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Service design for information searching

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Introduction. This conceptual paper discusses the ways in which service design and design thinking can be applied to improve information search processes.

Method. The paper shows possibilities for combining searches with service design and presents a persona-based, fictional case example of how a search might be improved.

Analysis. By using the case example, the paper shows that this approach can be used to improve searches and to develop search engine selection and search engines further.

Results. As the paper is focused on theory development through extrapolation, the key result is a recommendation for further research and experimentation on how to use service design to improve information searches.

Conclusions. The paper concludes with several directions for further research, including search engine marketing and design, task stage optimization, and the crowdsourcing of searches.

Introduction

This conceptual paper examines the ways in which service design may be used to create better systems and processes that assist users in information searching, which we, like Wilson (2000), define here as 'the 'micro-level' of behavior employed by the searcher in interacting with information systems of all kinds'. User experiences have been studied from a design angle to some extent within information research, for search engines (e.g., [Russell-Rose and Tate, 2013](#)) and for libraries (e.g. [Harviainen and Pikka, 2015](#); [Buchanan et al., 2019](#)). Yet we believe that the field is still in need of more knowledge on how information search processes can be designed as provided services, and how to further improve existing search tools from a user-centred perspective so that they assists users' search processes better.

Information searching has become ubiquitous in modern societies. Haider and Sundin (2019) call this search-ification, in which quick searches are used for sense-making in everyday life, and the searches permeate that everyday life so completely that they effectively become invisible (see also [Sundin et al., 2017](#); [Andersen, 2018](#)). In addition, search engines (particularly Google) are nowadays able to present not just results, but also the key information potentially sought, based on knowledge

graphs. Instead of access to documents, the searcher also gets information from those documents, both for assessment of the potential relevance of a source, and for quick answers to specified information needs. These preliminary answers, in turn, rely heavily on crowdsourced information from especially Wikipedia. ([Haider and Sundin, 2019](#)). Some of that content is of scholarly quality, but in general, it is hard to assess the value of a Wikipedia page, especially from an automatically created preview ([Mesgari et al., 2014](#)). All this furthermore relies heavily on algorithmic systems optimized by engineers, not human-centered design, including in the seemingly user-oriented but actually very business-driven case of Google. Service design, an approach presented in this paper, will be able to change this – if and when deployed correctly.

In order to understand the application of service design in this area, it is necessary to comprehend that the most ubiquitous search engines in everyday life utilize recommendation based on individual usage data or user profiles ([Haider and Sundin, 2019](#)). At the same time as they appear to be personalized and user-friendly, the search engines are actually becoming more opaque ([Buckland, 2018](#)). This is a problem, because users become unable to assess the quality of the search result set, and different searchers using the same query terms may observe different results (*ibid.*). Because of this, authors such as Harviainen ([2014](#)) have argued for increased transparency in service production, so that users can evaluate the quality of the service that they are receiving.

In this paper, we answer the question: How can service design techniques be applied to information search processes, in order to improve those processes? To answer it, we next turn to a description of service design as an approach and methodology, and then examine search processes as subjects of design.

Service design and design thinking

Service design is the application of design thinking principles on services, instead of tangible objects. It is a holistic methodology that applies tools from various design disciplines together. Already in 2011, Mager and Sung ([2011](#)) noted that the field of design was moving increasingly towards the intangible and ephemeral – services – even though those services are often still provided through tangible or digital products. Service design is thus more about a shift in focus than about what exactly is being designed ([Hollins and Hollins, 1991](#)). It is a growing, often very visual methodology, mindset and toolkit, in which the techniques and methods of approaches such as human-centred design are applied for the purpose of creating new services or radically improving existing ones ([Luojus and Harvianen, 2016](#); [Stickdorn et al., 2018a](#)).

Service design is not a single method, it is more of a methodology of its own ([Stickdorn et al., 2018a](#)). It relies on the idea of thinking about human interaction processes as designable services that can be improved, and then finding the right methods to instigate, innovate and select the best improvements that can be found and implemented. It is a very co-creative way of design, relying on involving various, preferably all, key stakeholder groups in each design process and at every relevant stage ([Penin, 2018](#)). It never relies on just one design method, but is an approach that links together several methods from its wide toolkit, such as service blueprints, journey maps and personas, in order to be able to address users' needs and not just their wants ([Stickdorn et al., 2018](#)). Some of the most popular methods will be described alongside the case example below.

