A 'History' of Search Engines: Mapping Technologies of Memory, Learning, and Discovery

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Can we draw a timeline onto which search engines fit? This is at once an ordinary and odd question. We constantly contextualize technology, linking new to old and contrasting similar to dissimilar; we do this implicitly through our usage, and it helps us to feel that we understand certain phenomena. For instance, most of us are implicitly aware of the history of the watch. Without consciously researching its history, a watch wearer might place their digital wristwatch in a family tree that stretches back to sundials, waterclocks, hourglasses, candle clocks, pendulum clocks, pocket watches, and quartz watches. In this example a timeline of development is easy to draw. The mechanical processes might be wildly different, but the ancestors of the modern watch all carry out a very similar purpose. The levels of material detail have changed over time, which means that a timekeeping device designed for the modern Olympics does a very different job from a sundial, but they are all manifestations of the same pursuit. This kind of timeline might be described as a lineage of intentions, whether timepieces use sand, water, or quartz crystals.

There are many different ways that we historically contextualize technologies. A second method might be called a lineage of machinery. From this perspective, instead of placing a modern digital watch in a family tree containing other timepieces, we might relate it to other digital devices. So we might implicitly link digital watches to other digital technologies regardless of their functions. This is a useful approach when thinking about how certain technologies were invented, and it also speaks to social and historical networks that constitute our historical past. Implied in the terms 'Stone Age' and 'Bronze Age' is that we form timelines and maps of history based on physical materials and machinery rather than more abstract intentions and goals. There are many other ways in which we place phenomena and technology into a historical lineage, many of which we draw on and build in our minds implicitly and that can deepen our understanding of contemporary technologies and behaviors.

Faced with the question of what lineage Google fits into, many people might recall Ask Jeeves, AltaVista, or relate the site to other methods of navigating the web. However, the broader question regarding the lineage of web search engines, and the contexts into which the collective technology fits, is much more problematic. Rather than attempting to answer this question by providing a comprehensive timeline onto which

search engines neatly find a place, this essay suggests that the *process* of thinking about timelines, lineages, and networks of relationships is much more useful than the construction of one single family tree of which web search engines are the most modern descendent. I will introduce a number of examples that relate to the ways in which we conceptualize search engines. Rather than tie them all together in an overly neat way, I will attempt to provide more questions than answers.

Considering the prevalence of the internet, World Wide Web, and search engines in our lives, we do not seem to have developed the right language for talking about them. This feeling is particularly acute when I talk to family and friends about my day-to-day activities studying search engines and when the words we use become more of a barrier than an aid. 'Is the internet a medium? Is the web a platform? Are search engines tools? Or just websites? Media? Directories?' Most of the time, these questions are avoided or ignored as irrelevant to the average user. It is unnecessary for users to understand the difference between the internet and the web in order to send an e-mail. Users do not need to know how search engines work to find out the year Barack Obama was born, or the date he became president. When our tools work, specific language or specialized knowledge may seem unimportant. When our expectations, intentions, and results are in line with one another, a deeper understanding of a technology and the vocabulary with which to discuss it recedes into the background.

However, when concerns are expressed about search engines and their effects on users, these implicit expectations become more prominent. Cries of privacy violation, worries that search engines change the value of knowledge or attention spans, fears that they provide dominant homogenous perspectives which ignore cultural differences, or, on the other hand, that they create filter bubbles, parroting search results back to users so tailored to their search behavior that it prevents them from experiencing new perspectives with which to question their own values – these and many other concerns are raised when our experience of search engines becomes misaligned with our expectations. Where these expectations are drawn from is a complex issue. One element of our expectations is the historical precedent set by technologies, ideas, and institutions, which users implicitly form as a family tree or lineage in which search engines are the latest incarnation. However, I argue that when users conceptualize a phenomenon, knowledge of previous technologies and institutions that had a direct effect on present technology is not the most prominent factor in that process. More important is our implicit process of mapping instances that we feel are similar or complementary, regardless of whether other technologies or institutions had any direct effect or relationship with the existence and identity of the phenomenon at hand. In this way it is our own individual, fluid, ad-hoc contexts that determine both how technologies are used and also our perspectives concerning how they should work.

Given that search engines do not fit into an established type of technology – they are not simply a website, medium, tool, platform, network, or service – our comparisons with historical instances, with where search engines fit within wider historical development, are important in understanding what we as users implicitly feel search engines are and what their capabilities should be. Yet in reality these historical developments are not linear, nor do we tend to think about them that way. Instead our knowledge of related phenomena constitutes a constellation of associations. This kind of rhizomatic thinking leads to multiple, often contradictory, overlapping histories that form a major

