Incorporating Technology: A Phenomenological Approach to the Study of Artefacts and the Popular Resistance to E-reading

Submitted by Matt Hayler, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in English, September 2011.

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Abstract

This thesis considers the phenomenological experience of e-reading (reading on an electronic screen) as a way-in to discussing wider issues of technology and our encounter with objects in our environments. By considering the resistance shown toward reading on iPads and Kindles in popular and academic discourse as a source of valuable "folk phenomenological" report, this thesis hopes to shed light on both the particular engagement of portable e-reading and the general experience of embodied encounters with artefacts.

The first chapter will consider the shortcomings of contemporary definitions of technology and aims to provide its own definition commensurate to the task of describing the intimate and very human encounter with equipment, an encounter which will be described as "technological."

In the second chapter an ontology (begun in the background of the first) will be developed which primarily considers our encounter with things that are as embodied as ourselves. This ontology sees evolution as an epistemological concern, with every evolutionary act occurring as a response to environmental pressures and producing a knowledge of that environment. This knowledge, it will be argued, in light of conclusions drawn from an engagement with Object Oriented Ontology, can be tested only via repeatable successful action with that which might be known. Such evolutionary concerns, it will be further argued, are equally applicable to our artefacts.

The third chapter will focus on metaphor and critical theory to consider how e-reading in particular might function as a material metaphor, enabling productive thought. It will conclude with readings of three texts which put the language of all three chapters to work.

This thesis draws on several fields, including Critical Theory, Cognitive Neuroscience, Evolutionary Epistemology, and Philosophy, the bringing together of which is intended to be of use to the still emerging Digital Humanities and the work's home discipline of English Studies as it gets used to the substantial alterations in the substrate of its object of study.

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To take embodiment seriously is simply to embrace a more balanced view of our cognitive (indeed, our human) nature. We are thinking beings whose nature qua thinking beings is not accidentally but profoundly and continuously informed by our existence as physically embodied, and as socially and technologically embedded, organisms.

- Andy Clark, *Supersizing the Mind* 217

We are frightened and rejoicing witnesses. We have experienced the transition from the pen to the typewriter, then to the electric typewriter, then to the computer, and all this in thirty years, in a single generation, the only one to have made the whole crossing. But the voyage continues.

- Jacque Derrida, *Paper Machines* 31

This may be the awakening, but it feels curiously like the fantasies that circulate through our sleep. From deep in the heart I hear the voice that says, "Refuse it."

- Sven Birkerts, *The Gutenberg Elegies* 229

The Digital Humanities are becoming increasing important to contemporary Humanities research. The field can be traced back at least as far as the 1980s and the emergence of "Humanities Computing,"[1] but despite this perhaps surprisingly long history the boundaries of its modern incarnation are still being fought. Mark Sample offered a round-up of the Digital Humanities related talks and workshops at the MLA 2012 conference in Seattle and noted that the "list stands at 58 sessions, up from 44 last year (and 27 the year before). If the trend continues, within the decade it will no longer make sense to compile this list; it'll be easier to list the sessions that don't in some way relate in (sic) to the influence and impact of digital materials and tools upon language, literary, textual, and media studies." But even as interest and, significantly, funding has grown, panels from the MLA 2012 conference, such as "Debates in the Digital Humanities,"[2] demonstrate the issue: what exactly are the Digital Humanities? The 2011 Digital Humanities conference held at University College London was organised under the theme "Big Tent Digital Humanities" and, at least in part, sought to address this question. The "big tent" approach calls for a wide variety of digital tools and media

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[1] Though we might trace the field back further to the cybernetics movement of the 1940s and its earlier inception in the 20s, see Andrew Pickering, *The Cybernetic Mind*.

[2] A panel which would also become a forthcoming book on the same theme edited by one of the panel participants, Matthew K. Gold.

related study to come together under the banner term of DH; the opposition often calls for a greater focus on the use of computing in Humanities research and emphasises the creation and dissemination of digital tools as a hallmark of the field[3]. In Melissa Terras' talk at DH2010, "Present, Not Voting: Digital Humanities in the Panopticon," she raised this issue for scholars who described themselves as digital humanists, that they "must not only understand [their] discipline [them]selves, but be able to communicate it succinctly to others," and this paper was still frequently being referenced in abstracts and sessions for the MLA and DH conferences of 2011 and 2012.

Whilst it is not my task here to answer the question of what should rightfully be considered DH, this thesis aims to be a contribution to this simultaneously emerging and yet wholly established field, and one which subscribes to the big tent approach by pushing at the edges of what should be included under its name, particularly in terms of theory. I want to make a phenomenological argument about how we understand and interact with technology, but the technologies that I will focus on to draw my conclusions, electronic reading devices, raise arguments which are increasingly central to the Humanities, and to English Studies in particular: If we want to stand against it, if we want to grudgingly accept it, if we want to embrace it then we must start to understand what happens when reading moves away from paper and onto a screen. This is a huge issue, and as such my particular interest here is not with any or every screen, but with the portable digital devices of the last four or five years, devices which, as will be argued, are the first real threats to the printed book as the primary carrier of written information. I want to argue that we make a significant mistake if we don't learn the lessons of Book History, bibliographic and textual scholarship, and also of recent theoretical work in the Digital Humanities, by taking into account the impact of the substrate on which our reading materials sit, and as such I believe these new artefacts deserve our attention.

But understanding is hard won. This thesis will argue that to understand e-readers, e-books, and readers' reaction to them, we must also better understand how we use technologies and artefacts more generally. E-reading is a special case of this wider phenomena and I hope to show that to understand either the specific instance or its parent group impacts upon our conception of the broader or narrower term. To better understand technology as a class of physical equipment[4] we must understand how we

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3   For more on these issues refer to Gold (ed.) *Debates in the Digital Humanities*.
4   We'll also consider, in passing, intangible technologies, ways of extending our abilities which aren't dependent on a physical item, man-made or naturally occurring, but the focus of this thesis is very

define it, how we interact with it, how it changes us, and how we make changes to it over time; I will argue that e-reading is the perfect case study for all of these effects. To better understand e-reading in turn we must negotiate the same principles, and we should turn to prior studies of technology to better situate them.

As I have already said, this pushes at a basic definition of what the Digital Humanities might be, but it nevertheless sits on a continuum from the theoretical work undertaken, at least retrospectively, in DH's name in the 1990s, work which formed the basis for the contemporary field. In *Writing Space* (Bolter, 1991), *Hypertext* (Landow, 1991), and *Hyper/Text/Theory* (Landow, ed., 1994) Jay David Bolter and George Landow set out theories, and theoretical implications for the new digital literature, databases, and environments that were starting to impact upon English study. These texts were rightly influential, but they were also very enthusiastic about the new forms and sought largely to see how the American academy's poststructual strategies of the time could be mapped onto digital products; there was little interest shown in the potential downsides of a shift in media from print to pixels, nor what was going on during programming, what effects code and coding might have upon the reader's reception of a text.

Espen Aarseth's *Cybertext: Perspectives on Ergodic Literature* (1997) bridges the gap between these early works and contemporary theoretical approaches to digital studies. Like Bolter and Landow, Aarseth was fascinated by the potential for the new hypertextual methods and what a "non-trivial" effort in traversing a text could mean for the kinds of work that might be created, but with his language of textons and scriptons[5] he also gave his readers a way into understanding the impact of code and increased the requirement to look at the apparatus on which they were accessing their new texts.

Picking up on Aarseth's language and, as we'll see in chapter 3, attempting to move on from Bolter and Landow's theoretical position, Katherine Hayles, first with *Writing Machines* (2002) and then with *Electronic Literature* (2008) sought to bring the close reading of classical English Studies to bear on digital resources, and also to see what effect those resources had started to have on more conventional printed work. Hayles' increasing sensitivity to the particularities of every aspect of digitisation has been hugely influential on the theoretical aspects of contemporary DH study and has

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much on physical interactions; even when considering metaphor and cognition it is bodies to which we will continually return.

[5]   A scripton is a line as it appears to the reader, a texton is a line as it appears in the text. Aarseth notes that these need not be the same; the code of an electronic text looks very different to the script that the reader encounters for instance.

made it both accessible to traditional media scholars and pushed it forward for a new generation of researchers. The effects of her work can perhaps be most keenly felt in that of her former student Mark B.N. Hansen who's *Embodying Technesis* (2000), *New Philosophy for New Media* (2004), and *Bodies in Code* (2006) join Hayles' rigorous digital reading practice with a philosophical concern with the body and Spinozan/Bergsonian/Deleuzian conceptions of affect[6].

Hayles' influence can also be felt in Matthew Kirschenbaum's *Mechanisms* (2008), a work which sits at the heart of recent theoretical discussions in the Digital Humanities, where the physical particularities of the computer are meticulously picked apart. Roughly, whereas Hansen encourages us to look at the effects of digital environments and artworks on the body, to read bodies better, Kirschenbaum asks us to look at the body of the machine to read *it* better; Hayles, in her readings of electronic and electronically inspired literature, looks at both bodies (though the human to a lesser extent perhaps) so that we might better read the text presented[7]. In each of these works there is a clear move away from Bolter and Landow's mapping of poststructuralism onto hypertexts, but they each retain an enthusiastic fascination with the new and how theoretical approaches might offer us a way into understanding.

In the drive for a phenomenological understanding of technology, and in particular of e-reading devices, this thesis continues the trajectory of the theoretical work outlined above; as Hayles sits roughly between the differently body-centred projects of Hansen and Kirschenbaum so too does this work, not in an effort to better read particular texts (though this will be addressed in the third chapter), but in an effort to better read the bodies of both user and technology and the point at which they meet. This meets a gap in the present academic literature: phenomenological readings of e-reading devices are numerous, but they're not where we might expect them to be. The astute observations of the effects of these new devices on the body and haptically-influenced psychology of their users are, as yet, under-represented in textual and digital studies research; Anne Mangen, whose work will be explored in the the second chapter, is starting to address these issues from a Cognitive Science perspective, but these effects also need to be discussed by Humanities scholars who are invested in these new forms of text and where they might sit in media history. Instead, the great abundance of

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[6] Hayles own concerns with the body and the text can be seen in *How We Became Posthuman* (1999) and they continue to haunt her later work; in *Electronic Literature*, for instance, she deals with the experience of time in digital texts.

[7] This has to be an artificial distinction, each of these writers wish to read texts better, but for the most part it holds as a rough division.

interesting philosophy on this subject is to be found in popular reports, blog posts, reviews, comments, editorials, and the like, and its this living archive that will act as a provocation to the chapters here (in the second chapter I will describe this work as "folk phenomenology," similar to a folk psychology in its need to influence, support, and also be challenged by academic work). Each chapter will begin with an idea commonly repeated in discussions of e-reading: "e-reading is unnatural," "e-reading doesn't feel right," "e-reading makes readers stupid." Each of these ideas appears frequently in the popular press and online, and deploying language which has become telling in itself in its historical precedent and more recent codification.

The work here then will draw on this material, interrogating the language and ideas being used and co-opted, and attempting to see what it brings to light and what it occludes in its prominence. In the second chapter I will also try and bridge some of the gap between the popular and the academic in my own report of what it's like to first encounter these devices; first person report has a rich history in phenomenological practice, originating with Edmund Husserl's descriptions of what it is like to encounter an object, what resonances it might produce within us, descriptions which have always mixed the seemingly banal, the literary, and the philosophical and attempted to make observations which appear both obvious and defamiliarising. From this base of attempting to articulate a novel experience I wil move on to developing a more rigorous phenomenological approach to interaction with artefacts, using e-readers as the principle example.

The phenomenology that I want to deploy has its roots in a Husserlian tradition of observation, report, and intention extended by Martin Heidegger's notion of a tool's readiness-to-hand and the user's experience of objects during use. I will build on this approach, however, by considering Heidegger's influence on contemporary Cognitive Neuroscience and seeking further empirical support for his claims, as well as rearticulating this scientifically aware phenomenology through Evolutionary Epistemology and Graham Harman's manifesto for an Object Oriented Ontology in *Tool-Being*[8]. The aim is to produce a phenomenology of encountering artefacts which can be at least partially supported empirically, and incorporates a variety of approaches to bodily experience to show how they might be productively combined in order to explore our complex interactions with technologies. An important aspect of the object-

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[8] Itself a radical re-reading of Heidegger's readiness-to-hand, a point I'll pick up again in the second chapter.

oriented approach is the building-in of the requirement that a full understanding of an interaction is dependent on also understanding the body of the artefact being interacted with; the phenomenological approach presented here wants to consider the points of relationship between user and tool, and, as I'll discuss shortly, whether that relationship should be considered special enough to be called "technological." This investigation will provide a language for discussing the artefacts we use to accomplish tasks in the world that we couldn't in isolation, to demonstrate that we have always used such things, that they are a part of our make-up, and to situate e-reading, if not necessarily particular e-readers, as another element along that continuum. It also aims to show that "technology" as a term is being deployed at all levels of discourse in a fashion which is incommensurate to the task of describing the intimacies of our interaction with objects and the cognitive processes they extend, processes which sit at the heart of how we understand our abilities. I will therefore offer a definition of the term which is sensitive to these issues before demonstrating how the experience of using the body in cognitive processes is applicable to the discussion of both technology and e-reading. Continuing my concerns with the bodies of both users and artefacts, I will turn to evolutionary epistemology in order to argue that artefacts develop via evolutionary pressures produced in response to users' phenomenological experience and that this allows us to see their forms as knowledge claims about their environment. In response to this I will also detail a phenomenological mechanism of "getting used" to technology, with e-readers as my example, showing the other side of the equation: how we adapt to artefacts as they conform to us. The thesis will conclude by demonstrating how, as our bodies affect our cognition, so to do the bodies of our tools in their functioning as material metaphors. This will be demonstrated with a consideration of several writers who use the artefacts of their day as productive sites of meaning in an extended text. In short I want to try and approach from all sides the intimate meeting of two physical bodies, the user's and the artefact's, and to consider their various effects on one another; as we shall see, the main sites of resistance to the change in reading practices marked by the digital can be traced back to bodily concerns, again making e-reading an apposite arena for this discussion.

The particularities of and distinctions between page and screen are in the process of being articulated as users come to understand them. Over the course of this thesis I will consider the tablet screen's projection rather than reflection of light (as seen in the printed page and Kindle screen); internet connectedness and distraction; changes in

haptics, ergonomics, and tactility; nostalgia, history, and mythology; and the perception of an artefact as technological (unnatural - e-reading) or naturalised (and somehow seemingly unartificial - a printed book). This list isn't complete, but in its being drawn from popular discussion I think that it represents the most pressing concerns experienced by typical users.

Before detailing a brief chapter breakdown I'd like to look a little closer at the objects which will often act as the final examples for the discussions presented here.

On 19 November 2007 Amazon launched a bid to expand its founding interest, the selling of books online, by releasing the Kindle electronic reading device. Following the frequently repeated promises to take book-length electronic reading (e-reading)[9] away from being a minority pursuit undertaken on a the tethered computer screen and into the realm of traditional bound-book like portability, the original Kindle, and its subsequent iterations[10] remain the totemic examples of this new form, appearing as a default in articles on the subject throughout the mainstream press[11]. Despite SONY releasing a similar product the year before[12] it's the Kindle which marks the first time the U.S. and U.K. public took notice, and in swift and significant numbers[13], of the adoption of a piece of equipment used exclusively for reading written content in a digital form (an e-reader)[14]. Prior to the announcement of the Kindle's release, critics of the potential for the mass adoption of electronic book (e-book) reading often looked to previous media revolutions for corollaries that might enable a prediction of the market to come. Their conclusion: what was required for the success of the new form was an "iPod for books," a device which did for electronic reading what the iPod achieved for

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[9]   The reading of written texts on a screen rather than a printed, or otherwise inscribed, material writing space.

[10] The Kindle 2 launched in February 2009, and an "international" version emerged in October allowing customers from over 100 countries to use the mobile internet connectivity enjoyed by U.S. customers from the first iteration. The third Kindle (Kindle 3) shipped simultaneously in the U.K. and U.S. on 27 August 2010. International postage was available from the U.S. site shortly afterwards.

[11] See, for instance, Patrick Béhar et al. "Publishing in the Digital Era: A Bain & Company Study for the Forum d'Avignon" or Craig Mod "Post-Artefact Books and Publishing," both of which use the Kindle as their sole example of e-reading devices, and the iPad as their default example of a tablet device.

[12] The PRS-500 (PRS standing for "portable reading system") went on sale in the U.S. in September 2006, and the PRS-505 begin to sell in the U.K. in September 2008. The PRS-350 and -650 launched in September 2010 and marked the first official foray into the Australasian market.

[13] The original Kindle sold out in five hours (Patel "Kindle Sells Out in 5.5 Hours").

[14] The first Kindle was only sold in the U.S., due in part to the difficulties of finding U.K. and European network providers for the internet enabled features of the device, but imports appear to have been fairly widespread, if largely undocumented, in these territories. The absence of internet connectivity ensured that it was never going to be of significant interest outside the U.S. (though anyone with an Amazon.com account could purchase the device), but reports in the national and international press were certainly fuelled by reporters able to actually interact with the new equipment.

the adoption of portable MP3 audio players, i.e. exploding the market, maximising the profits, and, more cynically, tying readers to a particular company's hardware[15]. The Kindle seemed, and was hailed to be that device[16]. It continues to be tremendously successful, it's third iteration leading the dedicated e-reader[17] market by some margin[18], and remaining the by-word for the new reading equipment.

After many months of rumour[19], Apple, the maker of the iPod, held a press conference on 27 January 2010 to officially announce the launch of the Apple iPad, a tablet computing device (see footnote 8) which caught the interest of e-reading commentators with its capacity for displaying e-books in colour (unlike the monochrome Kindle), on an arguably more intuitive touchscreen, and with greater capacity for annotation. The iPad was officially released in the United States on 3 April 2010 and in the U.K. (as well as Australia, Canada, France, Germany, Italy, Japan, Spain, and Switzerland) on 28 May[20]; the second iPad launched on the 11 March 2011, and to the U.K. and 24 other countries on the 25th. For many, the iPad represents another "true" start to the mass adoption of electronic reading; the sales for its two iterations thus far are huge[21], and outstrip those of the Kindle (though, as a multi-use device, it still leaves the question of where the most e-reading occurs unclear). The flexibility of the equipment may mean that as electronic reading materials and versatile tablet computing become normalised the desire to carry one device which combines all of the day-to-day functionality of the current range of digital media will win out.

But this thesis is not about future gazing, about suggesting which particular form

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[15] See for instance "The 'iPod for Books': Is It Game Over for Paper?"; Wilson "Has the iPod for Books Arrived?"; Munger "What the iPod for Books Needs to Be"; or Sebastian Mary's attack on the whole "hackneyed idea" in "Will the Real iPod for Reading Stand Up Now Please?"

[16] See Hansell "Amazon Pitches a Wireless iPod for Books" or Waugh "The iPod For Books?"

[17] Dedicated single-function device (SFD) or "single-use" e-readers focus on providing the writing space for book length materials as their main or only goal, most often attempting to emulate aspects of the codices which some hope, others fear, they might supplant. Tablet devices, to which we will turn very shortly, don't have this focus, attempting to be versatile screens capable of presenting a diversity of media equally capably. The term "tablet" (sometimes "slate") for this type of equipment evokes some of the earliest writing spaces in the historical record.

[18] "Shipments of e-readers…hit 5.1 million worldwide in the fourth quarter [of 2010], up 90% from the prior quarter and 116% from a year ago…Amazon remained the undisputed leader in the e-reader category, accounting for 59% of devices shipped...followed by Barnes & Noble at 11%, Sony, 5% and BenQ and Hanvon, each with 4%. Amazon gained 14 percentage points in share during 2010 and Barnes & Noble 3 points. In contrast, Sony's share has shrunk from 19% to 5% in the face of growing competition" (Walsh).

[19] See Matt Buchanan's guide at *Gizmodo,* "The Exhaustive Guide to Apple Tablet Rumours" which tracks patent rumours back to May 2009.

[20] See Apple's press release "iPad Available in Nine More Countries on May 28."

[21] Apple "sold some 15m iPads in 2010, the year in which the device was launched, and according to one forecast it could sell more than 40m of them in 2011...In 2010 iPads accounted for about 80% of total tablet sales" ("Taking the Tablets").

might come to predominate and why. E-reading is here, in myriad forms, and companies and apparatuses will spring up with increasing frequency. What this thesis will consider, however, is the discourse which surrounds these devices, a discourse which reveals something about their nature and reception, and what this might have to tell us about our wider experience of everyday life as tool users. Because beyond the interest, beyond the enthusiastic sales figures and adoption rates, digital reading has prompted concerns from bibliophiles, academics, high-school teachers, bloggers, parents, journalists, book-shop owners, librarians, and myriad other commentators from all levels of public discourse[22]. Their voices represent an often surprisingly coherent resistance to e-reading, one unmatched in voracity or constancy by its supporters. In-line with their most heard arguments I will invoke the Kindle and the iPad as representative devices of the current moment, but it is the resistance voiced which will most concern us here, a resistance the roots of which, this thesis will argue, emerge from somewhere deeper than the mundanities of voguish new tools and tap into some of our most fundamental concerns with being in the world. Though they will be tied, therefore, to the particular devices of the day I do want to position these concerns as something enduring in themselves.

Over the course of my argument here I would like to offer discussion of, and attempt potential explanations for the widespread popular resistance to electronic reading as it is represented in the mainstream media and public discourse of computer- and typographically-literate Anglo-American society. I must explain this paring down.

The effects of electronic reading and its associated equipment, certainly extend beyond the U.K. and North America, and will carry specificities even in different regions of those limited areas. My discussion will be restricted, however, to the predominant arguments found in the professional and lay media of these countries as they encapsulate the attitudes of faith and fear in the face of technological development that I would like to address. Cultures more dependent on the widespread deployment of complex or "high" technology in domestic life have markedly different attitudes to

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[22]   See, for instance, Sven Birkerts, *The Gutenberg Elegies: The Fate of Reading in an Electronic Age*; Robert Coover "The End of Books"; Caleb Crain "Twilight of the Books"; Alan Kaufman "The Electronic Book Burning"; Mark Ruxin "The Death of Touch and the Lost Joy of the Unexpected"; Christine Shaw Roome "I've Got the Screen Eyes to Prove it: How do Ebooks Really Compare to Traditional Books"; Sarah Schofield "Ten Things I Hate About eReaders"; Ben Ehrenreich "The Death of the Book"; Shane Richmond "The Printed Book Is Doomed: Here's Why"; Sam Leith "Is This the End For Books?"; David Dobbs "Is Page Reading Different From Screen Reading?" Susan Greenfield "We Are at Risk of Losing Our Imagination"; Gary Frost "Reading by Hand"; Anne Mangen "Why Bother With Print?"; and Max Bruinsma "Watching, Formerly Reading."

digital reading represented in their media. In Japan for instance, where care for the elderly increasingly includes robotics and all digital devices are expected to host an enormous catalogue of secondary abilities, long-form *keitai shosetsu* or "portable novel" reading on mobile phones has been established since 2006 (with half of Japan's best-selling novels in 2007 written for, and sometimes *on*, mobile phones (Yourgrau)). Though the form is often reviled by Japanese academics the resistance to a move away from codices still seems more muted; the novelty of the complex apparatus is gone, only its upper limits are questioned.

South American, Eastern European, African, Australasian and parts of the Middle and East Asian markets are often considered to be less lucrative to the American companies dominating the burgeoning e-reader market, and the penetration of the iPad and Kindle into these territories is both delayed and limited. As one study into e-reading notes "adoption rates [of e-readers] are projected to reach 15 percent to 20 percent of the population in developed countries...The United States and Korea are setting the pace and could see such penetration rates by 2015. Other countries, particularly those in Europe, will lag but eventually catch up" (Béhar et al 3); Africa and Middle and East Asia aren't even mentioned[23]. The debates in these geographical areas are very different, and in many cases become tied to literacy rates, the viability of internet access, or the democratic access to any kind of reading materials. Arguments surrounding e-books' deficiency in comparison to the codex, though important, can also smack of privilege when it is only through philanthropic ventures such as the One Laptop Per Child (OLPC) project that extensive reading can even becomes a viable option in some regions, and such issues highlight the specificity of Anglo-American concerns on this

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[23]   An overview of the countries the Kindle can be shipped to can be found in the *Blog Kindle* article "International release of Kindle 2!" Updated details on the various restrictions on wireless or 3G networking capabilities around the world with a comprehensive list of countries able to use these features can be found at the *Kindle Word* blog post "Listing of Countries with Free 3G and 3G browsing enabled - UPDATED." The list of countries excluded is telling:

> Afghanistan, Algeria, Azerbaijan, Bahrain, Bangladesh, Brunei Darussalam, Burkina Faso, Canada, Chad, China, Cuba, Djibouti, Egypt, Eritrea, Gambia, Guinea, Indonesia, Iran, Iraq, Israel, Jordan, Kazakhstan, Democratic People's Republic Of Korea, Kuwait, Kyrgyzstan, Lebanon, Libya, Malaysia, Maldives, Mali, Mauritania, Morocco, New Zealand, Niger, Nigeria, Oman, Pakistan, Palestinian Territories, Qatar, Saudi Arabia, Senegal, Sierra Leone, Singapore, Somalia, Sudan, Syrian Arab Republic, Tajikistan, Thailand, Tunisia, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen ("International release of Kindle 2!").

Few countries have been added since the Kindle 2 announcement, though Canada and New Zealand notably now have access. As described above, the iPad is currently only officially available in 25 countries, marked along similar lines.

subject.

An equally significant, though perhaps more prosaic reason for my focus comes from myriad language barriers limiting the scope of my exposure to the popular discourse on technology and e-reading from other regions, particularly their communities of bloggers, a resource that has been invaluable to the arguments put forward here, and without which this project could not exist.

In the absence of more global concerns, the thesis will centre around the notion that Anglo-American attitudes toward bound-book reading position it as more "natural" than its "technological" relative, and that this belief rests upon three larger concerns which do travel: our relationship with technology more generally, our existence as embodied beings, and our deployment of metaphor as an aide to understanding novel situations. Drawing on the popular manifestations of these concerns as they relate to e-reading, and as mentioned above, I will array my discussions around three phrases: "e-reading isn't natural"; "e-reading doesn't feel right"; and "e-reading is making us stupid." I want to investigate where these notions might come from, how legitimate their claims may be, and to some degree, to wonder if they're not, at root, much the same complaint: that reports of poor haptics and user stupidity stem from a perceived unnaturalness. Such ideas will be addressed in the wider context of the use and reception of technology generally.

This is certainly not a thesis against the idea of resistance, but the "mainstream media's often hyperbolic discourses…construct the new digital media's impact in terms of simplistic utopic/dystopic binary oppositions that foreclose reasoned and sober debates around digital and computing technologies' actual uses and effects" (Everett & Caldwell). Whilst much nuanced discussion of the issues occurs outside of editorials, the language which must be deployed has been hijacked and reduced, particularly terms like "technology," "intelligence," and "natural"; the words we are forced to use to ensure basic comprehension of the issues have either come to possess excess weight or have been emptied of meaning entirely, become vessels for half-understood agenda or misplaced hopes and fears. I will pay particular attention to the language that is used, however sensitively, especially that surrounding technology, to attempt to build a new vocabulary for such discussions whilst also demonstrating that to understand this current phenomena is to start to better understand our bodies and our minds, whether we realise it or not.

The first chapter will begin with by considering the claim that e-reading is "unnatural," particularly when juxtaposed to reading from a codex, and situate that idea within a history of attitudes towards technology more generally as expressed in the media, online, and in literature, from the Luddites and Romantics of the early 1800s to the American Romantics (Thoreau, Emerson, Williams) and onto the "neo-Luddites" of the twentieth century, a loosely cohered philosophy to be found in manifestoes, art, and direct actions identified by Steven Jones in *Against Technology*.

As this is a project primarily concerned with understanding embodied interactions I will focus on the notion of "visceral insulation" (Taylor 98), the idea that technology somehow gets between us and our environment, forming an unwanted mediating layer that deprives us of our natural engagement. This chapter, and portions of the second, hope to show that far from being somehow unnatural, the use of technology is at the heart of human action; technology, I will argue, is not the privileged domain of countries capable of producing highly complex artefacts, but instead underpins every human culture. This doesn't represent a deterministic argument, no technology can produce precisely quantifiable, predictable, or homogenous effects on the cultures in which it exists, but it is an assertion that the extensive use of technology is a determining factor in what makes us different from other animals and different from one another. The arguments of this chapter rest on the assertion that if the word "technology" can be used to describe something outside of our nature, and yet we are left with no word for the equipment which is inextricably interweaved with our everyday existence and history, then there is a failure of terminology which must be resolved. This need has become acute: as artefacts which are referred to as "technologies" become an ever increasingly significant part of our culture's way of life it becomes proportionally more vital to make that word into a subtle term which does work for us in contemporary debate. As such I will consider how the term has been deployed from its etymological roots, through various historical permutations (drawing on Leo Marx's excellent essay "Postmodern Pessimism"), and on into contemporary day-to-day use and attempts at theoretical rigour (Heidegger's "The Question Concerning Technology" being the most often cited attempt). With this example of technology's diversity, rather than specificity, in place I will advance my own definition, a definition which I believe is more sensitive to the intimate ways in which we are able to deploy equipment and which positions "technology" not as a class of objects, but as a type of interaction.

I will describe four key attributes an experience should possess if we are to think of it as being "technological":

- Extension - it extends our abilities.
- Communality - it exists as part of a cultural milieu.
- Incorporation - the artefact used can be "incorporated" via skilful use into our body image.
- Morphability - it has the capacity to alter some aspect of ourselves over continued use.

If an interaction with an artefact does not conform to these attributes I will instead suggest that the object is better understood as a "device," simply equipment for achieving a goal, and suggest, contrary to "common sense" approaches, that we would be far more accurate to consider some highly complex mechanical, electrical, and digital artefacts as not being technologies at all, instead saving that term for a particular kind of human engagement. Talking about any kind of homogeneity when it comes to human beings, however, is clearly fraught with reductionist/determinist pitfalls, not least because of our unique ability to modify our own pre-programmed drives and behaviours, often via cultural products, and with a plasticity unknown elsewhere in nature. But I would like to suggest only that to say that we don't have some common, repeated, and manifest traits from which we might identify the human race, however surmountable, seems both strange and misleading[24]. I will, throughout, often appeal to a biological base to our actions as readers which, whilst certainly not defining, are largely inescapable. Our bodies and the cognition that comes with them are products of evolution, and to ignore or write off that development, rather than seeing by how much we have strayed or can stray from it is not the path to a clear and subtle understanding of how we interact with our environment.

With a definition of technology established I will go on to argue that printed books are as "technological" as any e-reader, and that they are also as natural, in some aspects, and unnatural in others, as one another. This chapter will end with half of the working terminology for the project overall and an introduction to how we encounter

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[24] Antonio Damasio, in *Decartes' Error*, for instance identifies "somatic markers," the sameness of signals from the body that we experience each day, as the defining reason for continuity in our sense of self (165-203).

our technological objects, particularly e-readers which are clearly performing, or trying to perform each of the four elements described above as readers adjust to them.

   "E-reading doesn't feel right" is the starting point for the second chapter which considers the phenomenological experience of encountering objects, any object, and "getting used" to them. This chapter will argue that our aim in engaging with equipment is to promote successful interaction in the world for whatever value we currently attribute to "success." When we deem any interaction as unsuccessful we are prone to investing significant time in ensuring that the next occasion that the action must be performed will go more smoothly, or the outcome will be achieved to our satisfaction, particularly if we believe that the artefact will promote particularly useful action (e.g. car driving, learning to use a computer) or is seemingly unavoidable (e.g. learning to read). E-readers are objects which appear, for many people, to be an impediment to previously successful action, and I would like to explore both why this might be the case, and why I believe that the impediments, such as they are, can for the most part be overcome. This idea of "getting used" to e-readers will be considered phenomenologically in that I hope to show a mechanism at the heart of the experience which tends to be true for all engagements with unfamiliar artefacts.

   The chapter begins with an exploration of the importance of the body, touch, and gesture in thinking and reading drawn from Cognitive Psychology (Shaun Gallagher, Frank Wilson, Merlin Donald[25]), Philosophy (particularly the phenomenology of Husserl, Heidegger, and Maurice Merleau-Ponty), and popular report. These discourses will underpin the argument that one of the main reasons that we are so proficient with the codex, and so able to receive its physical suggestions, is that we have built up expert use of it through intense practice, establishing common "gestures" of use, and we are conditioned to its specificities in a way that many readers are not, yet, with electronic texts. But what does it mean to get used to something?

   In order to approach this idea the chapter outlines the basic evolutionary mechanism of adaptation to the environment in biological forms, the fundamental "getting used" in the natural world, and then takes that idea to the discipline of

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[25]   Throughout the thesis I will also be engaging with numerous Cognitive and Neuropsychological studies from experimental practitioners less well known outside of their host disciplines (Gallagher, Wilson, and Donald have all produced works which are attractive to lay audiences and have sizeable readerships). These studies, presented in scientific papers, have for the most part, never been discussed in Humanities circles, and several were only conducted within 18 months of writing this work.

Evolutionary Epistemology. The psychologist Henry Plotkin sees the evolution of creatures' bodies, as well as their cognition, as being a growth in a species' knowledge of the world, hence their forms represent an epistemological claim. My argument will be that our artefacts are also evolved, that they adapt to their environment of users, and in this way their bodies too can be seen as instantiations of knowledge about their world. In this way artefacts, e-readers for example, can get used to their users and we can read evidence for this in the rapidly emerging generations of e-readers beginning to know their audience. As far as I can tell, though other writers have considered the evolution of artefacts[26], there has been no deployment of evolutionary epistemology to consider the significance of artefacts' materiality.

With this mechanism in place the chapter will turn to the other side of adapting to equipment, the user, and consider the phenomenological experience of our own adaptation to novel objects. I will appropriate the term *eidos* from Husserl (and before him a tradition extending back to Plato and Aristotle) to describe not something's essence, as it has come to mean, but the features that we perceive of an object which makes it what it is to us. As we adapt to an object I will argue that it's *eidos* changes without any change occurring in the thing itself; as we familiarise ourselves with e-readers our *eidos* of them alters such that they cease to feel alien, becoming literally new items to our experience without ever changing in themselves.

Other terms from Husserl's work, "givenness," "constitution," or the contested term "*noema*," describe similar effects, but aside from the issues I have with these terms (which will be discussed more fully in the chapter) they are indelibly associated with Husserl's assertion that phenomenological appearances emerge directly from things "as they are." By refashioning *eidos*, however I get to preserve the weight of that term whilst altering the metaphysical assertions which underpin the changing face of perceptions. Although it is not the primary focus of this chapter, the relatively new field of Object Oriented Ontology (OOO) structures the underlying metaphysics of the phenomenological assertions outlined here, particularly as it's voiced by Harman (*Tool-Being*, *Guerilla Metaphysics*) who uses Heidegger's tool analysis (vital to the arguments on "incorporation" in the first chapter) to produce a new understanding of objects. OOO has a persuasive interest in the lives of objects themselves, independent of their apprehension even by the cause and effect of other inanimate forms. My arguments,

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[26] See for instance Walter Vincenti *What Engineers Know and How They Know It*; George Basalla *The Evolution of Technology*; and Carl Mitcham *Thinking Through Technology: The Path Between Engineering and Philosophy*.

throughout, are about materiality and the influence of the physics of things upon cognition, and I outline an aside on Harman's conception of OOO as an acknowledgement that agency in these performances of "getting used" is spread onto the things we use just as much as it is displaced from our minds and onto our bodies in a post-dualist understanding of thought.

The chapter concludes with a consideration of how we might get used to e-readers specifically, suggesting that it is not only possible but likely if we persist in using them frequently, refining our skill and feeding suggestions from our own use into their ensuing generations; there is nothing so alien about their form that we cannot adjust to them if we perceive a worth in doing so.

The last chapter is built around the idea that the new equipment for reading can somehow make us more "stupid," the phrasing drawn from Nicholas Carr's now notorious article for *The Atlantic* "Is Google Making Us Stupid?" Whilst Carr's argument is not directly concerned with portable e-readers, I will demonstrate how deeply intrenched ways of thinking associated with the internet have become in all forms of screen use, particularly with regard to hyperlinking, and as such why we must consider them in order to understand the newest reading artefacts. The chapter therefore begins by outlining numerous examples of readers concerned with how reading on screen, particularly the fractured reading practices undertaken online, have disrupted their, and others' ways of apprehending information.

Putting aside the forms of content consumed, I want to consider whether the artefacts of e-reading themselves could have an effect on cognition. That certain kinds of thinking can be fostered by the particularities of artefacts will have been partially explored in the second chapter, but the third focuses expressly on e-readers and codices as "objects-to-think-with" (Turkle, *Life on Screen* 48), artefacts which promote particular ways of thinking. By drawing on the psychologist James Gibson's notion of objects "affording" certain activities, this chapter will use George Lakoff and Mark Johnson's studies of our deep reliance on metaphor, particularly when encountering unfamiliar scenarios, to explore the notion of "material metaphors." The three terms, objects-to-think-with, affordances, and material metaphors, all point to how the use of things can alter how we think, but the form of e-readers, far from promoting stupidity or stifling novel thought in fact seem more adept at enacting the complexities of post-structural and postmodern philosophies concerned with breakdowns of hierarchy,

networks, and emergent properties, thereby enhancing the user's ability to question received wisdom, a function that the emergence of writing some few thousand years ago also achieved.

As we will see, however, this apparent promise risks restriction when the affordances of the codex are positioned as the "natural" or default way of engaging with written text. Linear access in particular will be criticised as the sole mode of engagement suited to our most significant thought processes, and the hangovers from this viewpoint will be explored in their manifestations in the new equipment. In this regard a term from archaeology, "skeuomorph," will be used to describe the repetition of book-like metaphors in digital forms which no longer require their strictures.

The third chapter concludes with "media-specific analyses" (Hayles, "Print is Flat...") of three writers, E.E. Cummings[27], Mark Z. Danielewski, and Jonathan Safran Foer, who responded to the means of production of their era and, in the case of Danielewski and Foer, address the threat of digitisation to printed pages and the codex form. These writers have each transformed the pages of their work into material metaphors, offering expanded capacity for meaning making, and again Danieleski and Foer show that far from limiting thought, digitisation, as a companion form or even a threat, can promote novel and nuanced ways of thinking about otherwise stagnating or invisible quotidian forms.

Over the course of the thesis I would like to demonstrate how we might bring the latest insights from Philosophy and Cognitive Neuroscience to bear on these three broad issues of naturalness, haptics, and intellectual impediment, particularly in their views on and meeting points regarding the impact of our embodiment on encountering objects in the world[28]. In this way I hope that the project sits at an intersection between English

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[27] For a discussion of the capitalisation (or not) of Cummings' name (often written as "e.e. cummings") see Norman Friedman "Not 'e.e. cummings'," and "Not 'e.e. cummings' REVISITED."

[28] This combination is hardly unprecedented. For several examples of how phenomenology has been incorporated into Neuropsychology see Shaun Gallagher and Dan Zahavi, *The Phenomenological Mind* 30-40. Gallagher and Zahavi describe a concept of "front-loading phenomenology":

> Just as experimental designs can be informed by specific theories, experiments can also be informed by phenomenological insights - that is, insights developed in independently conducted phenomenological analyses, or in previous neurophenomenological experiments. In such cases phenomenology is "front-loaded" into the experimental design, [though] there may or may not be any phenomenological method, or even introspection in the strong sense, explicitly used in the experiment itself (Gallagher, "Experimenting" 125).

For more examples of front-loading phenomenology see Larssen et al, "The Feel Dimension..."

Studies, Philosophy, the Digital Humanities, and the nascent "cognitive turn" in literary studies. As mentioned in the description of chapter two above, the thesis also draws on Evolutionary Biology's philosophical implications for theory of technology, and there is a clear reason for the broad spread of ideas that have been put to work here: There simply isn't a formulation of how people encounter these new artefacts, we have relatively little conception of how people approach them, interact with them, and on what terms, and as such we're also ill-equipped to learn from their deployment. Anne Mangen, a Psychology researcher whose work specifically deals with reading on screen, argues that

> [t]he feeling of literally being in touch with the text is lost when your actions - clicking with the mouse, pointing on touch screens or scrolling with keys or on touch pads - take place at a distance from the digital text, which is, somehow, somewhere inside the computer, the e-book or the mobile phone. Because of this ontological intangibility of the digital text, our phenomenological experience - reading - of the digital text will differ profoundly from that of a print text. The print text is tangible - it is physically, tactilely, graspable, in ways that digital texts are not (until they are printed out and hence no longer digital). Such a difference is phenomenologically distinct, meaning that it will have significant - if theoretically overlooked - consequences for our reading of the different texts ("Hypertext..." 408).

The third chapter will deal with the notion of "intangibility" that Mangen raises here, but what is important to note from the outset is Mangen's assertion that such vital bodily interactions (bodily on both sides of the interaction) have been overlooked. She notes that "[s]everal studies point to the importance of addressing the multisensory dimension of digital reading...without really pursuing the issue any further" (Mangen "Hypertext fiction reading")[29]; such information, I have argued, instead remains bound up within personal reports and the language used to report, whether it be popular, journalistic, academic, amateur, or literary, and as such the work of English Studies researchers familiar with interpreting written materials is vital in divining the effects of the medium currently being played out.

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[29] Mangen cites the following studies in this regard: Back "The Reading Senses"; Bearne "Rethinking Literacy: Communication, Representation and Text"; Kress *Literacy in the New Media Age*; Mackey *Literacies Across Media: Playing the Text*; Mackey *Mapping Recreational Literacies: Contemporary Adults at Play*; Merchant "Writing the Future in the Digital Age"; Walsh "The 'Textual Shift': Examining the Reading Process With Print, Visual and Multimodal Texts"; Walsh, Asha, and Sprainger, "Reading Digital Texts."

One final piece of terminology which needs to be clarified from the outset is my use of the term "codex." Most writers on the subject of the digital texts which act as replicants of print use the terms "e-book" for the artwork, "e-reader" for the device which holds the e-book, and "book" or "p-book" to describe the emulated printed corollary. What this emphasises is a norm of print from which an e-book can only ever be a deviation (and normally, as we'll see, a denigrated one). But I want to take and apply Derrida's notion that it isn't "appropriate to conflate the question of the book with that of technologies of printing and reproduction: there were books both before and after the invention of printing, for example" (*Paper Machine* 4); "book," as I'm using it here, refers simply to a written work of a length which would distinguish it from an essay or short story. The term is not precise (and I do not use it often) as my concerns here are rarely with content, more with the form and physicality of their presentation. I will instead deploy the terms "codex," or, less often, "printed book" to describe a printed work of this size bound down one side, and "e-book" to describe the digital equivalent, however it may be presented. This, I hope, will continually reinforce the medial specificity that I'm concerned with without privileging one side as the "true" presentation of the book. Book, after all, is a less than precise word in and of itself:

> All of our words for book refer, at root, to forms no longer recognizable as such: biblos being the Greek word for the pith of the papyrus stalk (on which texts in the Greco-Roman world were inscribed); libri being Latin for the inner bark of a tree, just as the Old English bóc and Old Norse bók referred to the beech tree. Likewise 'tome' is from a Greek word for a cutting (of papyrus) and 'volume' is from the Latin for a rolled-up thing - a scroll, which is the form most texts took until they were replaced by folded parchment codices. Prior to the late 13th century, when paper was first brought to Europe from China, the great works of Western civilization were recorded on the skins of animals. The Inca wrote by knotting strings. The ancient Chinese scrawled calligraphy on cliffs. (Do mountains count as books?) The printed, paper book, as we know it, dates only to the mid-fifteenth century, but those early Gutenberg exemplars were hardly something you'd curl up with on a rainy Sunday afternoon. The book as an affordable object of mass production...was not born until the 19th century, just in time for the early announcements of its death (Ehrenreich).

Perhaps the most important distinction in my use of "codex" is that it is intended to invoke the "book" of the popular imagination to which Ehrenreich finally settles in the above quotation. When the commentators discussed over the next three chapters say that

"books are natural" or "books are under threat" their readers knows exactly what they're referring to: mass market paperbacks, library books, second-hand book store books, and, to some extent, good looking hardbacks (at least in the discussions from bibliophiles). Certainly there is imprecision to this use, and yet it is widespread. The transcendent, Platonic book to which they refer is not a historically contingent medial instantiation, it is an eternal Penguin Modern Classics. Everything that falls roughly within range of this ideal will simply be called a "codex" or "bound/printed book" from here on out.

This thesis is based on the belief that a fundamental change in our reading practices will occur as we move from codex to e-book, but the fact remains that we cannot know what the effects will be, only that their possibilities need to be considered ahead of time. Such a conclusion can be drawn due to the extensive work in Book History Studies on the emergence and standardisation of reading practices over generations of engagement[30]. Though their often tend to be chapters addressing digitisation in recent Book History works, as yet there exists no extended study of how readers approach texts on portable digital equipment, particularly from a phenomenological point of view[31]. This comes by design of course, Book History is just that, a historicising practice, and we are only just approaching a time where such histories are even possible to write. The psychological approach that I'm advocating here allows for phenomenological considerations whilst working with and within a change which is occurring around us. In order to work with the current, the untested, this thesis associates its discussion not with Book History, but with fields which are capable of already having produced testable data as well as theory, fields not typically considered from within the Humanities. But we must seek out the moments of potentially pivotal importance as they arrive and assess them well; part of the role of the Humanities has surely become the identification of such potential sites. The birth of portable and widespread e-reading represents a genuine opportunity to learn as we upset one of the most defining evolutionary forces in our lives: the item under discussion is

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[30] See for example Jeffery Masten, Peter Stallybrass, and Nancy J. Vickers *Language Machines*; Warren Chappell *A Short History of the Printed Word*; Roger Chartier *The Order of Books*; Elizabeth Eisenstein *The Printing Press as an Agent of Change*; David Hall *Cultures of Print: Essays in the History of the Book*; Adrian Johns *The Nature of the Book: Print and Knowledge in the Making*; D. F. McKenzie *Bibliography and the Sociology of Texts*; and David Finklestein and Alistair McCleery *The Book History Reader.*

[31] David Levy's *Scrolling Forward* seems a notable exception, but again his focus is not on e-reading specifically.

not just reading, but the external storage of information, and the use of technology. It's a shock to no one, however, that writing can often capture the personal experience of the world in far greater detail than any experiment; as the Evolutionary Cognitive Psychologist Merlin Donald puts it

> [l]iterature affords us a great luxury, one that we lack completely in the clinical study of consciousness because even the most experienced clinicians remain outsiders to their patients' minds and are constrained by the formal, conventional nature of their encounters with others. Fiction is not so fettered. It is entirely the product of the imagination, and therefore, writers are not so bound by convention. Their perspective provides a… reality check, built from expert observations but from the inside. For this reason alone, literature must become part of our database. It is perhaps the most articulate source we have on the phenomenology of human experience (*So Rare* 78).

I hope that this project contributes toward reversing this flow somewhat, making more of the obvious and numerous links between the fields invoked in the discussion of electronic reading devices. To intentionally blind ourselves to aspects of the object under discussion is a non-workable strategy if we wish to progress in our understanding, but for most of us, myself certainly included, polymathism simply isn't an option. And yet I firmly believe that "some knowledge is better than none" (Donald, *Origins* 202), provided that we realise and acknowledge our limitations. In her own work on embodied readers and texts Karen Littau invokes ideas of "neurochemical" alterations to, and "literal rewiring" of brains via reading on screen (56-57), but she goes no further, providing little evidence for her claim. I think that this slip, which comes in the midst of an otherwise excellent argument, stems from an unavoidable acknowledgement that Neuropsychology had much to offer her project's thesis of the importance of not neglecting the body which interprets, or aids interpretation of a text. But recourse to a few lines of abstract "science," a mere payment of lip-service, is not enough; there must be an attempt to engage, at the same time as acknowledging when to refer the reader to the relevant materials if they wish to pursue the roots that lie beneath the borrowed idea, metaphor, or concept. At this stage dialogue, generosity, and deference to established expertise where necessary is what is required, and I hope that I have moved in these directions wherever possible.

Chapter 1 - The Tools of Our Nature

When the perverse ingenuity of man has outered some part of his being in material technology, his entire sense ratio is altered. He is then compelled to behold this fragment of himself 'closing itself as in steel.' In beholding this new thing, man is compelled to become it.

- Marshall McLuhan, *New Media* 195

The idea of humans versus technology is wrong...Technology is at least as critical to our identity as our soft tissues.

- Timothy Taylor, *The Artificial Ape* 189

"The use of technologies in reading is 'unnatural.'" This stance ranges throughout the popular discourses surrounding resistance to digital reading devices, from Sven Birkerts' assertion in *The Gutenberg Elegies* that he is "an unregenerate reader, one who still believes that language and not technology is the true evolutionary miracle" ((1996) 6) to David Gelernter's solution for digital technology being useful, but the codex being somehow "right": "I assume that technology will soon start moving in the *natural* direction: integrating chips into books, not vice versa" ("The Book Made Better," my emphasis)[32].

By using that word, "resistance," I fully intend to invoke a political, moral, or ethical claim to avoiding or repudiating the move toward a new norm of electronic text, to allowing a generation to grow up reading from screens rather than paper pages. Such resistance is at the heart of contemporary discussion of reading, and Birkerts is amongst the most eloquent, and most read, detractors, picking up on this language of the unnatural throughout his work. His playing up of a dichotomy between the reader's "natural" interaction with a bound book and the "unnatural" processes of reading on a multimedia screen recurs frequently throughout the …*Elegies*: "[r]unning the eyes down column-inches of print is part of the former way of processing the world, but it is no longer the natural mode for many. Not when bits of information stream in from every

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[32]   Gelernter would like to see codices augmented with certain digital elements; his examples include making it "beep" if you've misplaced it, or being able to search its text online (though why he prefers this option over a parallel searchable digital copy on his home computer that he simply chooses not to use for primary access is not explained), whilst maintaining the codex's functionality if the electronics fail.

source, there to be isolated and studied as needed" ((2006) 238). It is clear from Birkerts' phrasing here that this new mode may have become the default, but to him it seems far from natural. This way of thinking reaches its apotheosis in the following: "[w]hat [codex] reading does, ultimately, is keep alive the dangerous and exhilarating idea that a life is not a sequence of lived moments, but a destiny. That God or no God, life has a unitary pattern inscribed within it" ((1996) 85). This final quotation gets to the crux of the resistance to "unnatural" reading practices: for those set most firmly against digital reading technology, codex reading, and all of its related practices, has become an almost religious or spiritual experience, tapping into something at the centre of who we are. In this regard Alan Kaufman, in a ferocious article entitled "The Electronic Book Burning" says of his hatred of digitisation:

> My books have been hardwon. What made it all seem worthwhile was the book, the physical item, a kind of sacred and appropriate temple for the text contained within. Had I been told from youth that my literary destination would be some 7 inch plastic gizmo containing my texts shuffling alongside thousands of other 'texts' I would have spit in the face of such a profession and become instead a hit man or a rabbi...To me, the book is one of life's most sacred objects, a torah, a testament, something not only worth living for but as shown in Ray Bradbury's *Fahrenheit 451*, something that is even worth dying for. And yet, though I have been willing to sacrifice everything for the books I have written, compiled or just read, though I have given the days of my life, my years, my youth and adulthood to the book, as both sacred object and text, I am now witness to the culture turning away en masse from the book. The world is moving to embrace the electronic media as its principle mode of expression. The human has opted for the machine, and its ghosts, over the haptic companionship and didactic embodiment of the physical book.

Not all commentators would go this far, of course, and I suspect that many of those who imply or deploy that word "unnatural" would deride Birkerts' and Kaufman's polemic. But it does feel as if each instance somehow stems from a common pool, and part of the function of this chapter will be to investigate why the rhetoric of the unnatural is so pervasive in such resistance. As we shall see, however, this leads us out to a wider idea of the resistance to technology more generally, an idea which cannot be ignored if we want to best understand the concern with a move toward e-reading.

Technology, too, suffers this tag of the unnatural, the sacrilegious. As I intend to demonstrate, however, there is no such thing as "technology" by any persuasive definition, nothing we can point to or touch, or describe consistent properties of,

particularly in its day-to-day use. Technology is a consensus description of sets of artefacts and practices, but one which is singly unidentified as such. When we group items under the term "synthetic," for instance, they have a common property to which we can point: the term describes items which do not occur without processing of some kind. When we identify items, rituals, events, or people as "religious," or religiously significant, there may be no materially quantifiable property, but we can certainly describe why we might consider something or someone as such with little effort, appealing only to their immediate relation to some well defined cultural construction. "Art" is a perennially challenging category of artefacts and effort, but we can still make appeals to creativity, novelty, craft. There may be extensive arguments and recalibrations, particularly at the margins of what has traditionally been accepted as such, but at least the existence of the discussion makes the fluidity of the categorisation apparent. The same is not true, however, of "technology"; technology somehow just *is*, remaining resistant to nuanced definition even in its outlying cases: is a hammer a technology? Is it of the same order of things as a computer? Is complexity enough to distinguish between the two? This has led to a strange scenario where a commentator such as Birkerts can describe reading a book as the most "natural" thing in the world, but reading on a screen as a technological twist too far; this is possible, and acceptable, for the sole reason that most of us do not have a working definition of technology which excludes such an assertion. And yet I believe that a viable working definition can and should exclude Birkert's contention, and that any definition which fails to do so simply doesn't recognise the power technology wields over every human life. This, then, is where my argument will begin, by outlining a definition of technology so that we might better understand the resistance to the new digital implements of reading as existing in a continuation of an "adversary culture" (Marx "Technology: the Emergence...") with a long history and similar motivations aimed at the notion of "technology" at large. I will suggest that to say that any technology is somehow unnatural reveals the glaring need for a more nuanced definition of the term, one sensitive to our embodiment's relation to our equipment. As we shall return to throughout this work, changes in the artefacts of reading provokes such discussion as the reading experience is one of the most intimate technological engagements we can achieve, and both as bodily as dancing and as unnatural as driving a car. To better understand the term "technology" is to better understand the books we read, and as such I hope it will prove the right place to begin.

For nature, against technology

The history of resistance to what we would commonly call technology is most often traced back to the start of the industrial revolution and the Luddite movement[33] which saw outbreaks of violent dissent against the new machines of agriculture and production in the wake of widespread unemployment. Richard Bulliet, however, traces an even earlier history in "Determinism and Pre-Industrial Technology," the medieval Middle East being his case in point. Bulliet questions the notion of inevitability in a linear teleological progression of technological development, his research demonstrating that communities resisted adopting certain efficient technologies such as alternative yoking mechanisms for beasts of burden, the use of wheeled transport and wheelbarrows, and even early forms of print, all of which were deployed by geographically proximal cultures. The reasons he cites for such refusal include class-based resistance, but also ethnic and lifestyle factors, an attitude of "us and them" with relation to the surrounding cultures which prevented adoption of outwardly superior technological contrivances. It is easy to see how such moralism might feed into resistance with the belief that "they do x, we're superior to them and yet we use y, therefore y is correct/right/natural."

The reasons to resist technology, then, are numerous and have become deeply rooted around the world, significantly predating the proliferation of the complex artefacts which seem to mark out various contemporary cultures as being somehow more technologically minded. From the Enlightenment onwards, however, romanticised (and Romantic) resistances appealing to a return to natural living became increasingly widespread in direct proportion to the perceived impact of technology on the average citizen's daily life. Jones identifies a movement, "Neo-Luddism" (*Against Technology* 20), which draws upon the Luddite history, if in somewhat bastardised fashion, and can be taken to encompass viewpoints as diverse as a continuation of the original Luddite fear of displacing human labour with mechanical apparatus, to a full blown "technophobia," a more general fear of the negative potential inherent in increasingly complex technologies. Jones says of modern resistance to technology, and its extreme Neo-Luddite forms, that

> [m]any assume that to resist technology is a folly (if a noble one). The
> original historical Luddites in England circa 1811, the workers from

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[33]   See for instance Steven Jones *Against Technology: From the Luddites to Neo-Ludditism* and Nichols Fox *Against the Machine: The Hidden Luddite Tradition in Literature, Art, and Individual Lives*.

whom we get the name, have mistakenly been made into the poster children for this assumption. Today 'Luddite' often means 'deluded technophobe'...[D]etermined weavers and cloth finishers, skilled artisans demanding fair wages and control over their own trade, were often wrongly interpreted as champions of the simple life and of nature, as voluntary primitives and Romantics...[But, Jones argues, it was the Luddites'] right to *their* technology [that] they fought to protect, not some Romantic idyll in an imagined pretechnological nature (*Against Technology* 3&9).

Todays Neo-Luddites are, if not always apolitical, then certainly not always fighting for workers' rights, instead embracing an idyllic pretechnological state that modern society thwarts any attempt to move towards. I am certainly not suggesting that contemporary fears, however they are manifested, are unfounded, indeed the contemporary crises of global warming, oil spills, water shortages, grain riots, GM crops, and antibiotic resistant "superbugs" are continual reminders that questioning the unrelenting pursuit of technological progress is essential to any hope of a responsible consumer society. Jones, however, also acknowledges a problem in uniform resistance: "There are undoubtedly real technology-based conspiracies or patterns of connectedness at work behind the scenes and a general suspicion in this regard is not paranoid in the clinical sense: It is prudent citizenship...But the nature of any paranoid response is a tendency to universalize its fears" (*Against Technology* 176). The strength of the resistance shown toward digital reading seems to be a case of this universalised fear, demonstrating that the questioning of technological change may also prove detrimental if left unquestioned itself. Screen reading might mark a potential ecological improvement over the current printed book industry[34], may allow for greater and more democratic access to cultural works from all literate cultures[35], might encourage a generation used to television and computers not to abandon reading[36], and might even simply be a convenient way to access written material. If the resistance to it is just a slavish adherence to an older trend of cynicism in the face of the new then, no matter how useful or practical that trend, it deserves to be interrogated.

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[34] A round up of blog posts and newspaper articles on this discussion can be found at the *eco libris* site ("ebooks vs paper books"). The consensus seems to be cautiously in favour with one sizeable caveat: don't upgrade your e-reader too regularly.

[35] See for instance the Worldreader and One Laptop Per Child projects which provide libraries of digital texts to developing countries, the Worldreader project in particular providing work from Sub-Saharan African publishers and authors.

[36] See Lauren Barack "The Kindles Are Coming" report for the *School Library Journal* which discusses children's increased enthusiasm for reading on electronic devices for reasons of portability, secrecy (keeping how much reading they're doing from friends who might judge the activity), and novelty.

As I have suggested, codex reading has become built into a dialogue of the "natural," with screens and digitisation being positioned, by definition, as occupying an opposed unnaturalness. Nature is often, now, seen as the privileged term in a dyad with culture, artifice, or even the human, but "[m]uch of the extravagant hope generated by the Enlightenment project derived from a trust in the virtually limitless expansion of new knowledge of - and thus enhanced power over - nature" (Marx, "Postmodern Pessimism," 239). It is a resistance to this project of dominion which shapes Neo-Luddite critique, most extremely seen in the extension of Rousseau's "noble savage" (the most typically Romantic of resistances) to the anti-technology, anti-civilisation "anarcho-primitivism" touted by the philosopher and self-professed Neo-Luddite John Zerzan[37] and his sympathies with the manifesto of Theodore Kaczynski, the Unabomber[38]. More moderate resistant voices do, of course, exist, for example in the work of John Gray whose *Straw Dogs* questions the modern faith in the progress of technology as a replacement for religious belief, and earlier in the American Romanticism of Henry David Thoreau, Ralph Waldo Emerson, and William Carlos Williams where we can sense much the same way of thinking:

> Men have become tools of their tools (Thoreau 61).

> Here are great arts and little men. Here is greatness begotten of paltriness...Every victory over matter ought to recommend to man the worth of his nature. But now one wonders who did all this good...'Tis too plain that with the material power the moral progress has not kept pace. It appears that we have not made a judicious investment. Works and days were offered us, and we took works (Emerson "Works and Days").

> Machines were not so much to save time as to save dignity that fears the animate touch. It is miraculous the energy that goes into inventions here. Do you know that it now takes just ten minutes to put a bushel of wheat on the market from planting to selling, whereas it took three hours in our colonial days? That's striking. It must have been a tremendous force that would do that. That force is fear that robs the emotions: a mechanism to increase the gap between touch and thing, not to have contact (Williams 182-183).

Technology is about placing a mediating layer between us and the world to Williams, to save "dignity" as he scornfully puts it, a move away from our visceral interaction with

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[37] "It seems to me we're in a barren, impoverished, technicized place and that these characteristics are interrelated" (Zerzan, "Against Technology" 1).

[38] See Zerzan's *Elements of Refusal*, *Future Primitive*, and *Running on Emptiness*, and Kaczynski's "Unabomber Manifesto" (originally titled *Industrial Society and its Future*).

the physical for the sake of an unnatural propriety. There's also a sense of this mediation in Birkerts and Kaufman's work, that the new technology separates us from a rich physical world of which the bound book is a unique part[39]. Again, elements of this discussion are widespread online, with innumerable blog posts on the pitfalls of screen reading appealing to a perceived separation from material existence. The following is typical of such: "eReaders give nothing away about the journey you've taken with a book. No dog-ears, smells or smudges. They don't express a life shared with a story. In the future, people won't lovingly pass on the battered books they read repeatedly as kids" (Schofield, "Ten Things I Hate About eReaders")[40].

Andrew Feenburg also discusses technology in general in light of its mediation of our embodiment:

> God creates the world without suffering any recoil, side effects, or blowback. This is the ultimate practical hierarchy establishing a one-to-one relation between actor and object. But we are not gods...Technical action represents a partial escape from the human condition. We call an action 'technical' when the actor's impact on the object is out of all proportion to the return feedback affecting the actor. We hurtle two tons of metal down the freeway while sitting in comfort listening to Mozart or the Beatles (48).

Technology allows us to temporarily exert a dominion usually beyond us, diminishing our perceived effort whilst maximising our output, and making us come closer to the work of a God immune to Newton's third law, hampered only by our persisting embodiment. But the price is its acting as a barrier, an escape from the human, barricading us from and inoculating us to the world.

However, this isn't necessarily an aspect of a peculiar modern technology, it's an aspect of tool use that goes back thousands of years. What is different may simply be the extent to which such "visceral insulation" is deployed in every aspect of modern life:

> the comforts of modern civilization reduce the amount of food we

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[39]   We will see more of this in a discussion of Birkerts' notion of the relative "weight" of printed and digitised pages in chapter three.

[40]   Scofield's post is a good example of common problems with the new reading equipment emphasised in the popular resistance to e-reading, particularly perceptions of fragility ("an e-reader will break if my cat sits on it"), expense (Scofield invokes an imaginary phone call to a bus depot to negotiate an e-reader's safe return versus the sad, but relatively unproblematic loss of a codex), and battery life ("[t]hey rely on a battery which is bad for the environment, and impractical for camping").

> biologically need to burn metabolically in order to keep our bodies warm. But the technology that insulates us from cold and exhaustion also insulates us from the psychic rawness of nature. Visceral insulation is the trend toward disengagement from the actuality of hunting, killing, and gutting, or, in the case of domesticated animals, of rearing for the table and then physically dispatching...Visceral insulation is a reverb of increasing technology (Taylor, *Artificial* 98).

Undoubtedly, modern technology is connected to a distance from some of the harsher realities of keeping a large population fed, clothed, and sheltered, but is this a defining aspect of the technology or a particular cultural application? Taylor's discussion of such insulation in food production from "late-fourth-millenium" Mesopotamia would suggest the latter: found at archaeological sites exploring ancient Mesopotamia are

> thousands of ugly and cheaply made artifacts known as...BRBs [bevel-rimmed bowls]. These Urak-culture artifacts are the earliest prototype of the Styrofoam fast-food container: sun-dried, thick walled, conical sided pottery bowls for holding food...[E]ach was...filled, probably only once, with a basic, no-frills worker's ration of barley porridge. Sufficiently refueled to continue with the corvé labor that was needed to build large civic works...the worker (probably a slave) simply threw away the BRB...What the BRBs mean is that we know that there were by this time people in the world who had lost the direct chain of contact with the source of food that they ate...The psychological effect of BRBs should not be underplayed...; now that food was prepared centrally, animals were killed centrally. Or, in fact, away from the center, as that is what a 'shambles' was - the zone of the city where slaughter and butchery took place, out of sight. The appearance of this type of mass-produced fast-food vessel was part of an intensifying retreat from the wild, and an ever-greater control over the terms of death (*Artificial* 98-100).

Technology, then, is long associated with distancing us from our environment, and this might well contribute to certain Neo-Luddite positions, but it is unclear to what pristine past might be being harkened, what time where contact with the earth went unmediated (it certainly wasn't recent), an idea we will continue to pick up on throughout this chapter.

The resistance to modern technology, particularly the scare stories surrounding the effects of digitisation which we'll return to in the third chapter, have recently begun to be analysed, or lampooned, in light of their historical counterparts[41]. Kathrin Passig,

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41 Vaughn Bell, author of *A Better Pencil*, a book length discussion of this situation of the new amongst the old, also provides a short history of scares surrounding new media including writing, radio, and mandatory education in his article "Don't Touch That Dial! A History of Media Technology Scares, From the Printing Press to Facebook."

for instance, identifies some "Commonplaces of Technological Critique," arguments which have been put forth recurrently over recent years as generic criticisms of new equipment including:

- "What the hell is it good for?" - A phrase IBM engineer Robert Lloyd asked of the microprocessor in 1968.
- Who wants it anyway? - Harry M. Warner, one quarter of the Warner Brothers studio founding family team, is said to have asked in 1927 "Who the hell wants to hear actors talk?"
- "It is high time at this point to think about what the innovation is doing to the heads of children, adolescents, women, the lower classes and other easily impressionable citizens...Those weaker than I am can't handle it!" - "People read ...what is true and what is false mingled together, without examination, and they do this purely out of curiosity, with no real thirst for knowledge...Idleness becomes a habit and creates, as does all idleness, a relaxation of the soul's energy" a warning from the *Universal Lexicon of Upbringing and Teaching* in 1844.
- "If the new technology has to do with thinking, writing or reading, then it will most certainly change our techniques of thinking, writing or reading for the worse" - "For critics around 1870, the postcard sounded the death knell for the culture of letter writing, while in February 1897 the American Newspaper Publishers Association discussed whether 'typewriters lower the literary grade of work done by reporters.'"

