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When search engines stopped being human: menu interfaces and the rise of the ideological nature of algorithmic search

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ABSTRACT

Algorithmic search is entangled with a positivist ideology biased towards the assumption that neutrality can only be provided when search is performed by computational processes while shielded from human agencies. This article critically examines the ideological nature of algorithmic search, by showing how, between the mid-1970s and late-1980s, long before the birth of algorithmic search by search engines in the 1990s, a transformation from human interfaces to menu interfaces in online search helped encourage and normalise algorithmic ideology at the expense of a more humanistic ideology of search connected to library traditions. Based on a study of a broad corpus of archival materials in which online search appeared as a central object of description and discussion, it argues that the rise of menu interfaces in the 1980s encouraged the positivist nature of algorithmic search by decoupling a democratic service function at the front-end from the editorial function in the back-end, and by discouraging the use of human selection power and intellectual labour in the search process.

Introduction[1]

In early December 2016, it was widely reported that Google's first result for querying "Did the Holocaust happen?" was a link to the white supremacist Holocaust denial forum of Stormfront.org (Peyser, 2016). Google initially announced it would not remove the link, because tinkering with results by human intervention was not in line with Google's belief in the neutrality and objectivity of its engine. Editing search results would call into question the impartiality of the products of its supposedly unbiased algorithms and thus harm company values. Google's initial reaction triggered obvious controversy in both mainstream and social media. In response, Google decided to tweak its algorithm two weeks later, eliminating Holocaust denial sites from its results altogether (Peyser, 2016). Importantly, while as usual Google did not disclose anything about what it tweaked, the company was eager to stress that no human employees tinkered with its results, and its programmers only "made improvements" to the search algorithm to ensure "more high quality, credible content on the web" would surface in the machine's outputs (Roberts, 2016).

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Whatever controversies may appear, Google attempts to perform as an unbiased service tool for information retrieval, regardless of the fact that algorithmic processes cannot be neutral and always involve processes of selection, filtering and ranking (Gillespie, 2014). However, it is important not to dismiss Google's pursuit for objectivity as naïve, but to see it as a key component in the *algorithmic ideology* (Mager, 2012) that undergirds the design of its engine, and supports its massive use. Following Terry Eagleton, I understand the concept of ideology as a normalising force, which often leaves the cultural and contingent nature of societal practices unquestioned (Eagleton, 1991). Google's ideological pursuit for objectivity certainly seems to be effective in leaving algorithmic operations undisputed, as Pew Research Centre's latest report on search engine use concludes that "[r]oughly two-thirds of searchers (66%) say search engines are a fair and unbiased source of information" (Purcell, Brenner, & Rainie, 2012). Search engines, as media scholar Alexander Halavais rightly concludes, "have become an object of faith" that "are trusted more readily than they ought to be" (2009, p. 2).[2]

In this article, I critically examine the ideological nature of algorithmic search, by showing how, between the mid-1970s and late-1980s, long before the birth of algorithmic search by search engines in the 1990s, a transformation from human interfaces to software interfaces in online search helped encourage and normalise algorithmic ideology at the expense of a more humanistic ideology of search connected to library traditions. The former ideology has earlier been explained as primarily capitalist in nature (Mager, 2012), and as complexly entangled with Google's economic position (Bilić, 2016). Whilst these economic explanations are imperative, this article is concerned with the *positivist* nature of algorithmic ideology, in particular its assumptions about the information search abilities of humans vis-à-vis machines.

According to information scientist Birger Hjorland the "positivist view implies that searching can be done in a formal way (algorithmic) that retrieves relevant knowledge without bias in the search" (2015, p. 1563). Information scientist Julian Warner has associated this positive approach to information search with the computer science tradition of information retrieval (2010). Warner discusses it as biased towards the common assumption of *query transformation* – implying that the information request of a user can adequately be satisfied by a computer system that transforms a query into a set of results by automatically calculating the relevance of stored information relative to the query (p. 3).

Importantly, as Warner points out, this computer science paradigm in information retrieval can be juxtaposed to an alternative understanding of information retrieval in librarianship whose history is much longer, yet which today has become far less influential than the positivist view of algorithmic search (p. 5). Warner argues that the library tradition and library science carries forward two key values in search that have been neglected by the computer science tradition. First, it has emphasised *selection power*, the human ability to make knowledgeable decisions to further the search process (p. 9). Second, it has valued and acknowledged the importance of human intellectual labour for developing and exercising selection power. Selection power enabled librarians to take editorial control over the retrieval process, and the interpretation and evaluation of the results retrieved, meaning "a great level of iteration in search processes – and, most important, an understanding of what is going on during the search" (Hjorland, 2015, p. 1563). Following Hjorland and Warner's distinction between the two paradigms in information retrieval, I characterise the ideological nature of contemporary algorithmic search as one that is

biased towards the assumption that objectivity in search can only be provided when the editorial function is delegated to computational processes, and user selection power is shielded from this function, and reduced to a minimum.