part of our conception of what search engines are. For this reason I want to argue that a deeper understanding of search engines and their history can be gained by moving away from neat family trees and towards a nonlinear way of conceptualizing associations. The way we conceptualize the relationship between search engines and other technologies and behaviors is much more like building constellations of the night sky. We look at the stars and map their associations with one another based on narratives that are meaningful to us rather than accurate descriptions of how these heavenly bodies actually cohere. Consciously outlining the different ways in which we contextualize search engines can help us understand our implicit makeshift definitions, which in turn mould our behavior.
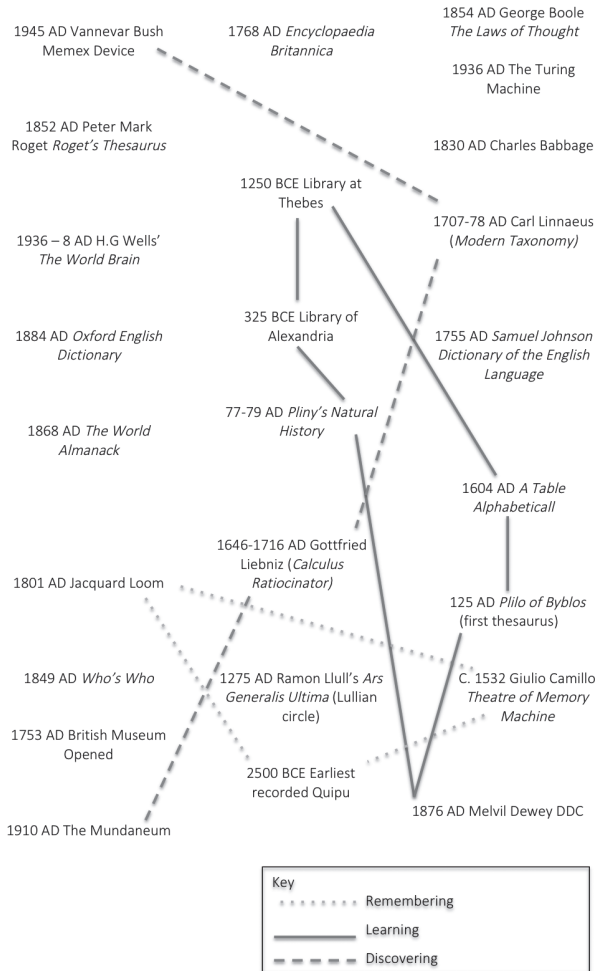
Fig. 1. An ad-hoc constellation of associations for technologies relating to remembering, learning and discovering (by the author).

Figure 1 shows a number of ideas, institutions, and technologies that relate to search engines. I could add more points of reference in the same way that star charts add more stars based on better telescopes and more thorough research. This way of presenting information decontextualizes it and in turn makes us focus our contemporary perceptions of what search engines are. We can add different categories by which the examples are grouped, build on existing categories, or remove examples entirely. This open-ended process provides us with more meaningful questions than a static timeline that simplifies the history of tools and thought. The questions opened up by making ad-hoc connections can be developed by choosing a point on our constellation of associations and discussing how search engines relate to other media in different ways.

I will outline three ways in which search engines are used, which I describe as remembering, learning, and discovering. While these are by no means exhaustive, these three ways have a range of historical ancestors and therefore provide us with a variety of overlapping constellations of association. While there are a multitude of behaviors associated with search engines, these three are important for relating to our conception of *knowledge*. Displaying them as constellations means these categories are flexible, and that new ones might be added. In doing so we widen the discourse around search engines.

Remembering concerns the use of search to recall information such as dates or names that we already have a clear contextual grasp of. Learning is searching for detailed information about areas we are partially knowledgeable about. Discovering is the use of search to provide ourselves with the unexpected. I will outline these three modes in relation to some examples from the makeshift constellation of associations I mentioned earlier, with the aim of providing a rhizomatic set of connections to other technologies and also hopefully to shift some of the conceptions regarding the newness and exceptional nature of web search engines.

Remembering, (or More Accurately, Forgetting)

> Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it.[1]

My use of the term *remembering* constitutes the use of search engines for jogging one's memory for things we would otherwise say we knew – sentiments crystallized by phrases such as 'Who was that guy in that film? You know, *that* guy!' and, 'It's on their second album, whatever it's called'. We often rely on these kinds of mental placeholders, however empty, because we know that correct searches will remind us of certain facts. As psychologist Stephen Kosslyn puts it: 'Once I look up something on the internet, I don't need to retain all the details for future use – I know where to find that information again and can quickly and easily do so. More generally, the internet functions as if it were my memory.'[2] Many have criticized this kind of behavior as one of the ways in which modern technology is making our levels of knowledge and understanding less

1. James Boswell, *The Life of Samuel Johnson Volume II*, New York: Penguin, 1986 (1791), p. 257.
2. Stephen M. Kosslyn, 'Social Prosthetic Systems' in John Brockman (ed.) *Is the Internet Changing the Way You Think?*, New York: Edge Foundation, 2011, p. 182.

substantial. Nicholas Carr in his 2008 article for *The Atlantic,* 'Is Google Making Us Stupid?', uses a metaphor that can usefully stand in for the frequently voiced opinion that the internet has fundamentally changed the way we think:

> What the Net seems to be doing is chipping away my capacity for concentration and contemplation. My mind now expects to take in information the way the Net distributes it: in a swiftly moving stream of particles. Once I was a scuba diver in the sea of words. Now I zip along the surface like a guy on a Jet Ski.[3]

Carr's metaphor reflects an entire mentality about the internet: the feeling of a profound sense of distance between the time before search engines, hyperlinking, and the web, and our wholly futuristic contemporary situation. It is as if we have passed one of, if not *the*, major technological watersheds. Carr goes on to describe how the internet, 'an immeasurably powerful computing system, is subsuming most of our other intellectual technologies. It's becoming our map and our clock, our printing press and our typewriter, our calculator and our telephone, and our radio and TV.'[4]

Carr's list of examples reinforces a version of technological change as teleological, monolithic, and always moving from less to more complex. The idea that new technology takes us places we have never been to, and also replaces ones we are familiar with, underpins the belief that there is no going back to the good old time of simplicity and authenticity. To return to Kosslyn's description of new post-internet behaviors and provide a more positive counterbalance to Carr's provocative arguments, Kosslyn reinforces the concept that, 'constant connectivity has posed various tradeoffs; nothing is without a price. But in this case – on balance – it's a small price. I'm a better thinker now than I was before I integrated the internet into my mental and emotional processing.'[5]

Even positive defences of the internet generally suffer from this kind of before and after television makeover-show metaphor. This type of thinking reinforces the attitude that media and technology affect us as if brought to us on the conveyer-belt of history, every new arrival overshadowing the rest. In the introduction I mentioned that family and friends skirt around terminology concerning what the internet is, and tend to avoid specific or technical language to avoid sounding uninformed. A similar attitude develops from many of the arguments by professional commentators, theorists, and thinkers, the majority of whom, I would hazard a guess to say, *do* have complete competency over terms and definitions. Many of these thinkers however, conflate the internet, web, search, and other aspects of new technologies for a number of reasons, perhaps for the benefit of their readers or to make their particular claims seem more fundamental or universal. However, in doing so they reinforce the idea that the issues or benefits all stem from one monolithic change in connectedness. When technology commentators talk about the internet and its ease of searching and finding, increased interconnectedness and speed compared to traditional media, they are, very often, talking primarily about the impact of search engines. If we can be more specific about

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3. Nicholas Carr, 'Is Google Making Us Stupid', *The Atlantic,* July/August 2008, http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/306868/.
4. Carr, 'Is Google Making Us Stupid'.
5. Kosslyn, 'Social Prosthetic Systems', p. 183.

the actual technologies that might be changing our behaviors, we have a better chance of finding points of comparison with other existing technologies, rather than talking about the internet age as if it were a journey into totally uncharted land.

While it is fashionable today to talk about Google as a mental prosthesis, technologies that extend our minds and memories are not new. There are a number of technologies and media that change the way we think and remember, some familiar and often still used, others less well known. I use the word media in a wide sense borrowed from Marshall McLuhan, whereby 'media are the intersecting points or interfaces between technologies, on the one hand, and bodies, on the other'.[6] When Samuel Johnson, in the above epigraph, referred to the knowledge of where to look, he was foremost referring to libraries. The rest of the quotation in fact states that, 'when we enquire into any subject, the first thing we have to do is to know what books have treated of it'.[7] While these kinds of structured resources will be addressed in the following section on learning, the behavior I want to address here is much more basic than the knowledge required to be familiar with a library. Rather, this lineage is based around tools for memory.

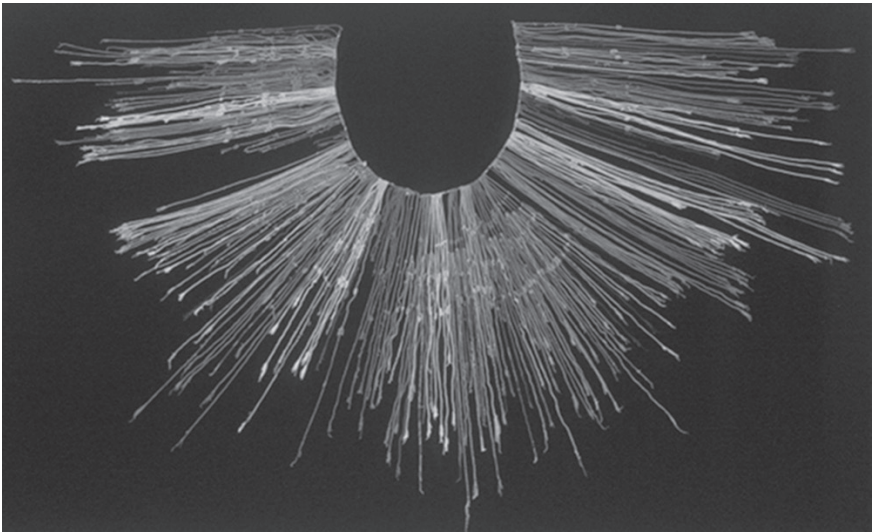To elaborate on the question of memory, I will now introduce a very old and culturally specific technology, the Quipu.