The central advantage of service design is that like more recent information searching studies (see [Kumpulainen, 2017](#), for examples), it seeks to look at entire processes in their contexts and environments, not just at singular factors that may affect a user experience. The idea of using design principles for also services was developed in Italy and Germany in the late 1990s ([Pacenti and Sangiorgi, 2010](#)), and has since then found growing audiences in many countries. Many different models for service design exist, but they appear to be strongly based on the same kinds of ideas and processes ([Stickdorn and Schneider, 2010](#); [Tschimmel, 2012](#).) Likewise, in addition to drawing ideas from human-centred design and deploying them on services, the methodology is also a close (if less formal) relative to user experience (UX) design, which has already been well applied to search engines ([Russell-Rose and Tate, 2013](#)), and in areas such as Search Engine Marketing and Search Engine Optimization ([Haider and Sundin, 2019](#)).

The key idea in service design is the use of participatory, human-centred methods to improve service provision and service experiences, or to innovate new services ([Stickdorn and Schneider, 2010](#)). It accomplishes this through a process that starts with background research. This is followed by the involvement of necessary stakeholders through various techniques and workshops, so that deep insight can be gathered on users, potential users, and potential non-users, and then finally prototyping, which enables a tangible means for examining which ideas work ([Stickdorn et al., 2018a](#)). The prototypes can be anything from cardboard to wireframes to simplified web designs.

Services and technologies are always created with visions of potential users in mind ([Hyysalo and Johnson, 2016](#)). Such visions can however be false, or hopeful, if done with insufficient data. To counter this, design thinking, and based on this, service design, recommend that all designs should be based on insight from potential customers ([Brown, 2009](#); [Stickdorn and Schneider, 2010](#)). Each stakeholder group, from designers to programmers to user segments has information of its own, some of

which is not normally available to the other groups ([Jones and Samalionis, 2009](#)). After it has been gathered, the information from such diverse groups is condensed and clustered in order to avoid information overload that would lead the design process into too many directions, and to sort out key findings ([Stickdorn and Schneider, 2010](#)). To achieve this, service designers use methods such as service mappings and blueprints that list key “touchpoints”, i.e., central moments of interaction between a user and the service, or “personas”, templates of imagined, intended users ([Luojus and Harviainen, 2016](#)). These are then used to create or improve services, using other service design methods, such as storytelling, brainwriting, design games, and rapid prototyping. In this paper, we use the example of a persona and an emotional blueprint to show how one technique could be used to find possibilities to improve searching, and then brainwriting and rapid wireframes to show potential next steps. Before that, however, it is necessary to discuss what it is exactly that we wish to improve.

Information search processes as improvable service processes

In library and information science, information search systems (such as web search engines, digital libraries and reference services) are traditionally seen as information services or as parts of organizational services (c.f. [Huvila, 2012](#), p. 27-28). Creating an index and a search system to access the desired information is basic work of information service providers, but nowadays it happens online. Particularly in organizational and e-commerce search, a service-oriented paradigm has been emerging (e.g., [Aier et al, 2011](#)). However, search systems are not yet commonly treated as services when they are designed. A more typical approach is an engineering-driven design approach that considers the service-thinking only as a secondary goal.

Based on observation, Pharo ([2004](#)) divided his Search Situation and Transition model into five elements: the work task, the searcher, the social/organizational environment, the search task, and the search process. We believe that each of these can be improved by service design. In fact, information retrieval research has for decades already been remarkably applying user-centred methods in its designs, just on a query or systems design level (e.g., [Ingwersen and Järvelin, 2005](#); [White, 2016](#)). The tools for systematically doing the same on also the human search experience level, however, have been missing. An early approach to solve this was problem management system suggested by Belkin, Seeger and Wersig ([1982](#)) that broke down the process of problem treatment into separable entities that feed the whole search. However, it treated search process as a problem solving task. Service design, due to its focus and orientation, can in this context be considered more searcher-focused,

instead of the more classical focuses on either work-tasks, search-tasks or problem treatment. This makes its application also very difficult, because human needs for information, and thus human search processes, are extremely diverse. Yet, as noted by Haider and Sundin (2019), generalities can be found. And when they can be found, they can be modified. This being said, the searcher's work nevertheless consists of task stages (e.g., [Kuhlthau, 2003](#); [Kumpulainen, Huurdeman and Keskustalo, 2018](#); [Vakkari, 2003](#)). Those task stages can be designed to a significant extent, as can be perceived relevance and decision-making during those stages, and the task formulation that follows ([Huurdeman and Kamps, 2014](#)).