Such history of railing against new technologies, and often in predictable fashion, suggests two important ideas for the argument of this chapter, and for the thesis more generally: i) that people frequently consider a move away from the equipment they are used to using as being at the very least problematic, and at worst an outright threat, and ii) when technologies have been around for a while they can seem to be a part of the natural order: "it's not these older technologies we have to worry about, it's those new ones that pose a threat, that strip us from the world."

The philosophy of Martin Heidegger is often identified as anti-technological in its stance against modern forms, particularly in "The Question Concerning Technology" where he outlines his concern as to the essence of contemporary technology acting as a restricted "unveiling" of the world. Perhaps the most vivid example of comparing the old and the new in that essay is his juxtaposition of the windmill and the hydroelectric dam: the windmill works within and alongside nature, whereas the dam tames it, encountering the river as good for the single purpose of producing electricity. Heidegger is often read as seeing our attitudes toward technology as corrupting and making impoverished our view of the world, where nature is revealed simply in its having a use

value, as being a "standing reserve" of materials, a means to an end and nothing in itself[42]. This too can be seen as a form of visceral insulation, a keeping of us from the world "as it is," our faith in domination misguided as we only tame a certain aspect of the environment in which we act. Heidegger, however, knew the importance of technology in day-to-day life and, though it certainly concerned him, his approach is more nuanced than a simple "anti-technology" screed: "For all of us, the arrangements, devices, and machinery of technology are to a greater or lesser extent indispensable. It would be foolish to attack technology blindly. It would be shortsighted to condemn it as the work of the devil" (Heidegger, *Discourse on Thinking* 53). It remains somewhat ironic, however, that I will shortly require Heidegger's work in instigating and fleshing out my definition and naturalisation of technology here.

How do we define technology?

The existence of such rich precursors to contemporary resistance should make it rather unsurprising that a seam of such voices have passed into mainstream consensus. I have already said that I do not believe that the questioning of technological change or progression should be written off, but saying that there is valuable reason for questioning or resisting technology suggests that there is an identifiable category of things which are being resisted, and yet this doesn't seem to be the case. The fluid use that the word "Luddite" has acquired - able to describe both the original mill workers campaign against job loss for the sake of machinic efficiency, and the Neo-Luddite who elects not to use email because they still like to send paper letters - indicates that perhaps something may be amiss. The problem is not solely that the politics has been evacuated from the term, rather that "Luddite" has come to mean any resister of technology, and this is a category that somehow includes mill equipment and email and seemingly everything in between. It is a category, if we believe Birkerts, that includes the Kindle, but not the printed book. Where is the boundary line which delineates which items should be included under the term? Langdon Winner suggested that technology could be defined as having moved from being "something relatively precise, limited, and unimportant to something vague, expansive and highly significant" (8), a definition unfortunately fairly close to a definitive description of the contemporary usage. W.

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[42]   For a good overview of Heidegger's attitudes to technology over his career see Ronald Godzinski Jr. "(En)Framing Heidegger's Philosophy of Technology."

Brian Arthur overstates the case somewhat when he protests that "we have no agreement on what the word 'technology' means, no overall theory of how technologies comes into being...and no theory of evolution for technology" (*Nature of Technology* 12), as we will see in the second chapter there have been a great many theories on how technology comes to pass, but the significant point is the lack of consensus in all aspects of technology: what is being argued about is rarely agreed upon.

When the Luddites were dismantling the machines which threatened to supplant them, the word "technology" was not in use:

> When the Enlightenment project was being formulated, after 1750...[f]or another century, more or less, the artifacts, the knowledge, and the practices later to be embraced by 'technology' would continue to be thought of as belonging to a special branch of the arts variously known as the 'mechanic' (or 'practical,' or 'industrial,' or 'useful) - as distinct from the 'fine' (or 'high,' or 'creative,' or 'imaginative') - arts (Marx, "Postmodern Pessimism" 242).

The word is derived from the Ancient Greek *techné* (craftsmanship, craft, art) and *logos* (ground, word, order, knowledge, reason), but would not start to become deployed in its modern usage until "the era when electrical and chemical power were being introduced...[W]hen these huge systems were replacing discrete artifacts, simple tools, or devices as the characteristic material form of the 'mechanic arts,' the latter term also was being replaced by a new conception: 'technology'" (Marx, "Postmodern Pessimism," 245-246[43]). Marx sees here, built into the initial deployment of the word, the mediation identified negatively by William Carlos Williams and euphorically by the architects of the Enlightenment before him: technology's

> relative abstractness, as compared with 'the mechanic arts,' had a kind of refining, idealizing, or purifying effect upon our increasingly elaborate contrivances for manipulating the object world, thereby protecting them from Western culture's ancient fear of contamination by physicality and work. An aura of impartial cerebration and rational detachment replaced the sensory associations that formerly had bound the mechanic arts to everyday life, artisnal skills, tools, work (248).

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[43] For more on the roots of the modern use of "technology" see Leo Marx, "Postmodern Pessimism," 247-249 and "Technology: The Emergence of a Hazardous Concept." Carl Mitcham's *Thinking Through Technology* also deals with the problems and numerous historical definitions of technology (143-154). See also Robert C. Scharff and Val Dusek *Philosophy of Technology* 206-244 in this regard.

In work from modern philosophers and academics such as Bernard Stiegler (*Technics and Time*), Martin Heidegger ("The Question Concerning Technology"), Jaques Ellul (*The Technological Society*), José Ortega y Gasset (*Meditación de la técnica*), Paul DeVore (*Technology: An Introduction*), and Michel Foucault ("Technologies of the Self") there have been repeated attempts to redefine or augment our notions of what "technology" actually refers to, and whole studies have been undertaken in the pursuit of a definition with which to begin pedagogy of the subject (Hansen and Froelich)[44]. That such projects must occur suggests that how we currently deploy that word is at best unsatisfactory, and at worst obfuscating and misleading. At the heart of the work of these thinkers is the idea that technology is more than just material *things*, that the term should include practices and mindsets as well as implements. In contemporary historical research this trend is best seen in the deployment of the term "technological system" to replace the solely artefact centred discourse that the study of technology had become:

> There seems to be a general agreement that any definition of technology must begin with material objects, but in many cases the definition extends well beyond the material core...Cultural critics such as Jacques Ellul and Lewis Mumford have argued that knowledge and ideology are inherently part of the meaning of 'technology'...In recent years, the meaning of 'technology' has been broadened as historians have come to favour the 'technological system' rather than the 'machine' or the 'invention' as the basic unit of analysis (Williams, "Political and Feminist..." 218).

Even though there has been a move away from artefacts as the definitive subjects of history of technology, Marx takes care to remind us that "[a] system is 'technological'...only if it includes a significant material or artifactual component" ("Postmodern Pessimism" footnote 245). Whilst I will argue that it need not be the case to define technology by the artefacts around which it is often arrayed, it is absolutely the

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[44] Stiegler is most interested in technical (as opposed to natural) objects after Aristotle; Heidegger deals with modern technology's treatment of nature as standing reserve; Ellul mostly concerns himself with *technique*, the skills available to a culture clustered around its artefacts, but also lays out a multiple point definition of modern technology (79-147); Ortega y Gasset saw technology as fundamental to human existence, and as what separates us from nature, but though he considered this to be our natural and ideal state, one foot in the world and one foot in the world we make for ourselves, he also saw modern technology as of a new order and one that could be too distancing; DeVore saw his object of study as "the creation and utilization of adaptive means, including tools, machines, materials, techniques and technical systems, and the relation of the behaviour of these elements and systems to human beings, society and the civilization process" (xi); Foucault considers the four "specific techniques that human beings use to understand themselves," technologies of production, sign systems, power, and of the self; Hansen and Froerlich present prior discourses, but largely leave the issue of definition to their readers.

canonical opinion in every level of the discussion of technology[45]. The principle problem with "technological system" as a more nuanced alternative is that you cannot point to one and they are hard to describe, requiring books and papers (at least) to outline. I think that this is a loss, and that we can save the word "technology" so that an academic usage might be improved upon and yet allow us to still be able to talk about specific items relatively independently of the conditions in which they sit, not to say that context isn't paramount, but so that we might retain the ability to say "this technology" and refer to a particular thing. A "technological system" might be the right term for the cultural surrounds of an artefact, instances of which are under extensive use, but it doesn't tell us anything about the phenomenological experience of that artefact and its classification as an object unless we have a sensitive definition of technology to begin with. A cultural aspect is one criteria which defines a technology, but it shouldn't be the only thing.

"Technology" remains a remarkably loose term; we might often agree on the objects under discussion - computer: yes, coriander: no -, but the specifics of why this might be so are vague. What makes a hammer of the same order of objects as an industrial press? Does everyone experience this mysterious parity in identical ways, allowing for the consensus, or does "technology" define items across a range of unrecognised and untheorised responses? What sort of impact on our lives might be common to objects defined as technologies? The answers to these sorts of questions can be found in most of the works cited above, but the internal contradictions, the consensus on the physical, the rigid distinction between more "natural" simple technologies and the complexities of modern technologies all point to a need for further work in this area.

I'll begin my own proposed definition by establishing a set of terms that I will use throughout this work principally: "technology," "device," and "equipment," but also "extension," "communality," "incorporation," and "morphicism." I also intend to show that not only is this specificity essential to attempting nuanced discussions of technological artefacts, but that the outlined terms also reveal items as technological

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[45]   Though this position is not without its detractors, such as Foucault's work in "Technologies of the Self" or this description of technological systems from Deleuze and Guattari:

> technology makes the mistake of considering tools in isolation: tools exist only in relation to the interminglings they make possible or that make them possible. The stirrup entails a new man-horse symbiosis that at the same time entails new weapons and new instruments. Tools are inseparable from symbioses or amalgamations defining a Nature-Society machinic assemblage. They presuppose a social machine that selects them and takes them into its 'phylum': a society is defined by it amalgamations, not by its tools (99-100).

which would never have, traditionally, been thought of as such. It will be this expansion of what might be considered under the term "technology" that will allow us a way-in to the next chapter on the "feel" of electronic reading, a chapter which will also further the phenomenological experience of technological interaction suggested here.

A common sense definition of technology

So abundant is the use of technology in all human society, from hand tools and basic weapons to industrial machinery and nuclear bombs, that the question I'd like to begin with seems redundant at fast glance, an elaborate point of clarification perhaps: what is a technology? If "technology" refers simply to external tools for getting work done then we can be certain that humans have technology at their hearts. We can look at the lives led by any nomadic or settled people, in any human habitat, from Inuit *tupiq* to Bedouin *bayt char*, from favelas to penthouses, and the defining trope of homo sapiens' existence is the use of equipment which extends our ability to ensure our thriving survival. Karl Marx saw this placing of ourselves out into the world in our made artefacts as a fundamental need: "Humanity needs objects as objects of its life-expression...The true human life becomes the externalized life" ("Economic and Philosophical Manuscripts..." 167). As David Rothenberg notes, "[t]echnology is the first act of humanity for Marx. Living through techne, we transform nature into history and thus into meaning. We cannot do this just by thinking about our place in the world, but only through working with the world...carving a world out of nature. Because we are human we look for our world outside of ourselves" (Rothenberg 74). Recent archaeological evidence offers support for Marx's belief, suggesting that basic tool use, what many would see as the first technological interactions, may have been a part of our hominid ancestry for over three million years[46], but without doubt it has been a part of *Homo sapiens'* life since its very beginnings, shaping our social structures, eating practices, and basic survivability. Taylor states this baldly: "There are seven species of great ape on the planet. Six of them live in nature. One cannot live without artificial aid. Humans would die without tools, clothes, fire, and shelter" (*Artificial* 1). Taylor's work demonstrates the intimate and inseparable relationship between humans and their tools evidenced throughout the archaeological record, and suggests that this combination may have actually allowed our species to evolve:

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[46] See Shannon "Evidence for Stone-Tool-Assisted Consumption..."

for females at least, some of the 'hands-free' benefits of bipedalism are undermined by the need to transport young and keep them safe...[T]hen comes the breakthrough: an inspired female picked up a twisted loop of animal skin - perhaps some sun-toughened membrane at a scavenging site, or some scorched but not burnt pelt from the embers of a bush fire. With the infant seated and the strain off the arm, energy requirements for moving with the child plunge, by a massive average 16 percent. So the pressure to make this discovery, even to remake it more than once, is huge...Although carrying slings do not in themselves drive brain-size increase, they certainly encourage it. Rather than having to fit a larger and larger cranium through a pelvic girdle that has contorted itself to support an upright frame, helpless babies can be catered for in a pouch. That they remain helpless - a week, a month, a year, several years - becomes less critical. So sling technology removed the glass ceiling on the degree of ontogenetic retardation (in primate terms, premature birth) that genus *Homo* could begin to accommodate. And that, of course, is the solution to growing larger brains: you do it once outside the womb (*Artificial* 123-124).

Taylor's thesis is vital in demonstrating just how fundamental tool use is to humans; with the theory outlined in the above quotation he positions it so deeply at our heart that we could not have come to exist without it.

The phenomenologist and philosopher Maurice Merleau-Ponty further describes how the extension of our bodily capacity continues to help in building up the various milieu in which we exist:

The body is our general medium for having a world. Sometimes it is restricted to the actions necessary for the conservation of life, and accordingly it posits around us a biological world; at other times, elaborating upon these primary actions and moving from their literal to figurative meaning, it manifests through them a core of new significance: this is true of motor skills such as dancing. Sometimes, finally, the meaning aimed at cannot be achieved by the body's natural means; it must then build itself an instrument, and it projects thereby around itself a cultural world (*The Phenomenology of Perception* 169).

This thesis will often return to the implications of this quotation because it holds a number of key points for the arguments presented: first, that a body is the necessary requirement for experiencing the world; second, that there is a root biology necessarily related to Darwinian selection which contextualises that body; third, that there is an intimate connection between meaningful movements such as dance and the "instruments" of technology; fourth, in disagreement, that instrument used can be

considered to be "natural" under certain conditions; fifth, that the use of such instruments is a projection of previously internalised, or restrictedly externalised experiences and meanings; and sixth, that the use of equipment is intimately bound to the culture in which the using body sits. Again, in this quotation we see that bodily extension is crucial, but somehow "unnatural." Is this how we should consider our technologies in general?

Let's attempt an initial common sense definition of technology, one which might encompass the entire spectrum of human tool use, from hammers to computers: Technologies are the implements onto which we offload tasks in order to reduce our expense of time or effort, and humans have proved themselves uniquely suited to their invention and use. Our interactions with such items are "technological"; "a technology" is an instance of an artefact with which we interact in order to accomplish something we could not by ourselves, e.g. a car, a hammer, a computer. This I would take to be a fair starting point as a contemporary definition of technology. When Heidegger asked "The Question Concerning Technology" he also began with what he saw as a common sense definition:

> We ask the question concerning technology when we ask what it is. Everyone knows the two statements that answer our question. One says: Technology is a means to an end. The other says: Technology is a human activity…[This] definition of technology is indeed so uncannily correct that it even holds for modern technology, of which, in other respects, we maintain with some justification that it is, in contrast to the older handicraft technology, something completely different and therefore new. Even the power plant with its turbines and generators is a man-made means to an end established by man…[T]his much remains correct: Modern technology…is a means to an end (312-313).

Aside from introducing the matter of complexity in technology (which he rules out, rightly I believe, as significant to a "standard" definition in any case), Heidegger gets to the same point from common sense here: technology enables, technology is a human activity. It is important to note that even when he progresses away from his original lay definition, Heidegger keeps technology at the heart of human experience and as to providing a "means to an end," a method for getting things done.

Why do we need to redefine technology?

With our initial definition in place it is important to ask why I believe we need to abandon, as Heidegger did, the definitions of technology that we already have which use these assertions as their base. In short, it is essential because they are not specific enough to deal with our complex interactions with items which extend our abilities. Some things are blithely referred to as technological, a supercomputer or particle collider say, when we encounter them in much the same way as we would a worn-down inscription on an unfamiliar monument - we are dimly aware that there is a meaning attached to the object, that there is information others may have gleaned, but to us it is inaccessible, corrupted, and so smoothly excluding as to be ignored as an inert facet of the world. This doesn't seem to describe our simply understood and precise interactions with a hammer or a knife in the actions for which they were designed, and yet these too are certainly technologies, the technologies from which all of our current interactions have emerged. A nuanced definition of technology should be able to account for the experience of the knife and of the collider, to account for initiate and expert use, and to recognise that each individual's encounters are not of the same order. As David Rothenberg has argued, a "successful explanation of technology should not blur saxophones and motorcycles, nuclear power plants and ball point pens, all into one wrong turn in the story of our species" (xiv).

A second, and equally important reason for the clarification, is that this chapter, and this thesis as a whole, will argue that the use of equipment is intimately a part of what it means to be human, that we use equipment in order to apprehend the world, to define our place within it, as extensions of our bodies and cogntion. Any definition of technology should also be able to account for the centrality of such activity in our lives, and render the phrase "technology is unnatural" as untenable.

In order to avoid using the term "technology" unspecifically I will use the archaeological/historiographical/material cultural term "artefact" to describe an object produced or affected by human labour, and Heidegger's term from *Being and Time,* "equipment," used in its simplest sense: items for getting something done; "[w]e shall call those entities which we encounter in concern '*equipment*.' In our dealings we come across equipment for writing, sewing, working, transportation, measurement" (97)[47]. I will tend to favour this latter term as it has at its core, the notion that we encounter such items "in concern," purposively, for "our most basic way of understanding equipment is to use it" (Dreyfus, *Being* 64). This commitment to use must remain in any definition of

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[47] For more on Heidegger's use of the term "equipment" see Dreyfus, *Being* 62-64.

technology: a technological interaction cannot occur by accident.

Gestalts

Chapter two will consider our perception of and interaction with objects in the world more generally, but it is important even at this stage to introduce the idea that we don't encounter things in their totality, but instead as an assemblage of what we know and what we perceive. Edmund Husserl and Merleau-Ponty described this inability to apprehend an object completely as its "horizon": I am restricted by my body and experience of time to only seeing a single plane of an object from a single vantage point under a single set of conditions, and am never aware of what occurs within the thing - this horizon is insurmountable. We'll return to these ideas, but for now I'm more interested in suggesting what makes up a technology, where its boundaries lie.

We encounter objects, all objects, as *gestalts*, but it is perhaps most obvious with the artefacts we create. I'm adopting George Lakoff and Mark Johnson's use of the word from their *Metaphors We Live By*, that of a collection of things that we tend to encounter together more frequently than we encounter any of the elements by themselves; Lakoff and Johnson say that gestalts "recur together over and over in action after action as we go through our daily lives…[T]he complex of properties occurring together is more basic to our experience than their separate occurrence" (71). For instance, I don't encounter my computer as a whole when I interact with it, I encounter the gestalt, *my* gestalt, of the computer. To explain this, consider the naming operation described in the opening paragraph of Giles Deleuze and Felix Guattari's *A Thousand Plateaus* where they say: "We have assigned clever pseudonyms to prevent recognition. Why have we kept our own names? Out of habit, purely out of habit…Also because it's nice to talk like everybody else, to say the sun rises, when everybody knows it's only a manner of speaking" (3). Names don't refer to singular coherent beings for Deleuze and Guattari, they are convenient signifiers to describe the polyphonic *mass* occurring in one body, as convenient as saying "the sun rises" and not having to think about the optical illusion caused by planetary orbits. In much the same way, I have long used that same word "computer" when at first I simply meant "keyboard, mouse, screen, tower, and Microsoft Word," the relatively small gestalt of my first interactions, and now intend all the aspects I have accrued knowledge of over years of use. I don't encounter the entirety of the object in the same way I might appear to with a hammer, a simple

gestalt of shaft and head[48], most of the computer remains inaccessible to me. But then the thing breaks and I have to open it up, see where the fan is and how it can get so clogged with detritus that it needs a vacuum and a cotton bud to fix it up. And then, as that wasn't so hard, a bit later I crack it open again and learn how to change out RAM, maybe add a hard-drive. My point is that the gestalt of the computer is both idiosyncratic and maleable; I can add to what the word "computer" means to me. I encounter the computer as a delimited, but non-intersubjective *thing*, even if I say "that computer over there," because amongst the world's computer users we are unlikely to agree on what exactly it comprises of. The horizon of the specific computer alters as we engage with it in different ways, and thereby alters what we intend by the word when we describe the class of equipment. Borges' "Funes the Memorious" comes to mind, a short story describing the fate of Ireneo Funes, a teenager with a perfect memory of every aspect of the world that he has seen. Funes cannot conceive of how the word "dog" "embraces so many unlike individuals of diverse size and form; it bothered him that the dog at three fourteen (seen from the side) should have the same name as the dog at three fifteen (seen from the front)" (*Labyrinths* 93-94). "Computer" also so changes; if I don't know that something is a part of a computer then I'm not referring to it when I say the word, I'm just setting my own personal boundaries of interaction under a word that everyone else is using to do the same thing; I'm saying that the sun rises.

It is the gestalt which determines the actions I conceive of as being enabled by the implement, rather than some realistic totality of the artefact's strictures. What would it mean to say that a computer or an e-reader is a technology under these conditions? Only that we perceive our interaction with the gestalt we have access to as being somehow technological[49]. This still says nothing about *why* the gestalt should be considered as a technology, however, unless the only rubric for a technology is that it is an item used to achieve a goal. As previously stated, it is this assertion that must be enriched and to which we must now turn.

Four criteria

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[48] Even then we might well say that we do not have access to the entirety of the hammer, we may be unaware of any number of things which contribute to its makeup - the glue which binds it, its molecular or atomic structure, its stress fractures and imperfections, weak and sweet spots, etc. For more on the always hidden aspects of objects see Harman *Tool-Being* throughout.

[49] This notion of gestalt artefacts will be important as the perception of some combination of elements might be seen as technological whilst another may not.

I will defend my reasoning for each of the following criteria, but first I'd like to simply outline what I take to be the minimum effects an interaction with an artefact has to cause or enable in order for that artefact to be considered a technology. To begin with, to make the topic as approachable as possible at first pass, we will consider only contemporary human interactions with objects most would likely readily define as being technologies under the common sense definition outlined above, items such as tools, weapons, computers, cars, and e-readers. Only later will we move on to interactions which may prove more controversial to define as being technological.

The four criteria I believe equipment must abide by in order to be considered as "technological" are:

- Technologies EXTEND our means or abilities to accomplish tasks.
- Technologies are COMMUNAL, existing only in communities of users.
- Technologies are able to become, if only temporarily, skilfully INCORPORATED into our bodies and minds.
- Technologies have an effect on their users, they are MORPHING.

So: Extension, Communality, Incorporation, and Morphicism; it is on these terms which I will defend aspects of digitisation, and problematise aspects of codex reading, not in order to point score for either side, but instead to show how a fuller understanding of technology allows for a more thorough consideration of how we represent and consume written works.

Extension

For a gestalt artefact to be considered a technology, i.e. equipment at the heart of a technological interaction, it must extend our capabilities. This assertion is deeply rooted in any lay definition of technology, and also in Heidegger's notion of equipment. When we approach an object with a concern or purpose it is because we are able to achieve something through our dealings with it that we could not achieve by ourselves, or the interaction saves us time or effort (again this is about achievement, of a faster speed, or a less tiring process). We shouldn't, however, think of technologies as merely implements which exist outside of ourselves to which we must turn in order to perform a task, but instead as equipment which alters the set of default practices we consider ourselves able to achieve in their absence, i.e. if something changes the practices

available to us then it moves toward being considered as a technology. We could not travel at speed without cars and planes, we could not type and print without computers, we could not have hunted effectively without spears nor butchered the catch without knives, and we cannot even intend to do so without these items:

> it is not too much philosophy to say that the emergence of technology was and is intimately connected with the extension of the range of human intentionality. Without a car...I could not have intended to go fishing..., given the distance involved; without a stone tool technology, our prehistoric ancestors could not have had the intention to kill big game... [T]he existence of objects, such as saucepans, not just allows actions but suggests them (Taylor, *Artificial* 152).

This is what makes invention such a significant skill - the identifying of gaps in human experience which might be reliably filled by a new apparatus which expands the repertoire of what we are able to achieve is not the experience of the average user of equipment, though it is, in whatever flash of insight, theoretically available to anyone. When it comes to reliable and repeatable equipment use we still pride those individuals capable of spotting gaps in our experience, but this isn't an aspect of what makes something a technology.

Marshall McLuhan suggested that media technologies are augmentations (extensions) of our basic discursive apparatuses; the phone, for instance, augments the mouth and ear, the television the eye, the clothing the skin etc. (*The Medium...* 31-40). All technologies must extend some aspect of ourselves in this way, whether relatively trivially such as a shoe extending the range of abilities achievable by the foot (covering rough terrain, sports use, etc.), or profound, such as the spear's extension of the hunter's arm, allowing for an immense shift in our culture and comestibles, and every change that is entailed by such a shift. This capacity for extension, or at least our panoply of extensive interactions, is a uniquely human trait: "We alone on the planet seem capable of creating and exploiting such a wide variety of action amplifiers, ranging from hammers and screwdrivers, to archery bows and bagpipes, to planes, trains, and automobiles" (Clark, *Supersizing* 157). Extension via equipment, far from being somehow outside of our nature, is a norm in all human societies. When a Neo-Luddite suggests that technology is unnatural are they suggesting that "natural" means "not human," that technology is the not-human, an extension too far; can anything human be natural? To say that something is unnatural because it is human is simple enough, and

holds in all cases, but the resistant commentators seen at the start of the chapter are certainly not using "unnatural" in this way; some things are described as unnatural because they don't fit the human form or a preferred way of being in the world. The iPad doesn't feel wrong in the hand because it is a human thing and therefore unnatural, instead, the arguments go, it is because it *doesn't* conform to the human that its unnaturalness is made apparent. In the quotation from Williams above it is not that human labour is unnatural, but instead that the machines that separate us from the world prevent an interaction which is somehow natural in itself. In saying why technology is natural or unnatural we must also therefore come to some preliminary conclusion as to what "natural" even means. To say simply that it is just the not-human is to construct nature artificially, by sterile différance. There seems to be an often deployed definition of nature, however, which allows in some human interactions as long as they are visceral. Tribal life or antiquated methods of production are often seen as more natural because they are somehow "in touch" with that non-human world, because they don't have a strongly mediating layer of equipment between us and things as they are, a noumenal world. A trowel is different from an industrial digger in this regard, the former allows us to get our hands dirty. The use of the body as far as possible without equipment is positioned as the more natural mode of engagement so that when it is said that technology, as a class of objects, is unnatural it is implied that it moves the body further away from the work to be done, or the substance that the work is performed upon.

This doesn't seem right, however, as much of the work to be done is inspired by prior extension, extension which allows us to even conceive of the desired outcomes. A trowel or spade may seem to place less distance between its user and the world worked upon than the industrial digger, but the digger could not have been conceived of without the use of the spade; the work to be done doesn't alter in kind, but its extent and our perception of effort in achieving it does. Inherent, then, in this discussion, are two broad kinds of "natural": i) a pre-human world in which we are most natural when we are most inert and ii) a pre-extension "human nature" which we deviate from when we place a greater distance between our bodies and the work in the world. I will say it plainly: i) is a philosophical/ethical/ecological question which should have no bearing on the definition of technology. Doing damage to a pre-human nature (if such exists in your milieu) with a tool or any other artefact is just a more efficient way of marauding unaided, pulling each blade of grass up with the fingers and kicking over every tree.

How we choose to act in the wold may well be against a pre-human nature, but it doesn't help us to define the tools with which we act even if those tools seem to promote new abilities. A kitchen knife offers both chopped carrots and a back-alley stabbing, and whilst the availability of these extended abilities are part of what the tool is to us, and therefore a part of defining whether it is a technology or not, which action we choose to undertake isn't. i) is part of a discussion of nature, and may or may not be true, but for our purposes it says nothing about the naturalness or unnaturalness of technology, nor the special cases of codex/e-reading.

ii) is more interesting for our discussion here. Technology is unnatural if it is not in our nature or it removes us too far from the world. Tool use and extension, I hope, is obviously within our nature when it comes to hammers and spears, but we perhaps blanche a little more at the thought of cars and colliders. We will continue to explore this idea of distance from the world on into the next chapter, and I hope to fully confirm the use of technology as being a part of our human nature. In this way I hope to refute the idea of technology as being inherently unnatural (at least as far as these two broad distinctions are concerned) and to show that electronic equipment for reading is no more or less natural than a codex.

> *Extension: The e-reader and the codex extend our ability to store information and alter our conception of what we can achieve.*

Communality

For a gestalt artefact to be considered a technology, i.e. equipment at the heart of a technological interaction, it must exist in a community of users, prompters, or refiners. This criteria is indebted to the work of "technique" philosophers such as Ellul who consider technology to be defined by the mode of thought that it prompts in a society, something captured, at least in part, by the historiographical term "technological system." I would like to suggest, however, that the best way to understand technology lies not in its either being the artefact(s) under consideration, or its/their cultural entailments, but instead a blend of the material, the personal, and the social as they affect a particular interaction. Here I will introduce the idea that equipment is encounterable without that encounter being technological.

"*A* technology" is always a shorthand for a set of specific community-structured

interactions clustered around an artefact which is itself an encounterable yet alterable gestalt. Under the criteria of "communality" comes the notion that technological interactions are always motivated and structured by communal pressures. Note that when I say "communality" I have explicitly chosen it over "culturality." "Culture" is a loaded term, and can imply fairly strict delineations; "community," on the other hand, can be any grouping from societies down to subcultures, small groups, or even pairings. Any of these different sized communities can exert quasi-cultural effects, where "cultural" refers to the set of pressures a community exerts on its members. By avoiding the term "culture," if not "cultural," we can account for the existence of newly developed technologies in niche groups such as computer hackers, circus performers, inventors, Formula One teams, or quantum-physicists, equipment which would not be encountered, I will argue, as technological by the wider society in which those groups exist.

To further define communality, let's consider the inception of tool use: "Innovative tool use could have occurred countless thousands of times without resulting in an established toolmaking industry, unless the individual who 'invented' the tool could remember and re-enact or reproduce the operations involved and then communicate them to others" (Donald, *Origins* 179). When a single being, through trial and error, was able to crack open a hard shelled nut with a rock for the first time they did not create a technology, and their interaction with the rock was not technological. Technologies emerge when that work is driven by cultural pressures and enters into a community. It is in a community that the drive to repeat such tasks is refined, through being able to access food others can't in this instance, thereby achieving hierarchical or survivable advantage, or through a community's inspiration to attempt experiments in the first place and in the future.

Beyond motivation and support for new creations, it is community that provides tool users with various skill sets and practices which it would be impossible to accrue through a lifetime of trial and error:

> humans link with a vast and diverse cultural matrix in early infancy and profit from the rich storehouses of knowledge and skill that have accumulated in our cultural memory over many millennia…The human brain is the only brain in the biosphere whose potential cannot be realized on its own. It needs to become part of a network before its design features can be expressed (Donald, *So Rare* 150&324).

This assertion is crucial to the thesis of Donald's work in *A Mind So Rare* - his placing of consciousness as the driving force of human evolution is supplemented by the idea that it is as communal agents, able to offload skills and problems into a "cultural memory" to be drawn on as needed, that we were able to emerge as skilled equipment users, technically adept and able to adapt rapidly to whatever environmental pressures we might face. Donald states that we cannot reach capabilities that most of us would consider to be fundamental without enculturation; there are elements of our minds which will not come "on-line" until we are embedded amongst cultural pressures. Our capacity for spoken language use, for example, though we are genetically predisposed to rapidly acquire it (or some form of abstract symbolic representation such as sign language), will lie dormant until cultural pressures prompt it into being. We will also see in the next section that the pedagogical requirements of any apprenticeship, including learning to drive and even how to use a computer, demonstrate that culture is a fundamental requirement of achieving any reliable skill set. "Our cultures invade us and set our agendas," says Donald,

> [o]nce we have internalized the symbolic conventions of a culture, we can never again be truly alone in semantic space, even if we were to withdraw to a hermitage or spend the rest of our lives in solitary confinement. Big Brother culture owns us because it gets to us early. As a result, we internalize its norms and habits at a very basic level. We have no choice in this (*So Rare* 298-299).

A significant aspect of the definition outlined here is that technologies exist only in extended webs of interaction by multiple parties, and part of encountering an artefact as a technology is the common experience of it as such. There is no reason to practice the skilful use of equipment outside of a community, no evolution of use will occur without sustained interaction by multiple members of a group; use stagnates without a cultural drive to excel.

"Communality," then, is the requirement only that a technology cannot exist as such in the mind of just one person (we will later consider another branch of interactions with equipment, devices, which are non-technical/technological, and we will see that one of its defining characteristics is its occurrence comparatively independent of a community's cultural pressures). The standardised use of an artefact in a community is one "mark" of the technological[50].

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[50] Extension is too fundamental to be considered an indicator that a particular interaction should be

One final point about communality inspired by Donald's words above: can someone create a technology if they retreat out of any community interaction to live alone? If someone working in the woods for long stretches, for months or years, comes up with new equipment for accomplishing a task, a new tool say, can their interaction with it be thought of as technological, will it become a technology for them where no community exists to aid its standardisation? I believe so, because that person, in this special case, brings their community with them, much as Donald describes. Shaun Gallagher and Dan Zahavi similarly see this community effect in shaping our perception of objects: "something affords me possibilities, only because I have seen some of those possibilities actualized by others...[A]lthough they may not be perceptually present, they are potentially and implicitly involved in the very structure of my perception" (*Phenomenological Mind* 103).

I don't believe, however, that a technological interaction is possible from a person with no prior knowledge of a community. The experiences of so called "feral" children[51], for instance, have told us much about the brain's dependency on cultural forces for it to reach its full symbolic capacity: "Socially isolated humans do not develop language or any form of symbolic thought and have no true symbols of any kind. In fact, the isolated human brain does not act like a symbolizing organ…It is apparently unable to generate symbolic representations on its own. It does so only through intensive enculturation" (Donald, *So Rare* 150). The same can be said of a child who is too young to take on board the pressures of its own limited milieu; cut off from communal pressures technological interactions are impossible. But such interactions can become standardised in the gaze of an internal community which continues to shape the mind of our creator in the woods. This could only be empirically evidenced by the types of equipment which would be produced by people of different cultures entering into isolation: they would, presumably, reflect the cultures from which those persons have been exiled, showing what values have been instilled, what is most important, the preference of efficiency or craft, etc., but without systematic study this must remain speculative. For the moment it will instead suffice to say that community forces, both immediate and internalised, shape which aspects of the gestalt artefact are encountered and privileged, what interactions might occur, and the drive to produce such interactions

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considered as technological; extension *is* the interaction under consideration, not a potential mark of its nature.

[51] For more on feral children see Michael Newton's *Savage Boys and Wild Girls: A History of Feral Children*.

in the first place.

> *Communality: E-readers and codices exist in communities of users of every scale, from international groups of millions or billions down to small groups of specialists. These communities structure every user's interactions with these artefacts, determining to some extent the gestalt that is encountered and the uses to which it is put.*

Incorporation

For a gestalt artefact to be considered a technology, i.e. equipment at the heart of a technological interaction, it must have the capacity to be incorporated into the user's body schema through skilful use. When we encounter an artefact as equipment we can refine that usage, standardise it, and go some way to making it automatic. When we first use a saw for instance, the jarring back and forth as the teeth catch in the grain are a world away from the expert carpenter's easy push and draw. Here lies another problem in a unifying definition of technology: if encountering a saw in use can be considered as a technological interaction then should that term apply equally to both uses of the equipment? Certainly both the novice and the expert user are extending their range of considered abilities, neither could hope to cleanly break the wood without the equipment, but the modes of interaction are so significantly different from one to the other that we should consider one to be technological and the other not: we can say that the novice's experience is not technological, and that they do not encounter the saw as a technology. Even if the saw exists with communal pressures for the user, for instance if they have entered into an apprenticeship, and they are entering the discourse surrounding the use of the tool which shapes the gestalt encountered and the interactions attempted, we should not consider their initiate experience to be of the same order as that of the master teaching them, despite the meeting of the first two criteria, extension and communality. The notion of "incorporation" is the criteria to be met in order to enable us to make this distinction, and it applies to computing, car driving, and machine-gun firing as readily as it does to simple tool use.

What distinguishes the expert user is that the saw feels like a true extension of their abilities. It is not just that the tool opens new possibilities, but that those new possibilities are encountered by a body *augmented* by the equipment; the equipment is

properly thought of as a part of the body during expert use, a soft-assemblage where components temporarily come together, and are just as easily separated, but when so joined allow for a function far greater than either component of this new machine in isolation. Andy Clark describes such a union between user and technology as "transparent":

> Transparent technologies are those tools that become so well fitted to, and integrated with, our own lives and projects that they are…pretty much invisible-in-use. These tools or resources are usually no more the object of our conscious thought and reason than is the pen with which we write, the hand that holds it while writing, or the various neural subsystems that form the grip and guide the fingers. All three items, the pen, the hand, and the unconsciously operating neural mechanisms, are pretty much on a par. And it is this parity that ultimately blurs the line between the intelligent system and its best tools for thought and action… There is no merger so intimate as that which is barely noticed (*Natural-Born* 28-29).

In order to understand how the body can achieve such a synthesis, and to defend its use as one of the defining traits of a technological interaction, I will take some time to explore its discussion in several academic discourses, principally from philosophy and neuropsychology. Incorporation is probably the most controversial of the four criteria, but it is vital to what this chapter is trying to argue: Technologies are indeed a class of thing, but those things, as experienced, are constrained only by the perception of users. If a user experiences an artefact as a technology then that is what it is, if they do not then it is not. This is one way to understand the perceptual difference between those who enjoy reading on screen and those who are troubled by it: the first group have, or are on the way to forming reliable technological interactions with the equipment. The four criteria are intended only to define the terms of an experience which might be appreciated as technological, and the criteria of incorporation eliminates a substantial amount of artefacts from that class "technology." To make it clear: the novice or inexpert user encounters, in some significant way, a different artefact to the expert who brings the object "on-board" with their body. If artefacts are only ever apprehended as gestalts then experienced use alters the size and complexity of the collection. We will return to the implications of these ideas in more detail in chapter two; for now I will limit the discussion to the act of incorporation.

Firstly I'd like to introduce the notion of a body schema, a classical neurological

paradigm which has been reinvigorated by contemporary research. The body schema is essentially the mind's internal representation of the material body's external boundaries and position in space:

> The somewhat anecdotal concept of body schema has been greatly enriched by modern neuroscience…First it has been found that besides proprioception[, the awareness of one's limbs in space, particularly focussed on feedback from joints], other sensory modalities (typically somatosensory[, sensory reception from skin, muscle, bone, internal organs, and cardiovascular system,] and visual) are crucial to its construction…Second, single-neuron recordings in the monkey brain have changed the vision of a 'purely perceptual' construction of a body map in the brain towards a more multicomponent, action-oriented one. In this view, multiple fronto-parietal networks integrate information from discrete regions of the body surface and external space in a way which is functionally relevant to specific actions performed by different body parts (Maravita & Iriki 79).

Angelo Maravita and Atsushi Iriki here outline how that mental representation of the gross bodily form is created and constantly updated, and part of that updating includes an action element: rather than just forming from idle sensory perception, the body learns about itself by acting, becoming aware of how its surfaces and forms functionally relate to an immediate environment[52]. Donald refers to this body schema as the "perceptual homunculus," our sense of perceptual self:

> It does not tolerate blatantly contradictory messages...A unified personal homunculus is a crucially important point of reference for calculating position, for coordinating movement velocity and direction, and especially for interpreting and directing self-action. To achieve this satisfactorily, the sensory homunculus must convey an accurate impression of our own bodies, located in an objective, three-dimensional space...This perceptual homunculus is no illusion, but it should not be confused with the Cartesian homunculus that is currently under attack from so many scholarly quarters. That abstract eighteenth-century philosophical category does not do justice to the body-based homunculus

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[52] For a survey of the confusion in distinguishing between body image and schema in psychology, cognitive science, and phenomenology see Shaun Gallagher (*How the Body* 1-24). Gallagher identifies the body schema as

> neither a perception, nor a conceptual understanding, nor an emotional apprehension of the body. As distinct from body image it involves a *prenoetic* performance of the body. A prenoetic performance is one that helps to structure consciousness, but does not explicitly show itself in the contents of consciousness (29).

A body image, a conceptual understanding of our body in space, separates us from our environment, whereas a body schema acts in concert with, or even incorporates aspects of that environment (38).

I am describing, which is nothing less than the integrated neural footprint of our embodiment, a deeply rooted perceptual and motor phenomenon, and the underpinning of a unified physical selfhood. Our complex egocenter is really a brain model of the physical self and the primary source of self-awareness (*So Rare* 135).

To separate our minds from our bodies is to fall into the trap of Cartesian dualism, to suggest that there is a self that somehow exists as a "ghost in the machine" of our physical existence. The perceptual homunculus is not akin to this idea, but it does recognise that there are components of our being that, though fully integrated with and constructed by our physical experience, are nonetheless experienced as virtual phenomena at the last instance; the perceptual homunculus, or body schema, is made up of our cumulative mental representations of our physical form and used to guide our actions. When we use a hammer there is a large amount of virtual mental model building (one of the primary reasons for the existence of the homunculus) that occurs in order to allow us to accurately position the face of the tool for a good strike. For this reason I would like to suggest that it is this homunculus that can be extended by technological interactions, and that it is significantly altered during a process of incorporation. When the carpenter uses her saw it becomes softly assembled into her body schema; when we say that it extends the abilities of her arm we can also say that the mental representation of the assemblage of the arm alters to include the tool, and this new assemblage necessarily has new qualities, and therefore new abilities, over the previously skin, bone, and flesh "hard" assemblage of her pre-extension body. Walter Ong hinted at something similar when he said that "intelligence is relentlessly reflexive, so that even the external tools that it uses to implement its working become 'internalized,' that is, part of is own reflexive process" (*Orality* 81).

When the carpenter uses her saw she no longer has to think about it, anymore than we must think about the pressures and tensions in our hands and arms when we reach to pick up an object[53]. The same cannot be said of the interactions of the novice

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[53]   Clark outlines this mechanism:

> Posterior parietal subsystems…operate unconsciously when we reach out to grasp an object, adjusting hand orientation and finger placement appropriately. The conscious agent seldom bothers herself with these details; she simply decides to reach for the object, and does so, fluently and efficiently. The conscious parts of her brain learned long ago that they could simply count on the posterior parietal structures to kick in and fine-tune the reaching as needed. In just the same way, the conscious and unconscious parts of the brain learn to factor in the operation of various nonbiological tools and resources, creating an extended problem-solving matrix whose degree of fluid integration can sometimes rival that found within the brain itself (*Natural-Born* 31-32).

user who is cripplingly aware of every aspect of the interaction and the challenge of linking each discrete event together. Part of the teaching during an apprenticeship will be the repetition of motions, over and over and over, until conscious contemplation need no longer occur. This is a process identical to that of learning to walk in infancy: the body must learn how to co-ordinate its assemblage in such a way that it functions, unconsciously, as a seamless unit, in short it must form its body schema during use. As Clark describes it,

> what is special about human brains, and what best explains the distinctive features of human intelligence, is precisely their ability to enter into deep and complex relationships with nonbiological constructs, props, and aids…We have been designed, by Mother Nature, to exploit deep neural plasticity in order to become one with our best and most reliable tools (*Natural-Born* 5-7).

"Deep neural plasticity" describes the body schema's, the perceptual homunculus', constant updating and refining of itself, the deployment of novel strategies when inbuilt routines fail us, the brain's ability to "rewire" pathways to perform new tasks rather than relying on the ossified channels of past successful strategies, and the acceptance of external equipment into its fluid being. It is this drive to become one that we see in apprenticeship, the forcing of the painfully conscious into unconsciousness. This forms the basis of the second important assertion for the notion of incorporation: technological use is skilful use; skilful use is unconscious; in order to differentiate between the experience of the novice and the expert we will say that the expert encounters the equipment of their expertise skilfully; thus the expert experiences an unconscious, skilful interaction with their equipment, a technological interaction, whereas the novice does not - a saw is not a technology to the initiate. Incorporation is the skilful deployment of equipment in extension rehearsed into invisibility. "Skill results from rehearsal, systematic improvement, and the chaining of mimetic acts into hierarchies… Whether we are learning to weave, manufacture tools, or cook food, we must learn a set of basic action sequences, generalize them, and rehearse them until they become second nature" (Donald, *So Rare* 264). This goes some way to explaining why the Large Hadron Collider is not of the same order of objects as my mobile phone. The criteria of incorporation, perhaps unintuitively, tells us that as I do not experience the Large Hadron Collider skilfully, invisibly, then I do not encounter it as a technology.

This idea of invisibility has been represented in various ways across various

disciplines, though to my knowledge no one else has suggested that it should be considered as a defining element of what constitutes a technology. I would like to consider a few of these representations to better elucidate and justify the notion of incorporation before looking at some further implications of the criteria.

Let's first take a literary example, though one which also draws on the evidence of neuroscience. David Foster Wallace's treatment of human reaction times in tennis, detailed in his essay for *The New York Times* on Roger "Federer as Religious Experience" is such a perfect description of the act of incorporation that I am attempting to outline that it is worth quoting at some length:

> Mario Ancic's first serve…often comes in around 130 m.p.h. Since it's 78 feet from Ancic's baseline to yours, that means it takes 0.41 seconds for his serve to reach you…This is less than the time it takes to blink quickly, twice…The upshot is that pro tennis involves intervals of time too brief for deliberate action. Temporally, we're more in the operative range of reflexes, purely physical reactions that bypass conscious thought. And yet an effective return of serve depends on a large set of decisions and physical adjustments that are a whole lot more involved and intentional than blinking, jumping when startled, etc…Successfully returning a hard-served tennis ball requires what's sometimes called "the kinesthetic sense"...English has a whole cloud of terms for various parts of this ability: feel, touch, form, proprioception, coordination, hand-eye coordination, kinesthesia, grace, control, reflexes, and so on. For promising junior players, refining the kinesthetic sense is the main goal of the extreme daily practice regimens we often hear about…The training here is both muscular and neurological. Hitting thousands of strokes, day after day, develops the ability to do by "feel" what cannot be done by regular conscious thought. Repetitive practice like this often looks tedious or even cruel to an outsider, but the outsider can't feel what's going on inside the player - tiny adjustments, over and over, and a sense of each change's effects that gets more and more acute even as it recedes from normal consciousness.

The complexity of using a tennis racquet accurately and at speed requires hours of practice in order for it to be truly accepted into the body schema. This is because of the fine grain of the control required. It can be likened to using a pole to extend our reach - if we stand on one side of a room and reach across it with a long broom handle we might, with very little practice, be able to hit something hanging from the ceiling, like a piñata, on the other side. Flicking a light switch, however, would be far harder, taking many attempts to determine heft and balance accurately etc. A single returning stroke in expert tennis play is maybe comparable to using the broom handle to type a short word

on a computer keyboard suspended on the opposite wall. In 0.41 seconds. The only way to achieve such results is to make the racquet as dextrous a part of the body as the hand which holds it[54]. As Wallace goes on to point out, this is the same process by which people learn to drive cars. The novice driver does not experience their ever-growing gestalt of the vehicle as a technology, but slowly, as their expertise increases, they will sublimate all of the little gestures and sweeping movements that must occur in order to control a car and assess the driving environment, and it is only at this point that their interaction might properly be considered as technological.

The neurologist Frank Wilson, in his work *The Hand*, writes about the act of becoming one with objects, and it is from the following quotation that I have appropriated the term "incorporation":

> this phenomenon itself may take its origin from countless monkeys who spent countless eons becoming one with tree branches. The mystical feel comes from the combination of a good mechanical marriage and something in the nervous system that can make an object external to the body feel as if it had sprouted from the hand, foot, or (rarely) some other place on the body where your skin makes contact with it…The contexts in which this bonding occurs are so varied that there is no single word that adequately conveys either the process or the many variants of its final form. One term that might qualify is 'incorporation' - bringing something into, or making it part of, the body. It is a commonplace experience, familiar to anyone who has ever played a musical instrument, eaten with a fork or chopsticks, ridden a bicycle, or driven a car (63).

Again, the body schema is restructured to incorporate external material objects into its perceptual model; the boundary line of the skin no longer functionally applies. Whether this opens up the idea of monkeys experiencing tree branches as technological depends on how we negotiate the second criteria of "communality." Is there a cultural pressure for monkeys to deploy tree branches in locomotion? Would a monkey raised in isolation spontaneously deploy the brachiating swing so typical of their species in the wild? If not, if there is a strong cultural element to the monkey's movement through the

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[54] In their review of the contemporary field in cognitive psychology, Maravita and Iriki look at tool-use studies which support this notion of complexity requiring proportional training:

> Intriguingly, whilst in some studies on humans the reported behavioural effects of tool-use occurred without any specific training…, in other studies substantial tool-use training was required to elicit these effects…It might be that simple acts, like pointing… or reaching with a stick will show behavioural effects without training, whereas more complex tasks involving dextrous use of a tool, such as retrieving objects with a rake…, require some training before any behavioural effects will emerge (84).

branches, then perhaps we should also consider that to be a technological interaction. My argument is not, unlike Heidegger's original common sense definition, that technology is an exclusively human preserve, only that the extent to which we can bring a vast array of equipment "on-board" is a uniquely human trait; that it is not ability, but malleability which singles us out.

In their review, Maravita and Iriki consider the mechanism for such acts of incorporation, examining in particular the research into
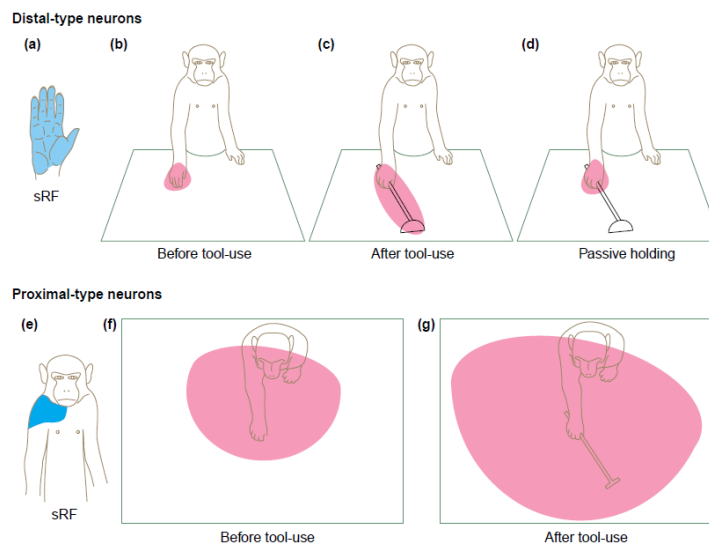
> [w]hat happens in our brain when we use a tool to reach for a distant object…Recent neurophysiological, psychological and neuropsychological research suggests that this extended motor capability is followed by changes in specific neural networks that hold an updated map of body shape and posture (the putative 'Body Schema' of classical neurology). These changes are compatible with the notion of the inclusion of tools in the 'Body Schema,' as if our own effector (e.g. the hand) were elongated to the tip of the tool (79).

The evidence presented in this review provides empirical support for Wilson's notion of incorporation, and also for the distinct criteria of technology to which I have attached that term. Maravita and Iriki begin by describing the neuroanatomical discovery of "premotor, parietal and putaminal neurons that respond both to somatosensory information from a given body region (i.e. the somatosensory Receptive Field; sRF), and to visual information from the space (visual Receptive Field; vRF) adjacent to it" (Maravita 79). This is to say that there are "bimodal" neurons which fire both in response to the somatosensory sensation (physical experience) of a body surface such as the hand, and also in response to visual stimulus in the area immediately surrounding that surface. Referring to two studies in particular, one conducted by Iriki[55], Maravita and Iriki outline the training of Japanese macaques to use a rake to reach for a food pellet dispensed out of their (the macaques) reach[56]. "In these monkeys, neuronal activity was recorded from the intraparietal cortex, where somatosensory and visual information is integrated" (Maravita 79). The studies aimed to record the activity of the bimodal neurons in this area. When using the rake for a sustained period of time, training its use, the monkeys' bimodal neurons fired in response to visual stimulus surrounding not just the hand, but also in the area around the tool; the mind of the

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[55] Iriki et al "Coding of Modified Body Schema..." and Ishibashi et al "Acquisition and Development of Monkey Tool Use."

[56] Japanese macaques "rarely exhibit tool-use behaviour in their natural habitat" (79).

macaque had begun to treat the rake as a part of its body, it had been incorporated into its body schema[57].

Distal-type neurons
(a) (b) (c) (d)
sRF
Before tool-use   After tool-use   Passive holding

Proximal-type neurons
(e) (f) (g)
sRF
Before tool-use   After tool-use

(Maravita and Iriki 80).

Maravita and Iriki conclude from this evidence that "[s]uch vRF expansions may constitute the neural substrate of use-dependent assimilation of the tool into the body schema, suggested by classical neurology…Hence, any expansion of the vRF only followed active, intentional usage of the tool, not its mere grasping by the hand" (79-81)[58]. Here we have crucial evidence of the nature of encountering equipment in use, rather than as an uninteracted-with object; incorporation into the body schema only occurs during interaction. A hammer held at one's side, or on one's belt, is not in skilful use, and is not therefore encountered in a technological interaction. It is only during the deployment of an artefact as equipment that the experienced gestalt can be considered as a technology, i.e. a technology comes into being only during use.

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[57] Evidence for incorporation during human tool use supports the findings of the more invasive procedures used to study the macaques. See for instance Carlson et al "Rapid Assimilation of External Objects Into the Body Schema."

[58] For a similar, though perhaps less compelling (as less invasive) example of incorporation in humans see Berti et al "When Far Becomes Near..." In this study a patient who suffered from near space "neglect" in the right hand side of their field of vision following a stroke (i.e. the patient perceived nothing in their right hand field of vision which the brain would code as being "near" to (as opposed to "far from") them) was nevertheless able to perceive objects coded as "far from" on both sides. When using a tool visible in their right field of vision the patient could extend the effects of their neglect to objects which became coded as "near" because in reach of the tool, i.e. the brain incorporated the tool to such a degree that it's reach equated the arms reach in causing the brain to code items as near or far; "the tool was coded as part of the patient's hand, as in monkeys [in Maravita and Iriki's review], causing an expansion of the representation of the body schema. This affected the spatial relation between far space and the body...[P]eripersonal space was expanded to include the far space reachable by the tool" (418).

Consider throwing a stone at a seagull: this is not a technological interaction. But refine the skill to a reliable hunting technique and suddenly the stone is an artefact at the heart of a skilful experience. We can think of computers in the same way: stumbling around the screen, hunting and pecking at the keyboard, having icons pointed out to you, learning how to double click with sufficient accuracy and speed (anyone who's forgotten the difficulties of such things should attempt basic tech. support for any user who has managed to remain basically insulated from our culture's obsession with screens), these are not technological interactions. But to the experienced computer user (and what they have made that term mean for themselves with regard to their gestalt), the computer forms the heart of a technological interaction. The physical artefact is not a technology on its own terms, it cannot be, anymore than can the stone. It is only a technology when encountered at the heart of a specific skilful interaction; the stone is as equally capable of being encountered as a technology as a computer when the interaction is of a particular type, meeting particular criteria

Let's move away, briefly, from the evidence for incorporation to be found in the neurosciences, and turn to phenomenology. We have looked already at Heidegger's "Question Concerning Technology," and also his definition of equipment, at least in a limited capacity. The use of that equipment, however, is what is central to his search for "The Worldhood of the World" in section three of *Being and Time,* and the skilful actuation of that use is something very similar to my own use of the term "incorporation."

Heidegger states that "[w]e shall seek the worldhood of the environment (environmentality) by going through an ontological Interpretation of those entities within-the-*environment* which we encounter as closest to us" (*Being* 94). Heidegger's task is to get to the nature of (the) world itself, and our Being within it, *Dasein,* something he believes we can only start to approach through the ontological study of the items in our environments which we draw closest to ourselves. It is due to the intimacy of our dealings with equipment, Heidegger states, that the nature of the world can begin to be revealed. If, as Merleau-Ponty suggested, tool use can become part of our medium for "having a world," then a better understanding of how we function as technology deploying beings may well be a step toward establishing how we encounter the environment around us, not necessarily the world "as it is," but the world as we build it through models from visualisation, physical experience, virtual experience, and

technological encounter - visual, somatosensory, internal mental, and technologically extended feeds for the perceptual homunculus.

There are two ways in which we can experience objects in the world for Heidegger[59]: in a theoretical stance where we encounter Things which are "present-at-hand," available for observation, but unavailable to experience as they are, and in use where we can encounter equipment as what it is, as ready-to-hand:

> Only because equipment has *this* 'Being-in-itself' and does not merely occur, is it manipulable in the broadest sense and at our disposal. No matter how sharply we just *look*…at the 'outward appearance'…of Things in whatever form this takes, we cannot discover anything ready-to-hand...the less we just stare at the hammer-Thing, and the more we seize hold of it and use it, the more primordial does our relationship to it become, and the more unveildly is it encountered as that which it is (*Being* 98).

When we are not using the hammer it is a Thing in the world, present-at-hand, and much as we may look at it we cannot access its nature. When we deploy it in a task, however, we start to gain some sense of it, we focus not on it, but on the work to be done. It is, unintuitively, in this *unfocusing* that we experience a "primordial" relationship with the hammer: "In its readiness-to-hand, it must, as it were, withdraw...That with which our...dealings proximally dwell is not the tools themselves... [T]hat with which we concern ourselves primarily is the work" (99). It is this understanding of the ready-to-hand which is so crucial to our criteria of incorporation.

Heidegger's concern is with getting to Things as they are; our concern with readiness-to-hand, however, is in seeing how the primordial relationship describes incorporation into body schema. But these differing concerns are both fundamentally connected in a notion of incorporation: in this reading, Heidegger's conception of a use-driven relationship with equipment is the very same *homo sapiens* trait of invisible skilful use that we have been discussing. When something is ready-to-hand we cease to concern ourselves with its nature as conscious consideration bars us from true incorporation; it is only in its invisibility that we come closest to it. For Heidegger this allows us to encounter the object as it is, for our concerns it allows us to bring that item

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[59] This chapter will utilise a widely accepted interpretation of Heidegger's tool analysis and division between presentness- and readiness-to-hand. In the next chapter we will be more concerned with Graham Harman's more radical reading in *Tool-Being*. Whilst I sympathise, as will be seen, with Harman's project, the more mainstream use of Heidegger's terms are too useful to us here to be nullified.

into our perceptual map of ourselves so that the only focus is on the work to be done, not the assemblage which accomplishes it. Technologies, in short, are ready-to-hand. This understanding of readiness-to-hand and incorporation are interchangeable, the only difference being the assertion of what it reveals, an aspect of the world on the one hand, or an aspect of human interaction with artefacts on the other. Our tools function as part of the apparatus which provides us with a conscious phenomenological world, and the rest of that apparatus is made up of the other feeds to the perceptual homunculus: the visual, the somatosensory, and the virtual. It is on each of these feeds that technology can have an effect.

The most significant effect of adopting this third criteria is just how many objects described as technologies under the common sense definition are suddenly ruled out as such. The criteria of incorporation introduces individual phenomenological concerns in order to differentiate between amateur and expert use, and in so doing renders a large amount of complex technological equipment as not technological at all. Under this criteria if you've never seen or heard of a mobile phone then it is not a technology to you, you could not have a technological interaction with it, it would just be a thing in the world, not even equipment. But through use it can start to function as equipment: the cultural pressures of your community drive the adoption and perseverance of that use, codifying and standardising it, and when this starts to occur the range of abilities available to the ear and mouth are extended in McLuhanist fashion. When you've texted and texted and texted, and chatted and chatted and chatted, and when you feel it buzz in your pocket and you don't even think, your hands already know what to do, and they fumble the thing up to your face with the call already answered because you know that's how to avoid that little delay between pressing the button and it actually connecting… *that* is equipment incorporated, a technological interaction, and one which might, as a shorthand, lead you to describe the mobile phone, as a *category* of objects, as a technology.

It is not enough, however, to just use an item. We may get some sense of the equipment, but true readiness-to-hand, true incorporation, comes from rehearsal into *skilful* use. As Clark states, drawing on the same study as that discussed above: "[t]he plastic neural changes…emphasized by Maravita and Iriki...suggest a real (philosophically important and scientifically well-grounded) distinction between true incorporation into the body schema and mere use" (*Supersizing* 38). A happy accident

of terminology makes the point very clearly here (Clark doesn't systematically use "incorporation" as an established criterion for any particular event): the work that Maravita and Iriki discuss is an effective demonstration which augments Heidegger's readiness-to-hand. The macaques had to be trained into displaying the bimodal functionality, but once it was there it became clear that a soft-assembled apparatus was created, truly incorporated because it was skilful. If Heidegger's assertion is that we only experience aspects of the world as it is in "primordial" invisible relationships then it is surely not just in use, but in *skilful* use that this occurs, an idea that we'll come to again in the second chapter.

Incorporation also troubles the idea of technology as a mediating layer, or a visceral insulator between us and the world. If a tool is brought on board then our encounter with the world through it would seem much the same as with the assemblage of our arms. One might argue that touch is mediated by the tool, but isn't this as true for a spade as for a mechanical digger? A driver of the digging machine who has incorporated the apparatus and who can respond to the viscosities and densities of the earth does not seem so far removed from the gardener, if at all. Perhaps the prejudice stems from our disbelief that such nuanced incorporation can occur, but Wilson outlines examples such as mechanics and engines (*The Hand* 173-178 and 293-294) and crane operators (89-90) who have attained just this level of skill, and other examples can be easily found in the relationship between musicians and instruments, drivers and vehicles, hackers and computers, photographers and cameras, etc. etc. It doesn't seem right to call technology an unnatural mediator simply because some tools require more practice to incorporate than others. Do technologies become somehow more natural as skill increases (or rather more built into our nature as we make them part of ourselves)? The implications for the new and complex e-reader and the simpler and over-practiced codex are clear: might the codex have been rehearsed into an apparent naturalness rather than being so *a priori*?

One final assertion must be made about the criteria of incorporation in order for it to stand up as a defining criteria of technological interactions: incorporation can still present an interaction as weakly technological, even if it exists only in potential. Let's take again the example of someone learning to drive. The car, when the novice first enters it, is not a technology, nor are their dealings with it technological. There will come, however, an in-between moment in the novice's learning when the equipment

they are deploying temporarily becomes invisible, only for a moment, when their hand reaches automatically for the gear-stick say, or the indicators are flicked off without a thought, when the mirrors are checked and the small manoeuvre executed without a conscious ticking through each micro-event, in short, where a particular skilful interaction occurs. At moments such as these the *potential* for incorporation becomes apparent. It is clear that it can be achieved, it is not beyond the user, and this is the very start of experiencing the car as a technology. We might say that at this moment the equipment "trends toward" being a technology; this is a tipping point. Such users might rightly speak of their dealings as technological because the range of abilities they experience as *becoming* available to the body schema has been extended, and they have also entered into a specific set of community relations and pressures. We will return to this idea shortly.

> *Incorporation: E-readers and codices can become invisible during use, allowing us to concentrate, for the most part, on the act of reading rather than the hand holding the equipment or the pages themselves. This is not to say that these things do not affect our reading, only that they do not occupy our conscious attention if we allow them to melt away. In this moment the body and either artefact form an assemblage for reading that is, in theory, empirically testable. Regardless of the brain's neuronal mapping, however, the phenomenological experience of incorporated reading is of the melting away of the apparatus[60].*

Morphability

For a gestalt artefact to be considered a technology, i.e. equipment at the heart of a technological interaction, it must have the potential for a morphing effect upon the user. This is the final criteria of what we should require of an interaction with equipment in order to consider it as technological. I've already spoken of the uniquely human ability to rapidly incorporate a wide variety of equipment into the body schema, but morphability says that this must also be capable of a lasting effect if we are to consider that interaction as technological. In its simplest guise, morphability is the long lasting or

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[60]   This assertion will be problematised somewhat in the section on "devices" below. To pre-empt that argument, a technological interaction is fragile and if interrupted the apparatus will return to our concern; this experience is not rare.

permanent extension of our conception of what we can achieve: a primitive hammer could make our ancestors know that they could gain access to hard-shelled nuts; now a car makes us know that we can cover a distance in a time far less then our biological walking gait could allow. The body schema is the virtual model of our boundaries and capacities and any medium-to-long-term change in this we can consider as morphing.

But even on the limited time scale of the individual human life (we will expand upon such a time scale after we have finished establishing the basic definition for individuals) there is more to morphability. There are the relatively subtle effects of practice, for instance, where minds and bodies are tested, strengthened, and honed through repetitive and concerted interaction: the touch typist has a skill unavailable to someone approaching the keyboard for the first time; the taxi driver's senses are more alert to the particularities of the road than the learner; the hunter who deploys spear or bolas has a hand-eye coordination to rival the speed of the quarry. For the individual user, morphability is perhaps best represented by these plastic changes in the brain. The incorporation of any tool will result in a physical change to an individual over time, and over much larger than the short term (and poorly understood) rearrangements of memory. Michael Merzenich, for instance, demonstrated that regions of the brain dedicated to sensation can grow and shrink in proportion to their use, in particular focussing on the shrinking of the visual area and commensurate growth of the area representing the fingertips in blind readers learning braille[61], and Norman Doidge describes a wide range of case studies of damaged and healthy brains in extraordinary conditions reshaping themselves over time (*The Brain That Changes Itself*). Such morphability, where our brains can restructure themselves in response to cultural and environmental requirements, are what make humans viable as a species - we're not the strongest, fastest, or toughest, but we are the most adaptable, turning to anything in the world which might give us an advantage at any given time, and then doing our best to bring such items into the conceptions of ourselves to maximise the effectiveness of use. Clark sees this activity occurring in

> humans and other primates…[which are]constantly negotiable bodily platforms of sense, experience, and…reasoning…Such platforms are biologically primed so as to fluidly incorporate new bodily and sensory kit, creating brand new systemic wholes. This is just what one would expect of creatures built to engage in…'ecological control': systems

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[61]   See for instance Alvaro Pascual-Leone and Fernando Torres "Plasticity of the Sensorimotor Cortex..."

evolved so as to constantly search for opportunities to make the most of the reliable properties and dynamic personalities of body and world (*Supersizing* 37).

