

*RENVOIS* OF THE PAST, PRESENT AND FUTURE:  
HYPERLINKS, DISCOURSE NETWORKS, AND THE STRUCTURING OF KNOWLEDGE  
FROM THE *ENCYCLOPÉDIE* TO THE WORLD WIDE WEB

Abstract:

During the Enlightenment, the encyclopedia emerged as a dominant technology for the collection, organization, and retrieval of knowledge. The technological features of the encyclopedia – its physical organization and system of navigation – impact both the user and the knowledge it is meant to impart. A notable example was the use of *renvois*, a system of cross-references – hyperlinks – featured prominently in Diderot’s *Encyclopédie*. Rather than simply relying on a structured and sanctioned presentation of knowledge, Diderot’s use of *renvois* often shaped the presentation of knowledge in an ideologically subversive way, weakening the discursive authority of the encyclopedia as a final source of knowledge by always deferring absolute meaning or knowledge to another article, often leading to unsettling juxtapositions, contradictions, and unexpected meanings that forced the reader to think anew. Readers relinquished their position as passive spectators of representation before whom traditional knowledge is merely presented to become an active and integral participant in the *Encyclopédie*’s production of knowledge.

In a McLuhanesque sense, the structure of the *Encyclopédie* – with its subversive *renvois* – was as important as the message it contained, an idea that Friedrich Kittler has developed in his theory of discourse networks. This paper will use Kittler’s framework to help understand the impact of the technological form of the encyclopedia and the use of *renvois* on the ability to organize information and obtain knowledge. Following the emergence of these versions of hyperlinks in the encyclopedias of early modern Europe, we trace the role of *renvois* in more recent knowledge tools, including the Memex, the World Wide Web, and emerging platforms that take advantage of the semantic web and rise of folksonomies. We will reveal how the structure of these new knowledge tools might impact – both positively and negatively – the ways in which information is shaped and knowledge is attained.

Keywords: Encyclopedia, Hyperlink, World Wide Web, Memex, Discourse Network, Semantic Web, Folksonomy

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*RENVOIS OF THE PAST, PRESENT AND FUTURE:  
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INTRODUCTION

Every age has its *knowledge tools*, its tools and technologies to assist with the collection, organization, classification and retrieval of knowledge. Our ancestors progressed from sharing knowledge orally and storing information only in their memories to the development of complex tools facilitating external archival and referencing of increasingly large sets of information and knowledge systems. This lineage of knowledge tools includes cave painting and textile patterns, clay and cuneiform impressions, reeds and hieroglyphics, bamboo and ideograms, parchment and the alphabet, monastic manuscripts and libraries, the printing revolution with its tables of contents and indices, codices and encyclopedias, and so forth through to the current wave of digital information technologies. Such knowledge tools are necessary media by which we gain knowledge, and as such, they play a crucial role in not only organizing and communicating information, but also in our fundamental understanding of the world around us.

This article will focus primarily on a particular knowledge tool, the encyclopedia. Many scholars have explored the unique nature of the modern encyclopedia and the epistemological implications of the desire to capture all of human knowledge in one accessible text (see, for example, Burke, 2000; Headrick, 2000; McArthur, 1986; Yeo, 2001). Such studies reveal how encyclopedias should not be regarded as agenda-free tools that can be used to find information and acquire knowledge in an inherently fair and un-biased manner, arguing instead that often only certain privileged information was included in the construction of an encyclopedia. These studies point to the importance of encyclopedias as potential sites of power for the control of

knowledge. This paper will add to these philosophical and social inquiries by focusing on the *material form* of the encyclopedia. The technological features of the encyclopedia – its physical organization and system of navigation – impact both the user and the knowledge it is meant to communicate. In a McLuhanesque sense, the medium of the encyclopedia is as important as the message it contains, an idea which Friedrich Kittler (1990) has developed in his theory of discourse networks. This paper will use Kittler’s framework to help understand the impact of the technological form of our knowledge tools on our ability to organize information and obtain knowledge. Following the example of the encyclopedias from early modern Europe, more recent Web-based knowledge tools will also be compared, including the interfaces to capitalize on the “semantic web” and the rise of “folksonomies.” This discussion will reveal how these new knowledge tools provide new means for users to take control over the ways in which information is shaped and knowledge is attained.