As pointed out by Pharo and Järvelin (2006), information searchers have a tendency to only consider a limited number of potential sources. This is in line with the findings of behavioural economics: too many options make it difficult for people to decide which to use ([Lyengar and Kamenica, 2010](#)). The selection can, however, be adjusted by effective design, such as priming certain options as defaults ([Thaler and Sunstein, 2009](#)), and by providing knowledge panels and "answer boxes" that are run by knowledge graphs – which on the other hand diminish transparency, and thus require a careful balance between optimization and visibility. In essence, an effective search design process would focus especially on moulding what Pharo (2004) calls the Information space: "the part of the information system that the searcher has navigated, as well as the information space anticipated by the searcher". Service design is about predicting customers' needs and answering them ([Stickdorn et al., 2018a](#)). It can therefore be used to modify which parts are likely to get navigated, and which anticipations are likely to be formed after each step in the navigation.

Search systems nowadays recommend pieces of information across a variety of information types based on past search behaviours and user profiles. Most designs rely on massive data about click-through-behaviours and base their predictions in search and click histories. If the searcher wants to take an opposite path to the provided information and see, e.g., information about controversial issues, the results may not be convincing. For example, in health related online searches users may seek relief or comfort, not necessarily medical information ([White and Horvitz, 2013](#); Ruthven, [2012](#), [2019](#))

It is not really possible to anticipate the initial human elements of selecting certain information sources, including search tools. Human needs and their triggers are simply too varied. It is, however, possible to use service design to improve search tools' effectiveness, ease of use, reachability, and desirability. For the service design process to function, all of these facets have to be considered. Otherwise the change remains incremental. The factors are furthermore interconnected. For example, an entertaining or hedonic use of an information system makes user care less about perceived usefulness and ease of use ([Van der Heijden, 2004](#); [Venkatesh and Davis,](#)

2000). As noted by Haider and Sundin (2019), the ubiquity of searching makes many information searches a form of entertainment (e.g., checking out Wikipedia for a detail during a dinner conversation), rather than exact, accuracy-seeking queries. This means people are satisficing (as per Simon, 1981) in much of their search behaviour, also on the usability of the search device in question, and searching for fun and/or convenience rather than for efficiency. The smartphone at hand wins over the PC, even for many complex search tasks, as it is continuously available. Likewise, in ubiquitous searching, relevance of the results (as per Sarasevic, 1996) are largely determined by immediate needs. Even more worryingly, searchers appear to settle for results on the first page of results (Haider and Sundin, 2019; White, 2016).

We believe that by using holistic design processes, searching can be improved. In the next section, we present a handful of methodological examples, which together form one way of finding out what can be improved and how.

Case example: profiling a search process

A central idea here is that one should not design search process facilitations from just one end at a time. Instead, a designer should work to co-design the necessary steps from both ends, and make sure that neither the history-searching, existing-practice oriented analysis of the current situation, nor an unrealistic vision of future achievements, is able to dominate the design. To access both sides of the equation, tools such as personas may be deployed, as can be e.g., silent brainwriting in which people list stages of a search process on post-it notes that are then clustered, and user interviews or the collection of user stories, in the case of an existing service. These are then combined in a holistic analysis. A persona is the condensed summary of a likely user, in a fictional but data-based form (Luojus and Harviainen, 2016). Typically, more than one persona is used, but in early development or for customer segmentation, sometimes just one is sufficient.

[picture would go here]	<i>"I feel that a quick search is enough, and I trust Google to deliver."</i>
"Jane"	
35 years old Employed as an accountant Married, with two children Average income	Jane has a tendency to make quick information searches during dinner conversations about what the facts are. At work she examines figures and data intensely, but needs to relax during free time and usually just checks the first one or two pages found by Google. She likes using recommender searches of webstores, and browses random results while thinking about what to maybe buy. Jane sees information sharing as a form of helping others know more.
Medium-high information literacy skills, but happy to usually satisfice when not at work	Motives: Wants to learn facts but not spend time on evaluating them. Sees search behavior as self-expression.

Figure 1: A fictional search-research persona

Using the example from Figure 1, a service designer would likely next host workshops in which key stakeholders would discuss how to best answer the needs of users like "Jane". The search process can be furthermore mapped by using tools like a service blueprint (e.g., [Patricio et al., 2011](#); [Stickdorn et al., 2018a](#)) and combined with not just a mapping of service touchpoints, but also emotional states as seen in Figure 2. For information searching, this is a highly suitable tool, as it in connection with methods like interviews, think-aloud, or written user stories is able to reveal and present contextual, cognitive and affective factors present in a particular search process. These can then be used as a basis for extrapolation, for the purpose of improving designs and processes through other service design tools.