Importantly, positivist algorithmic ideology is reflected and supported by the separation of a front-end – user interface – and back-end – engine – in contemporary search systems. The editorial function of selecting, retrieving and ranking, information is performed in the back-end by algorithmic processes. These editorial processes are separated from user activities at the friendly front-end, or user interface. Through continuous utility improvements and a minimalist visual design these interfaces *facilitate* querying, or what media theorist Geert Lovink termed a "society of the query" in which search as query formulation is an integral part of our lives, yet in which we are oblivious to the role of engines transforming queries into information (Lovink, 2009). Then laudable though the democratising potential friendly search interfaces afford to their users may be, the power of convenience is only shallow. Search interfaces afford empowerment of access, yet simultaneously "form a façade of user control" (Bilić, 2016, p. 7) that supports the opacity of algorithmic control over search in the back-end.

For over a decade, media scholars have studied and critiqued such politics of search engines (Granka, 2010) and in particular the leading commercial actor, Google. These works have challenged assumptions about engines as neutral and objective information intermediaries, revealing how they incorporate biases (Diaz, 2008; Goldman, 2006; Introna & Nissenbaum, 2000; Jiang, 2014; Mowshowitz & Kawaguchi, 2002); actively produce information and knowledge through mechanisms of profiling, ordering, filtering and ranking (Feuz, Fuller, & Stalder, 2011; Pariser, 2012; Van Dijck, 2010); and are entangled with capitalist ideologies (Mager, 2012; Pasquinelli, 2009) within a political economy of digital and user labour (Bilic, 2016; Fuchs, 2011). Additionally, a handful of studies assess the contingent histories of these retrieval machines (Duguid, 2009; Mayer, 2009; Rieder, 2012).

The current project is both critically oriented and employs history as its main analytical tool; yet, it still differs from either approach. Directing analytical focus to online search practices instead of engines, my argument will highlight that compared to online search practices in American public libraries in the 1970s, online searching with consumer information services at home in the 1980s involved key transformations in the search interface to the user that encouraged the ideological nature of algorithmic search.

To substantiate this thesis, I will first argue that, supported by humanistic types of knowledge associated with the field of library science, librarians encouraged transparency in the search process by coupling a democratic interface function with the editorial function of the engine, thereby maintaining full control over the search process. Subsequently, I argue that friendly software interfaces decoupled the democratic service function from the editorial function by separating front and back-end. First, these software interfaces, menu-based ones in particular, facilitated *query formulation*, yet masked the interconnected process of *query transformation*, which now occurred at a back-end that could not directly be accessed by the user. Second, these interfaces were designed for ease, to minimise cognitive effort, which varies inversely with values of human selection power and labour. Supported by discourses in design circles and computer magazines, these interfaces encouraged a new kind of empowerment that equalled power with access, and no longer with control over search.

Methodology and corpus

Before detailing each of the aforementioned insights in the following sections, I will begin with a brief description of the historical methodology used and the corpus studied. This study's methodology is closely associated with archaeological and genealogical approaches to new media and the Internet that have emphasised the importance of understanding common-sense phenomena associated with digital culture by unravelling the contingent and non-teleological histories that condition their existence (Goddard, 2015; Parikka, 2007, 2012). However, while these *media* archaeological studies typically centre on the materiality of media technologies, this study moves away from a focus on the technical artefact, placing the attention on the historical – specifically genealogical – examination of common-sense new media *practices* instead.

In his influential text, "Nietzsche, Genealogy, History" (1977), Michel Foucault described genealogy as a historiographical model by which to account for the contingency of transitions and transformations – continuities and discontinuities – that underlie the historical emergence of phenomena we take as natural today. This work loosely employs genealogy as a critical historiographical mode of "writing the history of the present" (Foucault, 1977, p. 31) to explain how the phenomenon of algorithmic search, and its associated ideology, already naturalised before the introduction of search engines, when menu interfaces presented a viable alternative to human interfaces.

In order to write this history of a present ideology of algorithmic search, a broad corpus of scientific journals (e.g. *Journal of the American Society for Information Science*), professional periodicals (e.g. *Online*, *Online Review*), book publications (e.g. *Online Searching Technique and Management)* and computer magazines (e.g. *Online Today)* in which online search appeared as a central object of description and discussion in the period between the 1970s and 1980s has been studied.[3] All of these sources are connected by a focus on the United States (US). The US formed one of the first societies in which search integrated with the lives of ordinary people in the period between the early 1970s and late 1980s. Additionally, many pivotal developments in search which took place within this period originated and were first researched, discussed and debated in the US context.

Human interfaces: connecting front and back-end

Practices of online information search in use of search engines are relatively new, yet mediation – human or technological – in online search is certainly not. In the early 1970s, online bibliographic searching emerged as a service for library patrons – mainly professional researchers – in American research libraries and large public libraries that automated parts of their manual search services in reference work with the introduction of networked computer systems for information retrieval (Bourne & Hahn, 2003). The most commonly used system in libraries was *Dialog,* which enabled users to search for indexed information in computer databases by means of Boolean query statements.

