



A New Model for Multitasking during Web Search

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ABSTRACT: A lot of studies have been performed in the field of information behaviour. Du and Spink (2011) recently presented a model that simulates on-line multitasking, cognitive synchronization and cognitive changes. This model does not integrate personal variables, however, nor the effect of task or web design. The void is discussed in this study. Information scientists and psychologists have shown that knowledge behaviour (IR) is influenced by: the affective environment, cognitive abilities, psychological influences, aspects of personality and sociological influences. This research explores how IR is affected by working memory (wm), cognitive control, cognitive changes and various flow-influenced objects and task variables influenced by the PAT (Personal, Artifact and Task) model. The work is exploratory and takes a mixed, realistic approach to the process. Thirty students from the university will take part. The testing methods include: pre- and post-questionnaires, working memory tests, Flow State Scale check, thought aloud data, findings, audio-visual data, site search logs and the use of the Critical Decision System. The qualitative data will be thematically labelled and analysed, and linked to the quantitative data. This research is intended to define the effects of all of these variables on the web's multitasking IR and provide a new comprehensive structure that will not only help information scientists understand this activity better, but will also help web companies create more successful web products.

KEYWORDS: Human-Computer Interaction, Interactive Information Retrieval, Multitasking Information Behaviour, Web Searching, MCC Model Of Web Search, Working Memory, Flow, PAT Model

I. INTRODUCTION

Web and online search engines are used by people to investigate and remember details. When online search is increasingly important for access to information worldwide, there is a need for more efficient models representing the relationship between people and online systems. Web search typically defined as multitasking behaviour-seeking knowledge, described as "the process of searching over time in relation to more than one, probably changing, collection of knowledge issues (including changes or shifts in beliefs, cognitive, affective and/or situational states)." When people multitask using the internet, there are a variety of factors involved: affective, emotional, psychological states, aspects of personality, and sociological factors [1]. Nonetheless, these factors influence multitasking knowledge behaviour in the search process at different rates, and more work is needed to further explore them in a web-based multitasking context [2].

This study is expected to identify:

- Effect of cognitive influences on knowledge actions with multitasking while using the internet. This research is intended to extend the previous web search model, considering the cognitive variables of individuals. Working memory research should also shed light on the actions of multitasking information especially in relation to cognitive performance, cognitive changes and their sub-levels.
- Relationships, if any, between cognitive changes and rates of coordination for and participant according to their capacity for working memory. It will analyze patterns of cognitive synchronization and changes.
- The effect of the site artifact and the characteristics of the tasks as per the PAT flow model. In previous versions, multitasking consists of juggling tasks between original and emerging knowledge problems, and multiple web search sessions and browsing windows. The research will include tasks and characteristics of web objects according to the PAT flow model, since this model recognizes the value of separating the task from the artifact within a



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computer-mediated context. The effect of the characteristics of web artefacts and tasks will be correlated with movement, cognitive shifts and cognitive coordination [3].

- The relationship between flow, cognitive synchronization, cognitive shifts and web-seeking procedures across the entire multitasking information behaviour case. The results of flow experiments should be correlated with the results of the working memory, allowing associations to be explored and their effect on multitasking knowledge behaviour [4].

II. BACKGROUND

Information behaviour:

Over several years knowledge habits have been discussed. Several knowledge scientists have developed models in which they have sought to explain this behaviour's methods and mechanisms [5].

Retrieval of Information (IR) is about scanning, filtering, and finding the information that people want. Various techniques were used to represent the operation. The solutions to the method underscore the significance of the method. At the other side, the user addresses the user and their principal function, as anticipated. Many methods concentrate on the cognitive factors in the interactions between the consumer and the program [6]. The word Interactive Information Retrieval (IIR) has been coined to describe the retrieval of information in relation to web browsing, but the cognitive processes involved are not properly defined. Several of those models are listed in the following sessions for completeness.

Web searching:

Several models have been developed to represent factors that can influence web use, performance, and web search engine selection and resources. For example, Du and Spink tied multitasking to cognitive coordination and cognitive shifts in their model [7]. We found that when people were multitasking on the network, we were looking for solutions to several problems or tasks at once. They even searched for answers to other relevant and irrelevant information problems when given an information task. People appeared to have their roles, plans, and processes organized [8]. They found that the cognitive shift of a person could be either a change of information for one subject ('holistic shift') or a change in cognitive states of the users when searching ('state shift'). Although useful, the main drawback of this model is that it does not include information about the cognitive factors and procedures that all of these processes that underlie and affect.