A "*super*plastic" brain (Donald, *So Rare* 210) such as ours, however, is one best suited to the expanded triggers of bimodal neurons detailed by Maravita and Iriki. After two weeks training the Japanese macaques' brains had altered so that they could measurably incorporate the rake after five minutes use and reach for the food pellet. But two weeks of training an adult human being can incorporate vastly more dextrous activities then simple reaching, and over time we are able to achieve the sort of staggering fine detail manifested by Wallace's tennis players. All such acts of incorporation must be met by a physical change in the brain, and this is a manifestation of morphability. This leaves us with a sense of the body schema as always open, reaching out, and significantly transient. Though many aspects persist, it is largely due to the constraints of our physical shape rather than some ineffable "human-ness":

> It is a mistake to posit a biologically fixed 'human nature' with a simple wrap-around of tools and culture; the tools and culture are indeed as much determiners of our nature as products of it. Ours are (by nature) unusually plastic and opportunistic brains whose biological proper functioning has always involved the recruitment and exploitation of nonbiological props and scaffolds (Clark, *Natural-Born* 86).

Clark here paints a very different picture of equipment use than that of the resisters of modern technology we saw at the start of this chapter. Far from separating us from the world, to Clark our principle technological interactions bring us closer to our nature as beings in that world. In this regard technology isn't "unnatural," its what we do. Some people may not like the direction in which we are being morphed through sustained equipment use and the related cultural changes that go along with such action, but they cannot attack this as being wholly "unnatural." Change is an effect of use, and use is our default mode of apprehension, like a shark's first bite of an unfamiliar object.

Morphability, then, is the final criteria of technology. If it is not met then the interaction is not technological, but if the other criteria are in play then morphability will surely follow. Change is the effect of the other three criteria, but it should not be ignored. If we are trying to decide whether we should rightly consider something as technological or not, one of the first avenues we can pursue is: what does it change in its user? If the answer is hard to find then that makes for a fine indicator that a

technological interaction is not occurring because technologies alter users and require users altered to their properties.

> *Morphability: E-readers and codices both alter their users by acting as a substrate for writing which materially affects how we think. But the artefacts themselves, rather than the material which they carry, are also morphing to some degree, representing a permanent alteration in the conception of what the user can achieve.*

Implications for the common sense definition

Let's return to our original common sense definition: technology enables, technology is a uniquely human thing. I hope that it is now clear how deficient this definition is for any nuanced discussion of the experience of a class of equipment which is at the heart of human experience. When we say that technology enables us to do things that we were unable to do before then this is perfectly correct, but should every object which allows for new abilities to be manifested be called a technology? What about reaching for one's car keys, lost at the bottom of a drain, with a length of bent coat hanger? Is this a technology, a technological interaction? The common sense definition would say yes, even though anyone using even a modicum of common sense would be able to tell that a makeshift key collecting hook is of a very different order of objects to the expertly used computer. As Wallace, Heidegger, Maravita and Iriki, Wilson, Donald, and Clark all assert in their various ways: skilled use changes the order of equipment we encounter.

The definition outlined here has drastic implications for a number of the artefacts which we would readily describe as being technologies as we are forced to ask a phenomenological question: who are they technologies for? Let's take the example of a passenger plane. The common sense definition states that a plane is unequivocally a technology - humans use planes to do something that they previously could not. But when we deploy our new definition the question arises as to when we should say that a particular user's interaction with the assemblage should be considered as technological. Here is the pilot's use broken down into the four criteria:

- Extension - The pilot is able to achieve an activity - i.e. flying, or travelling great

distances, or moving large groups of people - that they could not have achieved before.

- Communality - The pilot has been through flight school, experiences cultural pressures at various levels (global, national, professional, fraternal) to interact with the plane as gestalt equipment in a certain way.
- Incorporation - The pilot's available gestalt of the artefact will principally come from his interactions with the external boundaries of the plane (an awareness of its size for taxi-ing and turning), and the cockpit. The pilot can situate himself as a *component* within this assemblage, and this is a form of incorporation also[62]. A soft assemblage occurs where the pilot is able to perform activities functionally invisible to themselves: all the mirco adjustments of pitch and yaw done by "feel"[63], every unfocussed reach for a dial to make a correction, or the automatic performance of pre-flight checks.
- Morphability - The pilot's body schema has an increased range of abilities available to it. Hand/eye coordination will have been elevated; a feel for the plane will have emerged.

A pilot, then, could certainly describe his interactions with the plane as technological, or say that the plane, as a gestalt artefact, is a technology to them. But what of the aeronautical mechanic who works on the plane each day?:

- E - Not applicable. The *plane*, as a gestalt experienced during work undertaken, does not extend the abilities of the mechanic; they work on the plane with skill extending tools.
- C - The mechanic experiences a variety of cultural pressures to interact with their gestalt of the plane in a certain way.
- I - Whilst the mechanic is primarily incorporating her tools during skilful work, she might also have a sense of the feel of the plane, very different to the pilot's, but again born of repetitive engagement. The intuitive checks and adjustments of the pre- and post-flight equipment, and a sense of the whole operating smoothly might well be considered a form of incorporation.
- M - Not applicable. The plane, as a gestalt experienced during the work undertaken does not have a morphic effect on the mechanic.

Finally we should consider the experience of the majority of interactors, the passengers:

- E - The plane allows for a new, though relatively uncontrolled ability: the ability to travel at speed through the air.
- C - There are specific cultural pressures surrounding the act of flying which

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[62] See, for instance, Edwin Hutchins chapter on pilots being incorporated into their equipment in *Cognition in the Wild* (117-174).

[63] By feel I mean what, to the pilot, seems an ineffable sense of the whole: they make adjustments that feel right for the assemblage in which they situate themselves, and, far more often than not, they are the right adjustments. This stems from a deep skilful incorporation born of repetition, similar in effect to a dancer or gymnast's almost uncanny awareness of the shape and position of their physical form.

constrain, codify, and standardise the experience.

- I - Not applicable. Flying on a plane is a supremely conscious experience, and there is no way to incorporate the gestalt artefact that a passenger experiences. The passenger has no access to use the thing that they encounter.
- M - Not applicable. The plane itself is unlikely to have a lasting impact upon the passenger.

The new definition, when deployed, overhauls our consideration of mass aeronautic travel as a technology, as planes are a great example of an item that most of us *do not* encounter in a technological interaction. We are supremely conscious of it, well outside the community of those who actually *use* it in the skilful sense that has been discussed in this chapter, and we are largely unmorphed by its existence. It does extend our ability to travel, and if extension were our only criterion for a technology, as it is in the common sense definition, then it would be met. But it shouldn't be. This allows us to distinguish our passenger's interactions with, and experience of the plane as an object from those of the skilled pilot, and also to distinguish between the order of objects that includes skilfully used hammers and mobile phones, and the order of objects that includes passively sitting in a metal carrier. The current rubric of "technology" deployed in the popular press and far beyond cannot account for such distinctions, but I believe that the definition under discussion here can. When deciding whether something, not as a specific thing, but as a type, is a technology you would need to consider the majority in the audience that you're addressing. For instance, in our society it would be typical to define cars and computers as technologies, colliders and industrial machinery as not. Technological determinism is far less of a problem under this more nuanced definition. Did the printing press technology cause the enlightenment? Did steam technology change the world? "Does Technology Drive History?[64]" Well no, it can't do and can't have done, because most people do not experience technological interactions with new inventions, only the effects of those minority of users who may have experienced such. This immediately contextualises technological use rather than giving a sweeping agency to the mere presence of certain objects.

Devices

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[64] See Marx and Smith's book of the same name for a discussion of the history and interpretations of technological determinism.

With technology so defined we must turn to a different order of equipment, closely related, to refine the idea. What shall we call the class of artefact that we encounter in use, but that we do not have a technological interaction with? Certainly this still seems to be equipment - we encounter properties of the thing involved through use - but the "primordial relationship" is absent. I propose that we call this class of useable objects "devices," as this still connotes a means for getting things done, but has none of the implications of intimate relations we have bound to "technology."[65]

A device is a quick-and-dirty solution, to borrow an IT term, to a problem which exists for a single user at a single time, whereas a technology is a methodised and rarefied solution to a common problem in a community, a solution which both persists and affects.

An example of a device: if you drop your keys into a drain then you might turn to the available resources of the environment in order to retrieve them - you rush into your house, fetch that coat hanger, bend it into a crude hook, and, with a little difficulty, fish out the keys. This is a device; you interact with it as a tool, but not as a technology. It might extend your means, but once the task is complete your new device does not persist, and it has had no long-term effect on the way you interact with your environment. Taylor also provides a helpful anecdotal example from a fishing trip where he had to improvise a club from a nearby rock:

> Sacrificing smoothness for weight, and balancing a moral need for swift dispatch against my affection for my own fingers, I used three or four medium-weight blows. These unaesthetically but convincingly spit the skull, knocking the eyes out. Things improved with the second and third trout, and the fourth was neatly sent to wherever trout go when they die (my stomach I suppose). Afterward, Keith [Taylor's fishing partner] tossed our expedient artifact back into the water, and as the blood billowed off downstream, history evaporated. Unlike the rod, hook, and line, the improvised fish whacker reverted to being just another rock, unmodified and non-cultural (*Artificial* 45).

Taylor's fish dispatching device took practice to use well; we can see a process of incorporation here, and it also extended his abilities. The difference between it being a device or a technology lay in its communal function: community knowledge motivated

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[65]   Note that there is a similarity between my deployment of "device" and that of Albert Borgman in *Technology and the Character of Contemporary Life*. For Borgman a device is a piece of equipment, tangible or intangible, which separates the user from the realities of the work to be done and requires no skill (e.g. central heating vs. a wood-burning stove).

the search for the equipment, but Taylor's method had no return to cultural existence; when the tool was discarded, when it ceased to be equipment in use, it disappeared.

The distinction between a device and a technology, I would like to suggest, is not a binary opposition, but instead an analogue scale. We can move from approaching an object as a device, to interacting with it as a technology, indeed this must occur frequently: it is the only way that technological change can arise as we can never experience any novel object as technological instantly, due for the most part to the third criteria of incorporation, a state which, as we have seen, requires rehearsal into unconsciousness, a task proportional to the unfamiliarity, complexity, and dextrous requirement of the skilful interaction. All technologies must begin as devices, novel solutions to particular problems, from which a process of refining and defining occurs; devices are "pre-technological" equipment which might trend toward technologies over time.

Let's use our example of the coat-hanger-key-hook device and explore how it might become a technology, taking a similar generic trajectory to that which every technology must follow. The device already performs the first criteria: it extends our means by allowing us to reach into deeper and narrower gaps than we might otherwise have access to. As evidenced by the struggle to retrieve the keys on the first "fish" the device is not yet incorporated, the third criteria, but continued use could simply rectify this. And with all of these opportunities to rehearse the device into an incorporated state it is clear that key loss is a pressing problem in your community. Seeing someone else struggling, you might fetch your key-hook and demonstrate its use, and following a successful retrieval you might well discuss the implement, suggest modifications, recommend it to others. In this way the device can become a communal enterprise, standardising its use, the second criteria. As for morphability, our last criteria, who knows what sustained use by a community of users might cause? Most simply no one in the culture of key-hook users would see a small gap with tantalising objects for retrieval and consider them out of reach, there would have been a fundamental shift in the perception of abilities available to the user, particularly if the equipment, driven by cultural norms, was frequently kept about one's person much like a mobile phone. With these criteria met the key-hook could now be approached as a technological artefact by its experienced users.

This may seem a flippant example, but if we consider how the expert users would approach the object - as everyday, as normalised, adapted to its use - then we can

see that it is a far cry from the way the initial user experienced it as she urgently fished for her keys. A process of "technologising" the device has occurred. Note that the object itself doesn't need to change; technologising is not necessarily an augmentation of the equipment, but an alteration of our perceptions of the equipment we approach in use, and of our conception of what we can achieve with such.

What is the use of this distinction between technologies and devices? It allows us another way to distinguish between different ways of experiencing artefacts, to name the distinction between the novice and expert user's experience, and to demonstrate that objects which we often refer to as technologies are often more appropriately thought of as a different class of equipment, devices, such is our experience of them. We are better off reserving the judgement of "technology" for specifically encountered equipment because it allows us to more productively theorise a certain kind of interaction. "Device" might also function as a useful term for those resistant to new equipment: in the case of e-reading any promoter of the new reading equipment must justify why a fully technologised artefact such as the codex is being replaced by what many will experience as a mere device. This isn't an easy attack to answer to, as we'll see in the second chapter's discussions of path dependance and skeuomorphs. For now it is enough to see that though resistant reader's might well be able to read on an e-reader their dislike of the task, their feeling of unnaturalness in comparison to the codex experience, may stem from its existence as a device and the seeming unlikeliness of the technologising process coming underway, or being worthwhile.

I have already spoken of the "trend" toward technology in device use. The refining of skill appears to be a human drive, very few items are sustained in culture where the most skilful users are merely "quite good," there is always a cultural reward to those who can successfully incorporate equipment to the highest level, whether that be IT consultancy, guitar playing, cinematography, aeroplane piloting, car driving, or tennis playing. But it is impossible for technologies to remain entirely invisible and now we can say that the trend might be reversed and our experience can also move from the technological to the "device-ive." At these moments the technology ceases to be a part of soft-assembled, unfocused use and becomes, instead, available to conscious contemplation. It is not that the work necessarily ceases, only that it is no longer the sole, or at worst not even the primary focus. Such times are marked by periods of mistake, intense concentration, and drops in speed and productivity.

Heidegger identifies three different types of cessation of perceptual readiness-to-

hand:

- "Conspicuous" equipment is that which is not as ideally suited to the task at hand as we had expected: "When its unusability is thus discovered, equipment becomes conspicuous (*Being* 103).
- "Obtrusive" equipment is marked by the absence of the equipment we truly desire to accomplish the work: "It reveals itself as something just present-at-hand and no more, which cannot be budgeted without the thing that is missing. The helpless way in which we stand before it is a deficient mode of concern" (103).
- "Obstinate" equipment places an obstacle in front of the work to be done.

If we reach for a ready-to-hand pen and begin writing, but it is of the wrong colour, not black, but blue, then it is no longer a technology, but a conspicuous device. If we only have a pencil, and we need a pen, then the pencil, otherwise perfectly ready-to-hand as a technology, is an obtrusive device which ceases the work to be done. If the pen encounters wet paper which blocks the work to be done then it becomes an obstinate device. Anything which causes equipment to return to consciousness can cause a drop in the intimacy of the interaction, breaking the soft-assemblage into its constituent parts (typically, though not always, at the boundary of skin and world), and rendering the item at worst a thing to be contemplated, and at best unready-to-hand even as we attempt to deploy it as equipment, a device not a technological artefact to be used. These phenomenological definitions of the transition away from readiness-to-hand are useful analogues to the transition from technology back to device[66].

Recent cognitive psychological investigation into Heidegger's conception of a move away from readiness-to-hand also lend an empirical validity to this transition. The review conducted by Maravita and Iriki demonstrates how objects can become ready-to-hand, but their work does not explicitly engage with Heidegger, and as such they do not look for whether the trend toward a skilful/technological interaction can be temporarily reversed. A 2010 study by Dobromir Dotov, Lin Nie, and Anthony Chemero, however, sought to lab test Heidegger's assertions.

The study received attention from the technology magazine *Wired*, at first glance perhaps an unlikely home for such research, but the researcher's findings certainly make for compelling popular science journalism:

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[66] For more on Heidegger's distinction between the three modes see the translators' footnote for *Being and Time* 104.

An empirical test of ideas proposed by Martin Heidegger shows the great German philosopher to be correct: Everyday tools really do become part of ourselves…'The person and the various parts of their brain and the [equipment] are so tightly intertwined that they're just one thing,' said Anthony Chemero...'The tool isn't separate from you. It's part of you' (Keim).

The importance of this study from Dotov et al for the definition of technology that I have presented here, in particular for the criteria of incorporation, is hopefully clear. As a supplement to the Marvita and Iriki review it provides compelling evidence for incorporation, but also for the transition from technology back to device that occurs in moments of forced consciousness.

Dotov, Nie, and Chemero set out to

lend empirical support to Heidegger's phenomenology and more specifically his description of the transition between ready-to-hand and unready-to-hand modes in interactions with tools…Despite widespread attention in cognitive science and artificial intelligence to Heidegger's work, this interest has remained largely conceptual and no effort has been made to put Heidegger's theory in an experimental framework. A search of the PsycINFO database on December 10 2009, found no articles concerning Heidegger that involved laboratory work.

The team's paper therefore marks the first attempt to empirically test explicitly Heideggerian ideas about tool use.

The experiments conducted by the team deployed a simple setup. Participants in the study were required to use a computer mouse to move an onscreen pointer in order to play a game. A blue dot would continually try and escape from a grey "pen"; the participant would try and use the onscreen pointer to "herd" the dot back into place. "What allows the participant to guide the target is that it always tries to escape away from the pointer in a semi-predictable fashion. To make an analogy to Heidegger's example, here the mouse plays the role of the handle and the on-screen pointer figure plays a role similar to that of the hammer striking face." However, "[a]bout thirty seconds from the beginning of the trial a perturbation in the mapping between mouse movement and pointer movement instantiates equipment malfunctioning. It lasts a few seconds and then the situation returns to normal" (Dotov et al).
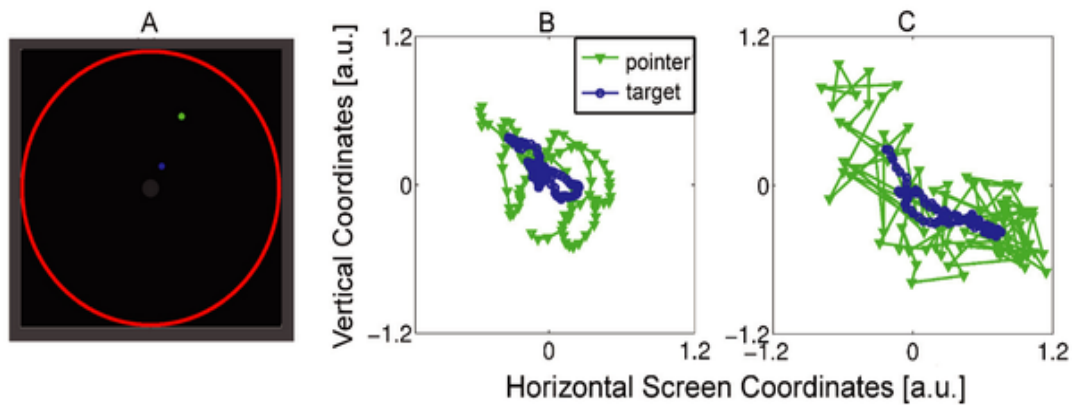
A single frame (a) captured during the course of a trial is shown and visible inside it are the pen, the gray center, and blue and green dots for the target and pointer objects, respectively. Representative pointer and target object trajectories on the screen from three-second excerpts with a normally behaving (b) and impaired (c) mouse are portrayed (Dotov et al).

The researchers made predictions in line with Heidegger's discussion of equipment: that the participant, as an experienced computer user, would "smoothly[, read 'skilfully,'] cope with the tool as…ready-to-hand," and that during the perturbation the mouse as tool would become the focus of attention and distract the user from a simple secondary task (in this case counting backward in threes from a given number). Their method for testing the first half of this assertion stems from the monitoring of a certain type of "noise," $1/f^{\beta}$, a power-law scaling in activity magnitude across the frequency range of data received from the analysis of the hand-tool system. Citing van Orden et al and Chen et al, Dotov et al

argue that $1/f^{\beta}$ noise found in an inventory of cognitive tasks is a signature of a softly assembled system exhibiting and sustained by *interaction-dominant dynamics*, and not *component-dominant dynamics*. In component-dominant dynamics, behaviour is the product of a rigidly delineated architecture of modules, each with pre-determined functions; in interaction-dominant dynamics, on the other hand, coordinated processes alter one another's dynamics, with complex interactions extending to the body's periphery and, sometimes, beyond…we can take the presence of a $1/f^{\beta}$ long memory process as indicative of the activity of a smoothly operating system, softly assembled by virtue of interaction-dominant dynamics…By looking for $1/f^{\beta}$ noise recorded at the interface of body and tool, we address the hypothesis that, while smoothly operating an instrument, a human performer instantiates such an IDS [interaction-dominant system] spanning the extended body-tool system.

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In short, skilful use of a ready-to-hand tool will manifest itself in an invariant scaling of activity magnitude over a frequency range - $1/f^\beta$ noise. This has, in prior experiments on human subjects, been linked to interactions where it is not the components (i.e. the parts of the body and the equipment) that dictate the effects of the interaction, but the *nature* of the interaction between the components that dictates its effects. In an interaction where the components themselves are subservient to the nature of their connection in terms of dominance then this is indicative of a "smoothly operating," i.e. skilful, soft assembled system, not a collection of components, but a single active entity. Dotov et al's prediction is therefore technically laid out as the expectation of the presence of $1/f^\beta$ type noise before and after the perturbation, and an absence of such noise during disruption, indicating a move from readiness-to-hand to unreadiness-to-hand and, in our terms here, from a technological to a "device-ive" interaction.

These predictions were born out with a marked trend away from $1/f^\beta$ noise during the disruption of the task, and its presence during fluid use:
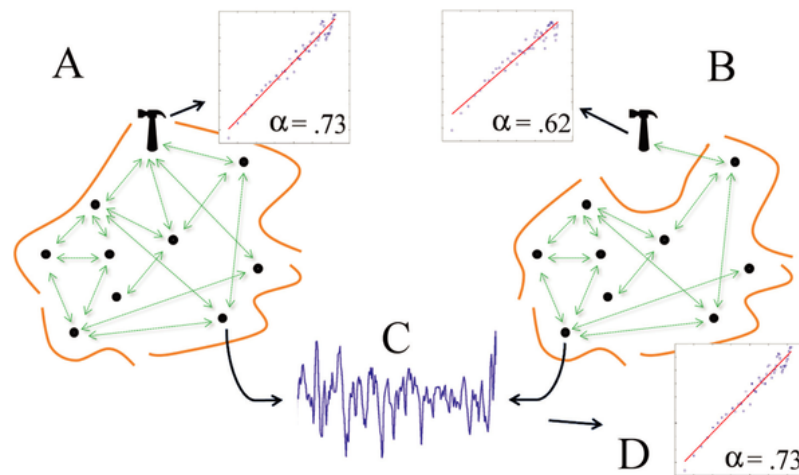
> The IDSs (delineated by the surrounding curves) are…softly assembled by virtue of rich interactions on multiple scales (double-sided arrows) among the components (black dots and hammer)...They either span across (A) or do not (B) the tool (hammer). It is assumed that the black dots stand for bodily structures (Dotov et al)[67].

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[67]   Further detail on the above schematic:

> Customarily, one studies such systems by collecting a time series locally from the behaviour of a single point of observation (C), that is, from a single element. Next, if possible one establishes their character as an IDS [Interaction Dominant System] by searching for power-law scaling of certain statistical quantities (D)...The scaling coefficient α reveals long-range correlations characteristic of 1/f noise in the hand-tool

We can see from the above schematic that the components of the body are always assumed to be treated as an invisible IDS, but during skilled ready-to-hand use the equipment is allowed to come "onboard" and become a part of that system. This is a restructuring of the IDS in order to form a new assemblage which accommodates the tool in use. The schematic at (A) essentially shows the extension of the body schema as the virtual model of the self is updated to include the tool.

The conclusion of the researchers' analysis appears to support the notion of a transition from technology to device:

> We are not arguing that the flow of interaction between tool and body is reduced in magnitude [during the perturbation], just that it is reduced in complexity. The mouse keeps providing sufficient local stimulation through the eyes and the sense-organs of the arm for the agent to maintain overall control over it, as when one is holding a foreign object in hand and is trying to figure out a specific property of it.

At these moments the equipment is returned to consciousness, dropping out of an IDS, out of the body schema in order to be observed as "conspicuous" or "obtrusive." It does not cease to be equipment, however, because we still encounter it in use; it's not that the work has become impossible, only that the experience with the equipment is not integrated in skilful control. This seems to ably represent a distinction between device and technology on the grounds of distinguishing between novice and expert use; the perturbation renders the expert user as unskilled.

Failures or challenges, as Heidegger and Dotov et al demonstrate, are disruptive. But unexpected success, perhaps at a task we were not even attempting to achieve, is also jarring as our perceptions are again altered. We look at the tool, marvel at our connection with it (thereby breaking that connection), and it may be some time before we are able to achieve that state again. Donald, in *A Mind so Rare*, argues that the work of the conscious mind is the mid-to-long term reflection on unconscious action, shaping that action, and shaping ourselves. Learning, as I've argued, is an entirely conscious activity until the activity is sublimated and able to be enacted unconsciously, skilfully. A

in normal mode (A) and approaches the uncorrelated white-noise level in (B) (Dotov et al).

Note that white-noise is associated with random interference patterns. $1/f^{\beta}$ type noise is sometimes called "pink noise."

beginner juggler will rehearse the coordination of hands and clubs or balls into unconsciousness by first very consciously examining the desired movements, and then attempting to adjust their own bodies to match a mental image of approximately, and to the best of their knowledge as an amateur, what is required. At times the objects being thrown will unexpectedly match the desired trajectories and be brought to consciousness through the novelty of success. For the most part they will be brought to consciousness as they have to be retrieved from the floor. When Heidegger talks about a becoming unready-to-hand he is, in essence, talking about these sorts of return to consciousness of a previously sublimated activity; "[a]lthough he concentrates on the special case of breakdown, Heidegger's basic point should be that mental content arises whenever the situation requires deliberate attention" (Dreyfus, *Being* 70). Often rehearsal in the beginning to intermediate skill levels are marked by a wildly oscillating movement from readiness-to-hand to unreadiness-to-hand, but it may be during these periods of transition that the greatest learning occurs. Little is learnt during conscious perception of the object, though a plan of action may be formed. Little is learnt during unconscious interaction, the objects, and the body manipulating them, are behaving as expected. But during our movements between these states, as the trend from unfocused action to consciousness, from device to technology, moves this way and that we learn much about ourselves and the objects we are attempting to tame.

How then is this distinction between devices and technologies to be mapped onto the assertions of unnaturalness in e-reading? Through the well-refined pedagogy and practice of our early years codex reading is refined into skilful invisibility, meets the four criteria, and should rightly be considered as technological for the typical experienced user in their typical interactions. Each new codex specifically encountered, however, will slip from this pristine position as we adjust to its weight, its inflexibility, and poorly cut or set pages etc., but within a few seconds the artefact once again seems to melt away, matching the ideal type in our minds which we identify as technological. Is it any surprise that when such expert readers encounter, or even consider the various apparatuses available for e-reading that some of them recoil? A lifetime's work of technologising suddenly to be faced with an unfamiliar device whose manufacturer purports it to be the same, or better than what is already known - this is rightly shocking. And those early uses, radically unfamiliar weights and sizes, misplaced keys, the requirement of manuals to help navigate nested menus, no paper to smell and touch, every instance jarring, conspicuous, obstinate, finally obtrusive as you put the thing

aside and say "how distanced we've become from the world, this is unnatural." It's a lot to get used to and this will be the subject of chapter two.

Before we move on, however, I would like to complete the wider definition of technology prompted by this debate and draw the conclusions of this chapter.

Atypical technologies

With these definitions of technology and device hopefully functioning - for the equipment we commonly encounter as "technological" or the quick-and-dirty solutions to unique tasks we use in our daily lives, and the various positions along that continuum - I'd like to turn to extending the definitions out onto interactions which it may seem more radical to classify as technological. This is the vital move toward better understanding the claims that technology in general, and the digitisation of writing in particular, is unnatural.

In the same way that Richard Dawkins posited a Universal Darwinism[68] that can include items of a hugely different order - e.g. the parity between the work of biological genes and cultural memes - I would like to suggest that the criteria that I have outlined for technological interactions with material equipment can be extended onto numerous orders of interactions with synthetic, organic, virtual, digital, or machinic equipment which abide by what might be termed a "universal technologism." As with Universal Darwinism, the reasoning for this extension is to suggest that we might better understand our interactions with these equipment if we were to observe, not their metaphorical parity with an established function, but their real abiding by the same rules as that which is established, recognising that a difference in the substrate of their existence does not mark their function out as of another kind (this is a deception born of a physicalist bias), but instead merely masks such similarity, that the fundamental mechanisms by which they operate are agnostic to material concerns. I don't wish to belabour this point as our principle concern here is with tangible things, particularly e-readers and codices, but a few brief examples are worth considering.

Let's start with a fairly well-trodden example of an atypical technology, that of literacy. Jay David Bolter, in *Writing Space*, mounts an argument for considering the skill of writing (rather than the implement used) as a technology, but also considers the

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[68]   See Dawkin's paper of the same name for more on the notion that Darwinian rules will apply wherever in the universe selective pressures are enacted.

frequent resistance to such an attitude:

> Writing is certainly not innate. Yet writing can be taken in and become a habit of mind. What is natural seems more intimately and obviously human. For that reason we do not wish to dwell on the fact that writing is a technology; we want the skill of writing to be natural. We like our tools and machines well enough, but we also like the idea of being able to do without them. Putting away our technology gives us a feeling of autonomy and allows us to reassert the difference between the natural and the merely artificial (36).

Here Bolter reasserts the received dogma of material technology as unnatural, with "tools and machines" being able to be "put away," allowing for a return to a natural state, i.e. the breaking down of a soft-assembled system. Writing, however, is for Bolter both a technology and an element of a hard-assemblage with a biologically discrete user "taken in" as a "habit of mind." It is important to note that this drawing-closer of an object through a technological interaction gives us a feeling that it is somehow natural in the intimacy of its use. If writing is a technology then how can it feel natural in a way that a computer or car doesn't, objects which are so obviously outside of ourselves, particularly when compared to the abstract skill of writing? There is a lot at work here in producing such a disconnect between writing and our modern machines, but the primary distinctions are frequency of use and the length of time that our culture, not just individual beings within it, have refined the interaction under discussion. A single person experiencing a technological interaction with a complex computer system, for instance, would not automatically render that item a technology for the wider culture in which they are situated, and this can clearly be seen in the general public's relationship with the room-sized monoliths of the 50s.

Consider also Plato's famous critique of writing:

> SOCRATES: They say that there dwelt at Naucratis in Egypt one of the old gods of that country, to who the bird they call Ibis was sacred, and the name of the god himself was Theuth. Among his inventions were number and calculation and geometry and astronomy, not to speak of various kinds of draughts and dice, and, above all, writing. The king of the whole country at that time was Thamus...To him came Theuth and exhibited his inventions...Thamus inquired into the use of each of them, and as Theuth went through them expressed approval or disapproval, according as he judged Theuth's claims to be well or ill founded. It would take too long to go through all that Thamus is reported to have said for and against each of Theuth's inventions. But when it came to writing, Theuth declared:

> 'Here is an accomplishment, my lord the king, which will improve both the wisdom and the memory of the Egyptians. I have discovered a sure receipt for memory and wisdom.' 'Theuth, my paragon of inventors,' replied the king, 'the discoverer of an art is not the best judge of the good or harm which will accrue to those who practise it. So it is in this case; you, who are the father of writing, have out of fondness for your offspring attributed to it quite the opposite of its real function. Those who acquire it will cease to exercise their memory and become forgetful, they will rely on writing to bring things to their remembrance by external signs instead of their own internal resources. What you have discovered is a receipt for recollection, not for memory. And as for wisdom, your pupils will have the reputation for it without the reality: they will receive a quantity of information without proper instruction, and in consequence be thought very knowledgable when they are for the most part quite ignorant. And because they are filled with the conceit of wisdom instead of real wisdom they will be a burden to society' (96).

To cultures like our own, where literacy is now the default, Plato's critique can sound unfathomably flawed. When we consider the structures, the education, and the development of thought that writing allows when it is incorporated, it is clear that writing is not an alien inhibitor, though it is, of course, an alterer, a morpher. Walter Ong suggests that this critique stems not from Plato's revelation of some truth about the unnaturalness of writing, but instead from the act's deployment in the Greek society of the time:

> Plato was thinking of writing as an external, alien technology, as many people today think of the computer. Because we have by today so deeply interiorized writing, made it so much a part of ourselves, as Plato's age had not yet made it fully part of itself[69], we find it difficult to consider writing to be a technology as we commonly assume printing and the computer to be (*Orality* 81).

Plato's critique, when we consider it closely, is not wrong - the mode of Greek thought has withered under the influence of the move to the almost total ubiquity of literacy in Western intellectual life - but that does not mean that chirography has not been naturalised. Part of its power, as with any technology, is not that it exists, nor that it is available (it would be a hardline determinist indeed who would suggest that the mere availability of a technology shapes our cultures and ourselves), but instead that it has been adopted so extensively that it underpins the fabric of our society, resulting in Bolter being able to assert that we have managed to trouble some Rubicon between the

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[69]   For further discussion see Eric Havelock's *Preface to Plato*.

"natural" and the "merely artificial." When we are faced with considering whether interacting with a computer is natural or technological (or device-ive) we look to its closest natural (or naturalised) corollary: writing. It seems so alienated in such a comparison that we assert its technological/deviceive status without question - technologies and devices are, it would seem, the complex ways in which we (generally) improve the efficiency of tasks identified during more "natural" undertakings (e.g. cars for walking, televisions for attending an event, telephones for travel etc.). But we make a mistake in comparing computing to writing and marking their differences as a sign that one is a technology and the other is a natural process. Here, then, is an example of a technology that doesn't feel like a technology after extended use beyond the timescale of a single human life (we'll consider technological effects over different stretches of time in the final section, on "granularities," below). Literacy can and should be defined as a technology for all skilful users; let's consider it under the four criteria:

- E - Literacy extends the capacity of our minds and working memory. It also extends the mouth and the ears in somewhat abstracted McLuhanist terms.
- C - Another quotation from Bolter sums up the communal aspect of literacy: it is

  a technology for collective memory, for preserving and passing on human experience. The art of writing may not be as immediately practical as techniques of agriculture or textile manufacture, but it obviously enhances the human capacity for social organization - by providing a culture with fixed laws, with history, and with literary tradition. Eventually writing also becomes the preserver and extender of other technologies, as an advanced culture develops technical literature (*Writing Space* 33).

  Writing only has use in a community; the reason of its existence is to pass signs between beings separated by time or space, or under pressures of silence.
- I - The quotation from Bolter that triggered this discussion makes the incorporation of literacy clear. It has become so deeply incorporated, so ready-to-hand, so invisible in use that we very rarely consider what occurs when we read or write, it seems as natural as speaking to many.
- M - Literacy has altered our minds in a variety of ways, not least allowing us to approximate an external memory allowing for more complex thought and storage of that thought, giving rise to the notions of legacy and formal culture. Donald also states the more material consequences on the user:

  Literacy skills change the functional organization of the brain and deeply influence how individuals and communities of literate individuals perform their cognitive work…There is no equivalent in a preliterate mind to the circuits that hold the complex neural components of a reading vocabulary or the elaborate procedural habits of formal thinking.

These are unnatural. They have to be hammered in by decades of intensive schooling, which change the functional uses of certain brain circuits and rewire the functional architecture of thought (*So Rare* 302).

To Plato writing was a *device* that devalued what came before it. As it trended toward a technology for more and more users, however, writing was later able to shine, something Plato would never see. Plato was able to set writing up as an inefficient device by comparing it to the "natural" analytic mode of thought cultivated by the Greeks. But, as with comparing computers to natural writing, might this not hide the fact that analytic thought too was somehow technological?

I would like to pause here only to open a floodgate: I do believe that analytic thought can be thought of as a technology, but I also believe that dance, language, the use of fire, and a great polyphony of other things typically thought of as non-technological, or natural, have existed as technologies over the course of human history because they abide equally well by the four criteria of technological interactions that has been set up here, if not always by the common sense definition which relies on a physical artefact which we can point at and label as a technology irrespective of the nature of the actual encounter of the gestalt experienced by discrete users[70]. In many ways what I am proposing returns to the etymology of "technology" identified by Heidegger: "The word stems from the Greek. *Technikon* means that which belongs to *technē*...[*T*]*echnē* is the name not only for activities and skills of the craftsman but also for the arts of the mind and the fine arts" ("The Question" 318). The definition that we have established throughout this chapter is sympathetic to this originary etymology; a universal technologism need not apply solely to material artefacts, nor to the results of actions that take the form of external representations. Instead we can say that this definition is agnostic to materiality in defining what should be considered as a technology, provided that the items under discussion abide by the four criteria we have outlined. This is again best illustrated by example:

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[70] There are some precursors to this idea. Foucault's four definitions of technology in "Technologies of the Self" is expansive in what it allows to be considered as technological, and Lev Vygotsky, in *Mind in Society: The Development of Higher Psychological Processes* and "The Instrumental Method in Psychology," argued for the existence of "psychological tools" such as language, writing, mathematics, drawing, mapping etc. which overlap with my notion of atypical technologies, functioning as intangible equipment. That said, the argument here is that the definition outlined in this chapter is potentially more capacious than that of either Foucault or Vygotsky, as well as offering a more particular reasoning for why such things should be considered as technological under certain conditions.

Dance[71]

- E - Dance extends an individual's self-perceived ability to communicate to a group.
- C - Dance functions as a technology in a community which is aware of the implications, the meaning and nuance, of the movements of the dancer. Part of the extension described in the point above is the need to communicate ideas which are either best expressed non-verbally, or cannot be expressed verbally, or to draw a group together via their standardised or recognised kinetic expression. Dancing for oneself is not a technological interaction, unless you are, in an unlikely though not impossible occurrence, using the standard techniques of your society in order to work through ideas which you might feel that you cannot linguistically.
- I - Dance is incorporated by expert users, and this is evidenced by actions which could not be consciously contemplated if they are to be strung together fluidly. This ability begins by the dancer making themselves supremely aware of the shape of their body in space during different motions, typically via pedagogic correction, through mirrors, or even via audience reaction. This heightened consciousness is then rehearsed and rehearsed until it disappears, for the most part, though it is still able to be interrupted by unexpected success or failure. The result is fluid expressive motion, where the dancer thinks about what it is that they want to convey and their general motions, rather the minutiae of the micro- and macro-movements required.
- M - The dancer's body is changed by the practice of dancing, growing leaner, tauter, more flexible. In undemanding practice, where gross physical alteration is far less, a dancer will still have their mental image of themselves altered, a heightened awareness of their altered capabilities, and a way of thinking that is not coded linguistically, but visually, physically, kinetically.

The dancer can also make a particular dance (equipment for meaning) into a technology, and can also experience their own bodies technologically as equipment for dancing (we will return to this last idea very shortly).

If we shift the requirement of defining technology from being artefact-centred to *equipment*-centered, then the four criteria begin to hold in such unexpected encounters. This allows for what I consider to be a more accurate view of how humans experience their world: We experience a host of things in use, and as exploitable, whatever they may be, and objects of the mind, ways of thinking and practicing, are no exception.

Taylor, in his exploration of Tasmanian Aboriginal tool use in *The Artificial Ape*, comes to a similar conclusion (33-54). Before they were wiped out by European settlers, nomadic bands of Tasmanian Aboriginals survived without clothes, may not have been able to make fire (instead carrying it with them in "fire logs" after discovering its

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[71] For more on the phenomenological experience of dance see Danielle Suzanne Vezina *Phenomenology and Dance*.

natural occurrence), and rarely built roofed domiciles. This led to a society in which there was very little private property, nor much in the way of social hierarchy. Taylor argues that, contrary to prior anthropological opinion, these people were not somehow "backward" or tragic, but instead may have been perfectly adapted to their environment, minimising risk as best they could, and only keeping what was absolutely expedient. Commentators, both from the time of the European encounter and reporting on the incident since, who had compared the tools available to the Tasmanians to those used by chimpanzees missed the point says Taylor:

> The more we look at the Tasmanian Aboriginal toolkit, the less the parallel with the tools of chimpanzees (legitimately enough made on formal grounds) makes sense. It is not just that the humans had more things, because with only two dozen items, it was not that many more. It is that their technology was not an add-on, an optional extra. It was essential and embedded. Chimps can live without tools. Humans cannot (*Artificial* 52).

The Tasmanians of this period were as "technological" as any other human society because they did not just elect to use tools, but instead used precisely what they needed to thrive in their environment and could not live without them. That their artefacts are the simplest collection in the *homo sapiens* archaeological record did not make them any less vital or suitable to their purpose. By reconsidering what we mean by the term "technology" we might be able to come to similar sensitive readings of cultural differences more often, rather than seeing our "advanced" societies as having so progressed that all others, at least (but rarely just) in terms of technology, are now just waiting to catch up. Technology is at the heart of all human experience of the world; the only thing that marks out a developed society's technology is the complexity of the artefacts it has chosen to deploy in that experience. It is not even that these tools take longer to master, but that basic access is perhaps more complicated than with more simple tools. Most anyone can throw a spear to some degree, but relatively few can hunt in such a fashion; it takes longer to acquire the basic skills of using a car, e-reader, or computer, but does something we would recognise as expert use, as mastery, really take significantly more dedication than that of the hunter to his tools? More importantly, does a society which sees people wake up, hunt, skin, and prepare food, make tools, make weapons, and engage in a rich participatory (rather than passive) creative culture really seem less technologically minded, if we consider technology as rooted in the

human experience of the world, than a society where we wake, drive to work, input at a computer, drive home, prepare food, and watch television? The artefacts in the latter experience are of a higher complexity in terms of realising the extent of their gestalts and maybe in attempting initial use, but are the interactions really stronger in their impact, or their use more skilful; is watching television or microwaving a meal even a technological experience? Morphability, incorporation (as skilful use) and an equipment's embeddedness in a community seem far greater measures of the strength of a technology than the complexity of the artefacts at the heart of the interaction.

To consider one final piece of equipment, let's look at whether the body itself can be a technology. Consider the schematics from Dotov et al reproduced above, where an interconnected system of black dots represent elements of the body as an incorporated assemblage into which the tool can be introduced during skilled use: we have to learn how to manipulate our bodies like this. Clark makes this point explicitly: "The human infant must learn (by self-exploration) which neural commands bring about which bodily effects and must then practice until skilled enough to issue those commands without conscious effort. This process has been dubbed 'body babbling'… and continues until the infant body becomes transparent equipment" (*Supersizing* 34-35). In our infancy we are a collection of items held together by skin, our brains are a mess of connections which need to be whittled into shape, and our use of the equipment not that we have, but that we *are*, is less than skilful. Over time we can rehearse the manipulation of ourselves into unconscious use. But incorporation, here the incorporation of the unskilled self into the skilful self, is only one of the criteria for a technology. Skilful use of the body, the creation of the body schema, is certainly morphing, and certainly extends the range of options available to itself, but is it communal? Short of looking to the lazy thought experiment "would a baby left to its own devices, with no contact with anyone or anything, develop skilful use of its body?" this question is near unanswerable. For that reason I am uncomfortable in saying that our physical forms, or our body schemas *in general* are technologies, because I am unable to support it in a way that I find satisfying. But activities like dance certainly mark a return of our physical equipment to consciousness, psychiatry can device-ify our psychology, brainwave imaging has even made people's hidden neurological activity available, in a limited way, to their consciousness allowing them to try and manipulate the images on screen by relaxing/tensing etc. At most times we encounter our body

schemas as invisibly working equipment for dealings with the world, but we are, perhaps, the only species which can consciously reflect on aspects of such an engagement, from metacognitive analysis to a free-diver's hyper-awareness of her breath, from yogic meditation to athletic refining of form. For these engagements a specific gestalt of body, the encounter with which Gallagher would call "body image," a gestalt where the schema is tailored temporarily to a specific use is made available to consciousness and can then be re-rehearsed back into unconsciousness, altering the nature of the global schema. When the body is made into equipment for use the same gestalt experience becomes manifest; it is not the whole physical form that is encountered, but instead merely those required aspects which must be rehearsed and then trained into invisible automaticity. Perhaps we can think of these skills as rotating a single line on a Rubix cube. We have no way of manipulating the whole cube so we must focus on and rearrange only one element, an element which cannot exist independently, but must be worked on as if it were such and then returned into the general scheme of the cube, fundamentally altering the arrangement of the whole.

An argument against the theory deployed here might stem from the observation that if the body schema might itself be a technology, and if anything which abides by the four criteria can be considered technological, which, as we've seen, can be opened up to any number of esoteric things, then what *isn't* a technology? But, of course, I'm not suggesting that everything is a technology, that our every interaction is a technological interaction, only that very many things can be. Not everyone is an athlete, not everyone is a philosopher, not everyone learns a new language, sees a psychiatrist, flies a plane, drives a car, or skilfully wields a hammer. A great many of the average person's interactions with objects in the world are device-ive, but, near everything is available to be technologised. This is the curiously human outlook, what may separate us from other primates: our ravenous search for opportunity, to apprehend every aspect of an environment, including ourselves, as exploitable when needed. The awareness of our limits, physically and intellectually, is part of our basic cognitive agenda. We constantly check and recheck these limits, establishing the shape and reach of ourselves, and try and work around any resistances that impede the abilities inherent in the virtual images produced. "[H]uman minds and bodies are essentially open to episodes of deep and transformative restructuring in which new equipment (both physical and 'mental') can become quite literally incorporated into the thinking and acting systems that we identify as our minds and bodies" (Clark, *Supersizing* 30-31). This, I would argue, is the

scope of technology.

Granularities

There is a final assertion that must be dealt with out of necessity for completing our definition of devices and technologies and with which we'll conclude this chapter. This thesis focuses, and will continue to focus on objects which should be considered as technological, or not, at the timescale of the individual human life. As the move from one mode of interaction to the other, from device-ive to technological, is over an analogue scale we cannot point to the moment where a device becomes a technology with any degree of precision. We can only appeal to markers of technology, such as communality, morphability, or the perceived depth of incorporation, indicators of the relative strength of the equipment's impact. There is also the point which I hope by now is clear: What is, for one person, a technological interaction can be, for another, device-ive, and an artefact encountered as a device by one person can be intimately technological to some other user. For the most part we can attribute this to the practice of interactions; if one person is able to experience a technological interaction around an item then it will be at least possible for other people to acquire such morphing skilful use, at least within the culture in which the equipment is embedded. However, we might also think of equipment functioning in different ways at different times; if equipment persists, as technological items often do, beyond the lifespan of the originary users, then its impacts need to be considered anew.

Technologies have always changed us, and the introduction of any new technological implement will continue to alter aspects of ourselves, however subtly. For the individual, sustained interaction might produce only a modicum of effect over the course of a life, or rather a minute amount in relation to species-wide effects of use. Over longer timescales, however, societies may be affected by equipment in such a way that new practices emerge which have a profound influence over all the minds which enter into them. More extensively, a new technology might begin to punctuate the equilibrium of evolutionary stability, altering our genetic makeup as our environment places selective pressures upon us which favour that particular technological interaction. Examples of such might include harnessing fire, and domesticating dogs for hunting and tracking. Technology, as ever, appears to be a relative term.

For instance literacy, for skilled users, is a technology. But on an evolutionary

scale writing is just another device of exosomatic storage, so unskilled and unselected for as yet to be incorporated into the species. At a cultural level, over the period since its inception writing has had a profound morphical capacity on the societies in which it has been deployed, at least on a par with the changes it instills in its every user. And yet if every literate person died today writing would disappear entirely and would only come to pass again if non-literate societies reinvented it. This is why morphability is a key feature of defining technology: it acts as a marker, however small, at different levels of granularity. For an individual, writing is most often a technological interaction save for those moments when it is made unpleasantly unready-to-hand due to deficient equipment, in aporia, parapraxis, etc. At a further remove, at the level of the society in which the user sits writing is still a technology, extending that society's perceived abilities, what we might identify as its "boundary schema":

> the effects of external symbols did not stop with the reorganization of the individual brain. They transformed the collective architecture of cognition and changed how the larger human community thinks and remembers. They also enabled many new forms of mental representation. There are now entire classes of cognitive work that cannot take place without external symbols. If we define symbolic technology very broadly, including everything from musical and mathematical notations to art, circuit diagrams, and maps, it is clear that most of our major cultural institutions and a high percentage of our cutting-edge work are completely dependent on symbolic technology (Donald, *So Rare* 304).

But as we pull back, to see societies with varying literacy rates at different times and places, and even further to a species level, or a genus level, we can see that this "technology" of writing is just another method some of these strange apes deploy to communicate with one another. Suddenly, in comparison to their use of fire say, it doesn't seem like much of a technology at all. And, we could also reverse this flow, consider finer details, finer grains, and look at the formation of individual words: at times technologies for meaning, at others mere devices deployed in the attempt to convey a new or difficult thought. And is a single letter a device or a technology? I hope that I have shown that any answer would have to include when, to whom, and why, and that any answer must necessarily vary across the grains.

"Technology" is not a fixed state. Dance can be a technology, but *a* dance can be a device. From an evolutionary perspective reading is a device trending toward a technology as literacy spreads; the harnessing of fire is a technology, and computing is a

device. At relative granularities fire and dance are of the same order, they are technologies. When we think about timescales longer than an individual life then we might think of how the effects operate on a subculture, culture, society, era, or species so that when we talk about an object as "technological" we might not experience it as such ourselves, but instead be addressing the communal aspect of the equipment under consideration, how it exists predominantly in a certain community at a certain time; there can be a consensus that most beings in that culture experience the object technologically. "Technology" is just a relative measure of the manifested strength of the effects of equipment use at various strata[72]. In this regard, granular considerations of technology, if pursued, may fall under Steven Connor's conception of a "Cultural Phenomenology":

> Cultural phenomenology would aim to enlarge, diversify and particularise the study of culture. Instead of readings of abstract structures, functions and dynamics, cultural phenomenology would home in on substances, habits, organs, rituals, obsessions, pathologies, processes and patterns of feeling...'Cultural Phenomenology' strikes me as a good name for the work I have in mind because it would inherit and preserve from the phenomenological tradition an aspiration to articulate the worldliness and embodiedness of experience - the in-the-worldness of all existence...attending...to the affective, somatic dimensions of cultural experience.

In this way "technology" could remain a phenomenological description of interaction with equipment, as outlined here, and yet we would remain able to talk about its relative effects across swathes of time and the aggregate of multiple bodily experiences.

Conclusion

The argument of this chapter has been a rewriting of the "common sense" definition of technology which is insufficiently nuanced, and that e-reading, as opposed to encountering a codex, is no more or less natural than that interaction, though it differs in terms of the complexity of the apparatus itself and the simplicity of initial interactions

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[72] We might compare this idea of looking at technologies as functioning differently at different granularities as being in line with Thomas Misa's call to study technology at the micro, meso, and macro scales (see Misa "Retrieving Sociotechnological Change from Technological Determinism"). The notion of studying technologies at relative granularities that I posit here, however, divides the strata temporally, whereas Misa's levels reflect the study of individual (common sense defined) technologies (micro) through to the effects of extensive technological systems (macro).

with it; that such a discussion must occur about the latter is seen as a direct result of the former. It has been suggested that, regardless of the initial challenge, skilful use of either equipment requires comparable levels of practice, but codex reading, for the current generation in our society, is so normalised and over-practiced as to be apparently more in tune with our nature. To best understand this discussion it has been situated in terms of a history of resistance to new technologies which have used opposition to nature as their key rhetorical tool. I have argued that neither "nature" nor "technology" is particularly well defined in these arguments, and continues to be poorly defined in the contemporary debates around e-reading. Whilst I have not attempted a definition of nature I have tried to show that nature thought of as something non-human is irrelevant to defining technology despite its radical implications for the ethics of using tools in the world. Nature in terms of "human nature," however, has been positioned not as in opposition to technology, but intimately bound to it. This assertion has been embedded in the definition outlined above, and in the four criteria which produce the phenomenological experience of technological interaction so defined. Below is an overview clarifying the terms "technology" and "device" that will be used for the rest of this work.

Technology

- A technological interaction concerns dealings in use which abide by the four criteria and, by necessity, emanates from an item of equipment.
- The term "equipment" is agnostic to materiality, it is merely the item around which a use-interaction sits. For reference to *any* kind of equipment at the heart of a technological interaction we can deploy the shorthand: "a technology."
- An artefact at the heart of a technological interaction is more closely allied to common sense definitions of technology: it is *material* equipment from which a technological interaction emerges.
- The shorthand "a technology" best describes the perception of item and interaction; the item by itself is best described as "equipment," "tool," or "apparatus" dependent on its materiality.
- No equipment can be encountered in its totality, it is always a malleable and personal gestalt.

Device

- A device-ive interaction concerns dealings in use which do not abide by all four criteria and yet, by necessity, still emanate from equipment.

- For reference to *any* equipment encountered in a device-ive interaction we can deploy the shorthand "a device" whether that be in learning, unskilled or initiate, or interrupted use.
- A device-ive artefact is often more closely allied to common sense definitions of technology: it is *material* equipment from which a device-ive interaction can emerge, and this can be easily mistaken for technology if it closely follows some of the four criteria.
- The shorthand "a device" best describes a combination of equipment and device-ive interaction.

With these definitions in mind I hope that a binary between nature and technology appears inherently false. Technology isn't somehow against a pre-human nature because we choose how we deploy it, it cannot act by itself; technology isn't against an unextended human nature because it is bound to us, and may even have caused ourselves to be. Along these lines, and with some pleasing coincidences of terminology, Walter Ong offers a potent foil to the Neo-Luddite attitude:

> Technologies are artificial, but…artificiality is natural to human beings. Technology, properly interiorized, does not degrade human life but on the contrary enhances it…As musicologists well know, it is pointless to object to electronic compositions…on the grounds that the sounds come out of a mechanical contrivance. What do you think the sounds of an organ come out of? Or the sounds of a violin or even of a whistle? The fact is that by using a mechanical contrivance, a violinist or an organist can express something poignantly human that cannot be expressed without the mechanical contrivance. To achieve such expression of course the violinist or organist has to have interiorized the technology, made the tool or machine a second nature, a psychological part of himself or herself…Such shaping of a tool to oneself, learning a technological skill, is hardly dehumanizing. The use of a technology can enrich the human psyche, enlarge the human spirit, intensify its interior life (*Orality* 83).

Ong saw technology's human/humanising power when it was "properly interiorized," but I have argued that something only becomes a technology when such internalisation occurs. But by so naturalising technology, or saying that computing and dance are of the same order, does this theory potentially do damage? Does it weaken the important task of questioning the deployment of new technologies, including widespread e-reading? I would suggest not; it shifts the fight from worries about technology as an abstract and general concept, to worries that are more specific, such as the use of computing in all areas of life, the extent of our visceral insulation, or the demand for teleological progress and a consuming faith in science. It is a move toward specificity, not a

neutering of the debate. If we understand dance and computing as related - though clearly fundamentally different in their praxis, function, and effect/affect - then we might avoid irrational fears based on false binaries, and instead start to hone in on the real problems in our deployment of certain equipment. Our taking responsibility for how we attempt to interact with our environments must be based on an awareness that we only came into being as exploiters, turning to whatever we could in order to survive and upset a Darwinian evolution which would have selected us out of existence. There is no reason for us not to have humility in the face of this, but "[w]e can never escape the bio-technological nexus and get 'back to nature,' because we have never lived in nature" (Taylor, *Artificial* 199).

Once a technical mode of thought has been introduced we find it hard to challenge. Technical thought is valuable, technological systems are hard to set up, and it's difficult and time-consuming to rehearse devices into invisibility; there are, in short, many good reasons to be resistant, maybe even as a survival trait. As such, replacing what appears to be a fundamental technology (bound books) with what appears to be a hopelessly visible device (e-readers), perhaps unsurprisingly can feel like a weak move, bereft. That this is not the experience of an increasing number of users, however, is telling:

> there's something seriously different about Apple's tablet...That difference can be summarized in two words: It disappears...Instead of living inside a box with a URL bar and a bunch of buttons alongside other boxes and applications, content takes over the device...You're not just looking at [the internet] through a browser, you're holding [the internet] in your hands (Tweney "iPad hands on").

If the benefits are worth it, and we can get used to the tools, then the technologising process can occur; it's what we do. It is to this idea of "getting used" to e-reading that we will now turn.

Chapter 2 - The Nature of Our Tools

[K]nowledge...lives in the muscles, not in consciousness
>   - John Dewey, *Human Nature and Conduct* 177

In the first chapter I considered the claim that digital reading devices are somehow "unnatural," and addressed their relation to technology as a class of objects to try and better understand the concern. I'd like to take the language of technology established in that chapter, and its attitude toward digital readers as physical devices which might become technologies over time, and bring it to bear on a second assertion from the discourse of resistance to reading on screen: "E-reading doesn't *feel* right." As with the assertion "e-reading/technology is unnatural," this idea is familiar within the popular conversation surrounding the subject and yet requires a consideration of, at least, its philosophical, physiological, and psychological aspects in order to realise the complexity of the statement and to more fully understand why it is so compelling.

This chapter will look at four distinct topics: To begin with we'll consider some examples of the popular and academic discourses surrounding resistance to e-reading rooted in haptic and tactile concerns, developing a sense of the phenomenological experience of interacting with codices, e-readers, and tablets. I'll then introduce evidence from experimental psychology as to why haptics and gesture may be an integral aspect of reading, and of thinking more generally. I'd then like to look at why codices seem to feel so right in the hand, and to suggest that this is something born of repeated engagement over both single lifetimes, and generations. This is hardly a radical assertion in itself, but I'd like to couch the discussion in terms of defining an evolutionary epistemological mechanism, a method of artefacts accumulating knowledge of their users, by which spending time with a class of object which provokes a particular kind of interaction might induce a familiarity which feels somehow "right", suitable, superior, or "natural," to return to the language of the first chapter. Following this discussion of how artefacts get used to us, the chapter will conclude with a consideration of the philosophical implications for our getting used to artefacts, attempting to marry the phenomenological experience of the process of "technologising" with an awareness of the underlying ontological structure of encounters with tangible equipment drawn from Object Oriented Ontology[73].

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[73]   The reasons for my focussing on Object Oriented Ontology are best saved for the discussion itself, but

Reports on touch

In the same way that folk psychology has become recognised as a source of evidence[74], so we can see the various reports of e-reading's unnaturalness and ergonomic inadequacies as a form of "folk phenomenology," a description of experience stemming from first person analysis which the reporter often feels can be exported, with limited modification, to other experiencers of the same or similar phenomena. Thomas Metzinger, in one of the few available classifications of the term, describes folk phenomenology as "a naïve, prescientific way of speaking about the contents of our own minds - folk-phenomenology is a way of referring specifically to the contents of conscious experience, as experienced from the first-person perspective...and is characterized by an almost all-pervading naïve realism." As folk psychology can often demonstrate useful examples, methods, and states to its academic counterpart, I would like to argue that folk phenomenological intuitive report has a lot to offer in terms of prompting us toward the issues that are central to negotiating what is qualitatively different about reading on a portable screen, indeed many of the reports already discussed in the first chapter would fall under the term.

Such an instance of inspiration also can be seen in the experimental design detailed in a cognitive science paper by Davoli et al[75] considering the effects of holding a text in the hands as opposed to having it stand supported upon a desk. The team first established a folk phenomenological distinction between the two reading postures via a poll, and to the extent that this, and related discourse prompted their experiment into being, or caused them to adapt its design, we might see it as an example of, adapting Gallagher's term, "front-loading *folk* phenomenology":

> when it comes time to really read an electronic document (i.e., one of importance that we truly want to absorb), many people would rather print it out to read than read it in its electronic form. There are, of course, functional advantages to a hard copy: It is portable, and it can be written on. Yet in our informal polling, these advantages are rarely invoked to justify the preference. Rather, a common response seems to be, "I just

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at heart the standpoint is appealing for our discussions here in its displacement of agency from solely human interlocutors; Object Oriented Ontology prompts us to consider both sides of an interaction as experiential.

[74] For an overview of the promise and problems with folk-psychology see Andy Clark "Folk Psychology, Thought, and Context."

[75] Christoher Davoli et al "When Meaning Matters..."

like to hold it," as if having the text in one's hands somehow fundamentally alters the way in which it is read (555).

The importance here is not the quality of the report, it's bafflingly vague, but that it exists at all and what it points toward: that holding reading material affects cognition at a preconscious level.

Similarly Lynne Truss, in her punctuation pedant's handbook *Eats Shoots and Leaves*, offers an illustrative folk phenomenological experience which seems to support this attitude: "Scrolling documents is the opposite of reading: your eyes remain static, while the material flows past" (181). Now, I don't agree with Truss' claim here, that the eyes don't move during reading when the material is scrolled rather than paginated, indeed all physiological data about eye movement during any form of reading would run counter to it[76], but this doesn't negate value in the report - fluid scrolling (such as can be found in some iPad reading apps (Wattpad for instance), on websites, or in desktop documents), to Truss, doesn't feel like reading at all, in fact seems its opposite, where the eyes do no work and the experience feels passive compared to the overpowering warp and woof of the machinery.

Christine Shaw Roome, a professional fundraiser for an academic library in Canada, writing this year about her first experience of reading from an iPad for the blog *Life as a Human*, reports a similar position to that of Truss above: she wonders if she's now even reading a book at all, so drastically has the feel of the activity altered:

> This did not feel like reading a book...[Her husband interrupts her] "I'm reading a book!" But, was I? I was missing the tactile features of the book, which often comfort me. The smell and feel of the book and the way you can see how far you've read by measuring the thickness of the pages. When I buy a book, I always take time to look at its design - the type face, the page weight and colour, the way the ends appear to be torn or are cut precisely. The texture of the cover and the photography or illustration that accompanies the title all draw me in and are part of the experience of enjoying a book. Sometimes, I buy a book just because I like how it feels in my hands.

Roome offers us a good survey here of the most familiar elements of the folk phenomenological debate surrounding reading on screen: it no longer seeming to be a book; it not *feeling* like a book; it not smelling like a book; the wedge of remaining pages being a consistent indicator of progress; and the object as aesthetic artefact.

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[76]   See, for example, Dehaene's *Reading in the Brain* (13-18).

The scent of physical books, old and new, is a frequently recurring issue in online and off-line debates of "the death of the book," and one which has become such a shorthand for the deprivations of reading on screen that a spoof range of aerosols (*SmellofBooks.com*) did the rounds in various discussions of the subject[77]. The appeal to smell might seem an odd reason to cling to a medium, but, if nothing else, it shows how deeply passions run in this regard, or just how far appeals will go to demonstrate the sanctity of the old form - everything about it is comforting.

Such ideas are recapitulated in another blog post by Anna Dorfman. Commenting on Johnathan Safran Foer's novel *Tree of Codes* (a work that we'll return to in the third chapter), Dorfman makes a similar argument for what is important in the codex reading interaction:

> I don't see the act of reading as a purely word-based experience. Reading is also tactile. Reading should involve interaction between you and the text in your hands. The speed at which you turn to the next page (or flip back to the one before) matters. That accidental glimpse you got of page 273 (while still only on page 32) while fishing around for your bookmark matters. The weight of the book in your bag - that subtle reminder that it's waiting for you - matters. The paper stock matters! The font, the letter-spacing, the margin width! It *all* matters!...And don't even get me started on the smell of old paper and fresh ink!

What really comes through in these detailed experiences, besides the recurrence of olfactory satisfaction, is the importance of haptic interaction; the feel of the book in the hands is an important part of grounding the experience as what it is. When this is missing the effect is so profound, the cognitive dissonance so great, that seemingly unintuitive questions, such as those seen in Roome's account, arise: "Is this even a book?" "Is this reading?[78]" We can find some support for this idea in Polt's

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[77] See for example Charlie Sorrell's "New Book Smell" at *Wired*'s Gadget Lab blog, Alison Flood's post at the *Guardian* book blog, "Making Scents Out of Novels," or the following: "Me, I've parted with most of my print library. For good. Ninety percent of my reading now takes place on-screen, although I'm uneasy about digital books living inside those intangible walled gardens. Can I pass them on to my kids, like my mother did with Camus to me? Will they keep my side notes? Will they smell?" (Martin Ferro-Thomsen "Reading Beyond Words").

[78] A similar idea can be seen in the following report from Max Bruinsma whose friend worries that her new activites with the written word somehow don't "count":

> I don't read, someone I know well told me. She meant that she doesn't read the way 'readers' read. People who can spend hours on end with a book in a chair or on the sofa, occasionally turning over a paper page and appearing to have completely forgotten that there exists a world outside the sentences they are reading. No, she's not one of those readers. But, I say, you actually read the whole day through! You scan articles and books, browse through websites and online fora, open and answer emails, gloss over

phenomenology of the typewriter: "as long as you're habituated to a particular design, that design works better for you than any other - because the precise activity that your body is doing with that design can be done, strictly speaking, only with that design" (Polt, "Typology..."). Polt is talking here about the different potential layouts for typewriters, but he offers a glimpse of what might so puzzle Roome: when the substrate for reading alters so does the engagement; codex reading can only be done with a codex, it is a particular thing. The question then becomes whether that engagement is so superior as to warrant being identified as the "true" (or "natural") form as in e-reading its particularities will, by necessity, disappear.

Lucien X Polsatron suggests that "the sole difference a paper book carries - in addition to the clearly superior epidermal pleasure it provides over that produced by touching plastic…is that the total weight of the text is constantly felt by the reader. This sensation perhaps gives the reader an impression...of possessing the whole of its meaning, an illusion whose loss could panic fragile souls" (35). This idea starts to close in on some of the detail motivating the folk phenomenological reports of resistance to reading on screen rooted in the tactile experience of the artefacts of reading: A paper book has come to *represent* knowledge, rather than just contain it, and its fixed and physical coherence, completed and separated from the world by its covers, projects the illusion of a definitive truth. The acquisition of knowledge and the "perfect" form of the codex are intimately associated, and we will return to the implications of the form of the bound book in the third chapter. Here, however, I want to continue to look at the significance attributed to knowledge gained from embodied books apprehended via touch.

