

Situational Impact on Search

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ABSTRACT

In this paper, we explore the characteristics of workplace situation and their impact on the search process, with an emphasis on disruptions and interruptions in the workplace.

Categories and Subject Descriptors

H.3.3 [Information Search & Retrieval]: Search Process

General Terms

Design, Human Factors

Keywords

Context, Situation, Workplace interruptions, Search.

1. INTRODUCTION

The physical and cognitive act of searching for information is often perceived to be a solitary one that takes place in isolation and in a continuous (start to finish) form. Much of the research in information search conducted in the laboratory and the field treats the search task in that manner. Yet work tasks are often conducted in dynamic, highly interactive environments in which people engage in many human-to-human activities as well as human-to-computer (or other inanimate object) activities over the course of a day. More likely, yet speculatively, an information search is handled intermittently, juxtaposed against a set of work tasks of mixed and competing priorities and with mixed human, tangible and intangible resources that can be devoted to it.

Research in information science involving the workplace tends to investigate how specific groups of knowledge workers are using the web to locate and collect information (Choo, Detlor & Turnbull, 1998, 1999; Hirsh, & Dinkelacker, 2004; Sellen, Murphy & Shaw, 2002). The focus of this research has been on modes of searching and browsing, the type of task, and methods, rather than the situation in which workers conduct their activities. There are many elements of a workplace that potentially can affect how a search is conducted and the success of the outcome. We focus on interruptions because they are inherent to all workplace environments and have the potential to impact work task, the search task and productivity.

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2. CONTEXT IN SEARCH

As illustrated in Figure 1, the search process contains three key ingredients. The individual (or group) who seek(s) information for some purpose brings a host of attributes to the search process. The information resource(s) – the content – in which the information is represented in a particular medium, also contains a range of characteristics, each of which also impacts the search process. The interaction and transactions between individual and content take place using some medium – a system. All three work together to achieve a desired outcome which functions under a set of conditions prescribed by a particular information use environment such as a hospital, a library, or a finance department. Within that environment are multiple situations or “working spheres” (Mark, González, & Harris, 2005) – jobs or sets of circumstances – that shape and influence the work task from which the search need emerged, and also dictate the circumstances in which the search will take place. From a research perspective, all of these factors and their elements potentially impact search, and this list is by no means exhaustive.

Some contextual characteristics such as expertise and prior knowledge have been addressed by previous research (see e.g., Holscher & Strube, 2000; Laxonder Biemans & Wopereis, 2000). In previous (and ongoing research), we have examined (or are examining) the effect of task domain (Toms, Kopak, Freund, & Bartlett, 2003), the critical role of task elements and the need for unique resources and tools (Bartlett & Toms, 2004), the relationship among work task, genre and information goals (Freund & Toms, 2005), and the role of medium and special task environments (Toms, Dufour, Lewis & Baecker, 2005).

Prior research has often considered situational variables as external to the search process. By this we mean that a search can be (and has been) construed as a ‘closed system’ – a query is entered and a response is received, which is the typical algorithmic approach to information retrieval. In our work, we argue that there are many actions and activities that take place prior to, during, and after the search process that have the potential to directly or indirectly affect search outcomes. These may include environmental factors such as heat and light, the nature of the workplace (centralized or distributed), the nature of reporting relationships, the style of office (closed or cubicle) and a host of other factors, some with a direct impact and some with an indirect impact. In our analysis, we focus on one characteristic of the workplace which has a direct impact on search: workplace interruptions.

3. INTERRUPTIONS

An interruption has been defined as “any disturbance to the normal functioning of a process in a system” (Cooper & Franks, 1993) and has been construed as “the process of coordinating

abrupt change in people's activities" (McFarlane, 1998, 119). More recently, an interruption has been defined as "an event within the notification system prompting transition of attention focus from a primary task to a notification" (McCrickard, Catrambone, Chewar, & Stasko, 2003). Generalizing this conceptualization, we define a search interruption as any event which prompts a transition of focused attention from the primary search task to the event itself. An abrupt change may affect cognition, perception and behaviour, which will in turn affect the search process.

Notably, an interruption may result in multi-tasking, but not all multi-tasking is caused by an external interruption, and not all interruptions result in multi-tasking. In multi-tasking, often the user has multiple information searches in mind or 'on-the-go' at one time (Spink, 2004), such that interruptions come from within. Multi-tasking behaviour can be made more efficient and effective when workers are not forced to step outside of their current working spheres and when tools support straightforward task switching and primary task resumption (Mark, Gonzales, & Harris, 2005).

