rate. At the same time, they transit and fuse ‘social’ and ‘natural’ differences in a manner which reconfigures all the worlds involved.

Transfixation harnesses a pause to reflect on ‘time’ or the temporality of media as a consideration of transversal media assemblage.Compatibly, Benjamin’s conception of the trace and the idea of a ‘recent past’ (Buck-Morss 1989, pp.65-68) hold value when applied to media’s increasingly smaller, faster and integrated formats of communication and signal processing. In this context, Benjamin’s trace can aid in identifying the operations of fast media by treating fast media as immediately archaic, without the need to wait for fast media to be written into history. For media to be labelled ‘trans’ there must be networks of operation across media types, iterations, borders and paradigms, and with this exchange comes the trace, that is always present, always already past, always absent.
Benjamin provides a primary platform for considering transversal media, as well as a method of thinking ‘with media’ that can be applied to theorisation and media archaeologies. It is Benjamin ([1927-1940] 2002, p.447) who addresses the movement and consequential play of difference between aura and trace. Additionally, Benjamin is a champion for mediums, like photomontage (Buck-Morss 1989, p.67), that have the ability to merge and intervene on the practice, cultural codes and channels that support them. Max Pensky describes Benjamin’s method, in its extension of Marx, as a kind of dialectical reversal between ‘wish images’ and ‘dialectical images,’ suggesting:

the collective expression of these archaic wish images, in order to become effectively reversed into a politically shocking force, must be represented, and recognized, precisely for what they are; and it is this representation and recognition that the dialectical image constitutes. (2004, p.185, italics in original)

Benjamin’s trace can be annexed by focusing on the symbolic work of signature media qualities in modes of digital re/production, especially the transversal operations of media artefacts ‘and’ their substrates. The approach is a starting materiality that extends media analysis beyond discourse to the symbolic work of the trace found at sites of feedback or crosstalk between wish images and dialectal images. To be of value this extension should encompass the media qualities and abstractions that assemble in translation and transformation alongside their supporting practice. The argument here is for a kind of media typology and topology less interested in media determinism, definition or discrimination, than in allowing the intermediary across analogue and digital assemblage to be found via the trace but not bound to it. More specifically,
observations of the active trace inherent in trajectories of analogue qualities as operators in analogue-digital assemblage form a methodological basis to capture the operations of media and media use throughout this thesis.

3.2 From Digital to Network Culture: Gaps to Connections

![Image of punched Jacquard loom cards (2016) that make up the informational pattern of a Jacquard loom made by Joseph Hood (1821-1893) held at the National Museum of Scotland.](image.jpg)
The trace of a medium in digital culture is shifting. Gere (2002), in his exhaustive mapping of digital culture, has shattered notions of the digital as centred on the invention of computers. Gere instead places emphasis on social manifestations of digital processes, coinciding with the technical, in digital culture. His analysis describes a bigger picture informed, in retrospect, by the qualities of computation technology. Networks of cultural, societal, economic and political elements share a relationship with the general function of a computer:

Digital refers not just to the effects and possibilities of a particular technology. It defines and encompasses the ways of thinking and doing that are embodied within that technology, and which make its development possible. … These different elements are as much a product of the paradigm of abstraction, codification, self-regulation, virtualization and programming as the computer. Digital culture has been produced out of the complex interactions and dialectical engagements between these elements. (2002, pp.13-14)

Gere describes society through a set of qualities based in digital culture that immediately set a challenge for a concrete trace. Gere describes a two-way relationship between modes of cultural practice and the development of digital technology. A concrete trace is challenged, for example, by not only the supposed virtualisation of its existence as emerging from digital re/production but also techniques of virtualisation alongside computational reproduction. The elements of the digital paradigm Gere lists above also echo a base symbolic differentiation of the digital from more analogue or linear processes of re/production and take us from a media
archaeological perspective grounded at the site of a specific medium to the cultural
techniques facilitated by a medium (to be explored in greater depth in Chapters 7 and
8). Gere’s digital elements come to the fore via a set of unique digital cultural practices
in addition to the “informational needs of capitalism” (2002, p.198). His listed
elements are: “Cold War defence technologies; avant-garde art practice; counter-
cultural techno-utopianism; postmodern critical theory; [and] new wave subcultural
style” (2002, p.201). However, the digital elements that inform these cultural outputs,
specifically “abstraction, codification, self-regulation, virtualization and
programming” (2002, pp.13-14) are distanced from their technological grounding.
Consequently, there is a gap in digital culture between the acknowledgment of
technology’s material workings and its wider cultural influence.

Three key reasons for a gap or distancing between the technology of digital culture
and its wider cultural influence will be suggested. Firstly, the symbolic work of
technical media is visible and accessible when mechanical but hidden when electrical.
For example, punched card technology emerged in the early 18th century, coming to a
state of industrial fruition in the early 19th century, exemplified by the textile pattern
‘programming’ of the Jacquard mechanism/loom (Fig.3.5). The method of pattern
storage and reproduction has a visible ‘abstraction’ in the correlation of punched card
rows and resultant weft patterns. Here, abstraction and codification are also evident in
the presence and absence of punched card holes, as a starting site for virtualisation, if
the absence of material for a hole is considered comparable to nothing or ‘0’ in binary
[1983] 2000; [1985] 2011) when noting that: “computers as they have existed since
World War II, are not designed for image-processing at all;” they are dimensionless
signifiers ([Kittler [1999] 2012, pp.226-27). Access to dialectical images associated with the media of digital culture, informed by hidden computation technology, is seemingly limited to the likes of screen definition, for example, increasingly smaller and hidden pixels and blinking light emitting diodes embedded in the surfaces of casings and ecologies of peripherals and connection devices. The mechanical ‘digital’ qualities of the punched card have retreated to an intervention and manipulation of electron flow. Consequently, attention is moved away from the inner workings of media processes and their representation as ‘things’ to a network culture of interface effects (Galloway 2013) and considerations of hybrid realities as ‘virtualisation’ (Gehmann & Reiche 2014) and ‘hybrid space’ (de Souza e Silva 2007), assisted by mobile and always connected user scenarios. Successively, this techno-cultural gap, or barrier between hidden technically complex things and their use, also hinders access to the concrete trace found at the site of specific inscriptive media and techniques, as explained by Gere:

Though as time goes on, their presence becomes harder to detect. Each of these elements is immanent within technologies we use and the means we use to understand them. To acknowledge the heterogeneous nature of digital culture is increasingly necessary, as the technology through which it is perpetuated becomes both more ubiquitous and more invisible. (2002, p.201)

So as the digital expands, Gere warns us to watch more closely, “as it is imbricated with our everyday existence” (2002, p.202), becoming an invisible force and consequently more difficult to trace.
Secondly, medium invisibility, via the influx of abstraction and universalisation is a ‘blackboxing’ (Fig.3.6) of technical operations. For example, to blackbox something is to abbreviate the engineering beyond the immediate comprehension of a system’s component or group of components for economic design, planning and operational purposes. Bruno Latour blames the likelihood of something being blackboxed on the success of a device’s design, suggesting:

> When a machine runs efficiently, when a matter of fact is settled, one need focus only on its inputs and outputs and not on its internal complexity. Thus, paradoxically, the more science and technology succeed, the more opaque and obscure they become. (1999, p.304)

Blackboxing as a recursive process of compartmentalisation and division of processing into discrete hidden chunks is characteristic of digital culture, and is as much a subroutine of technical design and creative production as it is generally evident in wider media use and consumption. Product use without specialist knowledge of inner workings is typical of capitalist consumerism.
Thirdly, hidden operations of the digital, on a somewhat speculative front, can be said to have a life of their own inside the blackbox. Autonomous processes further hinder accessibility to digital processes. Viral software, for example, has autonomy in the self-replication required for it to spread across the Internet and user machines as digital contagions (Parikka 2007). In such a scenario, there is non-human communication between software and machine and only the specialised practitioner can unbox it to trace the associated connection and inscription. On a less speculative front, engagement with ‘big data’ and social media will throw your shopping, search and media consumption habits back at you, via clever algorithms and artificial intelligence, in the form of screen real estate advertising—an automated process to the lay and not so lay. The autonomy of digital processes at the site of device or cultural inclination is veiled by our knowledge and means of access, but more so when the digital is viewed as a set of discrete qualities over a linear path of technological progress with less concern for networks and connection.

**Figure 3.7** Network of Works Produced in the ccMixter Community, data visualisation from the Participatory Media Lab (2007) showing nodes as uploads of samples by users, connections as remixing relationships and node size as the number of remixes produced.
Figure 3.8 Screen capture from Network Effect, a data visualisation website interface by Jonathan Harris (2015) that brings together over 10,000 videos, 10,000 spoken auto clips, news feeds, tweets, charts, graphs, lists and millions of individual data points. This image shows the filter option ‘hug.’

Gere’s reflection on digital culture works via a linear trajectory of development over time. Digital culture is quantified via discrete examples that help to realise a sense of critical control over the “power and force” that make up the digital (2002, p.201). The value of such a contribution is not to be undermined but is destabilised through contemporary non-linear temporality (Parikka 2012, pp.164-67) and the connectivity of network culture (Gansing 2011, p.100; Institute of Network Cultures). Kazys Varnelis makes a similar launching pad out of Gere’s work, suggesting:

>[C]onnection is more important than division. In contrast to digital culture, under network culture information is less the product of discrete processing units than of
the outcome of the networked relations between them, of links between people, between machines, and between machines and people. (2008, p.146)

Network culture, with an emphasis on ‘connection,’ is thus suggested to be the overarching media context in which the trace now sits. Gere’s digital elements of abstraction, codification, self-regulation, virtualisation and programming (2002, pp.13-14), inherently situated in network culture, hold the potential to become transversal and in their interconnection we find possible sites for trace. Varnelis’ (2008) relational ‘links’ are central to network culture and join nodes, hot spots or indicators of traceable data in media assemblage whether accompanied by human agency or not.

The connectivities of network culture are a double-edged sword for the trace. For example, a data visualisation of the ccMixter community (Fig.3.7) exemplifies an early (2007) form of network culture in action. ccMixter facilitates audio prosumers via the sharing of copyright free samples and ‘stems’ project files for remixing, review and further consequential remixing. The ccMixter visualisation shows the practice of sampling (inherently an act of segmentation and pastiche), branching out with nodes representing uploads and the node size representing the number of remixes produced from a sample. Connecting lines show a remix relationship. Hence, the image shows the potential and outcome of the ‘connections’ of network culture, while it also highlights how complex the relationship is between the connection, the original source, and its qualities of inscription. Another key example of network culture in action is in the shift to connections and visualisations possible in analysis of data. Jonathan Harris’ (2015) Network Effect (Fig.3.8) is a hub and interface to access global data from online
video, audio, news, micro blogging, statistics and individual data point archives. *Network Effect* humanises these immense archives by allowing access and emotive engagement via physically intimate key term filters such as ‘hug,’ ‘stare,’ and ‘eat’, providing a voyeuristic view into the networked archives. The piece also invokes tension and anxiety as access to the interface is limited, your connection is timed, and the simultaneous presentation of data sources is comprehensible but strangely fast and noisy as a concentrated experience of day-to-day networked data consumption. *Network Effect* reveals the incredible flexibility and power of networked connection across archives and their analysis, but also communicates a clear restriction of more direct modes of connection as an effect. The surface of a problem is exposed here: with immense networked connection comes disconnection. As a result, network culture is shown to be a challenge but also a calling for the concrete trace of a medium. Association of trace to network culture at this point is basic. An emphasis on connection, its properties, use and movement is an important basis for reflecting the context and consequential requirements of trace. However, a discursive or dialectic notion of connection in network culture, inclusive of a concrete trace, is a problematic consideration that the coming discussion of the trace will further explore.
3.3 Toward Medium-Specificity in Network Culture

Figure 3.9 Video still from *Headcrash*, by Michael Wirthig (2016), presented as part of the Behind the Smart World Research Lab at Ars Electronica 2016, showing a microscopic view of hard drive disc/platter degradation.

Figure 3.10 *Talking to Recyclers at The E-Waste Dump*, photograph from a website by Linda Kronman and Andreas Zingerle (KairUs) (2014) showing Zingerle extracting hard drives from scrap and negotiating a trade with workers.
To achieve a more comprehensive position on the concrete nature of the trace in network culture it is worth highlighting Jussi Parikka’s summation of ‘medium-specificity’ (2012, p.85). Parikka suggests that medium-specificity, as a branch of media archaeology, is the “realization of the importance of concrete software and hardware processes and platforms in media studies” (2012, p.85). In other words, in unboxing the medium or a mode of its construction, a concern with how the “machine itself posits the screen, the interface, and, on a technical layer, gives us the phenomenological experience of visuals and sounds” (2012, p.87) that become associated with cultural engagement. For instance, medium-specificity is a method of media archaeology that labels the action of looking inside the casings of blackboxed media as a starting point for enquiry. This said, it is suggested that medium-specificity should not be limited to sites of inner components and should look outward to question wider cultural practice and ecologies.

As an example of medium-specificity, the Behind the Smart World project initiated by Linda Kronman and Andreas Zingerle and presented at Ars Electronica (2016), in collaboration with an array of media artists and forensic specialists, taps into illegal e-waste dumping and recycling practices at sites in Ghana. These sites are controversial locations where first world e-waste ends up, either through illegal means or by the circumvention of loose waste importation policies. Notably, the practice of e-waste computer hard drive reanimation, with the purpose of finding personal data for organised crime activities, is a point of interest to the group. The group started the project by joining recyclers and trading for hard drives in Ghana (Fig.3.10). As one of the project collaborators, Michael Wirthig’s Head Crash (Fig.3.9) (a term referring to
a failed head read of the hard drive surface), combines a mass of microscope still images with drive plater dust, scratches and cracks as the trace of material degradation. These stills form a video work that captures a close-up of the fragility, but also durability, of the project’s collection of hard drives. Focusing on the inside of the hard drive highlights forms of the trace explicit to the wear of the inscribable surface of the drives, but also shows the trace of material intervention on the functionality of the specific device, such as dust. Ultimately, the material boundaries of retrieving data from such devices is exposed, yet the internal qualities of the device have a relationship to the practice of sourcing and reanimating hard drives for the purpose of extortion. The value and quality of the ‘found’ device are reliant on its physical state, holding potential data for identification and the piecing together of the drive’s original user and/or owner’s identity, records, photos, footage, etc. The unlawful process just described is not only an online network culture, it is also an ecology of media-specific network cultures heavily influenced by the material qualities of the hard drive and how they form a transversal potential to cross paradigms of material and economic use. For example, the physical durability of the hard drive allows an e-waste data reanimation economy to happen. The original purpose of designed durability in the casing and internal mechanisms of the drive, to store data reliably for consumers, also allows them to survive the likes of rough international transit, excavation machine battering and extreme environmental conditions, typical of dump sites.

Medium-specificity is a call for “more specific and nuanced analyses of the modalities of materiality in which we are embedded in cultures of abstraction” (Parikka 2012, p.87). Parikka’s reading and extension of medium-specificity is a life raft for the trace
to survive the ‘trans’ media of network culture and a platform to begin grounding conceptions of analogue and digital re/production for trace to move across. Why? Because a concrete trace needs a substrate to survive, and remaining aware and connected to the concrete realm of a medium provides a sensibility that is sceptical of ideologies, significations and knowledge manufactured in teleological fashion from supposed invisible digital forces.

In short, the context for the trace being presented here combines medium-specificity with Kristoffer Gansing’s rendering of ‘transversal’ media and network culture (2011; 2013) through Matthew Kirschenbaum’s (2008) focus on traceable inscriptive digital media surfaces. Consequently, Gansing’s media archaeology will be explored and then compared and situated alongside Kirschenbaum’s critical analysis. Gansing is of importance because his research reinvigorates discourse surrounding the traditional media binaries of ‘old/new’ and ‘analogue/digital’ in his media art practice and media archaeological theorisations—both binaries being central sites for the trace in a transversal media context. Gansing is based at Malmö University, Sweden, while also being artistic director of the Berlin Transmediale festival, contributing to an institution of media thought, media archeological practices, and the ongoing curation and archiving of experimental media practice in close proximity to German media theory. Kirschenbaum, on the other hand, is based in America, as a professor of English. His work on media (2008) comes from a literary grounding concerned with ‘writing’ and its means of transmission and storage positioned in digital humanities and cultural studies. Kirschensbaum’s (2008) writings address medium-specificity and are central to the consideration of trace in a media theory context. It is important to start with
Gansing as he more recently used the concept of the ‘transversal’ to unpack network culture via critique of media-archaeological theory and practice. Gansing focuses on the question: “how do technologies develop over time” (2013, p.297)? His transversal media practice response is an approach to media that is: “guided by the concept of transversality … to move across temporal, institutional, material and cultural aspects of specific media technologies and practices” (2013, p.13). Gansing’s transversal concept acts as a platform to observe and discuss the survival of the trace against and across its suggested crux site of transversal analogue-digital media assemblage. In this sense, Gansing’s navigation of relevant literature, consequential trajectory and some conclusive threads are aligned with the need for a reassessment of trace through digital network culture.

3.4 Transversal Network Culture and Media Archaeology

**Figure 3.11** Screen capture of The New York Public Library’s *Stereogranimator*, by Joshua Heineman (2011), showing how the library’s archived stereograph collection can be converted to 3-D animated GIF or anaglyph and shared by users.

**Figure 3.12** Screen capture detail of the *Stereogranimator* user share gallery, a bizarre matrix of once static stereographs that now flicker and jitter as two frame GIF files.
The New York Public Library’s Stereogranimator, developed by Joshua Heineman in 2011 (Fig.3.11 and Fig.3.12), is a fitting example of the taking form of a network culture media-archaeological site. The application utilises the institution’s grand scale digitised stereograph collection to assist users in searching, selecting and converting stereograph images, once produced for a stereoscope optical device, into animated GIF and anaglyph digital file formats. Users essentially merge the protocol and format of basic old and new or analogue and digital 3-D imaging to produce and ‘share’ results in a facilitated network. Consequently, as a digital and networked intervention on the stereograph, the application produces a unique medium mongrel, one that hinges on the distortion of the stereograph as analogue trace. The original dual images of the graphs lose their stereoscope and now flicker between two frames of a GIF, forming bizarre user generated grids of jittering pictures suddenly reminiscent of, and through, altered visual temporal qualities connected to the trace of film, GIF loops, digital display frequencies and the ‘pixel,’ amongst other things.

In the early stages of his dissertation, Gansing sets out network culture as “the ontological ground against which contemporary cultural production takes place” (2013, p.43). This place is suggested to be “performative” as it is in a constant state of change and partial control with a consequential “instable and processual nature” (2013, p.44). Gansing positions network culture in the contradictory tensions of four main foundations. The common denominator is a “heritage of cybernetics,” as an operational link to media archaeology, “where the past is transformed into a resource for maintaining the present and imagining the future” (2013, p.43). The four main
concepts are “Convergence and Divergence” (2013, pp.45-6), “Media Ecologies” (2013, pp.46-8), “Protocols” (2013, pp.48-50) and “Heterogeneity” (2013, pp.50-3). Under convergence and divergence, Gansing focuses on Jenkins’ 2006 *Convergence Culture*. Gansing suggests Jenkins’ main theme of convergence adheres to a libertarian binary logic in the consumption and production of popular culture (2013, p.46). In Jenkins’ media construct, notions of the transversal can struggle to be revealed due to focusing on the convergence of predefined media and not questioning the breakdown of distinctions between old and new media. Despite this concern, Gansing utilises Jenkins to further station network culture:

> [T]he network culture perspective highlights non-linear processes of emergence of new subjectivities in cultural practices (of countercontrol, hacking, tactical media, net art, etc.) which rather than in spite of are made possible because of contradictions in new media networks. (2013, p.46, italics in original)

To emphasise the importance of media contradictions and feedback, “grounded in medium specificity while acknowledging the contradictory social contexts of media” (2013, p.46), Gansing turns to Fuller’s *Media Ecologies* (2005) and his concept of “partial vertical integration” (2013, pp.39-41). For Gansing, partial vertical integration is where “the different parts that make up a media” (2013, p.46) are contradictory forces that define a state of network culture. Citing Fuller (2005), the examples Gansing (2013) gives are based on the commercialisation of sub-media elements that skirt the standardisation of an overall medium. Gansing points to the mobile device market where power adapters have to conform to a standardised voltage but connectors change or are varied considerably, forming parts and patterns of use from “material
qualities of digital media” that contribute to a more politicised overall media convergence (2013, p.47). For Gansing, the “media ecologies Fuller describes make up a network culture filled with contradictions between open and closed standards and formats” (2013, p.47), that read as networked medium-specificity with a realisation of the affordance the fallout of convergence offers. In this sense, one medium is always interconnected with a network of supporting yet contradictory material substrates, and this marks an active site for the trace to be found between concrete connections.

In short, the argument is that there is always a messy analogue underworld in both the negotiation of network substrates and the digitisation of the physical realm. The construction and installation of Internet infrastructure is a fitting example of messy negotiations and contradictory media (Fig.3.13). Abstruse fluorescent marking paint, coded to a relatively specialist protocol, is a trace of an underground physical network, seen here layered over a multitude of faded previous markings on a New York City street. The labyrinth of under-street services negotiated, just on a physical level of feasibility, let alone on those of policy, approval and economic bargaining, for new infrastructure is without question a notably complex and contradictory ecosystem.

Similarly, in terms of converting physical signals and maintaining specific devices, the modes of dealing with contradictory ecologies of modern computer connectivity results in an array of usability ‘hacks’ (Fig.3.14), as a mode of trace. The bare minimum requirements of power, storage/peripheral, Internet and audio connection demand four differing modes of physical connection and their subsequent protocols. Managing all these cabling requirements results in the likes of hubs, dongles, or most interestingly, bulldog clips. Direct practices of digitisation or conversion also harbour
a kind of contradictory media ecology trace at the meeting point of the analogue and the digital. Distortions in the archival processes of Google Books (Fig.3.15) are notable examples. In this case, image scanning errors distort the original artefact producing a trace of the conversion process and the medium of conversion, a trace that is a reminder of the messy physical dimension in A/D conversion.

Figure 3.13 Webpage image from www.atlasobscura.com (2016) as an exemplar of the network mapping work of Ingrid Burrington showing a construction worker tracing out underground internet network infrastructure.
Network culture, then, begins to be read as the space beyond the ideology of network “seamlessness” (Gansing 2013, p.47). In this light, Gansing moves onto the layering and tensions of web ‘protocols’ as a forming factor of network culture. He does this by discussing Alexander Galloway’s (2004) linking of a technical network concept “to the distributed power configuration of control society” (Galloway 2004 in Gansing 2013, p.49). The layers of Internet infrastructure that rely on protocol are for Gansing (2013, p.49), “a data link layer (sometimes also seen as comprising of a physical level
of cables, modems etc.), a network/Internet layer, a transport layer and finally an application layer”, that he suggests form a:

means of a transversal analysis, which considers both vertical and horizontal levels of interaction between the materiality of technology, cultural production and power. In protocol, by paying attention to the layering involved in the transmission of information … digital information emerges as spatially distributed on a variety of levels, and information sending as something which is constantly being negotiated. (2013, pp.49-50, italics in original)

However, there is contradiction found in the layered materiality of the Internet, demonstrated through alternative “heterogeneity” or metaphoric images of the Net. Like Terranova (2004), Gansing (2013, p.51) highlights how the complexity of information transmission across a material, layered and protocoled infrastructure is simplified “if we conceptualise the network as a form of real-time space through which information can simply move (as in flat space)”. For this study, the Net does not need to be so complicated; the Internet as a network is often generally confused between the physical infrastructure of the Internet and its use as the Web. Gansing points to the:

contradictory features of network culture at play in the level of technical materiality. These contradictions, between open and closed, between protocols, standards and practices should lead us to think of the technological not as a strictly instrumental realm of pure functioning but also itself a realm of tensions and unresolved states. The digital may seem like the force that through the principle of numerical representation … eradicates tensions associated with the analogue world, but in fact
its networked nature is depending on an incomplete aggregation of different standards always in flux, reflecting a diverse network culture and economy. (2013, pp.52-3)

The contradictory network culture, described above, is of particular interest. Aligning Nigel Thrift’s (2005; 2008) “cultural circuit of capitalism” and Gansing’s always-incomplete performative nature of network culture (2013, p.79), Gansing also leads the call for media archaeology to adapt to “a new type of compartmentalised difference, found in phenomena such as data-mining and user-generated content” (2013, pp.68-9). Gansing sits outside ‘analogue and digital’ as distinct binary media descriptors, allowing for a refreshed location for the terms from the perspective of transversal media theory:

The old and the new, the analogue and digital are not taken as exclusive phenomena but rather as operating in a techno-cultural network which can be opened up or traversed in order to ultimately point beyond, beside, behind or next to it. This is no longer a negative but a transversal ontology of the relation between technological development and media practice. (2013, p.80)

Here Gansing begins to open up the operational state of an always-amalgamated yet transversal analogue and digital means of re/production in networked practice. The motion graphic work of Cyriak, for musician and producer Bonobo (Fig.3.16), is a two-dimensional example of amalgamated analogue-digital production stemming from an intervention on archival material. Cyriak’s work involves the manipulation of archival analogue film through the technique of digital rotoscoping the motion graphic
or film production equivalent of photo cut-outs or deep-etching and innumerable kaleidoscopic layers made possible by digital techniques of pre-composed/compiled or nested video manipulation, duplication and repetition of layer properties. Ultimately, the combination of digital production and the characteristic qualities of 1960s analogue film is a nod to and a trace of past mediums. The movement it makes was once only possible with static photomontage or collage and now can be taken into the realm of time and motion digital composition. The resultant artefact, it is suggested, is an elegant example of transversal analogue-digital re-production in that it ruptures analogue and digital segregation in practice, beyond general associations of digital reproduction’s co-dependence on analogue substrates to function. However, such assemblages do not have to be dependent on archival sources to connect with or contradict analogue modes of production. Integration of physical materials with typically digital platforms also sits well here. An example is the work of New Zealand independent game developer Anthony Frank, whose video game Platypus (Fig.3.17) integrates a plasticine stop motion ‘skin’ with side scrolling shooter game play and mechanics development. The game exemplifies a unique field of cultural output that combines hand crafted analogue ‘skins’ as the trace of physical qualities within interactive digital products. Such artefacts represent a transversal layering of analogue and digital creative production that is more nuanced in combination than the likes of typical computer operating system graphical user interface (GUI) precedents. This collection of archive dependent and hand-crafted examples of media practice and technological development provides not only basic examples of transversal mediation in creative production, but also a site, matter and form for the trace to be couched in analogue and digital realms diversely assembled in network culture.
Figure 3.16 Screen grab from Cyriak’s motion graphic music video for musician and EDM producer Bonobo’s song *Cirrus* (2013), showing the innumerable layering, duplication and repetition of ‘rotoscoped’ 1960s archival analogue film footage.

Figure 3.17 Gameplay screen grab from Anthony Frank’s side scrolling shooter video game *Platypus* (2002) showing plasticine modelled game elements/assets.
Gansing’s (2013) position on media practice sits beside his concern with media archaeology and forms a contribution to the material turn in media theory. As Parikka says: “History is the form of narratives, while media archaeology is a non-linear engagement with devices and concrete apparatuses that physically carry the past into the present” (Hertz & Parikka 2010 in Gansing 2013, p.64). An echo of Benjamin’s non-linear concrete trace, as found in his dialectic image modalities (Buck-Morss 1989), is quite loud here. Notably, Benjamin’s “early excavations into the rubbles of modernity” are mentioned as a platform for media archaeology by Parikka (2012, p.5).

A central moment in Gansing’s thesis is the combination of media archaeology with technical development. At this point foundations of transversal media practices (2013, pp.65-7) that coincide with network culture (2013, p.79) are recognised. He says:

> Media-archaeologists evoke non-linear, cyclical and micro-temporal approaches that all stress a heterogeneous, particular and unpredictable temporality, never a stable and universal one. In this way it connects with the transversal perspective on media culture that I earlier defined as network culture, and in this context it refines the transversal approach to the relation between the old and the new as a key question of technological development. (2013, p. 67)

Gansing sides with Wolfgang Ernst’s (2006; 2011; 2013) brand of media archaeology. Ernst’s is a hardware-first approach to media archaeology where the machine performs media archaeology as objective analysis (2011, p.242). Additionally, Gansing entertains (an) archaeology like that of Zielinski (2006), who digs for the new in the old, unboxing hidden media constellations to the point of imaginary media. However,
Gansing’s extension of both authors is in highlighting a “time-critical” difference derived from media archaeology’s cybernetic foundations:

[M]edia operate according to a micro-temporality which is processual and event-based rather than historical and discursive. … In this view, media archaeology is a descendant of cybernetics; its non-linearity derives from the digital and networked archive which is caught up in a constant circular feedback of stored data operating in the present. Here, nonlinearity is produced not through telling the history of media evolution from the margins, but through a different epistemological starting point emphasising the archive itself as being non-linear. (Gansing 2013, p.69)

As Gansing points out, at the heart of media archaeology, immersed in network culture, are extensions and undertones of cybernetics via an emphasis on “machinic archives of the past” (2013, p.272). The media of the past and their now networked temporal archive and treatment afford a space and material for present and future media assemblage. However, there is a problem. Gansing suggests there is “a transversal realm of information exchange which can never be complete and which gives rise to inconsistencies across the realm of machines, humans and their cultures” (2013, p.270). The statement makes sense if we keep the crux elements of information and archival cybernetics in mind, such as system feedback, reflexivity and virtuality, that risk ideological separation from the material substrates of transmission and storage. Gansing’s concern is that ‘transversal’ media archaeology practice “needs to be attentive to the productive critical potentiality of unavoidable gaps of non-pasts (forgotten, repressed, misrepresented) in the cybernetic transmission process” (2013, p.270). Ernst appears to agree, suggesting that the “classical archive is preserved time.
But the digital archive has no intrinsic macrotemporal index. … It operates at a microtemporal level instead” (2013, p.82).

Figure 3.18 Promotional webpage image for NSW National Parks and Wildlife Services (2014) featuring a worker sporting the Google Street View Trekker at Barrington Tops National Park.

Figure 3.19 Screen grab of Google Street View by Greg Hughes (2016), from the Blue Mountains National Park, Pulpit Rock Lookout, showing image capture anomalies.
As an example of network culture archive ‘gaps’, the wayfinding service and location sharing archive of Google Street View has infiltrated and documented locations well beyond streets, including the trails of Australia’s National Parks. The Google Street View Trekker (Fig.3.18), as a geolocation, 360-degree panoramic image gathering backpack device, enables the wearer and Google to capture and offer an intricate virtual experience of remote and difficult to access locations. However, anomalies or gaps in Google’s archival abilities, such as the movement of people captured at a Blue Mountains lookout site (Fig.3.19), as well as image distortion at the peripherals of lenses and image stitching, produces glitches, awkward double-ups and figures with severed heads. Such imaging error is literally a gap in Google’s archive produced by the limits of the ‘machine’ on hand. The recording device, revealing itself by its flaws, provides a trace of the archival mechanism as an alternative feedback system with the potential for the machine and its limits to generate additional non-linear media-archaeological readings. The network culture’s media archaeological practice, having inherited cybernetic processes, needs to acknowledge the risk and potential of its epistemology in action.

Gansing’s (2013) notable contribution to media archaeology is to test it against concepts of technological development. Gansing sees media archaeology as weakened by not considering the converse linear and evolutionary perspectives of media (2013, p.70). He seeks to see if media archaeology can function in oppositional areas. He finds such sites in the designed and material properties of linear media production and consumption associated with commercial media considerations such as economics, media evolution (assimilation, survival and displacement) and planned obsolescence.
(2013, pp.72-6). How does one practice media archaeology, not only as media theory or observation but also as creative practice, in line with using media to perform media archaeology against linear media development? He says:

[I]t is involved in questioning the logic of linear and evolutionary technological development while also, as an artistic method, practically intervening into it, not only through a human-centred activism, but also by engaging the materiality of media technologies. (2013, p.79)

Figure 3.20 *Pixel*, a digital print, card and mirror assemblage by Siobhán Murphy (2015) showing an intervention on an analogue medium informed by the digital qualities of the screen.
According to Gansing, it is important to realise that creative practice through media archaeology should work in tension and question the more linear and evolutionary paths of media such as commercial technical development (2013, p.266-7). This is a process of revealing and questioning the forces behind media development via the materiality of media. One approach of particular interest is Gansing’s (2013, p.294) flipping of Bolter and Grusin’s *Remediation* (2000) to form ‘reverse-remediation:’ a mix of new/old media rupture contrary to “the formal logic by which new media refashion prior media.” (2013, p.273). Gansing defines reverse-remediation as:

a transversal media practice that opens up the old/new dichotomy, a making strange that holds potential for a critical innovation of media without at the same time being prescribed by the evolutionary model of technological development. (2013, p.294)
Gansing’s hope for a transversal media-archaeological practice is important. Bolter and Grusin (2000, p.73) note that “remediation is not replication or mechanical reproduction,” suggesting their concept of remediation does not emerge from a material basis set at a concrete trace in the likes of content storage, transmission and physical intervention. Perhaps Gansing’s ‘reverse’ adage could also point remediation back to the physical substrate of specific media. The experimentations with typography by Siobhán Murphy (Fig.3.20), for instance, posit the digital qualities of the ‘screen’ and its quantised qualities of pixel grids back onto traditional graphic design letterform customisation. Her work *Pixel* displays a finite grid consisting of card and reflective mirror squares: an analogue medium assembled via the physical ‘and’ interactive (mirror reflection) qualities of the digital screen. This manoeuvre is quite literally a reversal in that a traditionally analogue mode of production is reconsidered with the functional qualities of digital image processing. In consumer culture more broadly (and more directly medium-specific in that it is steered by counteracting medium functionalities) is the practice of vinyl prototype car wrapping (Fig.3.21). Bizarrely, car companies wrap soon to be released car models to disguise body form, features and colour, from ‘spy photographers,’ with elaborate and intricate black and white patterns. Not only does such a procedure add visual distortion for the naked eye as a single level of camouflage during public on-road testing, but the patterns also confuse digital camera autofocus algorithms and work against online image compression codecs to hinder the broadcasting of pre-release design details. The scenario asserts a kind of material ‘reversal’ in that the physical analogue components of the arrangement are folded back onto the digital and vice versa as a medium-specific feedback—the digital in the analogue as algorithmic pattern
production, and the analogue in the digital as the manifestation of rendered distortion. If Gansing’s ‘reverse remediation,’ as a media-archaeological foundation, does not point remediation to the physical substrate of specific media like the examples given, then there is a concern. Transversal network culture media practices risk becoming a new kind of non-specific (2013, p.235) force of representational exchange that is unique to, but works alongside, the medium-specificity of media archaeology. Ironically, this claim points to Gansing’s (2011; 2013) suggestion of a ‘generic’ force in network culture that is another challenge for trace.

3.5 A Media Archaeological Generic

![Figure 3.22](image.png)  
*Figure 3.22* Webpage image from knowyourmeme.com (2015) showing an exaggeration of the ‘#TBT’ (Throwback Thursday) social network culture phenomenon as a spoof ‘meme’ of President Lincoln taking a selfie via an implied mirror.
Gansing’s trajectory is of particular interest as a contextual position, demanding that the trace be reassessed if it is to be of value in engaging with network culture from a media archaeological perspective. In an earlier paper, Gansing proposes a concept of “transversal generic” (2011). In 2013 this concept becomes amalgamated with a rendering of media archaeology as a “media archaeological generic” (2013, p.265). The generic is a potential state of media archaeology for Gansing that is active beyond the confines of media art, evidenced in the output and treatment of analogue media in recent music production and film (2013, p.266). He suggests:

whether user- or industry -driven, old media content is constantly repurposed for new consumption. In this sense, digital and networked archives allow for a networked, modular and, most importantly, temporally non-linear version of the principle of creative destruction once posited by economist Joseph Schumpeter as integral to the evolution of the capitalist economy … This networked political economy gives us a background to approach media archaeology differently than as a by default radical force in network culture. That is, we should approach media archaeology not only as a critique of technological development and linear assumptions about the progression from old to new media. Media archaeology could in this way be explored according to the idea of a highly developed cultural ‘generic’ which is increasingly integral to much contemporary cultural production. (2013, p.267-8)

Any generic practice can be read as negative, producing “inconsistencies across the realm of machines, humans and their cultures” (2013, p.272); this clashes with the cybernetic efficiency inherent in media archaeology. However, the idea in this context
takes on different meanings and supports notions of a ‘transversal’ media archaeology. In the “incessant archiving and re-deployment of the past, we see how the past re-acquires a new kind force of becoming in the present” and the generic becomes generative (2013, p.273). The generic, via Gansing, reads as a source of affordance or materiality for media archaeology where transversal media practice is “a movement cutting across different temporalities, subjectivities and institutional frameworks” (2013, p.274). The generic is also an observation of media archaeology, where “media archaeological practice is becoming a generic feature of technological development in network culture” (2013, p.277). Gansing utilises the “non-philosophy” of Francois Laruelle (French philosopher: b.1937) to make his point:

Media archaeology as a generic cultural force embodies such transversality in its constant re-articulation of the old and the new across material, discursive, institutional, subjective and archival spectra. By way of artistic media-archaeological interventions, the old and the new of such fields are becoming, in Laruellian fashion, ‘transversal yet unilateral’, ‘universal yet incomplete’, ‘dual yet not dialectical’ and, we may add, simultaneously old and new: ‘The generic will be the Two that has lost its totality or system’. (Laruelle [2008] 2011, p.246 paraphrased by Gansing 2013, p.275)

Murphie et al. (2011, pp.2-3) suggest Gansing uses Laruelle’s ‘generic’([1986] 2010; [2008] 2011) to “test the limits and movements of media archaeology” and highlight Gansing’s ‘generic archaeological impulse’ spreading into “general culture (and as part of contemporary Capital within the cultures of digital and networked media)” which “means ‘new’ media are increasingly concerned with pasts, not the future.” The notion
of generic, in its instability and incompleteness, matches the qualities of network culture as a mix of “parallel disorders as well as orders” (Gansing 2011, p.113) where origin (or the ‘arche’ of media archaeology) is always subverted or in motion. The notion can be thought of as pockets or envelopes of order without strict origin. Gansing suggests:

There are no absolute origins to be found in this culture of constant computation and transmission of data. There is rather a constant generation of new links leading to what some have characterised as either a pervasive real-time culture … or a state of atemporality …, where all cultural forms and media content seem to be simultaneously accessible, extending across past-present and future. (2011, p.113; 2013, p.299)

A transversal yet generic media archaeological practice can be exemplified in mainstream photograph exchange by the popular social network practice of ‘Throwback Thursday’ (#TBT) (Fig.3.22). Urban Dictionary user Extra Testicle’s top voted definition of the tag makes the claim: “the photo MUST be from a different era in your life. Exemptions can be made allowing for newer photos to be used” (2015). Know Your Meme (2015) suggests the tag has also been “associated with things that are deemed classic or vintage since as early as 2003, when it was first defined on Urban Dictionary.” Posting and tagging nostalgia-inducing images, across the likes of Instagram, Facebook and Twitter, as a weekly activity has become generic to the point of displaying associated online etiquette, formalities and commodification, while forgoing objective historical discursive origins. Knibbs highlights that there are now over 40 million pictures tagged with ‘#tbt’ and 23 million with ‘#throwbackthursday’
The tagging trend has been adopted by common users, as well as socialites and celebrities, and has formed a set of guidelines enforced by public ridicule if not followed (2013, para.9). Throwbacks at least 5 years old and images originating from film-based cameras demand extra respect (2013, para.11). Throwbacks as a past iteration of a current topic, formality or event are also highly regarded (2013, para.10). And of course, the best throwbacks are consequently shared or retweeted further, distancing paths of origin, moving and subverting a stable archive. Additionally, the activity of appropriating content from a networked archive has become a means of service and marketing. The Lango messaging application, for example, releases Throwback Thursday animations and pictograms each week to be collected and shared (Knibbs 2013, para.16). And the practice has been targeted for social media marketing and brand strategies in line with the success of nostalgia-induced brand empathy and authenticity (Fitton 2015). There is a throwback ecology at play across the protocols of the Web that has spawned a micro-temporal system “which is processual and event-based rather than historical and discursive” (Gansing 2013, p.67). Throwback images shared and shared again resemble pockets of the past via the characteristics or qualities of the image’s content and reproduction, not a strictly linear narrative or an always-linked continuous path of historical content. A direct connection between past and present is made. However, the links in the connection are distorted, remixed or repurposed and archival origins become less stable. Connection with the past is compartmentalised via associations the user makes on a whim in relation to a present networked context. The past is more accessible, more sharable and more easily manipulated. Survival of first-hand signification, bias, transparency or cybernetic efficiency in communicating the past is not in question here, the survival of the trace
of media is. Within the network culture ecology, described to this point, the trace of media must follow. The residual traces of past modes of reproduction are also redistributed atemporally, amplifying a trace-structure that underpins network culture image exchange—the impressions and fragments of signs ‘and’ their grounding media.

3.6 Benjamin and The Generic

**Figure 3.23** Screen grab from the official *Star Wars* Instagram account (2014) featuring a #ThrowbackThursday post of 1970s *Star Wars* action figurines and showing the trace of VCR reproduction.

**Figure 3.24** Screen grab of Twitter user People_in_photobooth’s #tbt post displaying a ‘selfie’ taken via photo booth processing and highlighting the trace of analogue error and degradation.
The throwback practice highlights network culture’s infatuation with past media and content. In the “incessant archiving and re-deployment of the past, we see how the past re-acquires a new kind of force of becoming in the present” and the generic becomes generative (Gansing 2013, p.273). Again, we are reminded of Benjamin’s trace, and perhaps his suspicion of emulated trace ([1931] 2008, p.283-6), in the desire for the aura evidenced in throwbacks snapped with the likes of Instagram software photographic filters, adding another layer of the past via the ‘generic’ use of an analogue photographic trace. There is an amplification of Benjamin’s desire to read the past via synchronicity with the cultural forms of the present and simultaneous collective reception (Jennings 2008a, pp.15-17). Additionally, Benjamin’s image-world, as a “place in every photograph which encodes not just the specific character of a past moment but also the future” (Jennings 2008b, p.264), is reinforced, as collectively archived content is sporadically cycled forward. Furthermore, the collective testing of ‘new’ processes of reproduction, as observed via Benjamin’s wish-images ([1935] 2008, pp.97-8; Buck-Morss 1989, p.56), is found in throwback image exchange. The relatively new act of generic network archive trawling produces a collective body of images that facilitates the trace of an older means of re/production in the new (Fig.3.23 and Fig.3.24)—an act that marks the potential of technology while instilling a maturity in the new medium’s development. The wish-image notion, in this context, underpins Gansing’s suggested practice of media archaeology where users are (consciously or unconsciously) “practically intervening into it [evolutionary technological development], not only through a human-centred activism, but also by engaging the materiality of media technologies” (2013, p.79).
Alignments between mediation as annexed in network culture mediation, and an interest in how Benjamin’s trace may help inform inquiry, are made more complex when considering the concept of a transversal media generic. It is acknowledged that Benjamin highlights a dialectical reading of images that shares similarities with Gansing’s (2011; 2013) transversal generic as informed by the non-linear, microtemporal qualities of network culture, yet a barrier in alignment is evident. Benjamin seeks a genuine historical image in opposition to simply archaic images ([1927-1940] 2002, pp.462-3). This highlights an important difference between both writers relative to the notion of ‘dialectic.’ As a reminder, for Benjamin “image is dialectics at a standstill” ([1927-1940] 2002, p.462) and more than a one-way temporal continuous relationship between the present and the past but a ‘dialectic’ exchange between “what-has-been” ([1927-1940] 2002, p.462) and the now. Benjamin’s dialectical image is part of a “historical index” where images allow us to move toward “historical concrete forms” of a subject via an image’s supporting “language” ([1927-1940] 2002, p.462-3) or, in network culture terms, the supporting ‘protocol’ of dialectic images. For Gansing, quoting Laruelle, the generic is the “dual yet not dialectical” (Laruelle [2008] 2011, p.246 in Gansing 2013, p.275) with a lost totality or system. The protocol of connection or means of dialectic exchange at the site of inscriptive medium, it is suggested, is what is lost in network culture image exchange—a disconnection across the times of a potentially dialectical image.