#### KNOWLEDGE TOOLS AS DISCOURSE NETWORKS

Scholars of technology have long recognized the complex relationship between technology and society. Many humanistic, social and philosophical explorations into the intersection of technology and society suggest that the impact of technology on society is not neutral (see, for example, Latour, 1992; Mumford, 1964; Winner, 1980). Such scholars argue that technologies have, in varying degrees, certain social, political, and ethical biases; they tend to promote certain values and ideologies, while obscuring others. Our knowledge tools are not exempt from such technological biases. These information technologies – be they encyclopedias, computer interfaces, or web search engines – are not simply transparent windows or portals to a

discrete world of information. Rather, they act more like lenses, shaping, perhaps even distorting the information they present and framing the very knowledge their users are meant to obtain.<sup>1</sup>

In this sense, knowledge tools resemble what Friedrich Kittler (1990) calls a *discourse network*, “the network of technologies and institutions that allow a given culture to select, store, and process relevant data” (p. 369). When exploring and comparing the hermeneutics of eighteenth- and nineteenth-century literature, Kittler places his focus on the “exterior character” of each period’s notation systems – their discourse networks – prior to any questions of meaning. As Wellbery (1990) describes in the forward to Kittler’s text,

...such technologies are not mere instruments with which “man” produces his meanings; they cannot be grounded in a philosophical anthropology. Rather, they set the framework within which something like “meaning”...become[s] possible at all. (xii)

Discourse networks orchestrate and shape the structure of meanings in a particular society at a particular time. What is “technologically possible” determines “what in fact can become a discourse” (Kittler, 1990:232). Viewed from within this framework, knowledge tools similarly act as discourse networks to determine both the boundaries within which information is presented and the extent to which knowledge even becomes possible.

Further, the study of knowledge tools cannot be divorced from the structures of power that produce knowledge. As Michel Foucault (1980) has noted, the function of knowledge in society is inseparable from the structures of power and domination. He writes:

...the exercise of power itself creates and causes to emerge new objects of knowledge and accumulates new bodies of information.... The exercise of power perpetually creates knowledge and, conversely, knowledge constantly induces effects of power. (p. 51-52)

E.L. Saak (1997) sees this power/knowledge relationship at play with the pre-modern encyclopedic text, the *Chronicon*:

The encyclopedic knowledge contained in the *Chronicon* is didactic and normative, designed to enforce the intellectual moral order of that social system.... The *Chronicon* not only offers us a window into the intellectual and religious environment of the early thirteenth century, but also serves to reveal the extent to which the power structures of encyclopedic literature set the limits for the pursuit of knowledge. (p. 302-303)

The structure of encyclopedias, then, serve the purposes of a specific social and political contexts, not just organizing and presenting information, but shaping it in ways which exert control over how discourses of knowledge can even take place. In this way, the knowledge tool of the encyclopedia fits within Kittler's conceptualization of a discourse network: the encyclopedia's structure sets the very framework within which the knowledge it means to impart becomes possible to attain. This is perhaps most apparent when we consider the methods of organization employed within encyclopedic texts. As the next section will describe, these structural framings of information within the encyclopedia's pages impact directly the attainment of the knowledge embedded between its covers.

#### THE ORDER OF THINGS: ENCYCLOPEDIA ORGANIZATION OF KNOWLEDGE

The cumulative impact of the emergence of print culture, the Renaissance and the Enlightenment was an explosion of information from all areas of scholarship. The goal of having a universal and accessible compendium of all knowledge drove the continued development of encyclopedias in early modern Europe, but a key hurdle in such efforts was arriving at a method of organization for such a vast and diverse collection of information. The method of organization

within an encyclopedia can be viewed as “expressions or embodiments of a view of knowledge and indeed a view of the world” (Burke, 200094). Indeed, it is often through its ordering and organizational functions that an encyclopedia makes some of its strongest epistemological claims (North, 1997). This can be understood by examining the two main methods of organization adopted by the encyclopedists of early modern Europe: systematic and alphabetical.

### Systematic Organization

The systematic organization of an encyclopedia was typically rooted in rational and scientific approaches to knowledge. Carolus Linneaus’ revolutionary classification system for separating animals and plants into a hierarchical taxonomy influenced many encyclopedists to “experiment with ways of arranging their subject matter in similar upside-down pyramid fashions, with overarching general categories and subdivisions, all the way down to specific topics” (Stockwell, 200198). Similarly, many compilers of encyclopedias used and adapted the metaphors and graphic illustrations associated with the classification of knowledge. Diagrams of various kinds were common in philosophical works in the Aristotelian tradition, especially as interpreted by Petrus Ramus, whose pedagogic texts featured tree-like diagrams showing movement from general to more specific propositions by means of branching dichotomies (Yeo, 200123).