Both computer systems for information retrieval *and* human intermediaries mediated the information search process – retrieving bibliographic references from computer databases relevant to the information needs of library patrons requesting information. However, continuing a library tradition of reference work in which human intermediaries were key, librarians performed as the very *engines* driving the search. The brainpower of

these search specialists bore a considerable part of the responsibility in solving the reference problems of library patrons – taking full editorial control over the search process. In the journal *Online,* which was directed at online search professionals, library scientist Ann Van Camp described the intermediary role of the human searcher as "the interface between the end-user and the bibliographic retrieval system" who formed "the key to a high quality product being retrieved from [it]" (1979, p. 18). I argue that these human interfaces, supported by humanistic types of knowledge associated with the field of library science, encouraged transparency in the search process by performing as knowledgeable nexuses interconnecting a democratic *service function* – assisting all library patrons in satisfying their information needs – with an *editorial function* – selecting, evaluating and ordering information stored in computer databases relative to end-user needs.

Reference librarians as democratic intermediaries

Since at least the late nineteenth century, reference librarians acted as "highly personal and knowledgeable assistant[s] to users" who helped satisfy the information needs of library users at the *front-end* of the reference desk through a people- and service-oriented outlook (Deng, 2014). In this role, they personified the democratic mission of the library as a public service institution – that is, serving and satisfying the information needs of *all* of its users to the best of its abilities. This humanistic mission was safeguarded by the field of library science, which since at least the late 1940s had studied the seeking behaviours of its users in order to improve its information services based on their needs (Siatri, 1999; Varlejs, 1987). Theories of reference work aimed to professionalise search assistance by information intermediaries, providing models of practice for reference librarians to "become [...] specialist[s] in 'finding out', even to the point of validating the data" (Rothstein, 1961 as cited in Deng, 2014, p. 259).

With regard to online search services in the 1970s, the starting point of a search was a library patron – most often a professional researcher – making a reference request with the search specialist at the front-end of the reference desk. Similar to traditional reference work, patrons did not address specific questions, but only described their information needs broadly (Adams, 1979). This lack of specification necessitated a further demarcation of the information need by conducting pre-search interviews with end-users (Dommer & McCaghy, 1982; Maxted, 1983; Somerville, 1977) to produce "a detailed, accurate, and comprehensive description of the [information] need" in order to be able to subsequently "restructure it [the need] as a search" (Maxted, 1983, p. 50).

Different from traditional reference work, online search intermediaries transformed user needs into a search and, finally, relevant information, through a systematic and planned approach that was documented in written form in a so-called *search strategy*. In consultation with the library patron, a search strategy was drawn out before conducting the search at the computer terminal, and described which databases to search, in what sequence and, most importantly, the Boolean query formulations for the databases to be searched and the order by which these statements would be inputted in the system (Adams, 1979; Meadow & Cochrane, 1981; Oldroyd & Citroen, 1977; Oldroyd & Schroder, 1982). To produce effective strategies, search intermediaries merged the people- and service-oriented outlook and subject knowledge of traditional reference workers, with technical expertise in the form of sophisticated knowledge of databases (e.g. indexing

techniques, types of vocabulary control) and search systems (e.g. Boolean retrieval techniques, query and command language), and expert capacities in logical and analytical thinking (Hock, 1983; Van Camp, 1979).

The human interface as engine driving the search

Part of the reason for having search professionals, not amateurs, develop search strategies and conduct the search at the computer terminal, was economically motivated. Search was most commonly billed by time spent online, and as online time was costly, employing a carefully and professionally designed plan for conducting the search at the computer terminal minimised online time, reducing the total costs (Bourne, 1980; Knox & Hlava, 1979). As significant as these economic motives were, however, the application of a search strategy also formed a key condition for human intermediaries to maximise retrieval (Adams, 1979) and strengthen their performance as the engines driving the search. Search strategies encouraged the optimal coupling of human expertise and the technical affordances of the computer search system, and supported the role of the human intermediary in taking full control over the editorial function. Following library and information scientist Birger Hjorland (2015), I argue that Boolean search models afforded "the most advanced form of selection power ever developed in relation to bibliographical searches" (p. 1561).

To see how Boolean search encouraged human editorial control, it is necessary to understand the basics of the search architecture of commonly used commercial search systems, such as Dialog. These systems consisted of two basic components that were functionally and technically associated – a database structure and an associated query language for retrieving information from the database (Salton & McGill, 1983). Almost all commercial systems were organised through an inverted file design, an advanced form of indexing that proceeded direct file structures for reasons of efficiency. The inverted file was arranged on the basis of unique (searchable) concept terms with references to information items (e.g. bibliographic references) stored in a computer database. To retrieve information from the database, the human intermediary formulated a Boolean search statement consisting of concept terms that were used for indexing bibliographic references in the inverted file. Then, the computer system matched the query statement with indexed information on the basis of a so-called "exact-match" model (Belkin & Croft, 1987, p. 113). References retrieved with this model were only those that were indexed with concepts that matched exactly the (combination of) concepts articulated in the query statement, and these results were presented in an unranked order, as potentially relevant (Watters, Shepherd, Grundke, & Bodorik, 1985).