The fact that images in network culture struggle to concretely connect to their temporal physical medium in a microtemporal existence is what makes them increasingly generic. For example, the physical signature of a medium against time
is altered when the process is digitised: like film exposure time being emulated immediately rather than a set of darkroom tests and comparisons that connect an actual use of time to the contrast of an image. If we reinforce Gansing’s (2013) use of Laruelle’s ([2008] 2011) ‘generic’ via Galloway’s (2014) approach, further clarification can be provided. Galloway (2014) approaches Laruelle via a non-dialectic construct of ‘the digital’ and the ‘generic’. The idea of a generic acclimatising in network culture can be reinforced in charting Laruelle’s alignment to the digital via notions of the analogue, Galloway says:

If continuous being is essentially schizophrenic, a fragmentation producing a multiplicity of the self, generic being is essentially autistic, a withdrawal characterized by a diminishment, or simply a rewiring, of communication and relation. Generic being refrains from forming relations both with itself … and with outside objects or the outside world. (2014, p.57)

The physical qualities of a medium ‘presents’ more than it ‘represents’ the past in the present, but the concrete trace of a medium has a tendency to be emulated or manufactured digitally in a networked context, potentially becoming trapped in a realm of representation and symbolism rather than existing as concrete symbolic work. The trace in a dialectic image ‘may’ be present—for example, the scanned qualities of Polaroid photographic paper or the redeployment of digitised archival photographs—but the trace’s potential for ‘indexation’ is ‘rewired’ in allowing historical dialectic communication. This rewiring across the matter of the physical and the networked digital informs a media archaeological generic ‘and’ marks the trace as significant. The generic can be read as that which “subtracts its own attributes, negating and removing
them” (Galloway 2014, p.57) and, for media archaeology informed by the materiality of specific physical media, generic practices of network culture afford its subtraction. The potential for connection and communication in the networked manufacturing and exchange of images acts in resistance to Benjamin’s dialectic charge within and across images, making a concrete trace problematic in the state of network culture mapped by Gansing. However, the trace, concrete and other, as a medium itself, in its ability to maintain a semblance of connection between the physically present and the represented, is a mechanism that offers transversal access back to the dialectic.

3.7 Challenges for a Network Culture Trace: Saved by the Hard Drive
Gansing’s contextual positioning of the transversal role of the ‘generic’ in media archaeology amongst a network culture of cybernetic inheritance sets up some tough obstacles for a redeployment of Benjamin’s trace. A summary set of obstacles that the trace would have to function include:

- The performative, unstable, processual and contradictory nature of network culture.
- The treatment of analogue and digital phenomena conjoined under the umbrella of a techno-culture network.
- A media archaeology that works across non-linear and temporal approaches to media time while scrutinising more commercial or political manipulation of linear and evolutionary technical development.
- The generative transversal ‘generic’ in network culture media archaeology.
• The overall notion of transversal media practice itself, as a means to move across temporal, material and cultural aspects of media technologies, production and consumption.

The hypothesis proposed throughout this thesis hinges on the potential accommodation of the trace in these five areas. How then do we return to the concrete inscriptive surface of reproducibility that this study argues as a basis for the survival of the trace? The answer takes form by drawing on medium-specificity as mentioned earlier (Parikka 2012, p.84) and the work of Matthew Kirschenbaum (2008). Kirschenbaum seems to take heed of Gere’s concern for monitoring the influence of the digital across an awareness of network culture. Kirschenbaum champions traceable mechanisms of the digital against the supposed immateriality of digital network culture. In this light, Kirschenbaum can be aligned to Gansing, yet his means of amalgamating the analogue and digital are derived more directly from the traceable characteristics of reproduction in digital mechanisms than from a collective network archive context. Kirschenbaum allows a return to the physical properties of concrete traceable media surface. Kirschenbaum is championed by Parikka as one who “keeps a more careful eye on the multiple materialities” of media in medium-specificity (2012, p.84). However, Parikka positions Kirschenbaum as unique in the category, suggesting he provides:

methodology and vocabulary for these processes of the informational culture which, again, take as their starting point informational materialities which resist mere apparatus-focus but still are able to tap into the specificity of the time-critical processes in which contemporary cultural products – texts, images, sounds – operate and are stored. (2012, p.88)
For Parikka the argument put forward by Kirschenbaum represents a media archaeology founded “under the hood” of software and hardware, where the internals of the digital machine itself operate as an archive (2012, p.88-9). The purpose and function of Benjamin’s trace are revamped in this context. The concrete clues offered by past objects, “particularly visible in the plush of bourgeois interiors or the velvet lining of their casings” (Buck-Morss 1989, p.211), are moved to the internal components, processes and protocols of network culture computation artefacts. At this site we can tackle the accommodation of the trace in Gansing’s rendering of network culture.

Kirschenbaum traces digital media by reflecting on engagement with the physical qualities of analogue inscription. Kirschenbaum’s method functions as a counter to the ideology of a supposed immaterial digital virtuality. In this light, Kirschenbaum starts with a distinction from Kittler’s ([1986] 1999) digital translation of writing, as “the universal ones and zeros of digital computation” (2008, p.6). For Kirschenbaum, Kittler’s universality is too simple (2008, p.6). Kirschenbaum joins the practice and science of digital forensics with a reading of media heavily based in the inscriptive qualities of digital information and electronic writing storage devices. He suggests a force of ‘forensic imagination’ in digital network culture:

activated whenever process collapses into product, a spatial-temporal extrusion whose novel geographies and chronologies leave skate grooves looming like geological formations. (2008, p.253)
Kirschenbaum highlights the operations and trace of media mechanisms (including instrument, inscription, storage, read, write and transmission), indiscriminately across analogue and computational media, to form a reading of media’s present past (2008, p.258). According to Kirschenbaum, the mechanism is an “agent of irrevocable difference” (2008, p.258) that, in its hidden operations and division of time and space, produces gaps and loss in its perceived inscriptive process, the artefact proper and surrounding cultural activity. For the inscriptive process, the gaps and loss include the error, distortion, by-product, meta-data, limits of resolution and quantisation in signal or artefact reproduction. An artefact may be missed or not presented in the final product of reproduction from the inscriptive process. And surrounding cultural activity can include the consequence, concern or ideology formed from the gap or hidden components of a process or artefact. Aside from these three perspectives, a gain or affordance could be read into this summation as well, especially the generative potential of error, distortion and redundancy in creative production. At the level of computational mechanism, as a necessary base platform of digital network culture, these hidden qualities of media exchange, from the archival processes of digital network culture, are entry points for Kirschenbaum’s forensic take on media. In bridging the gaps across reproduction and digital representation, Kirschenbaum reads a path of inscriptive connection points where no trace is lost.¹³ Kirschenbaum’s trace is authored by firstly scrutinising devices that aid in producing ‘gaps’ in the understanding of hidden material processes.

¹³ Kirschenbaum utilises Latour most applicably in considerations of cascade and abstraction concepts (2008, p.139) citing Science in Action (1987). This study will bring a wider reading of Latour (1999) and align his ‘circulating reference’ in science studies to a reassessment of the trace and the tracing of media in method and practice.
Kirschenbaum negates the screen as a media ideology-forming trap, suggesting: “Screen essentialism becomes a logical consequence of a medial ideology that shuns the inscriptive act” (2008, p.43). The statement makes sense when the screen is thought of as an end device. Inscriptive reproduction generally does not continue from the screen as a device itself; it is a passive display relay of sorts, a skin, even if interactive. Digital immateriality, formed from the infatuation with screens in media culture and critique, for Kirschenbaum, reads as a danger to the material traceability of media connections via inscription in time and space (2008, p.6). The hard drive is an alternative to the screen for Kirschenbaum, inheriting inscriptive qualities from the analogue vinyl turntable or phonograph. The developmental details between the devices motivate enquiry (2008, p.6), and the analogy is made often throughout his text. Kirschenbaum’s focus on data or information storage that is not typically comprehended in the display of a system is a methodological point of interest, especially in approach to mechanical description and associated cultural techniques (2008, p.88). The principal concern here is with the hidden traceable inscriptive qualities that cross analogue-digital assemblage in re/production.

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14 Screen displays as a space to locate the trace in transmission and storage at the site of mechanism should not be ruled out. For example, the emergent ‘through glass transfer protocol’ and application prototype ThruGlassXfer (Latter 2014) is destabilising digital transfer security standards, bypassing the likes of system firewalls and intrusion detection via binary screen file transmission. The process works by software rendering out a series of Quick Response (QR) codes over time at a set frame rate; these QR codes in motion send a file to a mobile device with a camera as receiver. The process transforms the screen from a passive display device to a medium of machine-to-machine transmission. Files are sent via the process, a development beyond the relayed text and links achieved by traditional QR codes.
Figure 3.25 Microscope image of an Apple iPad Retina display (2012) showing ‘sub pixel’ arrays.

Figure 3.26 Scanning electron microscope cross section image of Samsung’s 850 Pro, vertical flash memory, solid state hard drive showing the cylinder stacks and substrate silicon of nano-level storage gates.
In positioning forensic practices and devices associated with magnetic hard drives, Kirschenbaum places importance on media surfaces via inscription, storage and transmission. The inscriptive qualities of the magnetic hard drive cut through the fall out of virtuality and supposed digital immateriality (2008, p.43) manifest as a media ideology based in digital ephemerality, flugibility and fluidity (2008, p.50-58). Kirschenbaum forms two materialities as heterogenetic extensions of typical material and symbolic differentiations in digital inscription, they being ‘formal and forensic’. He says:

Whereas formal materiality depends upon the use of the machine’s symbolic regimen to model particular properties or behaviours of documents or electronic objects … forensic materiality rests upon the instrumental mark or trace … Formally then, electronic data is pernicious by virtue of its susceptibility to symbolic propagation in an environment explicitly built and engineered to model ideal conditions of immateriality. … Forensically, electronic data is survivable by virtue of both dramatically expanding storage volumes … and the limits of the material mechanism. (2008, p.70-71)

In examining formal and forensic materiality Kirschenbaum considers analogue-digital signal processing and its dependent physical artefacts transversely. Kirschenbaum gives a close technical reading of the meeting point between the quantisation of inscribable media surface and symbolic digital bits. The combination allows particular media a unique affordance in “reveal[ing] much about computing in different contexts, allowing us to reconstruct salient aspects of now-obsolete systems and the human practices that attend them” (2008, p.32). Kirschenbaum’s combined
assessment at this base level resonates with a method of media archaeology hinged on the mechanical device’s own objective archaeological potential and points toward highlighting media ideologies that are oriented toward the immaterial or virtual.

Kirschenbaum differentiates formal materiality from forensic at “the juncture between analog and digital states, such as when a drive’s magnetoresistive head assigns binary symbolic value to the voltage differentials it has registered” (2008, p.12). Essentially this is a point where physical matter, in ‘on’ or ‘off’ states, becomes symbol and then digital signal or vice versa: the bits, or 1’s and 0’s, that ‘form’ a computational digital origin. Such sites are observed behind the surface qualities of devices, between the likes of formal graphical user interfaces and the forensic trace of hard drive substrates, such as sub pixel arrays of high definition displays (Fig.3.25) or the material qualities of solid state hard drives (Fig.3.26). The formal can be thought of as a relative function on an independent layer above the physical (relative in a timely or microtemporal physical dependence), but measured and contrasted on formal regimes (2008, p.13), such as universalising standards, programming languages, communication protocols and network protocols where symbol and syntax are synchronised to allow transmission, networked connection and for production to occur.

Kirschenbaum cautions us that his focus should not be misunderstood as the distinction between hardware and software. The site of focus is before such considerations in the movement outward from a platform of inscriptive surface. Interpretation of Kirshenbaum points toward actualising an analogue and digital co-dependency that merges the two in processes aside the concern of software. Software for Kirschenbaum
is removed from his notion of formal processes, in proximity to the physical mechanism, as an industry commodity that already has its own materiality (2008, p.14-15). What is closer to the inscriptive surface, yet confuses the space, is “firmware or programmable hardware, a contradiction in terms that literalizes the conceit of formal materiality at the very level of the chip” (2008, p.13). Firmware understood as permanent software set in read-only hardware inscription does not exemplify a meeting point between Kirshenbaum’s formal and forensic materiality. Kirschenbaum’s extended footnote on this alternative tells us that there is very little ‘firm’ about firmware; rather, it is another site of inscriptive substrate and a different kind of software, exemplified by the likes of flash memory chips (2008, pp.13-14) whose technology can be extended to more current solid state hard drives.

3.8 Microtemporal Media Archaeology: Trans Hard Drive to Bitcoin

Figure 3.27 In-game screen grabs showing a comparison of frames per second (FPS) resolution quality from the first person shooter game Battlefield 4 by Electronic Arts (2013).
The state of the trace in transversal movement across physical and symbolic assemblage situated in Gansing’s (2013) definition of network culture shares, in part, a trajectory with Kirschenbaum (2008). Kirschenbaum’s text develops a ‘forensic’ charge that questions the trace of digital media through the techniques of inscription and transmission. What is of more interest is affording how the trace can operate across Kirschenbaum’s forensic and formal renderings of materiality in analogue-digital amalgamation. This aim is not a struggle to highlight risky ideology or professed ontology, but a middle ground—a site to further observe the operation of the trace. Kirschenbaum’s dual materiality is useful as a platform that allows the trace to move across media paradigms, including material cultural practice and technologies. This is a position also in line with Parikka’s categories of materialities; the concern is not to facilitate competing materialities, but to set up a platform of defined materialities so as to begin research (2012, p.163-4).

It is around Kirschenbaum’s point of formal and forensic co-dependency that Mitchell Whitelaw (2008; 2012) finds purchase for his ‘transmateriality,’ a state of media “as always and everywhere material but constantly propagating or transducing patterns through specific instantiations” (2012, p.223). Whitelaw exemplifies transversal thinking in his concern with crossing or dissolving the ‘gap’ between measurable, verifiable, physical matter, human or non-human, as well as the symbolic qualities of digital representation. In citing and forming an extension on Kirschenbaum (2008), Whitelaw suggests that:
The digital is, of course, always and inevitably embodied; that concepts like ‘data’ are functional abstractions for describing the propagation of material patterns through material substrates. But that at the same time these material patterns - and here I mean everything from optical pulses to hard disk substrates, luminous screens and speakers pushing air - these material patterns, and the sensations and aesthetics that result are profoundly shaped by data acting as if it were symbolic and immaterial. Transmateriality is an attempt to ‘ground’ the digital without losing sight of its (let’s say) generative capacities. (2008, para.6, italics in original)

Whitelaw’s (2008; 2012) concept of ‘transmateriality’ in its extension of Kirschenbaum’s (2008) charge of digital forensics forms a bridge to connect Gansing and Kirschenbaum on a level of sensibility derived from the microtemporal treatment of inscriptive surface and substrate. Material patterns across time are forms of digital signal processing that condition transversal network culture, and consequently add to a generative generic media archaeology practice. This material and contextual structure does not need to be overly complex. Derived from Kirschenbaum’s description of formal and forensic materiality, the structure can be a simple play off between reproduction, storage and transmission/multiplication, as a ‘present’ physical process and an assemblage of physical and symbolic exchange that enters the risky or generative realm of representation. For instance, the power of image processing for competitive ‘hardcore gamers’ is critical in relation to physical reaction times in multiplayer gaming scenarios. Frames per second (FPS) of both machine rendering rates and screen refresh rates form a kind of blur of pulse patterns in the digital becoming analogue. The scenario is reminiscent of motion picture film frame rates but the illusion of motion is not the only critical requirement. In games such as Battlefield
4, by Electronic Arts (Fig.3.27), there is also the need for time critical interactive feedback, that is dependent on processor FPS performance, that integrates with a player’s reaction time for increased first person shooter ‘kills.’ For example, if a competitor has a system that can process images at 60 FPS and you only have 30 FPS your competitor has an advantage, with more frames and image detail, to make a split second ‘head shot.’ There is a play off between resolution, image detail, and FPS, the number of images available, where a user may drop resolution to allow a machine to handle more FPS. Gaming at this level is at the cusp of the meeting point between time critical digital processing and material patterns in peripheral interfaces. Ernst (2011, p.246) clarifies the scenario, suggesting that digital signal processing is “faster than what our optical and acoustic senses can continuously follow” and that “discrete operations have become able to represent continuous ones, approaching the reality of physical signals themselves.” Awareness of this illusion concerns a “shift to digital signal processing as cultural technology instead of cultural semiotics” (2011, p.242).

Kirschenbaum (2008) offers a foothold in thinking cultural technology and grounding it in digital media. Kirschenbaum uses the forensic concepts of individualisation and verifiability concerning the trace of digital media form and storage (2008, p.56). This process is only one example of media paradigm subversion amongst Kirschenbaum’s text that includes a levelling of analogue and digital media. Consequently, this is a process that subverts the notion of exact copies in digital media ideology and “the digital simulacrum” of “copies without an original” (2008, p.53) or exact copies of copies, a supposed distinguishing factor between analogue and digital media. Instead, a concrete traceability in a supposed digital fungibility
can be found, positioning the digital as equally stable and verifiable as what can be achieved in physical identification.

A recent example of digital media objects at play between formal and forensic materiality, in this vein, is the controversial peer-to-peer technology-based *Bitcoin* crypto-currency made public in academic research paper format, by the pseudonym Satoshi Nakamoto (2008).

![Diagram from Satoshi Nakamoto’s Bitcoin paper (2008, p.2) showing a digital signature ‘hash’ flow.](image)

The discussion of Bitcoin currency moves the focus away from Kirschenbaum’s ‘micro level’ forensic ideal (2008, p.54) that is modelled on the operation of the trace, such as physical evidence often confined to the courtroom and technical expertise. However, in combining Kirschenbaum’s (2008, p.56) concepts of the trace as
individualisation and verifiability with Gansing’s generic media archaeology practice (2013), a bitcoin represents an appropriation of an old for a new currency exchange arrangement, while simultaneously forgoing or working above traditional currency structures. Bitcoin is an example of a forensic materiality moving toward generic practice by lessening an emphasis on ‘micro’ level specialisation or expertise. Bitcoin makes the claim that it “is designed around the idea of using cryptography to control the creation and transfer of money, rather than relying on central authorities” (Bitcoin Wiki 2013a). The coins are comprised of digital signatures and each transaction has a unique signature supported by an impenetrable peer-to-peer network structure (Fig.3.28). Each coin, or coin division, and owner is retained in a “block chain,” a “shared public ledger,” and transactions are initiated via a “private key” (Bitcoin Wiki 2013b). Bitcoins, or their divisions, are verifiable individual digital network objects with transaction traceability and time stamping at the core of their function (Nakamoto 2008). Paradoxically, bitcoin properties are very much a play on the exchange value of formal materiality, yet their forensic traceability is also non-material digital code. The currency is unique in its operation; as a unit of value it has no institutional regulation in the way of a stable or direct connection to commodity value (for example, gold), commodity-backed money (for example, a representation of gold), government-controlled fiat money or central bank reserve currency. A fixed amount of bitcoin in circulation plus a set of timed releases (Bitcoin Wiki 2013b) qualifies the currency’s value and rarity, a digital network construct comparable to the mining and availability of precious metals. In representing a physical construct and the cultural technique of traditional currency and trade, Gansing’s (2013) generic force in network culture is observed in bitcoin technology. Bitcoin negates its parent
system by subtracting attributes and rewiring verifiable indices—it is a generative
generic version of traditional currency. A concrete trace in this generic realm cannot
rely on physical inscription only, but can become concrete via a forensic materiality
of verifiability.\textsuperscript{15}

3.9 Dual ‘and’ Dialectic: Hypertrace not Hyperreal

![MFM images of a hard drive surface showing the detailed trace required to reconstruct or reanimate data from a platter surface and identify misregistration or hysteresis.]

Digital media objects such as bitcoin still need physical points of contact for storage,
and accommodation for a physically concrete trace is scattered across multiple
computer hard drives or server locations in complex peer-to-peer networks. Network
complexity or anonymity only adds to representations of immateriality, but it is
bitcoin’s dispersal across varying physical layers of network infrastructure that
constitutes the practice of bitcoin mining. Bitcoin storage inspires reason for treating

\textsuperscript{15} It should be acknowledged that while bitcoin transactions are public and their activity traceable, an integral
process in the function of the currency, the peer-to-peer network structure and private key protocol means that,
for external authorities, bitcoin transactions are rendered irreversible and anonymous. This also adds to the
generative force of the generic.
both analogue and digital media similarly in their tracing and to find it we return to Kirschenbaum’s micro level enquiry. The processes of magnetic tracking, misregistration and hysteresis in media storage (Kirschenbaum 2008, pp.64-6), via the likes of magnetic force microscopy (MFM) (Fig.3.29), add to digital media stability in verification and individualisation. The crux is that digital objects when formed and written to disc leave a unique mark in planographic inscription that is not easily copied over nor completely removes their trace (2008, pp.95-6). There is always individual and traceable shadow data that is not essentially ephemeral but is still temporal, echoing notions of the palimpsest and trace as physical degradation (2008, p.66). This is another amalgamation point for the qualities of supposed analogue and digital paradigms, as Kirschenbaum (2008, pp.68-69) notes: “Our most persuasive evidence for the autographic individualisation of bit-level digital inscription comes not from sight, but from the instrumental touch of the mechanism.” Recognition of shadow data and individualisation in physical digital inscription presents a concrete trace with the ability to cross analogue and digital storage distinctions, as both are physical and both share time-based degradation qualities.

Kirschenbaum champions the digital traceability in analogue inscription as “an intervention in or modification of a physical substratum” (2008, p.59), making claims that exact digital copies representing a loss of physical individualisation are hard to support. Nevertheless, a distinction needs to be acknowledged between the trace as physical substrate, and simulation and sign referring to indistinguishable digital multiplication. Kirschenbaum does not specifically mention Baudrillard, but does hint at his concepts (2008, p.53), to the effect that Baudrillard’s ideas of simulacra (1983) and hyperreality (1988) are challenged by the verifiable traceability made possible by
the intervention of digital forensics in the manifestation of traceable conduit qualities. This means that analogue/digital, map or procession are examinable. Pierre Lévy (French philosopher, cultural theorist and media scholar: b.1956), (highlighted by Massumi (2002, p.309) as alternative to Baudrillard) also recognises the activity of past technologies in resisting ideal notions, such as terminal simulation emerging from a cultural semiotics of pre-emptive imitation, modelling or digital copies. Lévy cautions against a critique of technology that reduces it to an overriding force on society and culture. He says:

A technology is produced within a culture, and a society is conditioned by its technologies. Conditioned, not determined. … To say that technology conditions is to imply that it provides access to certain possibilities. That certain cultural or social options couldn’t seriously be contemplated without its presence. … A technology is neither good nor bad (depending on context, use, and point of view), or even neutral, for that matter (since it conditions or constrains, exposes or closes off, that range of possibilities). It is a question not of evaluating its ‘impact’ but of identifying those points of irreversibility where technology forces us to commit ourselves and provides us with opportunities, of formulating the projects that will exploit the virtualities it bears within it and deciding what we will make of them. ([1997] 2001, pp.7-8)

The point being made through Lévy is that network culture exploits a semiotic virtuality, not a virtuality of material digital potential (Massumi 1998, pp.309-11). Terminal simulation exemplifies a representational ideal, not temporal material patterns becoming symbolic or signal. Additionally, in a network culture of exchange,
often associated with the advent of Web 2.0 and social media, the readability of signs suffers and the nature of origin, signified or model is often subverted or goes unacknowledged. In this scenario of disassociated and shared signs, Lévy provides a platform for us to reconsider the importance of the trace over that of the sign:

The sign’s passage through media channels dethrones representation. … Within the semiotics of the commodity space, the sign no longer represents; it traces. … The sign no longer points toward a meaning or an object; it flows, radiates, diffuses, regenerates, and clones itself, proliferates. It is no longer a representation that has been accredited by transcendence, but a virus attempting to replicate itself, fighting against other viruses to occupy the media space … since within the commodity space, the sign is merely a byproduct of the processes of recording, reproduction, and distribution. ([1995] 1997, pp.167-8)

Considering the ground already covered, the trace, if anything, ‘is’ immediate evidence of the processes of re/production, whether or not the workable by-product of the sign’s redundancy or instability. The trace holds potential in that it is active at both the material surface of a medium ‘and’ subverted signification or systems of representation. The trace is a medium through which the physically concrete and culturally semiotic should be connected and acknowledged. In doing so, the trace can also expose the hidden operations of a medium as its archaeology requires close examination of cultural technology. Such a focus on the trace in network culture is a state of ‘hypertrace’ not the hyperreal.
Figure 3.30 Closed Circuits: Dual, Not Dialectic? Diagram by Greg Hughes (2016), visualising the ‘dual’ symbolic systems of wider network culture and the concrete actions or operations of technical media. The trace is illustrated as a proposed means of investigating a dialectic connection between the two seemingly closed systems.

The problem, as already covered in the discussion on Benjamin ([1917] 2008; [1936] 2008; [1939] 2007; [1927-1940] 2002; Buck-Morss 1989) and Gansing (2011; 2013), is the complication of concrete trace due to network culture’s ‘generative generic’ tendency to disconnect the medium-based interconnections in Benjamin's dialectical image method (Fig.3.30). This non-discursive or non-dialectic ‘disconnection’ is suggested to be due to a network cultural dependence on semiotics, automated or autonomous image exchange, and/or image production being made invisible, or simply the difficulty imposed by the accessibility of differing archive systems and qualities. These causes as bases for symbolic work dominate the dialectic potential of interconnections between the physical qualities of image production and exchange.
The irreversibility of the dialectic image’s demise is a particular concern and, with media ‘conditioning’ in mind, the trace is proposed as an intervention. The trace is a means of better understanding the conditioning effect of transversal media practice via its qualities of survival across the meeting point of analogue (physical) and networked digital symbolic work in network culture.

It should be noted again that Benjamin, in siding with notions such as ‘ur-form’ in his arcades investigation ([1927-1940] 2002, pp.462-3), sets up the present discussion that targets traceable media artefacts, their associated production and consumption, but not as notions of absolute truth, meaning or ‘essence’ associated with notions of origin. In short, it is the traceable interconnections between materialities and media substrates that are prioritised, over any desire to celebrate the interpretive original: where the original is that which may have left the trace. The priority should instead be a temporal objectivity observed from a transversal concrete trace that re-establishes a dialectical connection between mediums and materialities, not hermeneutic discourse. In a global network, Lévy’s ‘cyberculture’ is one where “cyberspace engenders a culture of the universal not because it is in fact everywhere but because the form or idea of cyberspace implicates all human beings by right” ([1997] 2001, p.100, italics in original). Lévy’s statement resonates with Gansing’s analysis of the role of the ‘generic’ in media archaeology where the generative generic is a result of universal network conditioning. “We are all in the same bath, the same communicational deluge. The question of semantic closure or totalization is no longer relevant” (Lévy [1997] 2001, p.100).
3.10 Medium-Specificity and Software Ideals

Figure 3.31 The n⁻¹ Dimensional Signifier, visualising a proposed path in which the trace traverses Kittler’s interpretation ([1999] 2012, pp.226-7) of Flusser’s ‘dimensions of representation’ (2000; 2011). Diagram by Greg Hughes (2016).

Cultural semiotics is not the only challenge for trace in a digital network culture. Eradication of medium-specificity and the thinking of a medium itself are challenged by post-media perspectives (the merging of all media forms into only digital signals and their manipulation). Kirschenbaum’s position adds resistance to post-media perspectives as much as it grounds the digital in the physical. Kirschenbaum notes the “slippage between media convergence and total recall” (2008, p.105). For instance, in *Gramophone, Film, Typewriter*, Kittler points out the misconception that:
The general digitization of channels and information erases the differences among individual media. … Inside the computers themselves everything becomes a number: quantity without image, sound, or voice. … —a total media link on a digital base will erase the very concept of medium. ([1986] 1999, pp.1-2)

For Kittler the notion of media being erased is entertained throughout his text. However, the scenario in software studies is upheld and promotes the extinction of media individualisation via the universalisation afforded by total digital symbolic exchange and software application topography. In 2001, Manovich argued that the notion of a medium was in danger and in 2013 he reinforces the motif further stating:

There is no such thing as 'digital media.' There is only software—as applied to media (or 'content'). Or, to put this differently: for users who only interact with media content through application software, the 'properties' of digital media are defined by the particular software as opposed to solely being contained in the actual content (i.e., inside digital files). (2013, p.152, italics in original)

Manovich appears determined to continue a history of digital processing informed by a software ideal and a vocabulary of universality, with less concern for unique mediums and medium-specificity.¹⁶ Kirschenbaum, displaying contradictory interests to Manovich, calls for a close investigation of the inscriptive surface of media by “working to discover the heterogeneity of digital inscription to the furthest extent

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¹⁶ Manovich’s post-media perspective and post-media literature are broad and beyond the need to map for this study; see The Language of New Media (2001a) and Post-media Aesthetics (2001b), and the foreword by Tim Leñior and introduction from Mark Hansen’s New Philosophy for New Media (2004), within which Hansen attempts to outline a post-media plethora and separate his argument from the movement.
possible” (2008, p.106). If post-media notions of dissolved medium topologies were to become conventional traces as established via Benjamin, the medium-specificity branch of media archaeology (Parikka 2012, pp.84-89), Gansing’s analysis of the transversal role of the ‘generic’ in media archaeology (2011; 2013), and the forensic materialities of Kirschenbaum (2008) would become inoperable. Kirschenbaum counters the idea, suggesting:

The lesson here is that the same channels of optical fibre networks that flatten media down to a universal symbolic regimen can also be employed to leverage that same regimen to write out or write-protect any data stream encoded to operate within it. (2008, p.106)

In other words, a universal data stream’s ability to dissolve specific media is a reductive ideal. There is little value for the trace in digital transmission (multiplication) if content is not rendered out in distinguishable form. Creative production and consumption would also be universally bland. In network culture the medium is rewired but not eradicated; for example, writing out optical data as audio signal is possible and a common digital media glitch or noise art practice (Kelly 2009; Krapp 2011, pp.53-7; Nunes 2012). The stability of a concrete trace is already challenged when lifted from the physical and placed in the digital as an emulated or manufactured representation; to eradicate the medium would only move toward greater semiotic subversion. Essentially, the problem is not the disappearance of media and their qualities, but rather the abstraction of their direct and material relationship to image processing potential. Kittler’s interpretation ([1999] 2012, pp.226-7) of Flusser’s ‘dimensions of representation’ ([1983] 2000; [1985] 2011) (Fig.3.31) highlights an
incremental concealment of the signified relative to computational media. Kittler suggests that “computers represent the successful reduction of all dimensions to zero,” in the final stage of an n⁻¹ dimensional signifier scenario ([1999] 2012, p.227), after crafted objects, drawing and painting, and linear texts. In short, computers themselves represent little as actors of image processing and production, hence the attention given to software. However, in line with medium-specificity, the trace can and does follow a path that traverses each representational dimension and allows calculation and computation to reveal symbolic work alongside manifestations of compensational computer interfaces. For example, by revealing the inside of the blackbox, the trace and techniques of tracing become a feedback bridge between content and non-content approaches to media because, simply put, the trace marks content ‘and’ medium.

3.11 Chapter Conclusion: Toward an Annexed Trace for Network Culture Observation
Kirschenbaum’s forensic trace is reminiscent of Benjamin’s trace that exposes a disconnection across transversal dialectical images. The trace of analogue media in assemblage with the digital is not impossible to locate but made more difficult and calls to be redefined. Yet this discussion is not proposing an intricate microscopic reading of technologies of inscription. Kirschenbaum (2008) offers this discussion a sensibility that is medium-specific. Parikka (2012) addresses various perspectives on media archaeology relevant to the consideration of the trace across analogue and digital amalgamation, especially in a network culture, as a layered archaeology of media production and use (Gansing 2013). Kirschenbaum (2008) and Gansing (2013) address a critical co-dependency in and around analogue and digital
assemblage that can help improve our ability to trace the uncertain and hidden processes of media exchange: in coding, inscription and recovery or exchange of data. Kirschenbaum focuses upon that which is found in analogue and digital inscriptions, the forensic and formal materiality of written data. Gansing (2013, p.80; 275-99) examines the treatment of analogue and digital phenomena as merged under the umbrella of a transversal generic, yet generative, media archaeology practice, such as the redeployment of old media in the new: as renewed medium use and a cultural impulse in content treatment. Both approaches are present in the field of media archaeology as mapped by Parikka (2012), and to both can be added the concept of trace found in Benjamin.

In the practice of media archaeology, if Benjamin’s trace is to function in the contexts that Kirschenbaum and Gansing describe, then the trace must move toward dual ‘and’ dialectic operation (Fig.3.30): dual, because the suggested ‘generative generic’ effect on transversal practice, given cybernetic network culture conditioning, sees media paradigms merged and rewired but operating in a non-dialectic manner (Gansing 2013, p.275) and dialectic, so as to move across analogue and digital assemblages, in terms of the trace’s potential to facilitate interconnection between cultural technology and cultural semiotics. Consequently, Parikka’s (2012, pp.84-89) medium-specificity, which champions Kirschenbaum, is vital to trace and the trace of media as it highlights the need to “rethink the machine as the archive: the software, the hardware, the protocols and platforms which form the visibility, the audibility, the statements of what is” (2012, p.87). However, the unique properties of a medium that form specificity are of less interest as a taxonomy and of greater interest in mapping creative and archival
use. Medium properties for the trace, then, constitute stepping-stones or trajectory points in the non-linear paths of media archaeology practice as an activity. The duality in the concept of the trace requires a transversal operation of media use across the technical and formal properties, both creative and applied, of digital and analogue media as a prolific and generic assemblage of information. Conclusively, the machine accommodates a material trace and the machine’s interface and image processing accommodate the beginning of the trace as the fallout of a subverted sign. In this sense, the trace as outlaid so far has an ‘elephant in the room’, for a Derridean reading of the trace\textsuperscript{17} must be undertaken. The trace is a link between, and needs to be of value across, broken or mutable ‘and’ immutable symbolic work. Derrida’s trace and the Actor Network Theory of Latour need to be dealt with and combined to clarify the dual operation of the trace.

\textsuperscript{17} It should be acknowledged that this study’s use of Derrida is distinct from Kirschenbaum’s. Kirschenbaum sets out a ‘grammatology’ of the hard drive (2008, pp.86-96), “its essential characteristics … as an inscriptive technology” (2008, p.88) and mentions Derrida’s \textit{Archive Fever} ([1995] 1996); however, it does not reference \textit{Of Grammatology} ([1967] 1997) or explicitly target Derrida’s concept of trace throughout the text. The present study thus uses Kirschenbaum (2008) as a platform for a need to continue a Derridean reading into the notion of a network culture orientation of the media trace.
4. BROKEN/ HIDDEN SYMBOLIC WORK: DERRIDA’S TRACE

Figure 4.1 Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*. This chapter is set at the point of ‘Trace: Broken/ Hidden Symbolic Work.’ At this position, the trace’s path through technical media, couched in network culture, has split in two to consider the mutable Derridean side of a proposed dual operation  trace.
Figure 4.2 Screen capture. *Planet Terror* (2007), showing Cherry Darling (Perf. Rose McGowan) in a sex scene with overlaid film degradation, directed by Robert Rodriguez and Quentin Tarantino for Troublemaker Studios.
[T]he notion of *program* is invoked. It must of course be understood in the cybernetic sense, but cybernetics is itself intelligible only in terms of a history of the possibilities of the trace as the unity of a double movement of protention and retention. (Derrida [1967] 1997, p.84, italics in original)

… a marked reminder that *différance* always already comes about by means of the operating principles of technical media. (Siegert 2015a, p.3, italics in original)

### 4.1 Why Derrida’s Trace?
The focus in this chapter is on the writings of Jacques Derrida (1930-2004), particularly deconstruction and the concept of the trace. The problems and paradoxes of using Derrida are explored along with a justification for transferring Derrida from a philosophical field to media research inquiry, inspired by Benjamin, technical media, media archaeology and cultural techniques. Deconstruction is aligned with symbolic work observed in creative production and its critique, specifically postproduction film effects, graphic design and typography. The central theme of the chapter is to approach
the trace from a Derridean perspective in order to move toward the combination of a post-structuralist take with concrete (Benjamin), immutable or forensic (Kirschenbaum and Latour) notations of the trace—in short, a discussion of Derrida as a tool for observing and theorising the proposed dual operations of the trace as media articulation. The trace is approached as a medium itself, to question the symbolic work of technical media centred on transversal analogue-digital assemblage in network culture. This manoeuvre supports the concept proposed by this thesis, referred to as ‘analogue-trace.’

When the qualities of analogue reproduction are converted to digital means, a transition of representational operations is evidenced. There is an alteration and disconnection between the original apparatus, the artefact and the channel of the converted quality. In tracking the path of a particular quality, we can say there is at once a loss and a gain. The loss includes, but is not limited to, specifics in historical indicators and contextualisation, the unpacking of meaning and intended purpose and the function of the medium used. The symbolic work of medium, artefact or channel loses the material ground of reproduction it was once set on. However, the gain in conversion is entry into a digital realm of mutable techniques of re/production where verifiable media trace transforms into something else. The symbolic work of digitised analogue media qualities is morphed and abstracted into modes of expression that generate image codes linked to non-specific pasts, but utilise a medium-specific trace. The trace is a central link between the two poles of such conversion and its articulation is a means to approach the observation of shifting modes of representation.
The special effects postproduction work of Troublemaker Digital for directors Quentin Tarantino and Robert Rodriguez provides a site to examine a generative trace in action. The directors made two films under the promotional ‘double feature’ title ‘Grindhouse,’ switching between primary and secondary director roles in support of each other’s film (Rodriguez, Tarantino & Volk 2007, pp.6-9). Tarantino steered *Death Proof* (2007), a zombie slasher, and Rodriguez *Planet Terror* (2007), a muscle car slasher thriller, both for Rodriguez’s Troublemaker Studios and Dimension Films. Their ‘grindhouse’ and double feature motif redeploy the genre of ‘exploitation’ films and cinemas, from the late 1970s and early 1980s. Working with digital production techniques the directors utilise and appropriate the qualities of B-grade low-budget film production (Rodriguez, Tarantino & Volk 2007, p.142). The qualities of such production become a trace of past methods of re/production. Analogue artefacts such as scratches, jitter, faded and inconsistent film stock types, poor splicing, lost or burnt out footage, from treatments in filming through to cinema projection, are observed in both films. As can be seen via a before and after composite comparison by Troublemaker Digital (Fig.4.3), these artefacts are physically converted, digitally composited/ manufactured, and combined with ‘stock’ footage from networked digital archives in their assemblage (Rodriguez, Tarantino & Volk 2007, p.142). In addition, this analogue-digital technique is not implemented to simply give the two films an old or nostalgic look consistently throughout; rather, the technique is part of the director’s arsenal of affect, used to enhance sequencing, the distinction of scenes and transitions with filmic medium-referential intervention. For example, in *Planet Terror*, characters Cherry Darling (Rose McGowan) and El Wray (Freddy Rodriguez), past lovers, reunite intimately in an irreverent sex scene. As the scene intensifies so too does the
amount of analogue film degradation as a progression of content effacement (Fig.4.3), culminating in the film burning out and the text “missing reel” being displayed before cutting to the next scene.

The trace of analogue film performs two interesting types of symbolic work when utilised by Rodriguez in *Planet Terror* (2007), and positions the trace as distinct from the ‘emulation’ or ‘simulation’ of a past medium. Firstly, the trace is used as an overlay on edited pacing adding to the scene’s construction. Secondly, the technique is especially media-referential in that the trace of increasing film degradation represents excessive plays of the scene through a projector, potentially because the content is a sex scene. Thus, the trace intervenes on analogue-digital re/production and in the process alters a broader consideration of media transparency. The observed trace resists being analogue because it is developed digitally and manipulated beyond analogue means, yet it resists being digital because it represents an analogue process. In this scenario, the trace is not simply a crude mimetic emulation, simulation or skeuomorph involving analogue reproduction. Firstly, this is because the filmic qualities are manipulated, iterated and ‘used’ beyond a simulation or emulation of original grindhouse analogue qualities in the versatility its digital integration offers through editing. Secondly, simulation or emulation implies transparency, immediacy, and modes of modelling, all of which the trace subverts as an obvious presence and re-working of the mediums involved. The trace, in this scenario, is not-analogue and not-digital, but rather a generative link or active element with its own symbolic force amongst wider modes of representation. These modes of representation resonate with Derrida’s concept of the trace.
4.2 Deconstruction?
The trace is a key concept active in Derrida’s theory of deconstruction. It is the role of the trace in two overarching understandings of Derrida’s deconstruction that is of concern. Firstly, there is his attempt to subvert the foundations of logocentrism via his famous application of semiotics and the critique of language on traditions of philosophy—a tricky folding of an inversion of speech and writing back onto the big issues of metaphysics. Secondly, and functioning under the umbrella of the first, there is a shift in concern from the identity or purpose of the author to a focus on the processual, the middle and the variously marginalised parts that make up whole written works or long-standing theses. Trace operates within these two areas of deconstruction and as such a perspective of deconstruction needs to be provided.

Derrida questions the foundations and boundaries of philosophy and our understanding of the act of reading, by ‘deconstructing’ the writers he examines in his discourse—utilising the terms or concepts in question but aggressively destabilising them for his own deconstructive critique and continued use. An example is found in Derrida’s harsh deconstruction of the autobiographical philosophy of Jean-Jacques Rousseau’s Essay on the Origin of Languages (1781), where the concept of the “supplement” aligns Rousseau’s theory of language with masturbation (Derrida [1967] 1997, p.165). Derrida’s approach has generated considerable academic tension and debate, making

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18 By nature of Derrida’s various explanations, deconstruction resists being defined and autonomously applied. Such an activity goes against the core thesis of his work—to subvert the foundations of metaphysics and logocentrism. In this sense, it seems deconstruction is set up by Derrida to have no foundation in definition. It seems to be a structural defensive move and, like the excessive length, complexity and ambiguity of Derrida’s writing, only makes critique harder. A debate about defining or justifying the application of deconstruction is not entered into, but rather accepted as existing, being used or let happen as a set of critical activities, and from that take what it has to offer in relation to the context of this study.
it imperative to set out a working understanding of deconstruction and the function of his concept of the trace, before turning to its application.