Fig. 2. An Inca quipu, from the Larco Museum in Lima (source: Wikipedia).

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6.   Paraphrased by Friedrich Kittler in *Optical Media,* Malden, Mass.: Polity, 2010, p. 29, in reference to Marshall McLuhan, *Understanding Media: The Extensions of Man*, New York: McGraw-Hill, 1964.
7.   Boswell, *The Life of Samuel Johnson*, p. 257.

In ancient Andean South America, a particular technology called a Quipu was used in a number of different regions. This device, often described as talking knots,

> consisted of a thick cord from which a number of strings were suspended in the manner of a fringe. These strings were of different colors, according to the nature of the object each represented: for example, yellow stood for gold, red for the army, white for peace. The colors, being limited in number, had different meanings depending upon the general purpose and scope of the Quipu.[8]

The Quipu could act as a memory device for complex narratives, as a record of a storehouse, rules, and decision-making, and could provide a map of an area, along with many other possible uses that historians still do not fully understand. Manipulating the strings provided sets of information that upon untying would act as a mnemonic device. Similar to the practice of tying a knot in a handkerchief to remind the user of something, except incomparably more complex, the Quipu relied on existing memories and contextual understanding from the user, the designated Quipucamayu ('keeper of the Quipus').[9] As the same sets of strings could be used for a multitude of different needs, a user must not only know the context but also the original intentions, dispositions, and other embedded behaviors that might have been encoded in its original tying. The Quipu then was not simply an exterior memory store or memory device; instead it was used as a remembering device. In it was encoded just the right level of forgetting. This level of forgetting was however not structured in terms of shallow and deep, since it did not provide a structure for more detailed memories to fall into place. Instead Quipus provided the basis for a more holistic process whereby memory was embedded in actions. The continued and repetitive use of the Quipu by many generations and in multiple regions allowed for change and adaptation but also solidified links between different types of knowledge and behavior. Quipus were dynamic, they altered the way in which their users thought and remembered and the way that individuals and societies built up their identities.

I am not trying to compare Quipus directly to Google. A direct comparison would flatten out the media-specific particularities of each technology. The historical and contextual differences are huge, so playing a spot-the-difference exercise is obviously not going to be helpful. However, if we draw on this massive gulf between contexts, pushing it to its limit, accepting all of its messiness, we can learn more about each technology on its own terms. If we tried to connect the use of Quipus to the use of search engines via a family tree or linear technological evolution, we would fail; they cannot even be described as the most distant cousins. Juxtaposing one to the other, however, can widen our thinking and draw it away from the overly specific considerations of search engines solely within our own context.

The Quipu is an ancient technology. Many archaeologists, in particular Ruth Shady, have argued that the earliest discovered examples are around 4500 years old.[10] Anthropologist Gary Urton has shown through written archival evidence that there are

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8.   Louis Baudin, *A Socialist Empire: The Incas of Peru*, New Jersey: D. Van Nostrand Company, 1961, p. 125.
9.   Baudin, *A Socialist Empire*, p. 128.
10. Charles C. Mann, 'Unraveling Khipu's Secrets', *Science* 309 (12 August 2005): 1008.

descriptions of the khipus contained in documents written at the time of the Spanish conquest (beginning in 1532) [which] reveal that the Inkas used khipus to record quantitative data (e.g., censuses and tribute records) as well as songs, genealogies, and other narrative forms containing historical information.[11]

Due to the number of Quipus found between these two eras, we can argue that Quipus were no passing phenomenon. They embedded themselves in a culture and fundamentally changed the nature of knowledge and memory in that culture for thousands of years. The exact way in which they were applied, however, is uncertain, due to their use in non-literate societies, which means no written account exists. Without a written record of their use, our historical knowledge of Quipus has become almost mystical, truly embedded within its own media. For these reasons many scholars and researchers have questioned the typical descriptions of Quipus. Urton is a foremost critic of the conventional descriptions of what kinds of uses Quipus may have been put to. Urton argues against the 'idea that the khipus represented an idiosyncratic, private (i.e., individual memory-based) system of notation such that an accurate interpretation of any particular khipu could be given only by the individual who made it'.[12] Urton draws on historical evidence that the Incan empire had high levels of bureaucracy and that many Quipus were used for transmitting laws and matters of the state. Quipus' use was less like an individual memory trick and more like a range of dialects and informally borrowed ad-hoc dialogue.

It is unsurprising that certain common practices evolved as the Quipu was deployed for such a long time. What is intriguing, however, is the malleable nature of these common codes or repeated practices. The work of Quipucamayu (the Quipu user) was both intimately personal and also shared with others, remaining ambiguous due to the open-ended possibilities of combinations of strings and ties. This flexibility allowed at all times the possibility that each Quipu message was transmitting or helping different users remember more or less information. This ambiguity doubles the difficulty of ascertaining the device's precise usage from a 21st century perspective. Not only can scholars not fully understand Quipus because of a lack of translated rules, etiquette, and application, but also it is entirely possible that Quipucamayus had so many different ways in which the personal and communicative use of Quipus crossed over that we might assume there was no universal understanding of Quipus during their time. The nature of remembering and forgetting using a Quipu necessarily undermines a complete understanding of how the technology worked. Quipus were used in a variety of different and fluid ways, and it was this plasticity of behaviors that changed the relationship between thought and knowledge for its users.