The Boolean search architecture, I argue, supported searchers in taking editorial control in two interconnected parts of the search: *information retrieval*, and the *evaluation* and *organisation* of the results retrieved. First, human searchers exerted full control over the retrieval of information from computer databases as, in the form of Boolean query statements, they formulated the "algorithms" instructing the computer search system what information to select from the database. Combinatorial logic – the use of positional Boolean operators – enabled searchers to specify the adjacency of concepts in various combinations within one search statement, combining concepts to intersect terms – "AND" – group them together – "OR" – or exclude them – "NOT". Boolean logic afforded a high degree of expressivity and decision-making in query formulation, enabling searchers to

operate strategically in order to retrieve "the maximum number of relevant items while keeping the noise level to a minimum" (Oldroyd & Schroder, 1982, p. 129).

To achieve maximum retrieval by formulating effective query statements, searchers had to make full use of their knowledge of database structures, the (controlled) vocabularies employed in indexing, and Boolean logic itself (Adams, 1979). The technical logic of the system had to be transparent to the user in order for the latter to take full advantage of it, and perform as the very engine driving the search. Taking full control over information retrieval by formulating Boolean search statements that exploited database structures, human searchers claimed full responsibility for the process Warner termed *query transformation*. The computer's task responsibility in the exact-match model, on the other hand, was largely *executive,* simply processing the criteria for selection that the human searcher had specified in the query statement.

Second, Boolean exact-match supported searchers to evaluate and organise retrieved results because, as mentioned, these results were not ranked to their degree of relevance (Watters et al., 1985). This makes the exact-match model fundamentally different from the partial (or best) match model employed in most contemporary search engines. In the latter, retrieved results do not have to exactly match the query statement, but a query is matched with indexed information by algorithmically calculating relevance – the degree of correspondence between an information need and data stored in a machine-readable-database – and ranking the retrieved information in descending order of their probability of being relevant (Belkin & Croft, 1987). Importantly, I would like to point out that it is not my intention to form any qualitative comparison between exact and partial match models, but to assess their difference. Not in terms of quality, but in terms of their bias towards either attributing editorial control to the human brain or to algorithmic processes – as Hjorland explains, "Boolean approaches differ from best-match systems in that the searchers maintain full control over the search process, whereas search engines work behind the back of the users, so to speak" (p. 1565).

Because retrieved results through exact-match were unranked, the degree of relevance of the results relative to the information need still had to be evaluated by searchers in order to present the end-user with an ordered set of references. Importantly, this assessment formed a part of an iterative process, which strengthened the search intermediary's control over the search. As part of the iterative process, search intermediaries continued their conversation with users throughout the search process in order to interpret, validate and assess the relevance of the results outputted by the system against the end-user's information needs and expectations (Maxted, 1983).[4] This demonstrates how searchers enmeshed the editorial function with the service function – assessing the relevance of information retrieved against the expectations of the end-users whose needs they were supposed to satisfy. In order to optimally assess the relevance of retrieved information, searchers had to understand how their earlier decisions involved in query formulation affected the selection of information by computer – why the references listed in the results were retrieved and, equally important, what information was *not* found, and the reason for its absence.

The intimate coupling of Boolean search systems with human searchers as interface between end-users and information stored in computer databases formed a key part of a culture of online search in American libraries that valued transparency for (end)users in the search process by interconnecting the service function with the editorial function –

not make them exclusive to either front-end or back-end, so to speak – through the figure of the search intermediary, and by positioning human knowledge and expertise at the centre of the editorial process in search. More than "users", librarians performed as "searchers", wielding the capacities of computer systems to take full editorial control over the search process – integrating user interface and engine in a single actor, so to speak.

Searcher empowerment: enhancing human psychology in information search

The kind of socio-technical coupling of searcher and computer retrieval process that maintained the editorial function in the hands of human librarians supported, and was supported by, humanistic types of knowledge produced by library and information scientists.

Based on the previous section it seems to go without saying to argue that searchers *had* to perform as engines because these older exact-match systems were limited compared to contemporary ones, necessitating humans to evaluate relevance. However, the support of library science further proves that the central position of human intermediaries in online search cannot simply be explained as a result of the technological infancy of search systems, and needs to be understood as part of a humanistic search culture that valued cognitive search powers over technological ones.

When the demand for online bibliographic searching increased exponentially in the late 1970s, library scholars directed attention to the theorisation of the search process in reference work (Benson & Maloney, 1975; Katz, 1982) and library and information scientists developed an interest in strengthening human thinking processes in the online search for information (Bates, 1979, 1981; Bellardo, 1985; Fairhall, 1985; Vigil, 1983; Wagers, 1980; Woelfl, 1984). Many of these scholars directed attention to the search behaviours of librarians, continuing the humanistic mission of the library. However, they added new levels of psychological complexity in addressing issues pertaining to the intermediary practices by which libraries assisted their users in satisfying their information needs, drawing on methods and theoretical frameworks from the social and behavioural sciences.

These scholars certainly recognised the benefits of computerised search, and acknowledged that computer systems for information retrieval introduced powerful bibliographic resources for information searching. Nonetheless, they assumed information needs of library users could never be sufficiently satisfied by online search, if not mediated by the search capacities of human information specialists.[5] For instance, preeminent library-oriented information scientist, Marcia J. Bates, advocated that a computer system could best be thought of as "a machine enhancement of human searching" (1981, p. 144). Bates took particular interest in the psychology of searching, arguing that human searchers performing a search process should ideally think by relying on natural and learned information seeking abilities to carry out a successful search on behalf of uninitiated users. To foster the growth of learned abilities, Bates conceptualised some of the underlying thought processes and skills involved in the human search process. She employed the expression "search techniques" (1981) as an umbrella term to refer to a whole array of "methods, heuristics, tactics, strategies, or plans" used by human beings as methods of furthering an online search (p. 139).