Before moving on to a more in-depth exploration of deconstruction and the trace, it is necessary to justify lifting Derrida from his philosophical context for the theoretical and methodological purpose of this study. Firstly, we need to align technical media and creative production, including modes of digital inscription and reproduction, to the focus on writing in his philosophy. Graphic design authors and critics, Ellen Lupton and J Abbott Miller, point out: “According to Derrida, any memory system can be called a form of writing, since it records information for the purpose of future transmissions” (Lupton & Miller 1996, p.5). This analysis of Derrida’s position is confirmed when, in an interview on deconstruction and the visual arts, he states:

We can always refer to the experience that we as speaking beings … have of these silent works, for we can always receive them, read them, or interpret them as potential discourse. That is to say, these silent works are in fact already talkative, full of virtual discourses, and from that point of view the silent work becomes an even more authoritarian discourse. (Derrida 1994, p.13)

The statement is only partly useful, though, as it does not specifically target writing; there is a connotation of spoken word. We can assume a language-based connection, albeit an “inflation of the sign ‘language’” (Derrida [1967] 1997, p.6), between such works and the reader, but to align deconstructive manoeuvres on writing with technical media in creative production we need a little more evidence. In the lead up to the claim that “there is no linguistic sign before writing” ([1967] 1997, p.14), holding writing as
primary to the phonetic, Derrida paradoxically inflates or champions what writing has become:

Now we tend to say ‘writing’ for all that [(all that language encompasses in signification)] and more: to designate not only the physical gestures of literal pictographic or ideographic inscription, but also the totality of what makes it possible; and also, beyond the signifying face, the signified face itself. And thus we say ‘writing’ for all that gives rise to an inscription in general, whether it is literal or not and even if what it distributes in space is alien to the order of the voice: cinematography, choreography, of course, but also pictorial, musical, sculptural ‘writing.’ ([1967] 1997, p.9)

The inscribable and reproductive processes behind creative production and media exchange sit well here. In championing writing and building to its subversion of speech, Derrida opens up a space to allow deconstruction’s application to inscriptive media. Derrida’s tone and exaggeration, in the quotation above, is an example of his deconstructive tactic of inflating the instability of meaning, while advocating writing. In this instance, he grounds inscription by suggesting a common denominator or elemental component of writing, the grapheme or written mark ([1967] 1997, p.9). “[T]he concept of the graphie [unit of a possible graphic system] implies the framework of the instituted trace, as the possibility common to all systems of signification” ([1967] 1997, p.46, italics in original). These units or elements become or are “instituted traces” and are integral to our continued discussion later, but for now there is a sensibility that allows alignment with the potential of wider inscribable creative production from the meaning and value of Derrida’s perspective on writing.
4.3 Deconstruction: Do Not Apply
From the analysis so far, it is maintained that the gap between creative production and philosophical writing is not a concern when inter-stitching Derrida’s deconstruction with contexts outside of its own. Deconstruction is also already well couched in the practice and criticism of creative production, for example, graphic design. The escalation of computer use, especially in design studio production, commencing in the late 1980s and early 1990s, facilitated a deconstructive typographic practice and visual style. This shift in approach to visual communications design occurred just as Derrida was being published in translation, from French to English, and influencing developments in American literary theory—a splintering that promoted processual freedom away from the more rigid economic dictates of past printing techniques and modernist formalities (Byrne & Witte 1990, pp.80-1). Lupton and Miller argue that deconstruction is not a shallow label for a visual style, but a strategy of creative production and critique:

The word has served to label architecture, graphic design, products and fashion featuring chopped up, layered and fragmented forms imbued with ambiguous futuristic overtones. … [D]econstruction is not a style or ‘attitude’ but rather a mode of questioning through and about the technologies, formal devices, social institutions and founding metaphors of representation … it describes a strategy of critical form-making which is performed across a range of artefacts and practices both historical and contemporary. (1994, p.346)
The statement and continued argument by the authors acts as late 20th century support for deconstruction’s acceptance in creative production, specifically typography. Lupton and Miller continue by bringing a consideration of typography to Derrida’s deconstruction, or the “Design in Deconstruction” (1994, p.354), effectively placing Derrida’s concerns with writing on the same trajectory as visual communication design’s concern with typography. Referring to what writing offers over the phonetic, the visual support structures of written language in the design of type and graphic layout are seemingly the same subject as in Derrida’s ([1967] 1997) subversion of Saussure’s structuralist theory on phonetic writing:

Key among these marks, which Derrida called ‘graphemes’, are various forms of spacing—negative gaps between the positive symbols of the alphabet. … The alphabet has come to rely on silent graphic servants such as spacing and punctuation, which, like the frame of a picture, seem safely ‘outside’ the proper content and internal structure of a work and yet are necessary considerations for making and reading. (Lupton & Miller 1994, p.357)

The meaning, value and play of these ‘supplements’ is the stuff of typography, the everyday considerations of a practising graphic designer or typographer. Derrida and typography are linked and not necessarily inadvertently or metaphorically. Lupton and Miller highlight *Glas* (Derrida [1974] 1986) as a publication by Derrida that troubles traditional academic document layout to disturb conventional patterns of reading and the meaning of text as content (Fig.4.4). The manoeuvre points to the relationship between the practice of typography and graphic design, but also highlights how the
text by Derrida negotiates with the material qualities of writing’s channel of transmission: printing.

Derrida’s text, in particular the layout and typography, as a manipulation of the material ground supporting the content of *Glas* ([1974] 1986), points to significance and critical value in the supposed redundant elements of a signal—a deconstruction via external elements as always already internal active factors in the relay of meaning.

Derrida’s *Of Grammatology* ([1967] 1997) is said to be a study of writing as representation (Lupton & Miller 1994, p.358). Typography is placed in the same
category, giving purpose to the ongoing application of deconstruction beyond a historical ‘ism’ in design (1994, p.363) and more a material operation. However, a concern missing from Lupton and Miller is a detailing of Derrida’s ‘trace’ as a concept within deconstruction. At this stage it is possible, with sensitivity to the differences in fields of study, to relate Derrida and his stance on linguistics and semiotics to the critique and deconstruction of analogue-digital relationships in the inscriptive technical media of digital network culture.

**Figure 4.5** Joan Dobkin’s *Poster for Amnesty International* (1991), designed in association with Cranbrook Academy of Art, showing the layering of and intervention on typographic codes as a mode of ‘deconstruction.’

In applying Derrida’s deconstruction to creative production and consumption, though connections have been made, there are still traps in actioning it as a potential reductive technique. An example is Meggs’ 1990 deconstruction for designers guide
titled, ‘De-constructing Typography,’ published in the Step-by-Step Graphics Magazine ([1990] 1991). The piece is credited for bringing deconstruction to a broad graphic design audience and consciousness. However, Meggs pacifies Derrida’s deconstruction so as to make it palatable for a design audience. Rick Poynor, covering much of the same territory as Lupton and Miller (1994; 1996), quotes the danger in Meggs’ explanation of deconstruction: “Meggs defines it as: ‘taking the integrated whole apart, or destroying the underlying order that holds a graphic design together.’ This reduces visual deconstruction to dismantling” (Poynor 2003, p.48). Poynor continues by supporting the link Lupton and Miller (1994) make between typography and Derrida’s writing on deconstruction, a connection going beyond dismantling a design style period to being a useful critical tool. Rather than a style of practice, deconstruction can be utilised “to ‘expose and revise’ the mechanics of representation” (Poynor 2003, p.67). However, Poynor’s tone is somewhat negative, due to the limited examples on offer in design practice and in Lupton and Miller’s critique of design’s relationship to deconstruction (2003, p.67). Tension exists between cultural output that intellectually engages with deconstruction’s post-structuralism and the commercial demands of graphic design practice as an uncomplicated message service. For example, Cranbrook Academy of Art is recognised for its engagement with deconstruction (Byrne & Witte 1990, p.203), including work such as Joan Dobkin’s Poster for Amnesty International (1991) (Fig.4.5). Dobkin’s work layers and intervenes typographic rules and consequently hands over evidence of production techniques and a heavier demand on interpretation.

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19 Since Poynor’s publication the trajectory has been expanded, notably in Bartal’s 2013 MIT DesignIssues article ‘Text as Image in Japanese Advertising Typography Design’ where the characteristics of Japanese letterforms in their denotive proximity to pictorial ‘analogy’ rather than textual representation illustrates a link to the text/image breakdown within Derrida’s deconstruction (Bartal 2013, p.66).
to the viewer. However, deconstruction as an industry-oriented design technique must also consider delivery of a client’s message (Byrne & Witte 1990, p.203). Differing approaches often become a reductive battle between techniques and style, exemplified in David Carson’s work for Ray Gun Magazine (1992 - 2000), where vernacular subculture titles for deconstruction such as ‘new wave’ and ‘grunge’, sit in tension with the legibility of text-based content. This tension questions the purpose and function of the designer, as late Modern transparent participant in communication or active Postmodern contributor to an exchange of positions between the designer/author and the reader/viewer. This debate is not critical to the trace, but the cultural output in question offers up articulations of the trace of a medium for consideration. However, like Lupton and Miller (1994), Poynor (2003) does not detail Derrida’s ([1967] 1997) trace, opening up potential for ongoing critique beyond his marginalisation of such a trajectory.

Derrida’s ([1983] 1988) perspective on deconstruction as method, critical or practical, demands more sensitivity than any of the design writers mentioned have conveyed. Deconstruction cannot be a specific technique, critique or method. In accepting Derrida and deconstruction, we must be careful, as his approach by its own nature defies being defined, as does the word deconstruction, according to Derrida:

Deconstruction is neither an analysis nor critique and its translation would have to take that into consideration. It is not an analysis in particular because the dismantling of a structure is not a regression toward a simple element, toward an indissoluble origin. … I would say the same about method. Deconstruction is not a method and cannot be transformed into one.
Especially if the technical and procedural significations of the words are stressed [(as in a design approach)]. … It must also be made clear that deconstruction is not even an act or an operation … not only because it does not return to an individual or collective subject who would take the initiative and apply it to an object, a text, a theme, etc. Deconstruction takes place, it is an event that does not await the deliberation, consciousness, or organization of a subject, or even modernity. *It deconstructs it-self. It can be deconstructed.*

([1983] 1988, pp.3-4, italics in original)

Derrida ([1983] 1988) portrays deconstruction as a process or event and as a set system left open; from this it cannot, in theory, become an autonomous method or critique. Deconstruction is a concept left open and destabilised by its own character and seemingly shaped by the system of symbolic work in which it is operating. Deconstruction’s existence folds its characteristics onto itself, making it impenetrable to definition. The core concepts of Derrida’s approach to reading, found throughout his work, reinforce deconstruction’s undefinable nature. For example:

The laws of reading are determined by that particular text that is being read. This does not mean that we should simply abandon ourselves to the text, or represent or repeat it in a purely passive manner. It means that we must remain faithful, even if it implies certain violence, to the injunctions of the text. These injunctions will differ from one text to the next so that one cannot prescribe one general method of reading. (1984, p.124)
There is not a one-size-fits-all when it comes to deconstruction; the event remains open to the influence or bounds of the work in question. In this sense Derrida and deconstruction become the defenders of “the impossibility of constructing a coherent and adequate theoretical system” (Sturrock 1979, p.155) on which we can base one general method of reading. This obviously reflects on attempts to define deconstruction itself and produces a paradox when one attempts to discuss or apply deconstruction. The paradox stems from the structure or institution that houses the foundational, unpackable or assumed elemental concepts that a system relies on. For deconstruction, it is western philosophy or the logos and, in order to not be reduced, deconstruction must resist becoming the force of its bounds by remaining open to itself. It also reinforces an acknowledgement that the concept requires sensitivity when lifted from its philosophical context. In this sense, to move a Derridean take on the trace forward and to review its value in combination with more immutable symbolic work and techniques, the concept ‘trace’ will be extracted, to seek ‘events’ of deconstruction-oriented trace in media articulations rather than deploy them.

4.4 Toward a Derridean Trace: Not Quite Here, Not Quite There
The Derridean destabilisation of set systems, methods or procedures by deconstruction places modernist and postmodernist thinking in flux, notably when stepping away from formalist and “modernist intolerance with linear narrative structures [that] emerged from a concern to render the contents of consciousness rather than the flow of external events” (Booth 1996, p.119). In Derrida’s discourse, reading and reception pull away from a concern for concepts of the authoritative individual and concepts such as consciousness and the influence of biographic identity, the author/designer, on
philosophic and cultural production. Our reception as readers of any medium and the purpose of the producer or supposed originator are altered. Derrida’s concept of deconstruction pushes us away from the autonomous origin by introducing elements of ‘undecidability’ that can alter an assumed modernist, supposedly pure or dialectical truths, as Derrida writes:

I have called undecidables, that is, unities of simulacrum, ‘false’ verbal properties (nominal or semantic) that can no longer be included within philosophical (binary) opposition, but which, however, inhabit philosophical opposition, resisting and disorganising it. ([1972] 1982b, p.43)

Derrida expresses undecidability through the notion of the virus, saying that a virus “is neither living nor non-living; … if you follow these two threads, … you have the matrix of all I have done since I started writing” (1994, p.12). The virus is an undecidable, a thing and concept that cannot be placed on either side of a supposedly all-inclusive binary arrangement and thereby subverts the arrangement. We are introduced here to a space that sits between institutionalised oppositions. Lupton and Miller (1996), from a graphic design perspective, in extension of their review of deconstruction (1994), summarise Derrida’s undecidability usefully:

Deconstruction asks how representation inhabits reality. How does the external image of things get inside their internal essence? How does the surface get under the skin? Western culture since Plato has been governed by such oppositions as reality/representation, inside/outside, original/copy and mind/body. The intellectual achievements of the West – its science, art, philosophy, literature – have
valued one side of these pairs over the other, allying one with truth and the other with falsehood. Deconstruction attacks such oppositions by showing how the devalued, negative concept inhabits the valued, positive one. (1996, p.3)

Derrida’s concept of undecidability enables us to make a passage through the texts he discusses to expose the weaknesses always already within their oppositions, like the ‘clean’ dualisms that we may take for granted, not to be confused with generative or dialectic dualities. The process affords a re-reading of work no matter how irregular it may at first seem. Destabilising the hierarchy of the dominant right-hand concept with its left-other not only destabilises the binary in question but also the system or structure that has relied on and privileged a supposed purity or presence within. As Derrida puts it:

by means of a double gesture, a double science, a double writing, … an overturning of the classical opposition, and a general displacement of the system. It is on that condition alone that deconstruction will provide the means of intervening in the field of oppositions it criticises. ([1972] 1982a, p.195)

From this understanding of undecidability emerges the trace, the key term relevant to this study. Derrida’s theory of undecidability is broken down further into, but not limited to, his ideas of ‘trace’ and ‘différance.’ The two manifest together and as such are explored together here. Trace and différance lead us away from focusing our understanding of reception on one given system or one producer. As Derrida writes:

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20 The distinction between difference and différance is a play on linguistics. In a sense, the distinction is a tool of deconstruction and a graphic or typographic play too.
The play of differences supposes, in effect, syntheses and referrals which forbid there from being at any moment, or in any sense, that a simple element be *present* in and of itself, referring only to itself. Whether in the order of spoken or written discourse, no element can function as a sign without referring to another element which itself is not simply present. This interweaving results in each ‘element’ … being constituted on the basis of the trace within it of the other elements of the chain or system. … Nothing, neither among the elements nor within the system, is anywhere ever simply present or absent. ([1972] 1982b, p.26, italics in original)

Derrida introduces his own word *différance* that, like deconstruction, is paradoxically indefinable as a word or concept, but exposes within itself and its function the problem of symbolism that is assumed autonomous and irreducible ([1972] 1982b, p.40). Derrida’s concept of *différance* involves a manipulation of the visual representation of language, which reiterates a connection with the process of typography and graphic design practice. Derrida prefers to use his invented word *différance* to express this idea, where an ‘a’ replaces the ‘e’ of ‘difference.’ The manipulated word cannot be distinguished through French pronunciation from its source. It is only when read or explained through the prevalence of writing or inscribed form that it can be perceived (Derrida 1991, p.98). As a tool of deconstruction, the invented word begins to question linguistics and the presumptions of Saussurian semiotics by simply privileging writing over speech, but Derrida’s tactic also sets out to question oppositions in metaphysics and our understanding of signification as an undecidable: “It’s neither active nor passive. It is more of the order of what is called the middle, in Greek grammar, neither passive nor active” (1991, p.99). It is neither signifier or signified:
*Différance* thus designates both a passive difference already in place as the condition of signification and an act of differing which produces differences. An analogous English term is *spacing*, which designates both an arrangement and an act of distribution. (Culler 1982, p.97, italics in original)

We may think that a neutral concept is a pointless exercise, but as Derrida explains, “This does not prevent it from producing conceptual effects and verbal or nominal concretions” ([1972] 1982b, p.40). In summary, Derrida resists this term being reduced; *différance* is a “differentiation operative … within a supposed intact system of sameness, and that gives rise to difference in any form” (Wills 2001, p.317). Derrida places the trace in the same vein, linking it to *différance* and, for us, aiding in the beginnings of a definition of the trace:

The trace (of that) which itself can never be presented: that is, appear and manifest itself, as such, in its phenomenon. … The trace is never as it is in the presentation of itself. It erases itself in presenting itself, muffles itself in resonating, like the *a* writing itself, inscribing its pyramid in *différance*. ([1972] 1982a, p.23, italics in original)

Trace becomes Derrida’s replacement for ‘sign.’ He writes: “I prefer to talk about ‘mark’ or ‘trace’ rather than ‘sign’: with the idea of trace, the distinction between signifier and signified is no longer at all possible, and the distinction of the authority of the word, the unity of the word, is called into question” (1991, p.105). Trace is an undecidable or that which exposes undecidability, in this case between the levels of presence and absence of a supposed autonomous meaning, especially within an ever-
expanding and layering system. Because of the trace or with the trace, there “is no word [(or sign/image)] in natural language, which carries in itself, in its connotations at least, a zone of symbolism which is irreducible. No word is absolutely univocal, transparent, whether it’s the transparent representation of a sense or a signified” (1991, p.105). Derrida describes an unstable system and again it is via a relationship with *différence*:

> There are only, everywhere, differences and traces of traces. … Différence is the systematic play of differences, of the traces of differences, of the *spacing* by means of which elements are related to each other. This spacing is the simultaneously active and passive production of the intervals without which the ‘full’ terms would not signify, would not function. ([1972] 1982b p.27, italics in original)

The statement echoes the links made earlier to graphic layout, in that there is no longer an autonomous origin or definitive ending. We have to focus on something else, the ‘play,’ the in-between, or the relationship between elements within a work, all of which are at once hinted at and hidden by a liminal state of traces. In terms of creative production, the ‘something else’ can easily be the process, the parts that make up the whole, a transversal conversation of elements, a focus on and within the text itself and the systems that support a text. There is no longer a safety or comfort in the producer-artefact in its reception and the relationships formed by reception. *Différence* and trace ask not to dismantle a work, but to seek and reconsider the trajectories and their systematic instabilities, within the work’s codes of communication. In this scenario, the input of a producer as an individual is of less importance unless they become a vehicle of ‘undecidability’ in the act of production.
In *Of Grammatology*, Derrida ([1967] 1997) reiterates this through a deconstruction of Jean-Jacques Rousseau’s essay *Origin of Languages*. According to Starobinski (1988, p.xi), Rousseau was a philosopher who “was unwilling to separate his thought from his person, his theories from his personal destiny.” An examination of his approach, in short, is that “he asks us not only to read and admire what he writes but also to admire him in what he writes and trust the person he was and is, before and beyond his book[s]” (Starobinski 1988, p.271). Rousseau combined philosophy and autobiography, which was of concern to Derrida for the reasons discussed above. Through his deconstruction of Rousseau’s text, Derrida moves to focus on the process of a work rather than the finished product. He states it in terms of the signifier signifying a signified:

It is not the body of the sign that acts, for that is all sensation, but rather the signified that it expresses, imitates, or transports. It would be wrong to conclude that, in Rousseau’s critique of sensationalism, it is the sign itself that exhausts the operation of art. We are moved, ‘excited’, by the represented and not the representer, by the expressed and not the expression, by the inside which is exposed and not by the outside of the exposition. ([1967] 1997, p.208)

He suggests that we look beyond the sign and appreciate the process that makes up a part of the whole system. It is important to understand here that this application of deconstruction as action, play or process is not negative. Derrida writes, “It’s not destructive, not having the purpose of dissolving, distracting or subtracting elements
in order to reveal an internal essence. It asks questions about the essence, about the presence” (1991, pp.96-7). However, the effect it has is to reduce concern for the identity of the producer and the beginning of the productive or reproductive process, shifting attention to the medium and content at hand.

We take for granted that which is destabilised and our focus is drawn to the ‘play,’ the ‘middle,’ the ‘represented’ and the ‘expressed;’ we are pulled away from any stable origin or meaning. We are also removed from any outside presence that is not held within a particular text or the materiality of the artwork/design, including the producer and his or her purpose and, in relation to digital re/production, any outside certainties of the medium. Paradoxically, the matter of an image/message and its potential readings are expanded, but denotation is complicated, troubled, uncertain, unanchored, no longer relayed with assuredness. This circumstance is comparative to the material ground of analogue reproduction that is subverted in digital reproduction, as set out at the start of this chapter, with the example of Tarantino and Rodriguez’s analogue-digital ‘grindhouse’ cinema production (Fig.4.2 & Fig.4.3). The medium and its trace become something other than themselves in analogue-digital assemblage, encased in a systemic middle ground and Derrida’s controversial point makes sense: “There is nothing outside of the text” or “there is no outside text” ([1967] 1997, p.158). Just as when discussing Jean-Jacques Rousseau’s position as writer, Derrida suggests:

[I]n what one calls the real life of these existences ‘of flesh and bone’, beyond and behind what one believes can be circumscribed as Rousseau’s text, there has never been anything but writing; there have never been anything but supplements, substitutive significations which could only
come forth in a chain of differential references, the ‘real’ supervening, and being added only while taking on meaning from a trace and from an invocation of the supplement, etc. And thus to infinity, for we have read, in the text, that the absolute present, Nature, that which words like ‘real mother’ name, have always already escaped, have never existed; that what opens meaning and language is writing as the disappearance of natural presence. ([1967] 1997, p.159, italics in original)

Derrida shifts focus, from metaphysics and phenomenology, to a position where nothing exists outside of writing. As the supplement to speech, the formation of writing is the basis of language and meaning. In a practical summary of this concept, Margaret Morse states:

The absence of the sender of writing is but one aspect of the original absence of writing itself. Once a message is sent, it is disengaged from context and intention, free to be read, quoted and iterated endlessly in other contexts, generating semantic meanings that are particular, secondary, and supplementary each time. (1998, p.13)

If the original message and meaning composed by the producer are destined to be altered, our concern and reliance on the producer are reduced, as too is our perspective of their purpose for selecting a particular medium. We are held in a state of reception that involves only the elements and the relationships of the elements within the representational system. From Derrida’s perspective, we are placed in an
ongoing system of representations of representations, of traces of traces, an emersion of *différance*.

**4.5 Finding Trace, Not-Finding Trace**

In discussion so far, we have yet to extract a working understanding of the concept trace, although the trace shares a relationship with *différance* and undecidability. But what is behind the trace from a Derridean perspective? Keeping in mind that we are moving a lens across a consideration of the written or inscribed trace in a broad material field of practice, rather than concentrating inquiry on the trace in metaphysics and philosophy, largely because the trace as a metaphysical construct has concerns and a history beyond the scope of this study. Yet it is unavoidable that we chase the Derridean trace as it is found in the deconstruction of metaphysics. Again because of the non-concept of undecidability, we must be sensitive to its use, and cannot assume Derrida is defining the term and its purpose and function in one way only. It is always in the context of deconstruction that undecidability and the trace act. It is that which cannot be described by the structure of metaphysics that motivates the deconstructive strength of its agency ([1967] 1997, p.67). It is not the one thing that is found, but what is found, and at the same time cannot be found, as Derrida writes:

> The trace is not a presence but is rather the simulacrum of a presence that dislocates, displaces, and refers beyond itself. The trace has, properly speaking, no place, for effacement belongs to the very structure of the trace. ([1967] 1973, p.156)
The trace is a paradox; its means fold onto itself, with an ability to destabilise via its own instability or structural thinning. We find the trace, “standing in for the impossible or lost origin while at the same time being the mark of every enunciation whatsoever” (Wills 2001, p.317, italics in original). The scope of the trace seems immense; however, it is a play on the boundaries of language and the field of metaphysics. Derrida, in deconstructing the semiology of Saussure’s championing of speech, as a basis of sensory experience, and Husserlian phenomenology, says:

The trace is in fact the absolute origin of sense in general. Which amounts to saying once again that there is no absolute origin of sense in general. The trace is the diffèrence which opens appearance … and signification. ([1967] 1997, p.65)

The trace becomes or has always been a link to an origin that cannot be defined or reduced. Derrida calls it “arche-trace,” a trace of origin ([1967] 1997, p.61). The scenario asks for or emerges from a space outside of or before language—an acknowledgment of something else beyond the instituted. This is a space of “non-human agency” that “Derrida invokes across textural history the movements of the ‘trace’ or mark ‘older than’ history” (Cohen 2002 p.18), a space beyond “the ‘instituted trace,’ a structure of infinite referral in which there are only traces—traces prior to any entity of which they might be a trace” (Culler 1982, p.99). We can move on from such grand extremes of the trace to extract a simple required link or dependence with the past in the trace’s consideration. Yet again, though, it destabilises! This time, in relation to time, Derrida points out:
[The] impossibility of re-animating absolutely the manifest evidence of an originary presence refers us therefore to an absolute past. That is what authorized us to call *trace* that which does not let itself be summed up in the simplicity of a present. … On the other hand, if the trace refers to an absolute past, it is because it obliges us to think a past that can no longer be understood in the form of a modified presence, as a present-past. Since past has always signified present-past, the absolute past that is retained in the trace no longer rigorously merits the name ‘past.’ Another name to erase, especially since the strange movement of the trace proclaims as much as it recalls: differance defers-differs. ([1967] 1997, p.66, italics in original)

It is understood then that a trace cannot be simply present or defined by the communicable means of the present and if we were to try with the means of the past then we would be entering the paradox of the trace or require another structure to work with the past. What is of great importance from this understanding is that the logic leads Derrida to reiterate the trace’s connection with *differance* and in that link both share a double action across presence and absence. We can now say that a trace, in ‘undecidable’ function, announces something at the same time as recalling something within the structure it is deconstructing: an absolute meaning can never be absolutely present. Consequently, forensic, immutable or concrete signification and substrata trace are brought into question.

Gayatri Chakravorty Spivak (1997, p.xv), in her ‘Translator’s Preface’ to *Of Grammatology*, notes that Derrida’s trace, coming from French translation, carries with it “implications of track, footprint [and] imprint, the mark of an anterior presence, origin [or] master”. However, Spivak suggests that trace can substitute for other
undecidables, such as ‘arche-writing’ or ‘difference,’ making trace, as used by Derrida, “a word that cannot be a master-word, that presents itself as the mark of an anterior presence, origin, master” (1997, p.xv). This highlights the importance of the trace as a platform for Derrida’s non-concepts and consequently deconstruction. Spivak also reminds us of where Derrida begins, where supplements begin, with the sign:

<table>
<thead>
<tr>
<th>The sign marks a place of difference. … [and] the structure of the sign is determined by the trace or track of that other which is forever absent. As even such empirical events as answering a child’s question or consulting the dictionary proclaim, one sign leads to another and so on indefinitely. (1997, p.xvi-xvii)</th>
</tr>
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The trace replaces the autonomous sign and is all that remains of signification after deconstruction, undecidability, and différance have been realised. It is the space between oppositions, between such traditional standards as reality/representation, inside/outside, original/copy, mind/body, speech/writing, and in the computational digital media of network culture, analogue/digital. The trace, when bridging analogue-digital assemblage, is simultaneously active and passive. The trace exists, but it is an element of signification within a layered and folding system of reproduction, a ‘thing’ and consideration of representation that is active across basal material medium qualities, the ‘ground’ of their channels and wider codes of symbolic work. However, the circumstance we are left with is a relational conversation of seemingly marginalised elements: traces of traces and an origin that is itself a trace. The trace sits between, or ‘is,’ that which is present and that which is absent. How useful is seeking, if at all possible, articulations of such a liminal and seemingly terminal plurality of symbolic work?
4.6 Chapter Conclusion

Derrida’s extension of the trace renders symbolic work perpetually at play ([1967] 1997, p.70), a state of ‘broken’ (into many pieces) ([1967] 1997, p.91) and/or ‘hidden’ layered over or absent signifiers. Consequently, we reach an impasse with the concrete, forensic, objective, and/or immutable hypothesis for the trace, from Benjamin then through Gansing and Kirschenbaum to this thesis. However, Derrida chose the word ‘trace’ because: “in all scientific fields, notably in biology, this notion seems currently to be dominant and irreducible” ([1967] 1997, p.71). But contemplation of the trace as concrete mark, thing, indicator must be sensitive toward its potential to be deconstructed and should not be confused with the break-down of signification for which the trace is responsible in digital processing.

Derrida’s trace, used in relation to its written form as the inscriptive mark as a basal element, is safely within its bounds of closure, materially linking to the “outside, ‘spacial’ and ‘objective’ exteriority which we believe we know as the most familiar thing in the world” ([1967] 1997, pp.70-71). However, when a concrete trace is digitised, the stability of such a linkage is destabilised, and the concrete trace becomes something else, it is shifted. When approaching technical media couched in network culture the trace in analogue-digital assemblage subverts its system of representation and complicates the modes of reproduction we might take for granted: “Writing cannot be a reproduction of spoken language, since neither one (writing nor spoken language) comes first” (Guillemette & Cossette 2006). Similarly, the trace in transversal practices of analogue-digital re/production, exemplified by the digital integration of filmic analogue artefacts in Rodriguez and Tarantino’s Grindhouse cinema (Rodriguez,
Tarantino & Volk 2007, p.142), is not-analogue and not-digital reproduction and neither ‘comes first.’ This is “a marked reminder that différance always already comes about by means of the operating principles of technical media” (Siegert 2015a, p.3), but in this case the symbolic work of the trace, as a mode of différance or distinction marked in digitisation, is open to be deconstructed on its own terms as trace. Thus, a duality is imposed between the broken and immutable symbolic work at play. A concrete trace can track, trail or be used to find a path to follow. Yet, in terms of a method or mode of knowledge to approach transversal analogue-digital media, Derrida’s trace has a sense of reaching a terminal state of indefinite signification.

The construct of theories reached, at this stage, is that an understanding of Derrida’s trace is a means to seek out or point to active sites of indefinite analogue-digital symbolic work. Ultimately, exploration of the trace inspires modes of media inquiry core to the goals of this thesis, the Derridean conception of trace is not to be strictly applied but is identified as a means by which to find articulations of concrete trace challenged by digital reproduction and broken symbolic work: this is the ‘what’ of inquiry, do we need the ‘how’? Trace leads to more trace, but ‘how’ does trace motivate this process? What is concretely there and how does it survive through or across modes of analogue reproduction assembled in digital networks? For a dual action ‘transversal’ trace to be conceptualised we need to return to immutable considerations of ‘tracing the trace.’ The following chapter considers the trace’s immutable symbolic work via Latour’s actor-network theory’s concept of ‘circulating reference’ (1999), drawn from science studies. This next step is critical in moving toward a method for ‘tracing the trace’ as the conjoining of broken and
immutable symbolic work evident in network culture. This next step will require the theoretical integration of Latour and Derrida, to develop the ‘analogue-trace’ concept and its relationship to transversal media.
5. IMMUTABLE SYMBOLIC WORK: TOWARD TRACE IN ACTION

Figure 5.1 Diagram by Greg Hughes (2016), Trace: A Taxonomy of Enquiry, visualising the overarching thesis path and current chapter position to the reader. This chapter is set at the point of ‘Trace: Immutable Symbolic Work.’ At this position, discussion of the trace’s path through technical media, couched in network culture, is split in two and a proposed immutable side of the trace’s dual operation via Latour is considered.
Figure 5.2 Screen grab: ‘Shrooms,’ track 8 from Jerobeam Fenderson’s audiovisual album Oscilloscope Music (2016). The work features a transversal use of an oscilloscope as an immutable mobile connection for audio and video. “What you see is what you hear … vector graphics drawn with sound” (Fenderson 2016).

Figure 5.3 Scientific diagram by Susanna Venn (2012), showing the location and positioning of ‘quadrats’ for the study of vegetation movement in the Australian Alps. The diagram itself is an example of an immutable mobile ‘inscription’ that transforms and connects the site to the position of quadrats in a chain of reference.
5.1 Latour?

How does one pass from the first image to the second—from ignorance to certainty, from weakness to strength, from inferiority in the face of the world to the domination of the world by the human eye? … The sciences do not speak of the world but, rather, construct representations that seem always to push it away, but also to bring it closer. (Latour 1999, p.30)

This chapter reviews key concepts from the work of Bruno Latour (French, b.1949) as they relate to the trace, notably, his foundational concepts for Actor-Network Theory (ANT). Also relevant here is Latour’s earlier notion of ‘circulating reference,’ manifest in the chains of representation he observes in scientific practices and describes in the text Pandora’s Hope (1999). Latour’s foundations are in philosophy, but he is also a founding figure in Science and Technology Studies (STS), approaching laboratory practices from an anthropological, ethnographical and sociological point of view in Laboratory Life: The Construction of Scientific Facts (Latour & Woolgar 1979). More recently (1987; 1999; 2005), Latour has applied a material-semiotic critique to science and engineering and consequently the technical media ‘instruments’ of the science fields he critiques play a major part and are of most interest in this chapter. Latour sits in the controversial middle ground between social constructionism and French relativism (Harman 2009, p.12) and “is not so much a ‘philosopher of science’ as a metaphysician working in a philosophy-of-science idiom” (Harman 2009, p.36). Referencing Latour allows for the development of a critical grounding that points toward consideration of the dual operation of the trace, as immutable symbolic work in combination with notions of ruptured, broken or hidden symbolic work, such as
Derrida’s trace, outlined in the previous chapter. The goal is not to impose on the thinking of either Derrida or Latour, but instead to combine them in a theoretical system of review and conceptual development, to be expanded on in the following chapter. Combining Derrida and Latour allows both to inform the concept of the active trace housed in systems of symbolic interrelations (Harman 2009, p.25). However, Derrida’s trace is on the side of ‘questioning,’ via disruption, intervention and subversion as a kind of exploration of symbolic work. Latour, on the other hand, it is suggested, is on the side of ‘answers’ via observation, following and ‘tracing’ as a kind of empirical engagement with the world. Yet neither Derrida or Latour will be imposed on intentionally, but rather combined in reviewing the potential of approaching media enquiry with a medium-specific concept of the trace as already outlaid via Benjamin, Gansing and Kirschenbaum. This amalgamation of approaches to media ultimately seeks a middle ground to ‘thinking’ and ‘doing’ media, a productive feedback between the speculative and proven, the conceptual and applied, the immutable and mutable, or the symbolic and material.

5.2 On Actor-Networks and Trace: A Few Clarifications
Actor-Network Theory is approached as “a means of explaining the conditions for the emergence of innovation” (Buchanan 2010, para.1), in this case, the innovation of, and approaches to, technical media involving transversal analogue-digital re/production in digital network culture. When considering Latour, we must account for the core elements of ANT: ‘actors’ and ‘networks.’ It is almost safe to say that in ANT, and specifically in Latour, every ‘thing’ is an actor in a network. Latour (1996), in ‘On
Actor-Network Theory: A Few Clarifications,’ predating and informing *Pandora’s Hope* (1999), aims to clarify misinterpretations of ANT. This text will be used as an entry point to ANT. Latour (1996, p.371) simplifies the acronym ANT to AT, and states: “AT makes use of some of the simplest properties of nets and then adds to it an *actor* that does some *work*”. In short, ANT is closely tied to an uncomplicated denotation of words comprising its acronym, so much so that ‘network’ is simply ‘nets’ and their ‘work’ facilitated by ‘nodes’ of connection (1996, p.370). However, this simplicity should not be extended to the contemporary operations of Internet infrastructure or web-based social networks. ANT is not, for example, as technically constrained as the Internet and its Web, as Latour suggests:

A technical network in the engineer’s sense is only one of the possible final and stabilized states of an actor-network. An actor-network may lack all the characteristics of a technical network — it may be local, it may have no compulsory paths, no strategically positioned nodes. (1996, p.369, italics in original)

Likewise, an actor-network is not to be limited to human social networks as the theory does not limit research to individual human actors, “but extends the word actor - or actant - to non-human, non-individual entities” (1996, p.369, italics in original). In doing so, the risk of reductive separations or assumed pre-determinants between the agencies of people and technology is removed (Law 1992, p.382-83). ANT moves across such divides indiscriminately or totally. A goal for Latour’s ANT has been to move across institutional confines and methods of engagement in the big silos of nature, society, semiotics and technology (1996, pp.369, 374). Arguably, ANT
captures an analogue representation of the world, in a one-to-one stamp of a network and its components, as Latour suggests:

    Literally there is nothing but networks, there is nothing in between them, or, to use a metaphor from the history of physics, there is no aether in which the networks should be immersed. (1996, p.370)

Latour (1996) also suggests that ANT, for this reason, is at first reductionist and relative theory. However, ANT is only a starting point in a irredentism and relationist ontology (1996, p.371). ANT begins analysis or observation of the actions of the world from a position that allows marginalisation, boundaries, frameworks, institutions and limitations of historically difficult dialectics such as far/close, small scale/large scale and inside/outside to be put to the side. Latour states that:

    The notion of network, in its barest topological outline, allows us already to reshuffle spatial metaphors that have rendered the study of society-nature so difficult: close and far, up and down, local and global, inside and outside. They are replaced by associations and connections. (1996, p.372)

How then does an actor or actant enter this mix of ‘associations and connections?’ Actors are not solely based on an examination of properties, behaviour or renderings of networks and relations, they are defined by a relationship of an ‘always already’ moving and changing array of influence and relations:
An ‘actor’ in ANT is a semiotic definition — an actant —, that is, something that acts or to which activity is granted by others. It implies no special motivation of human individual actors, nor of humans in general. An actant can literally be anything provided it is granted to be the source of an action. (1996, p.373)

The relational foundations of ANT transition away from semiotics as a mode of ‘meaning making.’ Instead, the emphasis is put on activity between actors in relational ‘movement.’ “Any thing that does modify a state of affairs by making a difference is an actor—or, if it has no figuration yet, an actant” (Latour 2005, p.71). Additionally, actors can be emergent, they can take form from defining effects on other actors in the ‘trials’ (1999, p.311) of a ‘performance’ (1999, p.308), like experimentation in a scientific lab to establish results. Such a focus on relational origin, with which actants have to abide, in a movement toward becoming actors, should inform a pragmatic “naming of action” (1999, p.308) as a basis for symbolic work. Interestingly, Harman (2009) sums up a reading of We Have Never Been Modern (Latour 1993) by providing a neat perspective on the relational movement of actants across a wider consideration of time in Latour’s philosophy:

We have never been modern because we have never really made a purifying split between humans and world. For this reason, we cannot say that time passes in terms of irreversible revolutions, but only that it whirls and eddies according to shifts in the network of actants. An actant is an instantaneous event, but also a trajectory that outstrips any given instant. (Harman 2009, p.68)
Harman’s position on Latour’s ‘actant’ reiterates an emphasis on a ‘thing’ being
defined more by its ‘trajectory’ of relational movement through time than singular
present events. Simply put, the actant or actor’s trajectory “crossing time across a
series of minute transformations” (Harman 2009, p.46) should define an actor.

ANT can be perceived as a semiotics of materiality. However, signification or
symbolic work is not emphatic, its platform is not just that of the ‘Sign.’ The problem
ANT attempts to circumvent is that of the dead ends reached in functional engagement
with the world when based on signs and what they mean. In ANT, meaning is derived
more directly from materials “extending semiotics to things instead of limiting it to
meaning” (Latour 1996, p.375). Consequently, method is freed for explanation
restricted to hermeneutic description and an “empty methodological frame” (1996,
p.375) is made possible, as Latour sums up:

Building on the semiotic turn, AT first brackets out society and nature to consider
only meaning-productions; then breaking with the limits of semiotics without losing
its tool box, it grants activity to the semiotic actors turning them into a new
ontological hybrid, world making entities; … it builds a completely empty frame for
describing how any entity builds its world. (1996, p.378)

It is in this post-semiotic toolbox that a concrete or forensic trace can be placed, as can
a Derridean extension of the trace, as a component in symbolic work, being a non-
method or non-concept in keeping with the methodological framework ANT seeks.
Neither ANT nor the trace imposes a precondition on actors; instead, both put “the
burden of theory on the recording not on the specific shape that is recorded” (1996,
p.374, italics in original). There is a double action in such a statement, as the trace can also be considered a subject that includes or ‘is’ recording in the action as ‘tracing.’ However, the ‘theory’ in this context is for the frame of reference or a methodology that is not forced on the actor’ or their connections in amongst a network (1996, p.374-75). Paradoxically, to expand this point we must first benefit from an inclusion of an altered semiotics:

But what about scientific truth and material efficiency? What about the reference ‘out there’ in hard scientific texts? This was the real test for semiotics and although it passed the trial a price had to be payed. In the practice of ANT, semiotics was extended to define a completely empty frame that enabled [the theory] to follow any assemblage of heterogeneous entities—including now the ‘natural’ entities of science and the ‘material’ entities of technology. (1996, p.374)

Moreover, the trace is also an actant becoming an actor. In this sense, the trace can be an object or thing to be followed, cutting across the concerns of ANT, as much as it is method or mode of investigation. For example, the trace in symbolic work, or methods of tracing, or modes of ‘tracing the trace,’ form meaning in a becoming an assemblage of trace/s. Sensibly, this framing is not a kind of silent observation and is understood to also connect with wider networks itself. Latour’s approach requires the activity of engaging with a network by entering into a study of the network (1996, p.375). Yet do not contact and movement leave a trace?

ANT supports the notion of the trace in the physical properties of re/productive media devices. As an actor taking form, the trace is granted activity under the microscope of
ANT. This is especially the case when the trace’s purpose is understood to highlight semiotic dead ends across an actor-network. At this point, we can get to the nuts-and-bolts of the trace as an activity across analogue-digital assemblage in digital network culture, without the hindrance of weighty etymological connotations or hermeneutics. As Latour says:

If one now translates semiotics by path-building, or order-making, or creation of directions, one does not have to specify if it is language or objects one is analyzing. Such a move gives a new continuity to practices that were deemed different when one dealt with language and ‘symbols’ or with skills, work and matter. (1996, p.375)

For the present study, an argument is made for a connection between Latour’s description of actor-networks and the trace: both occupy a process of path-building and path-breaking. By following the trace as both actor and method, the trace is shown to act as a node in networks of media assemblage, between symbolic work and material groundings. The aim is to move an observed and theoretical construct of the trace as an ANT-informed method of tracing to “deploy actors as networks of mediations” (Latour 2005, p.136, italics in original). This will be expanded on as the discussion moves toward Latour’s concept of the ‘circulating reference’ (1999).

Adopting ANT and applying it as a method to approach technical media, or suggesting a kind of trace associated with the theory, has complications and must be approached with some sensitivity. The main concern is the predefinition of networks and actors. For example, to point a finger at analogue-digital assemblage or a type of concrete trace as a predefined network or actor rubs against the crux of ANT. Trace, as a label
proper, may derive from its physical form, but in terms of ANT it is the tracing activity that should be prioritised as method. Notably, there are specific distinctions. A Latourean ‘tracing’ is a following or linking of continuous activity across a network or trajectory of focus (Latour 1996, pp.379-80) rather than a key mechanism of subversive purpose or process, such as Derrida’s trace in deconstruction. Latour’s ‘tracing’ is the recording of ‘movement’ as “a continuous tracing of action” (1996, p.379) that, for us, brings the method closer again to the function of reproduction across nets or networks, including time, essential to movement, and the very activities of reproductive mediation. Latour highlights a discrepancy in tracing networks, focusing ANT’s purpose, in application, on the processual investigation of actor movement relative to the description of network trajectories:

ANT is not about traced networks but about a network-tracing activity: … there is not a net and an actor laying down the net, but there is an actor whose definition of the world outlines, traces, delineates, describes, files, lists, records, marks or tags a trajectory that is called a network. No net exists independently of the very act of tracing it, and no tracing is done by an actor exterior to the net. A network is not a thing but the recorded movement of a thing. The questions ANT addresses have now changed. It is no longer whether a net is representation or a thing, a part of society or a part of discourse or a part of nature, but what moves and how this movement is recorded. (1996, p.378, italics in original).

Crucially, in the tracing activity described by Latour, a predefined trace should not be sought after, as in one ‘outside’ a network waiting to be found. What fits more suitably is that a trace is produced or reproduced as a part of the tracing activity.
Such a trace seems of most value to Latour. Essentially, any “circulating object” (1996, p.378) including a trace, should not be predefined but rather take form from “what other actors do to it” and the network-tracing should be defined by “what circulates and what makes the circulation be both co-determined and transformed” (1996, p.379). It is proposed, then, while risking strict adherence to ANT in having laid out a ‘concrete trace’ already, that the trace of a medium is a connection point between actors and has potential for movement. Thus, to be traced as an actant or actor itself, while also highlighting the means of recording (be it resultant representation or device), method becomes a trace-focused network-tracing activity.