Jane's thinking	"Hmm, is that true?"	"I need to check this."	"Maybe I should ask about this online."	"I'll Google it."	"This is what I want to know."	"Are these ten results useful?"	"This seems to answer my question sufficiently."
Stage	Anomalous State of Knowledge	Recognized information need	Seeking	Search tool selection	Query formulation	Result and relevance assessment; skipping ads	Information quality selection; satisficing
Primary Emotion	 Uncertainty	 Determination	 Restlessness	 Biased	 Hope	 Dissatisfaction	 Ambiguity
Observable Situation	Tension	Thinking	Picking up a phone under the table	Opening a browser or app	Typing in the search	Use of probably only first result page	Selecting a satisficing result
Support Processes		Public availability of sources		Existing marketing and knowledge of search engines	Recommender systems; aggressive autocomplete	Result ranking on first page	Link to an outside source (e.g., Wikipedia)
Potential Improvements and learning opportunities (contributions from service design, and things that can be improved by other service design tools)	Try to understand the ASK stage – soon machines may sense it and try to answer it without a search	Understand triggers of needs	Understand why a seeking process leads to a specific search	Find out selection criteria; make sure engine likely matches user need and predicts it if necessary	Non-fixed search with e.g., better Boolean functions, or stronger recommendation	Study what is seen as relevant; alter presentation order to make result more personalized; move ads to a less intrusive location	Ascertain basic answer retrieval is accurate

Figure 2: Example of an emotional service blueprint analysing Jane's frustrating, lookup-type information search (cf., [Marchionini, 2006](#)).

Using the results of the blueprinting, a service designer would typically call forth a group of stakeholders to plan improvements based on one of the now identified "pain points" ([Stickdorn et al., 2018a](#)). These would include people who frequently use the search engine for Lookup searching ([Marchionini, 2006](#)), people who use the search engine(s) for investigative and exploratory searching, representatives of the system provider(s) (preferably ones with actual possibilities to influence the design), and if possible, also non-users. A typical first stage would include brainwriting, or a "10 plus 10 exercise" (e.g., [Stickdorn et al., 2018b](#)), methods in which the participants draw or write improvement ideas on post-it notes, and then expand (in the case of the latter method) on the best-seeming ideas. In this case, such ideas might include "what would make you choose another (hypothetical) search engine?" or "what would make you want to use another device to do this?" These are then clustered and analysed together, and measured with other methods for developmental and financial feasibility ([Stickdorn et al., 2018b](#)). Other options would include, for instance, the deployment of a design game ([Vaajakallio and Mattelmäki, 2014](#)), in order to come up with novel improvement ideas.

The next stage would then be the creation of a wireframe - a digital or drawing-based model of the search engine ([Stickdorn et al., 2018b](#)), with which to ask people for feedback on what works and what is missing. Digital tools that allow e.g., hyperlinking from photograph to photograph make this nowadays a very quick and efficient testing tool. The goal of this level is to see how potential users would react to design decisions, including search accuracy (which is hard but not at all impossible to model using this technique) and marketability. The core target with this is to rapidly find out potential problems and possible advantages. In many ways, this is a way of combining existing UX knowledge by the system designers with rapid yet deep feedback from a wide stakeholder spectrum.

Once this stage is done, it is necessary to see whether the user-requirements fulfilling service would be feasible to implement. As this is not at all obvious – people love to get stuff for free, once they have had it free for a while, and thereby they are likely to satisfice rather than pay for what would in fact be more valuable for them ([Heimo et al., 2018](#)) – it is necessary to test the business plan of the search engine and its marketing ideals. In service design, this is usually done using the business model canvas by Osterwalder and Pigneur ([2002](#)), or one of its service-oriented variants (e.g., [Ojasalo and Ojasalo, 2015](#)). If that mapping, too, proves likely to produce positive results, the design process would move on to digital prototypes, as the cost-effect-result-satisfaction ratios would likely now be in sufficient balance for actual testing, even for a rather loss-averse service provider. Finally, the service may see daylight, in a form that serves information searchers better than before, and probably not just for Lookups, but also for more various types of searching, such as exploratory searching.