In a nutshell, library-oriented information scientists substantiated the idea that searching for information, whether online by computer or manually, was a fundamentally human

process and by its very nature a form of skilled human behaviour necessitating what Julian Warner described as *selection labour* (2010). In their view, information searching involved complex human behavioural and cognitive processes that could be enhanced by the use of various techniques, strategies and tactics, but which could never be fully mediated by computers. The aim of Bates and others devoted to the psychology of searching was to theoretically support the centrality of human thinking processes in the search for information, and to force a shift in attention "from a focus on the machinery, the information technology, to the brain that is running it" (Bates, 1979, p. 205).

Friendly software interfaces: decoupling front and back-end

The proliferation of personal and home computers in the 1980s, and the reduction in costs that accompanied it, formed enabling conditions for the transformation of the library's more exclusive online search culture to a public online information culture that prospered a decade before the popularisation of the World Wide Web. The explosion of the market for microcomputers in the early 1980s resulted in a rapidly expanding population of millions of people who were comfortable at a computer terminal and desperately sought applications (Campbell-Kelly & Aspray, 1996).

In the late 1970s and early 1980s, a number of online services sprang up that aimed to gain a share of this market, catering information and other online services directly to "the average person rather than [...] the professional researcher" (Glossbrenner, 1983, p. 10). These so-called consumer information services brought the information resources of professional retrieval systems such as Dialog to ordinary people at much less intimidating prices, while by the 1980s also adding a range of services (e.g. email, banking, shopping, real-time communication, online gaming) to their portfolio. They additionally expanded the scope of online information beyond bibliographic references, enabling online access to information of all sorts, including stock information, news, entertainment and so on.

With the microcomputer on the market "there was suddenly a vast new potential market of searchers to be tapped [by online services], outside the library environment, the traditional 'home' of online searching!" (Janke, 1984, p. 20). To tap into this home market, online services started to employ their own kinds of search assistants; not human ones, but computer ones, in the form of friendly software interfaces to the user, mostly menu-driven, affording the new computing masses to easily retrieve information by themselves at home. Logging on to one of these services, as described in *Family Computing* magazine, the user "entered the world of menus" (Springer, 1985, p. 26). The online service Compu-Serve quickly secured the largest share of this end-user market (Lewis, 1994).[6]

As librarian Donna Dolan pointed out, from its very beginning CompuServe was "intended for the end user with no *intrusive* [emphasis added] middleman" (1983, p. 104). The pressure on the middleman function of the library increased when new menu-driven software packages variously called "front-ends" or "intermediary systems" were introduced in the course of the 1980s that eased access to professional search systems such as Dialog (Lisanti, 1984; Markoff, 1984). Examples include personal computer software packages such as *In-Search*, *Sci-Mate*, *Search Helper*, *Search Master* and gateway systems such as *EasyNet*. The latter enabled access to hundreds of databases of multiple vendors including simplified versions of professional search systems such as Dialog Knowledge Index and BRS/After Dark.[7] Easynet acted as a technological intermediary that simplified search

for everyday users by providing menus that bypassed the "Boolean logic hurdle" (Janke, 1984) – translating a user's request into query commands that could be processed by one of the search systems it connected to (Howitt, 1985). In 1986, CompuServe incorporated the EasyNet gateway in its portfolio under the name *IQuest* (Houze Gerber, 1986).

Importantly, due to these "friendly", yet technological, search intermediaries, the use of human intermediaries in the search process no longer formed a necessity, and a culture of search could take shape separate from library practices and traditions. My argument in this section will highlight that menu interfaces comprised new types of *middleman* that in contrast to human interfaces encouraged the positivist nature of algorithmic search by decoupling a democratic service function at the front-end from the editorial function in the back-end, and, relatedly, by discouraging the use of human selection power and intellectual labour in the search process.

Menus as democratic intermediaries

Software intermediaries providing menus such as IQuest fulfilled a similar democratic function as their human predecessors. In the 1980s, particularly for users with no experience in computing, menu-driven systems acquired widespread use as a means of information retrieval (Shneiderman, 1986). They popularised in the course of the 1980s when the user base of personal computers broadened with masses of computer illiterate people entering the market (Lee & Raymond, 1993). To tap into this vast market, and enable all of these people access to information search, software designers were forced to lower the barrier of entry and "develop simpler, more easily understandable systems, which were typically menu-driven" (p. 3). In that sense, software intermediaries in search fulfilled a role very similar to that of human intermediaries. With their people-oriented, "user friendly" outlook, they functioned as democratic intermediaries, serving the needs of all users, assisting them in translating their information needs into computer processable query statements.