An expression of this can be found in Birkerts' work on the subject, work which also has a strong folk phenomenology of codex reading underpinning its assertions:

> Why, then, am I so uneasy about the page-to-screen transfer - a skeptic if not a downright resister?...I'm not blind to the unwieldiness of the book, or to the cumbersome systems we must maintain to accommodate it - the vast libraries and complicated filing systems. But these structures evolved over centuries in ways that map our collective endeavor to understand and express our world. The book is part of a system. And that system stands for the labor and taxonomy of human understanding, and to touch a book is to touch that system, however lightly ("Resisting the Kindle").

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newspaper headlines. Yes, but that's not reading, she says.

This quotation shows a distinct attitude towards the embodiment of the text: to touch a book is to experience a unique history of an evolved dynamic, and this will become more significant shortly. For Birkerts there is a history of haptic engagement which comes into play with every turn of the page, a kinesthetics (and, as we also saw with Roome, a kin*ae*sthetics) which acts as a physical reminder of the forces and efforts which go, and have gone into understanding. When we turn pages we engage with the systematic pursuit of knowledge, but it's not enough just to look, we have to become, for Birkerts, for Roome, for Davoli's respondents, *involved*.

The requirement of involvement is what I think can motivate resistances to reading on screen which appeal to haptic concerns. We saw in the first chapter that equipment can seem to be a mediating layer between us and the world until we incorporate it into our body schema, in short when we become intimately involved and can undertake tasks in a way which feels "natural." I would argue that we incorporate physical books, make them into technologies, via a heavily socialised progression which is standardised from a very early age; we create heuristics for the interaction with which we can shrink the scope of our attention down to the act and the act alone, provided that the equipment performs as is expected. Most of us are involved with codices, and all that they are able to stand for, from a time before we can remember, so it's unsurprising how deeply they can become embedded in our attitude towards the world and why we might be so resistant to a change in their form. To begin to understand this more specifically I'd like to consider the relationship between touch, gesture, and thought a little further beyond the folk phenomenological reports outlined above. Such first person reports are copious and readily available from any enthusiastic reader aware of the alternative reading mediums available to them, and are frequently nuanced enough to suggest that only paying attention to any one of these areas - the movements of the hands in gesture, the hands themselves, or the items that the hands encounter - will not be enough to understand what may motivate them. As such I will offer examples of work on each of these aspects which will hopefully be of use in recognising these accounts as significant, whilst also preparing the ground to suggest why they might also be surmountable, if not always in exactly the way that the reporters might wish them to be.

Touching and Thinking

The unravelling (or should that be restitching?) of the Cartesian divide between body and mind led to the founding of several fields, the principal two, for our purposes at least, being Embodied Cognition in Philosophy and the cognitive sciences, and Phenomenology (predominantly a philosophical discourse, but, particularly in relation to Embodied Cognition, one which is making its way into scientific practice, as we saw in the first chapter). Phenomenology is built upon the importance of first person report when discussing matters of embodiment and perception, and will form the basis of our discussion about the mechanism of adjustment to objects which will occupy the second half of this chapter. But let's first consider what Embodied Cognition, and in particular its insights about the use of our hands and gesture, has to offer the discussion of the unimpeachable materiality of the codex.

Shaun Gallagher, in *How the Body Shapes the Mind*, makes it clear from the start of his project just how fundamental the body in motion is to thought[79]: "In the beginning, that is, at the time of our birth, our human capacities for perception and behavior have already been shaped by our movement" (1). From before we enter the world our bodies have been rehearsing actions which have primed us for existing in our environment, the ways that we'll move, and the ways that we'll take onboard information. From those very first moments, movement is established as reciprocal, primed to be responsive to its surrounds: "precisely and quite literally, we can see our own possibilities in the faces of others. The infant, minutes after birth, is capable of imitating the gesture that it sees on the face of another person. It is thus capable of a certain kind of movement that foreshadows intentional action, and that propels it into a human world" (1). For Gallagher, as for most, if not all supporters of Embodied Cognition, it is the specifics of our bodies in movement, or in the desire for movement, that forms a large part of what makes us human.

Embodied Cognition is the study of, and belief in the body's capacity to affect, to deeply structure the activities of the mind, radically opposed to the dualism of the Western philosophical tradition. Though not solely a scientific discipline or subset of Psychology, Embodied Cognition often relies on experimental Neuro- and Cognitive

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[79]   Gallagher's project in this work is to develop a language which cuts across phenomenology, Cognitive Science, and experimental Neuropsychology allowing for a cohesive way of discussing the body's influence on cognition.

Science and psychological evidence for its claims. Those claims, however, can be both inspired by and in pursuit of philosophical or sociological ends; work in phenomenology formed the underpinning for its inception, and can still be found explicitly highlighted in work from George Lakoff and Mark Johnson[80] and Andy Clark[81].

Frank Wilson discusses issues we might readily describe as being the subject of Embodied Cognition in his work on *The Hand*. Wilson's research takes the idea that our bodies shape all aspects of our mental life and focuses in on the central importance of our hands to cognition: "I would," he argues, "[say] that any theory of human intelligence which ignores the interdependence of hand and brain function, the historic origins of that relationship, or the impact of that history on the developmental dynamics in modern humans, is grossly misleading and sterile" (7). Part of what I'm hoping to establish here is a theory of at least an aspect of human intelligence, and as such I want to be sensitive to Wilson's admonishment and to consider the importance of the effectors which directly engage with our reading technologies. It is therefore the hands that will receive most of our attention here.

A number of anthropologists and evolutionary psychologists have argued for the impact of tool use, of the dextrous use of the hands with an object from the user's environment, as being integral to both the development of brain size in our primate ancestors[82], leading directly to the evolution of *homo sapiens*, as well as to using that increased brain power to create language, language which would, for some cultures, eventually be made concrete and preserved in codices. Merlin Donald notes that

> [o]ddly our physicality...has a tight relationship with our capacity for symbolic communication, which evolved so recently. This includes language. All expressive systems are ultimately owned in the same way as any other motor system; that is they are self-rooted…The conscious mind may have reinvented itself and greatly extended its reach in language, but it has never lost its vestigial roots in embodiment. On the contrary, although human consciousness may have had to accommodate itself to the emerging symbolic structures of complex culture...it has always referred back to its roots in the physical self (*So Rare* 137&135).

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[80]   See *Philosophy in the Flesh* throughout.
[81]   See *Natural Born Cyborgs* and *Supersizing the Mind*. For more on the Embodied Cognition project see Margaret Wilson "Six Views on Embodied Cognition"; the excellent overview of "Embodied Cognition" at the *Stanford Encyclopedia of Philosophy*; Lawrence Shapiro *Embodied Cognition*; and Francisco J. Varela *The Embodied Mind: Cognitive Science and Human Experience*.
[82]   See for instance Stanley H. Ambrose "Paleolithic Technology and Human Evolution"; Beth Preston "Cognition and Tool Use; and Kathleen Gibson and Tim Ingold *Tools, Language, and Cognition in Human Evolution*.

For Donald, as for the advocates of Embodied Cognition, every aspect of ourselves and of our experience of our environment or culture, however complex, however seemingly purely cognitive, comes back to our physical presence, and this might offer us some indication as to why the "feel" of reading is so important. The codex is our long established tool for reading, a technology at the granularity of society if not species, and the structures that the reading ability is bound to - semantic, visual, haptic, even olfactory - are all concerned with embodiment at the deepest levels[83].

Wilson argues that

> If language and the employment of the hands for tool manufacture and tool use co-evolved - effectively forging a new domain of hominid brain operations and mental potentials that we collectively refer to as 'human cognition' - then we *should* find analogous links, or reinforcing effects, between purposive hand use, language, and cognition in the individual histories of living people (*The Hand* 34).

He goes on to discuss the work of Patricia Greenfield, particularly her study "Language, Tools and Brain: The Ontogeny and Phylogeny of Hierarchically Organized Sequential Behaviour":

> She proposed that the human brain organizes and oversees the child's interactions with objects almost exactly the same way it organizes and oversees the production of speech. These two specific skills (manipulating objects and manipulating words), and the developmental chronology associated with the child's mastery of those skills, proceed in such transparently parallel fashion that the brain must be: (a) applying the same logic or procedural rules to both; and (b) using the same anatomic structures as it does so (165).

Wilson sees in Greenfield's work clear support for his understanding of an evolved connection between language and the use of the hands in tool use. Further evidence for these assertions can be found in Stanley H. Ambrose "Paleolithic Technology and Human Evolution" where Ambrose sees the crafting of early tools as synching with the cognitive and linguistic abilities of early hominids. Striking stones together to produce blades "involve predominantly repetitive coarse motor control (percussion flaking). Primate vocalizations are also repetitive sequences of coarse motor actions." But tools

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[83]   In chapter one we saw this with relation to repurposed neural pathways as discussed by Dehaene and Wolf.

which combine elements

are hierarchical and involve nonrepetitive fine hand motor control to fit components to each other. Assembling techno-units in different configurations produces functionally different tools. This is formally analogous to grammatical language, because hierarchical assemblies of sounds produce meaningful phrases and sentences, and changing word order changes meaning. Speech and composite tool manufacture involve sequences of nonrepetitive fine motor control and both are controlled by adjacent areas of the inferior left frontal lobe[84] (1751-2).

Ambrose uses this evidence, alongside the archaeological record, to support a hypothesis of at least the coexistence and likely the coevolution of language and tool use, each activity reinforcing and manipulating the other reciprocally. Such connections would seem to come hard-wired, and the neural pathways that evolved for effective tool use seem to have been piggybacked upon by the development of an inbuilt capacity and drive to acquire a symbolic language. This is unsurprising when we consider the kind of intelligence which already needs to be in place for sustained dextrous tool use with multi-part equipment. Tool manufacture requires the knowledge that if a stick is attached to a stone then it can, as a unit, be a more effective and accurate way of striking a target; a mental image must exist to enable the intentional repeated creation of such objects. Mental representations which prefigure or stand-in for some object in the world are as much a precondition for creating tools as they are for developing a sign system. This is why the use of multi-part tools is incredibly rare, close to non-existent in other primates: it's not that they are incapable of using them, or even, in theory, of creating them; the insurmountable challenge lies, for the most part, in their inability to conceive of them.

When combined with other environmental factors, other selective pressures on the young *homo* line, the emergence of the symbolic thought required for complex tool manufacture and use led to an explosion of changes in the brain and cognition:

[whilst n]o one knows whether brain enlargement is specifically related to increased tool use...it is known that tools did not become complicated in their structure, nor were they kept and transported for long periods by their users, until quite recently. It is a virtual certainty that complex social structure - and language - developed gradually in association with the spread of more highly elaborated tool design, manufacture, and use"

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[84] Ambrose cites Greenfield "Language, Tools and Brain" and Kempler "Disorders of Language and Tool Use" in this regard.

(Wilson 30)[85].

What then are the implications of this deep relationship between embodied tool users and the capacity for symbolic thought for our present day changes in the technology of reading? In short, we have inherited brains shaped by the fact that "for millions of years primate dexterity preceded the increase of brain size in the hominid genealogy. This circumstance [has] engendered a learning pathway based on discovery by manipulation and tactile observation" (Frost "Reading by Hand"). This idea is important and worth reiterating: the manifestation of the brain with which we currently live, of the body of which the brain is a part, and the embodied cognition that they manifest together are all products of evolutionary processes which have favoured, have selected for, ways of learning which are intimately linked to manipulating objects with our hands.

Contemporary research into gesture certainly appears to bear out this hypothesis and to support Wilson's assertion that we should find links "between purposive hand use, language, and cognition in the individual histories of living people." Researchers have become increasingly interested in the connection between the body and thought (in no small part due to the debates prompted by Embodied Cognition), and work on gesture sits squarely within such discussion. A 2009 study conducted by Susan Goldin-Meadow, Zachary Mitchell, and Susan Wagner-Cook looked at young students being taught the concept of "grouping." Grouping is used in the solution of mathematics problems where a single term must stand in for several, e.g. $3+2+8 = \_\_\_+8$. The students taking part in the study had to learn to resolve such equations by finding the single digit which is equivalent to $3+2$ to fill in the gap, i.e. they must understand the concept of adding numbers together to produce an analogue which balances the sum. In order to teach this, tutors were getting students to draw a little "v" shape with their finger under the 3 and the 2, physically tying them together. "Previous research has shown that students who are asked to gesture while talking about math problems are better at learning how to do them. This is true whether the students are told what gestures to make, or whether the gestures are spontaneous" (Campana). Sure enough, students understood the concept significantly faster with the grouping strategy than when the technique was not deployed. But the researchers also found, over the course of the study, that it didn't matter where the students drew the "v" at all, i.e. it wasn't

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[85]   Ambrose's research supports just this notion.

necessary to link the 3+2; it was simply the act of making the gesture which introduced and sublimated the concept in "the student, through the body itself" (Campana).

The findings of this research seem to potentially offer a way-in to understanding some of the (scientifically and philosophically) naïve reports of resistance to digital reading technologies that we encountered at the beginning of this chapter. Goldwin-Meadow et al show just how important engaging the body is to learning: the students studied who made no gestures learned how to cope with the task at a significantly reduced rate to those who made an arbitrarily placed gesture that nonetheless evoked the concept under discussion. This has implications for understanding a shift in reading practices as the *gestures* of interacting with codices, the turning of pages, the feel of the remaining and consumed leaves held in each hand, dog-earing (or not), breaking spines (or not), all the physical attributes that make the act what it is are undoubtedly changed when the equipment changes. It may well be therefore, as Birkerts suggests, that there is something in the touching of a physical book that becomes combined with the reception of written knowledge to the extent that the folk phenomenological reports are indicating a genuine drop in capacity as some cognitive aspect(s) of the experience become(s) impoverished. Perhaps the gestures of reading print have come to prime the concept of knowledge acquisition, a particular way of thinking, and, as with the students in the above study, the denial of such gestures may interrupt or delay such thought. Suddenly the question of "is this reading at all?" starts to seem less obscure; in a very real way the act of reading changes, and may become a different way of thinking prompted by or in the absence of prompting from the movements of the hands.

In an earlier work from 2003[86] Goldin-Meadow had investigated gesture and found that it is likely to have a function beyond being simply expressive as

- We do it when talking on the phone.
- We do it when talking to ourselves.
- We do it in the dark when no one can see.
- Gesturing increases with task difficulty.
- Gesturing increases when speakers must choose between options.
- ...[and i]t turns out…that speakers blind from birth, who have never spoken to a visible listener and never seen others moving their hands as they speak, gesture when they speak. Moreover, they do so even when speaking to others they know are blind (Clark, *Supersizing* 123-124)[87].

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[86]   *Hearing Gesture: How Our Hands Help Us Think*.
[87]   I cite Clark here for the efficacy of his list of Goldin-Meadow's conclusions and to highlight the discussion of the study in scientifically-inspired philosophy.

Gesture, then, is fundamental, an innate part of our body schema like swallowing or reaching, something we perform automatically, and yet something which can intimately affect learning. Clark discusses the use of gesture as a way of extending cognition from the brain into the environment by drawing on Goldin-Meadow's work to show another way, beyond physically enacting a concept as with grouping, in which gesture might explicitly benefit learning:

> The physical act of gesturing, Goldin-Meadow suggests, plays an active (not merely expressive) role in learning, reasoning, and cognitive change by providing an alternative (analog, motoric, visuospatial) representational format...Encodings in that special visuomotor format enter...into a kind of ongoing coupled dialectic with encodings in the other verbal format…This…creates points of instability (conflict) whose attempted resolutions [often] move forward our thinking (*Supersizing* 125).

In this way, gesture actually appears to take on some of the role of an interlocutor, able to enact or code contrary positions in a temporary physical working memory and producing productive conflict.

What is important to convey here is simply that when we purposefully, consciously or unconsciously, move our hands in space it plays a demonstrable role in meaning and producing meaning. But in truth we simply don't know the extent to which performing actions which require specific repeated gestures and sequences of actions with relatively uniform equipment might standardise those actions, their place in cognition, and our perception of their effects. Folk phenomenological report is therefore a vital source of information prior to and prompting further research, and the reports outlined at the start of this chapter certainly seem to point toward a collusion between the gestures prompted by print and satisfactory cognitive experience, as if the change in media is developing some thus far inarticulable drop in performance.

Recent cognitive and neuropsychological work investigating the specificities of how we use, position, and even perceive our hands in action also suggests that they can have implications for our attitude toward our environment, i.e. our hands in use can affect how we gain knowledge of and from things in the world. This kind of work lends further credence to the assertion of the centrality of gesture to learning and cognising that I'd like to invoke here, and the importance of research in this area is equally

supported by reports from the new domains of reading. For example, a particularly striking folk report demonstrating the evolution of new thoughtful gestures for the new media comes from the classicist James O'Donell's description of his automatic hand movements connecting an online practice with his thinking:

> it's my fingers I notice...[W]hen you've asked a really interesting question...it's a physical reaction, a gut feeling that I need to start manipulating (the Latin root for 'hand,' *manus*, is in that word) the information...to find the data that will support a good answer...The sign of thinking is that I reach for the mouse and start 'shaking it loose' - the circular pattern on the mouse pad that lets me see where the mouse arrow is, to make sure the right browser is open, get a search window handy. My eyes and hands have already learned to work together in new ways with my brain - in a process of clicking, typing a couple of words, clicking, scanning, clicking again - which really is a new way of thinking for me (192).

We will consider the role of the internet in relation to e-reading and cognition in the next chapter. For now I simply want to establish that O'Donnell's report demonstrates that new equipment for accessing information has prompted not just new ways of thinking, but new gestures which match with and structure that thought.

There is an growing experimental cognitive and neuropsychological literature which would go some way to supporting O'Donnell's statement above. Conducted over the last five or so years, researchers have been considering how the use of the hands can prime our reception of the world, or, more bluntly, the use of our hands appears to shape perception. In Ed Symes et al "Grasp Preparation Improves Change-detection for Congruent Objects" a research group presented their subjects with a cycle of two images, one then another repeated several times, both portraying two dozen fruits and vegetables of various sizes[88], but with one similarly sized object changing (i.e. all objects stayed the same bar an orange changing for a similarly sized apple, hard to spot in the first few exchanges). The subjects were asked to indicate when they had identified which object altered between the images by either a) squeezing a handle (power grip) or b) pinching a switch (precision grip). When the object that altered matched the grip that had been "primed" to register the subject's knowledge of the change then latency of response decreased significantly, i.e. when an apple changed to an orange those participants which had to register the change with a power grip (the grip

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[88] All coloured blue or purple so they seemed relatively homogenous in all respects bar size and shape.

that would be deployed when interacting with the changing objects in grasping) outperformed those subjects who had to indicate the change with a precision grip. Priming the grip measurably affected their perception of a scene; they were more ready to see things that they were primed to interact with[89]. It is therefore possible to conceive that the expectation primed by performing certain gestures might materially affect the reception of information: moving our hands in a "readerly" fashion may affect our reception of the text to come[90]. This would seem to indicate that a codex which primes such readerly gestures would therefore facilitate a certain mode of thinking that would be lost on an e-reader promoting different gestures. But what we see in O'Donnell's statement above is the training of ,mental practice associated with a new set of gestures. Unlike power and precision grips, readerly gestures, as with the gestures of any skill, have learned rather than innate associations. This would suggest that a reader coming to a digital device for the first time might well suffer from not entering that primed state (or maybe priming for a different mode, if the gestures of the screen are associated with a skimming kind of reading for instance). But if this is the case, over time the e-reader gestures can be normalised too; significantly anyone who began their reading life on a digital device would not suffer from these issues. Again, this must unfortunately remain speculative though the studies described above do point to the likelihood of at least some variation of this occurring.

To return to our dominant concern, I'd like to explore a further study in this area which explicitly discusses the implications for how our hands might affect our reading. As yet, the research presented has been little discussed outside of Psychology, but it

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[89]   Also see similar studies by Symes et al "When Motor Attention Improves Selective Attention..." and "Integrating Action and Language Through Biased Competition." In each case "priming" affected perception. A study which is also worth attention in this regard is Reed et al "Grab It!: Biased Attention in Functional Hand and Tool Space":

> In four experiments that used a visual-orienting paradigm with predictable lateral cues, hands or tools were placed near potential target locations. Results showed that targets appearing in the hand's grasping space (i.e., near the palm) and the rake's raking space (i.e., near the prongs) produced faster responses than did targets appearing to the back of the hand, to the back of the rake, or near the forearm. Thus, the topology of the facilitated space around the hand is, in part, defined by the hand's grasping function and can be flexibly extended by functional experience using a tool…An embodied theory of spatial attention implies that our bodies and our experience using our bodies should help influence how attention is distributed in space and, as a result, how visual stimuli are processed (237&243).

Again we see evidence for the incorporation of tools, in this instance extending the "active" plane of interaction, where perception and response are improved in the region facing the palm or to the active range of a tool.

[90]   This would make an excellent area of future study into embodied reading.

would appear to support the folk phenomenological claim that a change in equipment, and therefore the gestures related to the activity, can have profound effects on the reception of written information. As a relatively little known study with direct import on the argument of this chapter it is worth discussing in some detail.

Davoli et al's study from 2009, mentioned above with regard to their poll on reading preferences, considers the hands' effects on perception, specifically the placement of the hands within the visual field during reading. The paper begins with a review of earlier works which addressed the brain's apprehension of the space surrounding the body (peripersonal space) and in particular around the hands as "several results have suggested that visual processing may be biased toward [this] space"[91]; such work "support[s] the conclusion that vision of the space around the hands is special" (556).

Davoli et al also note that "[s]everal studies have shown that the actions we perform with our hands can influence how we see[92]...These studies have revealed an intimate relationship between perception and action - in particular, the capacity for the latter to affect the former" (555), and it is into this discussion that the paper is situated. The team wanted to explore how use of the hands affected reading ability, in particular whether reading from a desktop mounted screen, where the hands are kept away from what is to be read, is detrimental to understanding semantic content when compared to reading with the hands holding the material. As already mentioned, prior work on the impact of handed action on perception

> suggest[s] that spatial processing is enhanced near the hands...Certainly, reading is a process that requires spatial processing. In particular, efficient reading requires the precise control of movements of attention and the eyes through the text, as well as spatial memory to help retain one's place on the page. It is thus quite possible that the preference for holding one's reading material may be attributable in part to the enhancement of spatial processing that occurs near the hands (556).

This makes intuitive sense when we consider tool use, an activity which predates any act of reading: we need incredibly precise information about our hands' position in space when we dextrously and accurately manipulate equipment. But reading is, of

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[91]   See L. Reed et al "Hands up: Attentional Prioritization of Space Near the Hand" and Schendel and Robertson "Reaching Out to See..."
[92]   For example Bekkering and Neggers. "Visual Search is Modulated by Action Intentions" and Fagioli et al "Intentional Control of Attention..."

course, not just about space and arrangement, it also includes content which requires semantic processing in order to produce meaning, and at the time of writing it simply isn't known to what extent the hands affect semantic processing. The study from Davoli et al marks the "the first test of that question" (Davoli et al 556).

Davoli's team initially conducted "sensibleness" tests, where participants were asked to rate sentences shown on screen as to whether they were intelligible or not, and then "Stroop tests," a standard measure of semantic comprehension in experimental Psychology, where colour words (red, green, etc.) are displayed with the letters either matching (e.g. "red" written in red letters - congruent) or not matching (e.g. "green" written in red letters - incongruent) the content that they spell out. The tests themselves are well established in Psychology research, with predictable results[93]; it was only the ways in which participants were required to indicate sensibleness or congruency which gave the surprising outcome of the experiments. Participants completed each round of the task by pressing a button attached to either the left or right hand side of the physical screen to indicate, for example, congruence and incongruence (i.e. the hands would be in the visual field near to the content to be interpreted), or by pressing buttons to the same effect held on their left or right leg (i.e. the hands would be outside of the visual field away from the content).

The team saw three potential outcomes for the results: i) semantic processing, as with spatial processing, would be boosted near the hands ii) increased spatial processing comes at the expense of semantic processing iii) spatial processing is improved, but semantic processing is unaffected (556).

The placement of the hands certainly did have an effect on semantic apprehension, but not in the way that predictions extrapolated from our folk phenomenological evidence might suggest: "the present results...suggest that semantic processing is *impoverished* near the hands. This occurred despite the known spatial-processing enhancements that have been reported" (558, my emphasis).

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[93]   The "Stroop effect," for example, has become the term for the delay in reaction time that occurs in reporting incongruent word/letter colour images. Original study by J.R. Stroop "Studies of Interference in Serial Verbal Reactions."
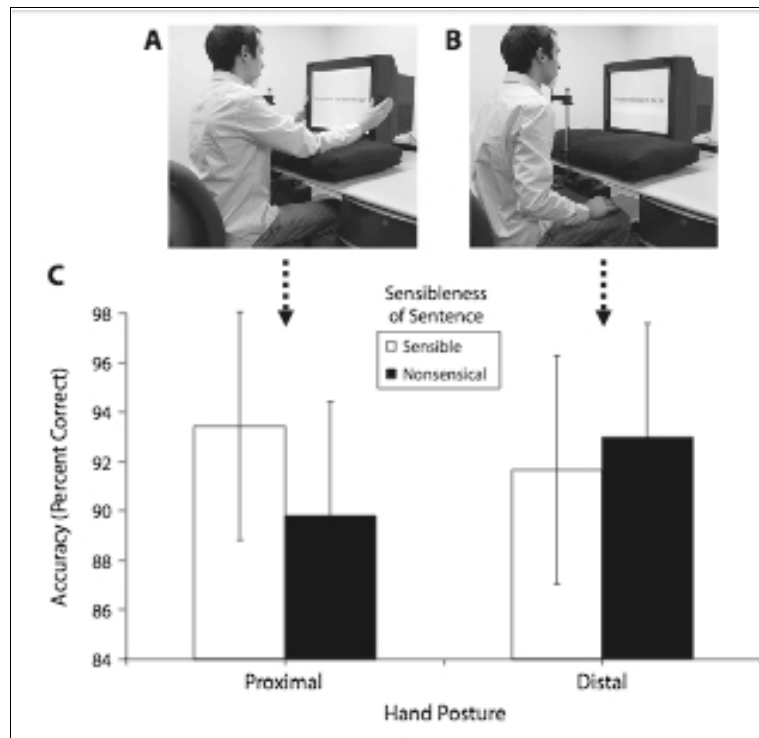
(557)

The team found a statistically significant, and in some cases dramatic drop in response times when a report of congruence or incongruence was indicated with the hands by the sides of the screen over being indicated with button pushes on the legs. This is striking (and unpredicted by the prior literature): despite the copious reports of preference for reading with a book held in the hands over reading from a desktop screen, Davoli et al's results suggest that this might actually be the *less* effective way of processing semantic information. The results were replicated in all three of the team's tests.

During the interpretation of the results the paper suggests that the effect demonstrated might represent

> a trade-off between semantic processing and spatial processing that can be altered by hand proximity: The enhanced spatial processing that has been observed near the hands...might be achieved at the expense of semantic processing...Indeed, it seems plausible that visual processing near the hands would be biased toward the spatial properties of objects and away from semantic ones. Objects near the hands may be critically important because they might be objects that need to be grasped or obstacles that should be avoided (560).

The incredible precision afforded to us by increasing the spatial awareness surrounding

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our hands - and it really is remarkable, particularly when you compare even the infants of our species to our closest primate relatives -, this precision seems to come at a cost, and Davoli et al identify that cost as manifesting in a decreased semantic understanding. When our hands are near something the drain of producing a heightened spatial awareness interferes with the comprehension of a type of information required by another realm.

How then does this data relate to the origin of the folk phenomenological accounts of a preference for holding written material in the hands? It may be that the spatial component of reading vastly exceeds the importance of semantic processing, but this doesn't seem right; however important orienting yourself within the confines of the page or the sentence might be, surely comprehending what passes before your eyes is at least as, if not even more, significant? But if the reading experience might, in some cases, be improved by *removing* our hands from visual activity then why, as Davoli's subjects support, do so many people prefer to consistently print digitised reading material out and settle down with their hands primed to interfere with meaning? Davoli et al suggest that "it is possible that many prefer to hold a hard copy rather than read on a computer monitor because of expertise in reading in this manner. Might the practice that some have with reading in a certain medium outweigh the potential effects of hand proximity? The resolution of all these issues will require further study" (561). It would appear that, though the task of handheld reading is cognitively costly, for expert readers the repetition of particular gestures overcomes or compensates for what might, ironically, be described as an "unnatural" (as in a poor match between the task and our nature) engagement. Somehow we have gotten used to reading in this way, somehow it has come to offer something more than the extra semantic processing available through keeping the material at a distance. Familiarity, practice, and experience are the features which stand out as synching the activity with effective cognition, overcoming any deficit in the impoverished match between certain equipment use and thought, so much so that the detrimental (but rehearsed) is experienced as the preferable engagement.

This notion of practice, of getting used to something to overcome initial limitation will inform the bulk of the remainder of this chapter, but first we must consider the third and final aspect of physical interaction with equipment for reading, after the primacy of gesture and the influence of the hands in action: the physical presence of the artefact itself.

Bookish bodies

The review of some of the cognitive and neuropsychological literature surrounding gesture and hands in action outlined above suggests that our tactile interaction with the world is of central importance to our understanding and learning. I'd like to consider the bodies of codices and e-readers, looking at some of the specificities in the experience of their use, but before we get into the argument of this section I'd like to offer a brief report of the experience of using the two types of e-reading equipment that I've been referring to.

Kindle 3
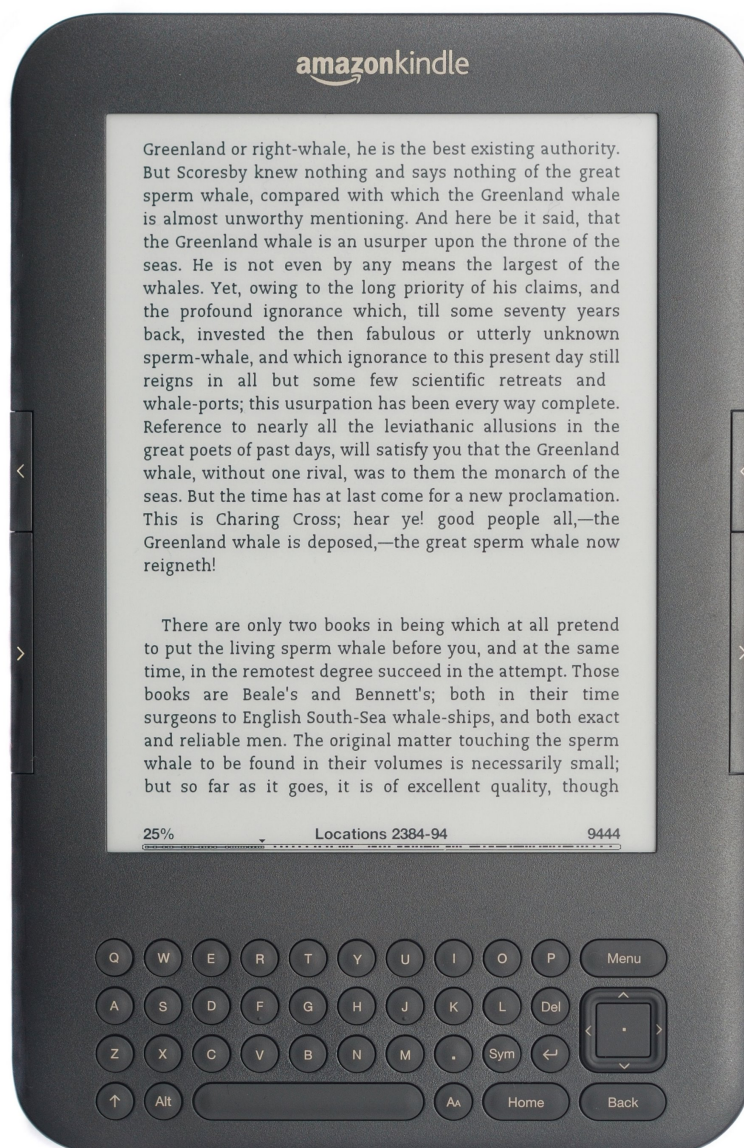
Amazon's third Kindle is a matte charcoal frame with a QWERTY keyboard and additional buttons for navigation of its menus and submenus at its base. Four more buttons, one tall one short running up either side are responsible for page changes (whichever hand you hold it in a larger button can be depressed by the thumb to move the pages forward, whilst the smaller button on the opposite side is pressed by the first or middle finger to turn the page back). It's very light, about the size of a small paperback in length and width, and only a few millimetres thick. The Kindle is plasticky and can feel like a toy, but when used with a protective case gains some reassuring heft (Amazon's official cases are leather, and open much like a codex). The buttons creak slightly when you press them.

The screen itself is grey, not white or cream like a familiar printed page, due to the persisting contrast difficulties in the e-ink screen equipment[94]. In its every implementation the Kindle evokes an older order: the matte texture of the screen and its surrounds are reminiscent of home computers of the eighties, and the relatively low resolution of the device for image viewing also speaks to that era. The screen in use for reading, however, is uncanny in its emulation of ink on paper. We're so used to screens projecting light at us, emanating, and yet here we have a dullness, viewable from any extreme of angle, clear in the brightest sun and invisible in the dark. There's an irony to this wonder though, something at odds with the name printed at the top of the object: to kindle is to start something, a metaphor drawn from fire making. Kindling is scraps of wood and scrub and brush, but to kindle is to throw a spark among them, make them flare. Fire and technology have a mythical past of course: Prometheus took something special from the Gods and was punished for making it mundane, a spark for everyone. This is what the odd toy of the Kindle feels like, a banal magic soon forgotten and simply put to use.

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[94] Electronic ink, or e-ink is a screen substrate developed by MIT and later the E Ink Corporation. An e-ink screen is made up of rough spheres filled with positively charged white, and negatively charged black pigment granules. By altering the current in a plate beneath the spheres either the white (clear) or black granules are drawn to the surface producing the screen image. For more on e-ink see http://www.eink.com/technology.html

iPad 2

The second iteration of the iPad is large, the size of half a laptop screen, and heavy enough that its security is uncertain when held in a single hand, a different experience to the Kindle entirely. It's nothing but a shiny latex-black frame with an aluminium reverse; on its face it has one button which takes you "home" should anything go wrong.

The screen itself is a glossy and hyper-responsive high definition and full colour multi-touchscreen. A brush of a single finger "opens" the device, a tap on the appropriate icon launches iBooks (or some other reading programme), and pages are turned or scrolled with similar swipes. For all of the tangible buttons on the Kindle it is strangely infinitely less tactile than the iPad; the required movements of the hands feel instinctive on the plain screen. Thanks to an internal accelerometer the iPad knows if its being held in a portrait or landscape orientation, or whether it's been rotated 180º, and it alters its screen accordingly, adjusting in response to the posture of the user. One thing you can't help noticing is that, even on its lowest setting, it is unrelentingly bright, and the glare can become too much during sustained reading, particularly in low ambient light.

It isn't a single-use device, acting instead as an extremely portable computer only without the tethers and accoutrements usually accompanying that engagement. The iPad

speaks of infinitude, a frame that can be, that needs to be filled with anything, whereas the Kindle, at every step, offers boundaries of what and how things can be shown.

The iPad professes simplicity from the start, just a pad says the name, a scratchpad for notes, for getting things done. But this is my pad, where I do my things, where I have a surface onto which I can call anything I like, onto which I can conjure. It should not be underestimated how special this thing feels in comparison to a Kindle, but this actually isn't necessarily a coming out in favour of the iPad, at least for reading. The Kindle melts away during use almost instantly, and the tactile feedback of the page turn buttons requires no hunting or new ways of interacting which must be learnt (though the iPad feels instant in selection and gesture there is still something alien in its requirements; a strange realisation, but it took a while to stop marvelling distractingly at how I somehow knew just what to do). The Kindle borrows all of its fundamental features from other familiar arenas; though it's secondary abilities might frustrate (something we'll return to in the third chapter), in reading it works cleanly and efficiently. The iPad also functions relatively seamlessly, but again the novelty is harder to assimilate: the touchscreen; gestural page turns; the glare and reflective surface; remembering to keep it charged; reading in the dark where, surrounded by blackness, it seems to be the only thing in the world, these things stand out.

We saw in the first chapter how technology is often perceived as putting a mediating barrier between us and the world, acting as visceral insulation, but I went on to criticise that view by suggesting that technology can be involved in some of our most intimate experiences with things in our environment. When we talk about e-reading equipment not feeling right in this regard then there is the suggestion that the text is somehow placed *behind* the object, that there is an additional layer that must be fought through before it can be accessed, and that this insulating layer isn't present with the codex. We can assume, therefore, that at least some users experience disruptive formal differences between the artefacts.

Physical books have depth, whereas pages appear for the most part as mere surfaces; the language we commonly use suggests the lost dimension: *in* a book, *on* a page. But e-reading, emerging for most current users predominantly from internet based computer reading and maintaining some of the characteristics of that mode, has far more in common with the flatness of pages than with 3D codices. Things are *on* Wikipedia, for instance, not *in* it, because despite its status as an encyclopedia it deploys the

architecture of the internet, comprised of pages, nodes, and we can never see the whole system to talk about depth, only ever appeal to the idea of, at best, the ever spreading map, at worst an expanding cosmos. Similarly, when we read the e-book version of *To Kill A Mockingbird* do we find Boo Radley in it or on it? And if in, then how much does this remain a hangover from an older mode rather than the language catching up to the perception of the current experience? Trusse and Roome's reports of pages sliding by with no reassuring depth to hold on to certainly don't seem to match up with Atticus Finch occupying a space inside the work, instead he seems to merely reside upon it[95].

These kinds of questions emerge out of our existence as embodied beings who are at their best when grappling with similarly physical objects:

> To be situated in the world means not simply to be located someplace in a physical environment, but to be in rapport with circumstances that are bodily meaningful...Those possibilities that my body enables..., just as much as those activities that my body prevents or limits, and that define what is possible or impossible - these are aspects of embodiment that I live with, and through, and that define the environment as situations of meaning and circumstances for action (Gallagher and Zahavi, *Phenomenological Mind* 137-138).

We define our environment, and our equipment, in relation to bodily positions and possibilities; as Merleau-Ponty argued in an earlier quotation, being embodied is the condition for us having a world to experience[96]. We are also primed to encounter

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95 Note that I offer up these notions only as an extrapolation of such folk phenomenological reports. In her essay "Print is Flat, Code is Deep" Hayles argues against exactly these types of assertion, putting depth at the heart of interpreting work found on screen by exploring the multilayered nature of digital texts from a base in machine readable code through to the human readable instantiation of the text on screen. But Hayles begins her argument by saying that this depth is ignored by textual scholars, let alone by the average reader who has little pressing reason to consider the equipment beyond their immediate experience of it. I'm therefore made more comfortable, not less, with offering these reports after Hayles' work; that essay exists because, for most readers, printed books have depth, coded books appear flat.

96 In this regard, and to which Gallagher and Zahavi are presumably referring in the above quotations, Husserl also characterised the body

> as being present in any perceptual experience as the zero point, as the indexical 'here' in relation to which the object is oriented. It is the center around which and in relation to which (egocentric) space unfolds itself (Hua 11/298, 4/159, 9/392). Husserl consequently argues that the body is a condition of the possibility for the perception of and interaction with spatial objects (Hua 14/540), and that every worldly experience is mediated by and made possible by our embodiment (Hua 6/220, 4/56, 5/124) (Zahavi, *Husserl* 98-99).

The abbreviation "Hua" refers to the relevant volume/page number of the 34 volume collected writing of Husserl, the *Husserliana* editions. Zahavi's familiarity with this immense body of work in the original German reveals his usefulness to anyone interested in Husserl's thought, and as such I will predominantly rely on his interpretation of Husserl as discussed in *Husserl's*

similarly tangible things in our environment; our radical dependence on our own bodies leaves us unhappy, particularly without training, in negotiating realms of seemingly pure thought or abstraction. This might go some way to explaining the response to the feel dimension of the e-reader experience. In a codex, the book and the medium are as physical as one another, they are the same thing, bound in an unchanging dialogue within that one item, and we've grown to understand that this is the reading (and writing) experience: essentially to acquire a specific and unique (though replicable) thing and to try and work out what it means to whatever standard we deem appropriate. The e-reader/e-book relationship is entirely different: "An electronic text literally does not exist if it is not generated by the appropriate hardware running the appropriate software. Rigorously speaking, an electronic text is a process rather than an object, although objects (like hardware and software) are required to produce it" (Hayles, "Print is Flat," 79). The e-reader is as physical as any codex, though it establishes different gestures and actions during use, but the e-books that can be read on it (not in it) are ephemeral, ghostly, temporarily brought to the surface to establish a bond with the tangible object before returning to somewhere else, leaving the physical form of the equipment to mean by itself and in other contexts, other combinations[97]. We have other corollaries for this experience of course, in television, computing, cinema, and varieties of music players: these all deploy stable physical objects which can call up diverse and transient content even as they inflect its reception, and as such we should hardly be surprised by the new reading equipment. But perhaps it is to be expected that when we make the obvious comparisons with these media, rather than with printed books, a reader such as Roome might ask "is this even reading anymore?" Reading had always, until the advent of the moving image, meant interacting with an object which *is* the codex (or the scroll, or the parchment). Cinema, television, and computing changed that arrangement, and the establishment of e-reading threatens to make the shift irrevocable. There is something to be lost here, though it might well be trivial, at least in terms of its importance to future generations of readers: with screen reading the book and the object are taken apart, any assemblage of work and substrate will be soft.

Phenomenology. My own understanding comes from the English translation of *Logical Investigations* and *Ideas Pertaining to a Pure Phenomenology*, as well as from the various articles and books cited throughout this chapter, but it is to Zahavi's expertise that I will, for the most part, defer.

[97] Again, the claim here is phenomenological rather than ontological. As Kirschenbaum ably demonstrates in *Mechanisms*, data doesn't disappear, and isn't devoid of physicality, something we'll return to in the third chapter.

In this regard, however, I'm grateful to Tim Carmody[98] for his comments on an early draft of this chapter at my research blog. In a comment left there Carmody invoked Gerard Genette's *The Work of Art: Immanence and Transcendence* in negotiating this issue and offered the following response:

> I'm all about this materialist-phenomenological approach to reading. But I think you may slight the way in which reading a book has always been a complicated interplay of immanence & transcendence...For instance, the codex book has never been the material FACT of the work of art the way that a sculpture or painting is. Likewise, the physicality of reading the paper codex is harder to ignore now that we have a very different (and on its face, less robust) physicality for reading all kinds of documents, including books...[W]hen you're working through the genuinely phenomenological (as opposed to the narrowly empirical) account of reading a book, its transcendence, the fact that it does not appear to be merely confined to that physical codex, is a genuine part of that experience.

This is an important point. The *immanent* instantiation of the printed text (in Genette's terms) is essential to understanding the artwork, but however much it conditions it, it is the sole site of the work: the *transcendent* text extends away over every edition, and every edition's history, and historical conditions and means of production etc., in short into the typical realms of Book History and Textual Studies. I'm certainly not trying to refute such notions, and Genette's distinction is elegant, but despite our reinvigorated interest in materiality after digitisation, and despite the transcendent artwork always already being present in printed works, I simply want to assert that the folk phenomenological discourse demonstrates that a change has occurred with a seeming breakup of the text down the lines I have described. I'm not trying to do the codex a disservice by saying that it often seems to be the whole phenomenological fact of the text in use by a typical reader; this is one of its wonders, and a wonder that doesn't translate in satisfying fashion to the e-book/e-reader experience.

One of the reasons for mourning the change in the physicality of reading technology that we must consider, therefore, is that the union of book and object may be a more effective textual instantiation than the e-reader and e-book theatre. Hayles, arguing against the abandonment of printed materials, suggests a possible example of such superiority: that "[k]eeping the [physical] book as a passive device for external

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[98] Carmody currently writes for *Wired* magazine, but he also had a previous career as an academic specialising in reading and phenomenology.

memory storage and retrieval has striking advantages, for it allows the book to possess robustness and reliability beyond the wildest dreams of a software designer. Whereas computers struggle to remain viable for a decade, books maintain backward compatibility for hundreds of years" ("Print is Flat" 84). We addressed some of the issues which might make e-readers seem unnatural in the first chapter, but it's worth re-iterating here that the reports of reading on screen not feeling right seem to have at least a partial basis in what is perceived as an over complication of the reading engagement. Physical books conform to our bodies and minds as other objects in our extended history have: they don't need batteries, they're always "on," they're relatively robust, and their workings are intuitive. The same cannot be said of e-readers. Again, a heightened complexity of basic use doesn't rule out adjustment, but initiates who are experts in the codex mode might well baulk at the switch. A related reason for a sense of loss in the seeming division of work and matter is that the physical book, in its uncomplicated materiality, resonates with our own bodies in a way that the e-reader as magic box cannot. Karen Littau states that "[t]he relation a reader has to a book is also a relation between two bodies: one made of paper and ink, the other flesh and blood. This is to say, the book has a body" (Littau 2). We've spent some time looking at the reader's body, but perhaps we need to consider not just the form of the bound paper book, but also its embodiment. "[T]echnologies[, of which bound books are illustrative examples,] are embodied because they have their own material specificities as central to understanding how they work as human physiology, psychology, and cognition are to understanding how (human) bodies work" (Hayles, *Electronic* 112). I want to take very seriously this notion that material equipment, such as a codex or e-reader, has a body which is worth understanding. To begin with it matches reported phenomenological experience, though the reports are harder to track down as the idea is tightly bound into the language we use to discuss or describe the form.

For instance, when discussing the history of the codex Bolter argues that "[t]he paged book became the physical embodiment, the incarnation, of the text it contained. Incarnation is not too strong a metaphor. Through printing, we have come more and more to anthropomorphize books, to regard each book as a little person with a name, a place (in the library), and a bibliographic life of its own" (*Writing Space* 86). There seems to be more than a degree of subjective report here, rather than a historicised statement of fact, but that's not to say that Bolter's is an idiosyncratic point of view, far from it. Littau's wider argument in *Books, Bodies, and Bibliomania*, for instance, rests

upon it, and Hayles notes that "[a]uthors regularly [think] of their books as offspring; characters in metafiction often tr[y] to peer out of the covers that contain...them to see the book as an object; the human form converge[s] with book technologies even in such inert metaphors as footnotes, spine, and appendix" (*Writing Machines* 39). And here we can see that implicit connection with ourselves: we describe books with the same words that we use to describe elements of our own material existence:

> Texts assimilate utterance to the human body. They introduce a feeling for 'headings' in accumulations of knowledge: 'chapter' derives from the Latin *caput*, meaning head (as of the human body). Pages have not only 'heads' but also 'feet', for footnotes. References are given to what is 'above' and 'below' in a text when what is meant is several pages back or farther on (Ong, *Orality* 100).

Do we flinch at the thought of separating the book from a body which is referred to in such human terms? Such ideas introduce bodies into the discussion of the codex in a non-trivial fashion. Regardless of language, Hayles' reference to books as offspring, Bolter's anthropomorphism, and Littau's explicit pronouncement all speak to interacting with printed books as being a true meeting of bodies, and, as I said, I'd like to take this seriously.

Bodies over time

This section will explore how printed book bodies and e-reader bodies are products of evolution. That they are evolved seems an outcome of saying that they are embodied: embodied things in the natural (i.e. non-artefactual) world have only come about due to evolutionary processes. I'm not saying that these artefacts could occur without our influence, quite the opposite, but I do think that it makes sense to look at their development as an evolutionary event and that it is productive to do so, opening up new areas of thought to be put to work on these objects. To examine this idea I'll detail a basic and largely canonical theory of evolution which will provide us with most of the terminology that we'll need before suggesting some ways in which the metaphors and ways of looking at the world developed by Evolutionary Biology's impact on Philosophy can help us to understand the change in form from codex to e-book. These ideas need to be in place before I can present the main drive of this turn to evolution: understanding the bodies of reading equipment as having evolved allows us to use the

language of evolutionary epistemology to discuss equipment and technology in general (and reading apparatuses specifically) as "embodied knowledge," and this offers a way to understanding the mechanism by which we adapt to changes in technology over time. This is important to our discussion of e-books because it suggests that any artefact can be adapted, and adapted to over time; no matter how "natural" codices may now seem, e-books can feel equally, if not more so after prolonged use.

Evolution begins with the meeting of two things: an individual organism (let's use an animal for our example) and an environment. The environment is simply the surroundings that the animal spends its time in, including everything within that space, members of its own species, plant life, weather, prey, predators, landscape, etc. etc. An animal is the expression of the genes passed on to it by its parents[99]. Environmental pressures, from what the mother eats during pregnancy to how much sunlight the young animal gets, can affect the way that genes are expressed, causing different selections to be made across the millions of ranges of available expressions made possible by the genetic instructions. The genes that an animal carries within it, inherited from its parents, are called its "genotype," whereas the epigenetic selections from the genetic ranges that cumulatively make up the animal are called the "phenotype": "the phenotype is the expression of that information in the flesh-and-blood individual that develops via a series of highly complex interactions with the environment" (Plotkin, *Darwin Machines* 95).

In evolutionary terms the animal is successful if it survives long enough to go on to reproduce, to pass on its genes by producing young after resisting the threats, and utilising the supports of its environment. This sets the stage for evolutionary effects. Reproduction and the influence of the environment on development are not evolutionary processes; evolution instead occurs because organisms and environments aren't fixed.

Environments can change in many ways, but lets take the example of a shift from a moist to a dry climate. In a relatively moist landscape many plants will have the

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[99]   Genes can be thought of as the fundamental but malleable instructions for building a body; they give a developmental range for every aspect of the animal, but like a recipe which recommends "a good pinch of salt" will mean that salt is always in the final dish, but the flavour will differ slightly or dramatically according to the interpretation of the instruction, so the expression of genes can vary across a range for each iteration. "Epigenesis" is the term used to describe the individual's final expression along such ranges. For instance a set of genes could state that a developing claw will grow between one and three inches long, and between half an inch to an inch wide; there is no specific gene for a two inch by one inch claw for example, genes just set boundaries, "additional information is gained from the environment during epigenesis - genes give some liberty for development" (Vehkavaara 213).

perfect conditions to thrive and our animal, a four legged herbivore mammal, has plenty to eat low to the ground. As such the fact that it is short doesn't stop it being able to reproduce: it is born with a blend of its parents genes, those genes are expressed through its development (*in* and *ex utero*) within an environment which allows it to live long enough to pass on its combination of genes by reproducing. If, however, the climate were to dry out, then the grasses our animal eats would start to disappear and it would find itself struggling to acquire food. If it starves too quickly then it won't be able to reproduce and its particular combination of genes will disappear. With all of the grasses dying out, however, isolated trees start to thrive as they have increased access to the remaining available water. Over time, the height of the available vegetation migrates upward and our animal's shortness has a real impact on its survivability.

As stated above, a process of epigenetic selection from a myriad of genetic ranges results in the phenotypic expression of an animal. If an animal's parents produced perfect clones of themselves (or of a blend of the pairing), i.e. passed on exactly the same genetic material that they carried, then these genetic ranges (if not their expression) would stay the same. But this isn't what occurs: in the same way that the environment is unstable and continually changing, so reproduction is not the perfect transmission of genetic material. Instead mutations occur which alter the ranges a gene or set of genes will dictate. In a world where vegetable matter is growing further and further from the ground those animals who can reach it will survive longer, be stronger, and have a better chance of reproducing. In biological terms they are "fitter," and we can think of this as their being a better fit for the environment they find themselves in. The ranges which produce our animal's neck are dictated by various sets of genes. In the drying out world the animals which express neck length at the higher reaches of the ranges will survive better, and the species' overall neck length range will therefore tend toward genes which more often express longer necks. Once in a while a mutation will occur which extends the range of neck length beyond its previous limit. If an animal carries these mutated genes, and during epigenetic development expresses toward the new upper limit of neck length and thus thrives, then these new rogue genes will become a part of the gene pool; their continued expression and success represents a change in the species. For our purposes here we can therefore see evolution as divided into three phases: *variation*, *selection*, and *reproduction*[100].

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[100] To flesh out an understanding, two good introductions to evolution and its history as a concept are Mark Ridley's *Evolution* and Carl Zimmer's *Evolution: The Triumph of an Idea*.

With an understanding of what I intend by "evolution" in place we can now consider whether material equipment, artefacts, could be thought of as having evolved, using printed books as our example. I should note from the outset that such an idea is not novel in and of itself, Peter Medawar going as far as to say that "[e]veryone has observed with more or less wonderment that the tools and instruments devised by human beings undergo an evolution themselves that is strangely analogous to ordinary evolution, almost as if these artefacts propagated themselves as animals do" ("Technology and Evolution"). But Medawar's example marks a distinction between the evolution of artefacts that I would like to suggest and that as it is more frequently discussed: "Aircraft began as birdlike objects but evolved into fishlike objects for much the same fluid-dynamic reasons as those which caused fish to evolve into fishlike objects." To me it seems that there is a mistake of environment here, of how and why artefacts evolve. Fish evolved due to the pressures exerted upon them by an aquatic existence, but aircraft feel no such pressures; the three stages of variation, selection, and reproduction have no identified corollaries in this example, and this distinction is one that needs to be addressed if we are to use that term "evolution" with any validity.

The evolution of artefacts has its supporters and detractors who typically question the ideas of cultural and technological (in its various prior technical and common sense definitions) evolution as part of the discussion of the evolution of ideas[101], or knowledge gains in science specifically, rather than with the physical bodies of the equipment themselves[102]. The detractors of the idea, whether considering the

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[101] William James' "Great Men, Great Thoughts, and the Environment" is almost certainly (in no small part due to the proximity of of its publication to Darwin's own work) the first theoretical application of evolutionary mechanisms to the progress of thought and ideas.

[102] See for instance Walter Vincenti *What Engineers Know and How They Know It*; Richard R. Nelson *Technology, Institutions, and Economic Growth* ("On the Nature and Evolution of Human Know-how" 115-138); and Carl Mitcham *Thinking Through Technology: The Path Between Engineering and Philosophy*. In a more tangible realm, Karl Marx, in *Capital*, saw Darwin's then new theories as a way of explaining advances in technology as the work of the many in small improvements, rather than grand ideas coming from a talented few, and Tim Ingold notes that "artefacts, too, may be grown, and that in this sense they are not so very different from living organisms…Just as the form of the organism is not prefigured genetically but arises through a process of growth within a morphogenetic field, so the form of the artefact is not prefigured culturally but arises through the unfolding of a field of forces that cuts across its developing interface with the environment" (*The Perception of the Environment* 290). W. Brian Arthur's *The Nature of Technology* and George Basalla's *The Evolution of Technology* are both concerned primarily with the invention and increase in complexity of artefacts. Both writers assert the distinction of their described mechanisms from Darwinian evolution, although they both also accept that users deploy Darwinian selective pressures once the artefacts have been created. Lastly, Bernard Steigler, in *Technics and Time*, also presents a chapter on "Theories of Technological Evolution" (29-81). Stiegler is heavily influenced by the work of André Leroi-Gourhan, particularly *L'homme et la Matière* and *Milieu et Techniques*. Stiegler finds appeal in Leroi-Gourhan's theory of a "zootechnological determinism," that as the fish "must" evolve toward the amphibian so the knapped flint "must" evolve toward the steel sword (*L'homme et la Matière* 13); there are only a few paths evolution can take, it operates within certain constraints. There is evidence for this idea, of

ideational or physical bodies, tend to appeal to a gross mismatch between biology and ideas or artefacts. But I hope that this impasse can be avoided from the start: there is no one-to-one match between the biological encoding of successful forms in organisms and the mechanism that I will suggest for the evolution of artefacts below. However, the description of evolution as I have outlined, stripped down to its elements, is broad enough to hold well in the adaptations of material equipment. We need not get bogged down in the minutiae of how DNA encodes particular responses to the environment, for instance, and whether this has a corollary in artefacts; if the three criteria hold for an identifiable "organism" and an identifiable environment, and produce adaptive results, then I would suggest that the term "evolution" is a productive description of events.

Firstly we need to define the individual (for the sake of clarity I'll abandon the term organism): the codex[103]. Next we need to define the environment which is going to place selective pressures upon it. With non-artefact entities the environment is easily defined: everything in the milieu in which it exists which can directly or indirectly impact upon its epi- or ontogenetic development or its surviving long enough to reproduce. But for artefacts, and for codices specifically, that milieu is more specifically defined, though the same principles apply: *we* are the defining selective forces for our artefacts, human users are the environment for our material equipment. Yes, conditions of, for instance, humidity fluctuate, and this can have a profound impact on the survivability of a codex, but whether or not it gets to reproduce (or be reproduced in response to this) is based on our allowing it to occur. Just as the vegetable matter's rising above the average neck length of our example animal was a way of the environment's "choosing" whether it got to reproduce, so we choose the fittest codex forms to be repeated, the one's that fit their environment, the ones that fit to us. That we can make this as a conscious decision rather than dispassionately enacting selective forces is irrelevant (and sometimes false); the end result is that the environment does or does not allow a new generation based on what has come before to emerge.

So if the individual is the book, and we are the environment, then we have at

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course: as we'll see, wood and hands guide the shape of saws, arms and jungle the length of knives, such constraints shape evolution. But I dislike the notion that we might be able to predict evolutionary processes, or that any path might have been certain: evolution, to be evolution, must be an emergent property, any apparent constraint could prove to be a mere failure of imagination except for the most extreme formulations.

[103] Again, this is the codex of the popular imagination as described in the introduction. Codices are clearly multifarious things, with a huge variety of forms being included under that name over the history of writing (and, more specifically, in histories of that history). For the purposes of this discussion, however, the term "codex" will largely continue to refer to a generic printed and spine-bound mass market paperback.

least the arena for evolution to occur. Next the three phases of the evolutionary process need to be established.

i) **Variation** - Is there the capacity for mutation in the codex form? I think that we can obviously say yes: from Gutenberg's first huge bibles to hotel pocket Gideon's there is clearly a range of sizes. From early metal codices and bound velum to contemporary recycled paperbacks there's a range of materials. From lithographic to laser there's a range in print. From handwritten and illuminated manuscripts to Times New Roman there's a range of typography. In fact for every descriptor of the codex there's a range of variation. It is also clear that there are predominant ranges for this variation to take place in, with odd mutations (e.g. oversize atlases, intricate bindings, die-cut pages, etc.) extending or altering those standards, with emergent stability representing a "species" change.

ii) **Selection** - For evolution to occur, pressures from the environment must cause a match or mismatch of fit for the individual. Let's use oversize books as the example. Most codices are a certain size because we, as the selecting environment, tend not to buy or use or demand books which we cannot easily hold or carry around with us. When there is no demand for an item, market forces (which, as they are related to our reception of books in a capitalist system, are part of structuring the environment for a codex, perhaps something akin to weather patterns in the non-artefactual realm) tend toward ceasing the production of that item. The proliferation and success of the average paperback book is based on a complex of selective pressures over generations of produced texts which increasingly came to match the needs of our bodies in motion amidst their cultural and economic milieu.

iii) **Reproduction** - Lastly is there a way for the attributes of existing codices to be passed on to the codices which follow them? Is there a relationship between "parent" and "offspring?" This would require us to think of the codices which follow those currently produced as offspring. Or perhaps not. If we think of the collected group of codices as a gene-pool[104], then it doesn't seem unintuitive to see any individual codex as the phenotypic expression of a set of ranges that comes directly out of that pool, and that the continuing success of that expression contributes to maintaining the pool as it is. The significant difference here between organism and codex seems to be one of agency: the organism struggles against the environment and *tries* to reproduce, whereas the codex is innately passive. But what *causes* variation, selection, and reproduction is not the measure of whether a process is evolutionary. In Marshall McLuhan's terms, we are "the sex organs of the machine world, as the bee of the plant world, enabling it to fecundate and to evolve ever new forms" (*Understanding Media* 56).

I believe that we can also extend these ideas out to any artefact. By shifting toward

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[104] The sum total of all of the living genetic combinations of a species.

thinking of ourselves as being able to exert conscious or unconscious environmental pressures we can see any number of ways that artefacts iterate over time. Think of the progression of hammers from rocks of all sizes held in the hands of early primates to the now common form of a piece of specifically shaped metal on a wooden shaft. We can imagine all of the variations that occurred along that lineage, and the ranges of expression that still exist today, from small household ball-peen hammers, to lump hammers, mallets, and sledgehammers, and all emerging from very similar selective and reproductive methods as those detailed for codices. For every artefact the same process must have occurred; if there are elements to be varied then human users have and continue to apply selective pressures which will affect the next generation of the species.

An evolutionary epistemology of objects

My reason for wanting to establish an evolutionary model for artefacts is it opens up a branch of philosophy which might help us in our discussions of the process of getting used to the new reading equipment, and to artefacts more generally. If artefacts abide by the basic structures of an evolutionary processes then might we be able to consider them in terms of evolutionary epistemology (hereafter EE)?

Epistemology - the study of knowledge, acquiring knowledge, and knowing - is blended in EE with evolutionary theory to describe two increasingly distinct fields: i) evolutionary principles applied to the progress of knowledge, particularly in the sciences[105] and ii) the study of knowledge acquisition in living beings, where cognition and knowing are seen as evolutionary adaptations, and bodies and the minds they produce are seen to reflect aspects of the world. The first branch is easier to explain in basic terms due to the approach that we've already taken here. Extending the three phases of evolutionary process onto thought, this conception of EE often suggests that there is a unit of selection in knowledge, possibly the meme[106], which can be varied,

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[105] See for example Franz M. Wuketits (ed.) *Concepts and Approaches in Evolutionary Epistemology: Towards and Evolutionary Theory of Knowledge* (in particular Erhard Oeser "The Evolution of the Scientific Mind"); Donald T. Campbell "Selection theory and the Sociology of Scientific Validity"; and Louis Boon "Variation and Selection: Scientific Progress Without Rationality."

[106] Richard Dawkins coined the term "meme" in chapter 11 of *The Selfish Gene*, "Memes: the new replicators." For Dawkins a meme is the smallest unit of meaning spread via cultural phenomena. In his original formulation it is a relatively unsophisticated idea, a rough analogy to the gene for something which might be replicated in a purely cultural environment: "Examples of memes are tunes, ideas, catch-phrases, clothes fashions, ways of making pots or building arches…[M]emes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the

selected for, and reproduced. This is an example of Universal Darwinism, and though the field attempts to explain subtleties such as the precise method of encoding information for the next generation, or the validity of making evolutionary claims about knowledge acquisition, the fundamental underlying mechanism is something that we've already addressed. Most theories of evolutionary approaches to technology fall under some variation of this first branch of EE.

The second branch is, if not necessarily more complicated, then perhaps less intuitive. It also rests on the fundamental principles of evolution, but its claim is not, or not solely, about the mechanism of human knowledge acquisition and transmission. This approach sees human knowledge as an adaptation, and, in some instances, that every evolved adaptation in an organism is best thought of as *being* knowledge. I'd like to adopt the vision of this type of EE that Henry Plotkin outlines in *Darwin Machines and the Nature of Knowledge*, as the elegance of his theory coheres with the bare-bones mechanism of evolution that enables Universal Darwinism to function. I would like to argue that Plotkin's approach allows us, through it's stripping out of the specificities of biological organisms' reproduction and genetic encoding of information, to talk about EE as it might apply to artefacts in their alternative environment of human use.

Plotkin's central idea is that as organisms adapt to their environments via evolutionary selective pressures, what successful individuals pass on to their offspring in each generation is not just genetic instructions for building new bodies within set ranges, but *knowledge* about the world that came before them (hence EE). His most striking example is that of the stick insect: a stick insect looks like a stick not because it tries or learns to, but because generations of stick insect ancestors survived more frequently the more that they looked like sticks and avoided becoming prey long enough to reproduce and pass on genes which stipulated increasingly stick-like ranges for new bodies to develop in. Plotkin argues that the stick insect's body has a knowledge of an aspect of the world far greater than its own mind is capable of.

This immediately raises the question "why use the word 'knowledge' to describe an adaptation?", and Plotkin asks the question himself: "why take the further step of

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broad sense, can be called imitation" (192).

The most famous fleshing out of Dawkins idea is Susan Blackmore's *The Meme Machine*, but the term has also achieved pop cultural standing, becoming a meme of its own, describing rapidly spreading (and equally rapidly dissolving) inexplicably popular media events, small quirks (a particular photo, a turn of phrase, a way of acting) which suddenly seem to be everywhere (or everywhere within a subculture), acting as satire, taking on semantic weight, or simply provoking a laugh over email.

equating adaptations with knowledge?...How can the wing markings of a moth[, for instance,] be knowledge?" (*Darwin Machines* 117). Plotkin defends the word choice on the grounds of looking at what knowledge means in "everyday life," saying that "knowledge, in its most common meaning, denotes a mental state that bears a specific relationship to some features of the world" (4). When we say that we "know" something we're stating that there is parity between two things: "a brain state, which is a part of organismic organization, and the world itself...which is the feature of environmental order relative to which that brain state stands" (117). Knowing someone's name, or where our house is, or what a book looks like, we incorporate that information into ourselves in some way; we materially modify ourselves to reflect an aspect of external reality however imperfectly. For Plotkin there must be a brain state which represents the thing in the world, or the aspects of the thing in the world that we have access to (a point which we'll return to shortly): "knowledge is always something that comes in two parts. There is the 'knower's end' of knowledge, comprising feelings, brain states and...the means of expressing the knowledge; and there is the 'world's end' of knowledge, which is that aspect of the world that is known. All knowledge is a relationship between the knower and the known" (10-11). Now this is not to say that there's a miniature version of the world playing out within our brains, simply that for an act of knowing to occur there must be a state of cognition or of memory which has a physical instantiation and which maps to our experience of, recall of, or interaction with an object or state in the world, and in that sense we might be said to incorporate and represent it.

By envisioning knowledge in this fundamental stripped down fashion Plotkin is able to use the word to describe adapted biological organisms' relation to the world. Evolutionary adaptations, like everyday human knowledge, also always have a

> relational quality. Every adaptation comprises organization of an organism relative to some feature of environmental order…The wing markings of a moth stand in relation to the nervous system of a predator, specifically the way in which that nervous system is wired such that the 'eye' [of the moth's markings] startles the predator and perhaps causes it to flee…All human knowledge has the same two-component relationship that adaptations have (116-117).

