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Self-Determination in Information-Stopping Behavior
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The Impact of Self-Determination on the Information-Stopping Behavior of Professionals: An Exploratory Study in the Software Industry

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Abstract

Online search has become an important part of professional and daily life. With an endless amount of information available, terminating the search when sufficient information is gathered is critical for managing decision-making. So far, research has analyzed cognitive influences: how people process information and how their mental models influence stopping. However, little is known about motivational influences arising from individual desires, preferences, or incentives. In this research-in-progress paper, we consider the role of motivation on stopping behavior. Drawing on self-determination theory, we develop a structure of motivation, propose its influence on stopping behavior, and conduct exploratory case studies on an individual level in the software industry. Our results show that a more self-determined motivation results in a more intensive and longer information search – that is, in later stopping. This finding is the first step toward the development of motivational stopping rules.

Keywords

Information seeking, Information-stopping behavior, Motivation, Self-Determination Theory, Case studies.

INTRODUCTION

Seeking and using information are common and essential human behaviors. In the time before the World Wide Web, information was stored in various places, such as individual offices, libraries, computers, or minds. These places, also called information sources, were separated by location, person, or channel and could not always be explored easily. However, the Internet has made the Web the most important "place" for accessing information, allowing a centralization of information search, and has changed people's behavior (Case 2012). Now individuals can access far more information, which requires them to develop new knowledge and skills to handle it. These requirements have also provided an extensive research area for scientists (Case 2012; Johnson 2009; Prabha et al. 2007).

In searching for information, people follow a generic pattern. First, they recognize that some information is needed. Individuals notice a gap between their informational state and perceived informational requirements, which are often dictated by a task at hand (Leckie et al. 1996; Prabha et al. 2007). This gap is also referred to as an information need (Case 2012; Johnson 2009). Second, people take actions to find the required information to satisfy their need. These activities could vary from remembering something to consulting an expert, and often include the Internet as a possible source (Leckie et al. 1996; Prabha et al. 2007). Finally, an individual decides to terminate the search: *to stop*. While numerous researchers have explored the complex phenomenon of stopping (e.g., Browne et al. 2007; Hemmer 2013; Kantor 1987; Pitts and Browne 2004; Prabha et al. 2007; Rapoport et al. 1972; Zach 2005), most of the research has focused on the cognitive components of human behavior (Browne et al. 2007; Kantor 1987). While some attention has been given to the importance of motivational factors (Browne et al. 2007), the cognitive perspective remains the major focus of research on search termination so far.

This research-in-progress paper attempts to address this scientific gap. The goal is not only to provide some evidence of a relationship between motivation and stopping behavior, but also to explore the origins of motivation and understand the underlying processes of its variance. Therefore, this work has an exploratory character. Two major research questions emerge:

- *What is an applicable underlying motivational structure for stopping behavior?*

- *How does motivation influence stopping behavior?*

The answer to the first question draws on a theoretical conceptualization of motivation derived from literature. To address the second question, we rely on results of an exploratory case study, executed with professionals in the software industry.

The remainder of the paper is structured as follows. The next section discusses major theoretical foundations, and is followed by a description of a theoretical framework and introduction of hypotheses. Next, the methodology of an exploratory study in software industry and associated procedures are described, and subsequently the findings from the case study are presented. Finally, a discussion section, which also addresses limitations, concludes the article.

LITERATURE REVIEW AND THEORETICAL DEVELOPMENT

Stopping Behavior and Stopping Rules

At some point, people assess the amount of information gathered as sufficient and proceed to the next step in their decision-making process (Browne et al. 2007). They do so by applying a heuristic, or stopping rule (Browne and Pitts 2004; Nickles et al. 1995), which is a mechanism "to stop information search and make a decision" (White and Harding 2007, p. 1). These rules can be either cognitive or motivational in nature (Browne et al. 2007). Cognitive stopping rules consider actual cognitive processes (Browne and Pitts 2004), including internal information processing and mental models of the world (Nickles et al. 1995). The literature contains several types of well established cognitive stopping rules, such as the mental list, representational stability, or a single criterion (Browne et al. 2007). Motivational stopping rules, in contrast, rely on "preferences, desires, or internal or external incentives, such as deadlines, costs, or preferences for closure" (Browne et al. 2007, p. 91). To the best of our knowledge, no research has attempted to derive motivational stopping rules. This work is an effort to address this gap in the literature and take a step toward rules with motivational aspects in their in origin.