Within software design circles, the technical convenience of menu-driven systems was typically measured against that of command line interfaces. The former were considered more convenient as they exploited the recognition of selectable options rather than the memorisation or recall of complex command sequences (Lee & Raymond, 1993). Dialog's knowledge index still employed a scaled-down version of the query language of its parent system, requiring users to input commands and Boolean expressions after a prompt sign (Tenopir, 1983).[8]

The gateway IQuest, on the other hand, employed a menu-driven system from the start (Houze Gerber, 1986, 1988). In a hierarchically tree-structured menu system, users advanced through a sequential selection process that step-by-step guided end-users in defining the main topic of the search (e.g. current events, business, law, economics), further qualifying the main topic (e.g. for economics, accounting, finance or insurance), and selecting a type of source material (e.g. professional journals, popular magazines, books on economics) (CompuServe, 1986; Bowen, 1986). At the bottom of the tree users entered the keywords they would like to search for, after which IQuest determined the database to be searched and performed the search automatically by connecting to the gateway, and "translat[ing] your query into a language that particular database understands" (Bowen, 1986, p. 13). IQuest then displayed a list of the 10 most recent references

retrieved, with the possibility of requesting additional references for a surcharge (Houze Gerber, 1988).

The menu interface as facade of user control

Software intermediaries such as IQuest, I argue, decoupled the democratic service function from the editorial function by separating the search process into front-end and back-end activities following each other in a sequential fashion. Editorial control, or what Julian Warner referred to as *query transformation* (2010), became a property of a computer retrieval process in a back-end, and no longer involved human intellectual labour. Behind the back of users, so to speak, these systems translated the search query into information, and presented this information to the user as a set of chronologically ordered references to documents (Bowen, 1986). Important to emphasise is that the change to software intermediaries did not involve any serious technological changes in what now formed the back-end of search systems – these still employed the earlier discussed exact match model, not the partial match systems employed in contemporary search engines. Nevertheless, I argue, the shift from human towards friendly software intermediaries increased the control of the computer system over the search process by disconnecting information retrieval in the back-end from (a diminished form of) *selection power* of users at the front-end.

The user's power to control information retrieval by computer and exploit the search architecture decreased, because with menu selection knowledge of system architecture was not imperative. In contrast to Boolean query interfaces, menu interfaces discouraged technical expertise as they assumed no relation between query formulation and database structure – an important condition for people that had little knowledge of computer processing, or with the indexing and retrieval structures of databases, to search for information in large collections of online data (Watters et al., 1985). That is, menus enabled a disconnection between the means of interaction – menu selection – and the retrieval structure of the database and associated retrieval techniques. Interaction in the form of decisions in the menu-selection process, hence the formulation of database queries, was strictly informed by knowledge of topic and content, not of system architecture and associated Boolean retrieval techniques (CompuServe, 1986). These decisions did not involve any awareness of how they affected computer-driven information retrieval in the back-end. Menus, for that matter, encouraged a non-technical form of selection power – solely informed by subject knowledge, not systems knowledge. In that sense, menu interfaces functioned as *facades* that concealed query transformation in the back-end, to facilitate query formulation at the front-end.

With technical expertise made redundant in the process of database selection and query formulation, iteration in the search process – interpreting and evaluating the relevance of computer search results – was thwarted. Not knowing how their choices in query formulation affected the search process by computer, users could no longer understand why the references listed in the results were retrieved and, equally important, what information was *not* found, and the reason for its absence. Then, instead of iterative process, menus encouraged a view of search as linear input–output process. Menus assumed a direct relation between information need and query, and supposed these needs composed unconditional *things* rather than objects relative to advances in the search process.

By facilitating input – assisting users in the selection of databases and appropriate key-words – query formulation at the front-end prepared *query transformation* at the back-end. Lacking the expertise to evaluate the relevance of the information that was output-ted, this output acquired the status of end-result, rather than an intermediate product the user interpreted and assessed through a series of considered decisions in which informa-tion needs were adjusted in accordance with progressive insight during the search process.

In conclusion, by decoupling a democratic service function from the editorial function, and by circumventing the use of technical expertise, menu interfaces tended towards a perception of search as automated *query transformation* instead of an iterative process driven by human selection power. Menu interfaces certainly helped democratise search in the 1980s by presenting a means of interaction for non-specialist users to take care of their own searches. However, I argue, they also provided the condition of possibility for the emergence of a more autonomous back-end taking editorial control over search in a retrieval domain that was more or less decoupled from the user's domain of control – the user interface – where ease of use conflated with selection power.

User empowerment: anticipating human psychology in information search

The rise of "friendly" software intermediaries in search also involved important shifts in the types of knowledge and associated ideologies supporting these new technological inter-faces to the user. Not library science, but a new science of software design that in the early 1980s emerged under the name of *Human-Computer Interaction* (HCI) shaped the form and function of these intermediaries. More or less opposed to library science, HCI con-nected the design of its interfaces to a principle of the least effort to lower the barrier of entry into computing, and broaden the market (Lee & Raymond, 1993). In support of the democratic function of enabling everyone access to information stored online, the conve-nience-based design of these interfaces aimed at minimising cognitive effort, which varies inversely with values of human selection power and labour.