This matching of body or cognitive states to world states is the underpinning assertion for Plotkin's vision of EE. Adaptations conform the bodies of the evolved organism to

the worlds that housed its lineage; a stick insect's body is the sum total of the knowledge gleaned from the environments of its ancestors combined with its own experience of the present environment during epi- and ontogenesis. In this way stick insects incorporate an aspect of the environment into their being: simply, they are material instantiations of the knowledge that the environments which preceded them favoured insects which looked like sticks. As Vehkavaara describes it:

> When natural selection makes changes in genetic information, this is interpreted [in this branch of EE] to be a knowledge process, and if this change is adaptive, it means the increase of knowledge...Adaptation through natural selection can be seen as...*evolutionary learning*, where lineages, populations, or species (but *not* individual organisms) are considered as individuals that are learning about the conditions of the survival of their 'members' - these 'collective individuals' are 'testing' their environments by their 'individual individuals'. These supraindividual learning processes explain how individual organisms have got...'*a priori* knowledge' (208-209).

Vehkavaara's description of the idea underpinning this branch of EE makes the relationship between adaptation and human knowledge explicit: think of a species as a whole as an individual and it becomes clear how this process is akin to a more mundane definition of knowledge - it pushes at the environment, learning by sacrificing the individuals of which it is comprised to selective forces, like turning the tumblers of a combination lock, sacrificing number sequences until the code is known and one state bears a successful relation to the other.

In this way, when we say that we know a stick insect looks like a stick in order to avoid becoming prey, our brains are simply performing a variation of what the stick insect's body does: conforming to an aspect of the world, materially representing it, spinning the tumblers until the knowledge fits. In fact the human ability to apprehend and reflect upon the world, such that we can make claims like "I know X," is itself an adaptation, a manifestation of the knowledge that the environments which housed our ancestors favoured those individuals who were able to acquire knowledge faster than the pace of generations. This leads Plotkin to state that "[i]f adaptations are knowledge, and if what we commonly call knowledge (or better, our ability to gain knowledge) is an adaptation, then what in ordinary everyday life we call knowledge is actually a special form of [the] much wider phenomenon" that Plotkin calls "biological knowledge" (xvi).

The question now becomes whether if the development of artefacts can be seen

as an evolutionary process, can the theories of this branch of EE also be applied to them? Are artefacts instantiated manifestations of knowledge of the environments which shaped their lineage? To my knowledge, no evolutionary theory of artefacts or technology in its common definition have explicitly drawn this conclusion. We might hear reference to artefacts as crystallised knowledge[107], but I'm not aware of any theorist outlining a mechanism as to why this might be the case, something I believe Plotkin's vision of EE and an artefact-compatible theory of evolution can ably perform.

For our stick insect, her ancestors were a mix of more or less stick-like insects; the fact that she exists today shows that her ancestors were the most stick-like. The gene pool of early insects generated billions of more or less "sticky" bugs over time, through various mutations, and those that most resembled sticks, who were better camouflaged, avoided being eaten, and survived to reproduce and pass on their stick-like natures to their offspring resulted in our current stick insect - she is an instantiation of the sum total of the biological knowledge of the aspects of the environments incorporated into the bodies of her ancestors. If we want to say that equipment can be a similar instantiation then we must find some parity between an artefact and these aspects of the stick insect.

The modern machete is a ubiquitous tool in many tropical countries where it's used to cut away vegetation when travelling through dense jungle, to harvest tough crops such as sugar cane, and also for butchering practices where a cleaver is a common alternative in other parts of the world. It's essentially a long knife, around a third to half a metre long, often with a slightly curved blade that's typically set into a wooden or plastic two part haft bolted together through a full tang. The machete, for our discussion of EE, is the **artefact** (the non-biological corollary for the organism), and unlike the stick insect's experience, its community of potential users are its **environment**.

Variation in knife manufacture and design, as with codices, is clear: from the first stone blades used by early hominids through to multi-component contemporary cutting tools, the sheer variety of blade lengths and shapes, handle styles, materials, components, etc. is staggering. This is to be expected of a tool which has been put to so many different uses around the world and for so long; every human culture has found the need for a sharp edge. Each new development comes from a mutation derived from

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[107] I'm thinking of Gillespie here: "Once we can see artifacts as crystallized forms of human labour, communication, and value, the importance of how they shape activity becomes clearer" (109). Whilst not explicitly citing knowledge here, Gillespie calls for an acknowledgement that artefacts embody a wide variety of tangible and intangible aspects of their users, and their users' histories.

environmental effects which alters the range of a feature to be expressed. For example, in a culture where knife blades are typically between two and five inches, a 15 inch blade is a mutation which, if used successfully, permanently alters the potential set of blade lengths for future generations of knives.

The contemporary, relatively standardised machete comes from a process of **selection** dictated by its environment. The stick insect's ancestors ran the risk of being eaten if they were not significantly stick-like; for every mutation which made them more vulnerable, predators, a pressure of their environment, frequently stopped them living long enough to reproduce. But for every mutation which made their genes more likely to provide a range of form and colouring akin to their surroundings, a range of appearances more accurately fitting the vectors of a twig, then the environment "rewarded" that trait by allowing it to be passed on. The insects' bodies matched a world state which remained relatively consistent over generations, thus their biological knowledge of that aspect of the world grew, they had incorporated an appearance to be found in their environment into themselves and into the group-as-individual. Machetes, however, don't look like any aspect of their human environment, but I would argue that the same process of selection occurs. Fitness to the environment for artefacts is the same as for organisms in as much as success depends on matching a world state in such a way that the environment doesn't obliterate the traits of this particular instantiation. In a tropical climate the machete shape is the best fit for its environment. This is not to say that the machete matches the jungle, or incorporates an aspect of the jungle, it doesn't; the machete has no evolved knowledge of jungle environments. But it does have a knowledge of how part of its environment intersects with the jungle, how human users experience that terrain. A short stone knife is no use for swiftly clearing plant life, so when metal came along which allowed for thin, strong blades which could be carried easily it was adopted for that task (and simultaneously for many others). Metal also introduced the possibility for a new variable: blade length. A longer blade allowed for large slashing motions to be made - inefficient for precision work, but perfectly suited to human passage through tropical terrain. *This* is what the machete matches: the repeated moments where knife users met the jungle; this is the aspect of their environment which relates to blade length just as the individual stick insect is the product of past insects' repeated intersections with predators in their environment which are unable to distinguish between sticks and insects. Blades would have become longer and longer as users discarded shorter blades and created, or requested the creation of increasingly

machete-like knives; similarly, blades that were too long or unwieldy would have quickly disappeared as failed experiments, failed mutations.

This is the moment of **reproduction**. Stick insects, having successfully evaded the selective pressures of their environment, would mate and return their particular combination of genes to the gene-pool, causing new phenotypes to express them in new ways, more or less successfully. The machete doesn't have genes, and it can't facilitate the creation of the next generation of long bladed knives, but the third evolutionary criteria still stands. When the stick insect mates this is also an adapted behaviour and therefore an instance of knowledge. The ability to mate relies on knowing, in Plotkin's conception of the term, that there will be other stick insects in the environment with which mating can occur. When offspring are produced, an aspect of the environment (another stick insect in this case) has caused the organism's genetic material to be reproduced; in this way reproduction is a concert of individual and environment. Machetes have a knowledge of the forces of its environment of users: its traits also get reproduced when an aspect of the environment causes them to be, i.e. when a long bladed knife is used successfully an individual user is more likely to recommend it to other potential users, and to produce or request this trait themselves when they next need the tool. Thus a machete's blade is a knowledge not only of how humans encounter jungle plants when moving through them, or any other activity in which it is put to use, but also of the consumer forces which can allow such a blade to come into being and be repeated. Blade length is a heritable trait in knives.

In his discussion of EE, Vehkavaara argues that

> The ability to act successfully presupposes the knowledge how to act successfully. Discursive linguistically expressed justification is not always necessary - if the ability to act *is* (successfully) *demonstrated*, no argument can overcome this ultimate proof of knowledge. This kind of demonstrable knowledge connects us to other forms of life - every living creature needs at least some knowledge how to act successfully (in its environment). Of course, knowledge does not determine the action it enables, it is just the precondition for the action. Although an action can be seen as a presentation of knowledge, the actual action is not necessary for the existence of knowledge - knowledge is *potential action, the power to do* (210 emphasis in original).

I will return to this idea of successful action presuposing knowledge (it will prove vital to the final argument of this chapter), but for now I'd like to focus on the notion of

knowledge as the potential for action which might go some way to further assuaging doubt with regards to mapping the processes of the naturally-occurring onto the artefactual realm. A stick insect is put into action in the act of being a stick insect; a genotype is knowledge in potential, a living epi- and ontogenetically produced phenotype is knowledge in action. Every second that the stick insect is alive it demonstrates that it has a knowledge of the consistent aspects of the environments which led to its being, that there will likely be oxygen to breathe, food to eat, light to see by, predators to evade, and other stick insects to mate with. The machete differs in that it doesn't act second by second, it only acts during use; but really the stick insect also only ever puts its biological knowledge into action when it is in concert with its environment, it just happens to never be outside of that environment. A stick insect born into a vacuum doesn't act, it has nothing to know and simply ceases. A machete outside of use also doesn't act, it cannot demonstrate and therefore cannot prove its knowledge until that concert with its environment begins. But the moment that it is picked up it comes into action, and the ensuing success of its use is a measure of the accuracy of its knowledge; as David Rothenberg notes "[n]o machine stands apart from its creator, no tool makes sense outside of its use" (xv). This fact actually allows us to use the notion of an evolutionary epistemology of artefacts (EEoA) to better define the term artefact: anything that potentially manifests a fit with an environment, but that cannot perform the extent of its evolved knowledge without the impetus of another agent. Artefacts exist as potential knowledge until they are in use; they have, in Vehkavaara's terms, "the power to do."

I chose the machete as an example because, as with the stick insect, we can reduce the discussion to what is functionally a single variable, comparing a range of blade length to a range of stick-like insect forms. In this way, as the stick insects stick-iness stands in for any single organismic adaptation, blade length in the machete is made to stand in for any one variable of any artefact, from the weight of a hammer to the size of a silicon chip. To finish this introductory discussion of an EEoA, however, we need to turn our attention back to the complexity of the codex and the e-reader to see how this idea can affect our discussions of the former feeling haptically superior to the latter.

Equipment for reading gets used to readers

A codex body is made up of myriad variables: mutations in form and size, bindings, prices, printing speeds, positioning of marginalia, materials, typography, variations of all parameters have been generated, selected for, and reproduced in successive generations by the environment of potential creators and consumers. Our ancestors ensured, as we continue to do, that these media artefacts became fitter, fitted to us, adapted[108]. And if all adaptations represent knowledge of an environment, then that means that books do not just contain knowledge, but that they *are* knowledge, manifesting the history of their ancestor's interactions with the humans which held them. There seems to be a relationship here to the statement that Birkerts offered at the beginning of this chapter: "these structures evolved over centuries in ways that map our collective endeavor to understand and express our world. The book is part of a system. And that system stands for the labor and taxonomy of human understanding, and to touch a book is to touch that system, however lightly" ("Resisting the Kindle"). I would say, absolutely, that the structures of the printed book, and that surround the printed book, have evolved, but further that the codex doesn't just *stand* "for the labour and taxonomy of human understanding," rather that part of its form is a knowledge of that understanding, an instantiation of the repeated moments where humans have tried to comprehend the world using the storage of script. To even touch a codex is to put it into action *as* a codex and demonstrate knowledge of this type. It is (perhaps) a more complicated relationship than the machete's bond with the repetition of human meeting jungle, but in the same way its success in action demonstrates the existence of this knowledge, even when it becomes challenging to articulate accurately.

We may feel uncomfortable with the idea that codices possess knowledge rather than simply store it, but this only reflects a prejudice surrounding the use of the word "knowledge": When we say a stick insect has a knowledge of the world within its body, I suspect that its own ability to cognise to some degree takes on part of the weight of this unintuitive assertion. An artefact, a knife or a codex, however, cannot allow us to displace that same weight of a knowledge assertion onto its own cognisance. But as

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[108] I realise that this suggests a teleological progression towards perfection, but of course this is far from the case. This apparent problem is solved by recognising the flux in any environment: sometimes codices are selected primarily on size, sometimes on affordability, sometimes on perception of exclusivity. With these and a thousand, a million more selective pressures, many in competition, we can see how a form can settles into a loosely fluctuating aggregate of desire rather than a simple perfection.

we've seen, the argument is not to say that printed books are somehow conscious of their acquirements, anymore than stick insects choose to reflect an aspect of their world, machetes choose to cut through jungle, or our own hands are aware of their frequently conforming to objects which we would like to grip. In each instance a bundle of adaptations represent a transcription of a tumultuous past in physical form; in every printed book's body there is an element of the use of every printed book that came before it.

And maybe *this* is why e-readers can feel so wrong: bound books are a knowledge of a hard fought struggle, and our new artefacts, though they draw on the codex's knowledge, may seem for some readers to be back with the typographic amoeba. This could lead us to add another aspect to our definition of technologies more broadly: "A technology has a greater knowledge of its particular environment of users than a device does." When we initially defined technology we came at it from the perspective of the individual user encountering a class of objects, and our definition reflected this. But now we can consider it from the artefact's perspective, where the group-as-individual's growing knowledge of its environment can be just as important. If the individual user doesn't feel that an artefact is sufficiently well fitted to them then the move from device to technology will always be impeded; an unwieldy thing, an overlong machete for instance, will never be incorporated, will always slip from readiness- to unreadiness-to-hand. This suggests that all e-readers need in order to facilitate an increasing move from being experienced as devices to be being experienced as technologies is time and generations. Contrary to the polarising folk phenomenological reports we've seen throughout this work so far, Davoli et al's study on hands affecting semantic content suggests that the most profoundly unintuitive equipment or method of performing a task can be normalised over time such that the practiced activity supplants a mode which would seem preferable. Equally important, however, is that the equipment and the method for the practice meet some threshold of usability.

It may seem a simple point, that in order to use something it must be useable, and that we get there by choosing usable things, but the language used to discuss technology, the familiar tropes of such discourse that we saw in the first chapter, demonstrate that we routinely miss this idea. Every drive to technologise something seems insurmountable, perhaps because we often start to put new equipment to use when it can be used to accomplish a task in barely adequate fashion for most users such

is its lack of knowledge: Early generations can be put to work by specialists and adopted by curious users before they are conformed to, putting off the less hardy with the suggestion that it will never be for them.

If there is nothing innately problematic about receiving information from a screen, but it simply doesn't feel right to do so in comparison to some prior form, then the suggestion would be that a growth in conformity with key aspects of human interaction with scriptural information is what is required. We might not be able to articulate exactly how this can come about, but we will certainly have a clear indication when it does: the e-reader in action in its environment of users will be a success, and that environment will repeatedly select for its traits[109].

Knowledge is the term that I want to use for the total information that a thing has about the environment that it acts in. I've argued that the move from a device to a technology may depend on the knowledge that the artefact has of the user as an individual in an environment of users. But that process of technologising also comes from the user's attitude toward the artefact. If we have seen one mechanism of "getting used," that of artefacts adapting to their users, then we now need to turn to a second mechanism: that of us getting used to them.

A phenomenology of understanding things - *Eidos*

The definition of evolved knowledge that I've outlined can be paraphrased as the total amount of information that an individual has about an aspect of the environment that it is in, where "information" refers to the what is known, however it is coded. The match between the machete blade and its potential users' meeting the jungle is knowledge that the machete has about its environment, its blade length codes the information known. This is an objective knowledge claim, where the accuracy of knowledge is predicated on it's provision of the potential for successful action (although the knowledge is produced by prior environments' work on ancestral individuals, the what is known refers to those aspects which persist for the environment of the current artefact). We also need a term, however, for individuals which possess information about particular objects within their environment. I propose the term "understanding" to describe this special case of

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[109] What must be emphasised, however, is that digital reading equipment need not mimic codices, this is wasted energy, they need only to correlate with contemporary human experience. We will pick up on this idea further in the third chapter.

knowledge; it too is an objective claim predicated on the potential for successful action. For instance, we, as individuals, have an understanding of a *particular* codex when are able to interact with it successfully[110].

But this is too simple, as is the assumption of knowledge during successful action in the world. When we know, or when we understand something, when we breathe because our ancestors breathed, or when we pick up a machete and use it effectively, what is it that we access? We can never know everything about our environments, but only code limited information about it in our memory or, over time, in our bodies. In the same way we can never understand everything about an individual object, we only ever have a limited access to things. This is not a simple claim.

Husserl stated that nothing in perception is purely and adequately perceived, a claim that can be traced back at least as far as the Platonic forms, but is perhaps best exemplified in Kant's attempts with transcendental idealism (in *Critique of Pure Reason*) to unravel the confusion of phenomena (appearances) with noumena (things in themselves). For Kant, the thing-in-itself is unknowable, experienced only in representation. Dan Zahavi argues, however, that this isn't how Husserl conceives of phenomena; he first outlines an implicitly Kantian notion:

> The phenomenon is the immediate givenness of the object, it is how it *apparently* is. If one wishes to discover what the object is really like, however, one has to transcend the merely phenomenal. It is a version of this concept of phenomenon that one can find in large parts of the philosophical tradition. The phenomenon is how the object appears to us, seen with our eyes (and thought with our categories), but it is not the object as it is in itself (*Husserl* 55).

But he goes on to assert that

> [h]ad it been this concept of phenomenon that [Husserl's] phenomenology [was] employing, it might have been nothing but a science of the merely subjective, apparent, or superficial. But...[o]n the contrary, Husserl operates with a concept of phenomenon that can be traced back to Antiquity. The phenomenon is understood as the

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[110] I'm also keen to use the term "understanding" as it relates to Graham Harman's interpretation of Heidegger. Harman reads Heidegger's use of "understanding," against Mark Okrent and Hubert Dreyfus, not as "know how" as opposed to theory, but instead as relating to a pre-theoretical mode, to refer to "that concealed layer of reality that underlies all conscious theory or conscious manipulation...it is nothing human at all" (*Tool-Being* 117). In this way, for Harman, all things can have an understanding of all things, and this adds value to my own use of the term which, whilst we will be concentrating on human interaction with artefacts, is in principle extendable beyond that meeting, from subject/object to object/object encounters.

manifestation of the thing itself, and phenomenology is therefore a philosophical reflection on the way in which objects show themselves - how objects appear or manifest themselves - and on the conditions of possibility for this appearance (*Husserl* 55).

When we know our environments, therefore, or when we understand something within them, it is not the things we appear to encounter that we know, but instead we are aware of the encounter itself as a manifestation of a thing, the knowledge/understanding of which we can judge only through successful action. When I said that the stick insect knows her environment she of course doesn't, she knows her ancestors' inheritance of past environments as they relate to particular elements of her own environment. But there are also always elements of even those specific things she's meant to know that escape her; her body does not access every aspect of what it means to look like a stick in her world, in fact it only relates to a tiny facet of the environment whilst the rest recedes from that knowledge; even her bodily knowledge of sticks is vanishingly discrete. It's maybe clearer to look at this idea in terms of understanding: When I interact with a codex as an object in my environment I feel that I can start to have an understanding of it, of what makes it what it is, but is this the case? For Kant I cannot ever know the thing itself (or rather cannot know if I know, cannot know if the representation matches the reality), but for Husserl I can move toward the thing, if only via accessing its representations; I only ever access what the thing performs in concert with my embodied perceiving[111].

   This notion of things retreating away from our intentions is important to understanding how we get used to interacting with artefacts and is, I feel, best captured by the new philosophical field of Object Oriented Ontology (OOO). OOO seeks to remedy a turn in Western Philosophy that Levi Bryant, one of OOO's originators, sees as developing after Kant's *Critique of Pure Reason*:

> In beginning with the hypothesis that objects conform to mind rather than mind to objects, Kant who genuinely sought a secure grounding for knowledge and freedom from the endless debates of metaphysics, paradoxically rids us of the need to consult the world or objects. For as Kant himself observes, this shift or inversion allows us to discern how it is possible for something to be given in advance. Yet if the world is given in advance, then there is no longer any need to consult the world or objects. Rather, philosophy, at this point, becomes self-reflexive,

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[111] For more on Husserl's attitude to what might be revealed about an object's formal and material ontology see Zahavi, *Husserl* 31-39.

interrogating not being or the world, but interrogating rather the mind that regards the world...What goes almost completely uncontested is the general *spirit* of the Copernican Turn, wherein the world is to be thought as conforming to the human, rather than the human to the world. Thus, nearly all the major trends of contemporary philosophy are direct descendants of the Kantian turn in one way or another ("Onticology - A Manifesto for Object-Oriented Ontology").

Although I am primarily concerned with human phenomenological experience of technological artefacts, the ontology which underpins my arguments here is indebted to OOO's return to a focus on a material world to which the human conforms, and as such it is worth outlining its leading proponent's claims to more fully realise the argument of this section.

Graham Harman[112], in *Tool-Being* interprets Heidegger's tool analysis (which we encountered in the first chapter's discussion of readiness-to-hand) as holding "*the whole of the Heideggerian philosophy*, fully encompassing all of its key insights as well as the most promising of the paths that lead beyond them" (15, emphasis in original). Against the more common readings that we've already discussed, Harman claims "that the tool-analysis is neither a theory of...human praxis, nor a phenomenology of a small number of useful devices called 'tools.' Instead Heidegger's account of equipment gives birth to an ontology of *objects themselves*" (1, emphasis in original). For Harman, Heidegger uses the hammer's melting away during use as a metaphor for a wider ontology of all objects, the full implications of which could not be accepted even by Heidegger himself who remains distractingly fixated on the human as the site of cause for objects coming into existence: "Whatever Heidegger's intentions may have been, his theory of equipment applies to all entities...It is vital we not be misled by the usual connotations of the word 'tool'" (2). Taking two terms which have become familiar to us, ready-to-hand (tools invisible in use) and present-to-hand (tools only observed or broken), Harman describes an existence for objects which will always retreat from the human, and in fact from all other objects they encounter; "readiness-to-hand (*Zuhandenheit*) refers to objects insofar as they withdraw from human view into a dark subterranean reality that never becomes present to practical action anymore than it does to theoretical awareness" (1)[113]. The argument of *Tool-Being* is that no object is ever encounterable as what it is, and, against Husserl, that the phenomena we do encounter are never simple

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[112] Another of OOO's original creators and the best known and most widely published of its practitioners.

[113] Harman's sequel, of sorts, to *Tool-Being*, *Guerilla Metaphysics*, looks at the possibility for interactions between objects in spite of their always receding from one another.

manifestations of things as they are. Adopting a notion from Xavier Zubiri, Harman is

interested in the non-relational aspects of things[114], the essences which recede from and

precede all relations with anything in the world[115]. Harman uses Heidegger's ready-to-

hand tool as a description of the hidden life of things, their "tool-being," and present-to-

hand "broken tools" to describe what we actually meet[116]. The tool/broken tool divide

doesn't, for Harman, describe an ontic distinction between two kinds of thing as it does

in the standard analysis, but instead describes two states present in every thing (45).

I won't adopt Harman's distinction of tool/broken tool, ready-to-hand/present-at-

hand here as those terms, in the conventional reading, still have too great a usefulness,

particularly to my own argument; as we saw in the first chapter, readiness-to-hand as

invisible extension during use is a real phenomenological and neurological feature of

expert interaction, and as such I have not, and do not evoke Harman's reading when I

use those terms. Instead of ready-to-hand/tool-being I will use the more conventional

term "essence" to describe the life of the thing in itself, and I will side with Harman, for

the most part, in saying that what we encounter is not a simple manifestation of the

thing's essence, but instead a whole new object, a combination of self and thing: "If I

stare at a bridge, this bridge-appearance is a parasite off of my Dasein, and could hardly

be less independent. If not for me, this appearance could not exist. What is truly

independent of me is not the *occurent* bridge, but the *executant* bridge, the bridge that is

hard at work in enacting its own reality and all that this entails" (emphasis in original,

125). The occurrent bridge is not born of the essential bridge alone, and the essential

executant bridge acts independent of and inaccessible to me.

What Harman's notion of tool-being fundamentally asserts is that "[w]hen I

encounter an object, I reduce its being to a small set of features out of all its grand, dark

abundance...[M]y encounter with the object is *relational*, and does not touch what is

independently substantial in the things" (125-126). At all times, however, we have

complete access to things as they are to us, or, more correctly, as they are *with* us. This

totality of subjective information I would like to term "*eidos*." I will focus almost

exclusively on the special case of understanding to explore this idea as we need to

explicitly tie the discussion to readers resistant to new reading technologies in order to

re-establish our argument so far, but I will also show that the term applies equally to the

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[114] Harman draws on Zubiri's *On Essence* in this regard.

[115] Unlike Zubiri, Harman doesn't believe that only certain things can possess an essence; in fact
       everything, and every combination of things, is an object with an essence and qualities which recede
       from any encounter.

[116] This distinction is described in *Tool-Being* (44-49).

stick insect's knowledge of the trees and the codex's knowledge of its environment of users, to the predator's understanding of its prey and the machete's understanding of the hand that holds it. The essential point from Harman's object oriented ontology to be kept in mind here is that an object is always trapped in two, an *eidos* we refer to and an essence we almost never meet. It's in that "almost" that I differ from Harman's approach, and start to move a little way back toward's Husserl's conception of the phenomenon as an expression of the essence of the thing. Harman states that "[t]ool-being is never convertible into any form of the as-structure, not even partially" (219), where the "as-structure" (another Heideggerian term) is the level at which we experience anything "as" something: "Objects do not unleash their forces upon us unnoticed. Rather, we encounter them as what they are - not running up against concealed dog-effects, but rather dog-as-dog, tree-as-tree, heat-as-heat, even while something forever withdraws behind these phantasms" (47). When we experience, for example, codex-as-codex Harman's approach states that whilst this manifestation is tied to an essential thing, no aspect of its true reality can be hauled up to this level. Contra Harman, I do think that we can escape the as-structure, and that we do so in a very Heideggerian mode: during use. I will argue throughout this section that we get toward the nature of a thing by repeatable successful encounters with it. We will also see, however, that just because we can reliably and predictably interact with a particular object doesn't mean that we ever drill down as far as we might imagine; repetition offers only an asymptotic approach, never quite getting to the thing; we can always be surprised.

Using the word *eidos* to describe, not what something is, but why it is what it is has been a part of Western metaphysics since Plato. From its first technical use it has been a term to be appropriated by philosophers interested in things and how they come to be. The original Greek word meant simply something's outward aspect, its appearance[117], but Plato uses the word, along with other terms[118], to describe his eternal forms. Heidegger says that

> [w]e, late born, are no longer in a position to appreciate the significance
> of Plato's daring to use the word *eidos* for that which in everything and in
> each particular thing endures as present. For *eidos*, in the common

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[117] For more on the etymology of *eidos* see Novak 1-2
[118] Including: phýsis, morphē, parádeigma, génos, ousía (Schäfer 157).

speech, meant the outward aspect [*Ansicht*] that a visible thing offers to the physical eye. Plato exacts of this word, however, something utterly extraordinary: that it name what precisely is not and never will be perceivable with physical eyes (*The Question* 20).

Later, in "Science and Reflection," Heidegger again states that "Plato names this aspect in which what presences shows what it is, *eidos*. To have seen this aspect, *eidenai*, is to know" (*The Question* 163). This is the first reason for why I want to use this term *eidos* to describe our attempts at access in understanding: it's historical link to knowing (understanding) what something is when it becomes present that is linked to simply seeing, to the how something appears as if the appearance were the whole thing.

Aristotle's use of *eidos* offers similar justification for my use of the term here:

> ειδος δε το τι ην ειναι εκαστου και την πρωτην ουσιαν.
> *Eidos de lego to ti en einai hekastou kai ten proten ousian.*
> By *eidos* I mean the essence of each thing and its primary substance (*Metaphysics* 1032b1-2, ctd. in Novak 1).

Quite apart from the distinction between Plato and Aristotle's ideas of essence and substance, the repetition should be noted of the movement from sight, aspect, to the what-makes-something-what-it-is that Plato performed with his use of the term. There's also a pleasing coincidence in Aristotle's use in earlier work such as *Categories*, where it can mean "kind" or "species."[119] Though I don't wish to evoke this aspect here, when I talk about *eidos* being the what-things-are-to-us, the what-we-think-we-understand, there is a prior resonance with evolved knowledge. Similarly, Novak also outlines a number of further etymologically convenient links between *eidos* and our present concerns:

> The term is a noun that is derived from the verb 'eido' which means 'to see.' The root of this verb is quite interesting because it originally contained a letter that in later Greek became obsolete, namely, the *digamma* which had the sound of a 'w' or a 'v.' Thus, we can see this root at work in the Latin verb 'video' which also means 'to see'...A further interesting linguistic connection presumably exists with the Sanskrit term 'veda' which also designates a cognitive activity such as 'knowing' or 'wisdom.' There is even a link with Old English in a term like 'wit', i.e., 'to know' (1).

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[119] For more on the distinction between these uses of *eidos* in Aristotle see Michael Woods "Form, Species, and Predication in Aristotle."

Eidos is, as coincidentally as with Aristotle's "species," historically tied both to visual media and to the act of knowing.

Later, Husserl used *eidos* "to mean the subject of the set of predicates which could not be removed from a thing after having submitted it to a process of imaginative variation in short, the essence of a thing" (Novak 5). *Idea* was used interchangeably, in the Platonic tradition that Husserl is evoking, to mean "form," but Husserl distances himself from *idea* due to the weight placed on the term by Kant, opting instead for *wesen* (essence/character/being/creature) or *eidos*[120]. For Plato the unavailable Forms were what lay beyond every object causing them to be; for Aristotle it was the immanent essence in all things; for Husserl phenomenology is similarly an "eidetic science," a seeking of what makes things what they are. The "eidetic variation" he advocates for reaching the essence of a thing is a thought experiment where aspects of the object are subtracted until it ceases to be identifiable as that object; all that is left, that "set of predicates" at the last point before it ceases to be the thing under consideration, is what makes it what it is, its *eidos*[121].

I want to use the term *eidos* in a related fashion - with its links from Plato onwards to that which enables us to encounter objects in the world - to describe what makes something what it is for us. I suggest the emendation as I don't share Husserl's faith in our ability to reach objects as they are, and want to suggest, instead, that our "getting used" to things is evidence of an analogue scale of approaching things in themselves, an unachievable teleology where, at every stage, we seem already to know the thing itself but couldn't be further from it. My starting point for this idea is the following quotation from Harman: "Whereas for Husserl the hidden hammer-at-work might be brought into consciousness whenever we feel like it, Heidegger finds it impossible in principle to make the withdrawn reality of the hammer fully reveal its secrets. There will always be a subterranean depth to the world that never becomes present to view" ("Technology, Objects and Things in Heidegger" 3). We'll return to Harman's reading of Heidegger shortly, and the implications derived from the latter half of this quotation, but first we must clarify the current use of *eidos*.

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[120] See, for instance, their use throughout *Ideas Pertaining to a Pure Phenomenology*.

[121] *Eidos* as essence is an important part of Husserl's ontology (see Smith, *Husserl* 141-161) with deep relation to Husserl's conceptions of time, and I don't pretend to do it justice here, merely to demonstrate that Husserl's usage is tied to what makes a thing what it is, as opposed to my usage: what it is to us in this moment. *Eidos*, for Husserl, doesn't exist in time, it is an essence which transcends the specific instance. Husserl's essential ontology is too precise to be productively dealt with here; interested readers are referred to the opening chapter of *Ideas I*, "Essence and Eidetic Cognition" (5-32).

In "The Question Concerning Technology" Heidegger uses the term *poesis* to describe a bringing-forth of the essence of what makes something what it is. In the way that we have already looked at individuals within their environment they are what they are because of the prior and current environments that put them into action; in the case of biological forms they are what they are independent of any encounter with another individual (Heidegger refers to this mode of bringing-forth, again from the Greek, as *physis*). Artefacts, as we've established, require use in order to put them into action in their environment, and this, I would argue, is *poesis* in the same way as the act of craftsmanship which creates them: it brings the equipment into what-it-is-as-equipment, rather than an object which, without human engagement, expresses no knowledge of anything because it has no relation to the natural, i.e. wider, spontaneous, enduring, pre-user, non-artefactual environment. *Eidos* is the term I would like to use to describe what makes the non-dependent biological form what it is to us, as well as what makes the dependent artefact what-it-is-at-all as artefact. The term exists under the Heideggerian interpretation of *poesis* in as much as it is a bringing-forth for the individual who experiences it.

There are other phenomenological terms that I might have used instead of *eidos*, such as "givenness" - "how [an object] appears to us, how it *apparently* is" (Gallagher and Zahavi, *Phenomenological Mind* 21) - or "constitution" - "a process that allows for the manifestation or appearance of objects and their signification, that is, it is a process that permits that which is constituted to appear, to manifest and present itself as what it is" (Gallagher and Zahavi, *Phenomenological Mind* 24) -, or a heavily contested word from Husserl's work: "*noema*."[122] But givenness is too tied into appearances to intend all that I require, i.e. we can understand more about something than how it appears, optical illusions being a simple example. Constitution is more apt, but also more tied to the *process* of how something becomes what it is to us. In *Logical Investigations*, Husserl states that objects aren't *in* consciousness as if they were in a box: before we can get at

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[122] For more on the trouble in reading Husserl's use of *noema* (the object-as-it-is-intended) see Zahavi's discussion in *Husserl* (58-60) where he details the distinction between "West Coast" and "East Coast" interpretations. Roughly, the West Coast interpretation sees *noema* as describing the object we encounter as ontologically distinct from the object "behind" that encounter, e.g. when we intend a pencil the object that we intend is an object of meaning independent of, though produced by, a thing in the world. In this interpretation the pencil that we intend comes between us and an object in the world. In the East Coast interpretation the object-as-it-is-intended is the object-that-is-intended as it is considered, i.e. it is not ontologically distinct, but instead a way of looking at the object as it is. Though not directly an interpretation of Husserl, as Harman's argument in *Tool-Being* progresses we can see that his conception of objects is tied to the West Coast interpretation of *noema*, though he accuses Husserl, in his faith in access to things, of occupying the East Coast position.

them they are constituted as being by our intending what they are for us (275)[123]. *Eidos*, as I wish to use it, is not the process of constituting, but the totality of information available to our intending. Finally, I don't use *noema* for the same reason that I am using *eidos*: for the latter the historic weight adds to the meaning and offers, if not clarity, then coherence. With the former, however, it is a contested term even amongst Husserl scholars, the weight is negative, and an alternative is preferable.

From here on, when I talk about knowledge or understanding I will be referring to the partial access we have achieved to things as they are, to their essence, where something in our immediate cognition, memory, or bodies matches something in the world, a match that is demonstrable only by repeatable successful action. *Eidos* will be reserved for that which we refer to when we intend, not the thing itself, but the changeable gestalt that we feel we know or understand and act upon, the apparent object. However, for every successful intentional action that we perform, within an environment or with an object, we demonstrate that our *eidos* of the intended thing has come at least partially in line with some aspect of the thing's essence. We will return to this point again soon.

So what is *eidos*, as I'm conceiving of it, comprised of? At its simplest it would be those aspects of an an encountered object that we would describe to someone if we were aiming to convey its nature, for instance that a glass is relatively heavy, fragile, transparent, and frequently used to hold liquids. This has appealing links back to Husserl and the eidetic reduction of an item, through the stripping out of anything that isn't essential, to its fundamental components in order to better understand it.

Whereas "givenness" is dependant on how an object appears to us, I would like *eidos* to refer to much more than that, to refer to any aspect of a thing which gives it a boundary in our mind, which marks it out from its environment as being what it is[124]. This would include, but isn't limited to:

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123 For more on Husserl and constitution see Zahavi, *Husserl* 70-75.

124 It is worth noting that the conditions under which we view an object are not a part of its *eidos* as this chapter conceives of it. Illumination, for instance, is not part of what bounds an object from the surrounding world in terms of our understanding of it; it's not, in the basic test, part of how we would ever describe the thing to others (though a particular translucency or reflective capacity may depend on certain environmental conditions we are still talking about an aspect of the object when we say, for instance, "you really have to see it in daylight in order to best understand it"). This relates to Husserl's notion of "optimal givenness," "the kind of givenness that offers us the object with as much information and in as differentiated a manner as possible" (Gallagher and Zahavi, *Phenomenological Mind* 91. Also see Zahavi, *Husserl* 35). As already stated, givenness and *eidos* are not interchangeable, but givenness contributes to the *eidos* of an object.

- Observations (visceral sensory experience, visual, tactile, etc.)
- Aesthetics (how it sits, intellectually, in visible, audible, olfactory, tactile, or gustatory relation to other things)
- Historical information (what caused it to be produced including, but not restricted to evolutionary processes)
- Scientific understanding (knowledge of its physical reality, chemistry, biology etc.)
- Classification (how we would describe it to others, how we would compare it to other things)
- Collective information (information regarding the item (or how it is positioned) culturally as passed on by other individuals)
- Action potential (what we expect to be able to achieve with, or to be denied by the thing)

In this way every eidetic experience is unique, as every encounter with an object will intend various combinations of these aspects, but a culture can instil standardised gestures for use, standardised ways of perceiving and responding that affect action, not by changing objects as they are, but as they appear to us. I've already discussed the changeable gestalts of technologies in the first chapter, but now it should be clear that I am referring to *every* object encountered as comprising a changeable experienced gestalt; the gestalt nature of technology is an effect derived from the gestalt experience of all things. *Eidos* is not, unlike knowledge or understanding, an objective claim. When an action is repeatably successful then we know that it must be based on accurate knowledge or understanding of at least some relevant aspect of the world. But *eidos* is only what we *feel* is understood (or known), and we can thus seem to know or understand things which are false or incomplete (and, as such, action is more likely to fail, to be impaired, or to be unrepeatable, the very opposite of demonstrable knowledge). Our intentional actions are always based on *eidos*, on an eidetic "seeming-to-be," rather than an essential knowledge or understanding, but it is only repeatably successful action which requires *eidos* to be accurate; luck is not a demonstration of knowledge. We can talk then of a "weak" or "strong" *eidos:* This is not an either or, but a continuum from a first basic encounter to a complete apprehension of what makes something what-it-is-to-you in that moment, functionally an apprehension of the thing itself, its essence. In line with Heidegger's notion of presentness-to-hand, the weakest *eidos* is to simply see an object, and maybe to contemplate it in some fashion. In many ways the idea of strengthening *eidos* is more intuitive then many of the issues that we've addressed in this chapter: look harder at something and you'll begin to understand it

better (though this intuitiveness, at least in part, must come from the terminology temporarily matching a way in which we commonly use it). We can grow that *eidos* by approaching the object and beginning to fill it up, to provide "fulfilment" in Husserl's terms, a growing understanding of the various profiles of the thing. As Zahavi describes fulfilment in his discussion of the *Logical Investigations*

> knowledge is not...static..., but a dynamical process that culminates when all of the profiles of the object are given intuitively. (It should be emphasized too that the profiles in question do not simply refer to the appearing surface of the object, but to the givenness of all of the properties of the object, be they properties that belong to the interiority of the object or properties such as solubility that only reveal themselves when the object interacts with other objects) (*Husserl* 34-35).

As we investigate an object we build up these profiles, strengthen *eidos*, fulfil it, and move towards completion. A complete *eidos* would require more than the Husserlian profiles, however, as it also includes our understanding of its cultural situation, what caused it to be produced (i.e. an understanding of what evolved knowledge it has itself), and the potential for actions of various intimacies that it provides for us, in short its every relation as well as its every aspect.

In a discussion of the phenomenology of typewriters Polt uses *eidos*, in line with Husserl, to refer to what makes something what it is, its essence, something that we can try to get to:

> Let's take a natural thing, an oak tree. The *eidos* of an oak is its 'oaking' - all the processes that it does. How those processes are done - and thus, what those processes really are - depends on how they are instantiated in its body, its particular matter, its wood, bark and leaves. As for our relation to the oak, we can never truly understand the *eidos* of an oak just by using abstraction and imagination to isolate some universal aspects of it (for instance, its genetic code); we have to keep open to seeing new examples of oaking. And it will be our bodily habits - our habits of testing, cutting, climbing on the tree - that familiarize us with oaks ("Typology...").

Polt's example here is instructive. For him, *eidos* describes what the oak as thing already is, and to strengthen it is merely to gain a greater understanding of what makes the oak the oak. I use the term to describe what makes the oak the oak *to us*, as opposed to an essence created from evolved knowledge as being what makes the oak the oak; the oak's

"oaking" is successful action in the environment it knows. This is what makes the oak what it is, it doesn't require us to put it into action, and I don't believe that it's essence is something that we can truly approach: we will never fully understand what makes the oak the oak. But we can have a measure of our understanding of the oak, and of that making, based on the success of our interactions with it; the more successful our interaction with something the more accurate our understanding of the relevant aspects of its essence must be, and we can talk of our *eidos* of the oak becoming more complex and strengthening, not as an aspect of the oak, but as an aspect of where we meet the oak and divide it off from the world.

   Harman states that

> [t]here must be some sort of complicated way in which being announces itself *in* appearances; otherwise, even approximate forms of knowledge would be utterly impossible. Just how this happens remains unclear. But in negative terms, it cannot possibly be through an as-structure that would adequately mirror the things themselves, or even one that would give us a closer and closer but merely asymptotic approach to the things. The gap between the two dimensions remains absolute (*Tool-Being* 160).

Because of the absolute distinction between the essence of the thing, and what it is that appears that we interact with, Harman sees no way for us to access any aspect of that essence in appearances (directly counter to Zahavi's reading of Husserl). I am suggesting that successful repeatable action can provide a hint of that essence. Although use exists at the level of the as-structure (we use a hammer as a hammer, not as a car or bathtub), ready-to-hand use, in its more common reading, is invisible; ready-to-hand use isn't an encounter with the hammer *as* anything, it's simply work (this is why I do not wish to let go of that term to Harman's own reading). When we can use that hammer again and again, reliably, predictably, successfully, we are accessing not just what the object is as-hammer, but also an aspect of its essence which allows the work to be done. We still do not encounter the whole hammer-being, by any means, there remain infinite aspects that are distant from us, but we get a hint of the thing itself, and that right up until the moment when the hammer fails us, or acts in a way that we don't expect and the spell of readiness-to-hand is broken: in that moment of surprise it is revealed that we never had access to all of the aspects of the thing relevant to the work to be done.

   In this way *eidos* can be both complicated and/or strengthened. To complicate *eidos* is simply to expand the gestalt that makes the thing what it is to us. Scientific

investigation is the ultimate complexifier, moving our perception beyond the levels at which we ordinarily operate. But knowing that something is made of atoms, for instance, needn't draw us closer to the thing itself, unless it amplifies the success of the interactions we can accomplish with it. Every atom, after all, is also an object with a being which recedes from us (we will return to this point). Complexity doesn't automatically draw us closer to the things themselves. In fact we can get toward things even with relatively little complexity. How many cat owners, for instance, understand the biology of their particular pet? And yet their understanding of those pets seems so strong. This is based on the success of their interaction with them; their *eidos* of the cat is strong because what the cat is for them matches some aspects of what the cat is in itself, it's essence, enough to provide a successful interaction far more frequently than the animal biologist, a stranger to the particular cat, who encounters it with a complex *eidos* already in place. The owner understands the aspects of the cat that relate to their interactions well enough; that the cat can still surprise (and frequently!) shows that the understanding is far from complete. David Hume's skepticism of our capacity for inductive reasoning[125] is resonant with this importance placed on surprise revealing the dearth of access that we have to a thing: just because something has been successful once, twice, or a hundred thousand times simply cannot mean that we know it will be true tomorrow, it merely suggests that it is probable, and maybe not even that (though Hume finally has faith in our instinct for what will endure; when it comes to successfully acting with the objects which surround us I have my doubts). As such, when I say that repeatable successful action implies some access to an aspect of the thing it really is in the weakest sense possible: that the object allows this kind of interaction, and this only holds up to the point that it doesn't and we're surprised.

A strong *eidos*, therefore, is a conception where what makes something what it is to us matches, at action facilitating points, aspects of the thing intended. If something changes too quickly, or if we never act with it on multiple occasions, we can never tell whether we have accessed any aspect of the thing in itself (this is what Harman argues from the start). But success is telling.

How do we measure the success of action? I have suggested that successful action is repeatable action, not a particular goal achieved with a particular tool, but any activity which can be achieved over and over again with few surprises. We might not

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[125] See Hume's *An Enquiry Concerning Human Understanding*, "Sceptical Doubts Concerning the Operations of the Understanding" (18-29).

know the chemical composition of graphite and wood, might not know the geometrical angles of hexagonal cylindrical forms, might not have training in draftsmanship, i.e. our *eidetic* experience of a pencil might not be complex, but believing that every time we put that pencil to paper we can make marks within our skill level as artists, a reality which manifests itself far more often than it does not, shows that we have a good understanding of the essence of a pencil (an understanding of a pencil) that we can transfer to other instances of things we believe to operate in the same way (and most often do, suggesting that part of what makes the pencil what it is is an aspect of most pencils), and that our eidos of the pencil, if not complex, is (relatively) strong. Strength and complexity of *eidos* are both only shown by report: strength is judged on repeatability, complexity is simply relative to the standard reports of similar type in our communities of users, e.g. what might seem a complex description to the average Kindle reader might seem standard or simplistic to a hardware designer or software programmer.

This perception of *eidos* goes some way to explaining why the bound book form feels more natural or more "right": because it acts predictably in line with the majority of objects in the world, always "on," not reliant on battery life, robust, and simple enough for nearly all users to intuit the move toward a technological interaction with it at encounterable levels (i.e. page-turning; the act of reading can be another matter entirely). We might even define modern technologies as those which deny intuitive progression toward technological use to the average user, at least in terms of what makes it go; our *eidos* can appear strong, but we are often surprised by our new tools because we don't understand why they function. As Derrida notes

> [w]ith pens and typewriters, you think you know *how* it works, how it 'responds.' Whereas with computers, even if people know how to use them up to a point, they rarely know, intuitively and without thinking - at any rate, *I* don't know - *how* the internal demon of the apparatus operates. What rules it obeys. This secret with no mystery frequently marks our dependence in relation to many instruments of modern technology (*Paper* 23).

That beautiful phrase, the secret with no mystery, describes the subterranean realm of tool-being as well as it describes the aspects of a technology which are most often unavailable to us (and there is much cross-over between the two). When we consider physical books as being more "natural," as we've seen it's not that they're not

technological, but that their encountered equipmental reality makes an intuitive sense; the act of reading on a digital reading device, however, is built around a set of unintelligible, non-technological processes which allow technologies to run on top of them. The average user will perceive the Kindle as a simple device, and their *eidos* of it might never need to be much more complex than that of the codex. But the Kindle has the greater capacity to surprise the average user: we have no default, or drive, to know what makes it tick.

An aside on OOO

To conclude OOO's rising to the surface in the present discussion, I'd like to go over a couple of implications for this work that emerge from having Harman's *Tool-Being* as its ontological underpinning.

One of the most radical of Harman's formulations is that the structure of encounters that he outlines doesn't just apply to human-oriented encounters. As an object oriented philosophy Harman extends his reading to how any two objects meet, whether that be the object human meeting the object codex, the object codex meeting the object human, or the object codex meeting the object table (with OOO revealed as the grounding for my thinking it is perhaps clearer why my discussion of knowledge began with animals and artefacts encountering their respective environments; ontologically I see no difference between human and animal, vegetal, or synthetic materiality. To understand cases we might regard as "simpler" are revealing when they can be shown to apply equally to the human case or vice versa). What this means, therefore, is that no two objects meet each other as they are, but only as they appear to them; objects too have only an eidetic experience of one another:

> No object ever unlocks the *entirety* of a second object, ever translates it completely literally into its own native tongue...[;] any object reacts to some features of [any object that it encounters] rather than others - cutting its rich actuality down to size, reducing it to that relatively minimal scope of reality that is of significance to it...[Harman imagines a heavy appliance resting on a frozen lake:] if the fact that the frozen lake supports an object is *not* its tool-being, then *what is*?...[I]magine that the ice now cracks or melts, so that the appliance smashes through the surface and sinks into the frigid depths of the lake...[T]he important factor is that the heavy object, while [experiencing] the ice as a reliable support, did not exhaust the reality of that ice. The appliance could have

been resting either on thin ice or on an eternal pillar of granite, and the supportive effect (prior to the disaster) would have been precisely the same, ignoring...the specifically *icy* experiences that the appliance may also have undergone (Harman, *Tool-Being* 223).

When Harman describes the heavy appliance as having not "exhausted" the reality of the ice this is the same as my assertion that it is surprise that reveals the lack of depth of our encounter with aspects of a thing. When a predicted action is unsuccessful this is the same as the heavy object's experience of the ice as support not being the totality of the ice; exhaustion would be a complete understanding, but surprise is the revealed asymptote, the "aptness to fall apart"[126] of any interaction. The appliance falling through the ice is "surprised" in as much as its prior experience hadn't exhausted the ice despite both objects appearing to be at rest with one another.

When built upon Harman's conception of object oriented ontology, what *eidos* is, as I've described it, can be complicated further:

> the tool-being of the hammer [its inaccessible reality] and the hammer *as* hammer [how it appears to another thing] are not simply two faces of the same entity...They must be two separate entities. For by hypothesis, the hammer as hammer has been *prehended*, and therefore has already come into relation with me as a different entity. Merely by prehending the hammer, I have created a new entity, a monstrous fusion of my own tool-being and the hammer's (Harman, *Tool-Being* 262, emphasis in original).

Here we see Harman's oblique relation to the West Coast interpretation of Husserl's *noema*: when we encounter an object as an object we form something new, a blend of my essence and its, and this object too has both an inaccessible subterranean reality and an impoverished expression at the level of the as. This can lead to complex formulations: The codex codexes, it has an inaccessible reality as codex, but my prehension of the codex as codex forms a me-and-codex which me-and-codexes, exists as me-and-codex, and can itself be interpreted, in diminished form, as me-and-codex etc.

So what does an object oriented approach offer our discussion here? Primarily it becomes part of seeing technology not as a class of objects we encounter, but as an experience we have during interactions; OOO asks us to look at both sides of that meeting. Rather than presuming an artefact's deficiency we have to ask about our own:

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[126] "ἀσύμπτωτος not falling together, < ἀ priv. + σύν together + πτωτ-ός apt to fall" ("asymptote, n." *Oxford English Dictionary*).

it might not understand us, but have we taken the time to try and understand it?

But an object oriented approach also forces us to abandon the idea of visceral insulation as an ontological reality. No doubt we are separated from slaughter in our contemporary experience of food and food production, and this is an important cultural issue which has implications for how we exist in and relate to things in the world. But when we say that the industrial digger keeps us from the earth, more so than the spade, then this is an argument which occurs wholly at the level of the as-structure. Neither the digger, spade, or our hands unaided get closer to the soil as it is than one another, they merely offer us different aspects of it: soil as scented, soil as heavy, soil as density, etc. Whilst we may choose to privilege certain aspects over others it isn't because they take us closer to the soil, but because historically those aspects have helped us to act successfully. A spade brings us no closer to the earth than the digger, but a digger does separate you a) from the aspects of the earth revealed by the combination of you and spade and b) from the work of the spade. In electronic reading a), the combination of you and equipment, is just as clearly distinct: the e-reader will reveal a different immanent text than the codex will, though the similarity of the script and of the movement of the eyes does overcome many of the gestural and eidetic differences that do occur, which is not to downplay them but to simply to realise them for what they are: a significant, but not deterministic inflection of the text encountered. Strangely, however, it is b) that seems to most trouble people. When it comes to e-reading, the folk phenomenological reports point to the fact that we may risk privileging spade-work as somehow more worthy than digger-work.

If we wish to better understand earth during the act of digging we should attempt frequent and varied interactions with it to build up a profile of successful action with more and more aspects, a simultaneous complexification and strengthening of *eidos*. We will still never get to the earth, but we will be closer than we were by using the spade, or by our hands alone which we intuitively insist must take us closer to things as they are. But did we ever feel closer to the earth when we simply used our hands? The spade reveals aspects of the earth such as its position within strata, the reality of bedrock, its ability to be compacted, to form pits, to be used as a building material, an insulating material, or, in the case of peat, as a combustible material; the digger reveals yet more again. The telescope and microscope, the thermometer, barometer, and seismograph, reading glasses, the mass spectrometer, the theodolite, and the dust that detectives use to reveal fingerprints all bring to attention (in eidetic terms functionally create) new

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aspects of things, of the world around us. With any rehearsed interaction we can seem to get phenomenologically closer even as ontologically we're forced to keep our distance, but sometimes we get tied to privileging certain revealed aspects. Typically, again, this is for reasons of successful interaction, but when these privileges become culturally protected, as in the case of the privileged "hard work" of the spade, or the "natural reading" of the codex, they can be hard to break out of even if their protection makes little sense in the continuing environment.

This chapter, and more obliquely the first chapter too, argued that it is *practice* which takes us closer to things, as close as we can ever get; using something we experience as a technology in order to perform that getting closer might just require more practice because we haven't spent our lives incorporating it, and with it, as we have with our bodies. It is in this regard that we can see how e-reading offers no more insulation from words and information that the codex does, just a set of interactions that are under-practised and that, in some cases, we are yet to see privileged. Selective pressures, practice, and time, however, are all it takes to strengthen *eidos* further, to technologise, and maybe get a little closer to another bit of our world.

OOO, as an underlying concern, gets us to focus on the bodies of things; it is via their bodies that everything encounters and divides up the world. Harman uses the example of tectonic plates clearly encountering one another as rock: they do not melt when faced with one another, one plate does not encounter the other as a tree or as soil; the plate encounters another plate *as* plate, but it doesn't exhaust its being (222). It is because of its own being as what-it-is that it experiences aspects of the other as what-it-is-to-it. In the same way we can think of how our own bodies encounter things, and they encounter us - our bodies are the enablers, structurers, knowers, and limiters of our experience of and access to the world, and this deeply affects our phenomenological experience. This is a fundamental aspect of the definition of boundaries which function through the eidetic experience of a thing. For instance, the harder it is to cleanly separate parts of an object with our hands, the more we typically consider them to be elemental to the object: a cup's handle is fundamental, a lid is not; a book's cover is, but a sticker is not; a seamlessly glued table seems a more whole object than one obviously screwed together. An object's physical boundaries for us are therefore most often defined in relation to our bodily experience of them. At an atomic level the cup is literally evaporating, exchanging electrons and energy with its surroundings, and there is a challenge to define its boundaries the further down we go, like tracing the exact

outline of a cloud. The point, however, is that *we don't live there*. The cup is built up of relations of things, but they are not its essence. The molecules of ceramic are made up of atoms, but *they* are not its essence. The atoms are made up of quarks, but *they* are not its essence. The moment anything encounters something as something, as cup, atom, or quark, then it interacts with it at the scale of that structure (or, in our case, we can attempt to bring that structure to our scale via equipment such as electron microscopy). A cup encounter's the table as support whilst the cup's atoms encounter the table's atoms in entirely different but related relations. And at no point does the cup reach the table, or the atoms reach the atoms, they all have an eidetic experience of what those things are to them, meeting only mediated aspects. We only differ in that we can meet the cup at our level, or use our tools to drill down and try and drag the atoms up to our level, or imagine ourselves down to theirs. At this point we are forced to neglect the cup as cup, and encounter it as a structure of atoms.

When I say that the essence of a thing is unknowable it is in part (though not primarily) because its existence exists across scales which don't include us. Every object has an essence because it holds together and has an effect at one scale, but at another scale it makes sense to think of the object as a structure, of the atoms in the process of acting out a cup, at another of quarks as acting out atoms, at another of superstrings acting out quarks, and who knows where on from there? "The hammer is always siphoned away into countless systematic unions...[T]he hammer is also made up of trillions of minuscule tool-beings which are by no means utterly dissolved in it..., a tool-being is always part and whole" (Harman, *Tool-Being* 279). At each level a sentient being living at that scale could make an appeal to essence, *eidos*, and network, what the object is, what it seems to be, and the structures into which it is inserted and which comprise it. We judge boundaries by the cause and effect of our level, and complex multi-part objects, such as watches, engines, and combination locks can confound our sense of scale (the computer even more so because vital components function at levels beyond our bodily comprehension). Multi-component objects, when encountered as such (the gestalts we encounter predominantly hide their complexity), seem to be both object and network at the same time, easily pulled apart, and yet one thing. The cup is complex enough, the computer is absurd. The e-reader is simultaneously a simple screen, and a complex of parts which rely on operating with precision at sub-atomic levels. The codex is the same of course, but phenomenologically it seems a simple mass, something to which we might sometimes pay attention to the cultural structure in

which it sits, but hardly ever, if ever, to itself as structure. This stems from its being able to apparently be perceived in its entirety at our scale, our bodies seem to match it all the way down to its components (pages) in a way that simply isn't the case with the internal workings of the e-reader.

OOO underpinned *eidos*, then, describes our growing sense of what something is, but it is a progression with no end and an infinite array of false paths. In a BBC interview from 1962 Vladamir Nabakov spoke about apprehending objects in a way which might be considered a folk phenomenological account of the notion of *eidos* that I'm attempting to construct here:

> Reality is a very subjective affair. I can only define it as a kind of gradual accumulation of information: and as specialization. If we take a lily, for instance, or any other kind of natural object, a lily is more real to a naturalist than it is to an ordinary person. But it is still more real to a botanist. And yet another stage of reality is reached with that botanist who is a specialist in lilies. You can get nearer and nearer, so to speak, to reality: but you never get near enough because reality is an infinite succession of steps, levels of perception, false bottoms, and hence unquenachable, unattainable. You can know more and more about one thing but you can never know everything about one thing; it's hopeless. So we live surrounded by more or less ghostly objects (qtd in Dee "Nature Writing" 27-28).

This accumulation of information, of specialising, is absolutely what I would like to see as the attempt to fulfil *eidos*, and Nabakov captures perfectly the impossibility of the task. We are left, always, with more or less empty ghosts, and as such everything that we have an understanding of, no matter how close we think that we may have gotten to it "as it is" or "why it is" will always have the capacity to surprise us when our actions, based on our understanding not of it but of an *eidos* we have constructed, are unsuccessful due to the effects of some unperceived or incomplete aspect. Gallagher and Zahavi describe perception as "an embodied coping with the environment" (Gallagher and Zahavi, *Phenomenological Mind* 99), and *eidos*, as a product of perception, will always be bodily contingent: we cannot ever know more than our bodies can provide data for. Dogs see fewer colours than we do[127], bees can perceive ultraviolet light[128], and birds may even witness quantum entanglement[129]; which of these creatures sees the world *as it is*? We struggle to even comprehend how these organisms

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[127] See Jennifer David "Color and Acuity Differences Between Dogs and Humans."
[128] See D Peitsch "The Spectral Input Systems of Hymenopteran Insects..."
[129] See Lisa Grossman "In the Blink of Bird's Eye, a Model for Quantum Navigation."

encounter their environment, and objects within it, and their experience reveals the lack in our own. But our bodies are also, as we've seen, what makes our brittle attempts at understanding possible.

With these definitions of knowledge, understanding, essence, and *eidos* in place we can return to the codex and the e-reader/e-book combination, the special cases for our concerns with technological equipment. In the first chapter we saw another analogue scale of weak to strong interaction with objects: technologising. Technologising can now be seen as a strengthening of *eidos*, a drawing closer of the object to better reveal more aspects of it. Equipment that we use as a device is equipment kept at a distance with the vast majority of its aspects left not understood, and as such we frequently have a lack of success in our engagements with it, the potential for surprise is too great. Equipment that is used as a technology is slightly better understood, and our frequently successful interactions suggest a strength of *eidos* that comes from matching states within the thing as they are (the unsuccessful uses, the returns to unreadiness- or even presentness-to-hand of course, reveal the incomplete nature of the understanding). Technologising is the act of making things feel right, of adapting to them, but also of clarifying, typifying, and setting up the boundaries of an object and what it can accomplish in a soft-assemblage with our bodies. To point at an object, or a set of objects, and call them "technologies" says nothing about the object as it is beyond our belief in its conforming to our bodies (and, eventually, our bodies to it) in such a way that it has the ability to provoke a relatively standardised, predictable, and repeatable sensory and use experience. A strengthening of *eidos* achieved by technologising comes about by improving the frequency of successful and repeatable extended action. Eidetic experience is not a layer of insulation between us and the world, anymore than a technology is for the task to which it is set; they are both the enabling assemblages of world, body, and cognition that allow us to act. Technology is a named type of intimate eidetic experience.

When something becomes technologised it can seem that we are getting to its essence, to how it is in itself, its "whatness." Therefore, when our sense of *eidos* is as strong as it is during a technological interaction (i.e. our conception of the object feels fixed, our intellectual apperception feels complete for all practical purposes, and our interactions are frequently and repeatably successful) then a fluctuation which challenges that *eidos*, which reveals a still limited understanding, hits us all the more

strongly. The fact remains that even in a strongly technological, i.e. deeply intimate interaction, whilst we may catch an object's whatness in glimpses through success, all that we can truly rely on remains the equipment's "thatness," not what makes it what it is, but simply that it exists to us at this moment as this thing. This perhaps goes some way to explaining the profoundness of the response to a very familiar object malfunctioning. Imagine writing with a pencil which suddenly splits and pierces the skin of your writing hand; running in favourite shoes and suddenly feeling the tips give way as your toes push out of the front; the steering wheel of the car, even for a second, becoming unresponsive. These scenes all have an element of danger, but in those reflective moments following the event there is also an aspect of shock that the familiar, the eidetically strong, the "fully understood" suddenly became alien; whatness was revealed as mere thatness, and simply understanding that something exists is no future guarantee of how it will perform.

The codex's knowledge, the resistant reader's *eidos*, the troubling e-reader, and meeting over time

Because we live in an unstable system where environments place changing pressures on mutating inhabitants, because we destabilise systems, and because we (as individuals and accumulative environments for equipment) are unstable ourselves, new facets of experience will continually be thrown up. "Reading on screen doesn't feel right" a reluctant reader says. "That doesn't matter," a happy screen reader replies, "you'll get used to it." What does this mean, to get used to something which started off feeling wrong? That this is possible means that an e-reader can be technologised, and we addressed this idea in the first chapter. I would now like to add that that process of technologising, a process of repeated use, also strengthens the reader's *eidos* of the object. As more aspects appear to the reader, as *eidos* is deepened, then this is an increase in a special kind of knowledge: the reader better understands the equipment. Greater understanding, as with all knowledge, increases the potential for successful action, in this case reading will cease to "not feel right" and instead will stop feeling like anything at all. Readers, even bibliophiles, rarely get interrupted in the activity of reading by just how *right* it feels; interruption is the preserve of decoupling assemblages, of becoming unready-to-hand, of malfunctioning, of surprise.

But it is also not enough to simply say that the reader will get used to an artefact

as they reveal it further, because reading is a meeting of *two* evolved bodies, the reader and the equipment. Whilst the reader might increase their understanding, this means nothing if the equipment has no understanding of them[130]. Each reader is part of the environment in which each item of reading equipment sits, they are an aspect of the environment to be known, a little bit of selective pressure on the gene pool, but also on the individual equipment like a successful predator being a part of the environment that affects all stick insects, but also, in that moment, a specific individual. And, just as with the individual stick insect meeting the individual predator, any individual (such as an e-reader) meeting an aspect of its environment (such as a resistant reader) can pass on the information it gains from that meeting to the next generation of its species. For the stick insects this can make the species come one step closer to looking more like sticks: the individual just didn't cut it and their genotype is eliminated along with their phenotypic expression, or they made it through this time giving them a chance to go and find a mate. For every successful event, that stick insect knows it lives in a world where it's particular bodily knowledge allows it to succeed, its continued successful action demonstrates this knowledge. In the same way, every time a resistant reader puts down a Kindle and says "no, this just isn't for me," and never buys one, and never recommends one, and maybe even actively tries to discourage other potential readers from getting one, a similar knowledge gain occurs: *that* Kindle didn't exist in a world where it could act successfully with *that* reader, with that aspect of its environment (success, for the Kindle as artefact, being use, being put into action). This affects the whole species, even if in a minute way, and minute effects played out over and over again is what evolution rests upon. Thanks to the peculiarities of their environment, artefacts tend to experience a much more focussed (as goal directed) set of selective pressures on each generation. Artefact evolution can be swift, at least until its knowledge of the environment is such that most of its encounters are successful; the codex has reached a relative equilibrium, the artefacts of electronic reading are under pressure.

With e-readers, indeed with any artefact, there is a hugely complex interplay of individuals, groups-as-individuals, and environments (which include or are comprised

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[130] Understanding may seem the wrong term, as the evolved knowledge of the artefact has not evolved in response specifically to a single reader, but to an environment of users. This need not trouble us, however, as knowledge and understanding are both just measures of fit to aspects of the world however they might come about. The stick insect has an evolved knowledge of past environments, and yet we say it has a knowledge of the present because aspects persist with which it has a successful relation. The same is true of the e-reader; any feature of it which matches us specifically (or rather its accessible *eidos* of us) is understanding. Knowledge and understanding can be, but aren't always evolved processes.

of individuals). For e-readers we have (at least)[131]:

- The individual e-reader in its environment of readers
- The individual e-reader's encounter with an aspect of its environment: an individual reader
- The group-as-individual of e-readers, the species (or equivalent term), experiencing the combined selective pressures of its environment of readers
- The individual reader in their environment which includes e-readers
- The individual reader encountering an aspect of their environment: the individual e-reader
- The individual reader contemplating the group-as-individual of e-readers
- The group-as individual of humans, not just the literate and sufficiently affluent and inclined members of the species, experiencing the combined selective pressures of its environment which includes, for some members, e-readers

All of these encounters are at play in the issue of getting used to any new equipment for reading, or to any artefact at all. Getting used to a new piece of equipment features an interplay between a) our (growing/growable) understanding of individual instantiations of the device (which can become a technology) and its (static) understanding of us as an aspect of its environment[132], and b) our (growing/growable) knowledge of the device as an aspect of our environment and its (growing) group-as-individual knowledge of us as environment. Put more simply: a) we can improve our understanding of an e-reader by using it and revealing aspects of it, and successful use demonstrates not just our improved understanding, but the understanding that it has of us *a priori*, and b) we can conform ourselves to a species of equipment and this affects future generations of e-readers by altering what they need to know in order to act repeatably successfully.