Simply put, “two actors are always mediated by a third” (Harman 2009, p.77) and ANT, as an applicable method with an agenda to “destroy spheres and domains” (Latour 1996, p.380), is not about dealing with supposed static or established networks in process. ANT is a tracing activity itself, involving techniques to render a deployment of description rather than a priori critique (Latour 2005, p.136). For ANT, tracing is an activity in highlighting what moves or circulates “by the competence it is endowed with, the trials it undergoes, the performances it is allowed to display, the associations it is made to bear upon, the sanctions it receives, the background in which it is circulating, etc.” and in this way reconstructs the realms that touch the forming network in analysis (Latour 1996, p.378). For us, then, a medium and a re/production are crucial actors in alignment with both ANT ‘and’ critical tools to trace the movement and connections across networks. In fact, in reaching toward an ANT vocabulary to apply via the trace, ‘mediation’ is a detailed key concept that offers much more than a basic medium-re/production construct.
5.3 Toward Circulating Reference: Reassembling a Medium
Latour’s *Reassembling the Social* (2005) refines the practice of reassembling networks over redefining networks. The text is a “travel guide” to the methodologies of ANT (2005, p.17) that provides useful key concepts important to approaching specific mediums, and wider notions of mediation. This guide helps expand a connection between Latour, technical media and the trace in analogue-digital assemblage. Of most interest for the present study is the glossary style terms, or techniques, for the tracing of actors found active in network observations, that retrospectively help point toward a better interpretation of Latour’s ‘circulating reference’ (1999).

Firstly, the relationship between notions of ‘uncertainties’ and ‘controversies’ offers entry into a network. ‘Controversies’ are the key source and starting point for ANT based observations of the world (Latour 2005, p.52). However, controversies are not necessarily high stakes fiascos, but simply things that point to an order of ‘uncertainties’ in an array of ‘actants yet to be,’ weakly defined actors, or obscured networks (2005, pp.21-120). The suggested trace of the controversy (concrete and importantly Derridean) can also be placed under the umbrella of ‘uncertainties.’ This practice connects to two key areas in ANT; in ‘Second Source of Uncertainty: Action Is Overtaken,’ Latour says:

An actor is what is *made* to act by many others … Action is borrowed, distributed, suggested, influenced, dominated, betrayed, translated. If an actor is said to be an *actor*-network, it is first of all to underline that it represents the major source of uncertainty about the origin of action. (2005, p.46, italics in original)
The trace, as a suggested actant in its own becoming figuration (Latour 2005, p.54), and with its Derridean connotations of undecidability and *differance* as outlaid in the previous chapter, is already a major hub of uncertainty. Additionally, the concrete traces of a medium—for example, artefacts of degradation, imprints, fossils, etc.—are made and ‘made to act’ by their source mediums and substrates as objects between figure and ground. Yet, as an object, the trace instils uncertainty in the absence of its source, motivating action to seek connection.

Secondly, the ‘uncertainty’ between Latour’s portrayal of ‘matters of fact’ and ‘matters of concern’ is an alternative starting point for ANT-based enquiry and lends us some resonance with traversal media practice. ‘Matters of fact’ are irreducible, supposably widely accepted objective objects or concepts, while ‘matters of concern’ align with ‘controversy,’ offering more ‘uncertainties’ for inquiry (2005, pp.87-120). Interestingly, the play-off between ‘matters of fact’ and ‘matters of concern’ touches on ontological approaches to reality. Latour (2005, p.114) suggests objects can be ‘gatherings’ or ‘assemblies’ of materiality, matter and physicality. ‘Matters of fact’ are not just uncomplicated physical objects but ‘given’ concepts and processes, such as scientific facts. These supposedly objective facts are rendered indisputable at an “end point, not the beginning as in the empiricist tradition” (Latour 1999, p.307). However, this is a trap because ‘matters of fact’ render actor-networks inert and less traceable (2005, p.114). For these reasons ‘matters of fact’ do not stand up well in network analysis or mapping; they close us off: “Something can only be of concern to stakeholders who are affected by it in some way” (Harman 2009, p.138). ‘Matters of fact’ are like echoes or rotten iconoclastic leftovers of modernism; Latour (2005,
p.114) instead suggests that it is ‘matters of concern’ that net a controversy or object and better instil uncertainties for inquiry.

Matters of concern, and the uncertainty and controversy they entail, should not be interpreted as a discrediting or subversion of matters of fact in the likes of science, forensics or the concrete. Rather, matters of fact have increased uselessness in their fixed position and objectivity, because they are less active in a network (Latour 2005, pp.87-120). Latour expresses anxiety about this effect in his work, where he seems to be debunking the practice of science when engaging with science. He refutes this accusation saying, “we want to add reality to scientific objects, but, inevitably, through a sort of tragic bias, we seem always to be subtracting some bit from it” (Latour 2004, p.237). Matters of concern are a plastic network ‘state of affairs’ as object, that highlight the risk in objectivity, while attracting and maintaining a point of interest as a thing or network of things (2005, p.119). Bluntly stated, matters of concern encapsulate the relational connections of matters and matter as seeded by uncertainty or controversies.

In the case of ‘uncertainties’ and ‘controversies,’ ‘matters of fact’ and ‘matters of concern,’ we have starting points for analysis, but is there scope or the bounds to tackle seemingly infinite networks? An answer can be found in Latour’s championing of the philosophy and practice of design, in a calling to its potential to help with what he refers to as the “ecological crisis” (2009, p.5) by which he means environmental impacts, climate change and the practice of communicating concern with these issues. Via an overview of Peter Sloterdijk’s (German philosopher and cultural theorist:
b.1947) philosophy of design, Latour (2009, p.6) draws a connection between ‘matters’ and the notions of ‘explication,’ ‘enveloping’ and ‘unfolding’ as a calling for design practice to contribute to environmental ‘matters of concern.’ There is no “Great Outside” or aether of a network to offer bounds, but Latour suggests “we move from envelopes to envelopes, from folds to folds” (2009, p.7). An ‘envelope’ holds an actor’s “performances in space and time,” not an order of divisions across properties, history, content and context (1999, p.306). In the ‘envelope,’ and its ‘unfolding,’ then, is an assembly of traced or traceable performance. And with the ‘envelope’ comes an acknowledgement of a network engagement that has scope and not an attempt at research dependent on the stamina or ability to cover the potentially infinite description of an infinite network. As a methodological task, in line with ‘matters of concern,’ finding scope implies a responsibility to not close envelopes or folds:

We don’t even have to deploy the complete set of agencies manifested by matters of concern. We simply have to make sure that their diversity is not prematurely closed by one hegemonic version of one kind of matter of fact claiming to be what is present in experience—and that goes, of course, for ‘power’ and ‘Society’ as well as for ‘matter’ and ‘Nature.’ (Latour 2005, p.118)

Following the above caution, to keep the bounds of enquiry open, Latour suggests designers bring matter into meaning or contested meaning through complex processes and output (2004, p.4). Furthermore, designers or design processes are called to integrate humans with elements of the world that were once considered external to human existence and survival, elements that have already “been carefully explicated, protected, conserved and maintained” (2004, p.7). Such a materiality brings matter to
increasingly complex arrays of folding, and ‘matters of concern’ as networks and, as Latour says:

This little shift in the definition of matter modifies everything. It allows practitioners to reuse all the notions of materiality and of artificiality by freeing them from the restrictions imposed by the older style of modernist matters of fact. … The idiom of matters of concern reclaims matter, matters and materiality and renders them into something that can and must be carefully redesigned. (2004, p.7-8)

These statements shape a convincing challenge for design philosophy and practice in reassembled networks. Latour proposes that design has a proven means of tracing relevant networks via ‘drawing things together’, visualising, or providing visualisation tools:

that capture what have always been the hidden practices of modernist innovations: objects have always been projects; matters of fact have always been matters of concern. The tools we need to grasp these hidden practices will teach us just as much as the old aesthetics of matters of fact – and then again much more. (2004, p.9)

The challenge proposed is a trigger point for practices and instruments of tracing and a guide for written analysis. Permission and purpose, amongst the seriousness of ecological crisis, are given to media forms and mediation that may be seen as closed off or ‘matter of fact.’ A transversal design practice is described or proposed. It is transversal in that realms and bounds are to be broken or crossed and left open for further work. Similarly, the technical media of design practice, rather than the
instruments of science Latour is familiar with, are brought under the spotlight. Likewise, imposed distinctions of old and new should be avoided, moved to one side and ignored when faithfully tracing a network and its actors. Such a method, informed by Latour, allows analogue-digital re-assemblage in the tracing of the trace that moves across two distinct systems: technical and representational. On the topic of ‘practice’, Latour defines it as an:

emphasis on the local, material, mundane sites where the sciences are practiced. Thus the word ‘practice’ identifies types of studies that are exactly as far from the normative philosophies of science as they are from the usual efforts of sociology. What has been revealed through the study of practice is not used to debunk the claims of science, as in critical sociology, but to multiply the mediators that collectively produce the sciences. (1999, p.309)

The field of science can be removed from this statement and replaced with any field or institution that takes form from the ‘practices’ in the network that bring networks into being, no matter what their grounding. Thus, transversal media practice and its analysis, in this instance via design, multiply ‘mediators’ as events or actors that resist definition and facilitate a making of difference (1999, p.307) in ‘drawing together,’ and tracing, matters of concern.21

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21 ANT has influenced design practice and theory since Latour’s (2004; 2009) call to action. See Networks of Design: Proceedings of the 2008 Annual International Conference of the Design History Society (Glynne, Hackney & Minton 2009) for an array of ANT-oriented positions across design focused topics, including a keynote address by Latour. Also see the work of Yaneva (2009) in the application of ANT to design practice and what designers do, ‘Border Crossings: Making the Social Hold: Towards an Actor-Network Theory of Design.’ And, most interestingly, concerning the theorisation of design ‘practice’ in line with ANT via systems and social practice theory see Lopes & Gill’s (2015) ‘Reorienting Sustainable Design: Practice Theory and Aspirational Conceptions of Use.’ The authors provide a mapping of design’s potential to meet Latour’s call to action. In moving design toward social practice theory, the authors transfer design from a focus on semiotics and material things to wider relational considerations and potentialities of what design practice can and should be relative to interventions on ‘sustainability’ as a ‘matter of concern.'
In summary, the concept of ‘matters of concern’ requires a scope defined by network ‘envelopes,’ and it needs a reopening/redesigning of mediators to multiply the links between otherwise compartmentalised subject-objects. The present interest in the trace and tracing across analogue-digital media now shifts toward the reassembling of analogue media amongst a complex network of action. This also involves asking the question: can the analogue-digital as metaphor, symbolic work and medium be reopened to draw out matters of concern and map controversies? The question targets an actor-network ‘envelope’ of medium-specificity rather than the wider concerns of design ethics and politics addressed by Latour (2009). However, it is here hypothesised, in the context of an expanded framing of a dual action trace to come in the next chapter, that the trace can be observed as event, actor and mediator. And in this way, the trace forms a network and trajectory to be followed. Yet before we get to this discussion we need to unpack several more Latourean mechanisms, relative to the thread we are following toward the concept of ‘circulating reference’.

5.4 Toward Circulating Reference: Black Boxes, Mediators, Translation and Transformation
Closely related to ‘matters of fact’ and systematically closing off objects, is Latour’s interpretation and use of ‘black boxes.’ Once ‘matters of fact’ settle in a network they are black boxed (Latour 1999, p.304). And as Graham Harman (2009, p.37) points out: “We have a true black box when a statement is simply presented as a raw fact without any reference to its genesis or even its author.” Latour’s (1987) use of the concept of the black box is founded in actor-networks made up of instruments and modes of inscription in science and technology. Historically, as a term, ‘black box’ emerged in
cybernetics to describe “whenever a piece of machinery or a set of commands is too complex” and the complexity within becomes of no concern in practice, “only their input and output count” (Latour 1987, pp.2-3). However, Latour is credited with introducing the concept of the black box to philosophical discourse (Harman 2009, p.33). Latour builds his definition of the black box through various descriptions of science and technology networks in *Science in Action* (1987) to suggest, “when many elements are made to act as one, this is what I will now call a black box” (1987, p.131). Latour uses the emergence of the commercially successful and personally affordable automated Kodak Camera (1888) and the beginnings of consumer photography to describe the black box. The camera is not only a complex thing in its inner workings, but the supporting Eastman Company commercial system that allowed the consumer to integrate photo development requirements, via a franchise business model, is a key part of the complex object (1987, p.131). The camera would not ‘work’ without its blackboxed network; this is the crux: if the object did not work we would need to open the black box and reconsider the network of ‘controversy’ and ‘uncertainty’ that settled to form its operation and subsequently moved out of sight. The momentum of innovation in science and technology is read by Latour as dependent on such networked objects and their blackboxing. However, the efficiency of blackboxing in a network renders practice “more opaque and obscure” (1999, p.304), requiring more work to be traced. Harman summarises the scenario of black boxes in relation to actors and a wider network in his reading of *Science in Action*:
We now have a world made up of manifold layers, none more unified or natural than the other. Every actant can be viewed as a black box or as a multitudinous network, depending on the situation. Actants can be either matter or form in different respects: matter for larger assemblies that make use of them, form for the tinier components they unite beneath their umbrella. … Even a chaotic or multifarious actant can appear solid under the right circumstance; by the same token, any supposed black box can be unpacked, and its components rearranged or challenged. (2009, p.34)

At this point, matter defined as an actant ‘used’ by another is important, as is the relationship between ‘matter’ and ‘form’, for as Harman highlights, black boxes can also be considered events in time (2009, p.46). Harman’s (2009) interpretation allows a return to ‘matters of concern,’ with a stronger link to objects as actants in networks of practice. Fittingly this also extends to the ‘enveloping’ concept described by Latour in championing the materialities of design practice (Latour 2009). A black box can be perceived as a network ‘envelope’ or collections of envelopes as manifold layers, ready to be opened or ‘unfolded’ to reveal associations and connectivity as network nodes.

Black boxes as both practices and material things can be useful as traceable connectors or nodes, in both their stability and what they hide, in that they indicate the way in which matters of concern can become closed off to become matters of fact. The black box, as event or actant, is a blinker and a point of investigation in one, ripe to be traced if opened. The black box for Latour (1987, p.253) is a link to, and amalgamation of science and its technology. In unfolding the output of the two subjects—in producing
facts, engineered innovation and machined automation—science and technology are brought together or seen as one (Latour 1987, p.253). The black box, in bringing together science and technology, reinforces ANT’s ability to indiscriminately cross and/or combine canonical silos like nature, semiotics and metaphysics (Latour, 1996). With the same black box perspective, ‘media’ can be adjoined to ‘technology’ to expose the hidden actants or ideologies of ‘technical media’ for expanded heterogeneous analysis. Medium-specificity as a branch of media archaeology (Parikka 2012, pp.85-7) is compatible with Latour’s (1987) rendition of the black box. Literally unscrewing the casings of media devices to look inside the black box is a central theme in media-specificity and the process reveals further actor network envelopes of components and materials.

Extending the concept of the black box allows for connections to be made between Latour’s concepts of ANT and technical media in the transversal analogue-digital media practice of digital network culture. A network, as it pertains to internet infrastructure or the Web, on which ‘network culture’ is based, is ‘not’ a direct reflection of ANT’s concept of a network (1996, p.369). However, technical media as specific mediums, or assemblages thereof, and associated techniques in practice, can be affiliated with Latour via events or actors that are both ‘intermediary’ and mediated. The distinction or relationship between these two concepts of ‘intermediary’ and ‘mediation’ is informed by the traceable indicators of ‘transportation’ and/or ‘translation.’ Each concept will be briefly outlined for methodological value. Firstly, an ‘intermediary’ transports “meaning or force” without change to what is sent and received via input and output. An ‘intermediary’ is also seen as one object or a network
functioning as one actor, such as a black box! (Latour 2005, p.39). Consequently, what is ‘transported’ between input and output can be traced, but it has no action or does not work well as an actor or agency as it does not facilitate distinction or difference. The tracing is futile unless effort is put into breaking open the associated black boxes, in the hope of controversy or uncertainty becoming mediator. ‘Mediation’ is an event or actor “that cannot be exactly defined by its input and output” (Latour 1999, p.307). Mediators are defined by action, and according to Latour, they:

transform, translate, distort, and modify the meaning or the elements they are supposed to carry. No matter how complicated an intermediary is, it may, for all practical purposes, count for just one—or even for nothing at all because it can be easily forgotten. No matter how apparently simple a mediator may look, it may become complex; it may lead in multiple directions which will modify all the contradictory accounts attributed to its role. (2005 p.39, italics in original)

Secondly, traceable actors, or ‘tracers’ as Latour refers to potentially indicative actors (2005, pp.127-206; 2009, p.2), and their ‘traceability’ (2005, pp.193, 229; 2011; 2007) are or become mediators in and how they transform or translate. Most simply, ‘intermediaries’ ‘transport’ and ‘mediators’ ‘translate’ in exchange or ‘transformation.’ Translation “is a relation that does not transport causality but induces two mediators into coexisting” (2005, p.108), in other words a point of connection. How actors are connected via mediators should not be predetermined, but rather they “might be associated in such a way that they make others do things” (2005, p.107, italics in original) and there are “translations between mediators that may generate traceable associations” (2005, p.108, italics in original). The measure of success or currency of
an actor in this relationship is elegant as “either it multiplies the mediating point between any two elements—and it is good—or it deletes and conflates mediators—and it is bad” (1996, p.378). These conditions are important in illuminating both a method and the traceability of the trace when and if it is found active in transversal analogue-digital assemblage.

5.5 Toward Circulating Reference: Instruments, Inscription, Immutable Mobiles and Action at a Distance
At the foundations of technical media and their theorisation, from a media archaeology and cultural techniques perspective, are instruments and the channels and operations of coded inscription (Parikka in Ernst 2013, p.18). Special focus is given to a medium’s symbolic work in the decentring, difference and distinction making it performs. This approach closely aligns with ANT concerning “technical objects and chains of operations (including gestures) in equal measure” (Siegert 2015a, pp.21,193). Likewise, Latour’s mediators have a platform of ‘instruments’ and ‘inscription,’ but they also carry with them the concepts of ‘immutable mobiles’ and ‘action at a distance.’ This set of terms comes to us again via the technology that forms science and the irreducible relational associations between science and technology (Latour 1987, p.253). Latour’s explication of ‘instruments’ and ‘inscription’ offers an approach to analogue-digital reproduction network envelopes. There is a slant toward the underpinning materialities of the two in enquiry, as an alternative to the interpretation of signs on the side of content or the consumer’s gaze. The pragmatism of science under review by Latour places emphasis on the traceable transportation and translation of properties as matter across reproduction. Latour describes “an instrument (or
inscription device) as any set-up, no matter what its size, nature or cost, that provides a visual display of any sort in a scientific text” (1987, p.68). Again, the definition is relational. An ‘instrument’ is that which produces the final inscription in a report or text, the building blocks of the movement or circulation of something across a network. However, an instrument is not considered an instrument proper if it simply provides readings and measurements along a research path, perhaps proceeding/receding to the state of a black box. In this sense, instruments are measured not only by their durability (Law 1992, p.287) in a network across time, but also by the extent of their use in or as ‘matters of concern.’ So, what was once an instrument and highly active in providing contemporary facts may now only be a device for measurement and readings (Latour 1987, p.68). In other words, an instrument “is what leads you from the paper [as scientific journal or publication] to what supports the paper, from the many resources mobilised in the text to the many more resources mobilised to create the visual displays of the texts” (1987, p.69). The idea suggests instruments are most active in a network when new or reactivated and a critical part of the innovation or invention taking form or informing research. What such a taxonomy of devices does is allow us to follow the most active or controversial device in a network, while not forgetting the overall process at hand and the other devices and practices that support them in operation. Again, Harman supplies a useful definition in a wider consideration of Latour’s philosophy:

The recording device is an instrument, … the final link in a long chain of transformations that allow us to see something ‘directly’ for ourselves. The instrument normally remains invisible until it is challenged: usually we accept images from cameras and telescopes as unquestionable data, until some dissident
begins to pick apart flaws in the distortion of their lenses. Viewed in this way, any
object can function as an instrument under the right circumstance, working to
mediate forces reliably as they pass from location to location. (2009, p.39)

Latour (1987; 1999) is interested in an area of activity surrounding the stability of
facts. However, what is of most interest is the way in which Latour (1987; 1999)
extracts a way to follow instruments and inscription as media or way of thinking about
media in assemblage, as a part of transversal media practice. For example, instruments
and inscription are unavoidable in the iterative process of a design challenge, the
planning and production of a film, or more speculative combinations of media forms.
Instruments of creative or transversal re/production may not be centred on mobilising
facts like science; however, they certainly share a mobilisation of inscription, “as types
of transformation through which an entity becomes materialised into a sign, an archive,
a document, a piece of paper, a trace” (Latour 1999, p.306). In this sense, the trace
constitutes a medium, as instrument, but also, as just mentioned by Harman (2009),
the trace is an activity surrounding the awareness of an instrument’s ‘distortion.’
Instruments can be active or black boxed as informed by the actor-networks of the
trace that form or inform an artefact of consumption. For example, typical media forms
or technologies have ecologies of inert readings, measurements and standardisations,
such as international paper sizes, frame rates or screen sizes. In addition, though, they
can also cross between ‘intermediary’ or ‘mediated’ connections of activity, not only
via content production but in and of themselves, their processes or operational
working, including their misuse or distortion. This media space is not so much a
scientific lab in action, but a ‘media lab’ (Emerson, Parikka & Wershler 2017)
concerning networks of devices to be potentially followed and is as integrated with the
technology, traceability and a production of science knowledge as it is with media knowledge, the production of meaning and the ‘re/production’ of production knowledge. This theme will be continued in Chapter 7 in alignment with a ‘trace in action’ and in reference to media archaeology and cultural techniques.

Following Latour’s approach to instruments and their inscriptions, it is possible to offer methodological approaches to the space between human and non-human actors. In following the practices of science, placing a priority on the trace as inscription offers refuge from wider interpretive media considerations. Informed by the notion that an accumulation of inscriptions and their movement is how knowledge is primarily produced, Latour sums up a methodological rule by saying:

Before attributing any special quality to the mind or to the method of people, let us examine first the many ways through which inscriptions are gathered, combined, tied together and sent back. Only if there is something unexplained once the networks have been studied shall we start to speak of cognitive factors. (1987, p.258)

The rule of method Latour outlines keeps us on the trail of network movement informed by instruments and their inscription as mediating actors, as distinct from their potential influence in wider experiential interpretation. The rule (which says that material inscriptions come before, and are considered before, cognitive analysis) may raise big ontological questions, yet it helps to keep the likes of philosophy of mind and dualist phenomenology at bay in mapping actor-networks. The rule may seem limited and lacking freedom. However, there are more relational concepts to add to our trace that expands the traceability of instruments and inscriptions.
Lastly, before moving to a reading of Latour’s ‘circulating reference’, the traceability of instruments and inscriptions should be described in terms of how it can be measured or valued in Latour’s ANT. This is done via two concepts: actors that become ‘immutable mobiles,’ and actors that can perform ‘action at a distance.’ ‘Immutable mobiles’ facilitate the material transformation of an entity via ‘inscription,’ be it facts, signs, actors or networks during their movement in a network. Latour suggests ‘immutable mobile’ is: “a term that focuses on the movement of displacement and the contradictory requirements of the [inscription] task” at hand (1999, p.307). An immutable mobile is “not displacement without transformation but displacement through transformations” (2005, p.223, italics in original). Immutable mobiles facilitate a movement of matter with minimal system distortion, such as scalability in the enlargement of photographic film, a drafting plan, “charts, tables and trajectories,” and their combinability (1987, p.227), or the likes of ‘perspective’ measurement applications in the re/production of objects associated with “innovations in graphism” (1986, p.9). ‘Action at a distance,’ similar to its meaning in physics, is for Latour a relational effect or connection without immediate physical connection, as made possible by the cyclic transformational potential of immutable mobiles:

History of technoscience is in a large part the history of these resources scattered along networks to accelerate the mobility, faithfulness, combination and cohesion of traces that make action at a distance possible. (1987, p.259)

Latour’s mediators perform a kind of symbolic work that is not broken or ruptured in transmission. In more familiar terms, their symbolic work is examined via a potential
not to distort or rupture content in the transmission of what is being materially transformed, abstracted or rearticulated. However, basic scientific method relies on the fact that for anything to be proven it must be repeatable and reproducible. This is why, in a considerable amount of symbolic work, such articulation or conceptualisation of the world via inscription is transparent, not hidden. In this framework then, the trace is not strictly Derridean by way of the work it performs. It does not subvert symbolic work, it upholds it in transformation. How is this brought about? Latour suggests:

By inventing means that (a) render them *mobile* so that they can be brought back; (b) keep them *stable* so that they can be moved back and forth without additional distortion, corruption or decay, and (c) are *combinable* so that whatever stuff they are made of, they can be cumulated, aggregated, or shuffled like a pack of cards. (1987, p.223, italics in original)

If the trace (considered here as concrete, forensic or projective), as individual inscription or assemblage, is itself at least partly ‘immutable mobile’, then a critical point of its articulation is met in the above quotation. Mobility, stability and combinations thereof create an awareness of “distortion, corruption or decay” in mediation. Consequently, if rendered effectively under such pragmatic conditions in a network, trace-based connections and ‘action at a distance’ allow matter to travel via verifiable representation, calculation and measurement:

A location can accumulate other places far away in space and time, and present them synoptically to the eye; better still, this synoptic presentation once reworked,
amended or disrupted, can be spread with no modification to other places made available at other times. (Latour 1986, p.10)

Inscription as immutable mobile, as verifiable trace, allows actors to utilise and traverse media assemblages or reassemblages in both time and space. Such a scaffold is useful as it adds or subtracts time to the ordering of inscriptions or a priori instruments. Consequently, this non-linear temporality allows a method to trace media invention, extension or re/activation via the substrates, archives or labs in which they may be exhumed relative to ‘matters of concern.’ In doing so, a kind of medium-specific (as opposed to hermeneutic) dialectic duality of trace can be observed in action, one centred on the feedback between the immutable functions of media ‘and’ the ruptured, hidden or broken symbolic work of media assemblages. This is a topic that will return throughout the following chapters, and that examines analogue-digital assemblage re/production and its trace as ‘retroactive’ (Harman 2009, p.84), a remaking of media, as well as a rethinking ‘with’ media that is akin to transversal ‘reverse remediation’ (Gansing 2013, p.294) and Benjamin’s ‘dialectical image’ ([1927-1940] 2002; Buck-Morss 1989).

22 A more in-depth overview and examples of this ordering and movement are provided in the concepts of ‘cycles of accumulation’ and ‘centres of calculation’ in Latour’s Science in Action (1987, pp.215-257). They are read as processes of networked envelopes, sites or hubs of inscription distanced from but transforming sites of enquiry.
However, there must be some fallout with instruments and inscriptions functioning as immutable mobiles. Transformation at its simplest alters matter or the form of energy, as a process of conversion. Comparably, in terms of method, an actor-network cannot be closed to other actors that associate or connect to the actors or actants of transformation. Whether immutable mobiles are mediators in wider considerations of representation or hard science, a signal cannot move through a transducer without some form of thermodynamic consequence. However, Latour’s actor-networks permit ‘action at a distance’ that is materially strict, but allows arrays of immutable mobiles to form trails of connection. In this sense, inscriptions fold or unfold in a cyclic sequence where one immutable mobile becomes a kind of content-signal for the next, while upholding a two-way relationship with a source, post, and/or prior immutable mobiles (Latour 1987, pp.215-57). Immutable mobiles, performing ‘action at a
distance,’ have consequence as material is always lost ‘and’ gained in the work they do. On this point Latour states:

We can see more, since we have before our eyes not only the image but what the image is made of. On the other hand we see less because now each of the elements that makes up the final graph could be modified so as to produce a different visual outcome. (Latour 1987, p.66, italics in original)

The key point of immutable symbolic work is that it is not some kind of inflexible, deterministic, impenetrable, objective or veritable image. Immutable symbolic work has the express ability to allow for seeing “what the image is made of” when actors, especially instruments and inscriptions, are brought together.

Notably, immutable mobiles do not need to be tied to the study or practices of science. Generally, the ethos of ANT, as already outlined, suggests that context should not be laid down before a network, as ANT’s purpose is to dissect institutionalisations. Latour explicitly describes immutable mobiles functioning in the realms of fiction and visual culture, and suggests that: “Innovations in graphism are crucial but only insofar as they allow new two-way relations to be established with objects (from nature or from fiction)” (1986, pp.9-10). When writing about the practice of design, Bernhard Siegert suggests, in a manner similar to Latour’s insistence on ‘optical consistency’ (1986, p.7), that the designer replaces the creative ego of the artist with “qualities such as mobilizability, combinability, scalability, superimposability, geometrics, and so on” (2015a, pp.122-23). Immutable mobiles are not hard to find outside of science; for example, the oscilloscope work of Jerobeam Fenderson (Fig.5.2) literally takes the
voltage signal measurement device into transversal media practice and utilises its immutable qualities. His audiovisual album, Oscilloscope Music (2016), renders graphics directly from audio signals allowing the viewer to see a measurable, comparable and transformable trace of what they are hearing. Immutable mobiles can also be found working directly with the physical trace of specific media. This is especially the case in archival or conservation media practice. For example, The Atlas of Analytical Signatures of Photographic Processes (Stulik and Kaplan 2013), and the inscription referents within, like the Autotype company’s (1907) carbon tissue sample book (Fig.5.4), code and connect the qualities of analogue carbon print photographic processes as immutable traces. The atlas is a mediator and immutable mobile in the identification of photographic trace, allowing network connections to be followed, back and forth, between photographs, times (dating), instruments and materials used. No matter the kind of immutable mobile, it would seem, they aid in bringing forth the concrete trace of media and “when immutable mobiles are cleverly aligned they produce the circulating reference” (Latour 1999, p.307).

5.6 Circulating Reference

It is a strange transversal object, an alignment operator, truthful only on condition that it allow for passage between what precedes and what follows it. (Latour 1999, p.67, italics in original)

Latour’s (1999) ‘circulating reference’ is an exemplar culmination and ‘visualisation’ (Latour, 1986; 2009) of the terms addressed to this point. I have prefigured its
introduction here because it brings together the key terms already covered including: actants, actors, actor-networks, uncertainties, controversies, matters of fact and matters of concern, envelopes and unfolding, black boxes, mediators, intermediaries, transport, translate, transform, instruments, inscriptions, action at a distance and immutable mobiles. All of these terms may not be explicitly dealt with through the ‘circulating reference’, but the foundation they provide is implied. Latour’s rendering of circulating reference is given diagrammatically as a tracing of immutable mobiles in action (Fig.5.5, 5.6 and 5.7). Each of these key diagrams will be discussed as a method of inquiry and they form an expanded vocabulary when approaching articulations of medium-specific trace across analogue-digital assemblage in the following chapters.

Again, it is important to acknowledge the potential tension between concepts of signification and semiotics and Latour’s actor-network theory. In outlining the foundations of the concept of circulating reference in Elements of Representation (Fig.5.5), Latour says:

Knowledge, it seems, does not reside in the face-to-face confrontation of a mind with an object, any more than reference designates a thing by means of a sentence verified by that thing. On the contrary, at every stage we have recognized a common operator, which belongs to matter at one end, to form at the other, and which is separated from the stage that follows it by a gap that no resemblance could fill. The operators are linked in a series that passes across the difference between things and words, and that redistributes these two obsolete fixtures of the philosophy of language. (1999, p.69, italics in original)
In making this statement, Latour follows scientists in the field as they conduct interventions on matter with instruments and inscription. The ‘gap’ he describes is not ‘for’ symbolic work across the historical silos of world and language (1999, p.69); it is a space where stability or verifiability across transformation is tested and distortion identified, not a “yawning gap between the text and the context. … The yawn is an artefact caused by a previous divide between nature, society and discourse” which ANT avoids in its “multiplicity of plugs between circulating objects” (Latour 1996, pp.378-79). Prevailinglgy, seeking absolute semiotic denotation or notions of reality is beyond the point of immutable mobiles and circulating reference, as Latour suggests:

The main quality of the new space is not to be ‘objective’ as a naïve definition of realism often claims, but rather to have optical consistency. This consistency entails the ‘art of describing’ everything and the possibility of going from one type of visual trace to another. (1986, p.10, italics in original)

Latour’s approach alleviates inscription from the perpetual thinning of meaning across signification and in doing so highlights the trace as it moves and transforms, along with an entity or matter of origin, through network envelopes of immutable mobiles.

The location and context for Latour’s chapter titled ‘Circulating Reference’ in *Pandora’s Hope* (1999, p.24-79), is a collaborative scientific expedition to a threshold site between forest and desert in Boa Vista. Latour follows and documents the scientific practices of a botanist, pedologists and a geomorphologist as they investigate why the forest/desert threshold of the location is shifting. Latour focuses on the scientists’ accumulation of recording techniques, instruments and inscriptions.
as they progress toward a final scientific report. Ultimately, the exercise allows Latour to examine the production of scientific facts, from interacting with physical matter through to representation, and brings findings to wider considerations of knowledge production. Latour forms three key schematics as a result of joining the scientific expedition (Fig. 5.5, 5.6 and 5.7). The first, *Elements of Representation and Chains of Elements*, shows the taxonomy of an immutable mobile element. The element consists of ‘matter’ illustrated to be followed by a step-up in transformation where ‘form’ caps and wraps a ‘gap.’ Here a two-way relationship is implied: the form of the inscription as the transformed matter and an unknown gap as a mode or requirement of the displacement in action. Each element of the schematic’s chain can be read as a stage of inscription. For example, the scientists start with the forest threshold site, then move to the tagging of trees to form a measured site grid, then to soil charts from the same grid, on and on with each inscription or network thereof. This diagram also highlights that to ‘reference’ is “to bring back” (1999, p.32) and representation “grows from the centre toward the two extremities” (1999, p.70), potentially infinitely. The diagram echoes the ethos of ANT here, in that a network should be observable at any stage or point and a verifiable trace should make this possible in both directions. In this sense, when ‘circulating reference,’ is used as a working concept, the first half of the term—‘reference’—“designates the quality of the chain in its entirety” and what circulates is a ‘truth-value’ “like electricity through a wire, so long as this circuit is not interrupted” (1999, p.69).
Figure 5.5 *Elements of Representation* and *Chain of Elements*, Latour’s first schematic iteration of ‘circulating reference’ rendered via the observation of scientists ‘in action’ at the border of the Amazon rainforest (1999, p.70).

Figure 5.6 *Circulating Reference* and *The Canonical View*, Latour’s refined diagrammatic iteration of ‘circulating reference’ and explication of mediation erasure, rendered via the observation of scientists ‘in action’ at the border of the Amazon rainforest (1999, p.73).
Latour’s next diagram, *Circulating Reference* (Fig. 5.6), is a refined iteration of the previous one, adding to the two-way annotations of element chains with the captioning “mediations from matter to form” (1999, p. 73). Here it is confirmed that we are dealing with mediators or intermediaries as immutable mobiles that hold together chains of representation, rather than modes of reflection, signification, correspondence or resembling that link to a supposed exterior world. As Latour suggests, mediated matter is inscription and transformation performing immutably, and it moves as follows:

> [E]ach stage is matter for what follows and form for what precedes it, each separated from the other by a gap as wide as the distance between that which counts as words and that which counts as things. (1999, p. 74)

This gap is not crossed or connected by a sign or physical channel, but rather by a stable “traceability” (1999, p. 46) of transformation across instruments, inscription and practice. As an example, the preservation and categorisation of plants by a botanist as practice and inscription, for Latour, literally draws specimen and annotated paper, and thus “writing and thing,” together (1999, p. 38). Such assemblages “are not exactly signs, yet they have become as mobile and recombinable as the lead monotype characters of a printing press” (1999, p. 38). The preserved and traced plants can meet past and future inscriptions via the protocols and codification established in practice (1999, p. 38).

Latour’s observation of a pedologist in action offers further detail on the movement of matter that underpins immutable mobiles. Notably, in this context ‘things’ and ‘signs’ begin to share a hybrid materiality of sorts (1999, p. 48), a conjoined instrument-
inscription that performs unique symbolic work. For example, following Latour in this regard, Bernhard Siegert highlights signs being treated as media in and of themselves rather than just signs (2015a, p.122). This brings the material ground of signs forward as a trace in networks of representation. The pedocomparator, like the ecologist’s, biologist’s or geologist’s grid-based ‘quadrat’ and supporting network of inscriptions (Fig.5.3), is an array of small soil sample compartments, and helps explain such a statement:

The pedocomparator belongs to ‘things.’ But in the regularity of its cubes, their disposition in columns and rows, their discrete character, and the possibility of freely substituting one column for another, [it] belongs to ‘signs.’ Or rather, it is through the cunning invention of this hybrid that the world of things may become a sign. … [T]he earth becomes a sign, takes geometrical form, becomes the carrier of a numbered code. … We are not jumping from soil to the idea of soil. (Latour 1999, pp.48-9)

The symbolic work of the pedocomparator is self-referential, yet with traceability as a priority over signification regarding ‘reference,’ the process pinpoints the value of the trace in discrete systems of representation or abstraction. Here generally, medium-specific operations of computational digitisation echo the pedocomparator, although they are temporally much faster in function. There is a dependence “on the conservation of traces that establish a reversible route to retrace one’s footsteps as needed” (1999, p.61). The inscription “is not realistic; it does not resemble anything. It does more than resemble. It takes the place of the original situation, which we can retrace” (1999, p.67, italics in original). With a culmination of trace, as found in the
final scientific report of his case study, Latour suggests it can be said: “I am indeed holding in my hands the forest of Boa Vista. A text truly speaks of the world” (1999, p.67). And it would seem that Latour’s ‘circulating reference,’ while the consideration of the term could constitute an entire additional thesis, is here of a distinct media-material grounding compared to the likes of simulation or modes of modelling set on resemblance. We are ‘clearly’ seeing networks of the trace as a mode of ‘visualisation.’

Latour’s two following key diagrams, *The Canonical View* (bottom of Fig.5.6) and *Reduction and Amplification* (Fig.5.7), highlight the consequences of considering representation as a circulating reference. Ultimately, there is a “dialectic of gain and loss” (1999, p.70), what Latour calls the “information-producing step” (1999, p.71). In writing toward these diagrams Latour lists key gains: “In losing the forest, we win knowledge of it” (1999, p.38), because “a thing can remain more durable and be transported farther and more quickly if it continues to undergo transformation at each stage of this long cascade” (1999, p.58). However, the final scientific report, in Latour’s presentation of accumulated inscriptions, is also a culmination of abstractions, and “an infinitesimal fraction of the original situation is preserved” (1999, p.66). Yet, the resultant inscriptions are concrete, “since we can grasp with our hands, and see with our eyes,” via events of construction, invention and convention (1999, p.66).
The dialectic of loss and gain across circulating reference, and Latour’s detailed schematic of the construct (Fig.5.7), provides a visualisation and a vocabulary to approach technical media that open up traditional phenomenology (1999, p.71) to actor-network theory. *Reduction and Amplification* (Fig.5.7) is an alternative, top-down, perspective of *Circulating Reference* (Fig.5.6). The series of stages is still read as a chain of representation via immutable mobiles. However, there is now relational ‘reduction’ and ‘amplification’ (1999, p.71) as we move from object or site, on the left, to final assemblage of inscriptions, to the right. At each stage, as reference and representation move from a central position to the extremities, properties are manifold and layered in what is lost and gained. Latour’s examples are: locality, particularity, materiality, multiplicity and continuity that expand toward ‘reduction,’ as well as compatibility, standardisation, text, calculation, circulation and relative universality.
that expand toward ‘amplification.’ The diagram’s key terms smack of generic distinctions, such as analogue and digital media, or physicality and digitisation, or new and old media. For example, Gere’s elements of digital culture—“abstraction, codification, self-regulation, virtualization and programming” (2002, pp.13-14)—and Gansing’s (2013, p.46) reading of Jenkins’ *Convergence Culture* (2006) on the binary logic in popular culture reflect Latour’s ‘amplification’ and ‘reduction’ dialectic in their most discrete or compartmentalised nature. In this sense, Latour’s terms already have associations with analogue-digital media. But the diagram and not just the terms, if adopted as a method to observe media, inspires feedback around ‘transversal media’ or ‘media ecology’. This is apparent in both the circulation of reference and the crossing lines of the diagram. Latour’s (1999, p.67) transversal objects as immutable mobiles with potential as instruments and inscription do not rupture or break traceability themselves, but make new connections and associations from a middle-position as unstable referents with others in media networks (1999, pp.70,72). The schematic leads Latour to conclude that phenomena, contrary to philosophical traditions of categorising human understanding, “are not found at the meeting point between things and the forms of the human mind, phenomena are what circulates all along the reversible chain of transformation” (1999, p.71, italics in original). The *Canonical View* diagram (bottom of Fig.5.6) is thus trumped by circulating reference in that there are many more points of reference between a thing and its word. There are many more mediations, once the mediators that have traditionally or culturally been erased are revealed (1999, p.73) and the black box is opened. Latour’s (1999) circulating reference is useful when unpacking networks of medium-specificity that
“on a technical layer, give … us the phenomenological experience of visuals and sounds” (Parikka 2012, p.87).

The catch with circulating reference, when considering it methodologically as an extension of innovation, speculation or contribution to knowledge, is its critical dependence on intermediary pathways or connections that cannot be broken. As Latour says: “one never travels directly from objects to words, from the referent to the sign, but always through a risky intermediary pathway” (1999, p.40). The input and output across a transformation are most stable in a chain of reference when there is “transportation that no longer transforms it” (1999, p.51). As already argued, the traceability of reference across mediation needs to be maintained. For example, a diagram cannot be “divorced” from its “series of transformations. In isolation it would have no meaning” (1999, p.67). An inscription needs to bring along all its baggage: “It speaks of a referent, present in the text, in a form other than prose: a chart, diagram, equation, map or sketch. Mobilizing its own internal referent” (1999, p.56, italics in original). Consequently, in the work done by immutable mobiles, there may be a requirement to produce chain links or introduce further instruments and practices to allow references to continue: “In sum, you have to invent objects which have the properties of being mobile but also immutable, presentable, readable and combinable with one another” (Latour 1986, p.7). The culmination of such objects and associated practice is what can generate a new material, rather than metaphoric, “worldview” (Latour 1986, pp.9-12). Considering the ethos of ANT, this invention or reactivation would involve a dependence on a network, especially an assemblage of instruments and their inscriptions as actors, but should also include that which is
within each as a black box. Ultimately, this is a process of realignment and reverse blackboxing (Latour 1999, p.184). Thus, considering medium-specificity an “internal referent” could also be an instrument or inscription’s own produced concrete trace, be it the spacing or relationship with material ground or substrate, the physicality of the mark it makes in and of itself, or other inscriptions in the chain of reference. Either way, the test, as with all other ‘information-producing’ steps, is that it is to be “a strange transversal object, an alignment operator, truthful only on the condition that it allow for passage between what precedes and what follows” (Latour 1999, p.67). The marker for a failed medium-specific immutable mobile, then, would simply be an inability to connect traceability via the trace in the network envelope or event under inquiry. What form and attributes of action such an entity can have, between chains of reference across analogue-digital assemblage, is a key consideration in shaping the remainder of this thesis.

5.7 Chapter Conclusion
Latour’s philosophy, as surveyed, is a ‘guide’ to the method of inquiry in this study as much as it helps define the trace. He provides a vocabulary through which we can approach media allowing the subject of study to tell its own story. This approach lies alongside Benjamin’s use of ‘images’ to “make conceptual points concretely, with reference to the world outside the text” (Buck-Morss 1989, p.6). However, Latour’s ANT, as has been detailed, is a stage in the development of the theoretical analysis for this thesis, not a strict methodological framework to be adhered to. Circulating reference and immutable mobiles are examples of ANT in action: a way to see how
actors can inform and be a tracing of the trace. Starting with a strict frame of reference or context, as has already been mentioned, is not ANT or what ANT should provide.