The division of topics into structured hierarchies is meant to help reduce large sets of knowledge to a logical and intelligible form. Supporters of systematic organization suggest that encyclopedias should be “designed like an onion, with the different layers of knowledge surrounding the ‘heart,’ or foundation, of unified science” (Stockwell, 200199). They argue that such an arrangement of entries is closely related to the way we learn. As Stockwell elaborates:

We study history, not individual events of single battles; biology, not koala bears or eucalyptus trees. We need a broad construct if we are to learn. Otherwise, the single events and specific things have no meaning. They are like building blocks that can't be stacked if you have no concept of the a building. Even the proverbial "man with a grasshopper mind" relates images in his rapidly changing thought processes to some broader picture. He visualizes sonnets and limericks as part of the field of poetry, and poetry as part of the field of literature. (p. 100)

The systematically organized encyclopedia attempts to preserve such connections and relations between knowledge, moving from the broadest categories down to its specific elements. The systematic arrangement of knowledge in early encyclopedias had obvious advantages: a reader could begin with one of the sections and obtain a deep and thorough understanding of that branch of knowledge; readers could also better understand the linkages and relationships between branches of knowledge.

Yet, such strict systems of classification carry risks. Linnaeus recognized that his classifications were "cultural constructs reflecting human ignorance" (Headrick, 2000:22). Or, as Bates (2002) realizes in his epistemological exploration of historical attempts to map knowledge, "any division and classification must be somewhat arbitrary, because the complexity of things does not lend itself to simple orders. All the distinctions between various kinds of human knowledge must be decided, created, distributed..." (p. 15-16). Such knowledge maps, common in many systematically organized encyclopedias, are problematic, Bates maintains, because "they reify particular orders and present them as an objective reality. The individual map defines one version of the world at the expense of other perspectives, excluding them with its appearance of scientific 'accuracy'" (p. 6).

All classificatory nomenclatures, then, are merely constructs of the mind, imposing on its subjects an arbitrary pattern that distorts their underlying reality.<sup>2</sup> The imposition of such an arbitrary classification system resonates with Michel Foucault's reaction to Jorge Luis Borges' descriptions of a Chinese encyclopedia which organizes the animal world according to a complex and foreign system of criteria: "(i) frenzied, (j) innumerable, (k) drawn with a very fine camelhair brush, ... (m) having just broken the water pitcher" (Foucault, 1971xv). What Foucault found most unsettling in Borges' Chinese encyclopedia is not the seemingly absurd categories that order the world of animals so much as one particular category: "(h) those that are included in this classification" (p. xv). Systematic order is fractured by this self-reflexive category, and the "monstrous quality of the encyclopedic order is not the oddity of juxtaposition but the destruction of a common ground for any order" (Bates, 20024). Such encyclopedic "order" represents not an ontological category, but only a rhetorical performance, a linguistic act that defines and classifies in order to exert control (Foucault, 1971xx).

Geoffrey Bowker and Susan Leigh Star (1999) continue this criticism of arbitrary classification systems, arguing that any such schema are inherently political: "Systems of classification (and of standardization) form a juncture of social organization, moral order, and layers of technical integration" (p. 33). They stress that the "material force of classification systems" impacts our world "epistemologically, politically, and ethically" (p. 10). Lucy Suchman (1997) makes a similar claim in her argument that whoever determines the classificatory categories, and how such categories can and will be used, imputes their own personal values and ideologies into the system, exerting power over both the user and the information itself.



The systematic organization of knowledge in encyclopedias, by definition, arranges concepts according to a preconceived and rigid system of categorization, a system that Foucault, Bowker & Star, and Suchman reveal to be not only arbitrary, but often politically charged. While the systematic organization of an encyclopedia was meant to encourage intensive reading and reveal the links between different branches of knowledge, its arbitrariness and strict structure impart a dogmatic rigidity on the way the information is meant to be read and understood. Considered this way, the systematically-organized encyclopedia embodies a discourse network which determines both the boundaries within which information is presented and the extent to which knowledge can be acquired.