On this note we return to search engines and the contemporary ways in which they are discussed. Although we cannot know the precise details of how the ancient Quipu technology was used, we know that even talking about the possible ways it might have been deployed allows us to interrogate the interplay between remembering and thinking. Could Quipus exist simply on a personal basis, did they need to be con-

11. Gary Urton, 'From Knots to Narratives: Reconstructing the Art of Historical Record Keeping in the Andes from Spanish Transcriptions of Inka Khipus', *Ethnohistory,* 45.3 (Summer, 1998): 409-410.
12. Urton, 'From Knots to Narratives', p. 411.

nected within an inter-medial field that took into account wider discourses? Is it inevitable that a personal memory, when structured through shared media, transmutes into semi-shared codes? Asking these questions puts my own use of search engines as a memory tool in a new light. When earlier I referred to different ways in which people use search engines to remember the names of actors or album titles, I drew a picture of how search changes the remembering and forgetting of individuals. From our experience we might develop personal codes. I frequently search the same query for names I commonly forget and have learned which searches always return the name I'm looking for and which don't. Remembering which search terms to use becomes a very personal code. I have a more direct link to certain pieces of information because I attempted to recall them before. However, search is unavoidably social. My search patterns are my own, but only because of the unspoken search behaviors of strangers. Often counterintuitive to an individual's attempted use of search engines as memory devices is that we must negotiate the combined personal mnemonic patterns of others. In my initial constellation (see Figure 1) of associated technologies, I grouped Quipus under the heading of *memory*. However, as this example shows, the collaborative contexts from which Quipus and other memory media are inextricable complicate the idealistic notion that technologies can be used simply to *remember*. Already this first example problematizes the extent to which we can establish proper boundaries between remembering, learning, and discovering.

The media archaeologist Jussi Parikka, paraphrasing the German media theorist Friedich Kittler, describes the situation by arguing that:

> Media determine our situation and are already inside our heads, inside our capacities of understanding and writing, our theoretical concepts, memories and such, yet these perspectives of a media-archaeological kind elaborate the wider intermedial fields in which the human body is trained as part of the modernization process.[13]

The link between Quipus and search engines is not direct and by no means concrete, however in the light of Parikka's comments, both technologies, by the very nature of their make-up, shape their users in comparable ways. Parikka's intermedial fields relate to the unconscious modes that develop between users of the same technologies, structuring their individual use and development of certain capacities, both in isolated and social contexts. With the Quipus we can see that the constellation of *remembering* undermines itself.

Learning, (or Searching for Details)

> At any point in history, institutions attempt to legitimate the current version of knowledge and truth by controlling the manner in which texts are ordered with respect to each other.[14]

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13. Jussi Parikka, *What Is Media Archeology*, Cambridge: Polity Press, 2013, p. 27.
14. Gary Radford, 'Positivism, Foucault, and the Fantasia of the Library: Conceptions of Knowledge and the Modern Library Experience', *The Library Quarterly* (1992), p. 418.

A second way in which we might relate search engines to other technologies is through the behaviors that constitute *learning*. By this I mean technologies that require prerequisite knowledge that can be enhanced or deepened through their use. In many ways this description corresponds to the above distinction of technologies for memory.

A point of comparison often made between search engines and other technologies is that of the future of the printed book in an increasingly digital age. Again, this kind of comparison creates a monolithic perception of the traditional kinds of knowledge transfer and ways of expressing ideas before the internet. Much of the dialogue surrounding the place of the printed book draws from wider-ranging issues concerning the importance of scholarship, traditional boundaries, and the hierarchies between experts and amateurs. What many people mean, however, when they speak of *the future of the book* in such a general way refers back to what historian Peter Burke describes as an 'intellectual tripod composed of curricula, libraries and encyclopaedias'.[15] Burke describes how, in the 15th century, due to the uniform way knowledge was structured and taught (through the linear and sequential systems of the trivium and quadrivium), each of these components reinforced one another. 'The order of books would reproduce the order of the university curriculum',[16] and this order, unlike our modern alphabetical arrangements, structured encyclopedias. This arrangement forced a strict relationship between different types of knowledge. Grounding in grammar, logic, and rhetoric was required before students could progress onto arithmetic, geometry, astronomy, and the study of music. The fact that each area reinforced the dominant way of organizing knowledge naturalized many associations and hierarchies built into the system. It was also hard for this system to be questioned due to the fact that areas of thought would be hard to discover without sufficient context provided by the dominant university courses.