When the happy screen reader tells the reluctant screen reader "you'll get used to it," all they can mean is: "when my understanding of the object became strong enough, the aspects of it that I encountered had a good enough understanding of me that a

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[131] Studies on histories of the book and of reading such as Elizabeth Eisenstein's *The Printing Press as an Agent of Change*; David Hall's *Cultures of Print*; Adrian Johns' *The Nature of the Book. Print and Knowledge in the Making*; D. F. McKenzie's *Bibliography and the Sociology of Texts*; David Finklestein and Alistair McCleery's *The Book History Reader*; and Alberto Manguel's *A History of Reading* all offer extensive discussion of the kinds of complexities listed here. Our approaches differ in their implications: histories of reading focus on the specificities of a particular encounter (and with that focus comes an increased range of complexity), whereas the short list presented here is intended to be derived from, and applicable to interactions with a wide variety of artefacts. That said, to my knowledge there are, as yet, no published accounts of how e-readers are encountered from a specifically book-historical perspective.

[132] "Static" may be disingenuous here. Does an artefact grow its understanding of a user when that user modifies it, wears it smooth, fixes a flaw, or otherwise conforms the thing to themselves? It cannot be our concern here, dependent as we are on defining the experience of the new, but I'm certainly sympathetic to this position.

reading experience could occur which I would deem successful. I feel now that my *eidos* of the object is strong, it's rare that it surprises me enough to disrupt the engagement." This clearly has no bearing on whether the same will be true for the reluctant screen reader, it's only a statement that it is possible.

But, following on from this, the accumulated pressures of all the happy and reluctant readers has an effect on the *next* generation of e-reading equipment. The next generation will tend to have a better knowledge of its environment, of the majority of readers any of its members might encounter, but those readers, through their gain in understanding, and maybe their technologising practices, will be a different group than those that the last generation met. Over time a feedback loop of knowledge and understanding can emerge. The stick insects, generation by generation, look more and more like sticks in an environment which includes individual predators that are either a) increasingly sensitive to perceiving the distinction between sticks and insects (resulting in even more stick-like insects in the next generation) or b) have gone off looking for other food (in which case the stick insects thrive until some mutation throws this new balance off). For e-readers, therefore, such a feedback loop will either a) make each generation of e-readers better suited to increasing numbers of individual readers who are, in turn, better equipped to interact with them, or b) there will always be a significant amount of readers who feel that, no matter how hard they try, their understanding won't overcome the gap in knowledge instantiated by the devices, and their discontent will manifest itself in keeping e-reading as a minority pursuit, or one with a significant amount of detractors, whilst simultaneously throwing up all sorts of strange mutations in e-reading devices as they try to adapt[133].

This, I would suggest, is a broad mechanism for rapid equipmental change, for getting used to things, for the kind of exponential growth which can lead from our roughly dividing carcasses with chipped stones found in the surrounding area, to moving through the undergrowth with the practiced swings of a machete blade which feels like an extension of the arm rather than a tool in use. But whereas a decent knife can last a (human) lifetime, the vagaries of market growth, planned obsolescence, and manufactured consumer demand have led to an environment for new equipment where replication is increasingly rapid and responsive. This can be positive in some respects,

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[133] Note that when I say "try" here I'm not suggesting that e-readers realise their problems and attempt to improve upon them. I merely want to express that their relationship with the environment, as with the stick insect finding a mate, prompts the next generation into being, and when a stable survival/success strategy is not established there is a tendency toward diversity in the ensuing offspring as all sorts of traits appear survivable, there is no accurate established knowledge.

with the right tools for important jobs, medical equipment for example, going from idea to indispensable technology within a couple of generations. But there is also a homogenising influence where mutations aren't given a chance to shine as users take no time to understand them, and the pressures of what we think we want march over what we may be better off with. Such problems are largely not under consideration here, but I hope that the language outlined is applicable to such concerns. I don't believe that e-reading is an inherently bad thing, I do think that we can adjust to it, and its equipment to us, but I also fear landfills full of misunderstood equipment and a culture where new mutations are prized over what could be most successful.

Use leads to beauty

Some people don't like the feel of reading books on portable screens. This is the statement with which we started this chapter. I began by suggesting some of the neurological reasons why this might be the case: that we are embodied beings; that that embodiment affects cognition in sometimes profound ways, particularly when it comes to the use of our hands; and that we can train certain types of thinking to be linked to certain gestures which might supersede any innate physio- or psychological propensity to prefer alternative modes of interaction. This would all suggest that when the physical aspects of the act of reading are altered then readers with established patterns of action are going to frequently report a struggle to adapt to the new interaction, even if at face value it looks much the same; the new equipment prompts gestures and feedback that disrupt our well-worn patterns of coping with reading material.

In the first chapter we looked at how we are able to adapt to the equipment we deploy, bringing it "on board" and incorporating it into a soft assembly with ourselves. The increasing popularity of e-reading devices, even beyond cultural factors such as marketing and hype, suggests that users are beginning this act of incorporation, of making e-readers their own, but also that e-readers are capable of being so integrated, maybe for the first time. In the language of this chapter, e-readers can now be adopted because the equipment has enough knowledge of its environment of users that they can be sustained as a form. But there's also been a simultaneous unfolding expansion of knowledge in the readers that make up that environment, a growth in individual understanding of how to engage with the new equipment which, for increasing numbers, are presumably becoming technologies and melting away during sustained use as new

heuristics are developed.

I cannot pretend that this is the whole story of how we get used to new equipment. What makes someone pick up a new device and try to make it a part of themselves? What motivates them to keep trying when it seems, unrelentingly, to remain a device? What finally makes that device match the reader enough that it can be used effectively? Maybe these questions are unanswerable; if they could be predicted then engineers would get rich by only producing equipment which suited users exactly, rather than throwing up iteration after iteration to see what sticks. What I hope I can say is that part of the reason such questions are challenging is due to the hidden complexity of the interactions between individuals, groups-as-individuals, and environments of individuals; I hope that I have shown that when artefacts gain a knowledge of us, and we gain an understanding of them - fleshing out an *eidos*, a what-makes-them-what-they-are-to-us, the strength of which bears a partial relation to the essence of the things in themselves - then we affect one another. The environment which must be known alters itself, the individual which must know is changed, and the adoption of equipment which is frequently technologised must represent, in some ways, a conforming to one another. The exact nature of every conformation is impossible to know, each is tied to the vastness of environmental influences and to the millions of individual users meeting millions of individual artefacts and reporting back, in various ways, to the pool which results in the next generation. But that such gains occur is written in the body of every object and in the mind of every user; in every repetition of a successful interaction there is the demonstration that knowledge of one kind or another has been gained.

Ellen Dissanayake, in *What is Art For?*, attempts an anthropological explanation for the emergence of physical art and its evolving and being sustained. She suggests that communities of early humans which made things "special" were more likely to survive, that making things special was an adaptation to the environment in which they lived (74-106). As John Carey describes her conclusions

> the fact of taking pains convinced others as well as themselves that the activity - tool manufacture, say - was worth doing. So art's function was to render socially-important activities gratifying, physically and emotionally, and that is how it played a part in natural selection. Anthropological evidence bears out Dissanayake's theory…Richard L. Anderson[134] finds that Inuit[135] art is not usually just decorative…Art

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[134] In *Calliope's Sisters: A Comparative Study of Philosophies of Art*.
[135] The contemporary Inuit society is the continuation of a nomadic tribe with roots leading back to the

means preparing tools for the shaman or toys for the children (34-35).

If Dissanayake is correct, and her argument is persuasive, then this making special is at the heart of artistic production, but also at the heart of equipment manufacture and use. There appear to be ready ties to Walter Benjamin's notion of aura in artworks, but there are also important connections with our current discussion. Something which is special is used and imbues the whole activity with its specialness at the same time as informing others that the activity is worth doing. In Dissanayake's argument this is the reason that equipment keeps getting made, even when the task of creation, such as making large numbers of arrows, or meticulously crafting knives, is onerous. We evolved to place value on craft and craftsmen because those groups which valued good work survived better; they were more successful due to their plentiful and superior tools. Art as we now understand it, argue Dissanayake and Carey, is the vestige of an earlier adaptation to make important things special.

This attribution of importance to objects certainly seems to persist; perhaps the near religious value placed on the codex form by some readers is part of this drive, a vestige of something which once kept our ancestors alive.

Whether this direct line is explanatory or not, we certainly place a lot of weight upon our objects and endow them with a life of their own. In the descriptions of the codex from its acolytes that we've seen throughout this work, that sense of specialness can be heard again and again. It's obvious that anyone who truly loves them knows that codices are much much more than words on a bundle of pages. But they're not of course, the bundle is *exactly* what they are; we just bring something else, something better, do our best to attach it, and, with practice, do. We still make things special. Physical books allow us to play with paper and bring it to life, half turning pages so that they pass by quicker, drumming fingers, running a nail under an important line, dog-earing corners, doodling and note-taking, mourning and then relishing the bangs and bumps and creases as they accumulate. It's hard to pinpoint the psychological effects of these things beyond a broad notion of adding importance, but that people mourn their loss suggests the pleasures, and maybe the necessity of physical interactions in daily cognitive action. But if this is the case then the outlook for e-readers is very hopeful: users will always develop their own routines of handed practice.

This is part of our understanding of objects: that our bid to find something's

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Stone Age.

boundaries, which can result in our bringing the aspects we perceive onboard as incorporated equipment, also gives something of ourselves back to it. Part of our *eidos* of objects worth integrating is a sense of their specialness, something that isn't a part of their essence. The codex is just a bundle of pages, but one which has become receptive to being something more.

I think that some resistant readers doubt that people will find a way to place importance onto their digital things in the same way that they have with print, but that's what technologising, something that I've tried to position as central to what it means to be human, is all about. Making things not just things, but equipment, and *our* equipment, is what we do. Every stickered laptop, every passed-on memory stick, every annotated electronic text, every emoticon-ed IM, every abbreviated SMS, every nail-varnished mobile, every cheap home movie, every bedroom recording, every tagged photo, every lovingly tended Myspace, Deviant Art, and Live Journal profile is testament to the fact that we spend our days making things our's, as in mine, and ours', as in for all of us. This is what I've tried to attach to that word "technology"; these are gains of understanding, of moving away from just a method for getting something done to being a part of us. How long could it be until e-books are regularly more than words on a bundle of screens? How long can it be until people, once again, use these things until they are beautiful?

We are slowly building the history for digital reading that on a long enough timescale will imbue screens with the same richness as paper pages. They traverse the same path as the machete: we find or make the objects, or cause them to be made; we use them; we select what makes them work, or what does not; and they get made again; and we become one with them; and we make them sing.

The most persuasive argument for the superiority of the codex form, over any representation of digital script, typically lies in the realm of haptics and interfaces. It is unsurprising that the form which has evolved over hundreds of years should have naturally worked its way toward fitting our bodies exactly; the codex has been tailored, adapted by the repeated use of generations. And the haptics of the printed form do make sense: it fits the hand; the pages are thin for the most amount of storage in a compact and cheap space; it is more portable than a carving, and more adaptable than a scroll; less complicated than an iPad; less fragile than a Kindle. E-readers possess a different, and currently lesser understanding of their users than a codex does. But, as we'll discuss in the next chapter, codices aren't perfect. No environment for knowledge is static,

evolution always occurs, and when it comes to our artefacts we would do best not to attempt to halt, but instead to guide it. E-readers, or something like them, can lose their device-iveness, can become mundane before becoming essential, and this is the path that every artefact we value or even love has gone through.

Chapter 3 - Thinking Through Artefacts

The most important thing to be opened during the reading of a book is a person's mind, not two slabs of cardboard

- Jeff Gomez, *Print is Dead* 168

We construct our technologies, and our technologies construct us and our times. Our times make us, we make our machines, our machines make our times. We become the objects we look upon but they become what we make of them

- Sherry Turkle, *Life on the Screen* 46

- Brian Dettmer, *Modern Painters*

My argument throughout this work has been that the complexity of our existence as embodied beings is often neglected by the language and models that we use to describe our interactions with equally embodied things in the world, and that such failures result in often misconceived ideas about technologies, a class of equipment best defined by phenomenological experience integral to our success in the world. I've used e-reading, and the discourse of resistance which surrounds it, as a conduit for these discussions as

the field has recently very publicly provoked arguments about bodily experience in cognitive activity, and this has supplied us with a great amount of folk phenomenological data on which to draw. As I have argued, e-reading brings together many of the most important facets of any discussion regarding embodiment and the use of tools.

In the first chapter I tried to show that the word "technology" necessarily fails us when it allows people to describe equipment as *de facto* "unnatural," and to suggest that the new equipment for reading on screen, if it can become a technology as defined here, is no more unnatural than the codices which came before them. E-reading is a potent example of something which we can see being turned from an unfamiliar device into a natural(ised) artefact by some readers, whilst just as many lament from the sidelines. In another generation I would have talked about the mobile phone, the home computer, the car[136], but I think that e-reading remains the best possible example today for talking about an encompassing definition of technology because it affects the written word, a technology in itself, and one which underpins almost all of our cultural existence in one way or another.

The second chapter used the consumer experience of e-reading not "feeling right," a more specific iteration of its perceived "unnaturalness," in order to look more closely at the adjustment of users to equipment, and equipment to users over time. Our definition of technology was fleshed out and related to the encounter of any object in our environment: technology is a particular structuring interaction, one which permanently changes, i.e. strengthens and increases the complexity of our *eidos* of the artefacts we use in order to accomplish a task. I also considered equipment as something which is evolved in an environment of users, something in which a history of adjustments from both sides can be read (and should not be forgotten). Again, e-reading is amongst the very best examples for discussing such issues as the generations and adoption rates are swift, and extensive feedback is currently being recorded by vocal commentators of all skill levels and in the adaptations of the equipment itself.

In this final chapter I would like to continue these lines of thought arrayed around a third concern from the discourse of resistance to reading on portable screens: that e-reading somehow makes us more "stupid" or otherwise alters or diminishes our

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[136] Examples of work in this vein include Lisa Gittelman *Scripts, Grooves, and Writing Machines: Representing Technology in the Edison Era*, William Boddy *New Media and Popular Imagination: Launching Radio, Television, and Digital Media in the United States*, and Friedrich Kittler *Gramophone, Film, Typewriter*.

intelligence. I would like to suggest that this concern, as with the previous provocations from each chapter, can be usefully explored by relating it to the embodied experience of readers, and that it in turn is best considered within, and sheds light upon a wider argument about technology and our encountering of objects in the world more generally.

I'll begin by looking at how this claim appears in the academic and popular literature and then go on to outline an approach to the assertion that I think is most productive for thinking about the impact of electronic reading devices, indeed any object or artefact on cognition. I'd like to suggest that perhaps part of the discourse suggesting that screen-reading makes its users less intelligent stems from its requirement and prompting of a new set of skills and gestures for reading and interpretation. These new skills cluster around new equipment as a widespread and correlating change in the *eidos* of that equipment as it is technologised. I will argue, conditionally, that change of this sort need not represent a lack, though something must always be lost in the change. I will also argue that we are able to use objects in the world as "material metaphors," that our equipment in use can enable us to think novel thoughts, and the chapter will focus on the type of thought prompted by screen reading juxtaposed to that of the codex. Again, I hope to show that e-reading need not be an impoverished cognitive task, but that it will always be, despite manufacturers' various efforts, a very different one to that of encountering a codex. I do not wish to be deterministic about equipment, to say that it alone can cause certain kinds of thinking, but I also believe that it is a mistake to see technologies, things brought onboard and into the machine of body and distributed or extended mind with which we cognise, as not facilitating or prompting certain ways of looking at the world. In the same way as the hard assembly of the body affects our cognition, so soft assemblies with our technologies can affect the ways in which we think, what we can think, and what we think about.

In the final section I will look specifically at the work of several writers who play with the materiality of the printed page and the creative equipment of their day in order to produce meaning. I will primarily focus on E.E. Cummings and the typewriter, Mark Z. Danielewski and the digital screen, and Jonathan Safran Foer and his inheritance and particular extension of the concerns Danielewski is writing with. The work of these writers in terms of either their skill with the material, or the uniqueness of their work in the times in which they are writing mark them all out as worthy of investigation, but each of them also engage with their respective artefacts in particularly

vivid fashion, arguably more so than any of their contemporaries, helping to make my points as clearly as possible. My own concerns will, for the most part, not be with the content of their work in a qualitative sense, but rather how it literally embodies their own changing *eidos* of the page, the book, and the codex, and how their popular experiments are a part of prompting similar change in others. The reinvigoration of the printed page's capacity for meaning in and by these writer's work is the polar opposite of the critics of screen readings' assertion that the screens themselves are somehow anti-intellectual; these writers provide us with an account of how eidetic change can alter the way that readers and creators encounter typographic technologies, and I hope that a case study of such will bring together and demonstrate the wider arguments of the chapter at work.

The claim

Commenting on Brian Dettmer's book sculptures (one of which has been reproduced above), Sebastian Mary raises a variation on the belief we've now seen expressed a number of times:

> Looking at these images of the physical matter of books, remixed into sculptures, I'm reminded of the process that texts are increasingly going through once digitized: amalgamated, remixed, reformed into new entities…Dettmer's sculptures invite us to think about deeply-held taboos around the sanctity of books as objects; a conversation that recurs - especially in the context of e-readers…[L]ike European villages dismantling local medieval chateaux to build outhouses, are we taking our cultural history so completely for granted that we're in danger of forgetting or destroying millennia of culture in a thoughtless reappropriation of its materials for our current preoccupations?

Mary is most interested in the remix aspect during his article, but he also raises the important question, as Dettmer does, of whether when we play with the forms of the book, more specifically with the codex, whether we are learning about, adding to, or neglecting what has come before. The new technologies of reading need not ask questions of specific texts, but instead challenge the sanctity of the form itself: why shouldn't we try to make books better?

We've seen two answers so far: "because it's unnatural" and "because it doesn't feel right." To this I'd now like to add "because it can affect the way you process

information, and to such a degree that it might make you stupid." This is perhaps the most provocative of the claims that I've taken from the popular discourse, but in variations on its explicit wording it might also be the most frequently heard. The use of the word "stupid" here comes from a popular and much discussed article in *The Atlantic* by Nicholas Carr entitled: "Is Google Making Us Stupid?" Carr's focus in that piece is with the glut of competing information online, and whether our outsourcing of memory to search engines and internet databases is making us, as individuals, intellectually deficient in one way or another, be that in terms of attention span or brute IQ (the former levelled at prospective readers and researchers of any stripe, the latter at young children still learning how to read). Carr's argument isn't specifically about the portable e-readers that this thesis has been dealing with, but as this chapter will argue, the internet and its associated reading modes and expectations are indelibly linked to the new reading equipment.

There is a growing body of competing literature on this subject, and Anne Mangen's often cited article "Hypertext Fiction Reading: Haptics and Immersion" provides an excellent overview of academic research into the impacts on cognition of reading on screen. What is immediately obvious from this paper (published in 2008), however, is that the field is small in breadth and scope, often unquestioningly applies findings based on web surfing or hypertext fiction reading onto linear e-reading on specialised equipment, and fails its own calls for further phenomenologically or embodied cognition sensitive research[137]: "Until quite recently...issues of materiality have been largely neglected in reading research overall. Several studies point to the importance of addressing the multisensory dimension of digital reading...without really pursuing the issue any further" (Mangen "Hypertext fiction reading")[138]. The kind of studies Mangen calls for are beginning to emerge, but their evidence remains patchy. One significant example is that of a study conducted by Muhammet Demirbilek which was reported in *Wired*: Demirbilek looked at the impact of graphic interfaces in reading,

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[137] It is telling that, in a talk at the Unbound Book conference in May 2011 Mangen still cites much the same studies, and makes the same conflations between hypertext, web surfing, and e-reading, at least as far as her freely available notes indicate. No empirical study that she cites comes after 2007, that is after the first generation of Kindle, bar one 2011 study (Ackerman and Goldsmith "Metacognitive Regulation of Text Learning: On Screen Versus on Paper") which only deals with desktop browsing.

[138] Mangen cites the following studies in this regard: Back "The Reading Senses"; Bearne "Rethinking Literacy: Communication, Representation and Text"; Kress *Literacy in the New Media Age*; Mackey *Literacies Across Media: Playing the Text*; Mackey *Mapping Recreational Literacies: Contemporary Adults at Play*; Merchant "Writing the Future in the Digital Age"; Walsh "The 'Textual Shift': Examining the Reading Process With Print, Visual and Multimodal Texts"; Walsh, Asha, and Sprainger, "Reading Digital Texts."

particularly a move from reading on a PC screen to reading on an iPad. His

> conclusions don't contradict Carr's assertions, but they suggest that the
> gap where information is lost between short-term memory and long term-
> memory is not due solely to hyperlinking [which Carr sees as a
> distraction, something we'll return to shortly], but also to the disorienting
> nature of the interface used. Carr is correct that the traditional PC
> computing environment (such as Windows or Mac OS X), which uses an
> overlapping-windows interface, is conducive to shallower
> learning....However [the studies] Carr [cites in support of this view]
> focus on interfaces that will soon be out-of-date. Newer mobile devices
> such as the iPhone, iPad and Android smartphones abolish the traditional
> graphical user interface we're accustomed to...On these mobile
> technologies - especially the iPad with its bigger 9.7-inch display - all the
> emphasis is placed on the content, and each launched app completely
> takes over the screen. The only pointers are our fingers...Demirbilek and
> I agree that the iPad-driven tablet revolution is poised to improve user
> orientation and learning" (Chen "Will the iPad Make You Smarter?").

Here Chen identifies another issue: how quickly studies go out of date while the

artefacts go through various iterations under the selective pressures of their users. Carr

was forced to draw his assertions about reading longer texts on a screen (newspaper

articles are his example) from data about the use of laptops and desktops, but the iPad

doesn't have the same material issues. Demirbilek and Chen argue that in comparison to

these earlier screen reading operations the iPad actually promotes focus (this does not

offer us any answer to whether the iPad is an improvement or retrograde step in

comparison to the codex of course)[139].

As researchers attempt to prove, one way or the other, variations on theories

such as Carr's one fact is clear: the workings of the brain have entered discourse on the

subject at every level, from the academic, to journalistic, to that of the casual blog, and

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[139] Tom Weber offers a similar report of increased focus for the Kindle:

> [I]t felt at first like a severely crippled computer. After all, it has a display screen, a
> keyboard - even a wireless connection and a web browser of sorts. But every time I tried
> to indulge my digital-media-trained attention span, pausing in the middle of a book or
> article to check baseball scores or skim a few blogs, the experience was too
> cumbersome to enjoy...Over a few weeks, I rediscovered my ability to simply read the
> book or article I had punched up in the first place...It's particularly enjoyable when
> reading a newspaper or magazine - enough so that I've been routinely purchasing some
> of these publications when I could have grabbed my laptop and read them for free on
> the web. In effect, I'm paying for the lack of distraction ("The Real Genius of the
> Kindle? 'Unitasking'").

Again this offers us little in the way of information regarding the Kindle versus print, but it does show
one apparent improvement of the apparatus over the desktop or laptop digital reading experience.

often frustratingly to the detriment of the rest of the body. That said, the neurological theories, and their widespread appeal, are well worth investigating. Most of this work considers the alternative reading modes prompted by internet surfing, but the issues of distraction, hyperlinking, and varied writing spaces are similar enough to be relevant and to begin our discussion. With tablet computing the lines between laptop and desktop browsing and e-reader type reading are increasingly blurred. The Kindle, as we'll go on to see, also contains more of this history of internet centred e-reading than we might imagine.

Maryanne Wolf, in her popular work on the neuroscience of reading, *Proust and the Squid*, offers a number of convincing arguments for why we might rightly express concerns with the way content is consumed online, particularly by young or otherwise still learning readers:

> [R]eading has begun to trouble me considerably as I consider the Google universe of my children. Will the constructive component at the heart of reading begin to change and potentially atrophy as we shift to computer-presented text, in which massive amounts of information appear instantaneously? In other words, when seemingly complete visual information is given almost simultaneously, as it is in many digital presentations, is there sufficient time or sufficient motivation to process the information more inferentially, analytically, and critically?…The basic visual and linguistic processes might be identical, but would the more time-demanding, probative, analytical, and creative aspects of comprehension be foreshortened? Or does the potential added information from hyperlinked text contribute to the development of children's thinking? Can we preserve the constructive dimension of reading in our children alongside their growing abilities to perform multiple tasks and to integrate ever expanding amounts of information? (16).

This quotation holds a number of the most pressing concerns for research into the altering neurology of reading: the effects of the abundance and availability of information; the intrusion of visual culture into the typographic; the shortening of attention; and last (and made very much least) the possibility that the new reading modes might be beneficial, if only in a supportive capacity, to childhood development. The importance (and our simultaneous ignorance) of these issues can't be underestimated. But as the internet becomes increasingly important to the lives of millions of people the research field becomes increasingly crowded and increasingly muddied, particularly as conclusions are being drawn from the results of relatively few

studies with small sample sizes, unpredictable control groups, and, for obvious reasons, limited sense of any long term effects. In contrast to Wolf's work for instance, the BBC reported that Internet use was good for the brain, at least for older users attempting to stave off dementia through increased mental activity:
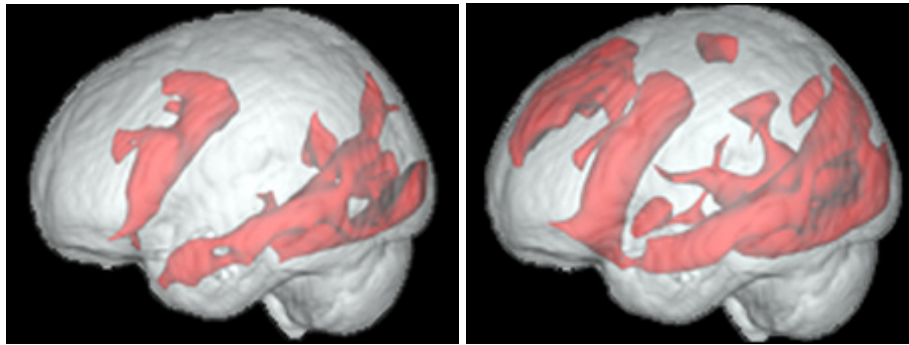
Areas activated by reading a printed book in the brain of an experienced web user (left) and areas activated by surfing the web stimulating more activity in the same brain. Lead researcher Professor Gary Small said: …"Internet searching engages complicated brain activity, which may help exercise and improve brain function" ("Internet use 'good for the brain'")[140].

This kind of argument, however, for net browsing as comparable to Sudoku in its benign effects, prompted Caleb Crane to write a counter in *The New Yorker* that extra brain activity is probably an argument *against* digitisation: "the journalist Steven Johnson argued that since we value reading for 'exercising the mind,' we should value electronic media for offering a superior 'cognitive workout.' But, if [Maryanne] Wolf's evidence is right, Johnson's metaphor of exercise is misguided. When reading goes well...it feels effortless...It makes you smarter because it leaves more of your brain alone" ("Twilight of the Books"). Such circles of evidence are common; commentators are citing just a few other writers because the diversity of studies and discussion isn't there (which is why we must encounter Johnson and Wolf again here on their respective sides of the debates).

The brain is frequently invoked as supported or destroyed by the new portable reading equipment, but there just isn't the published work which compares reading on screen to reading from the page; no one has put anyone in an fMRI or any other type of machine with a printed copy of *A Tale of Two Cities* and a digital edition to see what's different, no one has yet compared like for like. Maybe there's nothing to be seen about

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[140] For more on this effect see Gary Small et al "Your Brain on Google..."

the effects of e-reading in these patterns of oxygenated blood flow. But still we have a great many commentators seeking to reduce the argument to the pernicious impacts of "the screen," rather than any cultural or content issue, doing damage to our intelligence. Mark Bauerlein's *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future (or, Don't Trust Anyone Under 30)* perhaps best typifies this reductionist approach: midway into his argument he argues that "[t]he screen...promotes multitasking and discourages single-tasking, hampering the deliberate focus on a single text, a discrete problem" (94). The screen, in and of itself, often becomes the enemy in Bauerlein's hands[141]. The titles, let alone the content of popular works on the fate of thought for a generation of digital readers and internet users, though not as blunt as that of Bauerlein (or Carr's first provocation), are still telling: popular books on the impact of digital content and equipment on the brain, cognition, and society include Maggie Jackson *Distracted: The Erosion of Attention and the Coming Dark Age;* Gary Small *iBrain: Surviving the Technological Alteration of the Modern Mind*; Andrew Keen *The Cult of the Amateur*; Susan Jacoby *The Age of American Unreason*; Lee Siegel *Against the Machine*; Jaron Lanier *You Are Not A Gadget***;** Maggie Jackson *Distracted*; Hal Abelson et al *Blown to Bits*; and Nicholas Carr *The Shallows.* For all of the very real and relevant concerns expressed by work of this kind, when the worst criticisms of the internet and e-reading get frothed into broad generalisations of what the new equipment is doing to its users I can't help but think that the more puritanical commentators are increasingly envisioning people in the vein of William Gibson's "slitscan" viewers, that our screens produce a creature

> best visualized as a vicious, lazy, profoundly ignorant, perpetually hungry organism craving the warm god-flesh of the anointed. Personally, I like to imagine something the size of a baby hippo, the color of a week-old boiled potato that lives by itself, in the dark, in a doublewide on the outskirts of Topeka. It's covered with eyes and it sweats constantly. The sweat runs into those eyes and makes them sting. It has no mouth…no genitals, and can only express its mute extremes of murderous rage and infantile desire by changing the channels on a universal remote. Or by voting in presidential elections (*Idoru* 28-29).

Such vitriol (and the Gibson quotation is a just barely hyperbolic framing of some

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[141] I don't wish to dwell on Bauerlein's book, it can only be held up as a straw man, but for whatever reasons (perhaps simply the provocative title) his study is popular in these discussions and some of the language sufficiently similar to that of the popular debate as to be usefully indicative of a more general attitude.

commentators' pronouncements) foments with little nuanced consideration of the materiality or particularity of the condemned screens. In this chapter I'd like to turn the tables somewhat: I will continue to bracket out content for the most part (many of the critics described above don't actually do this, instead confusing the medium and the media where it suits their argument, but it remains an idea so widespread as to be worth taking seriously, if only to see where it might go) and instead focus on what effects might really inhere in the apparatus themselves; what does "the screen" actually promote? In the last chapter we considered the phenomenological experience of using the equipment, and I would like to expand on that here by focussing on critical theory and the capacity for physical objects to function metaphorically.

The ideas of this chapter are extrapolated from James Gibson's notion of "affordances." Gibson saw affordances as the what something in an environment "offers" an organism "what it *provides* or *furnishes*, either for good or ill...It implies the complementarity of the animal and the environment" (127). If a surface is horizontal, flat, extended in comparison to the size of the organism, and rigid enough to support its weight "then the surface *affords support*...Note that the four properties listed - horizontal, flat, extended, rigid - would not be *physical* properties of a surface...As an affordance of support for a species of animal...they have to be measured *relative to the animal*" (127). Note that an affordance isn't the same as an eidetic aspect, but rather a property of the thing: "[t]he observer may or may not perceive or attend to the affordance, according to his needs, but the affordance, being invariant, is always there to be perceived. An affordance is not bestowed upon an object by a need of an observer and his act of perceiving it. The object offers what it does because it is what it is" (139).

Donald Norman, in his guide for designers, uses Gibson's notion in order to consider the properties of materials and artefacts

> primarily those fundamental properties that determine just how the thing could possibly be used...Glass is for seeing through, and for breaking. Wood is normally used for solidity, opacity, support, or carving. Flat, porous, smooth surfaces are for writing on...When affordances are taken advantage of, the user knows what to do just by looking: no picture, label, or instruction is required (9).

Paper, in the terms Norman offers here, affords inscription and reading; there is a cultural component to both, of course, but there is also a material reality partially revealed by the culture. As Joanna Drucker puts it,

> [t]he force of stone, of ink, of papyrus, and of print all function within the signifying activity - not only because of their encoding within a cultural system of values whereby a stone inscription is accorded a higher stature than a typewritten memo, but because these values themselves come into being on account of the physical, material properties of these different media. Durability, scale, reflectiveness, richness, and density of saturation and color, tactile and visual pleasure - all of these factor in - not as transcendent and historically independent universals, but as aspects whose historical and cultural specificity cannot be divorced from their substantial properties. No amount of ideological or cultural valuation can transform the propensity of papyrus to deteriorate into gold's capacity to endure (*The Visible Word* 45-46).

Affordances, then, are part of the underlying reality of objects which we attempt to access during our more or less successful eidetic experience. Culture can program our reception of materials and artefacts, complicating and/or extending *eidos*, and we often act on cultural impulses until we learn for ourselves the true, or (to maintain an OOO-like scepticism) the seemingly true affordances of a particular instance.

Throughout the various debates of e-reading (including internet browsing) versus the codex there is an underlying thread which is pertinent to this discussion: that the *apparatus* used to access material can seemingly be as detrimental in itself as any new type or frequency of content it presents. This is what I would like to concentrate upon: although the types of media available on any equipment must also be considered, it is the gestures afforded by the things themselves, effects often neglected in the current literature, that this chapter will interrogate. I would like to say, along with the commentators seen above, that reading from a screen has an effect upon the user, one born of a combination of affordances and cultural reception. As Hayles argues, it does seem intuitively "reasonable to assume that citizens in technologically developed societies, and young people in particular, are literally being reengineered through their interactions with computational devices" (*Electronic* 47). But the important questions are "how?" and "to what extent?" The latter may have to, for the moment, be taken on a case-by-case basis, and is presumably heavily dependant on the exposure and the predilections of the individual; it is still too early to plot broader trends. The "how," however, is something I feel that we might be able to address, again because we can refer to an earlier history of technologies more generally, and equipment for reading in particular.

What I would like to avoid, however, is the pure technological determinism that

some of the above reports appeal to. As Merritt Roe Smith and Leo Marx describe it, the worst instances of technological determinism suggest that "a complex event is made to seem the inescapable yet strikingly plausible result of a technological innovation" (xi). Carr offers an example of how such determinism makes its way into the popular discourse:

> When printed books first became popular, thanks to Gutenberg's press, you saw this great expansion of eloquence and experimentation...[a]ll of which came out of the fact that here was a technology that encouraged people to read deeply, with great concentration and focus. And as we move to the new technology of the screen...it has a very different effect, an almost opposite effect, and you will see a retreat from the sophistication and eloquence that characterized the printed page ("How E-books Will Change Reading and Writing").

It is, of course, ludicrous to think that it was solely the affordances (if focus and depth can be described as such) of Gutenberg's printed works, rather than an increasingly democratic access to knowledge and a raft of other cultural factors which gave rise to any increase in eloquence and experimentation. In a similar light I certainly don't want to suggest that readers will be irreversibly altered simply by the equipment that they choose to deploy, or to reduce the complexity of cultural trends to the results of that form of reading. What I do want to suggest, however, is that reading on screen will have an effect on how readers think, particularly if they make their new screens into technologies. As with any other tool which is brought "on board" during the process of technologising, a new machine for thinking is made which comprises of (at least) user and equipment, and as we have seen these sorts of soft assemblages can enable activities that would appear unfathomable to the hard assembled bodies of the individual. But they also have the capacity to more subtly alter the activities we undertake and how we might conceive of them; affordances, as this chapter conceives of them, are shapers and guiders, not determiners of thought.

Derrida, for instance, during a discussion of his own play with the writing space, argues that the more extensive presence of the computer, and absence of paper, both in the world and in his hands, would have altered the work that he produced: "I think that the typographical experiments…, particularly the ones in *Glas*, wouldn't have been interesting to me any more; on a computer, and without those constraints of paper - its hardness, its limits, its resistance - I wouldn't have desired them" (*Paper* 47). There is

something in the paper itself, Derrida is saying, that prompted in him, that afforded certain kinds of thought, and therefore certain kinds of work. There is also, absolutely, a wave of cultural assumptions which surround paper, particularly the paper in printed books, which speak to and to some degree create "its hardness, its limits, its resistance," but to a greater or lesser extent those cultural biases must be able to cohere relative to the objects that they cluster around, as exemplified in the quotation from Drucker above.

Consider the alphabet. The alphabet is, primarily, equipment for preserving meaning, a technology for a great many people. If technologies were inert in the effects of their affordances then the alphabet would have no effect on thought in and of itself. The capacities that it endows (writing, storage, etc.) might feed into a culture in a way which enables change, but the individual's use of the thing itself should not have a result of its own. But this doesn't seem to be the case; Marshall McLuhan argued that the alphabet led to a certain kind of thinking:

> The alphabet is a construct of fragmented bits and parts which have no semantic meaning in themselves, and which must be strung together in a line, bead-like, and in a prescribed order. Its use fostered and encouraged the habit of perceiving all environments in visual and spatial terms - particularly in terms of a space and of a time that are uniform c, o, n, t, i, n, u, o, u, s, and c-o-n-n-e-c-t-e-d. The line, the continuum - this sentence is a prime example - became the organizing principle of life…'Rationality' and logic come to depend on the presentation of connected sequential facts or concepts (*Massage* 44-45).

This belief in the equation of rational thought with linearity, something we'll return to again in the context of the codex, has its roots at the very inception of the modern alphabet in ancient Greece and its effects on the early Greek literates. The first "complete" alphabet came from Greece, a system which included vowels for the first time, as opposed to the contextual cues of the earlier vowel-less Semitic scripts where a thorough knowledge of how a passage would sound spoken aloud was required for comprehension[142]. This completion of abstracting the spoken word into written characters severed the alphabet from any relation in material experience, particularly in comparison to the world imitative qualities of earlier (or contiguous in the case of the Chinese calligraphic script) pictographic writing. Walter Ong suggests that

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[142] See John Man's *Alpha Beta* and Henri-Jean Martin *The History and Power of Writing* (27-42) for an overview of the history and impact of the development of alphabetic writing.

it does appear that the Greeks did something of major psychological importance when they developed the first alphabet complete with vowels. [Eric] Havelock[, in *Origins of Western Literacy* (1976),]…believes that this crucial, more nearly total transformation of the word from sound to sight gave ancient Greek culture its intellectual ascendancy over other ancient cultures (90).

Such ascendancy derived from "the philosophical thinking Plato fought for [which] depended entirely on writing…[F]ormal logic is the invention of Greek culture after it had interiorized the technology of alphabetic writing, and so made a permanent part of its noetic resources the kind of thinking that alphabetic writing made possible" (Ong 24 & 52). As suggested in the first chapter, Ong identifies the alphabet as an internalised technology with a morphic effect on the cognition of its users. It is precisely the "kind of thinking" that the alphabet can engender that John Gray attacks at length in his anti-techno-utopian *Straw Dogs:*

> The development of writing has enabled [people] to construct philosophies in which they no longer belong in the natural world…The pictographs of Sumer were metaphors of sensuous realities. With the evolution of phonetic writing those links were severed...It is scarcely possible to imagine a philosophy such as Platonism emerging in an oral culture. It is equally difficult to imagine it in Sumeria. How could a world of bodiless Forms be represented in pictograms? How could abstract entities be represented as the ultimate realities in a mode of writing that still recalled the realm of the senses?...[T]hroughout its long history, Chinese thought has...understood that even the most abstract terms are only labels...As a result, Chinese thinkers have rarely mistaken ideas for facts...Plato's legacy to European thought was a trio of capital letters - the Good, the Beautiful, and the True. Wars have been fought and tyrannies established, cultures have been ravaged and peoples exterminated in the service of these abstractions. Europe owes much of its murderous history to errors of thinking engendered by the alphabet (56-58).

There should be a familiarity to Gray's words here: equipment, the alphabet, places a barrier between its users and the world. Of course, to Ong and Havelock, that mediating barrier is exactly what caused Greek thought to be so powerful: separation from the world was what was required to think abstractly. But to Gray, as for the resisters of technology that we encountered in the first chapter, that separation from the world

seems to simply produce too many mistakes of thinking[143]. To some degree, by re-appropriating Plato's bodiless *eidos* to an approximation of an object incommensurate with its richness I have sympathised with Gray's position. What is most important in this quotation, however, is that the alphabet has both enabled and shaped a certain kind of thinking. This is not to say that it was the sole arbiter of Greek thought, and of the Western philosophy which followed it, merely that it played a more or less decisive factor in it; as it separated its thinkers from the world its existence as something manifested in that world continued to affect the thought of any thinker who incorporated it into their cognitive strategies. In short, I don't think that it is deterministic to say that the things we encounter most intimately, be they alphabets, hammers, or codices, have an affect on our cognition, and that this is exactly the domain of technological use. As Gillespie puts it, somewhat darkly:

> Caught in the blood-in-the-ears rush of hype, smitten by novelty, we regularly overlook the most glaring of continuities. The immateriality of digital tools has often been pointed to as proof that they do not work like more earthly artifacts; our fantasies of frictionless digital transaction and intuitive interfaces preach the same mistaken faith - that our tools are silent partners, helping us in our goals with no agendas of their own (108).

But when it comes to the things with which we think, the equipment in as much as we use them, we are agnostic to materiality. As we will see we make the same mistakes, place the same faiths, and are rewarded with similar ends whether the tools we deploy are digital, mechanical, or ephemeral, i.e. purely thoughtful or abstract. When we talk about e-readers, even "just" the medium, then we must consider its unique physicality, the gestures it provokes, and the metaphors we use alongside their forms. I don't intend to make definitive, predictive, or qualitative judgements about the kind of changes that our e-reading equipment may facilitate in its users, but I do want to look at the mechanisms by which they may effect/affect that change, and what those changes might be, the "agendas of their own." I will focus on two distinct but related areas: metaphor inherent in equipment and the gestures these metaphors provoke in their users, and the changes in *eidos* and the gestalt of equipment that typically comes in response to such metaphorical use.

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[143] An argument against this notion, based on practice, was put forward in the first chapter and, to some degree, extended in the second.

The importance of being metaphorical

The essence of metaphor is simple: "understanding and experiencing one kind of thing in terms of another" (Lakoff and Johnson, *Metaphors* 5). The enabling potential of metaphor, however, is immense. Metaphor is central to how we think, it "pervades our normal conceptual system. Because so many of the concepts that are important to us are either abstract or not clearly delineated in our experience (the emotions, ideas, time, etc.), we need to get a grasp on them by means of other concepts that we understand in clearer terms (spatial orientations, objects, etc.)" (115). Lakoff and Johnson see metaphor as a fundamentally embodied experience, one which invokes the fleshly experience of day-to-day life in order to understand the abstractions our minds seek out.

As beings which evolved a staggering plasticity as a survival strategy to handle the pressures of a rapidly changing world[144] we have learned to turn to metaphor to overcome our limitations which stem from a lack of specificity. Humans were never the strongest or the fastest, but we became the smartest, where "smartness" isn't a measure of fact retention or IQ, but of the swiftness of our cognitive adaptation to novel situations followed by a continued refinement of successful techniques. The technologising of equipment, therefore, is simply one example of our adaptive smartness (another example would be our working tactically in groups to catch faster or stronger prey where speed of adaptability is paramount, as is the refinement of technique over time[145]). But our adaptability means that we are never experts in all areas, specialising only as the environment requires, and only developing those skills which are repeatably useful. Our bodies, not (on evolutionary timescales) our cultures or their conceptions, are the relative constants which broadly endure over time, so it is unsurprising that we have evolved to conceive of the world as it relates to bodily experience, not the vogueish abstractions of our era. "We may like to think that we can think of anything and in any way we choose. And perhaps we can, but doing so takes a great deal of hard work. For most people logic and mathematics are not 'easy'. Unconstrained, general, context-independent and domain-unspecific thought does not

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[144] Change produced by the migrations, ice ages, climate changes, variations in flora and fauna, and later the effects of new technologies, farming, hunting, and living practices etc. which describe our early history (and, picking up pace once again, continue to do so).

[145] We could, therefore, extend the argument and suggest that hunting practice is another instance of technologisable (if immaterial) equipment. I have focussed on the physical here, but, as discussed in the first chapter in the section on "atypical technologies," I believe the mechanisms still hold, in which case "technologisable equipment" might essentially describe our entire practice, or systems of practice, of being in the world.

come naturally" (Plotkin 198). Unconstrained thought, ideas without contexts, ideas which we cannot categorise are all troubling to us. *Eidos*, as described in the last chapter, is all about constraining things, putting boundaries around them, and for this reason the word's link to Aristotle's "species" is again appealing: establishing *eidos* divides up and catgorises the world relative to our form.

This may be why we're so dependant on metaphor, both in our abstract thought, as Lakoff and Johnson argue, and in our attitudes to any unfamiliar thing: to provide practical constraints and to deploy domains of intelligence that we have evolved through repeated use, either culturally or genetically, to enable us to adapt swiftly and to interact with aspects of the world successfully. Metaphors may be lies of a kind which weaken *eidos*, a way of talking about something which seems to get further from its essence, but they can also enable forms of essential understanding by enabling successful action. We may not access what the metaphor attempts to describe, but we do access something else about the thing beyond it, provided for by its fiction as we attempt to interact.

The objects that we deploy, however, can also be used as metaphors themselves, can be used to think through ideas in another domain, and this is where I'd like to begin.

Objects-to-think-with

In *Life on the Screen* Sherry Turkle deploys the term "objects-to-think-with" to discuss the prompting of novel thought via equipment use, and, as with the definition of technologically deployed equipment that has been set up here, for Turkle these objects can be both tangible or intangible. Her initial example is a facet of Freudian psychoanalysis: Freud's theory of the unconscious became immensely popular within his own lifetime, making its way into every level of discourse of the era, and his ideas regarding the interpretation of dreams proved particularly compelling. His work developed a memetic strength, a set of broad ideas embraced by the society which resulted in many more people engaging with the theories in their conversations and personal reflections than actually having read Freud's original work. Turkle argues that the power of Freudian ideas in the popular consciousness stemmed not from their necessary scientific validity, but becauase they offered "almost-tangible ideas such as dreams and slips of the tongue. People were able to play with such Freudian 'objects.' They became used to looking for them and manipulating them, both seriously and not so

seriously. And as they did so, the idea that slips and dreams betray an unconscious started to feel natural" (*Life on the Screen* 48). Turkle's language here is telling: objects-to-think-with require "play" and "manipulation." When something can be turned about in the hands it can start "to feel natural," and this establishes a link with canonical ideas of readiness-to-hand, where we get to the truth of things by engaging with, not just reflecting upon them. The enabling processes, therefore, of objects-to-think-with, whether tangible or not, stem from our growing understanding of them through repeated use as with any other practiced ability. Technologically deployed equipment is therefore a prime candidate to become such an object, but whereas Freud's broader ideas clearly had something to say, what does a thing, in an of itself, communicate?

We return here to Gillespie's "agendas" for objects and to Gibson's affordances. Tools have no agency in themselves to guide or prompt our thoughts, but when they are brought on board in repeated use they can and do shape the kinds of thoughts that we manifest, both during that use, and afterwards upon reflection. One example of such change, Turkle suggests, comes from "[t]he technologies of our everyday lives chang[ing] the way we see the world...When we look at sunflowers or water lilies, we see them through the eyes and the art of van Gogh or Monet. When we marry, the ceremony and the ensuing celebration produce photographs and videotapes that displace the event and become our memories of it[146]" (47). In the same way that our continued exposure to the capture of light, from painting to video, structures our day-to-day experience of light in the world, so exposure to Freudian objects-to-think-with structured the perception of the unconscious in the audience of the day.

Another example of an object-to-think-with can be found in the article from Carr which prompted the claim of this chapter:

> Sometime in 1882, Friedrich Nietzsche bought a typewriter - a Malling-Hansen Writing Ball, to be precise. His vision was failing, and keeping his eyes focused on a page had become exhausting and painful…The typewriter rescued him, at least for a time. Once he had mastered touch-typing, he was able to write with his eyes closed, using only the tips of his fingers…Words could once again flow from his mind to the page…But the machine had a subtler effect on his work. One of Nietzsche's friends, a composer, noticed a change in the style of his writing. His already terse prose had become even tighter, more telegraphic. 'Perhaps you will through this instrument even take to a new idiom,' the friend wrote in a letter…'You are right,' Nietzsche replied, 'our writing

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[146] Turkle is alluding here to an ideas explored by Susan Sontag in *On Photography*.

equipment takes part in the forming of our thoughts.' Under the sway of the machine, writes the German media scholar Friedrich A. Kittler, Nietzsche's prose 'changed from arguments to aphorisms, from thoughts to puns, from rhetoric to telegram style'[147] ("Is Google Making Us Stupid?").

Carr's principle assertion is that the tools we use can affect us in subtle ways, his own concern being with how the internet is changing his own memory and concentration for the worse. Nietzsche, it would seem, also found in the assemblage of his body with the typewriter a new way of thinking, a new machine for thinking with. The typewriter, of course, made no attempts to structure the philosopher's thoughts, but nonetheless it appears to have materially affected his output; somehow the tool afforded a different mode of doing philosophy.

We might think of such instances, at least preliminarily, as "direct" objects-to-think-with, where play with the equipment structures the kinds of thoughts that the user will go on to deploy in the same or similar domains, e.g. light capture structuring light observation in (photography and film), or ideas about the unconscious structuring thoughts about the unconscious, typewriters affecting writing output etc. But there are also "indirect" objects which structure thoughts in seemingly remote domains, acting more obviously metaphorically, and they offer us even clearer demonstrations of how objects themselves might inspire certain kinds of thinking. The new reading on screen demonstrably fits into both categories.

Because, as this chapter will argue, discussions of computing and the internet are necessarily impossible to separate from any discussion of digital reading, whatever form it might take, I'd like to use the internet as my first example of an indirect object-to-think-with. This will also provide a grounding in web-based thinking which we can apply more specifically to the Kindle and the iPad in the later sections of this chapter.

Thinking online

In her discussions of objects-to-think-with Turkle notes that "[p]eople use contact with objects and ideas to keep in touch with their times. They use objects to work through powerful cultural images, to help arrange these images into new and clearer patterns" (*Reading on Screen* 47). Here Turkle points towards the potential for objects-to-think-

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[147] Carr is citing Friedrich Kittler *Gramaphone, Film, Typewriter*.

with being used metaphorically: actions with objects in one realm can help to frame our thoughts regarding another pursuit, and this can aid us in those areas which are most new and therefore least intuitive. Janet Murray makes a similar point about the nature of our new digital tools when she states that "[w]e cannot rewind our collective cognitive effort, since the digital medium is as much a pattern of thinking and perceiving as it is a pattern of making things. We are drawn to this medium because we need it to understand the world and our place in it" ("Inventing the Medium" 11).

Robert Sapolsky discusses how Wikipedia can function as just such a metaphorical object-to-think-with:

> in just a few years, a self-correcting, bottom-up system of quality, fundamentally independent of authorities-from-on-high, is breathing down the neck of the Mother of all sources of knowledge [*The Encyclopedia Britannica*]...It strikes me that there may be a very interesting consequence of this. When you have generations growing up with bottom-up emergence as routine...people are likely to realize that life, too, can have emerged, in all of its adaptive complexity, without some omnipotent being with a game plan ("Weirdness of the Crowd").

Sapolsky's suspicion is that the very presence of commonly used digital tools which function and emerge in certain ways will trigger productive, or at least challenging thoughts in its users. In this light I'd like to consider our broad internet activities as objects-to-think-with and to rekindle an argument from the early theorisations of increasingly ubiquitous digital equipment which suggested that our new household electronic devices/technologies enacted the promises of poststructural and postmodern philosophy.

Digital theorists of the early nineties[148], many working in areas which would later come under the umbrella of the Digital Humanities, often referred to Vannevar Bush's work on the Memex[149], and to the limits and potential expansion via cybernetic equipment of the mind. In describing the Memex's augmentation of memory and recall Bush was at pains to emphasise its inbuilt relationship with a system which was already present:

> The human mind operates by association. With one term in its grasp, it snaps instantly to the next that is suggested by the association of

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[148] See for instance work from Bolter and Landow.

[149] Bush envisioned his unbuilt Memex as a method for navigating an ever growing file bank of microfilm that could be internally linked and explored freely.

thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature ("As We May Think" 44).

In this quotation, and others like it drawn from similar work by early digital pioneers[150], it was frequently argued that one could see how digitisation might manifest the asymmetrical linkages that had been in our cultural products all along, connections which were in turn relevant both to how the mind works and to the arguments for intricate but non-hierarchical relationships that were posited as tenets of the linguistic turn, a postmodern outlook, or many of the philosophies, methodologies, or broad ideas that they inspired. Bolter, for instance, suggested at the beginning of the 90s, in *Writing Space*, that

> [a]s long as the printed book remains the primary medium of literature, traditional views of the author as authority and of literature as monument will remain convincing for most readers. The electronic medium, however, threatens to bring down the whole edifice at once. It complicates our understanding of literature as either mimesis or expression, it denies the fixity of the text, and it questions the authority of the author (153).

Bush's fading, intricate web of trails inheres in this idea, as do the extensive associations between each node in the database, truisms for both brain and Memex in his eyes. As the powers of the digital equipment grew, their relation with the brain's workings and their apparent emulation of theorisations of textual production and consumption increased apace. These kinds of ideas can still be found, a decade after Bolter's pronouncements, in influential works for the Digital Humanities such as Everett and Caldwell's *New Media* (2003):

> When we understand computerized linking as a system of 'nested narratives - a narrative within a narrative'[151], following the rhizoplane

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[150] Theodor H. Nelson is often cited, particularly his Xandu project, similar to the Memex, outlined in "A File Structure for the Complex, the Changing, and the Indeterminate" and *Computer/Lib*. For work on earlier cybernetic theorists such as Grey Walter, and R.D. Laing, who explored the potential for empowering connection between man and machine see Andrew Pickering's *The Cybernetic Brain* and Katherine Hayles' *How We Became Posthuman*.

[151] Alluding to Barthes' *S/Z*.

structure[152], it becomes analogous to Freudian free association, which Lyotard interprets as 'a way of linking one sentence with another without regard for the logical, ethical, or aesthetic value of the link'[153]" (6).

Over time such notions became part of the assumed theoretical landscape, implicit, for instance, in Hubert Dreyfus' *On the Internet*: "With a hyperlinked database, the user is encouraged to traverse a vast network of information, all of which is equally accessible and none of which is privileged" (10)[154]. Nancy Patterson spoke more explicitly about hypertext's connection to such theories: "Hypertext makes us conscious of the blurring of the reader/author role. Book technology seems to fix our notion of authorship, while hypertext challenges us to rethink that role and the role of the reader" ("Hypertext and the Changing Roles of Readers" 76). George Landow, in *Hypertext* (and its modified reissues as *Hypertext 2.0* and *3.0*), is perhaps the theorist to most explicitly link poststructuralism with the field and equipment of computer science:

> Like Barthes, Foucault, and Mikhail Bakhtin, Jacques Derrida continually uses the terms *link* (*liason*), *web* (*toile*), *network* (*réseau*), and *interwoven* (*s'y tissent*), which cry out for hypertextuality; but in contrast to Barthes who emphasizes the readerly text and its nonlinearity, Derrida emphasizes textual openness, intertextuality, and the irrelevance of distinctions between inside and outside a particular text (*Hypertext* 8).

And yet more baldly, Landow sees hypertext as "an almost embarrassingly literal embodiment" of such theory (*Hypertext* 34)[155]. As time went on the extremity of the assertions tended to be moderated down, but, as Marie-Laure Ryan states, "it is easy to see how the feature of interactivity conferred upon the text by electronic technology came to be regarded as the fulfilment of the postmodern conception of meaning. Interactivity transposes the ideal of an endlessly self-renewable text from the level of the signified to the level of the signifier" (5).

Katherine Hayles' work is perhaps the clearest beginning of the end for this standardised appeal to a marriage between CompSci and post-60s continental

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[152] An allusion to Deleuze and Guattari's *Thousand Plateaus*.
[153] Lyotard, "Can Thought..." 30-31.
[154] For a snapshot of the mid-nineties critical theoretical responses to hypertext and electronic reading environments which laid the groundwork for Dreyfus' pronouncement see the Landow edited collection *Hyper / Text / Theory*.
[155] In *Hypertext 3.0*, published in 2006 14 years after the original, Landow sticks with his position of the link between late 20th century theory and hypermedia. As we are about to see, this approach has come under some attack, but Landow maintains that the theorists' "approach to textuality remains helpful in understanding our experiences of hypermedia. And vice versa" (*Hypertext 3.0* xiv).

philosophy:

> In the heady days when deconstruction was seen as a bold strike against foundational premises, hypertext was positioned as the commonsense implementation of the inherent instabilities in signification exposed by deconstructive analysis…In conflating hypertext with the difficult and productive aporias of deconstructive analysis, these theorists [Hayles invokes Landow and Bolter] failed to do justice either to the nuanced operations of works performed in electronic media or to the complexities of deconstructive philosophy (*Electronic* 32).

It is no coincidence that since Hayles' seismic, and rightly incredibly well received work in the field, such notions have been articulated less and less[156]. But I think that it's a mistake to ignore the idea entirely, to say that what Bolter and Landow made explicit, and numerous subsequent critics invoked, if more tentatively, is simply, and only, over-keen and mistaken. Hayles is right, of course, that hypertextual electronic environments cannot possibly capture the subtleties of the theories that they appear to perform, but Turkle's discussion of objects-to-think-with gives us a way to explore this idea and avoid simply disregarding it as spent, unsubtle, or misleading. When Turkle discusses the widespread interest in, and use of Freudian ideas of the unconscious, the concepts that were adopted were Freud's own in only the broadest of brushstrokes: that there existed a motivating force beyond our conscious will; that dreams could mean (clearly not a new idea, but newly revalidated by Freud's psychology); that people could be read for their subconscious, suppressed, or otherwise hidden motivations in simple tics and quirks (parapraxis); etc. Such notions, of course, failed to do justice to either the nuance of Freud's ideas or to the complexity of the unconscious mind, but nonetheless their deployment in the new objects-to-think-with, constructions that amateur users largely built amongst themselves, were undoubtedly both real and useful, introducing a complex idea into the popular mindset and keeping it there playfully. We shouldn't underestimate the effects of keeping unsubtle versions of more complex activities in people's minds; how many psychologists trained, for instance, because they'd heard of an unconscious that, if it hadn't become so accessibly debated, would never have caught their interest?

The same might be said, to some degree, of the enaction of complex

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[156] Kirschenbaum, for instance, inherits this scepticism: "There are a number of important respects on which the theoretical debate has advanced considerably since the first half of the 1990s. The appeal to high poststructuralism forming the backdrop of many of the early accounts has been abandoned, or at least its influence diluted" (43).

philosophical ideas prompted by digital texts. The idea is dissimilar to the Freudian example as it doesn't appeal to a single body of work, but the theme of approximations of potentially intimidating or unintuitive concepts becoming accessible to a broader audience is certainly at play. Turkle, therefore, does not necessarily overstate the case when she says that

> [digital] technology is bringing a set of ideas associated with postmodernism -…ideas about the instability of meanings and the lack of universal and knowable truths - into everyday life…[T]hrough experiences with computers, people come to a certain understanding of postmodernism and to recognize its ability to usefully capture certain aspects of their own experience, both online and off…Computers embody postmodern theory and bring it down to earth (*Life on the Screen* 18).

The key phrase is "set of ideas *associated* with postmodernism." When we say that the internet, databases and hypertextual structures enact deconstructive principles we're talking primarily about a relatively few broad notions such as intertextuality; the reader as producer; the impossibility of univocal meaning; the abolishment of hierarchy in favour of networks etc. etc. Note that such items appear frequently in deconstructive, poststructural, and postmodern discourse, but they are not exclusive to them. In the same way that an introductory course on these subjects might identify such tropes in order to teach the thinking[157], using them as a way-in, so might we also think of these ways-in as inherent within the equipment being deployed by an ever greater number of people, enabling an easier understanding of the thinking via metaphor. Consider Deleuze and Guattari's conception of the rhizome that must lie behind and emerge from every arborescent structure:

> Let us summarize the principal characteristics of a rhizome: unlike trees or their roots, the rhizome connects any point to any other point, and its traits are not necessarily linked to traits of the same nature…The rhizome operates by variation, expansion, conquest, capture, offshoots…the rhizome is an acentred, nonheirarchical, nonsignifying system" (*A Thousand Plateaus* 23).

This idea of the rhizomatic force lurking within the seemingly orderly arborescent structures of our lives must necessarily be far easier to teach, or even naively encounter

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[157] See for instance Peter Barry's *Beginning Theory* 72-73, where Barry lays out a list of what structuralists and poststructuralists "seek" incuding: "Paradoxes...Conflicts...Absences...Aporia."

in the age of a decentralised web of data that a billion people or more can access, explore, and contribute to, where hierarchical content industries are being broken down by rogue individuals propagating their idiosyncratic visions throughout a network which attempts to build new structures only to come to expect them to be torn asunder[158]. Similarly, when Ryan wishes to inform her reader of a complex post-linguistic turn assertion she finds a ready metaphor in the workings and gesture-prompting of hypertextual documents:

> The literary text, like language itself, is a self-enclosed, self-regulating system in which meaning is determined by a strategic configuration of elements…Meaning is not a preformed representation encoded in words and in need of decipherment but something that emerges out of the text in unpredictable patterns as the reader follows trails of associative connotations or attends to the resonance of words and images with the private contents of memory. *This operation is like following links on the internet*: surfing the surface, remaining in perpetual motion (193) (emphasis mine).

There's greater complexity on both sides of this equation (metaphor is never a one-to-one match) and yet objects-to-think-with are, for the vast majority of cases, and particularly for a lay audience, enough. Objects-to-think-with may not provide nuance, but they are triggers, supports, provocations. Far from making us "stupid," therefore, the equipment of the internet and its apparatus may actually facilitate novel thought; it might not reveal the full extent of the work of Barthes or Derrida, but the continuing relevance and potential for empowerment (or disempowerment) of some of their ideas are manifest in the machinery. That the content currently available might not be up to an equal task is almost a separate problem. This is not to say that the content is entirely divisible from the equipment, certainly the internet also prompts, facilitates, and supports particular forms of content, but the content that we currently see, and the content that so many decry, is not all that it is capable of. To argue against the internet, or "the screen" as being inherently degrading to intelligence is to mistake the apparatus for determining rather than conditioning the output; a similar argument might rail

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[158] Guattari, in *The Three Ecologies*, refers to the potential he saw in the newly minted internet for communication between otherwise disparate groups, offering the capacity to quickly organise, act, and dissipate again: "One symptom of this state of affairs is the proliferation of spontaneous and coordinated groups (organs of 'co-ordination') wherever there are great social movements. It is notable that they often use tele-messaging to enable the expression of 'grass-root' sentiments. (The Minitel 'site' 3615 + Alter is a good example of this). [TRANS: Minitel is a computerized information system available via the telephone system in France. It has been available for many years and predates the popular use of the Internet.]" (99).

against the codex for producing a stream of cheap thrillers.

        I'd like to turn to the kind of thinking that may actually inhere within the codex as a form, looking at its most enabling, and most restrictive traits. When combined with our consideration of hypertextual structures as objects-to-think-with we should then have a base from which we might better explore the kind of thinking which may be provoked by the new digital equipment for reading.

Codex thinking

I need to say again that we must be careful when dealing with the suggestion that certain kinds of thinking may inhere in using particular equipment such as a codex. The codex doesn't determine any kind of thinking in its users, but it can be seen as provoking certain kinds of thought from within the cultural context in which it operates, or, more often, to restrict certain kinds of thinking. Lakoff and Johnson give us a way of thinking about these structuring capacities of equipment in their discussion of metaphor.

        One of their most provocative explorations describes how we give "faces" to things based on the ways in which we interact with them: the "front" of a television is the side we want to view, the "front" of a car faces the direction we tend to want it to go. This seems a fairly logical way of bounding and orienting the world, of producing an enabling *eidos* for otherwise faceless things: making the bodies of objects akin to our own bodies which tend to act in the direction our eyes face. But we also ascribe faces or fronts to objects with which we don't have a particular plane of interaction: if we place a ball between ourselves and a rock or a tree we tend to think of the ball as being "in front" of the rock or tree. "In other languages (e.g. Hausa), speakers project fronts onto such objects in the opposite direction, facing away from the speaker" (*Philosophy in the Flesh* 34), but in English speaking cultures the whole world looks toward us. This convention, in Hausa or English, is always an embodied phenomena: "The concepts *front* and *back* are body-based...If all beings on this planet were uniform stationary spheres...perceiving equally in all directions, they would have no concept of *front* or *back*...Our bodies define a set of fundamental spatial orientations that we use not only in orienting ourselves, but in perceiving the relationship of one object to another" (34). Such metaphors, we might assume, emerge in relation or in analogous fashion to our bodies' shaping of our perception that we encountered in the last chapter.

        I would like to suggest that in the same way that our bodies condition the ways

in which we think about the world, by exporting conventions of our own form out onto other objects with which we interact or locate ourselves in reference to, in some smaller fashion so do the objects we encounter project elements of their form back into our way of thinking. Forms affect thought to some degree, and for those objects brought onboard in soft assemblages the potential for their embodiment to affect our thinking is increased[159].

To describe the act of form affecting thought I'd like to appropriate a word that can be found in Hayles' work: "material metaphor." For Hayles it is "a term that foregrounds the traffic between words and physical artifacts" (*Writing Machines* 22), an interrogation of the connection between script content and the medium. But I want to use the term more broadly to describe an object's shaping of our thought via its form, where its body acts metaphorically, causing us to think of one thing in terms of another - in this way we can position a material metaphor as an "indirect" object-to-think-with, allowing us to preserve Turkle's term solely for direct effects. The applicability of "material metaphor" for this purpose can be seen in the following quotation where Hayles discusses the metaphorical impact of the codex; what's striking is not its particularity to that object, but that the term describes the structuring of the interaction:

> We are not generally accustomed to think of a book as a material metaphor, but in fact it is an artifact whose physical properties and historical usages structure our interactions with it in ways obvious and subtle. In addition to defining the page as a unit of reading, and binding pages sequentially to indicate an order of reading, are less obvious conventions such the (sic) opacity of paper, a physical property that defines the pages as having two sides whose relationship is linear and sequential rather than interpenetrating and simultaneous. To change the physical form of the artifact is not merely to change the act of reading...but profoundly to transform the metaphoric network structuring the relation of word to world (*Writing Machines* 22-23).