From the 1980s onwards, HCI employed a user-centred design rationale (Draper & Nor-man, 1986) that connected to *usability* as its central principle of software design (Adler & Winograd, 1992; Gould & Lewis, 1985). Usability guided HCI researchers in their effort to facilitate a fluid connection between human cognitive processes and computer processes involved in the accomplishment of intellectual tasks (e.g. information search) with a com-puter by ordinary people (Card, Moran, & Newell, 1983; Shneiderman, 1980). Due to their popular appeal in the 1980s, the design of menu interfaces for search systems emerged as one the most studied topics in the field of HCI with numerous studies focusing on the organisation of menu frames, and the trade-off between the depth and breadth of these frames (Giroux & Belleau, 1986). The ideological tendency towards convenience guided these researchers towards the development of techniques for the design of menu interfa-ces that made "the process of relating the user's goal to the system as easy and natural as possible" (Karat, McDonald, & Anderson, 1986, p. 73).

HCI researchers assumed that eliciting information from machines had to be simple – that is, should comply with the design rationale that Steven Krug would later summarise in the slogan "Don't make me Think" (2009). Ease in use was thus equated with reducing mental effort, and to achieve such mental convenience HCI researchers aimed for menu

designs that would optimally *anticipate* human cognitive processes, for example by fine-tuning the menu's organisation and structure based on models of human behaviour in a decision-making process (Giroux & Belleau, 1986; Lee & MacGregor, 1985). As menu interface design expert Kent L. Norman put it in his influential book *The Psychology of Menu Selection*, "menu structure should be consonant with the user's cognitive structure" (1991, p. 26).

Prominent HCI researchers such as Ben Shneiderman have repeatedly connected such convenience design of user interfaces to goals of empowering people (1983, 1990). Menu interfaces indeed gave a new group of people the power to search for information. However, I argue, this was purely a power of access, not the kind of selection power enabling users to understand what was going on during the search. Then probably unintended by interface designers, menu interfaces gave users a false feeling of control over search as their selection power, and responsibility for the search process, now stopped where the menu interface ended.

Computer magazines played an important role in the normalisation of the convenience rationale, spreading HCI's ideology of empowerment as access amongst the general public (Conroy, 1988; Slatta, 1984; Springer, 1985; Sullivan, 1986). For example, magazines commonly discussed the delegation of power to back-ends as something that eased the responsibilities of users, rather than a loss of control over search. As stated in *Online Today*, "[t]he system [IQuest] now assumes more responsibility for directing the search. You need only follow the menu-based prompts, answering the questions that will ultimately provide the information you need" (Conroy, 1989, p. 16).

Needless to say, these values sharply contrasted with principles of library science that assumed a central role for human thinking and decision-making processes in the search for information. Computer magazines typically emphasised how satisfying the information need of the individual was more of a personal matter and delegation of such tasks to human intermediaries only added to misunderstanding, which was perceived as inversely proportional to productivity. Retrieving information independent of the library, for that matter, was repeatedly promoted as key to improving the productive use of information. As expressed in the *IQuest* user guide published in *Online Today*, "[t]ake one step closer to the highest level of efficiency – self-sufficiency" (CompuServe, 1986). Time and again it was emphasised how with online services such as IQuest, the time of "trudging of to the library" belonged to an inefficient past and users in search of information could now "count the time spent in *minutes* rather than days" (Conroy, 1988, p. 20).

United by the belief that self-sufficiency was indeed the highest order of efficiency, computer magazines linked a vision of autonomous individualism to computer-mediated search, giving shape to new kinds of information-savvy users. They portrayed menu-based systems as proper replacements of human information intermediaries, assuming they were functionally equivalent. For example, a feature article on IQuest published in *Online Today* portrayed the information tool as "Technology's Librarian" because the menu, as claimed, acted "as a guide to help us determine which of the hundreds of online resources will help answer our questions" (Bowen, 1986, p. 11). Needless to say, such discourse took a selective stance, highlighting the democratic function of reference librarians as personal assistants to all users, yet neglecting their editorial function; that is, the *dual* intermediary function of the librarian was obliterated from history, so to speak.

Interestingly, by the early 1980s, library and information scientist Virgil Diodato had made very similar observations on the basis of his analysis of how popular magazines discussed online searching (1984). According to Diodato, popular magazines exaggerated the functionalities of the new online services, while they failed to inform their readers about "the nature of searching and the role of the search intermediary" (p. 27). Diodato lamented the fact that the magazines neglected the value of human guidance and expertise in online searching and left the impression that there was "very little to mediate when one searches online" (p. 27). Additionally, Diodato wondered why the magazines did not "describe techniques for analyzing an information need into its major concepts and then transforming the concepts into appropriate search strategy", "demonstrate how to evaluate online results and then respond with alternative strategies", or teach users "how to respond to the vagaries of indexing techniques" (p. 27).

Conclusion

As I have aimed to show in this history of online searching, the rise of menu interfaces in the 1980s as alternative to the human interfaces of the 1970s, helped encourage and normalise algorithmic ideology long before the birth of algorithmic search by search engines in the 1990s. Menu interfaces provided the condition of possibility for the emergence of a more autonomous back-end, unharmed by human agencies, taking editorial control over search in a retrieval domain that was more or less decoupled from the selection power of users in query formulation at the separate level of the user interface. Inherent to this disconnection, menus facilitated a democratic power of access to search, yet discouraged the use of human selection power and intellectual labour in the editorial process.