We could argue that, although much has changed since the 15th century, different institutions of knowledge still reinforce one another. The ideas that some basic disciplines must be learned to progress to certain areas, that libraries are stocked in accordance to dominant paradigms of learning, and that encyclopedias contain a condensed version of libraries, still exist. What we can say is that encyclopedias, now mostly alphabetical, give multiple points of access, making learning and understanding more flexible and individualistic. Universities allow more freedom and specialization for students and do not try to mirror the complete contents and structure of libraries and encyclopedias inside the minds of students. Libraries are now arranged in a number of different ways, and the variations show how no single order of books is ideal or objective. I will now briefly focus on libraries and their methods of arrangement. Similar to search engines, the development of a practical technology also led to very philosophical changes in attitude.

Many library traditions altered gradually over time. However, one abrupt change was due to the innovations of Melvil Dewey when he created the Dewey Decimal Classification (DDC) system in 1876. The system provided libraries with a more fluid way in which

15. Peter Burke, *A Social History of Knowledge: From Gutenberg to Diderot*, Malden, Mass.: Polity Press, 2000, p. 87.
16. Burke, *A Social History of Knowledge*, p. 92.

books could interact, while at the same time reinforcing older hierarchies and divisions. When demarcating constellation relationships on our map of associations (Figure 1), it might be beneficial to juxtapose the process and mindsets involved in using search engines to the changing relationship users had to books within libraries in the late 19th century. Before the DDC, library catalogs were usually arranged in the 'alphabetico-classed style' that would denote a book's subject and location.[17] Books were usually categorized under one broad category with no sub-categorizing. The remainder of the call number would refer to a specific place in the library. For instance *On the Origin of Species* might have been marked J429, where J indicated biology, 4 the fourth tier in the alcove, 2 the second self, and 9 the ninth book. When a physical library moved or grew beyond its physical limits, the collection often required renumbering.[18] Books were frequently ordered on the shelves by the date of acquisition, since if one tried to implement either alphabetical or sub-categorization of subjects, a significant part of the collection would need to be reclassed with every acquisition.

19th century libraries were significantly smaller than today, as were their number of users, and these users were typically tied to an academic institution either as teachers or students. A typical library user would discover a book via a university syllabus, encyclopedia, or academic writing, thus reinforcing what Burke describes as the 'intellectual tripod'.[19] They would then rely on their own knowledge or librarians' to ascertain the main subject and consult a written index, the only source of information regarding the book's location. There are several problems with this system. First, libraries did not allow browsing to the same extent that they do today; the major categories were too wide to allow for semi-serendipitous research behaviors. Disciplinary knowledge was needed for both cataloging and retrieval, and this forced the process of acquiring new knowledge into traditional patterns, restricting new ways of thinking. Secondly, the written indexes were time-consuming to use and maintain; if a mistake was made in cataloging a book, it would effectively be lost completely. Furthermore, the catalog was handwritten, which not only led to mistakes but meant that there was usually only one or two catalogs per library. Due to their precious nature close supervision and guidance from a librarian was required, leading to less independent research. Finally, the specificity of pre-DDC systems, which focused on where a book could be found within a specific library space, meant that libraries were not easily comparable, hindering the use of multiple libraries.

All of these problems stem from the one major difference between the DDC and the library systems it set to overcome: before the DDC library classmarks related to the physical library space, while DDC classmarks refer to the books. This is an important distinction to make. The DDC marks a reversal of the hierarchy between books and libraries. The DDC shifts emphasis from a physical library space, which is made up of a number of ordered books, to a number of ordered books which together make up a library. The books were classified in relation to one another, and although Dewey's categories were based on existing structures, this change provided a renewed flexibility and opened up new possibilities for how ideas could be accessed and related.

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17. John Comaromi, 'Knowledge Organized is Knowledge Kept: The Dewey Decimal Classification, 1873-1976', *The Quarterly Journal of the Library of Congress* 33 (1976): 3.
18. Comaromi, 'Knowledge Organized is Knowledge Kept', p. 311.
19. Burke, *A Social History of Knowledge,* p. 87.

This change in library classification was a shift in technologies of learning, whereby the alterations in how information was navigated affected established contexts, which in turn helped provide new contexts.

The fact still remains that the books in a particular library need to be stored in a certain relationship to one another, and it is these relationships the user must understand in order to enter into its discourse. Perhaps distinct from the use of search engines as automated memory devices is the use of search engines for learning, or increasing the detail of a particular piece of knowledge the user is already familiar with. Search engine technologies provide access points, and much like a misshelved book in a library, an unindexed page on the web is removed from its context in a way that almost completely prohibits its use. Just as the links between webpages are in some ways more important than their content, the relationship of physical books within a library space provides a parallel way of thinking about context. Although the changes made to libraries in the 19th century do not link to search engines through any traditional linear progression, their juxtaposition might help us realize how technologies designed for practical purposes have changed traditional arrangements of knowledge through-out history, not just in a post-internet world. Associating the institutional structures of use that persisted through Burke's intellectual tripod to search technologies reminds us that search and retrieval are not new, and neither is the information explosion that scholars often lay claim to and have been for hundreds of years. The struggle to or-ganize a seeming over-abundance of knowledge is much older than the digital world it is so often associated with. The balance technologies are required to strike between knowledge prerequisites for learning and open-ended discovery has been part of a much larger technological history than our modern search engine dilemmas.