The form of the codex structures the reception of at least the content within it, but, I would further argue, also of the kind of thinking that follows on after use. We've already seen how the alphabet affected the thinking of its early adopters, not just in the reception of the texts, but in their wider philosophising, might the same be true of the codex? What kind of thinking might be built into its body?

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[159] In the last chapter we also saw how form affected thought, but the focus was on *our* form, *our* bodies; here I want to concentrate on the form of artefacts, more explicitly considering their bodies as enactive. That both of these formal concerns shape cognition and occur in tandem only emphasises their effects.

Walter Ong describes the predominant and radically freeing effect of the adoption of writing[160]:

> Since in a primary oral culture conceptualized knowledge that is not repeated aloud soon vanishes, oral societies must invest great energy in saying over and over again what has been learned arduously over the ages. This need establishes a highly traditionalist or conservative set of mind that with good reason inhibits intellectual experimentation. Knowledge is hard to come by and precious (*Orality* 41).

Societies which have both adopted and incorporated writing hugely expand their capacity for novel thinking, not only through its elimination of repetition for the sake of memory, but also repetition between people working on a problem. Writing, particularly that which is presented in a form which is easily copied, preserved, stored, and/or distributed begins to transcend space and time; by keeping track of what problems have been identified and which have been solved, which still persist, redundancy in research can be dramatically reduced. In this way the uses of the codex and codex-like forms have been radically democratising with implications for religion[161], expression, and the transmission and availability of ideas[162].

But the history of the use of the codex doesn't uniformly match up with the message of its form; particularly in the age of the internet and its swiftly produced, amateur, and often fleeting texts, it becomes clear that the codex doesn't inherently afford caprice or rapid response, instead promoting the positives and negatives of the glacial flow of received wisdom. The forces of history, culture, and society interacting with the equipment have undoubtedly shaped each user's phenomenological experience

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[160] For more on the power of the adoption of writing see Henri-Jean Martin *The History and Power of Writing* and David R. Olson et al. *Literacy Language and Learning*.

[161] Christians were the foremost early users of the codex, adopting it in order to disseminate and work with their Bible:

> [B]y the first century, Christians were tying loose-leaf sheets of papyrus or parchment together in tablets that opened down the middle. These codices were compact enough to be carried around in a satchel and produced at prayer meetings. The codex had two other advantages over the roll: with writing on both sides of the surface, it was more capacious; and whereas rolls had to be read sequentially, codices enabled readers to turn to individual pages at separate points in the book. Outside Christian contexts, the codex was nothing more than a handy notepad, chiefly reserved for administrative note-taking (McNeely 45-46).

Also see Colin Roberts and T.C. Skeat *The Birth of the Codex* in this regard.

[162] The most influential book regarding the history and effects of printing is surely Elizabeth L. Eisenstein's two volume *The Printing Press as an Agent of Change*. Also of note are Lucien Febvre and Henri-Jean Martin's *The Coming of the Book* and John Man's *The Gutenberg Revolution*.

of the form, but they are, contrarily, not the enduring aspects of its brute embodiment. The defining positive features of the codex are not its provision of freedoms, but its order, its stability, and its sense of authority, products of its boundedness. Birkerts invokes its biblical origins when describing those features indelibly connected to the experience of the object itself in a quotation we saw in the first chapter: "What [codex] reading does, ultimately, is keep alive the dangerous and exhilarating idea that a life is not a sequence of lived moments, but a destiny. That God or no God, life has a unitary pattern inscribed within it" (*Gutenberg* (1996) 85). The belief displayed here is in "[t]he stable hierarchies of the printed page" (3), where the linear order marks a steady teleological progression towards the enlightenment of the conclusion; the form wins out over the history of its deployment in the repeated phenomenological experience; a history of new freedoms and the democratisation of information is supplanted by the particular forces of preservation and continuity that are tied to the form of the pages themselves. Italo Calvino might as well have been describing Birkerts' fear of the screen's usurping this fought for order when he wrote

> you are gripped by the fear of having…passed over to 'the other side' and of having lost that privileged relationship with books which is peculiar to the reader: the ability to consider what is written as something finished and definitive, to which there is nothing to be added, from which there is nothing to be removed (*If On a Winter's Night* 112).

And Calvino, in his playful and experimental fiction, leads us to postmodernism. Jean-François Lyotard's frequently cited definition of postmodernism - an "incredulity toward metanarratives...[,] undoubtedly a product of progress in the sciences: but that progress in turn presupposes it" (*Postmodernism* xxiv) - is opposed by the "destiny" Birkerts sees enacted in the pages of the codex; to return to our earlier discussion of the hypertext database, the new digital technology might well represent an incredulity to the metanarrative of the codex[163].

       We have already considered in the first chapter how a printed codex is no more

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[163] Again, there is a risk here in saying what the codex is or isn't. The forms that a "book" has taken over the centuries is hugely varied, as evidenced by the scores of artists books which challenge the notion of what should be catalogued under an ISBN code (see, for instance, Johanna Drucker's *The Century of Artist's Books*). But again my concern is with popular resistance, with the codex as a well defined trope in common consensus. The implications of the phenomenological experience of this normative artefact are, I believe, as I have described, even though we might catalogue the hundred thousand things which buck the trend. This is a necessary evil of attempting to describe broad notions of interaction, but the ideas, as I intend them, should be easily applicable to any number of special cases with little modification.

or less "natural" than the digital texts which have followed them, but we can now come full circle and consider whether that enduring illusion of naturalness in the printed book matches up with psychological reality. As I'll go on to demonstrate, Hayles, whilst railing against the lack of subtlety in the reading of digital forms as enactments of a certain kind of philosophy, also tacitly argues for the naturalness of linear order, natural in its matching of form to the processes of human thought. And here is a way in which we might consider whether the new equipment, in and of themselves, might make us somehow mentally deficient: if there is a match between the metaphor afforded in the form and the workings of the human mind then it seems likely for there to be the capacity for ease of use, and for reinforcing benefits where the formal qualities of the medium support the way in which the brain already wants to work, rather than fighting against it. If the physicality of the codex provokes a type of thinking to which we are not particularly suited, however, then the case for the detractors strengthens.

Linear access is natural?

Bauerlein, attempting to explain his problems with the increase in time spent online, states that

> the cultivation of nonlinear, nonhierarchical, nonsequential thought patterns through Web reading now transpires on top of a thin and cracking foundation of print reading. For the linear, hierarchical, sequential thinking solicited by books has a shaky hold on the youthful mind, and as teens and young adults read linear texts in a linear fashion less and less, the less they engage in sustained linear thinking (141).

The argument, Bauerlein assumes, is so clear as to not need stating explicitly: Linear reading is so beneficial in and of itself that any move away from it will be detrimental to the equally beneficial activity of linear thinking. In "As We May Think," however, "Bush [had] argued that...the [hypertextual, non-linear] Memex was superior because it worked the way the mind works, through association. Kaye [Hayles' fictionalisation of her younger self] was not sure the claim was correct. Certainly she sometimes caught herself thinking through association, but logical ordering and linear sequencing were also important" (*Writing Machines* 75). Hayles' language here is as revealing as Bauerlein's: associative thinking is something to be "caught" doing, even if it is important, whereas *logical* ordering and linear sequencing one can be more open about.

The term "logical" is weighted, perhaps synonymous for "sensible"; associative thinking is implicitly illogical (this stance is familiar, if modulated down several notches, from Bauerlein's position and from the reports outlined at the opening of this chapter).

The question these quotations provoke is important: if the codex's linearity seems to match the best of the ways in which people can cognise then it may be important to preserve, but if there is an equal or even stronger alternative mode then the preservation of a form which promotes linearity becomes less crucial. I'd like to consider evidence of an acknowledgement of such a mode in the principle discourses that I have drawn in throughout: neuropsychology, philosophy, and naïve report, including a move toward incorporating literary voices.

From neuropsychology, Merlin Donald argues, as Hayles (despite her weighted language) probably intended, for a balance where the linear plays an important role. But the underlying or even typical mental processing Donald identifies is parallel, with associations being made between "frames within frames":

> Early hominids must…have evolved a capacity to…parallel process and thus compartmentalize their conscious mental activities, so that they could run several trains of activity concurrently, while reviewing and comparing experiences. This would have been necessary even for relatively simple achievements, such as group coordination, organized big-game hunting, and long migrations…The existence of this adaptation is confirmed in the nature of modern human consciousness. Although our experience is subjectively unified, our awareness stream is rarely one-dimensional in a structural sense…Running frames within frames concurrently is routine for our species. Moreover, it is a flexible process. Our conscious activities seem to be stacked, or arranged in cascade, whereby our working memory system can be subdivided into several simultaneously active zones, or narrowed to one, as the situation demands (*So Rare* 258).

Now, whilst such parallel processing need not be impeded by codex reading (it can easily be imagined how readers could think in simultaneous domains prompted by the content of the script, the form, the surroundings, personal history etc.) its materiality certainly doesn't actively promote such cognitive work. The multiple reading panes of internet browser tabs, however, enact or perform sympathetically with such a way of thinking, and if a balance is to be struck between multiple parallel frames and reductions down to a single stream for focus, then perhaps equipment which is able to

accommodate and promote both modes should not be the one to be denigrated *a priori* as making us "stupid."

For a perspective on this subject from philosophy, though one, admittedly, fascinated by neuroscience, let's return to Deleuze and Guattari:

> Thought is not aborescent, and the brain is not a rooted or ramified matter. What are wrongly called 'dendrites' do not assure the connection of neurons in a continuous fabric. The discontinuity between cells, the role of the axons, the functioning of the synapses, the existence of synaptic microfissures, the leap each message makes across these fissures, make the brain a multiplicity immersed in its plane of consistency or neuroglia, a whole uncertain, probabilistic system...Many people have a tree growing in their heads but the brain itself is much more grass than tree (*A Thousand Plateaus* 17).

Deleuze and Guattari see in the structure of the brain itself a non-linear and uncertain system at odds with the "arborealised" thoughts that can emerge from it. For them the privileging of linear and hierarchical thinking is the "unnatural" mode, the disorder or pathology of late capitalist society; it is the tree which should be hidden, or escaped, not the grass which lies at our heart. Once again the radical philosophy, the philosophy which, in its opposition to a hegemonic order, is potentially the hardest and most novel to comprehend, finds its broad themes best expressed in the new digital technologies[164]. For Deleuze and Guattari one should be "caught" thinking arboreally.

There are also abundant folk psychological and phenomenological reports on the competing non-linear thought to be found in literature. It is in this context that we can understand the words from the container which holds B.S. Johnson's *The Unfortunates*, an unbound "book in a box" to be read in any order: "The book form fails to capture the 'truth to life.'" The materiality of the codex matches neither the simultaneous stories of the world, or the minds that try to comprehend them with any consistency, and literature contains myriad of these small rebellions against the inheritance of linear order.

We can also see these concerns expressed by certain experimental poets attempting to apprehend this aspect of cognition, and it should perhaps come as little surprise, poetry being a likely site of struggle with the problems of words and worlds. Jorie Graham, for instance, in the second "Prayer" of her collection *Never* deploys a specific device, the use of rounded and squared parentheses, to layer meaning against

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[164] Deleuze and Guattari do not neglect the codex and they see within every "fixed" text various "striations" and "lines of flight," but it is always a rebelling against, a corruption, or an escape from the affordances of the form.

the linear drive of the line:

> I love the idea of consequence.
> Is that itself consequence--(the idea)?
> I have known you to be cheap
> (as in not willing to pay out the extra
>   length of
> blessing, weather, ignorance--all other
> [you name them] forms of exodus) (14)

There's a tendency in *Never*'s layered voices to use the rounded parentheses for corrections in the poetic voice, and the squared brackets for asides in a cadence that seems to exist outside of the dominant style of the collection; this seems a particularly print-able device where the distinction between the two punctuation marks is clear. We can see, in an earlier poem from the same work, how Graham builds up a discussion with herself in squared brackets midway through a line, detailing how the writing of the poem triggered memories which first interrupt, then aid her composition:

> skeletal diminuendos of glancings as they
> ascend the manifest up towards its upper reaches--soil,
> timothy, stone, manyness of stone, non-mortared
>   build-up of it--
> mistings of just-above-stone where the
> two of them meet, manifest, un-manifest [and how they
>   could not
> know who was looking at them][and that I was from
> another country][down to the very movement of my lips]
> [show me a word I can use][and how all that you say
> is taken from you, they take it, just like
> that it becomes smoke] smoke rising here as mist off the heavy
>   topmost stones ("Philosopher's Stone" 7).

There are, of course, many writers who have lamented the inability of words to capture the complexity of the world and of thought, but Graham, here, does not seem unhappy with words per se, only with the impossibility of the ever driving onward line to do justice to her thoughts, the shape of them in and of themselves. In this second quotation the mess of images that seem to contribute to showing her a word that she can use, the progression toward the word "smoke," is inadequately captured, still seemingly let down by linearity, the fact that there can't be layers at once; the variety of a moment of cognising in time can only be expressed, equated, with forward motion. Parentheses

become Graham's material metaphor. A punctuation tool that has long been used to signal the problem, in speech and writing, of capturing messy thoughts, of tangents and associations and novel promptings, is put to work metaphorically for the what the line instills in its users: "this isn't how we think, don't forget that, but also don't get over it by pretending that we don't think at all." Graham doesn't want her lines clean because thinking is messy. In a discussion of Graham's poetry, Helen Vendler argues that "[t]he appetitiveness of the mind, and the infinity of the world's stimuli, generate the excess of Graham's long horizontal lines, which generate, in their turn, her long vertical sentences. Any given poetic idea begins to produce, in Graham, a version of an aesthetic Big Bang with its vertiginous perceptual expansion and its receding conceptual distances" (54). It is in this expansion of perception that Vendler sees Graham's interest in the mess, the layers, her chance to "feel her way into the heterogeneity, simultaneity, chromatic change, spontaneity and self-correction present in all acts of extended noticing" (54). The associations given off by considering are natural for Graham and, regardless of the historical strictures of the line, they deserve, they need to be presented.

In relation to this we can return to Ong who considers associative thinking in terms of "redundancy": in one sense needless additional information (i.e. repetition or off topic associations are redundant), but in information theoretical terms redundancy actually protects messages from corruption, distortion, or misconception[165]. By providing additional contextual information and repetition it becomes less important for any one particle of information to be interpreted correctly:

> Since redundancy characterizes oral thought and speech, it is in a profound sense more natural to thought and speech than is sparse linearity. Sparsely linear or analytic thought and speech is an artificial creation, structured by the technology of writing. Eliminating redundancy on a significant scale demands a time-obviating technology, writing, which imposes some kind of strain on the psyche in preventing expression from falling into its more natural patterns (*Orality and Literacy* 40).

Ong sees in our originary speech patterns a more natural expression, of necessity, in relation to the patterns of our thinking: redundant, associative, (implicitly) richer in its

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[165] See, for instance, James Gleick's *The Information* (21-34) for a discussion of the redundancy built into both English and African talking drum languages. Because every word in the drum language is so similar to every other word their meanings become hugely context dependent, so much so that the average drum language sentence is eight times longer than its English equivalent (which, as Gleick demonstrates, also has a built in level of redundancy based around contextual clues).

grasping of a thing, particularly for the unaware, the unfamiliar. The artifice of the technology of writing "strains" the psyche and its "natural" processes, and though Ong possibly overstates a problem here (as we have seen, linearity isn't entirely unnatural just rarer than we might assume, and certainly not our sole means of thinking well) such strain can also be seen underlying Graham's parentheses.

Similarly Francis Ponge, attempting to describe the pine woods as he feels them, "the search for *everything* that can be said about pine woods *and only* of them" (109) (akin to a Husserlian eidetic reduction), also offers us layers, variations, associations:

> Like masts from base to midway up
> All crinkled, lichen-cloaked like an elderly Creole,
> With no constraint of lianas or cords between them.
> $\Big\{$ (with no smooth flooring on the ground)
> With no scrubbed floorboards on the ground but deep carpets,
>
> And bearing to the skies $\Big\{$ (hairdos)
> green, conical hats (79)

In various of Ponge's poems from *Mute Objects of Expression* the meaning of the contents indicated by the braces alters, sometimes offering straight variations, alternative lines, or the effect that we see here, similar to the example of Graham above, Ponge's own creative thought process, with the initial idea in parentheses followed by a more polished line elaborating upon it below. Ponge attempts to preserve some of the redundancy and *mise en abyme* framing of thought and speech that Donald identifies, and this feels entirely apt for this section of the collection where Ponge is attempting to put into the artifice of linear text the rich, simultaneous cognitive experience of encountering the woods.

We could also turn to E.E Cummings and a poem from *1X1*:

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it's over a(see just
over this) wall
the apples are (yes
they're gravensteins)all
as red as to lose
and as round as to find (Complete Poems 543).
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Again, linearity doesn't do justice to the way that Cummings thinks, or to the repetitious tumble of the conversation he implicates us in as we sneak a peek over the wall at his

behest. The parenthesis "(yes they're gravensteins)" takes us back in time and changes the subject of the line, describing the apples that, as readers, we've already passed over as if in response to our unreported interjection "do you know what variety they are?" or "are they gravensteins?" Such ideas don't mark an attack on linearity, or on the page, but they do highlight it's unnaturalness, offering a riposte to those who would position screens instead as the unnatural antithesis of the codex, the new practices prompted by which must be *de facto* inferior or detrimental. These instances highlight the contortions that thought must go through in order to be represented in a medium which affords motion forward as meaning at once time passed and the filling in of detail within a moment.

Where Ong rightly saw writing's capacity to set people free from the conservative repetition of established truths, when it comes to the message written into the body of print, of any unchangeable linear writing, Hans Magnus Enzensberger sees an equally novel capacity for suppressing a kind of freedom in thinking:

> The formalization of written language permits and encourages the repression of opposition. In speech, unresolved contradictions betray themselves by pauses, hesitations, slips of the tongue [parapraxis], repetitions, anacoluthons [changes of syntax], quite apart from phrasing, mimicry, gesticulations, pace and volume. The aesthetic of written language scorns such involuntary factors as 'mistakes.' It demands, explicitly or implicitly, the smoothing out of contradictions, rationalization, regularization of the spoken form irrespective of content (273).

Enzensberger draws us back, here, to the assertion with which I began the chapter: regardless or in spite of the content it presents or fosters, the formal qualities of a medium can shape thought. This assertion is shared, of course, by commentators who say that the screen is making us more stupid, but I have tried to show that if our most beneficial thought process is the process most related to our nature (as these commentators often seem to believe), then ironically the codex might well be the more unnatural shaper of cognition, preserving only the linear mode. As we have seen, however, there is a competing litany of voices implicitly and explicitly railing against the tyranny of a form which has somehow become *a priori* natural through a mistaken belief in its aping of how we think. This is not to say that the cheerleaders for the codex don't truly believe that the form is most appropriate. In much the same way as we might look at a typical countryside image and think that it is pleasingly "natural," forgetting

the centuries of human landscaping that have gone into its construction, so have many readers consumed printed books and reported that they appear to model their thoughts accurately. My contention is that perhaps they should have asked if their cognition has in fact been modelled to fit the printed page. As Sergio Cicconi puts it:

> Chirographic writing, and, later, typographic writing, have strongly modelled the organization of our thoughts, so much that now we tend to think of the linear and propositional structures of printed books as the most faithful representations of the way we organize thinking. But in spite of the paradigmatization of the 'printed-thought', a printed text is a very vague (and artificial) approximation of the flow of our thoughts.

We think in a "print" way, not because that's our "natural" way to think, but because our society has developed a heuristic of codex reading standardising the gestures of interaction and establishing reinforcing structures of use such as the privileging of "clean" linear thought over complexity or the realities of association, to select for its strengths in a very specific way. This has modelled our minds, and also our culture, so that organised linear thought has long been prided as intellectually superior, as a sign of the brain working at its peak; print reading, in the language of the last chapter, has been made special as the artefacts evolved. There is no doubt that organising one's thoughts into a cohesive narrative is often useful or even essential to action, but to suggest that it's our default, or even most productive state is a folly sustained by the equating of mental efficacy with the inflexible drive forward of the printed word. In the same way that the reduction of semantic understanding induced by holding a text in the hands seems to have been overcome by practiced use, so messy thought has been rehearsed into outward obsolescence. It may be the case that computer based reading which combines the hypertextual with the linear is the form most suited to our nature, or perhaps yet more applicable is some as yet unknown form, but as long as the codex is bound up in a doctrinal naturalness to which all else is inferior we are far less likely to be allowed to discover it.

Associating beyond the codex

If codex embodiment enacts an arborealised, linear, hierarchical, fixed, and unified approach to written thought then we need look at what metaphorical use might inhere in the new digital equipment for reading, where the hypertextual, computational database

network sits sometimes uncomfortably alongside the codex tradition. Let's begin with the general aspects of the materiality or apparent immateriality of digital books and the e-readers which hold them. This task is crucial, as Littau states, for drawing on a notion McGann put forward in *The Textual Condition*: "prior to the activities of particular readers, and prior to the production of particular readings, the very possibility of reading is conditioned by the physical form that the book-as-artefact takes. The kind of form will therefore determine the kind of reading, and the range of readings possible for or available to readers" (Littau 29). I'm arguing, however, that it is not just kinds of reading that are affected by form, but instead that reading influences kinds of thinking that are in turn affected, sometimes to a significant extent by the equipment that we deploy.

As I've already argued, both phenomenologically and intuitively eidetically, digital texts don't appear to be there, they seem as insubstantial ghosts on the screen that disappear when they're to be replaced by other content. As Anne Mangen describes them,

> [u]nlike print texts, digital texts are ontologically intangible and detached from the physical and mechanical dimension of their material support, namely, the computer or e-book...When reading digital texts, our haptic interaction with the text is experienced as taking place at an indeterminate distance from the actual text, whereas when reading print text we are physically and phenomenologically (and literally) in touch with the material substrate of the text itself ("Hypertext..." 405).

This perceived silencing of the hands' unique chatter with the brain, preceded by the text's chatter with the hands, may be part of what motivates resistance to e-reading built around feel and the apparent promotion of intellectual impediment. As we appear to take our hands out of reading, when we remove our tactile observation, it seems to induce a very human kind of blindness. Representations and fears of blindness[166], for all their ability to shock us with our own fragility, hold none of the horror of a true loss of touch, not just a numbness of the hands, but a removal of the skin from our sensation. To touch is never in our control - we touch against our will - always maintaining a point in pressure with something, hence the fascination with acrobatics, zero-gravity, or the weightlessness of floating in a heavily-salted sea (though none of these represent a true loss of touch or else they would become grotesque); never in our control, but for the

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[166] See, for instance, Derrida's study on representations of blindness in visual art, *Memoirs of the Blind*.

most part controlled (pain can be excessive touching, or the echo of a misplaced touch). No wonder that so many avid readers, so many holders of printed books, feel that they must speak out: in the seeming intangibility of the text might they subconsciously fear that the new technology will make us, if not paralysed, then haptically blind?

Such ideas are apparent in a blog post on "The Personality of Books and the Problem With My Kindle":

> I love my Kindle, but there's one thing that's…icky, about it. One thing that confirms all the background fear and dread I had about transitioning from actual paper to ebooks...The Kindle strips out all the tangible character of a book...When you remember a book you read, you're of course remembering the content of the book. But there are also physical markers about the book you remember:
>
> • The typeface, including the size
> • The color and tactile feel of the pages...
> • [T]he way it fades and ages, the beating it took...
> • The weight of the book, it's dimensions, and how it fits in your hand
>
> These tactile reminders help the book to occupy a place in your head. They help give the book a personality...With a Kindle, you get none of this (Barker).

Barker's concerns here are legitimate, if not insurmountable; as the Kindle design improves an increased range of fonts and layout options are likely to emerge, offering the important differentiation (on the more flexible iPad they're often already there). But what this report highlights is the importance of physicality and the perception, in line with Mangen's worries, that tangibility has been negated.

In terms of the specificity of the script instantiation's substrate, of course, this is largely correct, but the physicality of the form does remain, although it is hidden to all but the minority of users involved with the guts of the machine, with access to the reality of the forensic realm which Matthew Kirschenbaum describes in *Mechanisms*[167]. As Kirschenbaum notes "[e]lectronic textuality is...locatable, even though we are not accustomed to thinking of it in physical terms. Bits can be measured in microns when recorded on a magnetic hard disk. They can be visualised with technologies such as

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[167] Kirschenbaum identifies two kinds of materiality: "forensic" - "no two things in the physical world are ever exactly alike" (10) - and "formal" - the arbitrary material particularity, independent of forensic differentiation, of a particular interpretation of a data set, e.g. one set of image data producing a .jpeg, .tiff, .gif, metadata, histograms, watermarks etc. depending on what program interprets that set.

magnetic force microscopy (MFM)" (3). As well as discussing a typically invisible forensic materiality Kirschenbaum also asserts that software has extended material elements which should not be forgotten as evidence of its place in the world:

> Software is the product of whitepapers, engineering specs, marketing reports, conversations and collaborations, intuitive insights, professionalised expertise, venture capital...late nights (...labour), caffeine, and other artificial stimulants. These are material circumstances that leave material (read: forensic) traces - in corporate archives, on whiteboards and legal pads, in countless iterations of alpha versions and beta versions and patches and upgrades, in focus groups and user communities, in expense accounts, in licensing agreements, in stock options and IPOs, in carpal tunnel braces, in the Bay Area and New Delhi real-estate markets, in PowerPoint vaporware and proofs of concept binaries locked in time-stamped limbo on a server where all the user accounts but one have been disabled and the domain name is eighteen months expired (14-15).

Most significant for us here is that to suppose intangibility at any level of the digital text is simply a misreading: the software has a physical forensic materiality at the level of the hard disk image and in the materiality that it entails from production to distribution to use, and it is instantiated on a device which is equally physical and entailed[168]. That the phenomenological experience is of a discomforting immateriality is born of a weak *eidos* rather than a valid ontological claim. Practice and education, as ever, will surely demonstrate that though the hands' chatter has changed, the chatter still occurs. What can seem alienating at first, however, is that it is not only use that has changed, but what and how that use can mean.

Talking about electronic writing on a PC screen, Hayles' detailing of this seemingly spectral materiality is equally applicable to the e-reader:

> In the computer, the signifier exists not as a durably inscribed flat mark but as a screenic image produced by layers of code precisely correlated through correspondence rules, from the electronic polarities that correlate with the bit stream to the bits that correlate with binary numbers, to the numbers that correlate with higher-level statements, such as commands, and so on. Even when electronic hypertexts simulate the appearance of durably inscribed marks, they are transitory images that need to be constantly refreshed...to give the illusion of stable endurance through time ("Print is Flat" 74).

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[168] For more on Kirschenbaum's discussion of the alleged ephemerality and infinite malleability of digital text see *Mechanisms* 50-58.

Elsewhere this leads Hayles to argue that "electronic text is a *process* rather than an artefact one can hold in one's hand" (Hayles "Deeper"). When a book becomes a process, rather than something to be held, this must have implications for how we conceive of it. When we are first faced with an electronic text our *eidos* of the object, beyond the visceral experience of its sheer existence, consists of at least a new gestalt for us to work with, and a new context for us to situate it in, i.e. we must make it conform to being some sort of device if we are to use it. In the production of such an immediate *eidos* we must draw on prior contexts and prior gestalts for what we believe are similar artefacts; when we sit with a text, on a page or a screen, we establish a network which is complex enough that we must rely on prior conditioning in order to guide us through the basics of the engagement. If we encounter an object which needs to be hit, and we have a heavy object to hand, we don't particularly need to draw on a rich history of hammering (though we clearly do access our past experience in this activity), but text is different. The process of drawing meaning out of the complexity of a page, however it is instantiated, requires a fairly stable set of restrictions on the kinds of actions we can attempt, and the aspects we attempt to attribute meaning to. With poetry, for instance, we learn over repeated engagements that a line break can mean, but we ensure that this is not a part of our gestalt for a novel to be read, instead the line breaks are necessarily ignored. The rules for reading, of what should and shouldn't mean (and what ends up meaning anyway, due to the ways in which it might structure our experience), are complex and must be flexible enough to respond to variations in content (e.g. in a novel where line and page breaks *are* put to the task of meaning). Part of the struggle with the digitised work then, stems from our grasping to establish such gestalts for apparently incorporeal reading spaces that present text as a process.

The digital document, instantiated as a block of script, drives us to our history of print, and to writing more generally. But its appearance on an electronic device also sends us to our experience of various screens:

> Readers come to digital work with expectations formed by print, including extensive and deep tacit knowledge of letter forms, print conventions, and print literary modes...At the same time, because electronic literature is normally created and performed within a context of networked and programmable media, it is also informed by the powerhouses of contemporary culture, particularly computer games, films, animations, digital arts, graphic design, and electronic visual culture. In this sense electronic literature is a 'hopeful monster' (as

geneticists call adaptive mutations) (Hayles, *Electronic* 4).

The gestalt of the new kind of text, as our *eidos* of it forms, is at first massively expanded to include this sort of diversity of prior contexts which we might draw upon in order to attempt action and understanding; all of these things are suddenly part of both what "book" and "digital/electronic text" can mean. Hayles identifies the struggle in producing a new *eidos*, a shape that doesn't settle easily and that can only come through interaction: those first uses, if they are to have any chance of success, must heavily rely on our prior experience.

Lakoff and Johnson provide a simple example which might help elucidate this further, a description of how a change in conversation can be understood by deploying a gestalt from another realm:

> [B]eing in a conversation is a structured experience. As we experience a conversation, we are automatically and unconsciously classifying our experience in terms of the natural dimensions of the CONVERSATION gestalt: Who's participating? Whose turn is it?...What stage are we at? And so on. It is in terms of imposing the CONVERSATION gestalt on what is happening that we experience the talking and listening that we engage in as a particular kind of experience, namely, a conversation. When we perceive dimensions of our experience [of an exchange] as fitting the WAR gestalt in addition, we become aware that we are participating in another kind of experience, namely, an argument. It is by this means that we classify particular experiences, and we need to classify our experiences in order to comprehend, so that we will know what to do (*Metaphors* 82-83, capitals in original).

The conversation gestalt is born of experience with conversing, and we are able to form an *eidos* of what a conversation is to us, of its distinguishing parameters, so that when we are in an experience which seems to fit those particulars we can act with a predetermined heuristic or set of gestures which enable us to successfully negotiate that particular instance[169]. The gestalt of war, or, perhaps better, conflict, can be brought to the simple conversation gestalt so that we can, if necessary, become combative, give up or lose ground, attack weaknesses, and shoot down suggestions etc. (4). The gestalt we have for conversation alone is not enough to get us through the particulars of the new instance.

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[169] The term *eidos*, as it's described here, can also be used in conceiving our representation of our activities, of what they are to us. It too is a term agnostic to materiality where its broad mechanisms hold in a variety of instances.

Electronic reading (as with any novel engagement with new equipment) operates similarly. We have a default gestalt for bound-book reading that has emerged out of our ontogenetic experience. We are initially forced to apply that paradigm to electronic reading, but electronic reading is capable of and promotes interactions such as clicking, scrolling, swift changes and communication between content etc. which don't fit in with our printed book experience, and we must suddenly flail to find a suitable model from elsewhere to get us through the experience, one which can either be grafted onto the gestalt we first applied, or which might eventually supplant it entirely. Sometimes the search is brief, and we settle on and begin to redefine a prior relation almost immediately; sometimes we must swiftly cycle through options as the new engagement is so unfamiliar to our roster of previous experiences; and sometimes an interaction is even more subtle, fooling us into thinking that one or two of our past gestalts are more than enough to conquer the new instance and then surprising us, maybe weeks later, with their unsatisfactory ability to aid comprehension of the required aspects of the thing. This period of uncertain and unrelenting device-ive use as a new functional gestalt is forming is clearly not conducive to mental efficacy, and we might suspect that anyone for whom this time was excessive, too often witnessed in others, or never conquered in themseleves might not be disposed to championing the new equipment.

Lakoff and Johnson's discussion of structured gestalts being altered by metaphors drawn from other realms of experience also offers us both warning and explanation as to why it is not enough just to rely on a combination of the codex and computing gestalts and hope for the best:

> Having a basis for expectation and action is important for survival. But it is one thing to impose a single objectivist model in some restricted situations and to function in terms of that model - perhaps successfully; it is another to conclude that the model is an accurate reflection of reality… *To operate only in terms of a consistent set of metaphors is to hide many aspects of reality*. Successful functioning in our daily lives seems to require a constant shifting of metaphors (*Metaphors* 221) (emphasis mine).

Lakoff and Johnson deal with metaphors in the language we use that are shaped by our bodies, but their work can clearly be extended to our discussion by taking the term "material metaphor" seriously. If we keep on using a particular set of metaphors, i.e. gestalts drawn from other areas of experience, in order to understand a new interaction

then we will unavoidably hide many aspects of it; this is a lesson we learnt during our discussions of object oriented ontology in the last chapter which suggested that the way to best reveal a thing might be to consider it in myriad ways, though it will still always retreat in its totality. If we want to understand an e-reading device then we cannot stay thinking of it as a kind of codex crossed with a computer. This will prevent it from ever becoming a technology, we will not understand it, our *eidos* of it will complicate without strengthening. Instead we cycle through the metaphorical deployment of different paradigms until successful action is achieved, and then we work (or should work) on repeating that action, and this involves building a new *eidos*, a complex of a new gestalt in a new context, that we will later be able to metaphorically export to instigate new arenas if required.

Sometimes equipment comes to our attention which provokes such a new area of systematic use to acclimatise to, a new object to shape and be shaped by. During the strengthening of our *eidos* of this thing it might closely overlap with activities associated with our *eidos* of another type of object (indeed a type, such as the codex relation to the e-reader, which may have been part of provoking the new item into existence in the first place, a mutation of sorts which gets away and proliferates), causing a cognitive dissonance amongst the new users as similar activities, though impossible to be identical, can be attempted with both. If we get stranded wondering why an e-reader isn't behaving like a codex then we might certainly feel that the new medium is deficient, that it may be detrimental to our thinking because we can't use it as we want to. This is a problem, in the language of the last chapter, of understanding on both sides, a failure of metaphor, and one which can evolve to be built into the fabric of the thing.

Skeuomorphs and new kinds of reading

"Metaphors may create realities for us, especially social realities. A metaphor may thus be a guide for future action. Such actions will, of course, fit the metaphor. This will, in turn, reinforce the power of the metaphor to make experience coherent. In this sense metaphors can be self-fulfilling prophecies" (Lakoff and Johnson, *Metaphors* 156). The codex, as a potent object-to-think-with within our culture acts as a vital structuring material metaphor for the emergent eidetic experiences of the e-reader and the digital text. But an over reliance on this metaphor cannot help but lead to our treating the new

form as if it should act in terms of the old. This is problematic for several reasons, the most significant of which are that it impedes the new form evolving into all that it might be, maximising its understanding of its user (or its knowledge of its users) and it impedes our understanding of the thing, and therefore in some small ways our knowledge of the environment in which we live.

We can already see this failure in the reports that have been discussed here: much of the resistance to the new equipment can be attributed to a misunderstanding of what they are in comparison to the body of an idealised codex. Ben Vershbow and Dan Visel, writing at the Future of the Book blog well before the release of the Kindle, articulate this problem in relation to reading online and their exchange is worth spending some time with, beginning with Vershbow's initial post:

> A plant in a container grows differently than a plant in open soil. The roots conform to the shape of the pot. Similarly, our very notions of reading, of books, of knowledge classification are defined by the pot in which they grew. The texture of paper, the topography of the library, the entire university system - these were defined by restraints. Physical, economic, etc. And to a significant extent they are artifacts of their times...The computer, too, in its current stage of development, is an artifact of the paper book, the typewriter, and the supercomputer terminal. These define the 'pot' in which the computer has grown. And so far, the questions about online 'reading' are defined by this cramped root structure. Even though the pot has shattered, we continue to grow as though the walls were there ("The Cramped Root: Worshipping the Artifact").

Later, Dan Visel responded to this post, invoking an established metaphor which Vershbow also went on to mention, that of the "horseless carriage," as a way of understanding the newly invented automobile in relation to reading articles on Wikipedia:

> When we read Wikipedia we tend to apply to it the standards of judgment that we would apply to a book or magazine, and it often fails by these standards, as might be expected. When we're judging Wikipedia this way, we presuppose that we know what it is formally: that it's the same sort of thing as the texts we know. This seems arrogant: why should we assume that we already know how to read something that clearly behaves differently from the text we're used to? We shouldn't, though we do: it's a human response to compare something new to something we already know, but often when we do this, we miss major formal differences...Figuratively, what's happened with the Wikipedia is that a

new species of text has arisen and we're still wondering why it won't eat the apples we're proffering it. We judge it by what we're used to, and everyone loses. Were you to judge a car by a horse's attributes, you wouldn't expect to have an oil crisis in a century ("Learning to Read").

These commentators deploy familiar metaphors from other domains of experience in order to understand the new metaphors that are being put to work in comprehending digital reading: metaphors used metaphorically to reveal the misperceptions engendered by an over-reliance on metaphor. It's worth noting this kind of flailing for understanding lest we forget the sometimes hidden challenge of the new forms. Vershbow's point about the constricting pot, however, regardless of the image invoked, is vital: the codex evolved under constraints and provocations from its environment resulting in its materiality. If we treat the new forms as simply electronic codices then we inherit not only the useful structuring metaphors, but also a set of limitations in deployment and practice which need not restrict us. And when people experiment with new forms of production or consumption, and Wikipedia is a great example of both, particularly in comparison to the imposing physicality of off-screen encyclopedias, they can often seem bereft in their growing pains rather than a productive move toward eschewing unnecessary constraints (in the case of Wikipedia constraints such as storage, linking, portability, authorial bias, and decisions regarding suitability of materials can and have been ameliorated to a greater or lesser degree by the new formal practicalities). As Bolter puts it, the "shift from print to the computer does not mean the end of literacy. What will be lost is not literacy itself, but the literacy of print, for the electronic technology offers us a new kind of book and new ways to read and write" (*Writing* 2).

The "new book" that Bolter saw coming is more likely to become established, if it hasn't already, in the form of a text maintained on a handheld device rather than in any desktop- or laptop-requiring iteration as the connotations of "book," as we have seen, are tied to a lengthly text, one that is contained in a portable form. Though we can stretch such terms, though they might, even when stripped down this far, be immensely plastic, if they are pushed too far too hard then they will no longer seem to fit even the idiosyncratic gestalts we label "book." But at the same time, if we are too limited by our prior gestalts, if we don't push at them at all, then whilst we might not end up with the metaphorical equivalent of an unforeseen oil crisis, we can still end up with a car that doesn't like apples. In fact they're already here and may well be the real impediment to our intellect fostered by the new equipment.

We can read in the iterations of things in action the knowledge gains that culminated in their creation. The stick insect was the guiding example in the last chapter: its body can be read to know something of the worlds that preceded it. But there's also a form of negative reading that might be performed which focuses not on which aspects make something successful, but instead on those aspects which endure despite their *not* facilitating action, or even actively impeding it. In evolutionary terms these forms are called "vestiges," residual elements of evolved adaptations which were a part of the species' past when they fitted to the environment; "[t]he history of the species lives on in the modern species, and one of the most important pieces of evidence for this lies in vestiges of previous adaptations that may prove redundant, or useless, or even maladaptive, today" (Donald, *Origins* 121). The coccyx in humans, for instance, the extended "tail bone," is a vestige of the true tail that was a part of our distant simian ancestors' knowledge of their environment. Our artefacts might also be thought of as containing vestiges, and just as with their biological counterparts they persist because the environment doesn't enforce pressure enough to select them out. If the coccyx was a danger which often prevented humans from surviving long enough to mate then it would soon disappear entirely, but there seems little selective pressure on reducing the formation further, and so it stays. Vestiges are, in themselves, another kind of knowledge claim: a knowledge that the environments which preceded their manifestation were environments which largely tolerated the continued presence of their particular forms.

With our artefacts, of course, we create the selective pressures, and we aren't always neutral in the pressures that we develop. This also means that our cultural quirks, such as an over-reliance on prior gestalts deployed metaphorically but treated as reality (i.e. understanding in one realm is presumed to be wholly transferrable to ascertaining essence in another), can create pressures which *promote* vestiges in a way that is rarely found in the natural world. The term for these vestiges within artefacts, a term drawn from archaeology, is "skeuomorph":

> Simply put they are carryovers from an older technology or way of doing things that had value, and are retained as a semblance, and expectation. Characteristic of changes in technology, they confer a kind of luster. The technological reason for the feature has gone, but you expect it - it completes the object. Open a wine bottle and pour out the wine. Notice

that the bottom is dented-in, in a shape known in France as *le voleur* ("the thief"), because without it there would be more wine. When wine bottles were blown, there was no alternative: the molten glass bubbled out like a long balloon with a rounded end; this base was then flipped inside out as the bottle was set down to cool, producing the level circumferential basal ring that would allow the bottle to stand upright...the dent in the base has become a skeuomorph. *Le voleur* remains because we expect it to be there (Taylor, *Artificial* 152-153).

Skeuomorphs are readable evolutionary vestiges, hangovers from the deployment of prior gestalts in new *eidos* formation written into the things themselves. They can often be useful, acting as readily apparent material metaphors and enabling the adoption of new equipment more smoothly, as with any other metaphorical usage, by suggesting modes of engagement associated with the gestures and milieu of more familiar tools. This task is vital as there are approximately "30,000 readily discriminable objects" in the day-to-day life of a Western adult (Biederman 127-128). For this reason, as Hayles notes, they "are not unusual. On the contrary, they are so deeply characteristic of the evolution of concepts and artifacts that it takes a great deal of conscious effort to avoid them…[S]keuomorphs [can act] as threshold devices, smoothing the transition between one conceptual constellation and another" (*How We Became Posthuman* 17). But skeuomorphs, as with an over reliance on metaphors of any kind, can also preserve unneeded restriction. *Le voleur* is one example: why not have more wine(!), or use less glass? But there are more relevant examples. Take, for instance, the software that Apple launched with the iPad and iPhone[170]. Adam Greenfield, a former user-interface designer for the mobile telephone company Nokia, blogged about the cognitive dissonance he felt in using the software on his new iPhone 4:

> The iPhone and iPad...are history's first full-fledged everyware devices - post-PC interface devices of enormous power and grace - and here somebody in Apple's UX shop has saddled them with the most awful and mawkish and flat-out *tacky* visual cues...Dig...the page-curl animation (beautifully rendered, but stick-in-the-craw wrong) in iBooks. Feast your eyes on the leatherette Executive Desk Blotter nonsense going on in Notes. Open up Calendar, with its twee spiral-bound conceit, and gaze into the face of Fear. What are these but misguided coddles, patronizing crutches, interactively horseless carriages?...[A] networked, digital,

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[170] I don't want to focus on particular software beyond this example, preferring to explore the relative fixity of the physical devices themselves (though in the case of the single-use e-readers such as the Kindle the more fixed software can feel like a part of the thing itself). E-reading applications of greater or lesser complexity are abundant, with more emerging almost daily; any pretence at being up-to-date would come across as just that.

interactive copy of, say, the *Tao Te Ching* is simultaneously more and less than the one I keep on my shelf. You give up the tangible, phenomenological isness of the book, and in return you're afforded an extraordinary new range of capabilities. Shouldn't the interface, y'know, reflect this? ("What Apple Needs to Do Now").

As a designer himself, Greenfield sees these user interface designs primarily as tacky conceits, but more importantly he also feels that by giving up on the specific materiality of the equipment that the new software hopes to emulate, its "isness," we shouldn't also forget the new range of capabilities it allows; the differences, the gains and losses, need to be revealed, not occluded in a desperate bid to diffuse them. Erwin Blom states the matter baldly: "In an environment with new possibilities, I do not want to be confronted with old limitations." If Greenfield and Blom thought that we could look past these skeuomorphs, these panderings to what consumers allegedly need to be present in order to "complete" a digital calender or notepad, then presumably they would be less inclined to portray them as problematic. But these concerns for the interface's reflection of the new practices available stems, in part, from a fear that some users, maybe a majority, will not move on, will only hope to use a new thing in an old way, and a way that is not only short-sighted, but that the equipment might also not be able to live up to as it's not what it has evolved as a definition of knowledgeable success.

Another relevant demonstration can be found in the qwerty keyboard that's built into the base of the current Kindle and replicated in digital form on the iPad. The qwerty keyboard was designed by Charles Latham Sholes in the 1870s in response to the failures of previous designs, predominantly variations on

> a rectangular arrangement of keys...in alphabetical order. The levers manipulated by the keys were large and ungainly, and the size, spacing, and arrangement of the keys were dictated by these mechanical considerations, not by the characteristics of the human hand...When the typist went too quickly the typebars would collide, jamming the mechanism. The solution was to change the locations of the keys: letters such as i and e that were often typed in succession were placed on opposite sides of the machine so that their bars would not collide[171] (Norman, *Design* 146).

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[171] In an endnote, Norman wonders if this explanation may be somewhat apocryphal, after all "the arrangement of the keys doesn't completely fit the story...what about other frequent pairs such as e and r...? And it seems suspicious that the letters of the word typewriter all appear on the top row; some other constraints seem to have been operating." He also notes that there is very little difference between the keyboards of different countries where different letter pairings are more frequent (146). Even so, the mechanical concerns did need to be addressed, and the qwerty keyboard does a (perhaps surprisingly) adept job.

These mechanical requirements no longer exist on a modern computer keyboard, so the qwerty keyboard exists as an evolved vestige, though one at least partially sensitive to the language that it has to deal with. It would, of course, be an exaptation[172] if it happened to be the most efficient layout for typing, but it's not:

> There is a better way - the Dvorak keyboard - painstakingly developed by (and named after) one of the founders of industrial engineering. It is easier to learn and allows for about 10 percent faster typing, but that is simply not enough of an improvement to merit a revolution in the keyboard. Millions of people would have to learn a new style of typing. Millions of [keyboards] would have to be changed. The severe constraints of existing practice prevent change, even where the change would be an improvement (Norman, *Design* 148).

The qwerty keyboard, then, is good enough, but not perfect. Its continued existence in the face of the Dvorak layout is an example of a relative of skeuomorphs, "path dependence," where past decisions produce conditions which impact upon and limit new options for the development of equipment. Skeuomorphs partially prepare us for interaction, but by definition are redundant or inefficient (if this wan't the case then they would simply be material metaphors). Path dependence can result in skeuomorphs, and the qwerty keyboard's simultaneously unnecessary and yet unavoidable harking back to its mechanical predecessors is skeuomorphic, at least in part.

When something is adopted because it works vastly more efficiently or effectively than its predecessors, then it can begin to exhibit path dependent effects, rarely getting altered, fending off challenges to its form when the cost of reconfiguring its milieu is greater than the immediate benefits it can offer. We might say that such triumphs as that of qwerty over Dvorak are evidence that the equipment emanating path dependent practices doesn't have as significant a knowledge of its human users as the competing apparatus, and yet still manages, against evolutionary principles, to propagate. But it's more true to say that their knowledge is quite accurate, even if their *understanding* of any one user isn't as accurate as it could be. Knowledge of the user environment includes the variety of peculiar dynamics that calls them into being, and our manifest economics, the costs of time, training, and materials are all elements of

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[172] An exaptation is a beneficial adaptation which is being put to use in a way unlike its initial adapted purpose. Our ability to read is in this way arguably an exaptation, or draws on exaptations, deploying neural pathways which evolved for wholly different purposes.

what is to be known; qwerty is akin to the coccyx that never quite disappears.

E-reader design is fighting against the path dependence established by centuries of use of the codex, against choices long made, and in this competition they are manifesting material metaphors and skeuomorphic tics as their iterations build their knowledge of the user base and shape that base with offerings of familiarity. The alternative, one that Greenfield seems to prefer, is in the revelation of difference and the persuasion of the significance of the new form over the various costs of adopting it fully.

So which elements of the new equipment might be considered as skeuomorphic?

- Pagination - The Kindle and the majority of the reading apps on the Kindle still rely on pages of information which must be "turned" in order to progress (rather than scrolling for instance). The page, as a unit, has become divisive[173], but regardless of preference the reasons for its particular base-line dimensions currently has more to do with the economic environment of its printed cousins than being the optimised ratio for the equipment[174]. The iPad experience of pagination is more explictly skeuomorphic, at least in the official iBooks app, due to the user interface:

  Notice how lovingly the designers have made it look like you are in the middle of reading a physical book by drawing a little pseudo-3D evocation, down each vertical side, of the pages you have read and the pages you have still to read. What do you think this looks like when you are on page 2 of a book, or 2 pages from the end? I'll tell you what it looks like: *exactly the same*. It still looks like you are right in the middle. That's correct: because of the sentimental and unnecessary chrome, the app ends up *lying to you* about where you are in the text you're reading" (Poole "Against Chrome: A Manifesto").

- Immovable black and white text on white (or grey) page with infrequent use of images (much less video or sound) - the iPad in particular can provide multimedia presentations in a traditionally typographic environment. "Enhanced e-books" certainly exist[175], but their arrival is still trumpeted as something

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[173] Bob Stein, for instance, became compelled to write "A Defence of Pagination" at the Future of the Book blog.

[174] See Honor Wilson-Fletcher "Why Size Matters" for a discussion of different paperback sizes and their perception in book stores and publishing. One of the reasons for the increasing standardisation of paperback sizes, at least for books attempting to be best-sellers, are chain stores' displays of "3for2" offers at the front of the store, huge piles of tessellating literature: "Most novels, for example, have 300-350 B-format (ie standard paperback) pages. Deviate from this format drastically and your novel won't make it to the front tables of the bookshop. This means relatively few publishers do; and, in turn, the literary culture is shaped by that...So, even if they now seem natural, the lengths and formats of books are but cultural accidents" (Leith "Is this the end for books?"). For the origin of paperback sizing as it relates to the animal skins which held early written works see Carl Pyrdum "Why Are Books So Big?"

[175] Enhanced Editions, for instance, are a company specialising in e-books designed for iPad and iPhone. For a discussion of why enhanced e-books might not have reached a mainstream audience yet see

audacious. It's hardly beyond the equipment or programmer's skill, it would be hugely beneficial for things like text books, children's stories, and experimental fiction, and yet the standards of the print environment persist.

- Neglecting links - Endnotes can be frustrating to get to in a codex, and more so in an e-book (where they could also always be offered as a "layer" to be turned on or off), but hyperlinks are still rarely deployed to get to them. An author may not want their reader heading out of their work and online, but not linking within their own text remains an adherence to prior limitations.
- Page-turning effects and dog-earing - the iPad, as argued by Greenfield above, is guilty of the former, the Kindle of the latter (clicking "bookmark this page" in the menu discretely "folds" the corner of the "page" down).
- Page numbers - Amazon worked hard to get "true" page numbers for official Kindle editions of books[176], but why? The percentage gauge and slowly filling black bar at the base of the screen are elegant enough solutions to text which can morph at the touch of a button to nearly 10 times its original size and back again as the reader's eyes require. There's still oddly no concerted move toward a new standard for citing pagination or location in fluid digital texts.

Minke Kampman expresses hope for an end to just these kind of skeuomorphs:

> we're about to leave the stage of sentiment we are in now. A stage in which most of the commercial software and hardware still try to replicate the 'real' reading experience by imitating a book and having us turn the page, make bookmarks, and read chronologically . No wonder that we are still comparing the two ("Apples and Cabbages").

The implication here is clear: we are *burdened* by these things. They might not sound like big issues, but, to go back to Greenfield and Blom's fears, when combined they add up to a masking of the possibilities, many of them as yet unseen, that the new equipment and texts might hold. If authors, publishers, developers, or manufacturers were to singly or combined say "here's a new standard for page numbering," or "we won't do page turn effects or dog-ears anymore," or "we're abandoning the page as a unit" and cited their reasoning along the lines of "because digital is different and we want to see what it can do," then the landscape could rapidly change. Yes, new adopters would flail a little longer to find their way with the new equipment (the principle reason, of course, that nothing like this has yet been seen), but when they had adjusted they'd be fully engaged with a new interaction. If there is anything cognitively beneficial to be gained from using the new devices on their own terms, rather than the terms of the old order, then the combination of these skeuomorphic practices represents

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Christopher Mims "Are 'enhanced' e-books the future of books, or mere footnotes?"

[176] See Charlie Sorrell's discussion "Amazon Adds Real Page Numbers to Kindle."

an inhibiting of thought.

One of the principle ways in which the new e-readers alter the way in which we read, however, something no skeuomorphic adherence can hide, is in their relation to the hyperlinked structure of the internet. For all of the Kindle's appeal to being a single-use device, a tool developed solely for linear reading, it has wireless connectivity built into its every iteration, and free cellular network "anywhere" internet on the more expensive models (currently the only equipment which offers a full service of such, and maybe the only e-reader, thanks to Amazon's international reach, that will be able to do so, at least for multiple countries, for the foreseeable future). Ostensibly this access exists in order to buy books swiftly from Amazon's online Kindle store without having to go to a computer, but a functional web browser, though somewhat hidden within a menu labelled "experimental," is available via a few button presses. Presumably this experiment will conclude in future iterations with the browser's more open deployment. The same browser means that clickable hyperlinks can appear within documents. Amazon's advertising also touts that you can go from thinking of a book to reading it in under a minute[177], an activity indivisibly associated with a cultural expectation of connectivity, an expectation in stark contrast to the old order of libraries and bookshops. On the other hand, the iPad, as with any tablet, is an unashamed internet portal; any reading experience upon it will have to fit in alongside a default of web-based activity (Steve Jobs' keynote at the launch of the iPad began by describing the joy of "holding the internet right there in your hands" ("[SUBTITLES!] Apple Special Event January 2010" 1:28).

This deep and inescapable association with internet connectivity, in both types of equipment, is important to understand because it inflects any linear reading that occurs on their screens. This can be seen by folk phenomenological reports which express a desire not to be distracted during reading and of the joy of books staying "just books," for example:

> Books encourage and enable long-form thinking. Ebooks, because they are (*ex hypothesis*) on the Net, are distracting. They string together associated chunks and tempt us with links beyond themselves. It is easy to imagine ebooks providing the singleminded pbook [print/physical book] experience: "Press here to remove all links." But, of course, you could always unpress the button. Besides, since your ebook is on the Net

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[177] From the Kindle product page: "Books in 60 seconds - Download books anytime, anywhere" ("Kindle 3G Wireless Reading Device...")

> (*ex hypothesis*), all that's stopping you from jumping out of the book and into your email or Facebook [or to anywhere] is self-discipline. So, while ebooks can provide the single minded experience of pbooks, some of us may prefer the paper version to keep the distraction of the Net at bay (Weinberger "Will Books...").

Weinberger fears he might not be able *not* to take links, even if a simple option to remove them was available to him. One might wonder why people are reading things so dull as to drive them to Facebook in preference if the internet is simply made more easily available. This doesn't seem an argument against the form, after all if you're reading one book another text, computer, phone, or whatever else is often within reach; distractions always surround us. Regardless, this is a commonly voiced concern, and the "single use" marketing of the Kindle, for all of its inaccuracy, seems an attempt to placate such apprehension. Despite Amazon's efforts to hide the Kindle's functionality from their more cautious adopters, by allying themselves to any degree with the capacities of contemporary digitisation they cannot keep the internet out.

If it's always going to be a part of e-reading from the start let's return to hyperlinking, and to what it might mean. A hyperlink, most typically represented as an underlined blue word, when clicked takes the reader from the page that they are on to somewhere else, known or unknown. The author of the document sets the hyperlink marker, which word or image is clickable, and they set the destination; the reader chooses whether or not they are going to click the link. This doesn't mean, however, that an unclicked link has no meaning. Steven Johnson describes hyperlinks as an entirely new linguistic element, "the first significant form of punctuation to emerge in centuries" (*Everything Bad* 111), and this is an apt description; hyperlinked words do not change the words themselves, at the level of letters, but instead augment and alter their meaning and capacity to mean. In early writing systems pictographic script represented spoken words; the spoken "bird," in the simplest pictogram, would have a representational or symbolic parallel with the image of a bird. A text was accurate if the interpretations of each image matched some value of what the author intended. A chirographic or typographic written word is different: it is more precise, and part of its ability to better capture specific meaning comes from its representing, or coming to represent a spoken word inscribed many times with its own history and context. For instance,

> [l]inguists classify English as a *morphophonemic* writing system because it represents both morphemes (units of meaning) and phonemes (units of

sound) in its spelling...[T]he linguists Noam Chomsky and Carol Chomsky use words like 'muscle' to teach the way our words carry an entire history within them[178]…For example, the silent 'c' in 'muscle' may seem unnecessary, but in fact it visibly connects the word to its origin, the Latin root *musculus*, from which we have such kindred words as 'muscular' and 'musculature.' In the latter words the 'c' is pronounced and represents the *phonemic* aspect of our alphabet. The silent 'c' of 'muscle,' therefore, visually conveys the *morpheme* aspect of English. In essence, English represents a 'trade-off' between depicting the individual sounds of the oral language and showing the roots of its words (Wolf, *Proust and the Squid* 42-43).

To look at a pictogram of a muscle, it would always mean the concept of "muscle"; whatever the culture dictated that concept to be, the image would always suggest to the reader their current interpretation of that conventional concept. But if we look at the word "muscle", with its silent "c," then we get the full morphophoneticism of English coming to the fore: the Latin root, with its pronounced "c," hides within, a conceptual trace, a history more or less known, and more or less affective to the reader. But now paint that word blue and underline it, put it on a screen and it becomes imbued with possibility. This contraption now means the interpreted cultural concept of the spoken or inscribed "muscle," like the pictogram; it contains "musculus" and a history of use, like the inscribed word; but it also reminds us, without our even clicking it, in fact without, now, it even *being* a hyperlink of everywhere it might take us: anatomical diagrams, bodybuilding, bodyguards, seafood even, or somewhere we have yet to learn.

Consider for example this section from George Church's essay "Ctrl+Click to Follow Link":
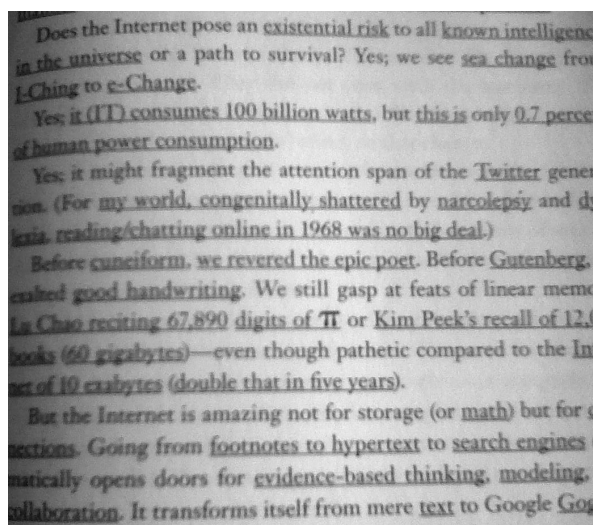
(143).

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178 Wolf cites N. Chomsky and Halle *The Sound Pattern of English* and C. Chomsky "Stages in Language Development and Reading Exposure" in this regard.

The urge to click is unbearable, and yet this is a paperbound essay. The links clearly have an effect here, are a part of the meaning of the writing; even if they cannot be followed they still have implications for interpretation. Hyperlinks, and their apparent manifestations, represent a personal aspect to every underlined word, of choices made to access, or not, a unique link or combination. They are *hypermorphophonemic*, conceptual, historical, possible.

But if every e-reading space is tied to hyperlink-inflected reading, either explicitly with an ever-present browser, or metaphorically through early-adopters deploying their computing gestalts to get a handle on the new screen, then suddenly any particular word need not even be a visible link, instead every word carries this new weight. Hyperlinks exist to remind us that we can head out into other texts, out into the world, that where we are is not the final say, and that the boundary lines we have revered in print are blurred at best, and potentially inconsequential. In the webs of text online, hyperlinks chart an authored path, whilst simultaneously reminding us that with Google only ever a few clicks away we can always break out from the document we're reading to wash ourselves in information whose connections are of a much more arbitrary and idiosyncratic variety. That promise of hyperlinks now exists in all digital texts, whether they appear online or not, and this weaves a gentle magic, existing as a fundamental, conscious or unconscious breakdown of the privileging of the boundaries set by the author or typesetter, and the immutability of bound paper text; for experienced readers of digital texts the hyperlink device can become an incorporated technology.

We can see this written in the expectations built into the equipment. The Kindle 3, for instance, allows you to search for any word within a document, and this parallels and extends one of the first hyperlinking systems created: the printed index. But any word, or word string, can also be searched for in your entire Kindle corpus, binding all of your texts together, drawing links and associations, or it can be searched for in the Kindle store, linking together the nearly 1 million available documents there (950,000 as of June 2011). The dictionary search function, highlighting any word on the page you're reading and looking up a definition in the built-in database, similarly parallels a pre-existing link making mechanism. But that same highlight and search function, with one more button push, can search for the term in *Wikipedia*, probably the second most popular example of the power of hyperlinked information, or on Google (the first).

Every word in a Kindle text is always already a hyperlink to somewhere beyond the text you're working with. This is the type of newness Adam Greenfield suggests should be made apparent by the interface, and yet on the Kindle it is subtle, untrumpeted, hidden an extra submenu away from a familiar index-type search almost out of embarrassment for its un-codex-like power, and yet it remains unavoidably a part of the new reading environment. As Nancy Kaplan asserts,

> [t]urning a book's pages…adds nothing to signification: the end of a page is an arbitrary boundary imposed by an intransigent material world. Taking a link from here to somewhere is not the same thing at all, for in the aggregate the set of chosen links and each link's place in the set play off against all the sets passed over. That doubleness - the links taken and those passed by - brings a particular reading into being (227).

A particular, and particularly new reading, hiding behind the skeuomorphic capital that the equipment still manifests in its software or hardware.

Hyperlinks are impossible to escape. On the one hand their potentially distracting presence may be seen as part of the detrimental effects of the new hardware, but on the other this very factor is a large part of the e-reader and e-book's new powers as objects-to-think-with, what might, if we can get past the codex as a default, be an enabler of new and productive thought rather than its impediment. How this new reading could unfold is, of course, unpredictable, but the remainder of this chapter will attempt to show some ways in which it is starting to manifest.

The weight of a body in theory

In 1991 Bolter argued that "[t]he intertextual relationship occurs everywhere in print….yet the electronic space permits us to visualize intertextuality as no previous medium has done" (*Writing Space* 164). *Writing Space* came out in the same year as the public launch of the World Wide Web[179], and the rise of ubiquitous internet access in the subsequent years would lay claim over the local hyperlinked documents Bolter was describing. Now, with the rise of a new generation of portable e-reading equipment since 2006, there's a medium which may supplant the internet enabled desktop computer or laptop in its status as an object-to-think with for intertextual, non-hierarchical, reader>author textual production and reception. Critics of the new technologies might

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[179] See John Naughton *A Brief History of the Future: Origins of the Internet*.

call them out as diminishing our intellectual ability, and in the short term they're likely right as we attempt to adjust; there may yet even prove to be something about these sleek screens' seemingly intangible documents that is problematic for certain kinds of apprehension, particularly in very young children learning to read for the first time. And related to the hardware, but not inherent within it, is the problem of "information overload" that commentators such as Carr refer to, not knowing when to stop clicking, when to disconnect and concentrate, when to read linearly rather than bouncing around the database, something that wouldn't occur with more traditional reading material[180]. This, however, is not a problem of "the screen" that Bauerlein and others fear, but rather a problem that needs to be addressed in education and cultural perception; no one is, or at least no one should be arguing that children shouldn't be taught how to read appropriately in the new environment, that they shouldn't be equipped with skills commensurate to the task of balancing diverse ways of interacting with media. But adults who didn't grow up with that education (and, unless we start teaching children appropriately, soon there may be too many of those) need to work hard too, to decide what they want from their sources of written information and entertainment and to try to produce a culture which values sustainable, responsible, enlightening engagement. As Google's Larry Sanger bluntly puts it,

> [d]iscussions such as Carr's assume that intellectual control has already been ceded - but that strikes me as being a cause, not a symptom, of the problem Carr bemoans. After all, the exercise of freedom requires focus and attention, and the ur-event of the will is precisely focus itself. Carr unwittingly confessed what is for too many of us a moral failing, a vice; the old name for it is intemperance (in the older, broader sense, contrasted with sophrosyne, moderation or self-control). And, as with so much of vice, we want to blame it on anything but ourselves ("Bleat for Yourself" 405).

Regardless, that these concerns exist is enough to render them important; they

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[180] That said, Vaughn Bell offers an interesting historical counterpoint:

> A respected Swiss scientist, Conrad Gessner, might have been the first to raise the alarm about the effects of information overload. In a landmark book, he described how the modern world overwhelmed people with data and that this overabundance was both 'confusing and harmful' to the mind. The media now echo his concerns with reports on the unprecedented risks of living in an 'always on' digital environment. It's worth noting that Gessner, for his part, never once used e-mail and was completely ignorant about computers. That's not because he was a technophobe but because he died in 1565. His warnings referred to the seemingly unmanageable flood of information unleashed by the printing press ("Don't Touch...").

shouldn't be ignored, but equally they shouldn't be taken as the dominant or most accurate voices. It remains the case that supporting empirical evidence just isn't present. Detailed studies with large sample sizes need to be undertaken, and opinions modified in their wake, but neither advocates nor detractors should assume that their position is currently clear. I have suggested, however, that we can start to go some way to forming opinions on whether screens themselves somehow have the capacity for making us more stupid: maybe, if we insist on retaining skeuomorphic design features that invoke older forms not as enabling material metaphors, but as path dependent restrictions on new possibilities for metaphorical use. But there is also much possibility for using the new equipment to think through complex ideas.