#### Alphabetic Organization

The broader shift towards alphabetic organization within encyclopedias by the late seventeenth century can be seen as a moment of emancipation from the strict hierarchies of systematic classification. Alphabetization was viewed as a more egalitarian method of organization – “the zero degree of taxonomy” – avoiding the hierarchies of systematization and reducing all subjects to the same ontological level (Yeo, 200125). In his study of one of the first alphabetic encyclopedias, Vincenzo Coronelli’s *Biblioteca universale*, James Fuchs argues that Coronelli’s choice of the alphabetic order was motivated by just such thinking:

The topical encyclopedia became for him a symbol of all the hierarchies on earth that he opposed, and correspondingly, he thought that by arranging his encyclopedia alphabetically, he was striking a symbolic blow against them. The alphabet was the great leveler. Religious matters would not be ranked above secular ones, mechanical skills

would not be placed below intellectual ones, and articles on princes would appear side by side with articles on peasants. (qtd. in Headrick, 2000:163)

Along with such ideological motivations, practical needs also drove the move toward alphabetization. Given the significant advances in scientific and philosophical understanding during this period, alphabetization simplified the integration of new knowledge into existing encyclopedias. Alphabetical organization provided the ease and flexibility for simple insertion of the most recent discoveries without having to fit them into existing classification systems or assess their “implications for traditional doctrines in long treatises” (Yeo, 2001:25). Finally, alphabetization helped transform the encyclopedia into a more user-friendly “quick reference” guide, providing a familiar and predictable arrangement allowing rapid consultation by users who were in search of particular items.

This move toward alphabetic practicality over systematic rationality had its own disadvantages. The alphabet is not a natural path towards understanding things, but an arbitrary method based on the native culture’s particular alphabetical ordering of letters. Many viewed alphabetical ordering as more arbitrary than even the most obscure systematic method of organization: Harold Innis complained that “encyclopedias may tear knowledge apart and pigeonhole it in alphabetical boxes” (qtd. in Burke, 2000:186), and Samuel Taylor Coleridge lashed out against such “an arrangement determined by the accident of initial letters” (qtd. in Stockwell, 2001:99). While alphabetical ordering enabled a more efficient access to encyclopedia entries, its adoption merely seemed to replace the ideological concerns of systematic organization with an equally arbitrary fragmentation of knowledge. Here, the “network of technologies and institutions” which constitute a discourse network – determining the frame within which information is presented – was the alphabet itself. While avoiding some of the

political and ideological problems of systematic organization, alphabetization threatened the coherent utilization of encyclopedias through its inevitable and absolute fragmentation of knowledge.

#### NAVIGATING KNOWLEDGE: CROSS-REFERENCES IN ENCYCLOPEDIAS

To counteract the perceived arbitrariness of alphabetic order, the practice of cross-referencing was introduced to guide readers to other entries on related topics, creating new discourse networks that shaped the knowledge attainable by encyclopedia readers. One of the first reference works to utilize cross-references was the *Cyclopaedia* published by Ephraim Chambers in London in 1728. Chambers took great pains to ensure the subjects in his encyclopedia were organized in proper relationship to one another. As he explained in the preface, “Our view was to consider the several matters not only in themselves, but relatively, or as they respect each other; both to treat them as so many wholes, and as so many parts of some greater whole” (qtd. in Stockwell, 200155). Chambers used an elaborate scheme of 47 divisions and subdivisions of knowledge which he combined with widespread use of cross-references at the end of various subjects, providing a complex weaving of articles, which themselves were arranged alphabetically. Chambers’ innovative use of cross-references to help systematically link alphabetically organized articles became the inspiration for the equally groundbreaking *Encyclopédie*.

The *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* (“Encyclopedia, or Reasoned Dictionary of the Sciences, Arts, and Crafts”) was published by Denis Diderot and Jean le Rond d'Alembert in France beginning in 1751, the final volumes being released in 1772. Totalling 35 volumes in its final form, the *Encyclopédie* was one of the longest

and most complete compendiums of information published in early modern Europe. In the entry for “*Encyclopédie*,” Diderot explained that his goal for the work was “to assemble all knowledge scattered on the surface of the earth, to expose its general system to the men with whom we live, and to transmit it to the men who will come after us” (qtd. in Headrick, 2000:156). Diderot wanted to collect all the knowledge previously held by a privileged few into one public work, accessible to all, and to “discover all the secrets painstakingly concealed by ignorance, hypocrisy, and falsehood” (Stockwell, 2001:86). Believing that a good encyclopedia should “have the character of changing the general way of thinking” (qtd. in Stockwell, 2001:88), Diderot built the *Encyclopédie* around a secular-humanist model of knowledge where philosophy was its trunk, and religion was merely one branch. Following Enlightenment thinking, Diderot’s approach implied that knowledge could come only from observation and inductive reasoning, not from revelation or religious authority. Headrick (2000) explains the radical nature of such an approach to knowledge at the time:

To a cultured class that was losing its passion for religious faith but had not yet surrendered to the passions of secular ideologies, secular humanism was clearly subversive and, for that reason, exciting, dangerous, and seductive. (p. 156)

One such subversive feature of the *Encyclopédie* was the thorough treatment of the *métiers*, or crafts. While previous encyclopedic efforts focused primarily on the philosophical and scientific arts, Diderot and d’Alembert gave equal attention to craftsmanship and the mechanical arts. The *Encyclopédie* represented a shift from viewing the mechanical arts as embedded in the minds and shops of craftsmen to a systematic written and pictorial representation worthy of as much intellectual consideration as chemistry or even theology.

Stockwell (2001) describes the revolutionary impact such encyclopedic descriptions of the crafts had on its eighteenth century audience:

By taking craftsmanship seriously for the first time, Diderot helped set in motion the downfall of the royal family and the rigid class system. Suddenly, in the pages of the *Encyclopédie*, every person became the equal of every other, because they had access to the technical and social know-how of the technicians as well as the scholars of the educated classes. No longer could the few claim the sole right of ruling the nation when Diderot had given a clear picture of how power was maintained and had exploded the religious and social myths that kept people in a condition of servitude. (p. 89)

By exposing these “religious and social myths,” the *Encyclopédie* was considered a threat to seats of authority, both intellectual and religious. It was castigated as “chaos, nothingness, a work of disorder and destruction, and the gospel of Satan” and accused of “having disseminated, far and wide, the seeds of Anarchy and Atheism” (Stockwell, 2001:89-90). Opponents of the *Encyclopédie* tried to block its publication, and many church and state officials attempted to censor its contents. To avoid the wrath of the authorities, Diderot and d'Alembert relied on irony, innuendo and indirection when discussing controversial topics in the *Encyclopédie*. For example, comments on injustice to the poor were hidden in articles on such mundane things as salt, while objectionable concepts such as “fornication” were scattered among unrelated terminology in articles on theology.

Perhaps the most used – and perhaps the most subversive – tool for avoiding censorship in the *Encyclopédie* was the cross-reference. Diderot and d'Alembert relied heavily on what they called *renvois*, articles cross-referenced to one another, thereby guiding the reader to radical

or subversive knowledge while eluding the attention of church or state authorities. As Stockwell (2001) explains,

...the reader of Diderot's article on Belbuch, one of the many gods of the Vandals, was referred by cross-reference to an article on immorality. The reader who turned to this second article would get Diderot's deist viewpoint, while the censor, having only one volume in hand for review, missed the seditious point. (p. 91)

*Renvois* can not only indicate subversive links between articles, but they can also juxtapose articles with opposing ideas or arguments, and thus exposed concealed relationships between controversial issues or hidden links between disparate pieces of knowledge. One of the most powerful functions of *renvois*, Vanpée (2002) explains, was to signify two contrary meanings simultaneously:

Confronted with two meanings, whether they are opposite or simply different, the reader is forced to compare, question, and think. The ultimate significance of the juxtaposition of contrary meanings is neither evident, direct or transparent but must be interpreted. (p. 232)

Such a model of reading subverted the traditional models of knowledge as singular and infallible, relying instead on a reader's interpretation of the differences or contradictions she might encounter when following the cross-references between articles. Again, Vanpée best describes this liberating function of *renvois*:

The author and editor can lay out the signposts of the detours for the reader to follow through the cross-references, but they cannot control the reader's interpretation of the differences or contradictions she then encounters between articles. How the reader interprets an article that both "confirms and refutes," "unsettles and reconciles" explicit

or implicit statements and arguments, exceeds the editor's and the author's command.

... Thus, this model of reading, which directs the reader to and through the contradictions and differences in the encyclopedic system, frees the reader as it loses control over him.

(p. 232-233)

In the *Encyclopédie*, such cross-references act as discourse networks, determining both the framework within which information is presented and the extent to which knowledge even becomes possible. But instead of the *constricting* ways knowledge was shaped by systematic organization, or the arbitrary results of the alphabetization of knowledge, Diderot's *renvois* shaped the presentation of knowledge in an ideologically subversive way to the *benefit* of the user. *Renvois* weaken the discursive authority of the encyclopedia as a final source of knowledge by always deferring absolute meaning or knowledge to another article. Rather than threatening or limiting the knowledge available to the reader, the discourse network of *renvois* enhanced the reader's experience of the *Encyclopédie*. Following the cross-references led not only to unsettling juxtapositions and contradictions but also to unexpected meanings that, in turn, forced the reader to think anew. Readers relinquished their position as "passive spectators of representation before whom the total meaning of all signs is played out" to become "an integral part in the machine's production of narratives of knowledge" (Werner, 2002270).