Another well-known model representing web searching is the one Wang, Hawk and Tenopir suggested. The multidimensional model incorporates three factors: the user, interface, and World Wide Web (WWW). The authors proposed that these causes are intertwined and influence cognitive, affective, and physical behaviors of humans. Participants completed a questionnaire in their experiment about web experience, anxiety and cognitive types. Instead, they had to check two knowledge issues on the internet [9]. Rieh and Xie studied how people navigate the World Wide Web. Participants searched for six separate topics per session, and explored how their level of interest, cognition and circumstance influenced their questionnaire reformulation. They found that, as a result of their cognitive, affective and situation phases, individuals reformulated their queries and according to three factors: content, format, and tool. The impacts of cognitive types were discussed by Palmquist and Kim. Researchers found that cognitive styles would only impact the web use and performance of new users, as opposed to seasoned users who were not so much affected by their cognitive styles [10].

Multitasking:

Multitasking was described as being able to do several things simultaneously, and successfully move between them. As people search knowledge on the Internet it's a normal activity. For example, Spink, Ozmutlu and Ozmultu (2002) conducted experiments to examine user behaviour while searching multiple topics. The findings showed more regular multitasking sessions, with a maximum number of topics per session 10, with an average of 2.11 topic shifts. For another report, users were asked to perform two and three web-seeking sessions by Spink's et al. The findings revealed that the participants were alternating between several sessions and queries. Topic shifts have occurred regularly, with 81 percent of two-question sessions having multiple tasks and 91.3 percent of three or more inquiry sessions. The researchers also found that individuals appeared to prioritize the activities and the approaches they were trying. Several researchers have tried to unveil behind this complex action the cognitive procedures. For example, they have found that working memory ability and attention can be predictors of success or otherwise of performance in multitasking. Morgan et al. also found that the spatial ability of a person as well as general aptitude could influence the efficiency of multitasking, in addition to working memory. Participants also had to multitask and complete



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questionnaires about their cognitive skills in their experiment. Judd and Kennedy have studied the multitasking behavior of knowledge among students. They found their memory output was poor when people multitask between various kinds of tasks.

Four factors are thought to be related to effective task switching: task selection, which is about prioritizing each task; level of demand, which is about the complexity of each task; multiple resources, which are related to the amount of resources needed/available to complete the tasks; and uncertainty about each task's needs. Spink and Park discussed the importance of cognitive types, individual differences and the relationships between information and non-information behavioural activities in their model of multitasking.

Cognitive procedures:

Successful execution of multiple tasks relies on the previous awareness of the subject area of the user and their ability to use different search techniques. In her IR coordination model, Ma (2008) proposed that perceptive, linguistic evidence and the quest for web logs contribute to coordination. She did not however discuss the cognitive processes in detail. Du and Spink outlined three sublevels of cognitive coordination: mission, function, and degree of strategy. The overall level of management of the information activities is the management. The level of cooperation function is about the processes, such as feedback, of people. The level of Strategy comprises two sub-levels. The first is the task-specific level of strategy, which is about how people reshape their questions to find more detail. The second sublevel is the category of global strategy, which is the key plan according to which people coordinate their seeking actions in a timely manner [11].

Cognitive shift is another studied cognitive process. Kulthau proposed that people should be cognitively moved from the stage of confusion as they begin to seek knowledge to the stage of confidence. Two different forms of cognitive changes were identified by Du and Spink: the holistic and the state changes. They noticed, however, that each participant may have various rates of cognitive changes, but did not mention which individual cognitive procedures contribute to these outcomes.

Personal dimensions from the fields of psychology and information science:

As stated earlier, it is thought that five key dimensions influence multitasking on the web: affective, cognitive, psychological, personality and sociological factors. Previous research showed that:

Affective factors which include categories of emotions and feelings

- Positive feelings can improve people's information seeking strategies as well as performance.
- Positive emotions lead to better performance and seeking process; having negative emotions, lead to lower performance.

Cognitive factors which include cognitive styles, the users' experience, working memory, developmental stages and aging factors:

- Verbalizer cognitive styles negatively affect the seeking process because people tend to focus on visual images and at the end the end they get lost. Field-independent people are more analytic and have better performance than field-dependent.
- Poor working memory (the ability to hold a specific amount of information while approaching other
- Information tasks negatively affects performance. Working memory capacity may predict reading and language comprehension which are related to information behavior. • People prefer to look for relevant knowledge, a method called biased. Therefore, people can pick which information to store and process by attention, and which not.
- People appear to pursue information on the basis of their previous experience, see Festinger who suggested the principle of dissonance.
- Prior knowledge of a individual has a positive impact on the performance-seeking information. Experts have been shown to use numerous and specific scanning methods in less time and with better performance than users of novices.
- Stages of development involve multiple cognitive processes, such as memory, language and decision-making).
- During every cognitive stage these processes take on different types. At the evolutionary point of view, knowledge behaviour includes the quest for multiple stages of knowledge.
- Aging has been shown to decrease the output of certain cognitive abilities, such as working memory and attention, and to increase visual and motor problems.