I've already spoken of hyperlinks, and the effects that they can have on the reception of a word; this effect is amplified by making every word a potential link in the Kindle and any future e-reader which attempts to ape its functionality, and the always-on anywhere internet of the iPad (and the tablets that hope to compete with it) continue the work begun by the desktop and laptop computer, also acting as a constant reminder that one can always be somewhere else, that all information can be connected. These kinds of interactive associative reading that are allowed, implied, or provoked by the equipment demonstrate the non-linear human aspect that can be found in hyperlink-enabled forms of reading. In *Narrative as Virtual Reality*, Marie-Laure Ryan uses a child's bedtime story as an example of a rarely passive audience: "Why's the princess called that?" "No, stupid, she doesn't go *that* way!" "But how many beans did Jack *get* for the cow?" During codex reading we all constantly ask these same (or similar…) questions of our literary texts, although the authors we have to endure as adults seem unwilling to accommodate our enquiries. As such we must constantly forge our own links with other texts and with our experiences in an attempt to fit each new document into our understanding. Internet enabled reading equipment allows us to return, somewhat, to asking the questions of our childhood (a time of near constant learning and reevaluating), seeking answers that we often had to wait too long to find for ourselves when our authors became silent Others. This finding of answers is, of course, a crucial facet of education, and not something to back away from; the only difference is that electronic hypertexts enable us to find answers to the more esoteric questions, to find the stranger links in our own fashion, and to find them now. The impact of this state of affairs, of no text being considered in isolation, of having the covers ripped off of our books and exposing them to their surrounds, is reflected in the Inuit word for

"internet": "When the time came...to find an Inuktitut[181] term...Nunavut's[182] former Official Languages Commissioner, Eva Aariak, chose 'ikiaqqivik', or 'travelling through layers.' The word comes from the concept describing what a shaman does… travel[ling] across time and space to find answers" (Soukup). Like the shaman of Far Northern Canada we move without moving in an uncertain journey to find what we need amongst our networked texts. Arthur C. Clarke's appeal to sufficiently advanced technology's being indistinguishable from magic seems resonant.

The new screens persist in their imperfect relations to linguistic turn philosophies and critical theories. Nancy Patterson saw in the ever changing face of the computer a material metaphor for Barthes' birth of the reader: "The fact that electronic text is no longer caught between the covers of a book, that it only becomes present when a reader calls it up on screen, invites the reader to come closer to the text, to write the text anew each time he or she engages with it" (74). But if the internet enabled PC matched the turn toward the word and to networked relations in twentieth century thought, contemporary philosophy may find a more suitably allied object-to-think-with in the e-reader or the tablet. Phenomenology's concern with embodiment, perhaps most vividly expressed in the work of Merleau-Ponty, became neglected in the wake of his student, Derrida, and Deconstruction. With the new century, however, and the continued work in fields such as Gender Studies, Queer Theory, the Extended Mind, and Embodied Cognition there has been a sustained return to the concerns of the body, incorporating the lessons of the abstract linguistic movements, negotiating Cartesian dualism, and looking at what it means to have, or to be, or to act with, or act within, or act upon a body. And yet here comes a technology which, at least in the texts that it projects, seems to have none. In the work of Digital Humanities researchers such as Hayles and Kirschenbaum who attempt to reveal and read the electronic text's continuing materiality we can see a parallel struggle to bringing the body to light in philosophy, psychology, sociology, and critical theory.

"Electronic text is the first text in which the elements of meaning, of structure, and of visual display are fundamentally unstable…[R]estlessness is inherent in a technology that records information by collecting for fractions of a second evanescent electrons at tiny junctions of silicon and metal" (Bolter, *Writing Space* 31). Mark Hansen also notes this restlessness and associates it with the screen's always containing

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[181] The Inuit language and dialect variants in Canada.
[182] The newest Canadian territory.

a Library of Babel-esque infinity of images based on alterations of the current image: any screen of information is "a merely contingent configuration of numerical values that can be subjected to 'molecular' modification, that lacks any motivated relation to any image-to-follow, and indeed that always already contains all potential-images-to-follow as permutations of the set of its 'elementary' numerical points" (*New Philosophy* 8). This aspect of the electronic text cannot help but be felt in its comparison to the codex reading from which it follows: that we can call up such a variety of materials without seeming to have the object in our hands change in any substantial fashion is a new experience, the phenomenological impact of which should not be ignored. Discussing this novelty, another influential early researcher of digital texts, Espen Aarseth, finds himself wondering "[w]hat is the difference, in terms of script, between *Don Quixote* on paper and *Don Quixote* on a screen? I believe they are the same, although I 'know' that the ink-cellulose relationship promotes and impedes different rituals of use than does the electron-phosphor relationship" (*Hyper/Text/Theory* 766). The "electron-phosphor relationship" has become the electron-liquid crystal relationship, or the electron-eink dot relationship, but the point still stands: *Don Quixote* remains scripturally the same, but the *text*, the complex relationship of script, medium, and reader, alters. Aarseth knows that they are the same words, but he also recognises that his interaction must be reconfigured by the change in medium, which prompts a change in himself in terms of the "different rituals of use," i.e. the formal change alters the reception of its content to such a degree that the mode of interaction, the gestures must alter too. Birkerts explains his own response to this change - a change which can feel highly problematic to anyone used to a sense of stability when it comes to printed text - as a difference in "weight," a belief that to move a text to the screen is to devalue it: "The word cut into stone carries the implicit weight of the carver's intention; it is decoded into sense under the aspect of its imperishability. It has weight, grandeur - it vies with time. The same word, when it appears on the screen, must be received with a sense of weightlessness - the weightlessness of its presentation. The same sign, but not the same" (*Gutenberg* (1996) 155). There are two important aspects to Birkerts' report here. The first is that even a single word can be somehow felt differently against the backdrop of its medium, that the way our bodies materially encounter the artefact can shape our reception of what it holds. The second is that this functions by comparison: the word on stone vies with time, but that same word is surely weightless on the screen only by comparison with more tangible artefacts. If we're used to reading on stone (or similarly enduring media,

bound paper codices for instance) then the sheer transience of the screen is shocking. But the transience of orality doesn't and didn't shock pre-literate peoples with no comparison. This leads us to wonder whether Birkerts' assertion will itself endure for some future generation which might grow up only knowing access to media presented on a screen. I'm not, particularly in light of what has been discussed in this chapter, solely appealing to such relativism. Something about stone as a material really does seem to suggest, to afford, if not grandeur then longevity, as the earlier quotation from Drucker would suggest. I merely wish to say that the cultural baggage might be played down over time, even if the suggestions of the material itself remain. In Birkerts' eyes, in a text's lacking permanence it begins to lack authority, something bound to the physicality of the codex that we often never appreciated was there.

Following MSA

This lack of appreciation is fast disappearing, however, prompted by the debates which are opened or reinvigorated by the new equipment. That they need to be begun, rather than continued, is the reason that Hayles, in her landmark work *Writing Machines*, called for literary scholars of all stripes, but particularly those involved with what would become more formally termed "electronic literature," to adopt a more Media-Specific Analysis (MSA). The Kindle, and portable e-reading in general should be of particular interest to proponents of MSA because it reopens, reinvigorates, or, for most non-academic readers, simply begins the debate surrounding embodiment and materiality in textual comprehension. When Jerome McGann wrote on the subject of the embodied text in *The Textual Condition* it wasn't surrounded by a thousand newspaper articles (let alone blogs and comments) speaking rapturously about the scent of books, old or new, and the joy of being able to read them in the bath. I don't mean this to be a flippant observation, but rather an acknowledgement that we are surrounded by extensive folk phenomenological reports of the change in reading experience prompted by e-readers; the mere existence of the new equipment alters our engagement with the old, emphasising once ignored aspects. Perhaps this is something akin to CDs replacing vinyl: again, it wasn't until the presence of the new medium that the particularities of something that already existed began to be, not appreciated (presumably they were already appreciated, even if not identified as themselves), but vocalised, rhapsodised. That so many voices in non-academic media and casual discussions are now speaking to

such specific aspects of the codex as paper weight, typography, contrast, pagination, the heft of the object, in short that they are discussing the intimacies of an artefact's embodiment and its impact on the reading experience is a minor miracle, and one which should get any researcher of writing technologies excited, particularly those who have bought into some flavour of MSA.

"Understanding literature as the interplay between form and medium, MSA insists that 'texts' must always be embodied to exist in the world. The materiality of those embodiments interacts dynamically with linguistic, rhetorical, and literary practices to create the effects we call literature" (Hayles, "Print is Flat, Code is Deep" 70); **"Media-Specific Analysis, [is] a mode of critical interrogation alert to the ways in which the medium constructs the work and the work constructs the medium" (Hayles, *Writing Machines* 6). Hayles saw the need for MSA arising from a neglect, in various forms of literary study, of materiality's capacity to mean:

> Whereas art history has long been attentive to the material production of the art object, literary studies has generally been content to treat fictional and narrative worlds as if they were entirely products of the imagination...By and large literary critics have been content to see literature as immaterial verbal constructions, relegating to the specialized fields of bibliography, manuscript culture, and book production the rigorous study of the materiality of literary artefacts (*Writing Machines* 19).

But "[l]iterature was never only words, never merely immaterial verbal constructions. Literary texts, like us, have bodies, an actuality necessitating that their materialities and meaning are deeply interwoven into each other" (*Writing Machines* 107). The codex always had a body, of course, but it was neglected through long use, through over familiarity, and most often by the very people who should have been paying it the most attention. Bibliography, Book History and Textual Studies are all, clearly, built around media-specific practices, and Hayles appreciatively notes their contributions; her concern is with literary scholars, researchers used to close reading who in their neglect of the material supporting the script haven't, historically, looked closely enough. Suddenly, however, at the birth of an increasingly normalised digital reading the body of the codex and the body of the reader, in their complex of gestures and affects, are beginning to be considered anew alongside the discussion of *where* a text occurs, and this in a variety of levels of discourse. Ironically, in part this stems from how such texts

can seem to be intangible themselves. Inherent within the new forms may lie the provocation to consider bodies of all kinds; the missing weight that Birkerts sensed is something which is being played with, not something that is being ignored.

Following Hayles' call for a more media aware criticism, I would like to take this final section as an opportunity to look at three writers who responded to the equipment of their times in order to produce meaning: E.E. Cummings, Mark Danielewski, and Jonathan Safran Foer. I hope to show that each of them were inspired by certain objects-to-think-with and used them both to alter their own *eidos* of what print could be and achieve, and to contribute toward provoking alterations in our own perceptual gestalts. In this pedagogical role they each provide us with something important: disruption, a revealing of the constituent parts of a thing so that they can never be put back together in the same way again. Their work exists as proof that technology didn't stupefy them, but instead enabled them to do things that were truly smart, and the products that they came up with become new objects-to-think-with and material metaphors for our own elucidation. In the case of Danielewski and Foer it was even the new digital media that made them think, despite any intellectual impediments it may also have offered.

The first lines of one of E.E. Cummings most famous poems reads:

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since feeling is first
who pays any attention
to the syntax of things
will never wholly kiss you (Is 5 93).
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Robert Wegner, drawing on these words, suggests that within Cummings' poetry can be found a warning: "The danger of unquestioning obedience to the syntax of things is sterility" (142). Not that Cummings wholly ignored the syntax of things; rather he paid meticulous attention to how others' adherence to the rules of language could enable their subversion, as an act, to mean. Those who obey unquestioningly the "rules" of things will never be wholly able to engage with the world; far better to test, to provoke and be provoked.

Cummings' most famous literary trope is his play with capital letters, notoriously extending out to the inscription of his name at times. But rather than a simple affectation Lloyd Frankenberg suggests that the device was enabling, allowing "his capitals the

ability to say more than their obvious remark, 'I am starting a line.' They...were restored to the ear ('mOOn Over tOwns mOOn'[183])" (x). Cummings' outlandish use of line breaks and punctuation can often, if not always, also be traced back to such impulses. Barry Marks, for instance, explores Cummings' use of the lines "so/!f!/t"[184]:

> By isolating the 'so' of 'soft,' [Cummings] added a 'logical' intensification by suggesting the idea 'so soft.' More importantly, the exclamation points surrounding the 'f' make the sound of the letter a metaphor for his precise meaning. Cummings says to us, 'If you really want to know what I mean by 'soft,' then listen intently, even feel the letter 'f.' Say it to yourself and observe the way you blow air over your lips. That's my meaning!' (101).

Frankenberg sums up the impulse nicely: "He goes behind the rules to the reasons; puts commas, semicolons, colons, question-marks and periods where they can be heard; leaves them out where they can't" (x). Marks would later articulate the power of Cummings' manipulations, saying that they "enable the reader to hear trains 'chewing.' They fracture the reader's expectations about the meaning of words and their relationship to one another" (101).

  An often overlooked aspect of Cummings' work, however, lies in his use of the typewriter. Similar to the function of his other literary devices, Cummings causes the writing equipment to go against the grain of its position: rather than being meekly invisible, allowing the words to speak for themselves uninterrupted, Cummings instead uses the typewriter in such a way as to extend his and its capacity to mean. I say overlooked not because no critic has ever spoken of it (far from it as we shall see), but because in the reproductions of his work in collections and online, in critical editions and quotations in scholarly journals the particular patterns and messages of the typewriter, so richly developed in the poetry, are occluded, not merely removed but erased and made impossible to think of.

  In an article that would be redrawn in his later biography, Richard Kennedy recounts Cummings' first experience of Ezra Pound's "The Return" which he discovered in 1916, immediately prior to the summer where he would begin the meticulous research which would lead to his purposefully machined poetry. Kennedy states that

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[183] A quotation from a poem of the same name collected in *No Thanks* (3).
[184] In the poem "(fea" (*Complete Poems* 653).

[h]e was moved by the linguistic expressiveness of the piece, which used modern diction and oblique treatment for a classical subject, the decline in the power of the gods. But the arrangement on the page, he said, 'the inaudible poem - the visual poem, the poem for not ears but eye - moved me more'…For Cummings, Pound's poetic example provided a release from formal bonds, and as he sat at the family typewriter trying out visual arrangements, he saw that there were immense possibilities for expressiveness in the combinations and the separations of the words on the page (176-178).

I'd like to pause here, with Cummings about to discover the possibilities of the typewriter, to suggest a critical idea with which to frame the discussion of a poem which is clearly a product of these experiments.

In the first chapter we looked at how the body can bring tools "on board" to such a degree that, during successful use, the brain makes no distinction between the tool and the limb holding it, at least not at the simple boundary line of the skin. If the body schema can be expanded to include tools, how else might minds mesh with objects in the world? Andy Clark and David Chalmers' work on "The Extended Mind" began with a related question and answer: "Where does the mind stop and the rest of the world begin?…Some accept the demarcations of skin and skull, and say that what is outside the body is outside the mind…We advocate [instead]…an *active externalism*, based on the active role of the environment in driving cognitive processes." When we count on our fingers, or use a pencil and paper to write down a shopping list, or increase our reliance on our mobile phones and internet document storage instead of keeping items in long-term memory (or learning them in the first place), then we actively recruit items in the world to further our cognition (and note that each of these aren't mere memory aids, they also affect what and how we think). Biological boundaries must be questioned, Clark and Chalmers say, as a common sense mapping of the boundaries of mental work; such work also goes on in the world. For instance, what if that work, save for such boundaries, would be considered a fully cognitive process? They invoke a "parity principle" to begin such a thought experiment:

If, as we confront some task, a part of the world functions as a process which, *were it done in the head*, we would have no hesitation in recognizing as part of the cognitive process, then that part of the world *is* (so we claim) part of the cognitive process…In these cases, the human organism is linked with an external entity in a two-way interaction, creating a *coupled system* that can be seen as a cognitive system in its own right...If we remove the external component the system's

behavioural competence will drop, just as it would if we removed part of
its brain ("Extended...," emphasis in original).

We saw in the first chapter Maravita and Iriki's discussion of how tools can be brought
"on board" into the kinaesthetic representations of our bodies in action; here Clark and
Chalmers state that our cognition can pass the other way and be spread onto objects in
our environment in such a way that the *system* of brain, body, and object can be thought
of as cognising (rather than simply a post-dualist construct of body-affected mind). If
we then take this parity principle and apply it back onto incorporated/ready-to-hand
tools then we can come to the following formulation: If there exists in the world a tool
even temporarily incorporated into a user's body schema where if the work performed
with it was achieved by the user's bodily assemblage alone we would consider it the
work of the body, then it is best considered as a part of that working assemblage, not a
mere addition to the thing which works. For example, if driving a nail could be achieved
by the brain's stimulating the shoulder working with the bicep, working with the tricep,
working with the elbow, working with the forearm, working with the wrist, working
with the hand, working with the fingers, then we would say that the nail could be driven
by the body, or by the arm or hand if we ignore the entailed apparatus. In the same way,
when the hammer comes on board with the arm, it extends our concept of the arm's
abilities, and the new *assemblage* is able to drive the nail - the hammer cannot drive the
nail, the arm cannot drive the nail, only the assemblage has that ability. However,
though the hammer is as invisible as any other biological element within the
assemblage, we still choose to mark a distinction at the boundary of skin and object,
seeing user and thing rather than a gestalt machine comprised of parts, a separation
which the unconscious action of our brains, for that time of work, does not. Clark and
Chalmer's parity principle asks "why?" In our conscious lives the distinction makes
eidetic if not ontological sense, but we largely addressed this issue in the last chapter.
Here, instead, we'll now see how this question might be usefully put to work in
considering the boundaries of written texts.

Kinaesthetic extensions

I would like to re-appropriate the term "kinaesthetic" as a critical theoretical term, one
bound to Textual Studies and MSA. I would like to use the term to suggest that as we

might naturally be kinaesthetes of our own bodies, appreciating consciously or unconsciously our gestures and their changing shapes in concert with our tools, so we can also become increasingly kinaesthetically aware of textual bodies, that the extent of their forms might be brought to consciousness and, crucially, made malleable in much the same way as our own in-built kinaesthetic experience. A "textual kinaesthetics" would be the attempt to expand or alter a reader's notion of what could or should be included in the meaningful assemblage of a text in action.

In this way, McGann's project in *The Textual Condition* could be considered under the umbrella of textual kinaesthetics as he passionately describes the text as "a laced network of linguistic and bibliographical codes…[S]uch matters as ink, typeface, paper, and various other phenomena…are crucial to the understanding of textuality… [A]ll texts, like all other things human, are embodied phenomena, and the body of the text is not exclusively linguistic" (13). In this call for a more nuanced notion of what should be included in the assemblage of the text, McGann extends our conception of "text," "codex," and "page," changes their meaning, changes what we might include under their name, and in so doing alters the way in which we apprehend their bodies. McGann's work has been vital in displacing the automatic privileging of script-content as the ultimate meaner, allowing for an image of the text, a body image, which is materially aware.

In the same way that cognitive science is revealing how we are able to spread our cognitive load onto our bodies (in gesture for instance) and out into objects in our environment, I would like to argue that critics, theorists, authors, poets, and playwrights can perform a function analogous to the psychologists: revealing how texts can spread the load of meaning further than the previous sanctity of their own minds (their content), onto their bodies (as Textual Studies and Book History have long argued), and out into objects in their environment in the vein of Clark and Chalmers' Extended Mind.

Barthes and McGann both speak of such objects when they rightly bring the reader into the meaning making of text. They, and the critics they've influenced have contributed to a sense of text that can describe operations of meaning which exist beyond the material body and script-brain. As Aarseth describes them, "[t]exts are cross products between a set of matrices - linguistic (the script), technological (the mechanical conditions), and historical (the socio-political context)" ("Nonlinearity and Literary Theory 766). Such work seems to suggest that we should think of text not as a thing, even in a particular instance, but instead as an *interaction*, an assemblage

triggered by a script presenting object (e.g. a codex) meeting an equally embodied reader-subject; the reader brings their baggage, mental and physical, and the codex brings its own along too, both lexical and material[185]. Barthes' essay "From Work to Text" is clearly relevant in this regard: he argues that a text is immune to single interpretations, and concerned with a web of interactions surrounding artefact and reader, a polyphony of interpretation, origination, and intertextuality, aspects which are necessarily untheorisable and unquantifiable in the particulars of their effects. The text's meaning is produced anew in each play of these meetings, but in some cases only to the extent that the reader is made aware of them. The material existence of the page can mean in all sorts of ways that are unconsciously recognised and incorporated into the text, but some meaning is made only when it is brought to our attention, dragged in out of the cold so that we can recognise its role.

I would like to explore these identifiable "calling-outs" from works to events outside of their immediate material existence, particularly those outside of the reader's own typical interpretative strategies. When we have become complacent with what a written text can be, a kinaesthetic extension is an instance in any work, literary or theoretical (or both), which teaches us to expand our comfortable image of how far a text reaches, and provides a new extensive way of making meaning for future readers and creators. The specific study of such would be Textual Kinaesthetics, itself an attempt to persuade its readers of an expanded definition of "text" revealed by an artwork or critic. The following examples are some preliminary kinaesthetic readings, but they will culminate with examples from two writers, Danielewski and Foer, who straddle all of our discussions here: lovers of codices in the face of the digital, but supporters of the power of the new forms; fascinated by materiality; and revelling in the meeting of bodies and traditions as sites for mass, democratic, novel thought and spaces which aid rather than impede, provoke rather than diffuse the wrestle with difficult theoretical, philosophical, and cultural ideas.

Extension in practice

In the summer of 1916, Cummings followed his encounter with Pound by sitting down at his typewriter and producing line after line of formal experiments, learning what the

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[185] In this regard also see Michel de Certeau (167-169).

machine could and couldn't do to words and letters[186]. In the first poem of his collection
95 Poems we can see how this play came to fruition in a kinaesthetic extension:

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iness
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This poem is a great example of one of Cummings' almost haiku like forms. At first it
looks like a mess of letters, but then we come to see the words, just four of them - in the
parenthesis: "a leaf falls," and surrounding that: "loneliness." It's arrangement enacts
the falling of the leaf described, the alternating "af" and "fa" in the 4th and 5th lines
suggesting its twisting descent on its way to the longest line, "iness," that forms the
ground; in this respect it is almost a concrete poem. Marks, during an extensive
discussion of these few words, states that "Cummings' poem does not make an assertion
about loneliness. Such an assertion would not have been very interesting...Instead, the
poem combines the abstract idea and the concrete image in such a way as to show us
something…it asks us to look at the printed page" (23). What, then, is particularly
important about the materiality of this poem? Marks begins by asking us to look at the
word outside of the parenthesis:

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one
l
iness
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"Thanks to the modern typewriter," he says, "whose letter 'el' (l) doubles as the figure
'one' (1), Cummings shows us that a very commonplace word is really a quite singular
word. It states its meaning five times. It says 'loneliness,' but it also says, 'one-one-one-

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[186] See Richard Kennedy's biography of Cummings' *Dreams in the Mirror: A Biography of E.E.
Cummings*.

*i*ness' (that is, the quality or condition of being 'I')" (23).

The significance of the typography is only available to us if we understand that the text extends beyond the material artefact of the poem from which it originates. It's not enough simply to see that there are what appear to be numeral ones on the page, because then we would misread the poem, we couldn't read the word "loneliness." Typically readers gloss over such peculiarities of typewritten typography so that they might get to the "text itself," appealing, as we have discussed, to a pre-established gestalt of what should be read. But this poem punishes such adherence to the syntax of things by withholding meaning, becoming boring. It's not just the final means of production that are written into the poem, not just the printing press and the paper, but also the equipment of writing, of thinking, that Cummings deployed. Forever enshrined in the poem is its inception, and for anyone who works it out for themselves, or becomes aware of Marks' own kinaesthetic study, his bringing to light of this peculiarity of the text, they cannot help but consider it and to go looking for it, or something similar, in Cummings' other poetry. And this is important because the text, when it now makes it into various reproductions, often isn't presented in even some simulacra of typewritten script, therefore erasing, in the absence of Marks' critique, the poem's full capacity to mean. *With* Marks' critique, however, every edition can become richer; even in the absence of the reproduction of a particular machined typography an extra layer of meaning exists as it is recalled.

With this idea in place we can read the poem more fully, seeing its mess of singulars and articles. To start with, it's the first poem in the collection, labelled simply "I," or one, and now the first line potentially reads "one" then "a," the indefinite article. Or, as Iain Landles argues, it might read "la," the French feminine singular, followed, in the second line, by "le," the masculine (38). With both Marks and Landles' readings in mind we might ask whether the representation of the sexes there refers to the two els, now ones, of the fifth line which sit paired whilst the wholly separate other ones mope at opposite ends of the clipped lines 1-8. What can make us feel worse when we are lonely, after all, than seeing a happy pairing? But, to the contrary, there might now be a tension in the letters after "leaf," from the second half of line four, which now reads "all's one, one-iness," or "all's oneliness," a statement either that everyone and everything is always alone, or, in another twist, that instead we continually live "at one" with the world, an assertion which subverts, trivialises, or perhaps provides a Whitman-esque solution to any temporary feelings of loneliness that we might have.

None of this could present itself were it not for the typewriter being dragged out of obscurity and into the text. Marks concludes that "Cummings' treatment of 'loneliness' adds to the word not a semantic quality but what critics of the visual arts call a 'plastic quality.' He does not deepen or extend its meaning in any way; it has suddenly become vital to the touch, as it were, and has become an object of delight" (24). Something different is going on here than a text merely referring with its content. When the poem talks about an apocryphal single leaf falling it doesn't bring the materiality of leaves into the text's meaning, only meaningfulness, as a single leaf falling relates metaphorically to loneliness. When the poem calls-out to the typewriter, however, it brings the materiality of that object into *meaning*, and not meaningfulness; the typewriter's operation has very little to do with loneliness, and yet it holds much of the burden, in the poem's extended text, of producing meaning. As Adam Kirsch notes, "Cummings was not the first poet to use a typewriter, but…he was the first to take advantage of its power to control the exact spacing and shape of every line, and thus to make a poem's visual appearance as important as its musical rhythms. What looks like a thin trickle of letters becomes, to a reader who has learned Cummings's tricks, a picture in print." More than a picture, it becomes an extensive object, one not limited by the boundaries of its scriptural brain, or paper and ink body, but a text, something always and unrepeatably unique in its every expression, a malleable and fluid, yet always boundaried thing.

Danielewski on film and online

Mark Z. Danielewski spent much of the nineties writing his debut novel *House of Leaves* against the backdrop of the growing internet. For all its relations to the new digital era, *House of Leaves* was written in a time largely before Google changed search (1998), before the iPod changed the music industry (2001), and well before YouTube changed the distribution of moving images (2005). But the internet, ubiquitous home computing, and the beginnings of the "threat" to the codex that digitisation is meant to pose are written deeply into the pages of Danielewski's book.

It would be both impossible and irrelevant to accurately detail the complexities of *House of Leaves*' plot, our focus must remain on how Danielewski kinaesthetically extends its ability to mean, but it can loosely be thought of as a haunted house novel about a house bigger on the inside than the outside; a reworking of the minotaur in the

labyrinth myth; a critical theory-heavy film studies monograph; a meditation on the power of the codex; and at least two family dramas all combined into a truly inspiring piece of fiction. The principle narrators are a blind man named Zampano, a Borgesian figure whose critical discussion of the film documenting the exploration of the house of the title drives the plot, and Johnny Truant, a young tattooist who inherits Zampano's draft and notes and attempts to make a book out of them, a book which has apparently been published as *House of Leaves*. As Hayles describes the structure of the work

> Zampano's account contains allusions, citations and analyses of hundreds of interpretations of *The Navidson Record* [the film under discussion], along with hundreds more ancillary texts. Johnny Truant's footnotes, parasitically attaching themselves to Zampano's host narrative, are parasited in turn by footnotes written by the anonymous 'Editors,' upon which are hyper-parasitically fastened the materials in the Exhibits, Appendix, and finally the Index (which like the index of *Pale Fire* turns out to be an encrypted pseudo-narrative of its own) (*Writing Machines* 111).

Beyond the labyrinth of footnotes, index, and appendices, *House of Leaves*' layout and typography is often visually striking. Most famously, in the colour edition every instance of the word "house" is coloured blue, and offset slightly; in the black and white edition (for the UK market) the offset seems more distinct and the word appears in grey. Other quirks include short sentences, single words, or even parts of words spread across pages in some sections, and script that is presented upside down, diagonally, or that requires a mirror in order to read it. Sometimes footnotes take up more space than the ostensibly principle text, going on for pages; sometimes the symbols indicating footnotes and addenda put chapters into loops, where the reader has to elect not to follow the path of the normally elucidating signs if they wish to progress any further. Sometimes, as in Chapter IX, *House of Leaves* looks like this:
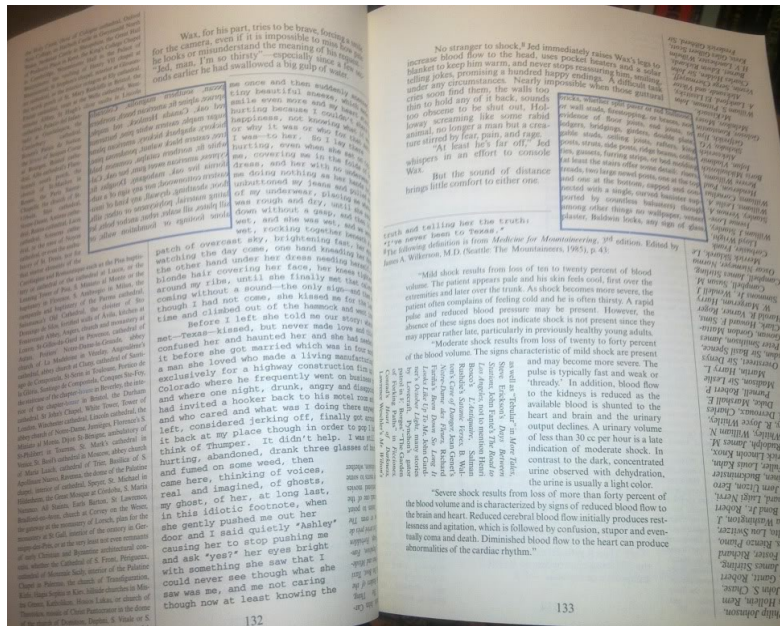
The left hand blue box shown here is intended as the obverse of the right hand box on the previous page; the right hand blue box will be repeated in reverse, mimicking its "back" on the next page. In this way a footnote passes as a core though this chapter - an attempt to list everything that isn't in the house: for instance there are no lights in the house "whether electrical discharge, incandescent, or combustion, no flame arc or gas-filled, tipless, inside frosted, decorative, general service, 10,000 watt aviation picture studio, projection, signal, Christmas tree, arc projector, photoflood, mercury, sodium, glow, sun, flash, black light, water cooled..." (123-125) etc.

From the early experiments of *Tristram Shandy*, through Apollinaire's *Calligrames*, to Cummings and other Modernist and Surrealist explorers, the layout of script on the page and the subversion of our expectations of what "should" be there, has a long history. Aarseth goes as far as to say that we have come to privilege a whole and "faultless" incorporeal text already over whatever might appear in a printed work:

> [T]he stability of paper-based documents is as much a product of our metaphysical belief in a transcendental text as an inherent quality of the physical object…Imagine a book in which some of the pages appear to be missing, or the print is unreadable every 16 pages, or some of the pages are repeated while an equal number omitted. Even if this copy is the only one we ever see, we automatically assume that it is not supposed to be this way and that a more correct version exists. It may never have been printed; but to us who can imagine it perfectly (except for the missing words, of course), it is still more real than the one we are

holding…we do this out of lack of respect for the copy; it appears to misrepresent the 'real' text…In short, we prefer the imagined integrity of a metaphysical object to the stable version that we observe ("Nonlinearity" 764).

Clearly such deeply embedded expectations, once again the syntax of things, are ripe for meaningful play and *House of Leaves* engages with just these kind of concerns. But if I'm to argue that Danielewski's book is kinaesthetically extending then I'm going to have to demonstrate that his motivations for making his pages look as they do comes from somewhere new, brings something unfamiliar into the text to the aid of meaning making, something that isn't there in the earlier experiments described above, or in other late 20th century, but pre-internet works such as Milorad Pavić's *Dictionary of the Khazars*, Mark Saporta's *Composition No.1*, or Nabokov's *Pale Fire*[187]. As with Cummings and his typewriter its the equipment of his day to which Danielewski turns - to digital film, and to the computer.

Danielewski's father, Tad Danielewski, was a television director and avant-garde filmmaker who steeped his children in a culture of cinema:

My sister and I didn't know it then, but what a magnificent and strange education. Every week Kubrick, Reed, Chaplin, Fellini, Bergman, Ford, Welles, Lean came into our living room. All their light, all their wonder, their genius and misconceptions, flung up on the wall like some magical hallway stretching into far away places…[D]uring th[e] first break [Tad had a projector and screen and charged Mark with changing the reels], my father would start asking the first questions: 'What are we really watching children?' 'Why that color?' 'Why that name?' 'What about the sound? The music? The performance?' 'Is this truly just about cowboys?' None of which compared to what followed the film - long discussions, hours long, sometimes inspiring, sometimes raw with the words of battle; and yes, of course fear. We covered everything. Structure, political content, aesthetic (or not) achievement…The film was just the starting point...it was the talk that mattered most ("A Conversation...").

We have the first clue to the importance of film in the novel in this quotation; the "magical hallway stretching into far away places," the impossible depth which the young Danielewski marvelled at, is projected into the mysterious hallway which

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[187] Pavić's novel is set out as a dictionary with entries which refer to one another, bouncing the reader around the text and leaving them unsure as to exactly how much they've read; Mark Saporta's *Composition No. 1* is a collection of loose leaves in a box to be shuffled before reading; Nabakov's *Pale Fire* sends the reader shuttling back and forth between an epic poem and its possibly insane curator's annotations.

appears, one day, in the house of the novel, a haunting of space into which the characters pass and begin to unravel. This fantastic and fearful emergence of depth might also refer to Auguste and Louis Lumière's seminal film screenings in late 19th century Paris. In what is most likely at least a partially apocryphal tale[188], on December 28th 1985 the Lumière brothers hung a plain white sheet against a café wall, called for attention, turned off the lights, and projected one of the first moving pictures, *L'Arrivée d'un Train Ã la Ciotat*, a static camera shot of a train pulling toward the camera and into Ciotat station. Legend has it that in this charged environment several panicked witnesses fled from the oncoming engine. Whatever grain of truth lies at the heart of this tale, the early novelty of both photography and film led to a belief that they were able to apprehend reality without mediation (to such a degree that photographs were initially refused the protection of copyright as the image had been created by the reflection and capture of light, a scientific tool for apprehending the world rather than a creative process). The apprehension of reality is a dominating theme of *House of Leaves*, and the illusion and promise of film to get at the world like no other medium is an appropriately constant tension (the book is the critical viewpoint of a blind man critiquing a film he can't have seen, mediated through a tattoo artist who's begun to hallucinate, and it regards the home recordings of a photojournalist).

Danielewski would turn his father's education in film toward postgraduate study, and later worked on the 2002 documentary *Derrida*, a film which comprised footage of and interviews with the philosopher for which Danielewski acted as assistant editor and sound technician. With a clear interest in the man and his work, it's unsurprising, therefore, that Derrida's influence can be felt throughout *House of Leaves*, in direct and imagined quotations, in its physical resemblance to pages from Derrida's *Glas*, and the importance of Deconstructive criticism to its statements about textuality, spectres, echoes, and recursion. But it's not in Deconstruction that Danielewski situates the truly extensive meaning making, principally it's in the magic hallway of film:

> That had been the design from the very beginning: to use the image of text itself in a way that had been studied very carefully for a hundred years by exquisite film-makers and to increase the reader's experience as they progress through the book…A very simple example is in an action movie. Before an action sequence, a director tends to present the audience with long shots and static views so the eye is fixed on a certain focal point on the screen and doesn't move. When the action sequence

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[188] See Martin Loiperdinger "Lumiere's Arrival of the Train: Cinema's Founding Myth."

actually comes in, a lot of short cuts are used and it intensifies the viewers' experience by shifting the focal point all over the screen. The eye is moving all around and there's an actual visceral response to that… So I began to theorise how one could adopt the same techniques textually (Danielewski, "Five minutes with Mark Z Danielewski").

Mark Hansen notes a clear emulation of the projected upon screen in *House of Leaves*' visual design during in Zampano's description of a videocamera running out of film during a rescue scene: "Spread out over the space of five pages (307-11, with slashes indicating page breaks) and located at various heights on the page, the following words are inscribed: 'The film runs out here, / leaving nothing else behind but an unremarkable / white // screen.' Here the blank page functions as a material analog of the blank screen" ("Digital Topography" 616). But in line with Danielewski's statement above, we might also consider a more oblique reference, a moment late in the novel when the house is being investigated. After a small group of explorers have passed through a newly appeared door in the owners' bedroom the house reveals its true scale and the nature of its topography, offering up a long corridor terminating in a set of steps that takes the group minutes to descend, but hours to re-climb. At the bottom of these steps, in pitch darkness, exists an enormous labyrinth, a shifting structure that gives the impression of an infinite entropic blankness. One of the group is injured in the darkness, and he must be hoisted up the shaft of the main stairwell. All is well, and he's progressing to the top until, suddenly, the dimensions of that space fantastically expand, the house warps, stretching the rope and leaving him dangling, almost there, suspended over the mouth of an ever-growing black abyss. That rope, despite, as we've been told, being able to withstand several thousand pounds of tension, is drawn tight, tighter, and then…

In a more traditionally typeset novel the detail of these events would be the end of a tense paragraph. But in *House of Leaves* this description, still only a few words, is spread out over 12 *pages*. We riffle through them, hungry to work out what is about to occur, and then we realise, now, slowly turning the last three pages with a sense of hideous finality as the rope

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-a-//

-ps (294-296).

It's a masterful piece of control over the reader, dictating our hands' actions in the world as well as the movement of our eyes, and the frenzy of our minds; it accelerates the action of turning the pages at the same time as making our heart beat faster. And that final three page "snaps" is a visual in line with Cummings' falling leaf, less subtle perhaps, but of the same school. Where Cummings' leaf slows us down and spins us about with eddies of orthographic topology, Danielewski's near empty pages make us breathlessly rush, our hands unable to keep up with our eyes in clearing the pages. There's something oddly invigorating in the making of the usual crawl of turning leaves into a tumble, where broken sentences, broken words need to be held in working memory for reconfiguration as soon as the hands and eyes can provide just enough content for comprehension.

In order to best make sense of this effect we must consider how Danielewski, like Cummings, has his work call-out to a site of meaning beyond its material body. Danielewski says that:

> My view of placing text on the page - aside from being influenced by the likes of E. E. Cummings or maybe some John Cage - was...cinematic. The point wasn't just to get really obtuse in the placement of the words. I was very interested in how the reader moves through a book. I've never talked to anyone who didn't feel a sense of elation when they'd read, say, 80 pages in an hour, because something was moving quickly - or expressed some sort of frustration because it took them an hour to read ten pages...I began to realize that cinema has an enormous foundation of theories on how to control the viewer's perception ("Building A House of Leaves").

In hyperkinetic film editing, which became increasingly mainstream throughout late eighties and nineties action cinema, Danielewski saw a new space for generating meaning, a riff on old styles, but something genuinely novel. It's important to note that there is no particular referred to film which is meaningful with regards to *House of Leaves*, instead the text makes the grammar of film in general an available site in tandem with the work of the material book. Hansen identifies the swift procession of the sparsely populated pages with "cinematic effects of temporal acceleration" ("The Digital Topography..." 617), and it is an awareness of the equation of medial speed with temporal speed and tension that makes this effect work. After all if we don't associate a swift turning of the pages with tension then we would be missing something of the

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extensive text that Danielewski is trying to offer us. We can easily imagine a link between flipping pages and boredom or skim reading were it not for our training in Hollywood and beyond that motion in media is equated with excitement. Film grammar is instead made to be a properly kinaesthetic part of the text.

Following George Lucas and Steven Spielberg's dominance of summer cinema releases throughout the late seventies and eighties, and the rise of home VHS, the American film industry, looking for ever greater spectacle, turned to the promise of new digital technology to draw people out to the big screen. As the industry increasingly found fans of its means of production, as evidenced by "making of" documentaries accompanying home video and later DVD releases of blockbuster films, the term "blue screen" became a part of pop-culture. With this in mind we can see another filmic link in the text, and a more digital one: the instances of the word "house" appearing in blue ink. "[W]hile Danielewski would not reveal his motives for using blue or 'house,' he was kind enough to offer that it has something to do with how blue is used in film. Knowing this, it's not much of a stretch to say that Navidson's house acts as a psychological 'blue screen'" (Wittmershaus). Not only the word "house," but the box surrounding the footnote which passes through chapter nine also appears in blue. Hayles sees significance in the infinity such a device invokes, a surface "onto which anything can be projected...[T]he text is attempting to project into this space the linguistic signifiers for everything in the world, as if attempting to make up through verbal proliferation the absolute emptiness of the House as a physical space" (*Writing Machines* 123).

There is, however, another explanation for the motif, also associated with an infinite blue: the hyperlink. Throughout, *House of Leaves* draws on the digitisation of the written word as it was already established at the end of the nineties during the book's gestation. From the sizeable index's functioning as a search engine (long a skill of the codex, but given greater weight in the novel with its more trivial entries (including "all," "and," "back," "can," "for," "here," "in," "into," "just," "more," "my," "not," "nothing," "only," "out," "so," "something," and the single use of the word "Yggdrasil") giving the impression that every word is searchable[189]), to the myriad

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[189] The index of *House of Leaves* allows

> readers to trace the different contexts in which the words appear and even the frequency of that appearance. So if you come across the listing for "for," you don't have to look up all the passages where "for" appears to be able to say, Wow, there's a prevalence of this word and here is a certain stylistic habit statistically represented with page numbers.

footnotes acting as hyperlinks that actually form entire parallel narratives, *House of Leaves* interrogates the digital challenge to the printed book. This challenge is something that Danielewski himself seems to have taken very seriously; commenting in interview on the complex layers of the work he suggests that

> [r]eally the only thing challenging about my book is the idea of a book itself. Older generations...will find *House of Leaves* difficult because they're prejudiced. They've been taught what a book should look like and how it should be read. Ruler-wielding didacts have instilled in them the notion that a book must start here, move along like this, and finish over there…But books don't have to be so limited. They can intensify informational content and experience. Multiple stories can lie side by side on the page...Passages may be found, studied, revisited, or even skimmed. And that's just the beginning. Words can also be colored and those colors can have meaning...Hell pages can be tilted, turned upside down, even read backwards…But here's the joke. Books have had this capability all along. Read Chomsky, Derrida, Pinker, Cummings. Look at early 16th century manuscripts. Hell, go open up the Talmud. Books are remarkable constructions with enormous possibilities...[S]omehow the analogue powers of these wonderful bundles of paper have been forgotten. Somewhere along the way, all its possibilities were denied…I'd like to see that perception change…I'd like to see the book reintroduced for all it really is ("A Conversation With Mark Danielewski").

House of Leaves never allows us to forget this agenda, not only because of the experiments' stark contrast to the majority of contemporary literature, but also in the bringing in of the threat to nearly every page: every instance of "house" in blue should also make us think of online links, blue words that can whisk us away to just about anywhere. Hansen, justifiably more focussed on the filmic aspects of the text, is somewhat dismissive of the colouration: "Making pseudoserious reference to the blue highlighting of hyperlinks on Web pages, the blue ink of the word "house" in the work's title transforms this keyword into something like a portal to information located elsewhere, both within and beyond the novel's frame" ("Digital Topography" 598). But I think that, though he's playful with it, Danielewski is deadly serious about the

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The index allows you to suddenly start asking questions about books you normally wouldn't think about in these terms. Wouldn't it be nice to have an easy way to find out how many and's (sic) appear in a Faulkner book or the King James? Or how many for's (sic) appear in a Virginia Woolf novel? Do they vary? What do these signs of reoccurrence reveal? Maybe nothing at all, but it brings that question to mind. And to me any feature of a book that invites readers to ask different sorts of questions is valuable (Danielewski, "Haunted House" 118-119).

Danielewski's interest in his work being in some way pedagogical, or otherwise elucidating to the reader, is clear here.

importance of this interpretation, particularly in light of, as Sonya Hagler notes, "[p]urple, the color of visited links, mak[ing an] appearance, in chapter twenty-one: 'I'm sorry, I have nothing left. Except this story, what I'm remembering now, too long from the surface of any dawn[190]'…Fittingly, this purple text deals with memory" (Hagler).

Blue effects screens, and blue links on computer screens, are brought together in the frequent instances of "house" and the footnote core sample, further examples of external forces being called upon to mean, in conjunction with one another as well as with the material book itself, altering our perception of where the locus of meaning is properly found within the text, and thereby readying us for any future works which might deploy the same or similar codes. Ink is rejuvenated in the text as meaningful, acting as a material metaphor for the equipmental structures surrounding the novel. "Why do we deprive ourselves?" Danielewski seems to ask, "of any opportunity to layer meaning?" Every instance of "house" in blue is a sore thumb, sticking out to remind us that a book is more than evanescent content: these are words in thick, black ichor, hammered in place by a metal reflection or dragged into shape with lasers. But simultaneously that materiality points to the potentiality of phenomenologically intangible links and their implications for print; Danielewski drags the materials and means of production into the extended and extensive text. Again, it isn't simply a case of bringing the means of production into the text, though, as Hayles notes, "[l]iterature in the twenty-first century is computational…almost all print books are digital files before they become books...They should, then, properly be considered as electronic texts for which print is the output form" (*Electronic Literature* 43). Instead, knowing well the traces that would intentionally or unavoidable permeate his work, Danielewski brings the internet and the threat of digitisation into meaning, as indispensable to the text, and simultaneously mounts a defence of the codex as a form. I think that this defence is an act of pedagogy on Danielewski's part, an attempt to strengthen and broaden our *eidos* of what a codex is, not simply as a response to a perceived threat, but also as a response to the provocation and excitements of the new electronic forms. Digital is not bad in Danielewski's eyes, he's far from being one of Steven Jones' Neo-Luddites, but what *is* wrong is underestimating or restricting the codex. That this occurs is thrown into stark relief by the adoration of digitisation: "so what if there are hyperlinks? Books could already do this!"; "so what if texts call out to one another? That was already happening!" For Danielewski the codex already acted as a material metaphor for aspects

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[190] (Danielewski, *House* 518).

of linguistic turn philosophy, and through his work's relation to the new forms he hopes to keep it as such until it is truly, rather than fraudulently, exhausted. In this way it also reveals how the new equipment caused him, and his readers, to think through certain ideas; rather than sequestering thought, *House of Leaves* is an example of another way in which digitisation can enervate it.

Foer's ruptured pages

I'd like to conclude with a brief consideration of Jonathan Safran Foer's late 2010 novel *Tree of Codes* in relation to the theoretical concerns outlined above, and to situate it as continuing on from Danielewski's faith in the codex in the face of the rise of e-reading and the reinvigorated interest in materiality.

     Tree of Codes started life as Bruno Schultz's *The Street of Crocodiles*. Foer printed off Schultz's novel (his favourite) and set about erasing letters and words and sentences to produce a new work, the sTREEt OF CrOcoDilES. The book we get to hold, however, is not simply the words Foer has hewn from the original; instead every copy is individually die-cut, the physical holes in the pages mirroring the now missing script from Schulz's novel. What we encounter is a straightforward paperback cover surrounding a collection of leaves that are more absence than presence, where we can see through to words 10 or 20 pages on from the space that we're "meant" to be reading. In this way, Foer deals with simultaneous thinking in his pages: Where Ponge and Graham's brackets vie for representations of simultaneity, *Tree of Codes* enacts it. A palimpsest forms, but not between Foer and Schulz; it becomes an oscillating, iterating palimpsest of itself. From the first page you can see elements of the text to come between the bars/barricades/supports of the cut-out page that you're currently on, and every page-turn will change that view. Words that you catch a glimpse of inflect, and are inflected by their surroundings over and over until suddenly you're upon text you've been reading in various ways for ten minutes, revealed now in its "true" context. Whether this saturates or empties them of meaning in the context of the story itself comes partly down to luck and the willingness of the reader, but the sheer performativity of the text, the making of a material metaphor for the way that words are just letters (which are just proxies for fragments of sounds), which depend and alter and turn on context, is an incredibly effective device, allowing the reader, any reader, to produce more meanings than they might expect from such a strange engagement.

Needless to say it's both beautiful and infuriating to interact with, impractical certainly, but I haven't seen anyone flick through it who hasn't experienced some frisson of excitement or wonder.

("Tree of Codes, by Jonathan Safran Foer").

Bloggers, before the book had even been released, were remarking on the form's relationship with the cut-ups of William Burroughs, the self-imposed constraints of the Oulipo group, and, most often, with Tom Phillips' *A Humument*[191]. Phillips' project is perhaps the most obvious comparison as he too started with another author's work and produced an artefact recognisable as a novel at the end of his process, painting and drawing over the lines of W.H. Mallock's *A Human Document*. But there's an important difference between Phillips' and Foer's creations. *A Humument* is an artist's book, a codex produced in a meticulous small run (in this case a single volume, though Phillips frequently creates replacement pages as updates). Though you can walk into most any large bookstore and buy a copy, or at least order it online, what you're getting is a facsimile in the same way that a postcard of the Mona Lisa is a facsimile; the postcard and the shop bought paperback are undoubtedly objects for consideration, but the aura[192] changes between the thing in the Louvre and the thing tacked to the wall of the study,

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[191] See, for example, Owen Troy "Typografriday: Tree of Codes Part 1."

[192] "Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be…One might subsume the eliminated element[, that which disappears in the process of reproduction,] 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" (Benjamin 1168-1169).

between the copy Phillips can display and the homogenous reproductions found on sale. The same is not the case with *Tree of Codes*: e*very copy is the primary artwork*, its meaning is richest in its incarnation as a mass(ish)-market paperback, not as the collection of Foer's scrawled-on printed sheets. The aura in this case is *in* the mechanical reproduction, not despite it. To return again to Genette, the transcendent text is located much more closely to the immanent reproductions than is the case with Phillips' project.

The kinaesthetic extension I want to focus on in the book comes in part from the increasing discussion of so-called "redacted" documents in our times. Boris Kachka, interviewing Foer for *New York* magazine, describes reading *Tree of Codes* as "a little like going through an FBI document full of blacked-out passages, except that the excised portions are now holes through which you get glimpses of subsequent text," and this does seem important. *A Humument* never felt like a redaction, just a creative use, an ever adding, not removing of value. Maybe it's the way that Phillips' paint and ink, and the paper and the glue of his collages sometimes only partially obscures the text that's no longer supposed to be there, allowing the palimpsest to emerge, for the two to mingle, at least to some degree. In Foer's work, of course, this can never happen: Schulz's text is obliterated, and that pang of regret (that I have no doubt will be experienced as an eerie "is this...ok?" by some readers) that a book (the pristine copy of Aarseth's thought experiment) has been somehow destroyed to make this one becomes significant in a way it might not have in a time less sensitive to leaked dossiers, expenses scandals, or whistle-blowing sites' attempts at selective and protective censorship. Plain white pages with sections missing, things lost through effort, black ink replaced with space, oddly with depth, undoubtedly feels politically resonant today. The sanctity of intact books is surely tied to a belief in their wholeness as a form of truth; that pang of regret at a desecration becomes tied, in *Tree of Codes*' form, to our belief that redacted documents aren't an "interpretation" or a "version," they're a species of lie.

The kinaesthetic extension comes from this appeal to wholeness: Foer's text calls out to the discussions of the fate of the book that we've seen throughout this work in order to produce a meaning which extends beyond the brutal and beautiful materiality of its production. It's a novel extension of textuality if only because of detailed die-cut's newness to mass-market presentation, but it's also no coincidence that this book appears at this time. The excitement of one blogger shows the effect that this form can have in this moment:

> [I]n an increasingly digitalized age where the printed word is said to be going the way of the Do-do (sic), Foer's most recent innovation in the way we read and write literature is a veritable wrench in the mind-numbing machine of blind progress that continues to degenerate our society's level of intelligence. Amen ("Tree of Codes by Jonathan Safran Foer.").

E-reading isn't the particular subject of the work, but in its impetus in heightening the debate of digitisation's effects on the power and reception of the printed word it cannot help but be drawn into meaning. In interview Foer has been explicit on this front:

> I started thinking about what books look like, what they will look like, how the form of the book is changing very quickly. If we don't give it a lot of thought, it won't be for the better. There is an alternative to e-books. And I just love the physicality of books. I love breaking the spine, smelling the pages, taking it into the bath...I thought: What if you pushed it to the extreme, and created something not old-fashioned or nostalgic but just beautiful? It helps you remember that life can surprise you...I love the notion that "this is a book that remembers it has a body." When a book remembers, we remember. It reminds you that you have a body. So many of the things we may think of as burdensome are actually the things that make us more human ("Jonathan Safran Foer Talks...").

In the light of our discussion, Foer's words are doubly meaningful: *Tree of Codes* (in fact any codex) remembers, remembers you have a body, knows, understands. Foer all but states the conclusions of the second chapter in this quotation: codices have something to teach e-readers as they know us better. This is why they continue to be deployed as skeuomorphic material metaphors. What Foer and Danielewski, what Hayles, Barthes, McGann, and Kirschenbaum entreat us to do, however, is to genuinely listen to both sides, to understand as best we can, to not rely on slavish metaphors and neutered applications, but to really consider what each form might best afford.

What *Tree of Codes* comes to mean, in the time in which it lives, depends on a conversation which surrounds it, and to a reader in 50 years who doesn't realise the weight Foer intended for its body to refer to, and who has seen all the various iterations of books that will come to pass, *Tree of Codes* will mean less and less until some critic points out what was occurring at this moment where some authors were forced to become interested in remaking print as sacred, as it seemed to them to always have been. For Foer, this sacredness is written into a burdensome body, not a *memento mori*, but a book which cannot be skim read because Foer's done the skimming, cannot be

digitised because what would be the point, and cannot be ignored because, well, *look* at it.

A Humument was released in a critically acclaimed iPad edition at the end of last year, on the 15th of November, the same day that *Tree of Codes* was published.

Before moving to my conclusions I would like to complete my statement on kinaesthetic extensions.

There must always be a first kinaesthetic extension for any reader. McGann has to tell you how the paper means; Barthes has to show you that the reader makes meaning; Kirschenbaum must offer pictures of suddenly tangible digital information; or you can work a new facet out for yourself, but no aspect comes to us theorised, preformed, and complete, any more than we start learning to read already knowing how letters make words. Cummings' play with the typewriter was novelly extending in a way that his expressive play with capitals and punctuation was not: a great many artists and readers knew that letters and interruptions could be made to mean, but no one had played with the typewriter quite as Cummings did. And if we were to find some writer that had then it would not change the point, they would just be the originators of the extension - this is the critic's argument, not the theorist's. Any device or practice, however, is extensive for someone who encounters it for the first time. If someone repeats a project then it might be extensive to any unfamiliar reader, but to the reader who knows the first experiments it becomes something else, maybe just another experiment, maybe something derivative. If we want to argue that a text is definitively extensive then we must prove that it is the first to call a new way of meaning into being, or the first in a long time, or the first in a culture, or the first in a particular form, essentially something unexpected, surprising. But none of this precludes a shamelessly derivative work from acting as a kinaesthetic extension to the naïve reader.

I would like to repeat myself a final time for the sake of clarity. Two things are extended by a textual kinaesthetic extension: i) the particular text's capacity to mean, and ii) the previously naïve reader's/s' understanding of what might constitute the active range of a form. My hope is that the term works as a provocation to thinking about what we intuitively attend to when we read a text, and how this gestalt of elements can be manipulated and expanded by writers and critics, that indeed it must be the case because of the nuanced conception of text that we've already inherited.

Conclusion

As we work toward critical practices and theories appropriate for electronic literature, we may come to renewed appreciation for the specificity of print. In the tangled web of medial ecology, change anywhere in the system stimulates change everywhere in the system. Books are not going the way of the dinosaur but the way of the human, changing as we change, mutating and evolving

<div align="right">- Katherine Hayles, Writing Machines 33</div>

Throughout this work I've tried, in essence, to argue one thing: that the discourses surrounding technology, and e-reading as a specific example, are at once revealing of the complexity of the terms and yet remain incommensurate to the task of expressing them. Understanding technology, much less e-reading, requires a blend of cognitive tools that are not in general use, and I've tried to show that in order to begin to understand the issues involved we need an interdisciplinary approach which draws from disciplines sensitive to embodiment, cognition, and, in the special case of e-reading, textuality. As such I've brought together work from Philosophy and Cognitive and Neuropsychology as well as from my native English Studies, and explored fields which traditionally sit across broad disciplinary boundaries such as Cognitive and Neuroscience, Embodied Cognition, and the Digital Humanities. But alongside these academic disciplines I've also tried to emphasise the importance of folk phenomenological reports, the living and growing database of people using the objects under discussion who are expressing themselves with increasing voracity, erudition, and awareness of the issues at stake.

The first chapter considered the idea that technology could be somehow "unnatural," coming between us and the world, and what this might mean for the resistance to technology as a class of object, and to e-reading more specifically. I argued that even if we take "technology" to simply be the equipment that we use to extend our abilities then, no matter how complex the interaction, this is neither a modern activity nor an "unnatural" one, indeed extensive artefacts are at the heart of what it means to be human. But there is use to this word, and to the resistance directed at certain objects and practices, so it should be reclaimed and put to work with increased precision to account for the diversity of ways in which we interact with things. I offered a definition of technology that is sensitive to embodiment, to the intimacy of interactions with objects

that humans can achieve, and to the capacity for equipment to alter the way we act in the world. By making technology a class of interaction with equipment that is agnostic to materiality I hope that the definition can account for the most dynamic of the fusings with ways of thinking and ways of acting that we are capable of. To describe the things we use, but which don't possess these capacities, or that we otherwise use poorly or inexpertly, I suggested the term "device," and this term may well be of use for those who hope to resist something, those who would say "this new thing can never be more than a device, but we have a technology right here." In this chapter, however, e-reading equipment was shown to be no more or less natural than the codices which proceeded it, but it was accepted that many users may not, as yet, experience a technological interaction when using them to read.

The second chapter looked at the claim that "e-reading doesn't feel right." The chapter approached this notion first by considering the "feel" of e-reading, providing and considering reports of the phenomenological experience of the equipment in use. It then went on to look at the role of the body in thought, particularly the hands, and how this might be disrupted by the new artefacts as opposed to the established practices of the codex. The second approach to the idea of e-readers not feeling right was to consider how we encounter objects in the world and get used to them; the process of "technologising" identified in the first chapter is a special case of getting used to an object, of coming to act with it successfully. This idea was further subdivided into two sections: firstly I argued that artefacts emerge out of an evolutionary process and as such can be considered, under the rubric of Plotkin's conception of a branch of evolutionary epistemology, to possess knowledge of their environment, their users. Secondly I considered the phenomenological experience of "getting used" to something, of revealing aspects of an object and engaging with it increasingly successfully. In this way we meet our artefacts in the middle, trying to understand them as they get to know us, and this promotes and accelerates the activity of "getting used" and repeatable successful interaction. This answered a hangover from the first chapter: many people do not experience e-readers as technologies, but the second chapter argued that they can and outlined the mechanism by which this, if it happens, will occur.

The third chapter considered the commonly heard notion that our new digital reading equipment impedes intelligence (in some poorly defined way). Again, it was emphasised that folk phenomenological reports shouldn't be ignored, but at the same point their motivations can be culturally prejudiced and swayed by vocal commentators

who don't always have adequate supporting evidence for their claims beyond their own suspicions. To take the claim seriously, that somehow the equipment itself, rather than any content displayed might perniciously affect thought, the third chapter looked first at how objects might affect cognition more generally by promoting certain ways of thinking, particularly via metaphor. We returned to the language of the first chapter to see whether the internet, hyperlinks, codices, or e-readers, functioning as objects-to-think-with or material metaphors, acted "naturally," i.e. were suited to our nature, as the folk reports seemed to suggest that an artefact's functioning closer to our natural mode of cognising was less likely to impede intelligence. In light of this I suggested that it may well be the digital equipment which are most closely allied to our natures and also promote novel and challenging ways of looking at our culture and cultural production. The chapter finished with a reading of several texts which used the artefacts of their day to create new works which produced their meaning whilst spread out onto those apparatuses.

For Danielewski and Foer the new digital equipment, in its perceived threat and in its enabling potential, is not only a site for meaning, but also a demonstration that these authors haven't been shut down by their engagement with the digital, but instead have been invigorated by it, as their readers will be and have been in turn; they keep the codex special. In *Paper Machine*, Derrida considered "the book to come":

> In this discussion we will surely have to come back to…religiosity, to this quasi sacrality, more precisely to this quasi resacralization that, with all the political issues it involves, has marked the entire history of technologies of inscription and archiving, the entire history of supports and printing methods - as if each stage, in a technological transformation, seemed the one to desacralize, democratize, secularize, defetishize, throughout an interminable history of Enlightenment or Reason…but as though each stage, all the same, was also inescapably accompanied by a sacred or religious reinvestment. For it is obvious, for instance, that if our generation is suffering from seeing the book yield ground in the face of other supports, other modes of reading and writing, this is partly because, inevitably, it has resacralized everything connected with the book (its time, its space, its rhythm, starting from the ways it is handled, the ways it is legitimated, even the body, the eyes, and the hands bent around it…) (12).

This "resacralisation" is part of the projects, and a site of meaning for both *House of Leaves* and *Tree of Codes*: Danielewski and Foer's books emphasise these resacralised attributes in the wake of the reimagining of the book, they focus on time and space

(seen in Danielewski's requirement of our jumping around, through footnotes and appendices, a space which mimics in some way the house it describes, and Foer's disruption of the orderly codex implication of the onward drive of time, giving us a sense of a sometimes thwarted simultaneity), and the body, the eyes and the hands that hold the work. But neither Danielewski nor Foer are neo-Luddites (Danielewski in particular deploys both Twitter and internet forums, the latter becoming an integral part of his writing after *House of Leaves* as his next novel, *Only Revolutions*, revolved around his fans' most memorable historical events of the last 150 years, reports he solicited online), and neither book, not *House of Leaves* nor *Tree of Codes*, could have been produced without computers and computer run printing and cutting machines. They might both have at their heart a fear of the codex being neglected in the face of the digital, but neither advocate a discarding of electronics, a breaking of the binary frames. There is space, they seem to say. By highlighting the power of codices they serve to highlight the specificity of these objects' position in a vibrant and competitive medial ecology; the space they occupy leaves much room for digital objects to sit alongside them as they mark what each can do best.

Bolter saw "electronic technology" as able to recreate the book in two ways, first by giving us new kinds of books which would also alter "the rhythms with which we read," but secondly by adding "to our historical understanding of the book by providing us with a new form that we can compare to printed books, manuscripts, and earlier forms of writing…The coming of the new electronic book helps us to understand the choices, the specializations, that the printed book entails" (*Wrtiting Space* 3-4). This, again, is at work in Danielewski and Foer's resacralisations: computers gave them new kinds of books, books which couldn't be made without them, books made in response to them, and which certainly alter the rhythms with which we tend to read, but they also force readers to deal with the specificity of print presented in two wedged piles, one giving to the other as the whole assemblage tries to mean in tandem with a reader and a world. I wonder if those who see threats in "the screen" and its new reading practices also see the same threats in such work which plays with the traditional form, short a history as it is, of the mass printed book? As Nancy Kaplan puts it, "ongoing debates about reading practices help reveal the epistemologies, ideologies, and power relations driving the conservative (and sometimes openly hostile) response of the academy to challenges mounted by alternative reading modalities" ("Literacy Beyond Books" 21). Certainly questions of whether reading on screen is an impediment to learning should be

asked, but however it is framed this question emerges from the belief that our prior reading habits might have been optimal, whereas more likely they have always been personal and tuned to the times. Reading used to be undertaken aloud and standing up, giving the act the weight it appeared to deserve. Books used to be read deeply, often, and thoroughly; now the best researchers, even textual scholars, must read a variety of materials, sacrificing the depth of the older modes lest they be left behind by current (and prior) debate. The landscape has grown and altered, books of all kinds have a new position in their environment, and reading practices have changed to meet them, always remaining suitable as the readers who deploy them aim for success. This is not to suggest that we shouldn't question a loss of depth in reading, but we should do so by addressing the times, not, or not solely the ever-tuning practices. Pedagogy should emphasise the importance and uniqueness of sustained arguments, of spending time with a single author and resisting the predominance of multiple surfaces. But we should also appreciate the newly tuned reading practices that digitisation allows for and may make manifest; scanning and diverse reading is a part of this, following trails of links, getting lost, layering thoughts on thoughts mimicked by windows in windows and tabs on tabs. We should learn how to teach it, not, or not only, to resist it.

> [Y]oung brains painlessly absorb the world their parents created, and that world takes on a glow of timelessness and eternity, even if it was created only the day before you were born...[M]y grandchildren will not have the fragmented, distracted, alienated digital experience that I do. To them, the Internet will feel as fundamental, as rooted, as timeless as a battered Penguin paperback, that apex of the literate civilization of the last century, feels to me (Gopnik 272 & 274).

Gopnik reminds us of something here: that the codex of the popular imagination is *our* myth, not that of the readers entering, or about to enter the world. Our ability to adjust to things as a species, as active interactors with objects, promises, I have suggested, that not only will the next generation get used to digital equipment, they will also make them technologies, they will adapt them, and adapt to them. In the absence of evidence, and there is an absence, of the effects of reading on screen on the developing mind we must turn to what we have: the past, the reports, and our instincts. The past, I have argued, implies adaptation: we adjust, our variety of tools can be brought on board and used into invisibility, this is at the heart of our nature and our interaction with things in the world. The reports, however, are also conclusive: despite some very strong cases for

democracy, accessibility of information, theoretical thinking through, and better matching of thought patterns, the overwhelming voice heard in popular discourse, and through much of the academy, is a tacit or vocal resistance; these things don't feel right, they're not natural, they'll make us all stupid. These reports are the collection of other people's instincts and as such they shouldn't be neglected. But neither should our own feelings, though they may not be heard as loudly. This work has been my attempt at an informed report, and with e-readers, with any useful equipment, my instinct has become that if trusted and given time new users can make things technological and beautiful, make them feel right, feel special, a part of their nature, and an aid to their thought.

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