As can be assessed from this theoretical example, information searches are likely to have accumulating reactions, or alternatively heavy disappointments, when the search engine fails to deliver. Nevertheless, many people are content with just satisficing ([Haider and Sundin, 2019](#)). How, then, to solve this through design? It is easy to argue that the order of results on a search page, which is known to have a strong influence on what people click (Pan *et al.*, 2007), should be altered, and that distracting advertisements ([Höchstötter and Lewandowski, 2009](#); [Lewandowski et al., 2017](#)) should be placed away from the top of the page. Doing so is highly difficult, however, even without counting in corporate interests. Recent studies in service design have nevertheless shown that a systematic use of its methods can be used to assess user needs and desires (e.g., [Harviainen, Ojasalo and Nanda Kumar, 2018](#)), so there is still hope. As noted above, search engine providers are already using user experience design to improve their services, but they are not going all the way that they could. The use of service design may facilitate the change, including the pre-search stages before selecting a particular search tool. What makes this approach

special are not the individual steps or tools, but rather the holistic, human focus. Used together, a set of well-chosen service design tools is able to reveal search processes in their longitudinal form, and to facilitate developments of better tools and processes.

For example, from simple chartings like Figure 2 and data from real persons, we could start improving search engines, webshop recommender systems, and the marketing of particular search tools. It is also important to get rich user data from varying and repeated instances, because what users may prefer from one search engine, or the same engine in a different context, may be very different.

Discussion

Remarkably, most search-oriented companies – whether working with search engines or e.g., webshops – appear not to be customer-oriented. Their search logics are those of engineers, made from the perspective of company need (see [Russell-Rose and Tate, 2013](#)). Or, in turn, they may rely on a dominant market position, whether by perceived superior efficiency (e.g., Google), through controlling what is easily available with a ubiquitous software package (e.g., Bing), or what is permitted in a certain country (e.g., Baidu).

In many ways, service design is about taking an ultra-qualitative approach to services, in this case information search possibilities. A risk exists in this, as it may cause not only researchers (as argued by [Vakkari, 2008](#)), but also designers to focus more on the individual user instead of social contexts and needs. On the other hand, it may alleviate challenges caused by less than optimal search results (e.g., [Huvila, 2013](#)), as it is able to focus on individual-level relevance. Likewise, the more is known about users' searching behaviour and needs, the better the first result pages of search engines can be made. That is not achieved with just log data or clicking rates, but requires also working with users – current and potential – themselves. That is what service design does, and is able to ask also much deeper "why's" on the reasons for searching, and decisions made during searches.

Just like it has been recognized for decades that information seeking may be affected by both cognitive and affective factors ([Wilson, 1981](#)), the use of search engines may be based on affective reasons, or simple laziness, instead of any rational decision ([Huvila, 2016](#)). Understanding such reasons is a matter of customer empathy and cannot be comprehended with just transaction log data. To fully achieve the balance between technological possibilities and human needs, human-centred interaction research is required. The methods which we discuss in this paper as examples are already familiar to some information researchers. What makes service design nevertheless special is the way in which those tools are combined and charted, often

thorough visual means, and almost always in cooperation with a wide set of involved people.

Conclusions and further research

In this paper, we have discussed the principles of how service design may assist in optimizing information search processes. As an approach, it offers new, holistic ways in which user insight can be gathered, combined, and utilized in improving search engines and the likelihood of their use. While the work in this paper is only theoretical, it carries implications and opportunities far beyond the scope of just one article. It may be next to impossible to directly affect the ways in which huge conglomerates like Amazon and Google deploy their customers' searches, but it is nonetheless necessary to discuss the very basics of how search engines function, and how they should be designed. Service design offers a new inroad into that knowledge. It adds a very human element to the algorithms in use, and thereby makes the system design much more user-oriented.

We see several research directions arising from these concepts. For example, the principles of service design can be used to lessen people's resistance to information searching (as per [Haider, 2017](#)), and thus to make them more likely to do fact checks. Likewise, they can be deployed at each stage of an analysed search task (as per e.g., [Byström and Järvelin, 1995](#); [Pharo, 2004](#); [Byström and Hansen, 2005](#)), to improve efficiency at that stage, or to make that stage more likely to happen. Service design can also be applied to optimize system recommendations, and how aggressively they try to anticipate users' needs, especially if combined with the principles of behavioural economics and choice architecture. All of these areas should be actively explored, so that not just search engines, but also search processes, can be further improved.

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