Psychological states which includes motivation and flow:



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- People seem to be happier when they're inspired and happy with their success. Revelle W. Nevertheless, Illies and Palmon found that when people look for and find information that could contradict their beliefs, then motivation appears to be a negative predictor of the performance-seeking information.
- People with good flow, defined as 'a balance between "skill" and "challenge"' with features such as: clear goal, feedback, concentration, focus, control, loss of self-awareness, transformation of time, and autotelic nature, performance aids.
 - Finneran and Zhang differentiated the variables of person, item, and task in their PAT model. For computing systems, these variables are the antecedents of flow; they are separate but at the same time correlated to one another.
 - Dimensions of personality like: neuroticism, extraversion, open-mindedness, competition and perception.
 - Extraversion is linked to production of knowledge, where the task was only positive.
 - Sociological factors which include self-efficacy from Bandura's social cognitive theory, also referred to by Wilson.
 - Self-efficacy (people's belief in successfully searching web-based information) appears to be a mediator of personal engagement, individuals seeking procedures, and perceived performance.

III. METHODOLOGY

The goal of this study is to investigate the working memory, flow, as well as artifact and task characteristics informed by the PAT model in a multitasking web environment. The work is exploratory and takes a mixed, analytical approach to the process. The key experiment will involve thirty undergraduate and postgraduate students from universities. There will be two phases to the analysis. More than 30 participants must take the test of working memory in the Automated Process Period Task in the first step. The researcher would then remove all participants who do not meet the test's accuracy criterion. The researcher would then hold brief pre-interviews after that. Participants from the same sector will be asked about certain activities they need to perform and about which they have advanced knowledge; and other activities they have little to no knowledge about. The researcher will then establish two specific categories of task-seeking information: two tasks for which participants have prior knowledge and two more tasks for which participants have no or little prior knowledge. The evaluation conditions will be based on these four activities and will be the same for all participants.

The second section will comprise the main experiment. Both participants will be required to complete pre-questionnaires with open and closed questions, and will be asked to complete for one hour the four knowledge gathering simultaneous tasks (multitask). In the experiment, they'll be told to "talk aloud," and the researcher will also observe them. Camtasia software will be used to precisely capture how the participants navigate the site. Participants would then be asked to respond to a post questionnaire and undergo a Flow State Scale study. The researcher will conclude by interviewing each participant using the Critical Decision Process. We'll report the interviews. The qualitative data will be thematically labelled and analyzed, and linked to the quantitative data.

IV. PROPOSED MODEL

A preliminary theoretical model is proposed which shows the possible relationship between web-based multitasking, working memory and flow, and the PAT model's effect. This study will monitor environmental and demographic factors as the study will be performed in a quiet setting and it is intended to recruit participants of similar age and educational levels. Similarly there will be controls in place to standardize the characteristics of the web function and the technologies used. The aim is to investigate the lower part of the model, particularly the relation between the capacity of working memory, flow rates and cognitive control and shifts as shown in figure 1.

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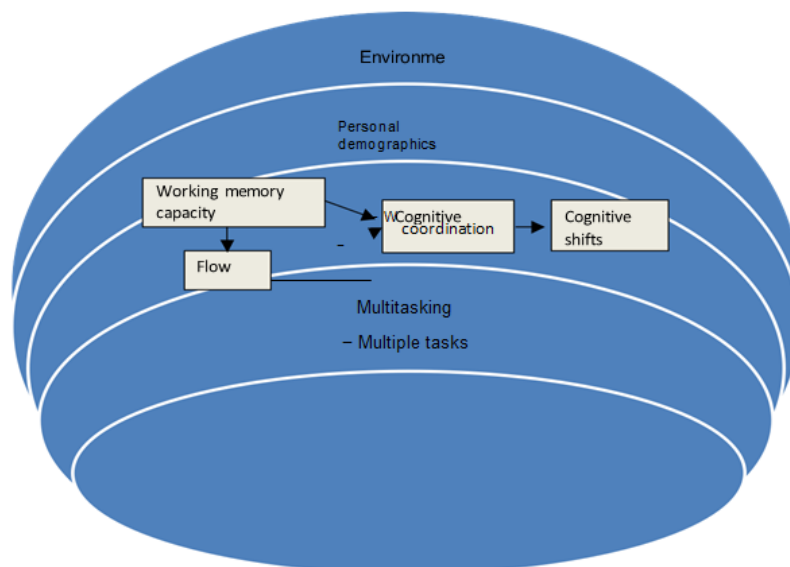


Figure 1. Preliminary model of the study

V. CONCLUSION

A new integrated architecture for the multitasking behaviour of knowledge on the web is expected to be developed. This new model would cover the personal dimensions of people in relation to web design and task characteristics and provide an insight into how various and specific variables can influence action seeking on the web. This will also demonstrate how the working memory ability, attention and flow rates of humans, affected by the PAT model, can affect cognitive function and cognitive information shifts. In particular, in relation to the working memory and flow, cognitive function and cognitive changes will be discussed in detail. Patterns of cognitive function and cognitive changes are likely to turn up. The findings are supposed to help web designers and companies create more effective Web products.

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