Then, this history of the naturalisation of algorithmic ideology in search serves to articulate the contingency of a current ideology of search biased towards algorithmic query transformation in the back-end separate from user activity at the front-end, and guided by the ideological tendency of ease to shield user selection power from the editorial function, and maximally facilitate user activities. As I have attempted to show, the nature of algorithmic ideology as it popularised in the 1980s involved a marginalisation of a more humanistic ideology of online information search in the 1970s that was deeply interconnected with library traditions, in particular the use of search intermediaries that coupled interface with engine to maintain control over a search process characterised by transparency. Based on this research, I argue that these more humanistic values warrant our attention in a positivistic search culture where the editorial gap between the haves (algorithms) and the have-nots (users) is widening with the former becoming increasingly refined and complex, while user activities are progressively pampered and formatted by search engine interfaces.

This article urges us to differentiate between the strengths and weaknesses of this library-oriented tradition and that of the computer sciences. It reopens the possibility of rethinking the role of human agencies in online search. Future work might further explore the role of interface design and search literacy, to see how possible interconnections between the limited and highly formatted activities of human *users* and the natural and learned abilities of human *searchers* to evaluate and judge the relevance of information, can further be facilitated. Specifically in today's culture of search where these latter abilities have been marginalised, researchers from both the computer sciences and the

humanities can further interrogate urgent questions, such as: what should the searcher know about the retrieval process? How does one lower the barrier between front-end and back-end and, in doing so, how does one strengthen the role of a searcher to make informed decisions during the search process? In other words, to borrow the succinct expression of Marcia J. Bates, "[w]here should the person stop and the information search interface start?" (Bates, 1990).

Notes

1. This article is a complete revision of Chapter 5 of my unpublished doctoral dissertation *Cultures of Use: An Archaeology of Computing's Integration with Everyday Life* (Kerssens, 2016).
2. Research which studies online search behaviour, making use of eye-tracking studies and search engine transaction logs, has repeatedly evinced this peripheral role of user selection activities at the front-end, finding that the majority of search engine users rarely visit the second results page (Jansen & Spink, 2006) and typically only view and click the top results (Granka, Joachims, & Gay, 2004).
3. From the mid-1970s onwards, search specialists discussed, theorised and organised online searching within professional library-oriented periodicals such as *Online* (1977), *Online Review* (1977) and *Database* (1978), and a range of textbook literature on online searching (Byerly, 1983; Fenichel & Hogan, 1981; Lancaster & Fayen, 1973; Lee, 1984; Maloney, 1983; Meadow & Cochrane, 1981) which presented essential information resources to human searchers, and to contemporary researchers aiming to understand the specifics of searching online in the 1970s. The periodicals *Online* (1977) and *Online Review* (1977) were consulted because together with *Database* (1978) they comprised the three publications for American information professionals and librarians with the largest subscription base. To find relevant articles, all issues of *Online* (1977) and *Online Review* (1977) between 1977 and 1985 available in Utrecht University library have been browsed for relevant articles. *Database* could have been included in the corpus, yet it was not available in any Dutch library. I did use some of its articles when referenced by other sources. CompuServe's own magazine *Online Today* formed the largest part of the corpus of computer magazines, because it was dedicated to the topic of online information access and search. Similar to *Online* and *Online Review*, I browsed all issues between 1985 and 1989 to find relevant articles. Additionally, I searched by computer through an index of the pdfs of all issues of the journal between 1985 and 1989 with relevant keywords. I did the same for the computer magazines *Byte* (1980–1989) and *Family Computing* (1983–1989) to broaden the perspective on the use of online information services for search beyond *CompuServe* alone.
4. See Somerville (1977) for a detailed transcript of a dialogue between user and librarian.
5. In the opening paragraph of her very influential article on "Information Search Tactics" (1979) library-related information scientist, Marcia J. Bates, started with a celebration of the knowledgeable librarian: "[f]or all the developments in automated and semiautomated information retrieval, nothing yet matches the ability of experienced human searchers – whether known as 'information specialists' or 'reference librarians'—who move skillfully among an enormous range of resources, both manual and on-line, to develop bibliographies or answer questions. We know discouragingly little about just what those skills are and how they develop; we cannot yet define what it is that an experienced searcher knows that a beginner does not" (p. 205).
6. With an exponentially growing user base since its introduction in the late 1970s under the name MicroNET, CompuServe was the largest and best known of the consumer information services. In 1994, CompuServe reached the pinnacle of its success with 1.7 million active subscribers (Lewis, 1994). Besides CompuServe, new online information services were launched almost yearly until the early 1990s when the World Wide Web went public, such as The Source (1979), Delphi (1983) GEnie (1985), Prodigy (1988), America Online (1990) and Apple's eWorld (1993).

7. These databases included information of many types, ranging from academic journal articles and conference proceedings, business and marketing publications, to more conventional topics such as those found in sports and entertainment magazines.
8. Menu interfaces were preceded by command line interfaces. However, already in the early 1980s, major public information services such as *The Source* and *CompuServe* provided menu interfaces as easy alternative to the command line (Glossbrenner, 1983).

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