Throughout the remainder of *Pandora’s Hope* (1999), Latour expands on his ‘Circulating Reference’ chapter (1999, pp.24-79) providing four further connections to technical mediation and the trace, as framed to this point, in the chapter ‘A Collective of Humans and Nonhumans’ (1999, pp.176-215). Key concepts are: interference, composition, the folding of time and space (reversible blackboxing), and crossing the boundary between signs and things. These concepts lead Latour to lay out a taxonomy of the crossover between humans and nonhuman actors, as it informs an exchange of properties across ‘techniques,’ in the production of knowledge and meaning. As fitting as it would be to continue a detailed review of these further concepts they expand the scope of this thesis too far. Latour’s circulating reference as an end point here lays a solid foundation for a movement to the frameworks of cultural techniques and media archaeology, by which connections will be made in Chapters 7 and 8 when addressing the importance of thing-signs and trace. The goal, or ‘subprogram’ as Latour may call it (1999, p.181), in bringing this chapter to a close, is to let Latour’s ANT inform a following of ‘trace’ actants across the assemblage of analogue-digital media in case studies to come. The consideration of the trace as both immutable mobile ‘and’ a means to identify broken or hidden symbolic work must be upheld. The goal of the proposed method has a double purpose. Its first purpose is to highlight what is lost and what is gained across the ‘reduction’ and ‘amplification’ of circulating reference points as they pertain to articulations of a medium’s trace. This is a Latourean approach that seeks out always-connected and verifiable traceability in
media events. Secondly, in doing so, circulating reference will be examined for where and how the verifiability, stability, or retraceability of the immutable mobile breaks down in medium-specific envelopes, if a disconnection or ‘interference’ (Latour 1999, p.178) can be found or argued. In this sense, the trace is to be looked for at the breaking points of a Latourean informed schema without imposing on the schema itself. And this is why the trace needs to be considered in its dual workings, as both immutable and broken, both Latourean and Derridean. The trace via its Derridean interpretation is discussed alongside the trace via Latour as it marks exit points from the confines of immutable mobiles, while acknowledging the trace’s potential in subversive interjection. This will be done while forming insights on the concept ‘analogue-trace.’ The hypothesis is that the circulating reference can be, and is, broken, when it comes to following analogue-digital assemblage in digital network culture. And consequently, compensation between circulation and analogue-trace needs to be theorised and demonstrated.
6. ANALOGUE-TRACE: IMmutable Deconstruction? Deconstruction Immutable?

Figure 6.1 Diagram by Greg Hughes (2016), Trace: A Taxonomy of Enquiry. This chapter is a lead-in to the node ‘Analogue-Trace: Media Archaeology and Cultural Technique’. At this position, the broken/hidden symbolic work of the trace is brought together with the immutable via a joint discussion of Latour and Derrida to form the coined concept of ‘analogue-trace.’
Figure 6.2 Repeat of Fig.3.30. Diagram by Greg Hughes (2016), *Closed Circuits: Dual, Not Dialectic*, visualising the ‘dual’ symbolic systems of wider network culture and the concrete actions or operations of technical media. The trace is proposed as a means of investigating a dialectic connection between the two seemingly closed systems.

Figure 6.3 Diagram by Greg Hughes (2016), *Analogue-trace: A Taxonomy of Enquiry: Dual ‘and’ Dialectic*, showing an expansion of Fig.6.2. Proposing ‘analogue-trace’ as a means to cross three spheres of symbolic work via a medium-specificity with dual and dialectic means.
Diagrams, lists, formulae, archives, engineering drawings, files, equations, dictionaries, collections and so on, depending on the way they are put into focus, may explain almost everything or almost nothing. (Latour 1986, p.5)

That pathway must leave a track in the text. Without that track, abandoned to the simple content of its conclusions, the ultratranscendental text will so closely resemble the precritical text as to be indistinguishable from it. We must now form and meditate upon the law of this resemblance. What I call the erasure of concepts ought to mark the places of that future meditation. (Derrida [1967] 1997, p.61)

6.1 Latour ‘and’ Derrida? Analogue ‘and’ Digital?
This chapter approaches the symbolic work of the trace as inherently and necessarily mutable ‘and’ immutable in the technical media of digital network culture. Latour and Derrida are influences on this theory and its method, at a macro level, as the discussion moves toward the symbolic and signal processing considerations of ‘analogue-digital’ assemblage. The concept of ‘analogue-trace’ emerges as quasi-signifier-and-symbol of inscription found at a processual site of becoming signs, a feedback loop between the analogue and the digital, that subverts both supposedly distinct terms, but also holds them together in digital network culture. Analogue-trace contributes to media-oriented vocabulary in that it may help make sense of the mediated and the mediums in which they are found. In the final chapter of this thesis, analogue-trace is also reinforced through a case study of media-archaeology conducted on analogue-digital converter circuits, informed by cultural techniques. Throughout these final chapters, theorisation
is progressively pointed toward medium-specific tasks to come. This chapter begins by approaching analogue-trace in a non-linear fashion.

The medium-specific task under consideration is set at a site of distinctions or differentiation between analogue and digital signals. However, while discussion is layered upon a supposed material/immaterial binary as it pertains to digitisation, considering both as technological processes and symbolic systems is important. Analogue and digital signals, considered via the engineering of signal processing, are not only material processes but also perform symbolic work, much to their confusion and detriment. To be medium specific, an analogue signal is the control of matter, such as electric current, in a continuous state within a closed system. However, symbolically, an ‘analogue’ reproduction is also a continuous and potentially infinite ‘analogy’ of the world, a representation or reproduction that transfers, not necessarily a direct resemblance of the world, but an abstraction or distortion of space and time before, or in, a relationship with digitisation. Digitisation is distinct from this process as a quantisation and codification of matter, more dependent on conceptualised protocols between human or non-human creators and users. Thus, the analogue, also a symbolic system in communication, can be thought of as not necessarily material and as much immaterial as any digital symbol/s or quantised signal.

It is the ground of both analogue and digital systems of communication that is most physically material or physical matter. It is the conceptualisation of matter that produces signs and moves us to immaterial space, dependent on, but somehow
elevated from, physical matter. The point of interest for the trace is its movement from ground to the extremities and fragilities of its figuration, amongst figurations, and the story it can tell on the way. This journey can be broken down, but not limited to, three spheres across re/production in transversal media practice associated with digital network culture: the supposed original qualities of analogue inscriptions; referential loss in the digitisation of them; and the digital reinvention or reactivation of them (Fig.6.3). The two-way circulation between all three is also critical to acknowledge, as is the two-way or parallel relationship of the analogue and digital along the way. This is a means to work across the supposed closed systems or dual symbolic dimensions put in play by the role of the ‘generic’ in media archaeology in digital network culture, as informed by Gansing (2013, p.275) via Laruelle ([1986] 2010; [2008] 2011) (Fig.6.2). Discussion points to the potential for such spheres to be both dual ‘and’ dialectic, not only dual or parallel. The separation between spheres is the consequence of a cultural reliance on semiotics, automated or autonomous image exchange, image production being made invisible, or simply the difficulty imposed by the accessibility of differing archive systems and qualities. It is here that Latour’s and Derrida’s different definitions of the trace, as surveyed to this point in preceding chapters, can be considered together without the intention to impose on either, and with sensitivity toward the disparate fields from which they come. Latour’s trace, as already examined via the ‘immutable mobiles’ (1986, pp.7-13) found within the ‘circulating reference’ (1999, pp.24-79), is a kind of connection point between other traces and is not strictly ‘only’ symbolic, yet it performs referential work that acknowledges semiotics. Such a trace, always already a part of an actor-network, is analogue. At the heart of ANT is the requirement to produce an analogue of the world in that continuous connection,
perhaps via the overcoming of digitisation as blackboxing (Latour 1987 p.131; 1999, pp.304, 253) or enveloping (Latour 1999, p.306), is sought after in referential meaning making. However, Derrida’s trace is ‘of’ the sign, but before it, or the subversion of it; not the opposite of symbolic work, but a ‘grapheme’ within (Derrida [1967] 1997, pp.9, 46), trace as a connection point between others traces but targeted as a virus ([1967] 1997, p.24) in the production of meaning. Here, the trace is active in the game it forces to take place between elements of signification that are absent and present—not here, not there, a processual on-off state, inherently digital even if only metaphorically. Additionally, Derrida’s ([1967] 1997) trace is born of the technical medium writing, already a digital mode of inscription and deconstructed to be mutable. However, Derrida’s ([1967] 1997) trace, active across any strictly immutable digital communication (encoding and decoding supposedly without error), is problematic as it corrupts exchange between writer and reader. Ultimately, as will be detailed here, bringing the body of Latour’s discussion of the trace (as discussed across previous chapters) together with Derrida’s employment of the trace (as discussed in Chapter 4) is a theoretical or methodological analogue-digital assemblage fit to cross-talk with analogue-digital (A/D) converter circuits as a medium of interest. Derrida’s ([1967] 1997) trace can be used to point toward an active trace at problem sites (broken or hidden symbolic work that stutters without reference) and Latour’s trace as an ‘immutable mobile test’ (1986; 1999) in following analogue-trace through analogue-digital media assemblages.

Methodologically, a manageable scope, point of entry and path to follow is required. The trace this project draws from Derrida is a means to highlight points of enquiry via
an affirmative deconstruction—a ‘disinscription’ and ‘reinscription’ (Cohen 2002, pp.7-9) of media certainties in the transversal practices of digital network culture. However, we must ‘trace the trace’ and thus afford/observe a trajectory to follow and allow further analysis to happen. Why? Because the two conceptions of trace as Derridean ‘non-concept’ and as Latourean immutable inscription combine to form a vehicle of sorts, and at least need an entry point and road to travel to function in the process of research. This is a problematic and perhaps impossible task if we are to see it through a Derridean lens. It is beyond the scope of this study to use the overall deconstruction of metaphysics, logocentrism, singularity or truth that Derrida ([1967] 1997) advocates as a methodological analogy in the analysis of the trace in digital network culture. Such a task would presuppose knowledge and experience deeply embedded in the history and criticism of western philosophy, and draw focus away from the objectives set here. What are taken, with sensitivity to Derrida’s ‘supplement’ ([1967] 1997, pp.144-64), are the main concepts behind the trace already formed and a forward movement marked with self-referential caution. Derrida highlights the enormity of trying to find a point of critical intervention for his tools of deconstruction, suggesting, in the light of the sign corrupting the structure of metaphysics and its past central focus on ‘Being’23 as presence, that:

The absence of the transcendental signified extends the domain and the play of signification infinitely. Where and how does this decentering, this thinking the structurality of structure, occur? It would be somewhat naïve to refer to an event, a

23 ‘Being’ is capitalised as a continuation of Heidegger’s focus on what it means ‘to be’ rather than ‘being,’ as an entity, a difference between presence and present. See Heidegger’s Being and Time ([1927] 1962).
doctrine, or an author in order to designate this occurrence. It is no doubt part of the totality of an era, our own, but still it has always already begun to proclaim itself and begun to work. ([1967] 1978, p.280, italics in original)

In the above quotation, the extremities of enquiry, or content for deconstruction, suggested by Derrida are vast, but also seemingly impenetrable. Yet in Latour (1999, p.306; 2009) it is perhaps the scope of a network envelope that has become or is too opaque. Derrida ([1967] 1978, p.280) writes of “the totality of an era” but also a continuous pre-history of sorts. His statement explains the enormity of the challenge and exemplifies the problem of hermeneutic discourse, but does not pinpoint a workable resolution. He continues to proclaim potential prominent philosophers who highlight the cyclic trap of western critique: “This circle is unique. It describes the form of the relation between the history of metaphysics and the destruction of the history of metaphysics” ([1967] 1978, p.280). His description is of the bounds of metaphysics as a field stuck in its own game, but also one at risk of entering deep critique. That is, to use a process in and of itself, to be self-deconstructive in a cyclic manner, risks altering the process or the foundations of that process, and so on perpetually. At this realisation, though, do you give up, knowing you are embedded in a vicious cycle? Derrida suggests it is impossible to give in:

There is no sense in doing without the concepts of metaphysics in order to shake metaphysics. We have no language—no syntax and no lexicon—which is foreign to this history; we can pronounce not a single destructive proposition which has not
already had to slip into the form, the logic, and the implicit postulations of precisely what it seeks to contest. ([1967] 1978, pp.280-81)

What troubles the boundaries of this trap is the trace, which for Derrida operates as a kind of kernel in the making of meaning that modulates between non-concept, signification and material thing. In this sense, the base level mutability of the trace allows it to be transferable to alternative means, instruments and fields of enquiry, such as transversal and media-archaeological practice. It may seem that the trace has a sufficient inherent resistance against being trapped in a system, as Derrida explains via his critique of metaphysics, yet when considered as method the trace cannot cleanly escape the ‘totality’ of its housing. In this sense Derrida’s trace is a means to solve the cyclic self-referential problem and reaches its peak versatility at the edge of language. It is this meeting of bounds, a stuttering at the edge, that opens the trace’s use a little further. The trace helps to set up a space for intervention across Saussure’s semiology, particularly the counter that “there is neither symbol nor sign but a becoming-sign of the symbol” (Derrida [1967] 1997, p.48). The trace is consequential here, as Derrida says:

Thus, as it goes without saying, the trace whereof I speak is not more natural (it is not the mark, the natural sign, or the index in the Husserlian sense) than cultural, not more physical than psychic, biological than spiritual. ([1967] 1997, p.49, italics in original)
Here the trace sits before the sign, or replaces the sign, and is not of any field but is at the base of the systemic structures of any arena of discourse. There is thus further demonstration that the trace is central to the present study. However, to suggest a universal trace as method is dangerous. To employ Derrida’s trace requires sensitivity, a cognisance of its inherent undecidability and doubt, as he says:

I have tried to indicate a way out of the closure imposed by this system, namely, by means of the ‘trace.’ No more an effect than a cause, the ‘trace’ cannot of itself, taken outside its context, suffice to bring about the required transgression. ([1967] 1973, p.141)

In effect, the trace has force within and before the means of recording and critique, making the trace a flexible interdisciplinary discourse. This is also why the trace has no true home, is a non-concept, yet still has a significant purpose and function in the movements of deconstruction. As Derrida says: “The trace has, properly speaking, no place, for effacement belongs to the very structure of the trace” ([1967] 1973, p.156).

The complexity of a Derridean trace at the bounds of conceptualisation, and performing symbolic work from the ground up, is beyond or resists being a complete method of strictly applied research. Derrida’s trace is a mode of entry into a system of focus by questioning or observing the destabilisation of distinctions or binaries in meaning. In this sense, any final resolve is trumped by a perpetual thinning of paths to be followed and the bounds of the communication system at play. Ultimately, such
a trace ‘in action’ highlights breaks and dead ends in these paths. What are these paths? It is in answering this question that a structural move is made: one remaining sensitive to a concern for deconstruction’s disconnection from applying the trace directly or strictly or inflexibly and instead allowing the trace to move across or within a guided method of investigation. A more accessible path for the trace is required—a planning for/of its trajectory, even though Derrida’s term is volatile. This is why a dual operational trace is proposed: meeting Latour’s ‘immutable mobiles’ in ‘circulating reference,’ to better target the medium-specific ground of symbolic work. This is a proposal for the dialectic duality of the trace, one observed in action via the feedback between the immutable functions of media ‘and’ the ruptured, including the hidden or broken symbolic work of media assemblages. Thus, there is a side stepping of terminally vanishing signs at the margins of language, and a putting of weight on the relations of matter and media objects in the symbolic work they perform. Considering both thinkers as surveyed to this point, Derrida and Latour can be used to construct a trace that helps make sense of medium-specific meaning production concerning the shaky semiotic materiality that occurs across transversal analogue-digital media assemblage.

Nevertheless, Latour does not describe or take up an explicitly similar perspective to the dual trace-based approach to media being proposed. Likewise, deconstruction and Derrida’s trace do not pass rigid ANT tests. Setting up a hurdle for analysis to overcome, Latour makes quite clear that:
ANT has been confused with a postmodern emphasis on the critique of the ‘Great narratives’ and ‘Eurocentric’ or ‘hegemonic’ standpoint. This is, however, a very misleading view. Dispersion, destruction, and deconstruction are not the goals to be achieved but what needs to be overcome. (2005, p.10)

In the current context, deconstruction and its approach to the trace represent the identification of side effects in a network, while ANT and Latour provide methodological guidance on approaching the study of a network, one that positions media and its reproducibility as a subject on an equal playing field with human and non-human actors (2005, p.10). At this stage, it is imperative to address these issues with a combination of conceptual material drawing on Latour and Derrida.

The goal of placing Derrida and Latour in proximity is found in the explication of both their modes of trace, combined to re-articulate a theory of the trace applicable to medium-specificity. The proposed outcome is that media can be observed, tracked or mapped via an affirmative deconstruction, which involves using deconstruction beyond a tactic to expose terminally thinning signification. In this sense, Latour’s (2005, pp.87-120) inert ‘matters of fact’ can be reopened to become ‘matters of concern’ via deconstruction. When deconstruction is left at the stuttering of the trace, unsettled by the bounds of a system of language and the “impossibility of securing meaning in text” overwhelmed by the “endless play of difference without any centre” (Gere 2002, p.154), we can pick up on Latour’s ANT and ‘circulating reference’ (1999) as they sidestep the suggested dead ends of deconstruction and postmodern pastiche (Wheeler 2010, p.192). Notably, the circulating reference is schematically diagrammed to be based on the movement of representation outward from a centre

It is suggested that Derrida’s deconstruction ([1967] 1997) echoes the digital and Latour (1999) the analogue in an ‘overcoming’ of idealised digital representation in analogue-digital assemblage. In suggesting this, it must be kept in mind that to seek either an analogue or digital truth is not the point, as the two are symbolic symptoms of representation and reproduction that require communicative protocol in force and momentum. For Derrida ([1967] 1997), it could be suggested that language and the work of signification, in its communicative force, is central to a perceived reality via an impossibility of meaning. However, for Latour (1996; 1999), semiotics in representation is certainly not as significant. Reducing the two to ‘only’ analogue and digital is not the point, though; it is more about the forming of a metaphoric example to get a return across the transversal state of analogue and digital re/production. Derrida’s ([1967] 1997) critique, as previously conveyed, can be considered digital in proximity to writing as an already digital construct and a trace that is not to be followed as a path but is more a segmentation or break in embedded systemic paths—a trace system “considered subversive in so far as it creates a spatial and temporal distance” (Derrida 1984, p.116). In fact, Derrida highlights digital qualities of both quantisation and discontinuity via Jakobson and Shannon for both speech and writing ([1967] 1997,
Latour’s (1986; 1987; 1996; 1999; 2004; 2005; 2009) trace, on the other hand, is not marginalised by a focus on post-structural difference or a folding of polar meanings. Latour, across the sensibilities of his constructed and exemplified methods, acknowledges and unfolds compartmentalised meanings, via such concepts as the ‘black box’ (1987 p.131; 1999, pp.253, 304) and actor-network ‘envelopes’ (1999, p.306), and demonstrates a continuous stream of information abstraction and movement via ‘circulating reference’ (1999, pp.24-79)—a potentially infinite analogue as empirical method. Latour’s stand is not of modernist interpretations of origin, the logocentric, or master words and their dualisms and “shows this object/subject dichotomy to be false, as well as any dialectic, or compromise” (Wheeler 2010, p.192). Overall, with Latour (1993; 1999) comes a trace backed by a desired alternative to the use of dialectics as they pertain to postmodern hermeneutic critique that pushes for the loss or rupture of reference in signification amongst representation.24 Considered in reverse, the non-human actors of Latour’s (1987, pp.64-8; 1999, pp.206-7) trace, such as instruments and inscription as immutable mobiles, can be brought to Derrida’s ([1967] 1997, p.46; [1974] 1986) utilisation of trace born of inscriptive spacing at the ground of signification. Ultimately, both point to and can be brought together at media objects (physical devices as instrument and inscription) of transversal practice that cross between analogue and digital reproduction and leave a trace in their stuttering between the two modes of signal processing. Consequently, the focus of method is on such objects not about constructing, acknowledging, recycling then applying existing frameworks, but rather about opening a frame of reference, a materiality, before hitting the go button. This

allows a movement away from subjective/objective philosophical concerns (Wheeler 2010, p.189) and hesitations imposed by a layer of thinning signification between a supposed reality and pragmatic practice (Harman 2009, p.24). Such a move could bring the concrete elements of Derrida’s trace closer to the material focus of media archaeological considerations in digital network culture that also point toward cultural techniques as method for approaching media with a Derrida-Latour combination in mind, the focus of Chapter 7.25

6.2 Analogue-trace

There is no longer a simple origin. For what is reflected is split \textit{in itself} and not only as an addition to itself of its image. The reflection, the image, the double, splits what it doubles. The origin of the speculation becomes a difference. What can look at itself is not one; and the law of the addition of the origin to its representation, of the thing to its image, is that one plus one makes at least three. (Derrida [1967] 1997, p.36, italics in original)

What are the variables in the strange equation Derrida puts together in this quotation? As it pertains to transversal analogue-digital practice, the trace builds to make ‘three,’ but the trace of what? Signal distortion! To be provocative and in the spirit of deconstruction it could be said that there is no analogue/digital binary,  

25 It is recognised, in review, that Latour crosses a lifetime of terrain and is leading to interdisciplinary ontologies beyond the scope of his earlier work focused on here. For example, the extension of ANT and \textit{We Have Never Been Modern} (Latour 1993) in the recent book publication and associated crowd sourced enquiry, a necessary network culture edition of actor-networks: \textit{An Inquiry into Modes of Existence} (2013). It is, rather, his foundational methodology and alternative phenomenological philosophy set in the trace of scientific ‘instruments’ and ‘inscription’ across practice that is of most relevance here.
only signal and its trace as distortion. This section introduces and frames the concept of ‘analogue-trace.’ Essentially, analogue-trace is a means to deconstruct notions of ‘analogue/digital’ binary opposites, and better approach the symbolic work of A/D converter circuits. analogue-trace takes form by pointing to Derrida’s concept of trace as well as technical definitions of analogue and digital signal processing. The taxonomy of enquiry targets, firstly, signal processing as priority; secondly, analogue as ‘continuous’ modes of symbolic ‘analogy’; and thirdly, culturally informed analogue technology labels for mediums of reproduction, information storage, and transmission—in other words, analogue signal as priority, analogue as sign and supposedly analogue thing as consequence. This chapter section begins by offering an understanding of ‘analogue’ through the trace, exploring paradoxes in the combination of analogue and trace, and concludes by moving the developed concept toward alignment with inquiries in media archaeology and the study of cultural techniques.

In order to set up a connection between the trace and the analogue we must return to the techniques of Derrida, utilising a paradigmatic tradition of critique in engagement with binary sign opposites, for example, the paradigms of mind/body, reality/representation, inside/outside, presence/absence, and of course, writing/speech. The idea here is to fold the less institutionally or culturally privileged sign onto the supposed stability or acceptance of the other—a means to afford difference. According to Cohen (2002, p.6), for Derrida, difference, *differance* and trace are “at once a temporal and spatial movement.” The distinguishing factor of interest is in the graphic overlay and influence of the mark in the systemic value of
writing as language, highlighting the importance of what is not being said amongst that which is said. The supposed opposites of analogue and digital can be introduced to open critique in a similar way. In such a dualism there is immediately difference. In this argument, we do not assume that digital reproduction is more valued or positive than analogue or vice versa. In an overall general scale, the uptake of digital technology and the speed of technical progress are seen as communicationally and socially positive. However, equally prevalent are the reactionary and negative views of digital network culture and technology, often expressed in forms of dystopian science fiction and reactions to ‘fast media.’

The analogue/digital paradigm is not a construct of absolute or mutually exclusive opposites; they are already transversal, for example, a digitised photograph is an analogue (analogy) of a scene or vista. And in that instance, the digital signal processing of the image is hidden behind an otherwise analogue process of peripheral capture and viewing. As an example, in vernacular discussion, practices of crafted, hand-rendered, film-based work and the like are often labelled ‘analogue’ in contrast to computer-based production which is called ‘digital.’ The terms are inflated beyond their etymology, with the digital mutability of inscriptive technical media, existing before modern computation, referred to as analogue and lumped in the same category as anything vaguely physical or material. Nevertheless, there is an inherent coexistence between the terms; analogue is not necessarily ‘not-digital’ and digital is not

26 General examples from cinema would include: Larry and Andy Wachowski’s Matrix Trilogy (1999-2003), Ridley Scott’s Blade Runner (1982), based on Philip K. Dick’s novel Do Androids Dream of Electric Sheep? (1968), and James Cameron’s The Terminator (1984). General privacy concerns about digital databases and personal consumption data collection, contagion, software viruses and the diseases of information are other examples, as are reactionary measures such as the “slow media manifesto” (Köhler, David & Blumtritt 2010).
necessarily ‘not-analogue.’ The binary is a transversal process amongst a wider culturally informed system of language surrounding reproduction technology and its variants, what Barthes may categorise as “combined and anomic oppositions” (Barthes [1967] 1983, p.165). Simply, the analogue/digital binary when forced together is an antonym pair rather than an absolute pair of opposite terms. From this general view, and a technical understanding or medium-specific take on media, we can only play with the idea that analogue and digital are physically, contextually and contrarily opposed. However, positioning analogue and digital as binary opposites, in relation to a field of reproduction and representation, allows assessment through undecidability and deconstruction to begin—in already not being distinct the terms are already unstable, ripe for deconstruction and locating the active trace.

`Différance` and a path of trace, as indication of difference, are already at play in trying to establish a simple analogue/digital duality. In seeking absolute contradiction or a binary we are chasing a continually varying pair of meanings: is it there or it is not? There is no in between; for example, we would need to instead seek an analogue and not-analogue or similarly digital situation, in the most faithful sense. It would be strictly on ‘or’ off and consequently a digital construction of signification, an impossibility given the two signs at play: analogue and digital. Furthermore, the process of seeking unique oppositions, no matter what variety, within set structures and systems is a process of compartmentalisation and ‘is’ digital. The analogue/digital pair is definitely not on/off in a digital sense; they are of a more-or-less temporal build, and there is a ‘between’ of comparison rather than contradiction and thus they are analogous. The entire construct is inherently unstable if some form of mutually
exclusive goal is sought after, and that would be frankly pointless. The coexistence of
the two signs instead depends on a trace: the immediately transversal. Additionally,
the use of writing as a digital system of discreet signs adds another layer of instability.
To discuss digital signification in relation to analogue we ‘must’ use the analogue and
conversely we must use the digital to discuss the analogue. The system of critique, its
temporality and spacing, subverts and instils undecidability in the stability of analogue
and digital as signs: “one plus one makes at least three” (Derrida [1967] 1997, p.36).
And it is the ‘third’ that opens space for ‘analogue-trace,’ a kind of name, specific to
an analogue and digital domain set on the intervention of not only meaning but
communication channels. Here, what Siegert might call analogue-trace, in expansion
of Serres ([1980] 2007), is a “parasitical (supplementary) carrier” (Siegert 2015a, p.27)
in referential function, a precession of “interruption, difference, deviation,” opening
symbolic work to be as much about the generative interruption of a communication
channel as about sender-receiver relationships (2015a, p.21).

There is also undecidability in the logic of more technical definitions of analogue
reproduction. Analogue and trace as individual terms afford a beautiful oppositional
paradox worthy of acknowledgment when conjoined. Stand-alone analogue
reproduction, via medium-specificity, is by nature autonomous. It is one continuous
sample of information safely marginalised in the constraints of how we can physically
control matter and less dependent on wider systems of symbolic protocol as is required
in the digital. In this vein, the analogue is more closely related to a logocentric position
and can represent the opposite of, if there can be an opposite, or perhaps more an
antithesis to, Derrida’s deconstruction. Analogue reproduction is closer to the
logocentric presence of being and speech, as opposed to Derrida’s reinvention of and focus on the fluidity of writing, which is closer to digital reproduction, as it “is considered subversive in so far as it creates a spatial and temporal distance between author and audience” (Derrida 1984, p.116). analogue reproduction is more closely related, through its character and presence in the physically real, or that which is of irreducible matter and singularity, to traditional “metaphysical definitions of Being as some timeless self-identity or presence” (1984, p.105). At a fundamental level, analogue reproduction sits closer to traditional systems of philosophical logic. However, it is when analogue reproduction is lifted into a digital realm through systems of mixed analogue and digital apparatuses, as well as digital emulation of the analogue, that analogue-trace is formed.

In returning to the double action of Derrida’s ([1967] 1997) trace across presence and absence, an annunciation and a recalling, we can build links between the trace and more medium-specific networks of analogue re/production in consumption and distribution. At this site, any sense of analogue signal processing is being traced or becoming trace in its reproduction or transmission: a tracing of the trace—for example, when media qualities typically considered analogue, such as the ground and inscriptive qualities of a medium, are reproduced or manufactured digitally and lifted as a material-signal from an analogue grounding or inscriptive base. The echoing of instability between the traces of presence and absence, in such a system, can be what reveals yet hides the trace. The description of the trace given by Colapietro points to this complexity:
I see footprints outside my apartment and infer someone was here; I see clouds and infer it will rain. The trace is tied to what is not present, for example, what is no longer here or what is not yet here. For Derrida, it is tied to what could never, in principle, be present. … Traces are, as it were, a ladder which we can use to climb up a ridge and, after reaching the ridge, kick away. If presence is possible, signs-or-traces are dispensable: At some point, we can discard them, for they are no longer needed. We shall see face-to-face, without the intermediary of signs, God, or Nature, or whatever other name we might use for what can be absolutely (that is, fully and finally) present. (1993, p.197, italics in original)

For Derrida ([1967] 1997), and for the addition of trace to analogue reproduction, the ‘ladder’ exists as an in-between state of undecidability. The presence of analogue reproduction within digital reproduction is marginalised by its relatively new home in the digital network apparatus. Qualities of analogue reproduction, in digital emulation and manipulation, motivate the undecidability, the ‘ridge’ that cannot exist. All that remains for analogue reproduction is assimilation as the ‘ladder’ and the combination of analogue reproduction and trace forming ‘analogue-trace’ as a means to describe this phenomenon.

When we combine this understanding of analogue with trace and frame it with contemporary trends of transversal analogue-digital practice, an entry point or tool is formed for analysing how analogue reproduction performs symbolic work within digital network culture. In network culture, analogue-trace, it is suggested, supplies a way to perceive, appreciate and produce elements of the analogue and analogue reproduction in the transversal analogue-digital assemblage. Here, when the trace of
the analogue is re-inscribed to the point of material-signal distortion, we can no longer say or verify, without reversible ‘immutable’ inscription, that a particular digital work contains, was constructed from or originated from the analogue or its trace. Here “there is no outside-text” and “what opens meaning and language is writing as the disappearance of natural presence” (Derrida [1967] 1997, pp.158-59). All we have is the middle, the pseudo-present processual emulated qualities of the analogue as subverted signs or traces of undecidability and différance, temporal and spatial elements that form analogue-trace.

At this point it is worth acknowledging that Hainge (2005; 2013), in his use and interpretation of ‘noise’ across aural and visual spheres of media engagement, sits close to the developing concept of analogue-trace. In ‘No(I)Stalgia: On the Impossibility of Recognising Noise in The Present’ (2005), Hainge talks of nostalgia via the inversion across time of recognisable noise. Definitions of noise, from signal processing to wider cultural implications, form interesting discussion elsewhere (Shannon 1948; Kelly 2009; Parikka 2011a; Krapp 2011; Nunes 2012; Hainge 2013) and do not need to be repeated here. However, amongst other concerns, Hainge’s (2005) approach to ‘noise’ is understood as that which can hold and bring forth the qualities of past media. Hainge highlights hand writing in contrast to screen writing, open source digital typefaces based on the visual qualities of past typewriters, and the hiss and crackle of vinyl audio recordings. These qualities play with a kind of reference across time where the noise of media is not discernible in present modes of

27 ‘Natural’ is understood as a kind of mythological purity or absoluteness that Derrida is confronting with his concept of writing.
transmission and storage, but rather discernible noise qualities are manifest in present media via a nostalgia value. For example, Hainge says:

[P]ast and present become strictly contemporaneous with each other here, noise being always present yet only recognised after the fact, and nostalgia is thus turned on its head; for no longer being simply a return to the past it becomes a premonition of the future also, a noisy proclamation that today’s PC is tomorrow’s typewriter.

(2005 p.9)

In part, a trajectory is shared; however, there is a distinction between the movement of noise and analogue-trace. The trace of the analogue is not only noise, or in a signal processing sense is only partly concerned with noise. Yes, in Hainge’s (2005) case, like the trace, noise is twofold, revealing past media in present assemblage, as a reinvention, reactivation, or reverse remediation. Noise reveals itself in contrast or reaction to the clarity of more noise free digital transmission and a supposed projection toward the future, perhaps akin to Benjamin’s ‘wish image’ ([1935] 2008, pp.97-8) or what Lisa Gitelman might call a “structural amnesia that already pertains” (2006, p.7) in resistance to strict recordings or writings of historiography and archival practices relative to media and their wider cultural networks. However, the trace can emerge from noise as a mode of interruption or erasure in a processual act of becoming medium, transmission and storage. In other words, when noise becomes trace it is no longer noise, but a recognisable and potentially reversible or avoidable distortion as it becomes that which is monitored or measured via the trace and thus conceptualised. Hainge may agree in suggesting, via review of digital glitch audio experimentation, that supposed noise ‘in use’ by practitioners becomes something other than noise
This makes most sense in a strict medium-specific way regarding signal processing. Characteristics of digital compression types and the tell-tale signs of algorithms rupturing render a trace of error, potentially in relation to integration with analogue processing, rather than the particularities of material qualities at the noise floor of instruments or physical environments. Additionally, Hainge’s definition of noise (2005) is temporal and functions across the spacing of what is not seen as an understanding of a reproduction system. Yet, the surrounding critique and embedded position in the structure of a medium, regarding noise, as defined by Hainge, revolves around definitive media types, as if noise is dependent on a foundational media referent or “empirical mark” (Derrida [1967] 1997, p.61), required to be recognised as the noise of a reproductive system. In a Derridean sense, the trace does not have this requirement, but it is what must be overcome in the Latourean sense. Thus, noise can be analogue-trace but only in ‘becoming’ a trace or an always already trace in the most faithful Derridean sense. For this reason, noise and trace share a site at a fundamental level of symbolic work, but are not strict echoes in media research. If anything, analogue-trace is to be found most applicably in, but not limited to, the veiled noise floor of digital signal processing, which is always at play with absence and presence in analogue-digital assemblage.

The concern at this stage is not with a form of anxiety around detached signification caused by digitisation, as if the analogue provided some form of more pure or faithful link to an object of signification. Rather, the fluidity or transversal potential given to or emerging from analogue-digital assemblage regarding the symbolic work of media at hand is the key. We can no longer easily discern, without prior knowledge of the
production process, the origins or existence of an analogue presence/absence within an analogue-digital re/production. The ground of a medium’s channel, and consequently the spatial and temporal properties that help conceptually and culturally position a medium, have shifted. A piece of recorded music containing the recognisable analogue character of a sampled vinyl record could be a completely manufactured digital patch or plug-in effect. The texture and character of a brush stroke or wooden type press within a visual digital composition could be a direct scan or the result of a digital filter and pixel manipulation. The analogy of traditional photographic manipulation tools in the graphic user interface of photo manipulation software is an icon of high-speed effect, changing what it means to be a practising creative professional. The transversal state of analogue experience and digital mobility alters what it means to engage geographically and socially. Consequently, we cannot confidently say “that is the scratch of vinyl” or “that is a brush stroke produced by hand” or “that is a dodge and burn tool” or “we are ‘only’ here and now.” To follow the thread fleshed out so far, such statements are on the verge of being impossible as they fade away. We are left with an undecidable, something thinner than a trail of analogue-digital visual metaphors, skeuomorphism or emulation of definitive media noise in and of its trace. With Derrida’s trace there is no discernible origin. We are detached from a link not only to the identity of the author but also to the identity of analogue media within the analogue-digital emulation. What is left is orphaned analogue qualities that we know are not inherently digital but also only hint at an alternative sphere of reproduction: analogue-trace! Deceptively, it would seem such undecidability does media-archaeology and media-based typology no favours, yet it acknowledges a media presence and a non-reductive relational value. In this sense,
analogue-trace is the trouble starter, but also a vehicle of investigation that provides a means to highlight a lack of reference in transversal media practice and a continuing movement toward opening and questioning media actor-networks. We should keep in mind that any final pinning should not strictly occur, but should be left open and be a desire or goal in generating open or speculative questions. A focus on the ‘ladder’ is more important and the rungs may or may not take us to desired levels of empirical stability, but should highlight the outcomes of a continuity and fluidity across analogue-digital media and practice.

6.3 Chapter Conclusion
What has been presented is a methodological paradox that reflects affirmative deconstruction as much as it leaves open discussion. The addition of trace to the analogue is not a means to an end. In forming analogue-trace, transversal analogue-digital assemblage is put forward and explored from a technical and theoretical position. This can be seen as a tentative methodology for establishing a workable foundation on contemporary oppositions that are available to be deconstructed. This is where the use of analogue-trace in the traditional sense of a thesis, as a means to an end, or to prove and maintain a particular statement, stops. This is where the trace as an undecidable is attached, rather than applied, to allow further theoretical and practical exploration. Research with an end in sight before it is complete verges dangerously on not being research at all. Through this study’s interpretation of Derrida’s undecidability, research is seen as a processual journey of hypotheses, of being open and positively naïve, by stepping away from the *logos* and a reducible truth of historically set rules and functions (Derrida [1967] 1997, p.19). How can one
seriously interact with collective institutionalised network culture media memories, with micro-temporal exchange, and with each major word and concept carrying a history of philosophical, semiotic, cultural, social, political, epistemic and contextual weight, while hoping to come to an autonomous non-logocentric set of propositions?

It is the generation of criticism and discourse that has aided in the persistence of Derrida’s deconstruction. Similarly, it is with the hope of usefulness within media discourse and practice and to the exploration within this study, that trace is attached to analogue.

The context in which analogue-trace has been positioned and pointed toward is one of thinking with or via media and their transversal qualities in assemblage. There is little use in introducing an autonomous concept into a relatively rapid ever-evolving and folding context of media study. Analogue-trace is not only a call to develop concern about the extinction of media forms and how we value the way we frame and manipulate our understanding of analogue reproduction in a digital realm. It is also an entry point, through Derrida’s aforementioned deconstruction and trace, for generating discourse and shaking the foundations of digital symbolic work with the trace of the ‘other’, an undecidable-analogue that, like Derrida’s position on deconstruction’s covert movement, lies within digital symbolic work as a virus exhibiting positive symptoms:

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28 The concept of the ‘other’ is yet again a heavily weighted word that defies being defined, due to its broad use in critical discourse. Exhaustive exploration of the concept ‘other’ is outside the scope of this study, especially in respect to its link with the concept of radical otherness or ‘alterity’. The general use of the word here is taken from Derrida’s *Deconstruction and The Other* (1984). “Deconstruction is, in itself, a positive response to an alterity which necessarily calls, summons or motivates it. Deconstruction is therefore vocation—a response to a call. The other, as the other than self, the other that opposes self-identity” (1984, p.118).
The movements of deconstruction do not destroy structures from the outside. They are not possible and effective, nor can they take accurate aim, except by inhabiting those structures. Inhabiting them in a certain way, because one always inhabits, and all the more when one does not suspect it.


Again, this is not an attempt to corrupt one or the other, with its other, which would be a reduction to or a return to the logos. The gap between presence and absence, the gap so central to Derrida’s position, that is, between the signifier and the signified, between what we can take from his analysis of speech and writing, is adopted so as to retain the analogue-trace as deconstructive.

The paradox continues through the addition of Derrida’s ‘non-concept’ of the trace. The nature of the trace, and consequently analogue-trace, pushes us away from being able to put a finger on something. However, analogue-trace is delineated within a realm of dissemination, the realm of media digitisation and the analogue/digital paradigm already established: “It cannot be defined in terms of oppositional predicates; it is neither this nor that; but rather this and that … without being reducible to a dialectical logic either” (1984, p.110, italics in original). As described earlier, the assumed “oppositional predicates” of analogue and digital signification are lost and, because of this, are prevented from “being reducible to a dialectical logic” (1984, p.110). What we do have, though, is the proposed analogue-trace, a starting point in a dual ‘and’ dialectic approach, made so via the use of medium-specificity. We must remember that whereas Derrida’s discourse is testing
philosophy and language, the analogue-trace employed here questions the porosity of representational and reproductive media referents.

In the sense that analogue-trace is framed within the language of ‘writing out’ technical media with technical media, it cannot be a true Derridean non-concept or undecidable. However, analogue-trace can be allowed to happen as a non-concept or undecidable from within this fold. If someone were to point at a particular transversal work or associated practice and say “that is analogue-trace,” it would seem a contradiction in the use of the term and a return to an empirical mark, yet that is the exact purpose of constructing or deconstructing the term. They would in fact be pointing at an undecidable, a mediated trace as an entry point of discovery in difference and différance. To use analogue-trace would be to notice a lack of analogue presence and the trace of the ‘other.’ This would be a temporal movement amongst the spacing of an analogue/digital structure that immediately illuminates the différance between the two. In this sense analogue-trace faces the same problem as deconstruction. Analogue-trace from a Derridean perspective aims at deconstructing analogue-digital certainties or ideologies, but it has to do so from within the system of media apparatus or artefact. From this perspective any logocentric, autonomous sense or air of self-identity within its application is not referring to itself as a noun or ‘master’ sign; it is pointing to what cannot have a finger put on it, to what is on the tip of the tongue and to what is between annunciation and recall. Analogue-trace highlights the surrounding media structure and splits its reflected image. Thus, the application of analogue-trace resists being contradictory or paradoxical, simply becoming an entry or testing point for wider networks of reference, specifically ‘immutable mobiles’ in ‘circulating reference’ as
informed by Latour (1986; 1999). Conclusively, analogue-trace is an entry point to analogue-digital assemblage; its symbolic work, as concept, is proposed to perform like an analogue-digital and/or digital-analogue converter that is set on ‘dis-inscription’ and ‘re-inscription’ (Cohen 2002, pp.7-9) in modulated effect, a contemplation of absence/presence via medium-specificity. This makes analogue-trace a fitting means to contemplate relationships and connection points with the symbolic work of A/D and D/A converter integrated circuits (ICs) as material things. In many ways, media archaeology and cultural techniques, as fields of enquiry, combine to form a resonant media-based literary context for the analogue-trace to be couched. It is time to move much closer to tracing the trace of analogue-digital assemblage via A/D converter circuit architectures.
Figure 7.1 Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*, visualising the overarching thesis path and current chapter position to the reader. This chapter covers the node ‘Analogue-Trace: Media Archaeology and Cultural Technique’ and moves the discussion toward ‘Analogue-trace: A/D Converter.’ At this position, the trace is considered via media archaeology centred on Ernst (2006; 2011; 2013; 2016) and cultural techniques centred on Siegert (1999; 2003; 2007; 2012; 2013; 2015a; 2015b).
Figure 7.2 Electro-Harmonix’s *Superego: Synth Engine* pedal, released 2012, photo by Greg Hughes (2017).
Figure 7.3 TC Electronic’s Hall of Fame 2 digital reverb pedal, released 2017, featuring ‘analogue dry through’ and TonePrint technology, photo by Greg Hughes (2017).
And the study of cultural techniques is interested in precisely these medial conditions of whatever lays claim to reality. Because what divides analog media and digital media is not ontologically given, not even on the level of concepts or on the level of a history of ideas. (Siegert 2015b, para.68)

… you are entering a completely new dimension in which the image is no longer a question of iconography, but a question of the distinction between signal and noise. (Siegert 2015b, para.121)

As already argued, ‘analogue-trace’ is a pointer for a non-concept, a trace of a medium without ground, a combination of the broken or hidden symbolic work trace performs, under a Derridean guise, in dual and dialectic relation to the immutable mobiles of Latour’s (1986; 1987; 1999; 2005) circulating reference (1999). This chapter moves, with analogue-trace and the readings of trace established so far, through a critique of media archaeology and the study of cultural techniques, to conclude the accumulation of theory surveyed for this thesis. The construct of theory will then be applied to an examination of a set of device architectures that quite literally underpin and make possible analogue-digital chains of operation, devices known as analogue-digital converters (A/DCs). The ‘concrete’ trace of a medium can lose its material ground when we follow it across analogue/digital thresholds in both signal processing and symbolic work. The problem with a ‘concept-thing’ is that it brings with it well-trodden distinctions, such as content/medium, internal/external, presence/absence, actual/virtual, body/mind, matter/symbol, noise/signal, sense/nonsense, natural/unnatural and software/hardware. In the case of an overarching level of transversal media practice, the problem of a breakdown in
analogue-digital binaries can be ignored because transversal practice is in an operational or performative state of networked and mixed archival analogue-digital means of re/production. For example, the World Wide Web and Internet are the home for complex packets of non-linear chains of operation, more than they are an accommodation of stable indexed linear chains. Cultural semiotic exchange, or content, in network culture echoes this cybernetic materiality of medium. However, close examination through case studies informed by modes of medium-specific media archaeology and cultural techniques can reveal basal analogue-digital media operations that are reflected in wider cultural output.