Role of Motivation and Theory Selection

The role of motivation in professional settings cannot be underestimated (Erez et al. 2001; Osterloh and Frey 2000). Different professionals, also referred to as knowledge workers, contribute to various parts of organizational processes: in management they define overall strategies, in R&D they develop new products, in marketing they advertise and develop packaging for products to attract customers (Davenport 2013). Among other professionals, software engineers are considered an important group of knowledge workers by many researchers (e.g., Carneiro 2000; Leckie et al. 1996; Witt and Burke 2002). They usually spend a significant amount of time searching for information, and they consume more information than they produce (Leckie et al. 1996). Because of the importance of these workers, interest in understanding their motivation is increasing, but no general theory has yet evolved (Beecham et al. 2008). The goal of this work is to explore motivational processes in information-stopping behavior among professionals in the software industry.

To select a theory of motivation, we analyzed the theories applied in human information behavior literature (e.g., role theory, rational choice theory, principle of least effort) as well as well established motivational theories (e.g., achievement motivation theory, expectancy theory, goal-setting theory) in terms of their conceptualization of motivation, assumptions about individuals, influence on behavior and proposed determinants. We ultimately selected self-determination theory (Deci and Ryan 1985) to serve as a foundation for the conceptualization of motivation. This theory proposes a structure of motivation, has a strong relationship to individual behavior, and conceptualizes major influencing mechanisms.

Self-Determination Theory

Self-determination theory (SDT) (Deci and Ryan 1985) is based on a classic distinction between intrinsic and extrinsic motivation. Intrinsic motivation "refers to a performance of an activity for no apparent reinforcement other than the process of performing the activity per se" (Davis et al. 1992, p. 1112). Such behaviors represent a prototypical instance of self-determination. In contrast, extrinsically motivated behavior is executed to attain (or avoid) certain contingencies, such as rewards or negative consequences. However, such externally motivated behaviors can also be self-determined (Deci and Ryan 1994; 2002). SDT also defines amotivated behaviors,

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which are "not considered motivated because they are not regulated by intentional processes" (Deci and Ryan 1994, p. 3). Amotivation is a radical state in which the individual has no intention to act, as when people just "go through the motions." The distinct types of motivation can be represented along a self-determination continuum (see Table 1). Extrinsic motivation lies between amotivation and intrinsic motivation and covers the continuum between these two extremes, depending on the extent of the self-regulation.

The regulatory styles of extrinsic motivation have differing influences on the persistence of one's behavior. In *external regulation*, where actions are controlled by contingencies, individuals most probably do not continue to maintain or transform the behavior (Deci and Ryan 1985; 2000; Ryan et al. 2010; Standage et al. 2005). In *introjected regulation*, where individuals administer the consequences to themselves, behavior still remains relatively unstable in terms of its maintenance or transformability (Deci and Ryan 2000; Müller and Louw 2004; Ryan and Deci 2000). In *identified regulation* and *integrated regulation,* no external or internal pressure is present, and such behaviors are often associated not only with investing more effort but with more interest and enjoyment related to a certain outcome (Ryan and Deci 2000). A higher level of integration of external values into an individual's own value system often results in behavioral effectiveness or better assimilation within a social group (Ryan et al. 1997). It is possible to move along the continuum to a more internalized motivation by increasing the level of and satisfaction of three essential needs (Ryan and Deci 2000), which we discuss in the next section.

Table 1: The Self-Determination Continuum (from Nonself-Determined to Fully Self-Determined)
(according to (Deci and Ryan 1985; 2000; Ryan 1995; Ryan and Deci 2000; Ryan et al. 1997; 2010)

Motivation Regulatory style	Description	Self-regulation	Relevant regulatory processes
Amotivation Non-regulation	Behaviors perceived as caused by forces out of one's control	n/a	Nonintentional, nonvaluing, incompetence, lack of control
Extrinsic motivation — External regulation (ER)	Regulated by external means, no integration of external values	Very low, controlled by contingencies	Compliance, external rewards and punishments
Introjected regulation (IJ)	Recognition of values by an individual, but not a complete acceptance of these values as own	Moderately low, consequences are not administered by others, but by the individuals	Self-control, ego-involvement, internal rewards and punishments
Identified regulation (ID)	Recognition of the underlying value of behavior and acceptance as own, no external pressure	Moderately high, identifications still can be isolated from the self	Personal, importance, conscious valuing
Integrated regulation (IR)	Inclusion of the identification, but also assimilation of the value to the remaining aspects of the self	Very high, much in common with intrinsic motivation; extrinsic motivation, as actions are executed to attain certain outcomes	Congruence, awareness, synthesis with self
Intrinsic motivation Intrinsic regulation	Activity directly refers to internal values, desires, interests	Very high, actions are executed because of enjoyment of an activity	Interest, enjoyment, inherent satisfaction

During information search, individuals are usually guided by a certain goal or a task at hand (Leckie et al. 1996). Therefore, we assume that information seeking happens because of a desired outcome but not because of a search activity per se, and we focus our article on extrinsic motivation. SDT allows an analysis of major motivational forces, depending on the type of regulation. To address a commonly known *level* of motivation, we introduce task complexity, which is often used as a basis for developing a theory of motivation.