Discovery (or Study Without End or Reason)

> Man would no longer need documentation if he were assimilated into an omniscient being – as with God himself. […] Everything in the universe, and everything of man, would be registered at a distance as it was produced. In this way a moving image of the world will be established, a true mirror of his memory. […] In this way, everyone from his armchair will be able to contemplate creation, as a whole or in certain of its parts.[20]

So far we have covered two areas that constitute part of the identity of web search engines – remembering and learning – and shown to some extent how similar aspects within these behaviors can be found in other unrelated media. We have seen that when placed in a new context, questions on what is important about search engines can be better formulated. As we have seen, the previous two categories blend into one anoth-er. This provides a space for new categories to be tested, and for the map connecting search engines with other phenomena to be reorganized, opening up space for new perspectives that can be further questioned. It is in this context that I will now discuss the distinction referred to in figure 1 as discovery. One of the primary aspects of web search engines that is often seen as new and unrelated to past media is their ability to

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20. Paul Otlet, *Monde: Essaie d'Universalisme*, trans. Anthony Judge, Brussels: Editions du Mundaneum, 1935, p. 391.

provide access to unexpected areas of knowledge of which the user has little previous experience. Of course this kind of open-ended behavior is linked to the previous distinctions, since the question of prerequisite knowledge required for new discovery rears its head once more. This situation allows us to ask the question, to what extent, then, does a search engine enable unconstrained movement through unexplored information in a way that makes sense? In this case, although previous technologies have been implemented to an extent, it is perhaps more productive to compare the intentions of particular technologies. As Eric Kluitenberg argues:

> More often than not, the expectations contained in such imaginaries far exceed what actual media machines are actually capable of doing. However, the actual media machines are themselves inflicted with impossible desires that are ascribed to, or are projected onto them, by their designers as well as their perception by the public. The transition between imaginary and actual media machines, in terms of their signification can be almost seamless.[21]

The transition between the imaginary and actual occurs often when discussing search engine technologies. This is particularly the case when thinking about original intentions and future possibilities and very often happens when things go wrong. To address this transmission between real and imaginary technologies, I will now briefly outline Paul Otlet's Mundaneum, an institution that aimed to collect and make accessible all human knowledge. The Mundaneum was actually built, and aiming for the impossible was integral to its identity.

Paul Otlet (1868-1944) was a Belgian polymath who spent a large portion of his life working with Henri La Fontaine on various exploits that they hoped would promote world peace. One of Otlet's many ideas for connecting a world becoming more fragmented and hostile throughout his life, was called the Mundaneum. The Mundaneum, which was built and functioned in an unfinished state for a time (hence the ambiguity between actual and imaginary), was planned to house all the world's knowledge. Otlet described it in 1914:

> These collections are conceived as parts of one universal body of documentation, as an encyclopaedic survey of human knowledge, as an enormous intellectual warehouse of books, documents, catalogues and scientific objects. Established according to standardized methods, they are formed by assembling cooperatively everything that the participating associations may gather or classify.[22]

Not simply designed as a storehouse of information, the Mundaneum housed a number of staff who were employed to answer questions from anyone willing to pay a small fee. Knowledge would be open to many more people than the traditional model previously allowed. The time in which these inventions came about is no coincidence. Otlet wanted universal knowledge to break down nationalistic and class

21. Eric Kluitenberg, 'On the Archeology of Imaginary Media', in Erkki Huhtamo and Jussi Parikka (eds) *Media Archeology. Approaches, Applications, Implications*, Berkley: University of California Press, p. 48.
22. Paul Otlet, '1914 Advertising Pamphlet Qtd', in W. Boyd Rayward, 'Visions of Xanadu: Paul Otlet and Hypertext*', JASIS* 45 (1994): 240.

barriers, giving anyone the opportunity to participate in his project and become world citizens of peace in the pursuit of knowledge. He saw the Mundaneum as a centre-piece of the world city he was designing with La Fontaine. Unlike other ideas for drawing together information in a dynamic and futuristic manner, for instance H. G. Wells' idea for a World Brain or Vannevar Bush's Memex, Otlet's negotiation between the imaginary end goal of his project and the early stages of organization were key to his project. The Mundaneum had to be built in order to matter at all. Otlet's designs for a universal collection of knowledge went a step beyond familiarity with an existing system or a new structure that could be imposed on existing materials. The Munda-neum aimed to break not only national and institutional barriers but also the barriers of authorship, tradition, and the physical constraints of publishing. Otlet 'wanted to penetrate the boundaries of the books themselves, to unearth the substances and conclusions inside'.[23]

Akin to search engines, the staff at the Mundaneum would answer queries with quo-tations, photographs, and film footage extracted from their original work but with sufficient references to place it in context. The Mundaneum was constructed by analyzing books and other materials, selecting the most important conclusions, and translating that information onto index cards to be used as facts for any number of different contexts. At its height the Mundaneum contained over '12 million individual index cards and documents'[24] and employed full time operators who could answer questions, provide information, and work for anyone on an individual inquiry basis. During the Nazi invasion of Belgium in 1940, the Mundaneum was stripped and re-placed with an exhibition of Third Reich art. Its legacy lives on, and in the late 90s many of its remains were found and have been reconstructed as a modern museum in the city of Mons.