3.1 Elements of Interruptions

An interruption can be classified according to many dimensions. Some of these are derived from McFarlane and Latorella (2002), and Jett and George (2003). An interruption and how that interruption is handled by the user (or a surrogate) have sets of distinctive characteristics. In addition, the interruption also has likely outcomes that are separate from the search but which impact the success of both information and work tasks. Finally the interruption takes place in a workplace situation with a host of factors that may indirectly affect how the interruption is handled by the user. We have identified some of these below:

Characteristics of an interruption:

- a. *Source*: an interruption may be supplied by the user, by another person, by a computer, by an animate or inanimate object;
- b. *Channel*: the source may be face-to-face, or may be mediated by another person, by a machine, or by some other object.
- c. *Expression*: verbal or non-verbal with or without an audio effect; contain affect characteristics, e.g., positive & negative politeness;
- d. *Intent*: the interruption may be an alert, forcing cessation of the activity (e.g., the fire alarm), or a suggestion, or recommendation of help with the primary task.

How the interruption is handled by user:

- a. *Coordination method*: immediate, negotiated, mediated, and scheduled;
- b. *Length of the interruption*: time between point of interruption and point at which the activity recommenced; additionally, length may be controlled or limited by the user or controlled by the source of the interruption.
- c. *Fluency in task resumption*: how easily the user returns to the primary task.

Effects of an interruption:

- a. *Effects on user*: loss of focus; loss of awareness and/or engagement with the activity; change in short term memory contents; distributed attention (multi-task (volunteer or delegated));
- b. *Effects on task*: loss of control over the activity; depends on point in the process (beginning, middle, end).

Mitigating / exacerbating workplace factors:

- a. *Facility factors*: level of noise, physical environment, open office versus closed office settings;
- b. *Organizational factors*: distributed versus centralized location, traditional versus virtual supervision;
- c. *Workplace culture factors*: interruption expectation level, interruption saliency for the individual, interruption relevance to the task, impact of interruption on perceived performance pressure, awareness of others, cultural collaboration;
- d. *Managerial factors*: explicit pressure of search versus explicit pressure of interruption; implicit pressures; real versus imputed level of supervision.

3.2 Interruptions and Search

Interruptions in the workplace have been studied in many specific domains including decision-making (Speier, Valacich, & Vessey, 1997), map-reading (Nivala & Sarjakoski, 2004), code-debugging (Robertson et al., 2004), text editing (Burmistrov & Leonova, 2003), skill acquisition (Langan-Fox, Armstrong et al., 2002), and within organizational life (Jett & George, 2003). Despite the attention given to workplace interruptions, there has been very little focus of this issue in the context of information search and retrieval. Because of the dynamic nature of many workplace situations, a search is likely to be interrupted, and/or the user distracted by characteristics of the situation. Attention economies are limited; interruptions and distractions are likely to have an impact on search outcomes.

Interruptions can have both positive and negative impacts on work outcomes by acting as an unwanted *distraction* from an important task or an *attraction* to valuable information (McCrickard, Catrambone, Chewar, & Stasko, 2003). Managers rely on interruptions to initiate activities, jog their memories, and deal with situations before they reach crisis points (Hudson, Christensen, Kellogg, & Erikson, 2002). Interruptions may reduce boredom and increase challenge, thereby having positive emotional effects (Zijlstra & Roe, 1999). However interruptions may have a deleterious effect. Zijlstra and Roe (1999) observed that office employees modified their work strategies when confronted with interruptions. Although they maintained the same quality output, their accelerated pace resulted in more effort; over time, increased speed and exertion could result in burnout, as well as lack of accomplishment/motivation.

The challenge in examining the impact on search is in determining how search (as a task) differs from other work tasks. Do interruptions that affect other work situations have similar effects on search? If so, the challenge will be in limiting the negative effects while harnessing the positive ones. That will require studying interaction effects to determine how to identify

situations in which an interruption might be positive. For example, a seemingly endless stream of query-to-results-lists click-streams might suggest that the user is on the wrong track and needs an interruption. On the other hand, typical collegial interruptions may indicate the need for appropriate interface tools to aid the change in user focus. This may require the equivalent of sticky notes or something that holds the previous 'thought pattern.' The search tool and computer mediation may also have a bearing on search fluency, and search resumption fluency. In addition, we expect that there is some level of pressure from the workplace context, whether reward-related or explicit/implicit direct supervision that produces optimal search outcomes.

3.3 Proposed Study of Interruptions

In our work we plan to study the effects of an interruption on search outcomes. Using a mixed-methods approach, we will observe the effect of an interruption on knowledge workers' interruption management strategies while performing simulated search tasks. We plan to manipulate the timing of the interruption within the search process (e.g., when initiating search task versus engaged versus completing), and the type of interruption (e.g., related or unrelated to the current task) to observe the change in the search process, and assess search outcomes. Our long term goal is to re-design the interface to help with re-engagement in the search.

4. SUMMARY COMMENTS

Isolating workplace contextual factors that affect the search process and that may be gathered relatively unobtrusively is one of the leading challenges in interactive IR research. The contextual factors discussed in this paper are unlikely to impact search algorithms, and improve ranking. Instead, these factors affect the search process, and will lead to modified interfaces and new tools to aid the searcher within the search process. Understanding external influences and how to develop aids that help manage interruptions and assist with re-engagement in the search task would be of great benefit to knowledge workers and organizations.

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Figure 1. Contextual Factors that affect Search. Adapted from [22]