In terms of a direct medium-specific analogue-digital transversal practice, the guitar effects pedal industry represents an interesting example. The intimate relationship between a guitarist and their guitar tone, the responsiveness and qualities of signal manipulation, is an exhibition of hybrid transversal analogue-digital signal manipulation techniques. Individuals interested in ‘analogue only’ production have become less purist in accepting the usability and expanded aural possibilities of analogue-digital intersections. Mike Matthews, the founder of Electro-Harmonix, saved the company from bankruptcy in 1985 via a mass market vacuum tube buy-up, when facing competition from cheaper Japanese produced audio products. Matthews pursued the harmonic distortion of ‘tubes,’ and “by 2004, New York City-based New Sensor [an Electro-Harmonix subsidiary] controlled 50% of the world’s tube market … with sales of $9 million” (Serchuk 2005). Matthews has also remained faithful to analogue equipment with a pedal circuit design of non-digital effects known for
playability and dynamic response time. Interviewed in *Music Trades Magazine*, Matthews makes this clear:

The more complex the product, the more you chop up the sound, compress and compand it, the more you lose the feeling. The feeling starts when you first pluck the string; the note’s attack contains frequencies that get lost in these complex digital devices. Some companies claim that they model or simulate our effects, but even if they sound basically the same to the audience, they just don’t feel the same to the player. (Matthews 2003)

In contrast to Matthews, Electro-Harmonix has not been averse to the integration of digital technology in its effects pedals. The company produced one of the world’s first guitar-oriented digital delays—the 1980s ‘16 Second Digital Delay’—which has subsequently been reissued (2004-2008). The company has also focused on unique adaptations of earlier pedals and experimental designs, to further penetrate a saturated market and inspire musicians, promoting Matthews to say: “Both technologies are important, and we don’t shy away from either” (Garrett 2014). For example, the ‘Canyon Delay & Looper’, released in 2017, offers intricate delay modes in combination with reverbs and modulation, and the Super Ego: Synth Engine released in 2012 (Fig.7.2), allows users to ‘freeze’ notes, sustain and layer them infinitely. Such pedals offer complex signal sculpting in a small footprint made possible by an integration of analogue and digital signal processing.

The challenge, when it comes to complex analogue-digital signal processing, is that most guitarists do not like to lose tone from their main signal source: their guitar. An
important relationship exists between analogue signal sources and the chains of pedals put in front of amplification, highlighting a culture of analogue-digital techniques in signal manipulation. This culture emerges from the signal integration and modulation inside and between pedals in effects chains. Digital processing and ‘true bypass’ switching are a fundamental example of what isolates any pedal processing from a signal chain. In an ‘off’ mode switching removes the pedal completely from a circuit, ‘bypassing’ any interference, signal buffering or load the pedal circuit may otherwise impose on a signal. Beyond this technique, processes get more complex in terms of maintaining an analogue signal. Tore Mogenson, business manager, public figure for, and creator of TC Electronic’s current guitar pedal platform, highlights the foundations of A/D integration in the company’s catalogue of digital pedals. This catalogue includes the Hall of Fame 2 reverb pedal, released in 2017 (Fig.7.3), a pedal that offers replication and modulation of an array of reverb spaces. Essentially, the processing of many little delay time snippets is required and only possible with digital processing in such a small pedal footprint. Concerning digital pedals, Mogenson points to the importance of ‘analogue dry through’ (Mogenson in Steinhardt & Taylor 2017), in which ‘dry through’ is the digital processing of only a ‘wet’ component of the signal. This occurs when signal is effectively split at input, with an analogue signal maintained and mixed with the final digitally processed signal on output. The signal as a whole is never fully converted to digital in the process. Mogenson suggests this is important because A/D conversion causes noise and latency that may not be a problem with only one pedal, but multiplies to be notable when pedals are added together (Mogenson in Steinhardt & Taylor 2017). A/D conversion was a serious concern for the company with, in 2012, the TC Group filing a patent for their own ‘Pulse modulation A/D-
converter with feedback’ integrated circuit invention (Arknaes-Pedersen & Pedersen 2012). In addition to this integration of signal processing, TC Electronic’s ‘transversal’ approach to analogue-digital product design expanded to meet digital network culture. Pedals such as the Hall of Fame 2 offer user programmable setting slots, in this case three (Fig.7.3). A patented and trademarked ‘TonePrint’ technology is integrated into the pedal as a receiver for shared user, sponsored artist and company generated pedal settings, via the TonePrint editor software. The patented technology allows users to take control of otherwise fixed components and settings within a pedal (Mogenson in Steinhardt & Taylor, 2017). Additionally, the transmission of settings can be achieved by hijacking one of the most analogue of signal sources in a guitar-to-amp chain, the guitar pickup, with a digital audio signal. This technology allows users to sonically ‘program’ a pedal by pointing their phone at the pickup of their guitar (Mogenson et al., 2013) (Fig.7.4). Overall, this technology and the techniques of signal processing that integrate and surround the product, including the online sharing of user generated patches, makes for a transversal analogue-digital pedal. This is a dialectical site between dual systems of reproduction and representation. Perhaps most importantly, the signal culture that is formed from such devices moves the language of pedal use, design techniques and critique from signal quality and characteristics, as derived from electronic components in analogue pedals, to the incorporation of algorithmic qualities and considerations. Musicians and pedal fanatics now refer to their preferred ‘algorithms’ (Mogenson in Steinhardt & Taylor 2017) (Fig.7.4). Here, the underlying mixability and remixability of medium and content is a kind of transversal practice that is not reduced to analogue ‘or’ digital, and nor should it be.
In this context, to analyse the state or operations of the trace we must commit to the intersections of analogue and digital modes of re/production as lines through artefacts and their substrates. On a basic physical and symbolic level, at the site of mechanism or device, what happens when the analogue is converted to digital and/or the digital to analogue? This chapter, and the following, are grounded in the representational operations of foundational devices central to network culture creative re/production and consumption. Analogue-to-digital (A/DC) and digital-to-analogue (D/AC) converters will be filtered through the schools of thought of media archaeology and cultural techniques. These converters will be examined as to how they operate and the media archaeology they provide, while describing them as
cultural techniques, essentially bypassing hermeneutic readings and strict linear/historic narrative, for a medium-specific focus. It is noted that, paradoxically, when discussing technologies there are inherent symbolic protocols. Both analogue and digital systems of re/production are based on and are differentiated by their symbolic difference. However, a focus on the form ‘and’ function of technically symbolic or ‘coded’ systems supplies a materiality that informs wider cultural symbolism. Wolfgang Ernst considers the scenario through media-archaeological approaches (what he terms ‘archaeography’):

Technological media that operate on the symbolic level (i.e, computing) differ from traditional symbolic tools of cultural engineering (like writing in the alphabet) by their registering and processing not just semiotic signs but physically real signals. The focus shifts to digital signal processing … as cultural technology instead of cultural semiotics. (2011, p.242)

Ernst (2011; 2013) gives permission to unfold trace pointers from technical definition and the explanation of signal processing in the transition from traditional inscriptive analogue media to inscriptive digital signal processing while also considering the wider cultural symbolic work of signals. For example, the trace pointers of noise, error, redundancy and degradation can be emphasised as a culmination of signal distortion in addition to a mechanism of Derridean deconstruction. From this perspective, cultural techniques relative to the trace’s survival across A/D conversion in transversal media production and consumption can unfold, be observed, and identified.
Since 1926, A/DCs and D/ACs, contemplated as material ‘things,’ have followed the path of semiconductors (transistors) set by the catalysts of ‘integration,’ ‘speed,’ ‘accuracy,’ ‘efficiency’ (power consumption) and size across electric current control (Harpe, Hegt & van Roermund 2010, pp.1-4). The pinnacle of this path is microprocessors and automated computation. However, aside from this developmental or evolutionary take, converters have the potential to inform the concept of the trace. Converters are often taken for granted, hidden away as integrated circuits or ‘chips,’ within our increasingly common collections of digital tools and toys. Generally, they are ‘signal processors’ and convert continuous physical analogue signals into quantised or discrete digital codes and vice versa. The converters are necessary input and output devices in the peripherals central to human-computer interaction and the means to record and reproduce the physical world digitally, the go-betweens of dual materialities, one physical and haptic, and the other seemingly hidden and consequently abstracted. In this light, these converters are a site inside the ‘black box’ with potential to consider the digital alongside the glow of actors and the cultural complexities associated with software and human-computer interface. Ultimately, we are looking at the operations and formation of a specific mechanism, as medium in a context of networked digital communication, both hardware and software, that is indexical of protocol processes.
7.1 Toward a Media Archaeology of the Analogue-Digital Converter via Cultural Techniques

A/DCs and D/ACs, as electronic hardware and conduits for signal processing, are ripe for deconstruction. As Geoffrey Winthrop-Young asserts, cultural techniques are “operative chains composed of actors and technological objects that produce cultural orders and constructs which are subsequently installed as the basis of these operations” (2015, p.458). Both converters and cultural techniques rely on perpetual, processual and recursive feedback loops in the codification of their output. Yet the focus at this point is not software, ‘coding’ or levels of programming language. Wendy Chun, for
example, suggests that software cannot be reduced to “data stored on a hard disk” and that it is a complicated ‘thing’ that exists as a hardening of processual behaviours informed by and informing ecologies of subject/object, knowledge and power (2011, pp.3-6). Software is acknowledged as a candidate for cultural techniques, but is ‘up the chain’ from the converters and certainly not where we are starting. Like Kirschenbaum (2008), we are microscopically closer to the material surface and operations of integrated digital mechanisms than to ‘software’ (Fig.7.5). That said, the transversal nature of A/D and D/A conversion is a comparatively processual, real-time and temporal set of operations associated with the invisibility and transparency of computation, including micro processes inside smaller devices in close proximity to A/D and D/A conversion, such as in smart phones and digital cameras.

McKenzie Wark (2015, para.34-7) plays on Chun’s (2011) and Galloway’s (2012) definitions of computers as interface, hardware and software, as machines of metaphor, analogy and allegory, suggesting that computation inspires ideals depending on the perspective from which they are approached. Wark suggests:

This is the sense in which for Chun the relation between analog and digital is analog, while for Galloway it is digital. Seen from the machine side, one sees code as an analogy for the world it controls; seen from the software side, one sees a digital simulation of the world to be controlled. (2015, para.37)

At its core, this perspective reflects several modes of media archaeology, as it highlights the importance of media performance as difference and distinction, constructing a base materiality from the concrete ‘stuff’ that comes before symbolism.
to take hold of reality. The complexities of difference between software and hardware, including wetware for that matter, extended to the analogue and digital, are a consequence of the transversal production and consumption of network culture. We could think of this complexity as a build-up of understanding or misunderstanding based on a history and the processes of black-boxed technology, mapped via self-referential metaphor, analogy and simulation. The ‘generic’ practices of the transversal (Gansing 2011; 2013), while supposedly dual and not dialectic, can return to a kind of dialectic connection via basal devices and cultural techniques that produce or offer difference and generate symbolic distinction. The hope for the concept is not so much an additional perspective as a productive middle ground set at A/D and D/A converters.

Wark (2015) highlights the ambiguous cultural definitions of ‘information’ in relation to its historical formation and material reality. He asks for a reconstruction of its history, hinting at the importance of difference between information inside and outside the machine; as Wark suggests:

Information is a slippery term, meaning both order, neg-entropy, form, on the one hand, and something like signal or communication on the other. These are related aspects of the same (very strange) phenomena, but not the same. The way I would reconstruct technical-intellectual history would [put] stress on the dual production of information both as a concept and as a fact in the design of machines that could be controlled by it, but where information is meant as signal, and as signal becomes the means of producing order and form. (2015, para.62)
Mapping the reality of information is not a priority at this point, although Wark’s logic in argument is important. Information as ‘slippery’ subject/object is central to the state of the signal and the signal is what is transduced through the most rudimentary of A/D/D/A conversion devices. Wark (2015) highlights a state of difference in the operation of information as culture, as in the formation of concepts and machine, but does not indicate how the desire to ‘reconstruct’ understanding via the dual historical operations of machine and concept can be met. Sharing similar concerns with Wark, Byfield (2008, pp.125-32) maps the lack of definition of ‘information’. Byfield (2008) links anthropology to cybernetics via Bateson (1972) to filter through the complexities of information’s general use and material groundings in systems of communication. Consequently, Byfield (2008) reinforces the importance of ‘difference’ in what information itself means, but also what it is, when interpreted by humans, quoting a famous definition of ‘increments of information’ from Bateson as “the difference that make a difference” (Bateson in Byfield 2008, p.130). Taken literally, such a phrase is a self-referential play on the ‘process’ of converting and sending information as a signal: the word ‘information’ is noisy and parasitic in its transmission, highlighting the complexity of combining narrative and machine.

What Wark (2015, para.62) seems to ask for can be approached and potentially answered via cultural techniques. As a reminder, cultural techniques considers the interplay of the material/physically concrete and the symbolic in the ‘processual’ chains of operations ‘and’ techniques, human and non-human, that unfold before and after the use of specific media (Siegert 2015a, p.13). Cultural techniques is aligned with materialist motifs in media enquiry that have been utilised, in the present thesis.
to this point, with a less specific nomenclature. For example, Matthew Kirschenbaum, perhaps unaware of the more recent mappings of cultural techniques, promotes a similar approach as a “machine reading” in examining the cultural action that stems from the computer hard drive as a specific device (2008, p.88, italics in original). Siegfried Zielinski’s mention of tracking and the ‘trail’ (2006, pp.26-7) in *Deep Time of The Media* is connected to both cultural techniques and media archaeology. Zielinski reminds us how, in following the trace, a formation and classification of signs takes place. Zielinski also warns us how trailing or tracing processes can complicate and blinker archaeological findings due to a reliance on media as the “instruments of cultural techniques” (2006, p.27). In other words, the medium at hand for media-archaeological ‘practice’ can be read as informing ‘and’ blinkering case studies and should be acknowledged in establishing method. Zielinski ([1985] 2010) could be described as closely linked to the German foundations of cultural techniques discussed in Parikka (2013, pp.149-57). But in his digging up of forgotten media constellations to the point of imaginary media narratives (Goddard 2014, p.1767), Zielinski ([1985] 2010) could rub against more empirical medium-specific associations. At this point, connections should be made to French theory, exemplified by Stiegler’s (1998; 2008; 2010) *Technics and Time* series with focuses on Derrida’s concepts of ‘*différance*’ and the ‘supplement’ relative to the “prosthetic supplementation” (Mules et al. 2009) of technology, that is read as a similar centring on a broad definition of a medium forming reality. Siegert (2013, p.50; 1999, pp.244-5) has furthermore aligned a Derridean approach to cultural techniques.
Cultural techniques can also be associated with territory covered in media art and software studies, such as Matthew Fuller’s (2005) enquiry titled *Media Ecologies*, where relations to media are considered beyond one base medium, to the components that make up a medium. Fuller is interested in systems of contradictory, open and closed nested media formats (2005, pp.39-41) and their “relationality” (2005, p.174). Taking into account that Fuller’s ecologies include the protocols and standardisations that form from media and intervention upon or by them, an emphasis on material-symbolic operations and actor-networks is shared with cultural techniques study.\(^{29}\) Fuller’s ecologies may not be as elegantly ‘dug up’ from exhaustive medium-specific archive trails, leading back to ancient Greek and Roman inscription, such as Siegert’s (2015a, p.25), but his discourse has resonance. Fuller (2005, p.40), in highlighting human and non-human agency in a medium’s misuse to form a “technological rupture,” aligns with Siegert’s (2015a, p.23) Serresian ‘parasitic’ take on cultural techniques: “a history and theory of interruption, disturbance, deviation.”

To be fair to the operative ontic-epistemic constellations of intermediality formed through the lens of cultural techniques, the likes of Fuller’s (2005) media ecology may not be seen as peering deep enough into media history. This would only be the case if we took a strict nondiscursive approach to the media archaeology of cultural techniques. This could be understood as an approach based on the roots of archives that acknowledges media-archaeology especially when couched in digitisation (Ernst 2013, p.24). If applied here, Benjamin’s ([1927-1940] 2002) approach to the recent past as materially historic or prehistoric and understood through a concrete trace, can

\(^{29}\) For an extensive overview of other potential points of connection between cultural techniques and theory of relevance see Parikka (2013).
solidify analysis via temporality. This enables the application of enquiry designed for a deeper past to recent technological development. Thinking with Benjamin ([1927-1940] 2002; Buck-Morss 1989), in combination with Fuller (2005) and cultural techniques, gives certain permissions to consider more recent media systems as always already technique and technology. This is a suggested temporal point of beginning to unfold cultural techniques and relocate Benjamin’s ([1927-1940] 2002) trace into a media-archaeological practice. Thus, cultural techniques will be observed, with scope informed by the surfaces of media or sites of concrete or immutable trace in practice, as points of adverse connection in communication exchange. Why? Firstly, such a theoretical assemblage is not a reductive simplification, but rather a kind of temporal media-archaeological approach to cultural techniques. Secondly, priority needs to be given to observing the trace across transversal paths of representation in the assemblage of inscriptive media and technique alongside Gansing’s (2011; 2013, p.265) practice of media archaeology, which identifies the transversal role of the ‘generic’. We do not all have the time or the need to trace doors back to antiquity (Siegert 2015a) or to go as ‘deep’ in time as to track media ecologies to constellations of their geological substrates (Parikka 2015a; 2015b). All modes of media analysis have a threshold; the priority, in the spirit of cultural techniques, is to pinpoint change via the culturally concrete as informed by recursive practice or operations. It is hoped that seeking packets of representational operative chains, an unfolding and ‘leaving open’ of envelopes in Latourean terms, will offer a user-friendly approach to the examination of cultural techniques and meet the microtemporal condition of network culture.
7.2 Approaching Cultural Techniques via Media Archaeology

The kind of media archaeology that is being brought to cultural techniques is three-fold: context, theory and method. Gansing’s analysis of the role of the ‘generic’ in media archaeology (2011; 2013, p.265), as a suggested condition of transversal network culture practice, discussed in Chapter 3, is context. Ernst’s (2011; 2013) brand of media archaeology that meets cultural techniques at the site of temporally defined archives will be adopted to reinforce a media-archaeological observation of digital network culture ‘and’ define an approach to the specificity of A/D and D/A conversion. Three motifs are taken from Ernst (2011; 2013, the first of which is a reaffirmation of a medium’s trace as essential to media archaeology analysis, as an extension of but differing from Kittler ([1985] 1990; [1986] 1999). Secondly, Ernst’s (2011; 2013, pp.55-82) method prioritises media doing media archaeology, while being inclusive or pointing to cultural semiotic consequence. This method also points Ernst (2011, p.251; 2013, p.98-9,195) toward affinities with cultural techniques. Thirdly, Ernst (2013, p.100) identifies a micro-temporal archive state based on physical digital storage becoming merged with transmission in immediate accessibility. Transmission and storage become one with cultural consequence, aligning with Gansing’s discussion of the role of the ‘generic’ in media archaeology (2011; 2013, p.265); each motif will be briefly expanded.

Kittler ([1986] 1999) and Ernst (2011; 2013) inform the analytical potential and insistence on the technological grounding of the trace. For instance, the two share a concern for the ‘data flow’ of phonographic technology that can also be distinguished
at the site of the mechanism’s analytical qualities. Making an example of Edison’s short-lived 1877 invention of an inscriptive phonograph, Kittler suggests:

In principle, even though Edison for practical reasons later separated recording units from replaying ones, it is one and the same stylus that engraves and later traces the phonographic groove. Which is why all concepts of trace, up to and including Derrida’s grammatological *ur*-writing, are based on Edison’s simple idea. The trace preceding all writing, the trace of pure difference still open between reading and writing, is simply a gramophone needle. Paving a way and retracing a path coincide. ([1986] 1999, p.33, italics in original)

In the quotation above, Kittler highlights the two-way qualities of the trace as merged by a mechanical process, and the notion of the trace itself as a medium between capturing and replaying aural data: a concrete alternative to discourse. Kittler argues that the phonographic device suggests a one-to-one stamp of reality and supposedly human influence on the instability of the trace. Consequently, the quotation aligns with French post-structuralist thinking at the point of Derrida’s trace ([1967] 1997) and puts weight on an inscriptive trace ‘outside the text’ in favour of audio recording. A reading Kittler ([1986] 1999) opens up here is an elevation of Derrida’s ([1967] 1997) trace from the bounds of grammatology to suggest a concrete trace at the surface of sound reproduction processes, and not only the trace of a sign at the site of writing’s relationship to codes of signification and speech. At the same time, the statement reads as if Kittler’s ([1986] 1999) material trace still holds a charge of Derrida’s ([1967] 1973; [1967] 1997; [1972] 1982b) ‘difference/ *différance*’ as a deconstructive mechanism of technical media. Ernst (2011; 2013) is of particular interest here as he
maintains some spirit of Kittler ([1986] 1999) in his notion of media archaeology; he sees the phonograph as some kind of ‘continuous’ trace of reality in unfolding a materiality of media. For Ernst, the process of audio reproduction meets computation, to form a media ‘archaeography,’ set in the processes of signal transduction and conversion. He says:

While philological analysis of the marvels of oral poetry (Homer’s epics in antiquity, Serbian guslari in the present) remains within the logic of cultural technologies (alphabetic writing and musical notation), media-archaeological analysis, by computer-aided fast Fourier computations, of speech below the elementary units of what can be expressed by letters (vowels, consonants) gives access to the material dimension (the physical world) of a cultural moment. (2011, p.243)

Here Ernst identifies a materiality of communication media that works alongside the codification of written or aural language, but is also physically and temporally distanced from the analogue phonograph definition of the trace. The focus is a proximity of ‘network data flows,’ to categorise like Kittler ([1985] 1990; [1986] 1999), not an ontological competition of definition. If we consider Ernst’s ‘material dimension’ in the quotation above as a site for the trace, what is proposed is a tracing activity as measured, recorded, stored and transferred by an instrument but also by the qualities of said instrument’s intervention on the signal or as the channel of a cultural event. This is a trace of the medium itself: “Media archaeology exposes the technicality of media not to reduce culture to technology but to reveal the techno-epistemological momentum in culture itself” (Ernst 2011, p.253). Ernst’s approach is not a closed one, nor one determined by instruments and inscription, but is sensitive to broader cultural
engagement via the insistent addition of a medium’s trace as historical ‘and’ cultural semiotic probe. He also suggests:

In media-archaeological awareness, this recording primarily memorizes the noise of the wax cylinder itself—which is a different kind of ‘archive,’ not cultural-historical but cultural-technological, a different kind of information about the real. Media archaeology opens our ears to listen to this as well, not to filter it out (as opposed to the ‘cocktail party effect’ of hermeneuticized psycho-acoustics). (2011, p.250)

Parikka summarises the motif in Ernst’s thinking as “about finding what in the semantically noisy is actually still analytically useful when investigated with the cold gaze of media archaeology” (Parikka in Ernst 2013, p.36). Ernst’s trace is a material discourse mechanism that compares to Kittler’s call to ‘scrutinise by trace,’ where trace becomes a game of ‘trace detection’ (1999, pp.85, 123, 143, 150) and as a ‘reality’ check on media’s terms, including the mechanical influences a medium’s limits of operation have in producing a trace or an assemblage of traces. This use of trace is especially the case when Kittler discusses film, where the trace reveals itself to us in how it manipulates and cuts a reflected body image. Here the trace is the effect of media illusion (Kittler [1986] 1999, pp.150-1) or the implied absent in inscription or recording. In short, Kittler seems to leave his earlier phonographic analogous trace ([1986] 1999, p.33) behind and returns to a trace defined by incomplete signs as formed by the optical, time critical and code limits of film production. In contrast, Ernst (2011) begins analysis at a concrete trace of a medium left as a material mark in reproduction or transduction and remains closely tied to the theme. However, this claim is somewhat speculative as neither author purposely defines the trace in great
detail as a theory itself. Either way, both offer insight into the use of the trace as analytical method. Ernst’s (2011; 2013) method is preferred as it expands the potential of a verifiable trace, or assemblage of traces, used as a platform materiality, that may point to wider symbolic work.

From a media-archaeological perspective, how Ernst (2013) identifies a shift in media storage becoming real-time transmission is of interest. This shift in media storage is a condition set by the materiality of digital network micro-temporality working into analogue electronic archival accessibility: “Following this methodology, one reads traces of digital technologies into history, not the other way around” (Lovink in Ernst 2013, p.193). For Ernst the idea of memory, as digital storage, is approached via a media archaeology that applies the operations of computation to thinking about archives in relation to time. With relevance to storage and transmission, these are: “Cycle time, … Latency (the time it takes a functional unit for data to be shifted and relocated) … [and] … Access time (… the sum of latency and transfer time)” (2013, p.97). Beginning with these computational processes, storage is moved to a state of transfer, switching what we may think of as a digital archive to a common network practice of on-demand content. Real-time content ‘streaming,’ is one example (2013, p.98). Ernst continues:

With supremacy of selection over storage, addressability over sorting, there is no memory in the emphatic sense anymore; archival terminology—or rather the archive itself—becomes literally metaphorical, a function of transfer processes. … Repositories are no longer final destinations but turn into frequently accessed sites.
… the cultural techniques of re-activable storage are in a permanent state of latency.

(2013, pp.98-9, italics in original)

Ernst also identifies the computational process of ‘buffering’, the process of temporally storing data in physical storage regions to aid in an ‘almost’ real-time transfer, as a micro-temporal memory/transmission state, labelling it “minimal delay memories” (2013, p.100). The highlight here is that transmission is also a hidden ‘on the fly’ combination of storage and calculation, further merging the distinctions between transmission and storage, as technical processes and concepts. Ernst elaborates further on the distinct properties of digital archives and suggests:

It turns out that storage is nothing but a limit value of transfer. Seen from a media-archaeological perspective, transfer and storage are two sides of the one coin: storage is transfer across a temporal distance. (2013, p.100)

Ernst’s observations, as presented here, write digital data processing back into traditional understandings of archival storage and align network cultural media archaeology practice to its computational materiality. Ernst cautions us that there “has always been data circulation between the needs of an inquiring present and the archival documents; only online does this circulation become a closed circuit” (2013, p.100). Traditional forms of analogue or pre-network computational media are ‘converted’ into a unique archive, defined by online formats and protocols. Furthermore, if content is manufactured digitally or online its analysis should acknowledge a default distinction in archival qualities. Thus, unless concerted effort is made to ‘write out’ online archival material to non-online systems of transmission and storage, two broad
archive systems, defined mostly by temporality, exist in parallel. These two archives are not a direct reflection of the paradigms of analogue and digital media but rather a means of exposing an archive and defining its accessibility as informed by signal processing. General notions of online ‘echo chamber’ effects regarding user political orientation and news sharing on and filtered by social-media platforms would be a logical wider cultural implication of this medium-specific starting point. The material realisation that the online data processing of network culture is an inherently closed system aligns with Gansing’s description of the ‘generic’ in media archaeology (2011; 2013, p.265). Digital network culture, approached via the base operational qualities of its media, allows us to see parallel or ‘dual’ systems of media exchange rather than dialectic ones. As a reminder, the condition of the generic is a closing off and negation of supporting systems (Fig.6.2 and Fig.6.3). Here Ernst (2011; 2013) underwrites the cultural techniques of network culture with a concrete archival foundation that conditions its generic activity. Thus, Ernst (2011; 2013) inspires a method to consider data processing as specified by A/D and D/A conversion and the need to write what is discovered back into an analysis of the trace against generic network culture. The outcome could be two-fold: a discussion of activity at sites of dual archive systems becoming dialectic; and the influence of the trace at these sites. It is here that we need to pursue the trace as cultural technique.

7.3 Ernst and Cultural Techniques
To an extent, cultural techniques emerged alongside media archaeology and Ernst’s (2011; 2013) compatibility with it does not need to be extensively outlined. However, of particular interest is a shared medium-specific and material focus on the symbolic
work that manifests difference and ‘distinction making’ in the feedback between cultural activities and what constitutes a medium. There is a mediated middle ground between technology and the formation of cultural symbolism that cultural techniques facilitate. In cultural techniques, there is a sensibility that is grounded in the “material differences that make a difference without being reduced to representations and signifying chains” (Parikka 2013, p.153). Ernst has taken a hard stance in some cases, bringing the machine as medium to meet motives of cultural techniques:

Media ‘archaeology’ discovers a kind of stratum—or matrix—in cultural sedimentation that is neither purely human nor purely technological, but literally in between (Latin medium, Greek metaxy): symbolic operations that can be performed by machines and that turn the human into a machine as well. (Ernst 2011, p.251, italics in original)

The above statement by Ernst on its own could easily be mistaken for speculative fiction. However, Ernst’s media-archaeological approach is also a theory of cultural techniques in its acknowledgement of symbolism that is not reduced to either semiotics or medium determinism, but rather a vibrant middle ground. This is further evidenced in interview format in conversation with Geert Lovink; Ernst says:

My media archaeology is archaeology of the technological conditions of the sayable and thinkable in culture, an excavation of evidence of how techniques direct human or nonhuman utterances—without reducing techniques to mere apparatuses. (2013, p.195)
Ernst’s (2011; 2013) position, as provided in the previous two quotations, aligns with the central motifs of cultural techniques. Siegert (2015a, p.14) sets out the emergent field of cultural techniques as not strictly anti-semiotic and not restricted to either side of the meaning production offered by material objects or symbolic ‘things.’ There are shared undertones of post-structuralism and deconstruction at the site of cultural techniques’ observations on mediated intervention (2015a, p.14). Cultural techniques encompasses more than iconic signs, symbolic form, and code systems; “they assume the position of a mediating third” (2015a, p.14). As has been said, there is a certain resonance between media archaeology and cultural techniques. However, subtle differences between Ernst’s (2011; 2013) media archaeology and cultural techniques need to be noted. Parikka suggests that Siegert and Ernst convey difference in relation to signs and signal processing:

[T]he Berlin situated media archaeology of Ernst desires to replace an analysis of signs with that of signals. … Siegert’s stance does not neglect the materiality of signals but adds to it a slight modification: we analyse signs as signals and our cultural accounts are embedded in understanding of the physical, engineering and technical aspects of media as techniques. (Parikka 2013, p.154)

This reading of Ernst (2011; 2013) is interesting for two reasons. Firstly, a media-archaeological approach, it is suggested, should not express subjective anomalies such as ‘desire’ toward the analysis of media, but rather should unfold as knowledge from a kind of impartial observation of media as culturally concrete technical devices, their archives and relative infrastructure. Ernst’s (2011; 2013) reflexivity in media archaeology has moved well beyond the “no concept of media” or “gay science”
scrutiny of early media archaeology (Siegert 2007, p.28) to an explicit or empirical media ‘archaeography’ (Ernst 2011; 2013). For example, Ernst’s media-archaeological analysis does not just ‘do what it wants’ and is grounded in “media studies as exact science” based on the “physically real (in the sense of the indexical) traces of past articulation” (Ernst 2013, p.173). Ernst’s media archaeology is kept in check and enforced by media observation and technical explanation, exposing signal processing as central to his findings on the cultural channels of technical media, not a ‘desire’ to replace notions of the sign. Ernst and Siegert certainly meet when questioning the “logocentric concept of the sign” (Siegert 2015a, p.32) with technical media and Siegert highlights signals as “the physical materiality of signs” (2015a, p.31). Surely both authors see material signals as signs?

Secondly, Ernst’s (2011; 2013) media archaeology is at the epistemologically empirical edge of the field compared to what the field has become more broadly. However, media archaeology, both as explored by Ernst and as a field in and of itself, hinges on cultural techniques. For example, Apperley & Parikka (2015) probe the implicit conditions of game ‘platform studies’ with media-archaeological questions to form a more explicit archival grounding for the emergent mode of media analysis. Apperley & Parikka stress media archaeology’s potential in more thoroughly mapping the condition of the archive that historically supports a subject. In Apperley & Parikka’s words: “how the technical archive frames questions of epistemology: How do technical media govern, guide, and enable culture?” (2015, p.16). The definition of media archaeology that supports this mode relies as much on specific technical readings as it does on pecking at the boundaries of game platform studies with an open
and speculative media archaeology supported by techniques of creative and critical media practices (2015, pp.14-15). Convincingly, Apperley & Parikka write media archaeology into platform studies in two select ways: the medium ‘and’ supporting techniques, to expose what is missed or ill-conceived by its lens. Consequently, it may be suggested that there is little friction in bringing Ernst’s mode of media-archaeological method and cultural techniques together with an examination of the trace through A/D and D/A signal conversion.

7.4 Cultural Techniques: Toward the Trace and Analogue-Trace of Conversion

Figure 7.6 Screen grab (2017) of a Google image search for ‘Cosmo Kramer Door,’ featuring Cosmo Kramer, played by Michael Richards in NBC’s Seinfeld (1989-1998).
According to Siegert ‘culture’ is not used to mean a refined ‘cultured’ society, but instead is about addressing a “humanoid-technoid hybrid” and a “plurality of cultures” wherein there is a “complex actor-network that includes technical objects and chains of operations … [T]he human actor has always already been decentred by the technical object” (2015a, pp.192-3, italics in original). The technical objects or techniques Siegert reveres vary from architectural thresholds (2015a, p.194) to “concrete sign practices” (2015a, p.123), such as inscriptive medium processes like “drawing techniques” (2015a, p.125) and “projective graphic operations” (2015a, p.135) that facilitate a recursive dynamic merging of “technologies and symbolic work” (2015a, p.13). However, Siegert advises that cultural techniques of greatest value form a materially endowed symbolic reality only when a “processual rather than ontological definition of first-and second-order techniques” is observed (2015a, p.13, italics in original). Here Siegert refers to cybernetic theories where the difference between first and second-order techniques is part of the critical taxonomy where symbolic output is unique to a second-order and defined by self-referential potential. For example, we can write about writing but we cannot so easily “thematize the making of fire while [or with] making fire” (2015a, p.12). Siegert reiterates:

We need to focus on how recursive operative chains bring about a switch from first-order to second-order techniques (and back), on how nonsense generates sense, how the symbolic is filtered out of the real, or how, conversely, the symbolic is incorporated into the real, and how things/signifiers can exist because of the interchange of materials/information across the ever-emergent boundaries by which they differentiate themselves from the surrounding medium/channel. (2015a, p.13)
Siegert’s key illustration of cultural techniques is a door. The door works in relation to the cultural distinctions of inside/outside and, as “architectural media,” doors “simultaneously thematize this distinction and thereby establish a system that is made of the operations of opening and closing” (2012, p.8). Siegert suggests: “the door puts inside and outside into a special relation in which the outside first becomes properly outside and the inside first becomes properly inside” (2012, p.9). The door as medium and its physical operation harden or potentially pre-empt symbolic distinction. Siegert’s approach “moves ontology into the domain of ontic operations” (2012, p.9). This is a perspective set in the materiality of recursive processes that ‘form’ the symbolic through the mediation of distinctions rather than well-ordered sets of supposedly predefined ‘human’ actor discourse. Siegert entitles these cultural techniques “basal” media “that cannot be restricted to one or the other side of [a] distinction” and form a “mediating third” (2013, p.61). For example, the apartment door central to almost every episode of NBC’s sitcom Seinfeld (1989-1998) is basal to the distinctions of outside and inside, informing the symbolic embellishments added to its operation by Cosmo Kramer, played by Michael Richards (Fig.7.6), often announcing the tone and plot of an episode and the relationship boundaries between Kramer and Seinfeld.

Siegert’s mediating third annexes Serres’ ([1980] 2007) three-branched parasite model of communication with shared emphasis on ‘noise’ (Siegert 2015a, p.21). In this model a parasitic influence sits before and between sender and receiver, as an opening for a communication channel, that makes a system of communicative exchange possible. Siegert suggests: “[W]e do not start out with an unimpeded exchange … it is the
parasite that comes first,” consequently “the third precedes the second: That is the beginning of media theory” (2015a, p.21). For Siegert, through Serres, “the fundamental relationship is not between sender and receiver, but between communication and noise” (2015a, p.21). Siegert’s use of Serres emphasises a preliminary or emergent space from which a medium of cultural techniques emerges and emphasises the symbolic potential of the channel. The existence of a host system of exchange is quite literally dependent on its parasitic elements. An exchange between sender and receiver may be able to ignore the parasite in operation but the parasite, as a “being of relation,” operatively “short-circuits the channel” (2015a, p.23). This observation is especially the case in formal signal processing where source, noise, transmission and channel are strictly interdependent, for example, in the early work of Claude Shannon (1948). Siegert continues: “Hence in all communication each expression, appeal, and type of referencing is preceded by a reference to interruption, difference, deviation” (2015a, p.21). It is this take on communication that turns “information exchange, appeal, or expression” into an “act that creates order by introducing distinctions” and “turns the means of communication into cultural techniques” (2015a, p.23). Joining these processes of disturbance and order are actors that recursively sort and filter in their symbolic work. James Clerk Maxwell’s (1872) thermodynamics thought exercise, dubbed Maxwell’s demon or ‘the demon at the door,’ in early cybernetics underpins such thinking: a hypothetical finite being given just enough information to sort fast from slow molecules to control temperature difference and entropy. The demon is a fitting metaphor for an operation that seeks order between symbol and material or information/knowledge and energy/matter. Serres says: “What is work? Undoubtedly, it is a struggle against noise. … To work is
to sort. Maxwell’s demon is unavoidable, just like the parasite. Alas, they are twins perhaps” ([1980] 2007, p.86). Additionally, Siegert suggests: “Not by chance is Maxwell’s demon a gatekeeper. As long as doors fulfil their informative function, they sustain a disequilibrium of energy or knowledge that defers overall entropy” (2015a, p.201). Siegert’s door example witnesses the door as “both a material object and a symbolic thing” (2015b, para.51, italics in original). Thus, the door can be observed as parasite, filter, channel and medium as a particular cultural technique between material thing, disturbance or noise, and symbolic thing. To continue logically, the door is a primary source of a particular kind of operative symbolic work; the symbolic distinctions of opened and closed can be ‘swapped out’ with other fitting material things that perform in the same way or result in similar actor-network operation, if scenarios of exchange, human or nonhuman, share recursive operative resonance. In this regard, the trace and analogue-trace can act as gateways that always already operate between material-symbolic disturbance and order in the mutable and immutable symbolic work they conduct across medium, content and supporting substrates. Considering broken or hidden symbolic work, analogue-trace can operate like a door in closing off chains of operation via its inherent ‘absence’ but materially the door can also leave a trace to be traced and be open in its presence; be it a worn groove in floor boards, degradation of inscriptive surface, projective pathways or ‘action at a distance’ to be followed, or the trope resistance and deflection provided by the door in the movement and annunciations of Cosmo Kramer as he busts through a TV studio set’s threshold (Fig.7.6). The trace and analogue-trace interrupt ‘and’ sort like ‘demons’, making them fitting cultural techniques.
Figure 7.7 *Book of Hours* illuminated by Vante di Gabriello di Vante Attavanti (1480-1485), held in Fitzwilliam Museum, Cambridge.

Figure 7.8 *Escaping Criticism*, oil on canvas painting by Pere Borrell del Caso (1874), held in the Bank of Spain, Madrid.
Figure 7.9 Web image of BBot (Browsing Bot), a video projection and mini-computer with internet connection sculpture, by Anne Roquigny, James Hudson, Marie Koch and Laura Mihai.

Figure 7.10 Web image of a Webjay Audiovisual installation performance from Webjays Surfing (2016).
There are two other features of cultural techniques that point toward the trace’s ability to be observed as a ‘basal’ technique and a key force in distinction making: a type of remediation and the processing of “residues and leftovers” (Siegert 2015a, p.24). The first is set on the idea of recursive “self-referentiality” (2015a, pp.164-91; 2015b), concerning media change as mapped through media genealogy, while the second hovers around a continuation of the concept of the parasite. Firstly, then, the focus is on the observation of the distance between “sign and sign carrier” as a media-based premise for the ‘process’ of representation as defined by a medium’s materiality within its content (2015a, p.190-1). In this sense, the medium becomes its own parasite. Siegert highlights pictorial illusion in “trompe l’oeil” painting as an example (2015a, pp.164-91; 2015b), where “there is a constant oscillation between the transparency of the illusionary pictorial space and the material opacity of the support” (2015b, para.31). Due to the play of perspective in such paintings, the ground, frame, border, niche or support of the work becomes a material ‘and’ symbolic thing. However, Siegert suggests the painting technique is not so much a means to position or dupe the observer as a “conflict between two cultural techniques of gazing and reading. At one point these two techniques were interwoven, but in the course of medial differentiation the techniques themselves were differentiated” (2015a, p.169, italics in original). These two techniques are suggested to have formed in the medium of the illuminated book (2015a, p.191). Consequently, Siegert suggests:

So something that is usually thought of as a matter of style, a history of style, can instead be ascribed to a history of the differentiation of a medium. And with this, we arrive at the possibility of describing painted things like the niche as a reentry of the
material side of one medium into the content side of another medium, or as the result of compromises between contradictory aspects of a medium that is in the process of differentiation. (2015b, para.38)

Siegert explains how trompe l’oeil is formed as “a symptom of the suppressed order of co-presence and the figural” (2015a, p.191) in the merging of illuminated book and still life painting. The illuminated book asks for a cultural technique of reading ‘and’ gazing (a merging of text and ornamental border); as witnessed in the Book of Hours illuminated by Vante di Gabriello di Vante Attavanti (1480-1485), there is a bringing together of figure and ground that conducts symbolic work (Fig.7.7). Trompe-l’oeil examples like Escaping Criticism by Pere Borrell del Caso (1874) (Fig.7.8), which in its content refers to both the painting’s frame and a viewing context via the title, is also a fitting example of a gateway between medium and image codes. These cultural techniques recur, and potentially make possible codes of symbolic work in the forming and disruption of mediums.

A transversal example from network culture can be found in WJ-S Production’s BBot (Browsing Bot) (Fig.7.9) and the practice of Webjaying (Fig.7.10). BBot responds to a strange calling to have a material presence in public exhibition contexts for the video projection of curated and networked, often geographically separated, collaborative performance of Webjay content as real-time or precomposed mixes of audiovisual Web content, reminiscent of DJs or VJs as an extension of ‘remix’ cultural techniques. As elegant and bizarrely pointless as the browsing bot may seem, it brings surfing the Web, already beyond self-referential medium awareness, into the network practice of archive and Web trope remixing and gives it material form in gallery contexts. Such
works as the illuminated book, trompe-l’oeil, and BBot integrate symbolically associated ornaments, blurring sign carrier and “the sign or represented object” (Siegert 2015a, p.190). Consequently, representation “is not a semiotic issue; it has to be viewed as a process. It is a coding procedure” (2015a, p.191), always in action and influenced by the materiality of media.