This reminds us that the ways in which our knowledge tools affect the information they present – the way in which they act as discourse networks – is not always disadvantageous. The *Encyclopédie*'s reliance on cross-references challenged and changed the common ways of thinking. Its web and circuit of cross-references were the "secret utility and inner force of the entire work" (Werner, 2002266). The *renvois* subverted the rigidity of a linear reading of the *Encyclopédie*, freeing the user from the constraints of systematic organization. Such an open-

ended and path-indeterminate system of information navigation resembles the vision of three pioneering designers of knowledge tools of the twentieth century: Vannevar Bush, Ted Nelson, and Tim Berners-Lee. Their visions for the memex, hypertext, and the World Wide Web, respectively, represent innovative discourse networks meant to free users from the hegemony of fixed information organization in much the same way *renvois* did for the readers of the *Encyclopédie*.

#### TWENTIETH CENTURY *RENVOIS*: MEMEX, HYPERTEXT & THE WORLD WIDE WEB

As noted above, one consequence of the *renvois* in the *Encyclopédie* was the liberation of the reader from strict systematic or alphabetic organization systems. By using cross-references, Diderot and d'Alembert created a non-linear environment to organize and guide navigation of the knowledge presented in that eighteenth century work. Similar non-linear information organization and navigation reappeared two hundred years later in the pioneering work of Vannevar Bush. Bush, science advisor to President Franklin D. Roosevelt, published “As We May Think” in 1945 as an attempt to mobilize the scientific community after World War II to develop knowledge tools rather than military tools. Mirroring the explosion of knowledge Diderot experienced during the Enlightenment, Bush realized the amount of scientific data was growing at an incredible pace in the first half of the twentieth century, and argued that people needed to find new ways to organize and access information through the use of new technology:

The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships. (Bush, 1945:102)



Further, Bush realized the constraints of the dominant systematic method of information organization:

Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing. When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing it down from subclass to subclass. It can be in only one place, unless duplicates are used; one has to have rules as to which path will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and re-enter on a new path. (Bush, 1945:106)

Here, Bush recognized the limitations of interacting with a system through a rigid data structure: if the data is stored in classes and subclasses in a database, then users must delve into classes and subclasses, navigating through that database as required by its data structure rather than by their own interests or personal method of information organization. In short, Bush understood how systematic organization of information can act as discourse networks to shape how information is made available and limit the ability to gain knowledge. Bush's goal, then, was to invent new knowledge tools – new discourse networks – to help users locate, organize, coordinate, and navigate through the increasing amounts of research information, and to free them from the constraints of rigid systems of classification and data organization.

What made a piece of information valuable, Bush suggested, was not the overarching class or category that it belonged to, but rather the *connections* it had to other data. As a solution, Bush proposed the “memex,” a mechanical knowledge tool, half microfilm machine and half computer, to support the process of thinking through “associative indexing”:

A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory. (pp. 106-107)

The memex would aid the process of thinking through a mechanized indexing system, where different pieces of information in the indexing system could be connected together by creating individualized associative *trails*. A trail was analogous to the trail of mental association in the user's mind: A memex user *builds* a "trail of interest through the maze of materials available to him" (Bush, 1945:107) as he explores the collection of knowledge presented.

The memex's trails, like the *Encyclopédie's renvois*, represent a way of organizing and navigating information that subverts the strict, inflexible dictates of systematic or alphabetic conventions. Documents can be connected for more elusive, transient reasons, and each item might have many trails leading to it. Bush's vision inspired another pioneer in knowledge tools, Ted Nelson, who wrote twenty years later of a new knowledge tool that would enable users to publish and access information in a nonlinear format. Nelson called this format *hypertext*, a "nonsequential assembly of ideas" where the ultimate goal was "the global accumulation of knowledge" (qtd. in Stockwell, 2001:168). With hypertext, users of knowledge tools would no longer be constrained to read in any particular order, but could follow links in and out of documents at random – navigating via hypertext is open-ended, the path being determined by the needs and interests of the reader.