The aims of the Mundaneum provide us with a renewed perspective for modern search engine technologies. In many ways the projects are connected. Google's mis-sion statement 'to organize the world's information' describes Otlet's project just as well as it does Google's.[25] The beneficial element of drawing these two projects into juxtaposition is simply to argue that search engines are not internet dependent and were attempted before our contemporary connected age. The aspect I find intriguing about the Mundaneum is that, even though it seems old fashioned with its employ-ment of index cards and physical boxes of notes, and even though its aims seem unfeasible, it still sounds inspirationally futuristic, even today. The teams of workers designed to pick out the most important parts of documents, the human contact and control when filing a request, seem at face value more sophisticated than our cur-rent situation of secret algorithms and black-boxed methods. Or are we also pleased that the world's information is out of the hands of individuals? Is the reduction of human bias or error in exchange for the computational errors of machines a cause for celebration? If we for a moment ignore the practicalities of the project and treat the Mundaneum as an institution we might aim for, does it reveal certain hopes and concerns we have for our current situation regarding search engines?

23. Alex Wright, *Glut: Mastering Information through the Ages,* New York: Cornell University Press, 2007, p. 187.
24. Wright, *Glut: Mastering Information through the Ages*', p. 188.
25. Google mission statement, www.google.com/about/.

Hopefully examples like the Quipu, Dewey Decimal Classification, and Paul Otlet's Mundaneum, however contextually estranged, can open up new questions and areas for debate when thinking about the ways in which we use and rely on search engines. Drawing on my metaphor of mapping constellations onto historically unrelated media, I wish to provide a wider area of analysis and more ways to question our current technologies. Through the use of examples the particular constellation categories set up at the start of this essay – remembering, learning, and discovering – have become less distinct. I believe this shows how the process of drawing up multiple non-linear narratives about a technology is perhaps more productive in our attempts to understand its effects than a traditional lineage. Rather than allowing our analysis to be shackled to unrealistically direct historical timelines, we need to decontextualize our technologies in order to see familiar ones in a new light. If search engines themselves do not respect traditional boundaries, then when we study them, why should we either?

References

Baudin, Louis. *A Socialist Empire: The Incas of Peru*, New Jersey: D. Van Nostrand Company, 1961.

Boswell, James. *The Life of Samuel Johnson Volume II*, New York: Penguin, 1986 (1791).

Burke, Peter. *A Social History of Knowledge: From Gutenberg to Diderot*, Malden, Mass.: Polity Press, 2000.

Carr, Nicholas. 'Is Google Making Us Stupid?' *The Atlantic,* July/August 2008, http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/306868/.

Comaromi, John. 'Knowledge Organized is Knowledge Kept: The Dewey Decimal Classification, 1873-1976', *The Quarterly Journal of the Library of Congress* 33 (1976): 17-31.

Google Mission Statement. www.google.com/about/.

Kittler, Friedrich. *Optical Media*, Malden, Mass.: Polity, 2010.

Kluitenberg, Eric. 'On the Archeology of Imaginary Media', in Erkki Huhtamo and Jussi Parikka (eds) *Media Archeology. Approaches, Applications, Implications,* Berkley: University of California Press, 2011.

Kosslyn, Stephen M. 'Social Prosthetic Systems', in John Brockman (ed.) *Is the Internet Changing the Way You Think?* New York: Edge Foundation, 2011.

Mann, Charles C. 'Unraveling Khipu's Secrets', *Science* 309 (12 August 2005): 1008-9.

McLuhan, Marshall. *Understanding Media: The Extensions of Man*, New York: McGraw-Hill, 1964.

Otlet, Paul. *Monde: Essaie d'Universalisme*, Trans. Anthony Judge, Brussels: Editions du Mundaneum, 1935.

Parikka, Jussi. *What Is Media Archeology*, Cambridge: Polity Press, 2013.

Radford, Gary. 'Positivism, Foucault, and the Fantasia of the Library: Conceptions of Knowledge and the Modern Library Experience', *The Library Quarterly* (1992): 408-424.

Rayward, W. Boyd. 'Visions of Xanadu: Paul Otlet and Hypertext'*, JASIS* 45 (1994): 235-250.

Urton, Gary 'From Knots to Narratives: Reconstructing the Art of Historical Record Keeping in the Andes from Spanish Transcriptions of Inka Khipus', *Ethnohistory* 45.3 (Summer, 1998): 409-438.

Wright, Alex. *Glut: Mastering Information through the Ages*, New York: Cornell University Press, 2007.