The self-referentiality Siegert observes is similar to Gansing’s reading of “reverse-remediation” (2013, p.294) in that there is first “a transversal media practice that opens up the old/new dichotomy, a making strange that holds potential for a critical innovation of media” set in the qualities of host media. However, for the concept of a cultural technique the focus is on an ontic operational movement at the beginning of what can specifically be called a medium. The theoretical extreme is that “Media as such do not exist;” they instead “emerge from a motley, contingent crew of actors, gadgets and events” that Winthrop-Young labels “‘pre’-mediatic” (2015, p.460, italics in original). This pre-media state of representation is what differentiates the cultural techniques approach and is exemplified by the merging of concrete sign practices as a kind of media genealogy or media as “recursive exaptations” (2015, p.459). This definition, involving the iterative self-referentiality of media, can be aligned with Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) dialectical image that highlights a medium that “interrupts the context into which it is inserted” and thus “counteracts illusion” (Benjamin in Buck-Morss 1989, p.67). Benjamin’s alignment not only is evident in the observation of specific media, but also informs the approach and structure of his entire arcades project (Buck-Morss 1989, p.67). Similarly, WJT Mitchell echoes Walter Benjamin when writing on metapictures,
“pictures that refer to themselves or to other pictures, pictures that are used to show what a picture is” (1994, p.35), and “reflect on the intersections of visuality, language, and similitude, where they engage in speculation and theorisation on their own nature and history” (1994, p.82). All in all, from a cultural techniques perspective it is the materiality of media that ‘makes possible’ or ‘makes lucid’ symbolic code practices and is the parasitic ground of the channel between sense and non-sense, communication and noise. Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) dialectical image, including his sub notions of image-worlds ([1931] 2008, p.279; Jennings 2008b, p.264), wish images ([1935] 2008, pp.97-8; Buck-Morss 1989, p.56) and most importantly trace, without doubt, position the trace, or the use of the trace, as always already a basal cultural technique. The concrete trace also precedes the symbolic but does so via an oscillation with that which is left behind by the medium and that which is absent in reproduction and representation. It is the trace of the medium in self-referentiality that can be considered a parasite and a force of difference and distinction in the channel between matter and symbol, signal and noise. Winthrop-Young notes that notions of media emergence are not “predetermined” or some sort of “teleological evolution” but rather:

Every new refunctionalization is possible because a preceding abstraction enables users to understand something new about their communication system, and every stage operates as the input for a subsequent processing of the system. (2015, p.459)

This is a strange middle ground where a medium is both doubly present and considered via analogue-trace as absent pointing toward where “[d]ifference and deviation have turned into cultural techniques that process residues and leftovers” (Siegert 2015a,
This is the trace: a medium and cultural technique between materiality and the recursive codification of symbolism in representation, but more importantly, this in-between node of mediality connection is ‘analogue-trace’ when considered in contexts of analogue-digital re/production and signal conversion.

The second notion of cultural techniques relevant to the trace is its focus on the distinctions of presence and absence. A concrete trace from Benjamin’s ([1927-1940] 2002, p.447) or a simple forensic standpoint implies two things: something has been present but is now absent. Siegert (2015a, p.195-99) uses Benjamin ([1936] 2007) to emphasis a rupture in the archive of representation via operations of ‘unfolding’ and ‘annunciation’ in Robert Campin’s 1425-28 Mérode Triptych (also known as the Annunciation Triptych) as an exemplar cultural technique in early Dutch painting. The painting is a foldable ‘altarpiece’, the wings hinged to the centre frame, with recursive un/folding as a motif throughout the three images from elements of doors, books, cupboards and window shutters and an overall dynamic between inside and out, open and closed. Evidently, just as the painting’s frames are ‘open,’ the objects within are mostly open. The windows and shutters are open, the Book of Hours is open and the door to Mary’s inside setting is open. The overall scene is assumedly ‘open’ to the annunciation of new information regarding Mary’s pregnancy. This is in addition to the whisper of an angle and perhaps divine positioning of book pages on the table. Most importantly, though, the door to the left of the angel Gabriel, open to the devoted figures kneeling at the door, shares a hinging axis with the physical frame of the painting’s left wing and centrepiece. The annunciation is not just for the iconography of the subject matter; it is also for the viewer or user as unfolder of the piece via a
relationship between the trace of content and the material frame. Here annunciation involves a presentation of information via symbolic work in relation to physical ground—the frame and its function in both a recursion of pictured unfolding and an operational connection between frame and image. This is a rich dynamic relationship between the presence and absence of content in medium and medium in content facilitated by the trace of each. The point being made, again, is that the image surface is interrupted by the extension of ‘door’-like operations from material ground to pictorial representation and merges seeing (appearance) and vision, or, in the religious context of the triptych, “the profane and the sacred” (Siegert 2015a, p.199), as a consequence. As a reminder, Cosmo Kramer’s door (Fig.7.6) connects the trace of the door to the narrative of a script providing new ‘surprise’ information, as an annunciation, for a Seinfeld episode. However, Kramer’s door does not provide an obvious material operational link to the television screen. The Mérode Triptych provides something a little more concrete. From a cultural techniques perspective, the annunciation is not just for Mary; via iconography, it is an annunciation of mediation seen or used and not just envisioned. This example is another demonstrating sign practice, grounded in the processes of material mediation, preceding symbolic maturation inclusive of self-referential connections to the trace in reproduction and supporting substrates. The triptych is set around the presence and absence of a material frame against the pictured representation of religious iconography and akin to Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) concrete trace. As Siegert states:

The folding apparatus thereby initiates a game of presence and absence. … In classical terms of representation the annunciation is absent, given that we are dealing with the pictorial representation of a past event; as a vision, however, which—to pick
up on Benjamin’s famous phrase—has entered the age of its mechanical reproducibility, it is present. (2015a, p.198, italics in original)

In Benjamin’s ([1936] 2007) case, resonance is also found at the shift in aura against trace ([1927-1940] 2002, p.447); specifically, the annunciation of the medium’s trace and supporting substrate facilitates a break in the ‘inapproachability’ of an artwork set in tradition and helps position and read media historically (or media archeologically), collectively and thus politically. To merge terminology inspired by Benjamin ([1936] 2007; [1927-1940] 2002; Buck-Morss 1989) and Siegert (2015a), the trace is the attribute of a medium that reveals the parasite as a channel to us. The trace as a not-yet-representation or symbol “is appearance of a nearness” (Benjamin [1927-1940] 2002, p.447) that makes the codification of representation and reproduction more explicit, interrupting the sacred or the auratic. ‘Seeing’ the present is done via the appearance of an object-medium as trace ‘but also’ the trace of the object as cultural technique in recursive pictorial representation as a ‘visioning’ of the absent. The trace of a medium becomes the in-between or a go-between of absence and presence in representation and thus itself a cultural technique, one that instills difference and distinction in the making of meaning. Here the trace of a medium can be symbolic in material formation, filling the spatial distance and temporal gaps of a communication system, as it becomes open to self-referential observation and conceptualisation. Notably, such a notion of absence and presence, if not as conveniently ‘hinged’ together as the Mérode Triptych, reiterates and can turn to Latour’s ‘action at a distance’ via immutable mobiles (1987, pp.215-57) for support. All this can be witnessed via the material surfaces of inscriptive media in the processes of
communication before, or while, acknowledging post-structuralism and Derrida ([1967] 1997), such is the elegance of cultural techniques.

The discussion of presence-absence as informed by the trace can be extended to meet cultural techniques via considering absence as an awareness of exclusion in systems of mediated exchange. Siegert (2013) elaborates on an all-inclusive observation of the materiality surrounding basal cultural techniques that opens up the potential for the trace to also become basal—a recursive meditating third in and of itself. Siegert suggests:

By assuming the position of the third, an interface between the real and the symbolic, basal cultural techniques always already imply an unmarked space. By necessarily including the unmarked space that is excluded by the processed distinctions, cultural techniques always contain the possibility of liquidating the latter. In other words, cultural techniques always have to take account of what they exclude. For instance, upon closer scrutiny it becomes apparent that musical notational systems operate against a background of what elides representation and symbolization – the sounds and noise of the real. (2013, p.62)

To say that the trace is the potentially excluded “unmarked space,” as Siegert suggests above, would be reasonably incorrect. A concrete trace ‘is’ a mark and can be the result of inscription, but Siegert, by identifying sounds and noise, is again referring to an awareness of the material ‘ground’ of a cultural technique. The clear-cut example of musical notation implies a distance between a materiality and the notation process that organises or codes it as technique. Sound and noise are not actually present in modes
of notation; unless we move focus to the qualities of the notation surface, it is absent. The trace, it is suggested from this example, does not impart full symbolic influence until there is a process of reproduction more akin to that of Kittler ([1986] 1999, p.33) and Ernst’s (2011, p.250) gramophone inspired trace, which merges symbolic operation with the mechanical trace of an unmarked space. However, when the trace is negotiated or witnessed via practice, as an actor in operation, the trace belongs to neither side of the presence/absence or material/symbolic distinction exclusively, becoming an ‘analogue-trace,’ echoing Derridean considerations of a trace that “does not let itself be summed up in the simplicity of a present” ([1967] 1997, p.66), and can meet definitions of basal cultural techniques. When being interviewed about his task of translating Siegert’s Cultural Techniques (2015a), Winthrop-Young reminds us that:

> while culture-technical operations create culture and order (and sometimes disorder) by introducing distinctions which allow us to distinguish message from noise, order from chaos, culture from nature, these operations themselves belong to neither side. (2014, para.8)

An example to accommodate the trace as a kind of medium in operation that belongs to neither side of the presence/absence distinction is to think of the trace as both that which is a technique involving analysis of what is left behind ‘and’ a planned action, as in an intentional or emulated process-based tracing. Of course, a basic concrete trace already holds the potential for distinction between absence and presence, while being fully neither, but considering it as an intentional practice exacerbates differentiation. Such a trace is perhaps a flipped forensic trace, or thought of as involuntary trace working with the voluntary. This is a dual action trace that works across broken/hidden
symbolic work and as immutable mobile—dual and dialectic. A trace can be a technique of projection as much as it can be a process of capturing or recording, ultimately due to a layering of representational stages or steps. Siegert identifies the trace as an integral process in the practice of design and projection, planning, experimentation and discovery in drawing techniques (2015a, pp.125, 142). Notably, Siegert highlights the Renaissance spolvero technique that uses small pin pricks in a drawing to transfer the lines from the cartoon to the painting, relative to the medial ‘reproduction’ potential it offers, as a generative design stage behind artwork execution. He says:

> Because it is used for the purposes of reproducibility, it can transform into a trace of the original—an individual and creative originality that manifests itself in the unfinished, that which is still open for future alteration. … Techniques of scaling, transferring, and impressing give birth to the idea. (2015a, p.142, italics in original)

Equally viable are techniques of directly tracing the physical world through representation and abstraction as reproduction. A basis of reality can be set in the ‘meaning making’ of inscriptive intervention/invention as iterative “ornamental and grotesque figurations” (2015a, p.128) as the “unconcealing of a specific substantiality, a specific materiality” (2015a, p.124). Siegert uses Leonardo da Vinci’s famous process journal, the *Codex Leicester* (1510) and other key process figures (2015a, pp.125-128) as examples of design techniques defined by the drawing practice of an “artist-engineer” (2015a, p.124). According to Siegert, Leonardo studied the behaviour of water through repetitive sketches in differing scenarios, such as how it moves around different shaped objects, essentially mapping water with drawn line, a process
that immediately abstracts water in representation as water is not a collection of lines. In the process Leonardo discovered valuable information about water’s potential as a physical entity and an “inventive entity” (Siegert 2015a, p.128) relative to its generative symbolic work set on the trace as transference, allowing him to identify:

boundary planes shaped by the interaction between moving elements. In other words, these boundaries are traces of forming or deforming geological and climatic processes. A plane surface is for Leonardo the trace of a levelling, a convex surface the trace of a filling, and a concave surface the trace of a hollowing by water currents and shapes. (2015a, p.125)

A comparative realisation is made when drawing technique and the techniques of hydrology (2015a, p.125) are merged and the transference of the ornamental qualities of water joins that of the picture plane and becomes generative ground. In Leonardo’s case this leads to a mediated observation of “design as something that takes place within the experimental system (rather than out there in nature)” (2015a, p.126) that allows for further transference/tracing as a drawn mediation of discovery or connection. For example, according to Siegert, Leonardo also discovers a unique way to draw hair in making ‘drawn’ comparisons between the movement of water and the line of hair, unfolding an understanding and additional technique derived from the two subjects connected by the picture plane of drawing in operation (2015a, p.124). Wider cultural implications of such a trace are produced in infrastructure planning and negotiations as a generative design stage in civil works. For example, Sydney CBD light rail upgrade plans (2014) allowed onlookers to witness an array of layered markings (Fig.7.11). Essentially, these markings are a coded system representing
different underground services, a trace that ‘draws’ together existing infrastructure, plan documents and landmark references (or trig points) to avoid damage to existing work and consequential litigation between contracted companies. This is now a standardised code and, when in action, brings together both a trace of the present (existing structures) and absent (projected structures)—a crossing of dual systems to become dialectic in both a commercial and a mark-making sense.

![Markings on the street in the Sydney CBD](https://via.placeholder.com/150)

**Figure 7.11** *Markings on the street in the Sydney CBD*, web image by Ben Collins for *Business Insider* (2014), featuring the trace of underground infrastructure systems.

Ultimately, Siegert’s identification of “transfer operations” (2015a, p.124) is core to the cultural technique of an intentional or voluntary processual trace, while being relevant to notions of residual concrete trace. However, when we move the trace into the context of digital reproduction, as a technique of representational transference, we witness a shift in trace’s concrete basis’ or ground: the trace becomes the ‘analogue-trace’ most properly. If we extend a gramophone example to the realm of digital
reproduction, a problematic middle ground is formed, where an unmarked space becomes the trace of an absent medium. In a medium becoming the content for another medium the ground of the former is abandoned. The emulation or sampling of vinyl crackle as trace in digital audio production and consumption, for example, is no longer the trace of a medium atop an unmarked acoustic space. Instead, the trace of the medium, in terms of cultural techniques involving the digital reproduction of sound, now works atop an unmarked space of A/D and D/A conversion: the electroacoustics of the real. Sybille Krämer (2006, p.106) extracts the key cultural techniques explored in Kittler’s *Gramophone, Film, Typewriter* ([1986] 1999), these being ‘time axis manipulations’, and suggests that: “with digital technology everything that can be switched is essentially invisible to the human senses, nothing that is significant can even be perceived.” This statement seems to exclude the paths of inscriptive circulating reference (Latour 1999), or the symbolic work relationship, that can emerge from or with time-critical, discrete unit, or digital ‘switching’ of signals.

In an always already analogue-digital space-time, the act and mark of inscription are neither present or absent; they are a complicated ‘analogue-trace,’ a connection between broken/hidden symbolic work and immutable mobile. Inscription is broken in the disconnection from a material ground but becomes immutable mobile in the ‘action at a distance’ performed at pre-medium sites of symbolic work. In this abstraction, the trace connects the symbolic to the material. But the self-referential play of the medium as a mode to observe the solidification of the symbolic, from the host channel under analysis, is distanced or absorbed and becomes absent. Thus, it is suggested, transfer operations, including Latour’s (1986, pp.7-13; 1999) immutable
mobiles across circulating reference, are in a perpetual state of negotiation, a transversal mode of conversion and feedback between the mutable and immutable symbolic work of digital network culture.

Siegert (2015a) has also highlighted processes of representation in a ‘digital space’ as problematic. One notion that defines the digitisation of the real, for Siegert, from a base technique is representations of ‘nothing’ (2015a, p.27). For example, a ‘0’ (zero) represents an empty space or the “absence of a digit” and we can “write the absence” of something, “thereby turning real gaps into a set of discrete, countable elements. The real is digitized” (2015a, p.27). The gaps of materiality as rendered absent in digital symbolic work are in themselves a trace of nothing, suggesting an ongoing process between the codification of presence and absence. This process, as a recursive operation, moves from the ‘on’ and ‘off’ symbolic work of formal signal processing, through to the reproduction and consequential remediation of medium qualities as emulation or samples in wider cultural output—the cultural technique of analogue-trace in the presence/absence of digital re/production. Here there is a shift in representation, notably a crux thread, in Siegert’s (2003) Passage des Digitalen (Digital Passage). Kromhout (2014, para.8) highlights Siegert’s “identification of a rupture, rift, crack or break … in the classical representational order of writing.” Essentially, this rift is an awareness of techniques of inscription that complicate representation, notably processes outside the text, that have formed a historical “digital logic” where “the digital has always been part of the analog and vice versa” (Kromhout

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30 Passage des Digitalen (Siegert 2003) is yet to be translated to English from German. However, the text has been considerably exposed to an English-speaking audience via interested bilingual academics at the Digital Passage blog: https://digitalpassage.wordpress.com/.
Notably, Kromhout says: “The digital blinks. It ends as soon as it starts. It is present in its absence” (2014, para.9). With no doubt, the echo of the trace, as something concrete and with post-structuralist connotations, can be housed here. From his observations of sign practices, Siegert notes:

the digital and the analog are not episodes in a history of media, but, instead, the technical media are an episode of the digital and the analog, of the era of graphē [of inscription]. (trans. Kromhout 2014, para.5, italics in original)

Siegert is pointing toward a state of digital media not as an historical chapter, but as a shift in sign practices relative to techniques of inscription. Of interest is mediation that departs from the concrete in detaching symbolic work from physical actors. By representing absent things there is consequential risk or fallout, but there are also potentialities in ideological and imaginary readings of media (2015a, p.205).

If digital media are defined by broad inscriptive lineages, including what we may consider practices of both analogue and digital mediation against the codification of absence/presence, how do they manifest in the computational and network (or cybernetic) cultures of the 21st century? Cultural techniques would argue that we must keep to identifying recursive sign practices across time to better expose the culturally concrete. As an example, Siegert (2015a, pp.202-205) follows the meaning-making of the door to its supposed final stable terminal. The definitions of open and closed as defined by the operation of doors, as cultural technique, recur in a digitally informed cybernetic space, but become unstable in three key ways across Siegert’s identifications. All three are select examples of ‘conversion’ operations that coalesce
to point toward the value of the trace as a means to observe or perceive states of communication as analogue-trace in action.

7.5 Cultural Techniques in a Digital Space: Three Alliances with Analogue-Trace.

Figure 7.12 Screen grab of Ableton Live’s Vinyl Distortion emulation (2016).
Figure 7.13 *How the CNN [(Convolutional Neural Network)] ‘sees’ an unpaved road*, by NVIDIA Corporation (2016), featuring automated symbolic work as an internal image exchange between car, camera, generated road feature maps and artificial intelligence pattern recognition.

Figure 7.14 *Outline of the DeepFace architecture*, by Facebook AI Research (2014), showing the automated and hidden symbolic work of the artificial intelligence.
Firstly, as already mentioned in regard to Siegert’s use of the door as cultural technique, there is a concern with the recursive representation of nothing or gaps as in the trace of an absent analogue ground or an ‘unmarked space’ in A/D conversion for the absent to be dealt with in the present. The cultural output implicated in this concern may include the in-general emulation of physical operations in software graphical user interfaces (GUIs), but of more relevance is the specific digital emulation of the trace in re/production. For example, Ableton Live’s Vinyl Distortion emulation plug-in (Fig.7.12) allows users to ‘manufacture’ a phonographic trace in a digital audio production environment, essentially removing direct contact with the original device, not reproducing a material acoustic space but a computational electroacoustic one: an ‘analogue-trace’ in the material and symbolic play between the absence and presence of an analogue referent.
Secondly, symbolic work is hidden by, or in the automation of media in operation, including image exchange and signal conversion. For example, the manufacture and exchange of pictorial data in artificial intelligence processes of driverless cars, like that of NVIDIA Corporation’s Convolutional Neural Network’s (Fig.7.13) ability to map and learn road features via pattern recognition, internalises and systematises symbolic work, as an automated exchange of images, unless written out for testing and review. Another example is Facebook’s DeepFace face recognition AI (Fig.7.14), which performs hidden symbolic work in the automated exchange of face images, but also the inaccessible perception of speed at which image exchange occurs. Cultural techniques must acknowledge inscriptive processes that ‘write’ themselves. In the digital space, Siegert (2015a, p.201) argues for a departure from Georg Simmel’s (German sociologist and philosopher: 1858-1918) concept of the door, as a symbol-object that “speaks” ([1909] 1994, p.7) through forms of human agency defined by a “symbolic sense” of separation and connection ([1909] 1994, p.6) or “uniformly in human achievement as human achievement” ([1909] 1994, p.8, italics in original), to further consider the material-symbolic work of the ‘automatic’ door. Jon Cockburn ([2005] 2015, p.10) has examined Simmel’s ([1909] 1994) address to the differences between the bridge and the door, particularly Simmel’s assertion that “it makes no difference in meaning in which direction one crosses a bridge, whereas the door displays a complete difference of intention between entering and exiting” ([1909] 1994, p.8). In particular, Cockburn notes Simmel’s ([1909] 1994) failure to address that unique form of architectural portal that harnesses the properties of both a bridge and a door, the revolving door and its qualities of movement when he states that:
It is neither a door nor a bridge, yet it operates as both. In its action as a revolving door it momentarily captures interior and exterior space and connects the two, only in the next instance to cut each space off from the other. (Cockburn [2005] 2015, p.10)

Cockburn’s explanation of the revolving door’s operation permits the unique threshold to be thought of as a mechanical two-way converter between interior and exterior spaces. The physical intervention of the door on both the user’s walking path and internal-external building spaces cuts off a direct path between spaces, recursively halting, and thus quantising, the user, and effectively creates a spatial feedback loop.

Continuing his description of the revolving door, Cockburn notes that:

As a function of its mechanics, the revolving door moves to open onto the street, then becomes enclosed before opening again into the interior of the building, is again enclosed before opening once more onto the street, and so on, in a process of perpetual recurrence. The private space of travel occupied by those who pass through the door is as temporary as it is illusory… this space is one that builds expectation before the unfolding vision of the direction in which the person is moving, regardless of whether that movement is toward the interior, the exterior or the space between. ([2005] 2015, p.10)

Similar to Cockburn’s ([2005] 2015, p.10) description of the revolving door, but pushing its automatic qualities toward a more terminal reading, Siegert (2015a) argues that the revolving door is essentially always closed. The door is an actor in defining automation processes; its operation as cultural technique is altered, closed off to human actors, aligning with the codification of environment and crowd control rather than
with the symbolic reinforcement of thresholds and the distinctions of opened and closed (2015a, p.201). Going beyond simple mechanics to consider the automatic door, the circumstance is one in which human actors are removed from a direct causal process and physical relationship to the structuring of events. This is the “disappearance of the door from human life: the absence of the door handle” (2015a, p.202) and the introduction of “an invisible power [that] rules over their opening and closing” (2015a, p.203). When extending door-based operations to practices of cybernetic electronic switching, digital signal processing, Siegert (2015a, p.205) identifies a process that is never still or stable, but rather in a constant feedback loop. Siegert now says of the door that it “corresponds to the cybernetic feedback loops of pairs of electronic doors, or flip-flops, in which one door triggers the opening of another by its closing, and vice versa” (2015a, p.205). Essentially the door as cultural technique has become inaccessible and destabilised, but more importantly indicates change as informed by a thing or the symbolic processes identifiable in the interruption of symbolic work by said thing. In other words, a cultural technique can jump ship from its host material network of operations to be found in the recursive operations of a new host actor or actor-network. The door as an unstable thing is a “constantly growing and changing network of operations and practices” (Siegert 2015b). Consequently, the meaning-making or knowledge production of a door’s operations changes as an actor of its own accord, as Siegert points out:

Modern doors have irretrievably forfeited their nomological for a cybernetic function. The basic distinction between inside and outside has been replaced by the distinction between current/no current, on/off. (2015a, p.203)
The next step is to extend this analysis of the door further, and connect it with the analogue-trace of door, no longer as object, but as function. Operations in the process of being converted, at the point of perceptual human inscription, to differing mechanical, electronic, cybernetic or digital processes provide a space for symbolic work that accommodates a kind of trace as a cultural technique: “[F]olded, wired, and coupled into each other as feedback loops, doors as cultural techniques have lost their moorings” (Siegert 2015a, p.205). Trace and analogue-trace become a process or fallout of conversion, signal processing, and algorithmic practices, between absence/presence and internal/external and a significant focus for further investigation in a realm of technical media. Siegert suggests: “the image is no longer a question of iconography, but a question of the distinction between signal and noise” (2015b). The trace of technical media offers analytical potential when focused on the distinctions of signal and noise across the exponential universality and “exchangeability of channel and source that is typical for the information-theoretical model of communication” (2015a, p.31).

Thirdly, and as a consequence of the first and second points, cultural techniques in a digital space, couched in transversal digital network culture, are according to Siegert (2015a, p.32) a shift to symbolic work set in a materiality of signal processing, derived from the Shannon-Weaver (1948; 1963) model of communication in combination with Serres’ ([1980] 2007) parasite concept. In this scenario, Siegert’s (2015a, p.32; 2015b) identification of ‘filtering’ signal from noise, as an operation, becomes a cultural technique that positions the ground of signs at a site of intervention, the parasite and Maxwell’s demon, between matter and technical media or the “technical real.”
Consequently, for example, “as signals, words come before their meaning” (2015a, p.31). And, to extend the example, it is the trace or analogue-trace of words, as absent and present fragments between signal and noise, that emerges as a generative and perhaps equally degenerative layer of filtration between signal-signs and noise. To pinpoint Parikka’s (2011a, p.259) terminology, this is a space between the formal qualities of communication theories (Shannon 1948), ‘noise’ as “nonsignifying” or “a-signification,” and Siegert’s (2015a) ‘sign.’ It is also here that perhaps Siegert (2015a) meets the media ‘recording’ or reproduction thread of Ernst’s media ‘archaeography,’ where, on a base level, “the recording device itself becomes a media archaeologist of the signal processing of culture” positioned before “the human ear [that] always already couples the physiological sensual data with cognitive cultural knowledge, thus filtering the listening act” (Ernst 2011, p.244). Ultimately, there is a charge to make ‘invisible mediation visible with media,’ as a cultural technique of filtering, at play.

Trevor Paglen’s Autonomy Cube (Fig.7.15) materialises this idea by bringing a Tor network node and WiFi access to gallery users. The work offers a view of the complex electronic modules that make up an access point and offers an open WiFi hotspot, but routs users’ connections through the Tor network, effectually connecting them to a global array of Tor relays, becoming anonymous and un-trackable in the process. This is a hidden set of operations made public, a process of revealing in the filtering of technical operations and materials. Any practice of improving the comprehension of large data sets and complex operations can be included within such motifs. Information design and data visualisation are examples, harking back to Latour’s (1986; 2009) call to draw things together, to reclaim materiality via ‘matters of concern’ (Latour 2004)
in unfolding envelopes of complex actor network operations (Latour 2009). In terms of cultural techniques, the call is a process of reclaiming the materiality of media. In facing cybernetic mediation, Siegert suggests:

If exclusion and inclusion, parasite and host, are no more than states of an oscillating system or a cybernetic feedback loop, then it becomes necessary once more to inquire into those cultural techniques that, as media, process distinctions. (2015a, p.32)

There is a challenge thrown down by Siegert here, a purpose for research and the forming of questions, at a base material-symbolic level of meaning and knowledge production. The charge can be considered a call for medium-specific literacies and reflexivity in ‘opening up’ media operations that have become closed off to human actors, with potential to inform wider cultural actor-network observations. The notion of ‘filtering’ requires a filter. Trace and analogue-trace are proposed as potential filters, enabling a reification via methods such as reverse blackboxing (Latour 1999, p.184).

In summary, three key points from Siegert (2015a) that point toward the usefulness of analogue-trace in transversal network culture media inquiry are: the representation of nothing as a founding technique of the digital; the automation and consequential closing-off of symbolic work as it pertains to network culture; and the operation of filtering signal-signs from noise. All three notions point toward analogue-trace as a type of ‘pre-mediatic’ tool (Winthrop-Young 2015, p.460) and cultural technique (Siegert 2013, p.61) that is of value in processing distinctions, meaning and culture.
7.6 Chapter Conclusion: Making the Invisible Visible

Making the invisible operations of media visible or the symbolically hidden or broken immutable against the increasingly automated, autonomous, or that which is perceivably beyond reach, is an important meeting point and challenge for media-archaeology and cultural techniques. Primarily, this chapter has discussed that such motives are aligned at the epistemological potential of medium-specific and medium-symbolic approaches to media found in Ernst (2011; 2013) and Siegert (2015a) as approached via the trace. For this thesis such a methodological charge to make the invisible visible is reinforced by a foundation provided by Benjamin. Benjamin ([1927-1940] 2002) championed the potential of technology for “proletarian revolution” (in Buck-Morss 1989, p.64) and promoted media literacies and technology-informed critical reflexivity via ‘Anschauungsunterricht’ as a media-oriented pedagogy (Jennings 2008a, pp.12-13). However, concrete trace as central to Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) dialectical image, has witnessed a change in cultural techniques and lost some grounding. As Trevor Paglen says of the early 21st century state of images:

We no longer look at images–images look at us. They no longer simply represent things, but actively intervene in everyday life. We must begin to understand these changes if we are to challenge the exceptional forms of power flowing through the invisible visual culture that we find ourselves enmeshed within. (Paglen 2016)

As a movement, New Aesthetics predates and shares concerns with Paglen, as the quotation above indicates. The basis of new aesthetics is an exposé of interventions on human perception by the vision, the images collected and exchanged, of digital
networked devices. In 2011, James Bridle began his ongoing Tumblr Blog archive of captured ‘machinic vision’ images entitled *The New Aesthetic*. Bridle coined the concept, stating that new aesthetics is “not a movement, it is not a thing which can be done. It is a series of artefacts of the heterogeneous network, which recognises differences, the gaps in our overlapping but distant realities” (Bridle 2011). The situation of ‘ignorance as bliss’ arrived at in network culture via a blackboxing (Latour 1987; 1999, p.304; 2005) of network technology and its control, and the symbolic work of media operations and signal processing being closed off to us due to feedback loops in automation (Siegert 2015a), can culminate in what Gansing describes as the transversal generic of media archaeology (2011; 2013, p.265). Bridle’s new aesthetics looks to rupture media invisibility for “a non-technical audience” (Bridle 2013, para.5). The new aesthetics is archival creative practice associated with complex systems of technology, the educational purpose of technology, and activist tendencies that motivate a general desire to make invisible agendas and operations visible. Bridle acknowledges the ‘politically’ definite interest in the critique of systems that is behind new aesthetic images and their ability to educate users as to the operations of particular technologies:

Each image is a link, hardcoded or imaginative, to other aspects of a far greater system, just as every web page and every essay, and every line of text written or quoted therein, is a link to other words, thoughts and ideas. Again, in this the New Aesthetic reproduces the structure and disposition of the network itself, as a form of critique. (2013, para.5)
Bridle’s 2013 manifesto and practice constitute a brand of network culture media archaeology engaged in reading the network with the network. The shift, regarding images, in transversal network culture is centred on filtering signals from noise rather than semiotic image exchange. But images have not disappeared; just their re-production and exchange have shifted as have their mediality and basal cultural techniques. In the context of networked automation, although not centred on iconography, techniques of ‘filtering’ images from networked signal-noise is possible when the trace of broken or invisible symbolic work is traced to become immutable again. Such images are the analogue-trace of signals and noise, performing immutable symbolic work in networks of broken or hidden symbolic work and can be found from ‘under the hood’ of A/D and D/A converter integrated circuits.
8. ANALOGUE-TO-DIGITAL CONVERTER: DIGITAL-TO-ANALOGUE CONVERTER

Figure 8.1 Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*, visualising the overarching thesis path and current chapter position to the reader. This chapter is set at the final node ‘Analogue-trace: A/D Converter’ where a media archaeology of A/D converter architectures is performed that witnesses the trace as a set of cultural techniques of analogue signal pre-processing, feedback, integration and distortion.
Figure 8.2 Method and Apparatus for Controlling Electric Currents, patent diagram featuring the first ‘solid-state’ transistor design by Julius Edgar Lilienfeld (1926).
Because with digital technology everything that can be switched is essentially invisible to the human senses, nothing that is significant can even be perceived. (Krämer 2006, p.106)

The sonicistic approach is not restricted to audible sound; electronic images are techno-mathematically analysed and digitized for compressed transmission in the same way. (Ernst, 2016, p.30)

This chapter describes and explains devices known as analogue-digital converter (A/DC) integrated circuits. Discussion of these devices represents an applied stage in the investigation of analogue-trace as much as an exploration of the symbolic work performed by A/DCs concerning signal processing. The site of the proposed examination is ‘under the hood’ of A/DCs. However, explanation is not conducted by opening devices and dealing with their inner mechanics directly. Furthermore, the devices, in examination, are not hooked up to be bench tested as some exposé of electrical engineering test results and oscilloscope measurements. The media archaeology to be conducted is ‘of the trace,’ utilising the theory, diagrams, architectures and formulae of conversion contained within and provided by the design, invention and operations of the device. In this sense, we are still reading via an opening of the black box but the actor-network of the trace, in breaking down the physical and metaphoric casing of the device, is the main focus and a medium-specific media-archaeology informs further discussion where appropriate.
8.1 Under the Hood: Toward Some Cultural Techniques of Analogue-Trace via A/D-D/A Converter Signal Processing

A/D and D/A converters, as specific technical media, manufacture distinctions in symbolic work via the three main alliances made between Siegert’s (2015a) contemplation of cultural techniques, working in a digital realm and analogue-trace. The three alliances identified in the previous chapter were: operations of quantisation; the representation of nothing; and automation and filtering. Considered on an operational level relative to doors, A/D converter devices are in a perpetual state of conversion as recursive acts or operations of conversion between absence/presence, opened/closed, inside/outside, actual/virtual and between technical readings of analogue/digital. When focusing on converters as a specific medium, the issue is not so much that “doors have lost their moorings” (Siegert 2015a, p.203), for complex devices are relatively concrete in terms of their immediate operation, but that, as Ernst (2011; 2013) warns, the door panels of modern conversion between the analogue and digital realms open and close so fast as to provide near latency-free microtemporal signal processing. This pace is due to arrays of comparators acting as a threshold between electrical voltage and digital signal in A/DCs. From this perspective, the codification of representation is essentially informed by operations of signal conversion, and filtering as voltages are exchanged for bits and bytes. As will be explored, the process of conversion is not neat and tidy. There are multiple methods of conversion; both sides interfere with each other involving automated error correction, gaps or redundancy and systematic dependencies. There is a messy ‘transversal’ site between the analogue and the digital, but it is also a continual conversion of perspective from the inside or outside of the medium. Ernst’s evaluation is a reminder that technical media associated with signal processing at a microtemporal level, and
especially an ‘online’ level, becomes a “closed circuit” (2013, p.100). For Ernst, archival systems are separated and defined by their temporality, by a digital computational space that is defined by the melding of transmission and storage processes piloted by decreasing cycle, access, latency and transfer times (2013, p.97). Due to the operations of computer media and network culture, representational artefacts and their archives, user-based and institutional, on the digital side of conversion move to a mutable mathematical and ‘measured’ digital space. This is a cultural space as informed by medium, where we have:

a feedback loop between an analogue past and a digital present … by digitizing analogue source material in the archives and bringing it into a technomathematicized present… The microtemporality in the operativity of data processing (synchronisation) replaces the traditional macro time of the ‘historical’ archive (governed by the semantics of historical discourse)—a literal ‘quantization.’ Our relation not only to the past but to the present thus becomes truly ‘archival.’ (Ernst 2011, p.251)

In this sense, Ernst offers a techno-cultural state for A/D conversion that suggests a melding of co-dependent systems set on quantifiable ‘filtering efficiency’ that is informed by the melding of data transmission and storage. The analogue side of conversion, while informing digital operations and representational interfaces, stands stubbornly immutable unless converted. The trace as a mechanism or method of enquiry across A/D and D/A conversion allows for access to the pre-mediatic and the post, always already, specific technical processes or operations of filtering. Thus, A/D and D/A converters as defined by the temporal and spatial gaps of the symbolic work
they find, can be doors or transversals between supposedly separate archives, analogue/digital, online/offline and material/symbolic.

Two steps should be taken to continue a medium-specific approach to inscriptive media conversion. This first is a discussion of the distinctions of analogue and digital from a technical signal processing perspective, as defined by the technical operations of conversion devices. This approach is inherently interdisciplinary and allows for analysis via the methodologies of media archaeology and cultural techniques, including reference drawn from the operation of specific devices and supporting texts from fields such as information science and theory, electrical engineering, device manufacture, data sheets and patents. Secondly, the medium-specific operations of conversion must be written back into transversal network culture ‘in practice’ via a media archaeology and cultural techniques informed reading of the trace. The first will be dealt with here. The second has already been considered via the constellations of transversal practice examples described earlier in this document and will be discussed in the closing of the present thesis (Chapter 9).
8.2 A/DC-D/AC: Feedback, Analogue Affordance and Distortion

![Diagram of SAR vs Pipeline vs ΔΣ A/D Converters Sampling Algorithms Comparison](image)

Figure 8.3 SAR vs Pipeline vs ΔΣ A/D Converters Sampling Algorithms Comparison (Successive Approximation Register vs Pipeline vs Delta-Sigma), diagram by Texas Instruments in *A Glossary of Analog-to-Digital Specifications and Performance Characteristics* (2011).

The A/D converter is a fundamental on which the transmission of cultural re/production and communication depend, and analysis of signal is a necessary point of entry. An electronic signal is communication or re/production in a transient state, the movement of communication over time within a system, apparatus or medium, between point A, a source, and point B, a form of reception. From a technical engineering perspective, the steps between these two points entail:

- The generation of a thought pattern or image in the mind of an originator.
• The description of that thought pattern or image, with a certain measure of precision, by a set of aural or visual symbols.

• The encoding of these symbols in a form that is suitable for transmission over a physical medium (channel) of interest.

• The transmission of the encoded symbols to the desired destination.

• The decoding and reproduction of the initial symbols.

• The re-creation of the original thought pattern or image — with a definable degradation in quality — in the mind of a recipient, with the degradation being caused by imperfections in the system. (Haykin 1989, p.2)

This process outlines a basic human-to-human system. Forms of technology that generate and receive signals, without human intervention, can replace the mind of an originator or recipient. This scenario does not draw a distinction between transmission and storage, as both could be integrated. The rudimentary A to B transmission, when applied to a system containing analogue and digital signal integration, immediately highlights an openness to interference, disruption or intervention, via a housing for conversion in ‘coding’ and ‘decoding’, that promotes the parasitic qualities of or on signal ‘degradation.’ It is the comparative differences, treatment and use of the signal within analogue and digital systems of transmission that will help us find trace pointers that cross the coding and decoding of signals.

Technically, a signal can be broken down by the relationship of its variants and time. “A signal is defined as a single-valued function of time that conveys information. Consequently, for every instant of time there is a unique value of the function” (Haykin 1989, p.2). Within an analogue system a signal has a direct relationship with time, for
example continuous amplitude waves (green lines in Fig.8.3). For any instant of time there is a fixed or specific value, technically understood as “an amplitude (i.e., value of the signal at some fixed time) that varies continuously for all time; that is, both amplitude and time are continuous over their respective intervals” (Haykin 1989, p.4, italics in original). On the other hand, within a digital system the process is quantised:

Signals are described as sequences of samples that may take on a continuum of values. When each sample of a discrete-time signal is quantised (i.e., it is only allowed to take on a finite set of discrete values) and then coded, the resulting signal is referred to as a digital signal. (Haykin 1989, p.5, italics in original)

In other words, an analogue signal is a continuous whole sample taken from a source while a digital signal is a group of smaller discrete samples as a form of converted ‘measurement’, as in the sample divisions of amplitude waves (Fig.8.3). An analogy can be obtained by replacing ‘the stuff’ of signals with sand, with the goal of relocating a pile of sand in a set period of time. An analogue system would scoop up the whole pile and move it, losing only what physically falls through its scoop. A digital system would take many smaller scoops over a set period of time. The digital system ideally would not physically lose any sand in the process, but it would not have moved as much sand, resulting in a smaller pile of relocated sand. Using this analogy in place of a technical understanding, we can see that both systems have unique forms of signal degradation across a channel. For analogue systems, loss is found in the limits of the overall physical system. In digital systems the limits of the overall physical system ‘and’ the size, amount and successful transfer of samples come into play. What is notably exemplified via this description is the integration of ‘gaps,’ between samples,
as supported by a signal system that forms a basis for digital representation similar to that defined by Siegert (2015a, p.27).

A digital signal is capable of being translated and manipulated in terms of representation. The digital signal sits one step further from the original source, through coded translation and the preparation for signal conversion, than an analogue reproduction. Digital signal processing is a mix of redundancy and finite reproduction. A physical source is measured and finitely rounded up or down to reduce error and make manageable data transmission. As an example, the result of digitisation on one hand, relative to content immutability, is further compression for speed and storage over the Internet, in formats such as MP3 for sound and jpeg for visuals. On the other hand, we have advances in high definition digital reproduction and storage, such as 4K Blue-ray, where sample rates and bit depths are increased with the aim of closely reproducing the source. Both ends of the digital spectrum rely on standards of acceptable resolution and redundancy that sit alongside the efficiency and latency of system performance.

Both analogue and digital systems of reproduction, in terms of the quality of the reproduction, are reliant on the quality and integration of the hardware reproduction system and its components. However, digital reproduction’s threshold is its depth and breadth as a system of protocols and translations, while analogue reproduction functions on the limits of potentially infinite molecular-based systems. Consequently, there is a comparative difference in signal treatment between the two signal systems even if difference, in output, cannot be perceived or is hidden. Almost immediately,
the consequence of conversion and the gap between systems begin parasitic symbolic work, as an extension of representing nothing as zero or ‘off states.’ Manovich (2001a p.52), for example, splits the digital into three categories: A/D conversion as digitisation, followed by “common representational code, and numerical representation,” positioning the latter as most relevant to revolutionary media change and a pointer for the dominance of ‘software’ in media enquiry and technology cultures. Manovich (2001a p.132-33) describes output conversion as a movement from “material object to a signal” to incorporate digital computation only at the end of a three-stage process: “material object to electronic signal to computer media” Here Manovich is implying that the movement from source to electronic signal is as mutable as digital output because it offers near equal signal modification potential. Furthermore, this overview points to a taxonomy of new media derived from the base level of quantisation in A/D conversion that, for example, includes “modularity” as a feature (Manovich 2001a, p.30): “Media elements, be they images, sounds, shapes, or behaviours, are represented as collections of discrete samples (pixels, polygons voxels, characters, scripts)” that form larger cultural assemblages and processes. The comparative difference between Manovich’s description and an approach to conversion as informed by media archaeology and cultural techniques as undertaken in the current project is the potential for the ‘gaps’ in samples and wider cultural channels of modulation to become gateways to the unmarked space of the material symbolic work of transversal network culture, to filter the presence and absence of noise and signals.
At its most rudimentary level, A/D conversion involves multiple stages of signal manipulation, dependent on the qualities of the original signal source and the required digital output. An in-general explanation of the operation is an analogue source being modulated to a base logic and representation, or the reverse for D/A conversion. This operation does not have to be held within a small IC chip. There is a long history of these kinds of operations, and an archaeology of conversion in non-electrical and non-semiconductor formats could be included here. For example, Analog Devices Inc (2005, pp.1.1-1.3) highlights a complex 18th Century Ottoman Empire ‘hydraulic’ converter for the regulation of public water supply. Today we would recognise this as an 8-bit D/A convertor. The system incorporates a complex array of weighted nozzles, header tanks and spillways to effectively digitise an automated distribution of water. This is a material example that shares much with the programmatic qualities of the Jacquard loom, in 1801, which codified textile production via punch card pattern storage and mechanical transmission/transfer. To push the example further back in time, smoke or drum signals could be considered a site of A/D conversion, like the complex communication of the African talking drum as highlighted by James Gleick (2011). Without a basis of alphabetic writing as codex, users of the drum converted speech to drum intonation and beat spacing. Again, we are reminded of wider and deeper networks of digital communication ‘not’ determined by electronic computation but by the inscription of time and space. However, the starting point here is most specifically concerned with ‘solid-state’ technology (the use of integrated solid materials to manage electron flow) of the post vacuum-tube variety, dominated by semiconductor (transistor) electric current control. Why? Because the transistor is a
stage or format of circuit ‘integration,’ in terms of decreasing physical size and efficiency, from the recent past of contemporary devices.

Figure 8.4 Op Amp 709, integrated circuit packaging/pin function and suggested circuit schematic diagrams by EZ Parr (1982).