Task Complexity

Tasks are often employed to represent situational characteristics in behavioral research (Hackman 1969) and to represent variables that are "a crucial factor in formulating a comprehensive theory of motivation" (Longenecker 1962, p. 221). Numerous conceptualizations for task complexity exist. For example, *task structure* is the degree to which a person can recognize and understand the necessary inputs, information requirements, and relevant processes as well as the outputs a priori (Browne et al. 2007; Byström and Järvelin 1995). When a task is well structured, the person knows the required steps to perform the task. Such an attribute is important to characterize a situation, because "the structure reflects the state of the problem environment as perceived by decision-maker" (Browne et al. 2007, p. 92). One proposed topology of *task complexity* has the following attributes: (a) presence of multiple paths to a desired end-state; (b) presence of multiple desired end-states; (c) presence of conflicting

interdependencies; and (d) presence of uncertainty or probabilistic linkages (Campbell 1988). Overall complexity depends on the degree to which an attribute is applicable (e.g., present or absent, high or low) as well as how many attributes apply. Not every attribute is present in every activity. For example, in judgment tasks, the presence of multiple paths and multiple desired end-states is irrelevant, or in problem tasks, the attribute of multiple paths can be neglected (Campbell 1988). Resent studies in IS have also used task complexity to study information-stopping behavior (e.g., Browne et al. 2007; Hemmer 2013).

RESEARCH FRAMEWORK

Figure 1 shows the proposed theoretical framework. The dependent variable *late stopping* is defined as a postponement of a search termination decision during an information search. The two independent variables *perceived task complexity (PTC)* and *perceived need satisfaction (PNS)* influence the dependent variable *late stopping* through the mediator *motivation to search*. Motivational *level* and *regulation* represent the construct of *motivation to search*. The *level* corresponds to the well established low-medium-high assessment of motivation, whereas the *regulation* addresses the regulatory styles from SDT.
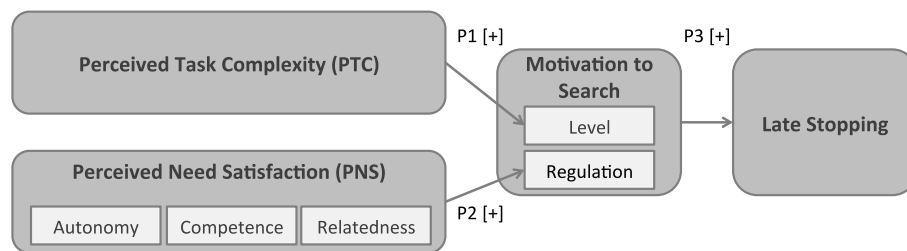

Figure 1: Preliminary research framework

Perceived Task Complexity and Motivation

The independent variable perceived task complexity (PTC) represents a subjective assessment of the overall complexity of a task, as perceived by an individual. An increase in PTC is determined by an increase in the number of paths and end states and the relationships among those. In our investigation, we rely on the assumption that software engineers prefer complex tasks to simple ones. This idea is supported by the "need for cognition" concept, defined as "the tendency for an individual to engage and enjoy thinking" (Cacioppo and Petty 1982, p.116). Need for cognition is a general trait of an individual to participate in a cognitive act. Individuals with a high need for cognition have a disposition to elaborate a task more intensively than those with a low need for cognition. Professionals in the software industry can be considered to have a relatively high need for cognition, similar to that of faculty members of a university and in contrast to that of assembly line workers (Cacioppo and Petty 1982). Thus, we propose task complexity to be a trigger for motivation to engage in information seeking:

P1. The higher the perceived task complexity (PTC), the higher the level of motivation to search.

Perceived Need Satisfaction and Motivation

SDT postulates three "innate psychological needs" to achieve self-determination: autonomy, competence, and relatedness (Ryan and Deci 2000). *Autonomy* is "a need to...give input [and] self-endorse activities and beliefs" (Standage et al. 2005, p. 414). It refers to the desire to have a self-organized experience that conforms with one's sense of self (Ryan and Deci 2000). Autonomy differs from independence or individualism. Autonomy is about a will and an internal coherence of individuals with their own actions, whereas independence is about whether one relies on other people (Ryan 1995). In the present study, we operationalize autonomy as a possibility for participants to decide on their own about how the selected task will be done, how the information search can be approached, and how they will decide to end the search. On the basis of SDT, we propose the following:

P2a. The higher the satisfaction of the need for autonomy, the more internalized the regulation of the motivation to search.