Nelson's vision of nonlinear and nonsequential linking of information via hypertext was brought to fruition by Tim Berners-Lee, developer of the World Wide Web. Applying hypertextual links to the growing collection of documents on vast computer networks such as the Internet, Berners-Lee also followed Bush's paradigm of associative trails when he noted that

“inventing the World Wide Web involved my growing realization that there was a power in arranging ideas in an unconstrained, weblike way” (Berners-Lee, 20003). Berners-Lee understood the human mind’s ability to link random bits of data and envisioned an online information-space where anything could be linked to anything – a web of information:

Suppose all the information stored on computers everywhere were linked... Suppose I could program my computer to create a space in which anything could be linked to anything.... Once a bit of information in that space was labeled with an address, I could tell my computer to get it. By being able to reference anything with equal ease, a computer could represent associations between things that might seem unrelated but somehow did, in fact, share a relationship. A web of information would form. (20004)

In 1980, while an independent contractor at CERN, Berners-Lee proposed a project based on the concept of hypertext, to facilitate sharing and updating information among researchers within his lab, and to escape from the “straitjacket of hierarchical documentation systems” (p. 21). This resulted in the eventual creation of the World Wide Web (WWW), the distributed hypertext system that operates over the Internet. By using hypertextual linking, the WWW allows documents, ideas and concepts to be stored and shared in ways similar to Bush’s call for associative trails to guide information navigation, and Nelson’s vision for a “nonsequential assembly of ideas.”

Both the memex and the hyperlink structure of the World Wide Web can be viewed as discourse networks in the same vein as the *Encyclopédie’s renvois*. All play a role in determining both the framework within which information is presented and the extent to which knowledge even becomes possible. And like the *renvois*, these knowledge tools of the twentieth century act to – at least in part – enhance the user’s navigation and understanding of knowledge. They free

the reader from the “straightjacket” of fixed and hierarchical systems of information organization, allowing open-ended and non-determined navigation of information. Through these tools, users can organize and navigate information following their own intuitive means, based not on imposed hierarchies or alphabetization, but on their own habits of thinking – following leads, making connections, building trails of thought. Like with the *renvois*, these tools allow users to become “an integral part in the machine’s production of narratives of knowledge” (Werner, 2002:270), subverting, perhaps, the traditional structures of power that Foucault (1980) feared in previous discourse networks.

#### LOOKING FORWARD: THE POTENTIAL OF *RENVOIS* IN EMERGING WEB TECHNOLOGIES

While the World Wide Web has become a dominant knowledge tool at the end of the twentieth and early twenty-first centuries, the prevailing methods of navigating this web of information has limited its ability to act as a fully subversive discourse network. Web directories, such as the initial incarnation of Yahoo!, attempted to add some sense of organization and navigability to the Web. Yet, by providing a structured hierarchy of websites organized by subject in a manner similar to a library classification scheme, these directories fell victim to the same faults of early encyclopedias: Relying on humans to evaluate and place Web sites within the directory places them in a position of ontological authority over which sites are included (and which are not), and where in the hierarchy they belong. The systematic organization of knowledge in Web directories, by definition, arranges concepts according to a preconceived and rigid system of categorization, destroying the non-linear, hyperlinked structure of the Web.

Web directories were quickly replaced by the Web search engine. Rather than relying on human-based directories, search engines rely on complex ranking algorithms designed to take advantage of the Web's hyperlinked structure to organize and make the Web navigable and useful (see Kleinberg, 1999; Brin and Page, 1998; Page et al., 1998). Rather than treating pages on the Web like books in a library that can be neatly classified into rigid categories, Web search engines exploit the inherent link structure of the Web, locating, indexing, and ranking pages based on their relationship to other pages, in order to "make sense of the vast heterogeneity of the World Wide Web" (Page et al., 1998). Yet, despite their central focus on the hyperlinked structure of the Web, search engines fall short of fully-capitalizing on the non-linear and potentially subversive nature of the Web. Rather than capturing the ways in which the hyperlinked Web might reach the liberating potential of a digitized *renvois*, search engines fall into similar biases that plagued encyclopedias and Web directories that preceded them.<sup>3</sup> Indeed, as today's prevailing knowledge tool – the web search engine – merely represents the latest discourse network which limits the framework within which information can be accessed and knowledge attained, failing to fully realize the potential of the hyperlinked *renvois* of the World Wide Web.

Might a new discourse network for the World Wide Web emerge which frees users from the hegemony of fixed or biased information organization and navigation in much the same way *renvois* did for the readers of the *Encyclopédie*? Can Bush's full vision of independent navigation and creation of personal associative links for others to follow be realized on the Web? The remainder of this article will briefly discuss two emerging knowledge tools that might rise to these challenges: the mSpace interface that taps into the "semantic web," and the rise of "folksonomies."