Figure 8.5 Figures 7 and 8 circuit schematics from JL Baie’s 1966 Coupling Transistor Logic and Other Circuits Patent.
A complex array of 18th, 19th and early 20th century technologies led to the development of the transistor and its integration into electronic circuits. Media architectures, such as telegraph and telephone pulse code modulation (PCM), ‘war machine’ electron tube switching technologies and early commercial A/DC tube-based circuit development (Analog Devices Inc 2005, pp.1.4-1.13), would provide fitting media archaeologies for A/D conversion and are acknowledged but fall outside the scope of the actor-network envelope (Latour 1999, p.306) required here. It was not until the transistor that profound circuit ‘integration’ took place, and as noted by Harpe, Hegt, & van Roermund (2010, p.1), this innovation began in 1926 with the patent *Method and Apparatus for Controlling Electric Currents* by Lilienfeld (Fig.8.2). The significance of the early transistor design is its position at the beginning of electric current switching and conversion technologies, as reproduction and amplification, a smaller charge controlling/copying a larger current, in a format that moved toward modes of circuit ‘integration’ independent of larger and more demanding components. According to Harpe, Hegt, & van Roermund (2010, p.1) the production force of signal system integration led to logic gates and microprocessors for computation, as well as “mixed-signal ICs” in the form of the A/DCs and D/ACs as we know them today. It was ICs, such as the 1964 ‘709’ operational amplifier (Fig.8.4), that cemented transistor and diode component integration into an accessible universal chip for commercial and amateur use (Analog Devices Inc 2005, p.1.24). These ICs developed relative to device standards and logic protocols, for example: TTL (transistor-transistor logic), NMOS (n-type metal-oxide-semiconductor logic) and CMOS (Complementary metal–oxide–semiconductor) as described in schematic form in patents such as JL
Buie’s 1966 *Coupling Transistor Logic and Other Circuits Patent* (Fig. 8.5). All these technologies and their contexts of development have previously been subjects of study in media archaeology and cultural techniques, stimulating discussions on information/communication science and cybernetics, including the Macy conferences (1941-1960), as noted by Parikka (2011a, p.263). However, it is the concept of ‘integration’ as it pertains to trace that is of most interest here.

![Figure 8.6 Schematic diagram of a general communication system, from Claude Shannon’s ‘The Mathematical Theory of Communication’ (1948).](image)

Our current understanding of digital circuits was formalised in mid-Twentieth century communication theories. In the 1930s and 40s, research by MIT engineer and mathematician Claude Shannon formalised information as a concept of statistic probability measurement (1948). Shannon understood that the Boolean algebra (George Boole 1815-1864), combined with a binary logarithmic base logic, could be used to better utilise arrays of electronic relays and solve mathematical problems. Coincidentally, not long after this observation, the transistor entered production, replacing bulkier relays, capacitor current storage and vacuum tubes, evolving into
combinations of transistors as integrated circuits, then microprocessors. Shannon, with the support of Warren Weaver (1953), refined Hartley’s Law and John Tukey’s term ‘Bit’ for the measurement of information, applying improved instrumentation and theory to the developing technology of the binary digit or Bit:

The choice of a logarithmic base corresponds to the choice of a unit for measuring information. If the base 2 is used the resulting units may be called binary digits, or more briefly *bits* ... A device with two stable positions, such as a relay or a flip-flop circuit, can store one bit of information. (Shannon 1948, p.380, italics in original)

This was a defining period in communication theory, where physical modulation, the transposition of signal amplitude across media, began to be inter-stitched with protocols for discrete, quantised or distinct signal pulse states, symbolised as the numerals 0 and 1. Eight bits became a byte, and binary combinations referred to as ‘words’ began to represent numerals and letters. Universal protocols of binary representation such as the hexadecimal system and libraries of code subroutines or functions “formed the basis of the first high level computer languages” (Robinson 2008, p.101), allowing computer software to emerge and progress alongside hardware advances. The momentum of this development was inspired by the negation of signal-to-noise ratios and entropy as against the reliability of communication channels to replicate signals more effectively. Shannon’s theory elevated a layer of ‘discrete’ transmission as mathematical statistics and probability distortion control (Fig.8.6), from the likes of physical thermal or electromagnetic interference.
Ernst’s (2013, p.96) and Siegert’s (2015a, p.205) use of flip-flop switching as a base medium operation, informing transitional media memory and feedback loop doors respectively, emerges from the core of A/D conversion as IC transistor switching circuits utilising the relative absence or presence of electric current becoming ‘on or off’ binary states. For Ernst (2013) the fact that these circuits hold one of two states until receiving another input charge is a form of memory. For Siegert (2015a) the process of logic gating as automated feedback between the two transistors of a flip-
flop circuit effectively acts as a co-dependent automated door operation, expanding and altering the notion of door like operations, as cultural technique, from architectural to automated electronic signal processing.

Flip-flop switching observations, as a basis for media archaeological investigation and informing cultural techniques can be expanded via close examination of specific devices and processes of A/D conversion. However, as a core operation of A/D conversion, the basic flip-flop is a component or elemental process of a broader ‘system’ of integrated components and processes that suggests A/D conversion, based on integrated circuit structures, is an intrinsically modular, recursive and ‘transversal’ process. For example, a simple Flash A/DC schematic (Fig.8.7) shows an array of transistors as comparators at the input quantisation stage of a conversion circuit, the flip-flop or required combination thereof only one amongst a wider network of conversion stages. Thus, A/D conversion is a fitting material ground for a medium-specific expansion of discussion relating to the flip-flop switch/door, as a basis for network culture trace.

Ernst identifies and lists “a media-archaeological hierarchy of technical memory levels” as derived from computer processing (2013, p.97). Ernst does this to compare micromedia memory with social and/or cultural modes of storage suggesting that traditional or institutional archive access as defined by ‘storage and transmission’ is giving way to a technocultural emphasis on ‘instant-access’ transmission only (2013, p.98). Broadly, Ernst writes medium-specific operations back into wider cultural practices as a mode of media informed reflexivity. Similarly, a media-archaeological
perspective would suggest that A/D conversion has a hierarchy of four key levels of interconnected operations: the analogue signal ‘pre-processing’ as sampling; the sequencing or buffering; the central conversion to binary representation from quantisation; and digital ‘post-processing.’ Regarding IC signal conversion, surrounding these operations are environmental influences on circuit systems, such as thermodynamic concerns, especially the operating temperature of sensitive devices in heat ladened environments, the performance or influence of base material qualities of primitive components, and hierarchical inheritance of connected/integrated components. Concerning IC conversion, the typical sender and receiver taxonomy of transmission is broken up into: a source from the physical world; a stage of analogue signal processing or preparation; the A/D conversion proper; further digital signal processing; and then digital output (Harpe, Hegt & van Roermund 2010, p.3). In general, D/A conversion is the reverse of these A/D conversion stages.

In more detail, the conversion process starts with an analogue source signal that is never fed directly into logic gates. There is a pre-processing stage involving analogue current control where signals are sequenced, sampled or “normalised” as defined by the requirements of the “A/DC input ranges” (Analog Devices Inc 2005, p.2.2). Essentially, the limitations of a specific A/DC circuit, chosen relative to effectiveness for a given signal source, provides a kind of design feedback for the analogue interface required to perform conversion. At this point in the conversion process the signal is already at a noted level of “voltages or currents representing the actual analog phenomena” (Analog Devices Inc 2005, p.2.2). Notably, this is a stage where voltage and current are measured and thus inscriptively referenced to represent and reproduce
the signal source. In other words, symbolic work has already begun. Therefore, signal ‘normalisation’ via signal pre-processing techniques informs a set of potential media-archaeological footings from circuit design processes (Analog Devices Inc 2005, pp.2.2-2.23), such as signal:

- Scaling (amplification or attenuation of direct measurement from a source).
- Linearisation (mapping voltages from non-linear sources/sensors).
- Demodulation (obtaining a signal from a carrier/source modulation).
- Filtering (the removal of unwanted source signals like low or bandpass filters).
- Sample-hold (an analogue input sampling or signal matching where current is held in capacitors with a timed switch control to be better serialised in preparation for conversion).
- Comparison (comparing steps or the change in the measured value of a signal).
- Combination (of the previous techniques or of relative sources).

Pre-digitisation techniques also inform the classification of A/D converter circuit design or architectures. For example, direct-conversion or Flash A/DC works with cascades of voltage comparators to perform low resolution high-speed sampling of sources in radar processing (Maxim Integrated 2010). However, particular bandwidth sources and design contexts may demand higher resolutions and less noise, such as the demodulation techniques ‘subranging’ or ‘pipelining’, a kind of integrated resampling and refinement loop, much like graded sand papers, from coarse to fine signal refinement, in combination with sample-and-hold pre-processing (Analog Devices Inc 2005, p.3.26). The key point in this first stage of conversion is that infinite signals
from the physical world begin to be ‘distorted,’ on a basic level of signal influence/change from continuous unaltered signals to measured and shaped signals, in a representational operative path before finite digitisation as quantisation takes place. This first stage of conversion is evidenced and influenced by the array of techniques from and applied to analogue circuit design. The trace of this distortion manifests both from the characteristics of the applied pre-processing or sequencing technique of A/D conversion, and digitisation at the immediate site of binary output. Thus, a cultural technique as recursive process unfolding from A/D conversion is one of projective preparing, affording or ‘filtering’ the analogue for digitisation, while being self referentially influenced by the input and output requirements of the system.

![Block Diagram of Sigma-Delta Modulation](image)

**Figure 8.8** Block Diagram of Sigma-Delta Modulation, by Motorola (2003) showing post-processed signal feedback into an analogue signal source.
The next stage of A/D conversion is set at the site of quantisation as translation, typically to or from binary gates proper. A specific type of conversion and device architecture, as an example, is as follows. Firstly, the IC equivalent of the flip-flop switch, the ‘comparator,’ is a specific component within integrated A/DC design (Fig.8.7). Secondly, the process and architecture used for high quality/resolution conversion sources and low noise applications, such as high-fidelity audio recording sound cards, is known as sigma-delta modulation conversion (SDM) (Fig.8.8), and is an advanced pulse code modulation (PCM) (Analog Devices Inc 2005, pp.3.109-110).

A comparator is “a 1-bit A/DC” and “there is no A/DC architecture which does not use at least one comparator of some sort” (Analog Devices Inc 2005, p.3.42). A basic comparator contains two transistors essentially performing a flip-flop switch “and its output is a logic level indicating which of the two inputs is at the higher potential” (Analog Devices Inc 2005, p.3.42). As its name suggests, a comparator compares voltage. In a basic PCM architecture, varying analogue signal pre-processing options aside, quantisation via comparator or combination of comparators takes place by outputting samples to binary logic based on a prescribed set of voltage intervals or steps (as seen in Fig.8.3 & Fig.8.9), whereas the “PCM is a digital representation of an analog signal where the magnitude of the signal is sampled regularly at uniform intervals, then quantized” (Digital Formats 2008). The number of intervals informs a sample depth and the number of samples over time represents the sample rate. For example, a high-quality audio signal has a bandwidth of approximately 22kHz, the human ear capable of perceiving 60Hz to 20kHz. Respected audio interfaces have a sample rate of 192kHz and 24-Bit depth/resolution with a resultant storage requirement of 4608kBps (per channel). These figures suggest incredibly detailed
transmission or reproduction, but are less demanding than higher speed signal spectrums as utilised for wireless or optical broadband communications. If an audio source has been pre-prepared for us—for example signals converted from a microphone as transducer and sampled for the requirements of a circuit—we now have a signal waveform that can be theorised in hypothetical optimum conditions. As a starting point for the description of a quantisation stage of conversion, PCM in line with Flash A/DC will be used because binary logic is generated most simply from a direct relationship between one comparator and a quantisation interval (Watkinson 2013, p. 4.12) compared to other systems. The general process of PCM quantisation is described as follows:

different quantized voltages are compared with the unknown analog input until the closest quantized voltage is found. The code corresponding to this becomes the output. (Watkinson 2013, p.4.12)

Figure 8.9 Wikimedia image of original signal, quantised signal and quantisation error amplitudes (2008).
The important point is that the analogue input is truncated in the conversion process to meet pre-set interval voltages. The resultant quantised waveform is a staggered or ‘stepped’ approximation of the original signal’s continuous amplitude (Fig.8.9). On a basic level, A/DC quantisation becomes a game of join-the-dots between truncated points to reproduce the original signal. This is where quantisation error comes into play (Fig.8.9). “Quantization error is defined as the difference between the actual analog input and the digital representation of that value” (Maxim Integrated 2002). Principally, due to circuit design and theorisation, there is the possibility that a stepped ‘gap’ of no data is produced between samples and it is at this site that complicated representations of nothing, importantly ‘before’ or in line with the binary state of zero, unfold to compensate for signal loss. In fact, considering the operation of comparators, it is more likely that a binary ‘zero’ unfolds as a representation of voltage difference or lower potential value than as a state of ‘nothing,’ making quantisation error a more interesting candidate to pursue in the context of this discussion of the trace. In other words, as an analogue signal is sampled to be converted to a digital one there is a meeting point between material and symbolic work in the representation of nothing. Redundant voltage is dissipated via resistors as heat or other crucial circuit environment operations and diagrammatic mathematical techniques, as the compensatory symbolic work for absent signal, are required to convert a signal.

Audio reproduction is a good platform to exemplify quantisation error as symbolic work unfolding from a struggle to represent nothing in measurement and conceptualisation. The manifestation of symbolic dealings with quantisation error
becomes a significant trace of absent or distorted analogue signals. Quantisation error becomes audible ‘and’ circuit quantisation distortion, especially in a poorly designed converter or adversely utilised device, when the original signal is altered due to a rounding process to meet voltage steps. Firstly, concerning the quantising range available to a system, an example is when a low level volume or stage of quantisation around a dynamic drop to zero volts is attempted (Watkinson 2013, p. 4.10). The quantisation of an effectively low or silent analogue signal will potentially generate an unwanted signal in digital reproduction as the original’s values are lifted relative to a limited amount of sample depth. The output when heard is like a hiss or hum (Watkinson 2013, p.4.10), essentially generated by the process of digitisation, becoming quantisation distortion, rather than a physical noise floor. Additionally, digital clipping occurs when input signals move outside the quantising range (Watkinson 2013, p.4.12). A signal at the ‘peak’ of a circuit’s range truncates at the extreme of the range resulting in an audible spike or ‘clip.’ The visual equivalent can be witnessed when video cameras are pointed at intense light sources and bands of pixels block out in the reproduced image, a process typical of a lower resolution device’s preview screen. The quantisation errors mentioned so far are basic ‘aliasing’ concerns. Frequencies “are ‘folded back’ or replicated at other positions in the spectrum” (Maxim Integrated 2002). A more complicated type of aliasing is a type of banding or sidebanding:

If an input is supplied having an excessive bandwidth for the sampling rate in use, the sidebands will overlap and the result is aliasing, where certain output frequencies are not the same as their input frequencies but instead become difference frequencies. (Watkinson 2013, p. 4.2)
The resultant audible outcome of this scenario would be incompatible frequencies due to overlap and harmonic differences as a high pitch granulation bell effect. There are numerous ways around these problems. For example, the foundational Nyquist-Shannon sampling theorem (Weaver 1953, p.276; Watkinson 2013, p.4.2; Analog Devices Inc 2005, p.3.111) states that sampling rates need to remain at a minimum of twice the input frequency; anything below this and replication slips back into aliasing as waveforms cannot be plotted and converted to binary with accuracy—notably, filtering or limiting signals in analogue pre-processing and to increase sample depth, which effectively means less quantisation truncation is required. However, workarounds involving more hardware cause economic and efficiency issues, with low-level signals identified as a problem. In 1957, Bernard Smith (pp.657-58) introduced a workaround that incorporated a process of companding on PCM by using non-uniform sample step sizes starting from more finite voltage intervals for weaker signals and expanding to larger intervals for strong signals. This solution established an efficient electronic representation for a signal, while utilising the same number of samples. Furthermore, complex mathematical theory has been developed to better meet the limits of circuit quantisation ranges in order to ‘ideally’ replicate an input signal exactly.

As a consequence of quantisation error, important conversion accuracy processes and devices have been developed. Of most interest are methods that utilise feedback loops between analogue and digital signals. In addition to wider IC environment and power supply influences, there are two notable methods to improve A/D signal conversion
accuracy: dither, and the sigma-delta modulation (SDM) converter architecture. In audio signal conversion, it is best practice to add error back into the conversion process to make any quantisation error less obvious to the human ear, as analogue or digital “dither” (Watkinson 2013, p.4.10). Dither effectively adds randomisation to a signal thereby reducing audible distortion with noise. Dither effectively spreads samples across the quantisation range to be refined by a process of averaging: “Quantizing error becomes a function of the dither, rather than a predictable function of the input signal” (Watkinson 2013, p.4.10). Dither can be simply added to an input signal as low-level analogue noise or controlled and fed back into the conversion process during or in conjunction with a digital signal processing chain, for example the feed back into the system via the output of an integrated D/A converter (Watkinson 2013, p.410).

The sigma-delta modulation (SDM) converter architecture (Fig.8.8) integrates functionality similar to D/AC dither and extends the idea of analogue and digital feedback across processes of conversion. Compared to PCM, the operation of SDM, as suggested by the name, is based on the ‘change’ or ‘delta’ of a signal rather than set voltage values in quantisation (Analog Devices Inc 2005, p.3.109). This change in the signal is then integrated back into the circuit as ‘sigma’ (Analog Devices Inc 2005, p.3.113). The basis of delta modulation quantisation is that the “comparator output is converted back to an analog signal with a 1-bit D/AC, and subtracted from the input after passing through an integrator” (Analog Devices Inc 2005, p.3.109). The resultant circuit functionality is not based on the binary logic produced by an array of comparators, like Flash converters, but rather a kind of automated feedback loop or traced and operable error signal achieved by the combination of A/DC, D/AC and
digital filtering in the one operational stage of conversion (Analog Devices Inc 2005, p.3.111). Concerning SDM, there is not a clean divide between analogue input and binary output. Under the hood of the black-boxed process is a layered interdependence, driven by the evolution of signal distortion control for improved resolutions and IC efficiency. Equally important in this context is the environmental disunion of the two realms: “Digital circuits create a hostile environment for the analog circuits by causing interference, which potentially reduces the performance of the analog circuits” (Harpe, Hegt & van Roermund 2010, p.3). Switching frequencies and the ripple noise of multiple ICs and voltage regulators in power supply architectures can build to form system beat frequencies. The problem is exacerbated in ICs due to the micro-proximity of micro components. Consequently, the digital side of conversion, if there can be such a thing in converter integration, is again critical to consider beyond just a bit stream output from a black-boxed chip. The feedback of the digital into the analogue and analogue into the digital is self-referential, in the cultural techniques sense, at the level of signals in A/D converters and their supporting circuit networks.

The main point in listing devices and processes of A/D integration is their significance as a basis for the trace-oriented cultural techniques that form the basis of the investigation undertaken in this thesis. In the complex dealings and representation of A/DC-D/AC quantisation feedback there is interdependency between the analogue and the digital. Importantly, at the messy point of conversion, analogue and digital reproduction is always-already transversal beyond obvious system co-dependency. The trace of quantisation and its error is manifest as physical and representational signal referents in the examples listed above. However, from the designs, mathematical
and diagrammatic practices mentioned, this trace becomes something other than noise when filtered and formally integrated in conversion systems. Watkinson suggests that:

"treatments which then assume that quantizing error is always noise give results which are at variance with reality… Once an unwanted signal becomes a deterministic function of the wanted signal, it has to be classed as a distortion rather than a noise. (2013, p. 4.10, italics in original)"

The process described by Watkinson (2013) highlights a unique technical ground or materiality, informed by the trace of distortion and thus distortion as a basal cultural technique recursively iterated in the physicality of electronic signal control and architectures of A/D conversion, echoing Shannon on signal transmission:

"If a particular transmitted signal always produces the same received signal, i.e., the received signal is a definite function of the transmitted signal, then the effect may be called distortion. If this function has an inverse—no two transmitted signals producing the same received signal—distortion may be corrected, at least in principle, by merely performing the inverse functional operation on the received signal. (1948, p.406)"

When measurable and projectable, noise, or even better the trace of noise, becomes ‘distortion’ via the legibility, or symbolic work, of noise in relation to processes of signal measurement and manipulation in A/D conversion. This is evidenced by the interferometry techniques of analogue and digital signal analysis across signal preparation, quantisation error and SDM. The two realms, analogue and digital, share
a trace-based dialectic, via quantisation error distortion. Such practice has a chronological history, regarding signal processing: before solid-state ICs became mainstream, early theoretical analysis of quantisation error (Schouten & Groenewout 1952) identified a transition from noise to distortion. Subsequently, the symbolic work associated with signal ‘distortion’ unfolds, quite literally, as a filter, in reference to Siegert (2015a, p.32; 2015b), for signal from noise. This reading of noise can still be the case even if ‘distortion’ slips back into being perceived as a kind of noise (Weaver 1953, p.265). This theme, in itself, is not ground breaking; for example, in astronomy the distortion of light signals from the likes of ‘variable’ or ‘binary’ stars is analysed for identification and classification and this dates back to ancient Egypt. However, in terms of cultural techniques, distortion highlights an archival ground of symbolic work in close proximity and relation with noise, while realising its distinction and parasitic potential. Peter Krapp, similarly to Siegert (2015a), draws a close connection between Serres’ ([1980] 2007) ‘parasite’ concept and Shannon (1948), but highlights the integration of the two-way technical reading of distortion:

[T]his renders the distorting interference not only as ‘parasite’ but also as a second order signal source, where it can act both as negation and as a generation of received signals. (Krapp 2011, p.vx)

Forgoing the scope required for the ‘noisy’ definition of alternatives to or extensions of Shannon-Weaver’s model of noise (Hainge 2013; Krapp 2011, Nunes 2012; Parikka 2011a), the symbolic work that comes from A/D conversion reveals itself in dealings with ‘distortion’ as influenced by feedback, error and the representation of nothing. Like a concrete trace, a distorted signal as electrical, digital, graphical, statistical,
notational or mathematical impression, for example, stands between the absence and presence of a signal as a mediating third. Additionally, it is perhaps the case that there is also productive parasitic tension between the distinctions of distortion and noise as formed by A/DCs. In the spirit of Shannon (1948), and perhaps cybernetics, the digital realm is more slanted toward automated or workable distortion as opposed to the random or “resistant qualities of noise” (Hainge 2011, p.137) associated with non-digital transmission. In terms of cultural output as content, the process of digitisation makes it hard to suggest that digital noise can remain noise (Hainge 2011, p.136). In this sense, the A/D conversion performed by digital technical media, as an episode in Siegert’s “era of graphé [of inscription]” (2003 trans. Kromhout 2014, para.5), can become a process of filtering ‘signals’ from ‘noise’ via the analogue-trace as an annunciation of distortion in signal conversion as a point of investigation. Recursive medium-specific processes of A/D conversion’s integration of distortion hold potential in approaching wider trace-based cultural practices and operations. Conversion provides an archival ground of operations that circulate referentially and conceptualise themselves in transversal network culture.

8.3 Chapter Conclusion
A/D and D/A converters, acting as a housing or outer layer for the door-like operations of internal flip-flop switching, model the transversal media practice distinctions of not only inside/outside and opened/closed, but also what can be considered analogue/digital. The operational ‘distinctions’ inherent in A/D and D/A converters do not just connect the use of analogue and digital means of re/production; like Siegert’s (2012; 2015a) doors they allow both to be better understood via the operations of
conversion as a preceding mediating third. It is suggested that, like Siegert’s doors, converters “simultaneously thematize” distinctions and “thereby establish a system that is made of their operations and essentially become the “carrier of cultural codes” (Siegert 2012, p.8-9). The trace’s potential as a cultural technique is also found at the site of A/D converters. Systems of analogue-digital re/production and consumption, held together by converters, are also elemental sites for the trace in the context of transversal practice, due to their iterative and recursive processes of conversion utilised in wider media output. This is a kind of signal culture embedded in wider outputs of transversal network culture. The trace, understood as both concrete and an operation aside or prior to the symbolic, more as analogue-trace and perhaps inflections in or from noise and signal distortion, can consequently inform or subvert its housing network of cultural codes. In other words, a media-oriented trace, it is proposed, is a cultural technique couched as a parasitic notion in the recursive symbolic operations of A/D and D/A conversion. This is a dual action trace that works across broken/hidden symbolic work and as immutable mobile—dual and dialectic.

The analogue, as understood via A/DCs, can be attached to the trace, making analogue-trace something between the material ground of conversion and the projective trace needed to plan for the digital and its operations. In this case distortion is a deconstructive trace born of a medium’s influence on signal ‘and’ the trace as networks of immutable mobiles formed in dealing with distortion. At this point in describing A/DCs, the earlier analysis of Derrida’s and Latour’s models of the trace (from Chapters 4, 5 and 6) can be brought together, under the label of analogue-trace as a
distortion or abstraction of supposed gaps in the chains of Latour’s (1999) circulating reference. As Ernst reminds us:

With the age of so-called analog media such as the phonograph and the cinematograph, signs of or in time themselves can be registered. Not only do they maintain a symbolical relationship to macro and micro time (such as historiography), but they inscribe and reproduce functions of time themselves. It is only with the digital computer that the symbolic regime dialectically returns, this time in a genuinely dynamic mode (which differentiates implementation of software from the traditional Gutenberg galaxy): algorithmic time and operative diagrams. (2013, p.30)

Ernst highlights the presence of dual symbolic regimes when considering analogue and digital media; the analogue defined by its potential to ‘fix’ signal, sign and trace in the medium; and the digital defined by its ability to elevate symbolic work from its fixings. The two can be considered distinct dual symbolic systems as isolated by A/D conversion. However, a digital mutability between signal, sign and trace is made possible by “algorithmic time and operative diagrams” (Ernst 2013, p.30), the two being the trace of A/D conversion and thus cultural techniques of A/D conversion. Here, the analogue-trace of A/DCs, as made culturally concrete by the recursive trace of distortion and the inherent feedback between analogue and digital signals, at least at the site of digital signal creation, allows the analogue and digital to be dual ‘and’ dialectic across the transversal ground of their symbolic regimes. This is a site of both “logical replication” ‘and’ “physical replication” (Ernst 2013, p.93), never just immaterial bit streams, and a potential site for basal cultural techniques that carry
cultural codes of digitisation alongside the emulation of past media that conducts self-referential dereification (2013, pp.93-4).

In conclusion, there are two kinds of trace that stand out through applying informed analysis of A/DC and D/AC conversation, inclusive of D/AC yet weighted toward A/DC. Firstly, there is the ‘analogue signal pre-processing’ stage of conversion as a kind of preparation or projective operation for digitisation that is evidently informed by a feedback relationship with the requirements of the digital side of conversion. Secondly, there is ‘distortion’ as unfolded from the feedback and interdependence between the analogue and digital in operations of conversion. Thus, the culmination of the two approaches ‘filters’ or ‘makes visible’ the symbolic work of processes that self-referentially struggle, compensate, distort and rupture media in an attempt to represent nothing as the absent in the present. These two themes expand considerations of spatial and temporal cultural output, as trace-based cultural techniques, and identify some symbolic work that supports and defines how the trace survives transversal analogue-digital media assemblage within digital network culture.
9. CONCLUSION

Figure 9.1 Diagram by Greg Hughes (2016), *Trace: A Taxonomy of Enquiry*, visualising the overarching thesis path and current chapter position to the reader. This chapter highlights the path of the trace that has been followed and reflects on the strengths and vulnerabilities of positions reached.
How does the trace of a medium survive transversal analogue-digital media assemblage and what qualities of the trace hold potential in thinking about media cultures and practice? The core concern of this thesis has been to examine the ‘analogue and digital’ as informed by tracing the trace. Specifically, methodologies of media archaeology have been applied to the A/D converter of analogue to digital signals and their various articulations of the trace, arguing that the ‘analogue and digital’ are always already integrated. The result this study has identified through examination and explanation of the A/D converter is two standout types of trace as signal interrelations: signal ‘preprocessing’ and ‘distortion.’ As types of technical media and cultural systems of symbolic work, the analogue and digital can perform as ‘dual’ actor-networks, working in parallel and separated by the likes of: blackboxing (Latour 1987, p.131; 1999, p.306); a transversal yet generic media archaeology (Gansing 2011; 2013, pp.267-72); media ideologies disconnected from material and forensic groundings (Kirschenbaum 2008, p.43,258); differences in time critical archive characteristics (Ernst 2013, p.100); and a closing off of symbolic work via digital media automation and operational feedback loops (Siegert 2015a, pp.15, 192-205; 2015b). These reasons for ‘dual’ analogue and digital processing are the result of identifying modes of broken or hidden symbolic work in action when considered via Derrida’s deconstruction and trace ([1967] 1997). Analogue reproduction’s re-functionalisation in digital network culture, as outlined (Fig.6.2), is an example in contextual taxonomy of a shift in symbolic work. In this symbolic work, the supposed original qualities of analogue inscriptions and the referential loss in the digitisation of these inscriptions are reinvented or reactivated but also lose their material representational ground. This hierarchy of symbolic work finds a range within Kittler’s
interpretation (2012, pp. 226-7) of Flusser’s ‘dimensions of representation’ (2000; 2011), as visualised in Chapter 3 (Fig. 3.31). This approach highlights an incremental concealment of the signified due to the removal of dimensional signifiers by computational media (Kittler 2012, p. 227). However, this thesis has suggested that it is in crossing the material-semiotic boundaries and taxonomies between the analogue and the digital as dialectic that symbolic work, as trace, contradicts the ‘dual’ and connects both systems to become ‘dual and dialectic’ in transversal practice.

The ‘dual and dialectic’ state of analogue-digital media is akin to the ‘transversal’ as either a channel that is found, or as disparate combination put together, that connects, reveals and/or produces an additional path of communication. In this context, the trace, including the ‘analogue-trace’ proposed in this thesis, acts as a mediating third, parasitic and basal cultural technique (Siegert 2013, p. 61). Trace can be said to theorise the trace’s self-referentially and its reflexivity as a kind of recursive inscriptive practice that in its projected state feeds back into the material-symbolic processing/coding of a medium, becoming a key player in the forming of dialectical images (Benjamin in Buck-Morss 1989, p. 67), or wish-images (Benjamin [1935] 2008, pp. 97-8; Buck-Morss 1989, p. 56), as new refunctionalisations (Winthrop-Young 2015, p. 459), or reverse-remediations (Gansing 2013, p. 294) of media in the interferometry of cultural techniques. Consequently, trace can be said to bring together, facilitate and conversely circumscribe the ‘dual and dialectic,’ the transversal and cultural techniques as related concerns in thinking about the meaning making media perform.
The A/D dialectic, more than a media-based contradictory argument, has been shown to become generative. The medium-based self-referential symbolic work of the trace witnessed via the A/D converter becomes a third inscription between analogue and digital signal processing that enables a better understanding of the two as intervention, identifiable integrative proposition and/or theorisation of practice. As Derrida says: “the law of the addition of the origin to its representation, of the thing to its image, is that one plus one makes at least three” (Derrida [1967] 1997, p.36). In Latourean terms, “two actors are always mediated by a third” (Harman 2009, p.77). And, like Siegert’s notion of a “mediating third” (2013, p. 61), the A/D converter precedes the analogue and digital and emphasises a relationship between ‘communication and noise’ rather than just ‘sender and receiver’ in media enquiry (Siegert 2015a, p.21). The conclusion reached, via the concrete trace of A/D converters as both an integrated circuit substrate, akin to Benjamin’s notions of a trace fossil (Buck-Morss 1989, pp.56, 211), and a ‘network envelope’ of ‘immutable mobile’ diagrams in circulating reference (Latour 1986, p.9; 1987, pp.227, 259; 1999, p.307; 2005, p.223) reduces the analogue and digital as actors in a system of representation to a process of conversion before expanding them to analogue, A/D conversion and digital again. The identification of a third trace means that previously held binary notions of analogue and digital are dissolved to form an always already analogue-digital merger in signal and symbolic conversion. This is not an exclusion of either, or some type of proposed deterministic media-eating-media convergence in which analogue-digital becomes a specific other, but rather a transversal and time critical state of oscillating signal feedback in modulation.
Trace, via conversion, has brought together three entities of discourse to become two: analogue-digital and its trace. Profiling analogue-digital and its trace does not imply side-stepping iconography. Instead the analogue-digital and its trace utilise foregrounding inspired by Benjamin’s trace and Derrida’s deconstructive trace, in the consideration of symbolic work central to computational digital media in network culture. Consequently, the discussion of analogue-digital and its trace seeks to address a “short circuit between the imaginary and the real” (Siegert 2015a, p.205) that requires a ‘filtering’ of signs (2015a, p.32; 2015b, para.121) from signal-noise networks, rather than a semiotics ingrained in iconography. This reading of Siegert (2015a) annexes a medium-specific approach to media in digital network culture for a perspective in which the activity of signals and channels informs or oscillates with the forming of a medium ‘and’ in turn informs distinctions in the making of meaning: a new formalism in the formless presence of the trace.31 Thus, what the trace does or how we ‘trace out’ signs, as techniques of filtering, becomes critical and points to a third player generated from two: analogue-digital, trace ‘and’ distortion. The path this thesis has taken (Fig.9.1) to follow articulations of the trace has been: a movement from the concrete trace, to a transversal trace (a trace that in network culture oscillates via feedback between broken/hidden and immutable symbolic work), and on to a trace grounded in the A/D converter as it negotiates presence and absence outputting representations of ‘nothing’ as an analogue-trace. The mostactive

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31 This is not a media deterministic approach but rather one that is open to such contemplations. The approach is informed by Latour and as such, in the process of observing media actor-networks, should leave open inquiry to allow further connections and expansions of network envelopes. Informed by Derrida, the approach insists on continued affirmative deconstruction of symbolic work as/of method and subject/content. Consequently, and as aligned with cultural techniques, the basis of the trace and analogue-trace implies a relationship, feedback or oscillation between signal, channel, medium and ‘meaning’ observed in recursive symbolic work.
trace found in following this path has emerged from, or as, ‘distortion,’ witnessed as a mode of inscriptive signal filtering and a site or annunciation of signal-signs in formation. To be provocative from this conclusion it could be said: there is no ‘outside’ the signal, only signal, A/D signal processing, and the trace of distortion in an era of technical inscription.

The relationship between trace and distortion, as a filtering of signal-signs from noise via a medium-specific media archaeology of A/D converters, encompasses a few final concerns that need to be addressed. Firstly, signal preprocessing, feedback and distortion as ‘findings’ within a hierarchy of technical A/D conversion should mean a ‘writing back’ of them, as a media archaeology informed by Ernst (2011; 2013 pp.97-101) would do, into the aural, optical and linguistic outputs of wider digital network cultural. Such a stage of enquiry is not going to happen as an additional section to this thesis, but distortion and the A/D converter can be read back or fed back into the start of this study’s path (Fig.9.1). This would also encourage a non-linear and medium-specific-first reading to be taken of the document as a whole.

Secondly, pointing to distortion in the symbolic work of images is close to the work of others that can help to reinforce the theorisation of the trace. Different traces of argumentation can now be followed through the thesis. For example, Benjamin’s image-worlds ([1931] 2008; Jennings 2008b, p.279) and Mitchell’s (1994, p.45) ‘metapictures’, discussed in Chapter 2 of this thesis, can be understood to illustrate self-referential codification and reading of images, whereas Siegert (2015a, p.189) highlights media distortion. Siegert does this via Victor Stoichita’s (1997) review of
early modern meta-painting, placing the term under the banner of “The Birth of Representation” (2015a, p.189). Siegert (2015a, p.191), on “coding procedure” in Dutch still life painting, describes an emergent formalisation of distortion informed by material intervention relationships between “sign and sign carrier, figure and ground” (2015a, p.190) and consequently a network of medium processes and their distortion of ‘the figural’ can inform or found understandings of representation.

Thirdly, terms such as ‘black box,’ ‘feedback’ and ‘distortion’ arrived at via A/D converters, describe things and effects dependent on the fields of signal processing, formal communication theory and cybernetics. As Krapp reminds us, distortion relative to noise is a mode of feedback in operational observation “formalized as a cybernetic insight” in media cultures (2011, p.xv). This is prefaced in the formal qualities of communication theory made culturally concrete in Shannon-Weaver models of signal processing (Parikka 2011a, p.259). Distortion is well covered in sciences of signal processing and in critiques of media operations and media cultures.

This thesis, in tracing the ‘trace,’ has explored how the trace survives transversal digital network culture. The theory of distortion reached deals with specific devices and inscriptions as a methodology or media-ontic theory of ‘networks of trace’ or ‘trace networks.’ Consequently, distortion is defined by the struggle for both the device and its supporting inscriptions to maintain circulating reference (Latour 1999) when supposedly signifying ‘nothing,’ or dealing with representational ‘gaps’ between matter and signal in the conversion of a signal. This is the case whether distortion is a found, recorded, re/produced or projected trace. The material signal-signs identified are inscriptive dealings with a generation and/or addition of signals
to source signals, loss of signal or redundancy, system feedback techniques as informed by distortion, and circuit design techniques as informed by the frequency range required to be converted.

For the discussion to reach this point of distortion, both highly theoretical and specific sites of media and their assemblage regarding the trace have been covered. Firstly, key media thinkers informed a redefinition of the trace as analogue-trace. Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) dialectical image places emphasis on a concrete trace as the distortion of history in a media-political context via medium-based readings outside ‘the text,’ and with this came a ‘bringing back’ or protection of archives and grand plans to counteract illusion with the tools of illusion. Secondly, Benjamin’s ([1927-1940] 2002; Buck-Morss 1989) concrete trace was aligned with transversal network culture allowing for discussion to test its applicability to this study. Network culture was approached via Gansing who highlights media ‘contradictions’ and ecologies (2013, p.46), suggesting a realm beyond pure functioning, one of many protocols and layered with “tensions and unresolved states” (2013, p.52). This is a kind of look-at-media-networks for affirmative distortion, which is transversal, and echoes the necessary analogue-digital feedback required for A/D conversion to exist technoculturally (Ernst 2013). Kirschenbaum (2008) was used to reaffirm a concrete trace in network culture, taking transversal considerations closer to the surface of the mechanism. Kirschenbaum can be described as identifying the broader cultural distortions imposed on media if their casings are not opened up beyond interface, immateriality and the likes of “screen essentialism” (2008, p.43). Thirdly, Derrida’s deconstruction and trace ([1967] 1997) assisted with techniques of identifying and
instilling or finding distortion in logocentric media, and was used to identify the symbolic fragility of the trace. Fourthly, Latour’s immutable mobiles were discussed due to their definition of “innovations in graphism” (1986, p.9), where matter becomes “materialised into a sign, an archive, a document, a piece of paper, a trace” (Latour 1999, p.306). This understanding was used to suggest that instrument, inscription and network distortion (1987, p.259) should always be acknowledged in circulating reference (1999). Lastly, Ernst (2013) and Siegert (2015a), as covered in this thesis, supply a media archaeology and cultural techniques methodology for how ‘media distort media’ and the wider cultural codes and practices that stem from such distortion. This distortion is, in part, an expansion of Kittler’s mediality where ‘signatures of the real,’ as identified by Hainge (2013, p.274) citing Kilter (1999, pp.16, 188), are most closely made by direct ‘continuous’ inscriptions that trace the ‘unmarked’ spaces of the world uninterrupted, for example, the recording of audio via the engraving and later retraced phonographic groove (Kittler [1986] 1999, p.33), which can be loosely labelled a kind of analogue reproduction. Media beyond this basis further distort ‘the real,’ entering semiotic exchange made complex by mechanical or electromechanical abstraction and the requirement of supporting codification and protocol in reproduction and representation. Ernst (2011; 2013) and Siegert (2015a) extend this notion to identify ontic operations in how media recursively distort themselves and consequently the spatial and temporal distortions that communication rests on, and were used to approach the A/D converter as such.

Parikka’s (2011a, p.259) description of noise finds a waypoint between the formal qualities of communication and a ‘nonsignifying’ other or ‘a-signification.’ However,
this ‘other’ should not be considered as only noise, but rather as an in-between mode of connection as interruption or intervention as a third actant: that of a trace-informed ‘distortion’ between signal and noise. Distortion is an action and actor in a signal network and there is no outside the actor-network, only actants becoming actors (Latour 2005, p.71). Notably, as informed by practices of A/D converter signal processing, distortion is a kind of recognised signal change or layering, the action always already a process of codification and systemised between ‘sender and receiver’ and ‘signal and noise,’ being navigable and/or usable. In the act of inscription, the trace of noise, signal or message is always already at a level of distortion. This material basis of the trace is the negotiation and application of destructive and constructive signal amplitudes. As framed via reference to key thinkers, the emphasis has been not a negation of noise so much as a realisation or ‘medialisation’ of signal manipulation as it moves into distortion, in traceable, broken or hidden symbolic work, in the signal processing of culture. Media literacies of distortion are at stake here, no matter what the potential actor-network of communication under scrutiny may reveal itself to be. The theory of trace that has been constructed through this thesis highlights distortion for processual realisations and helps return signal modulation and interference to ‘immutable mobile’ states of inscription.

Krapp (2011, pp.89-90) cites the influence of Foucault ([1966] 2005; [1969] 1971) when discussing approaches to media distortion, saying: “instead of emphasising coherence, totality, and continuity, media studies after Foucault foregrounds breaks, conflicts and discontinuities” (2011, p.90). However, as already stated, the articulations of the trace presented in this thesis point toward the trace as dual ‘and’
dialectic, transversal; as archival and as concerned with a media ‘genealogy’ or the
processing of distortion in circulating reference primarily as recordings, leftovers,
substrates and residues by which to reinterpret history. The references to Benjamin
([1927-1940] 2002; Buck-Morss 1989) worked into the discussion of digital network
culture bring his trace forward in time and position a Benjaminian notion of trace
alongside a discussion of the transversal in Gansing (2011; 2013), a forensic trace in
Kirschenbaum (2008) and lastly, digital storage and transmission in Ernst (2011;
2013). Discussion of Benjamin’s ([1927-1940] 2002; Buck-Morss 1989, p.64-7)
observations on the recent past as immediately historic or prehistoric, through the
construct of theory presented, allows his trace to meet the microtemporal conditioning
of transversal network culture technologies. Arguing that a connection can be made
between Benjaminian and media-archaeological (Kirschenbaum 2008; Parikka 2012;
Gansing 2013; Ernst 2013; Siegert 2013) concepts relating to media temporalities
shifts the legacy of a Benjaminian trace into network culture media-archaeological
practice. As demonstrated by the many examples of network culture explored and the
comparisons made to the media in the 1920s and 1930s, Benjamin’s ([1927-1940]
2002; Buck-Morss 1989) thinking and observations still hold relevance to the trace in
advanced electronic processing, including studies in transversal media archaeology in
digital network culture.

How then does the trace of a medium survive? As examined, the trace is a means to
cross and connect, via medium-specificity, that which is mutable and immutable, ‘past
and present,’ ‘absent and present’ and ‘found and projective.’ Via the trace the
symbolic work of signal control, formal instrumentation and inscription joins the
hidden and broken, or the analogue-trace, of the present via ‘action at a distance’ (Latour 1987, pp.215-57), especially when direct contact between actors is not made or possible. Distortion in, or emanating from, the ‘trace’ is thus an intentionally open-end point waiting for connection. Trace and analogue-trace concern the connotations of distortion amongst media cultures including any influence on signal transmission and storage, such as noise, entropy, error, glitch, redundancy, degradation and the like.

However, the concept of the trace is of most value when connecting the actor networks that surround symbolically volatile signal actions. Distortion itself has the potential to rupture and is a test for networks of immutable mobiles in the Latourean sense (1986; 1987, p.259). The issue of signal ‘control’ is a ‘matter of concern’ (Latour 2005, p.119; 2009) and enables a process of taking control of the signal via an awareness of distortion to make the invisible visible, no matter the complexity, force, social or political motivation. In considering distortion via trace, the signal-sign versus noise circumstance is not only of interest in terms of inscriptive output for signal error control or modes of noise cancellation. Analogue-trace, as a kind of signal distortion from specific device to wider media production, can be a starting point for filtering how and what symbolic work does and how network culture is conditioned by techniques of trace that oscillate between mutable and immutable representation. Here distortion highlights the recursive operative chains of cultural techniques or circulating reference (Latour 1999), as networks of trace, that filter symbolic work from the real in rupturing their mediums or channels to produce distinctions in meaning (Siegert 2015a, p.13). This is not just a space for oscilloscope readings and signal control in the negation of distortion; it is a potential entry point to the study of media, set between ‘sender and receiver,’ and ‘communication and noise.’ The trace is an instigator of
rethought or new channels via the network relations of inscriptions. The trace is a channel for the cultural codes of distortion and survives via the negation of, or emerges from, signal distortion. Perhaps that is how the traces of media survive transversal analogue-digital media assemblage in digital network culture.
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