In 2001, Tim Berners-Lee described his vision for the Semantic Web, an extension of the World Wide Web in which the semantics of information and services on the Web are defined and machine-readable, making it possible for Web tools to understand and satisfy the requests of users, enhancing the ability to find, share and combine information on the web (Berners-Lee et al., 2001). Researchers at the University of Southampton have developed *mSpace*, a semantic web interface “to help explore relationships in information” and “build knowledge from exploring those relationships” (see Schraefel et al., 2005; Wilson et al., 2006). *mSpace* closely follows Bush’s vision for the memex by giving Web users the ability to build and share associative links when browsing the Internet. As *mSpace*’s creators explain:

An *mSpace* presents several associated categories from an information space, and then lets users manipulate how many of these categories are presented and how they're arranged. In this way, people can organize the information to suit their interests, while concurrently having available to them multiple other complementary paths through that information. (*mSpace*, n.d.)

By supporting contextual and user-determined organization of information, *mSpace* works as a truly subversive discourse network, enabling structures of knowledge to emerge beyond the hierarchies of systematic organization or the existing link structures of the Web. *mSpace* remains in early development, and much work remains before this model of Web navigation could become widespread. Nevertheless, it remains a promising vision of the potential for future knowledge tools to enable navigation of the Web in the ways Bush and Nelson envisioned.

A second emergent knowledge tool with the potential to free users from the hierarchical straightjacket of information organization is the phenomenon of *tagging*, also known as folksonomy. Tagging is the practice of collaborative categorization using independently chosen

keywords. It typically involves a loosely knit group of people cooperating spontaneously to organize information into categories. Examples include [del.icio.us](http://del.icio.us), a community of users who tag and share their Internet bookmarks, [Flickr](http://Flickr), a photo-sharing site, or [Technorati](http://Technorati), where users can search tagged blog entries. Tags represent a unique user-defined categorization schema, challenging and offering benefits over traditional hierarchical or structured methods of organizing information. As Joshua Schachter, the creator of del.icio.us, stated “a bunch of people doing ‘okay’ tagging may actually have a higher net value than an authoritative organization telling you how information should be organized” (qtd. in Roush, 2005:22). Or, as Clay Shirky (2005) summarizes when describing the benefits of tagging-based organization systems:

The signal benefit of these systems is that they don't recreate the structured, hierarchical categorization so often forced onto us by our physical systems. Instead, we're dealing with a significant break – by letting users tag URLs and then aggregating those tags, we're going to be able to build alternate organizational systems, systems that, like the Web itself, do a better job of letting individuals create value for one another, often without realizing it.

Together, tools such as mSpace and platforms that support folksonomies represent emergent Web-based knowledge tools that might become the next dominant discourse networks acting to shape information in ways that enhance one's ability to gain knowledge. The future study of these emergent technologies, contextualized within the history of the encyclopedia, will contribute to our understanding of how our knowledge tools frame information and shape it in ways which exert control over how discourses of knowledge can even take place. Perhaps, with these new user-defined discourse networks, the traditional structures of power that Foucault

feared, and Diderot attempted to circumvent with his original use of *revois*, might be, at least partially, subverted.



## ENDNOTES

1. For studies of how encyclopedias shape information and knowledge, see (Bates, 2002; Burke, 2000; Saak, 1997; Werner, 2002; Yeo, 2001); for the ways computer interfaces impact how we relate to information, see (Johnson, 1997; Raskin, 2000; Shneiderman and Plaisant, 2005); for concerns over biases in the delivery of information via search engines, see (Chandler, forthcoming; Diaz, 2008; Goldman, 2006; Introna and Nissenbaum, 2000; Vaughan and Thelwall, 2004).
2. My use of the term “arbitrary” to describe systematic organization systems is not to imply that they are not well thought-out or useful. Organizing a set of things based on size, for example, might be a well-structured and useful systematic method. Yet, it remains arbitrary in the sense that there are a multitude of other variables (color, use, density, etc) that would be an equally-useful categorization scheme.
3. Various scholars have revealed that search engines are not neutral gateways to the Web (Introna and Nissenbaum, 2000), possibly insert their own biases into results (Diaz, 2008; Goldman, 2006; Mowshowitz and Kawaguchi, 2002), and perhaps merely strengthen already dominant voices, limiting the ability to tap into the fully distributed nature of the Web (Cho and Roy, 2004).

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