Competence is a "need to effectively interact with one's environment and yield wanted effects and outcomes" (Standage et al. 2005, p. 414). This need can be satisfied by accomplishing challenging but achievable tasks, obtaining positive feedback, or feeling responsible for the successful outcome of a task (Gagne and Deci 2005; Ryan 1982). Perceived competence is necessary for any type of motivation (Deci and Ryan 2000). In the current research, the satisfaction of the competence need is operationalized by examining the task complexity or the task-related challenge and its influence on motivation and whether the task provided the engineer with the opportunity to display or enhance his or her knowledge. On the basis of SDT, we propose the following:

P2b. The higher the satisfaction of the need for competence, the more internalized the regulation of motivation to search.

Relatedness is the "need to feel connected and accepted by significant others" (Standage et al. 2005, p. 414). It is centrally important for a person to feel personally related to key persons in the surroundings (Ryan and Deci 2000). The satisfaction of the relatedness need will be addressed by importance, experience, and teamwork and collaboration with others in the particular situation. On the basis of SDT, we propose the following:

P2c. The higher the satisfaction of the need for relatedness, the more internalized the regulation of the motivation to search.

A major overarching proposition represents the main focus and statement of SDT. The three basic psychological needs, when satisfied, increase the internalization of motivation. However, should they remain unsatisfied, the locus of control and the quality of overall well being decreases and the person's activity becomes controlled by external forces (external or internal to a person), making regulation of motivation more external (Ryan and Deci 2000). We derive the overarching proposition from SDT:

P2. The higher the perceived need satisfaction (PNS), the more internalized the regulation of motivation to search.

Motivation and Stopping

Previous work on SDT suggests that a more autonomous extrinsic motivation leads to more engagement (Connell and Wellborn 1991), better behavioral effectiveness (Ryan et al. 1997), and better results (Miserandino 1996). We assume that performance is related to the wholeness of individual tasks. A professional driven by a more self-regulated motivation tries to accomplish these tasks better, as the company's values are more integrated and associated with the self. Assuming that better quality of the task is related to the information an individual finds to solve the task, we can conclude that motivation drives individuals to postpone the search termination and to look for possibly better results. Considering this argumentation, we propose:

P3. The higher the level and the more internalized the regulation of the motivation to search, the higher the probability of late stopping.

METHODOLOGY

Research Context

The participants in this exploratory case study were six male software engineers of varying seniority working within different teams in a software company. The average age of the participants was 34 years (standard deviation 4.55), and the average professional experience was 8 years (standard deviation 4.26). Participation was voluntary and the participants received no reward.

Research Methodology and Procedure

As noted, the current investigation is exploratory. It aims to enhance the research about stopping behavior by asking "how" and "why": why do some people give up their search earlier than others, and how does motivation influence this discontinuance. Additionally, it aims to clarify the motivation for stopping, as no theory explaining the phenomenon of motivation within overall stopping behavior exists. Finally, the context of the phenomenon is a complex real-life context of everyday life of humans. These characteristics favor an exploratory research design (Yin 2009). We rely on an individual as a "case", and we apply a multiple-case design based on literal replication logic to allow a cross-case comparison and to increase external validity.

In the past, SDT was mostly applied in quantitative studies. We use this theory in a qualitative study because it provides a hint as to why motivation can be separated into different regulatory styles. Additionally, the existing operationalizations of the theory's constructs were helpful in designing interview questions based on existing validated instruments. These questions were prepared in advance according to four major topics: The opening part of the interview was about the overall working responsibilities and environment. The role and importance of online environment together with a personal definition of software development were also included to identify the specifics of the case. In the second part, participants were asked to recall a task they had performed as part of their everyday work. The only constraints given were that the task must have been of a certain minimum level of complexity (according to Campbell 1988) and that it must have involved information search. Participants were asked to describe the task, the overall search, and the search termination process. They were also asked to name the reasons for stopping and why they stopped at this specific time. During the third part of the interviews, the participants were asked about the importance and peculiarity of needs from the SDT for the selected task, and

about the level of *regulation* in their motivation to search (according to Müller and Louw 2004; Standage et al. 2005). Furthermore, the participants elaborated on the influence of *regulation* on information-stopping. Finally, they were asked about their understanding of motivation, and about their motivation to continue searching during task solving. The term *motivation* had been avoided before this part of the interview due to possible individual interpretations. The closure of the interview provided additional insights on motivation and its relation to participants' information-seeking and -stopping behaviors.

Interviews were held in German, which was the native language for all participants. Each interview lasted between 30 and 45 minutes (with one interview taking 70 minutes), was accomplished in person, and was audio-recorded. Subsequently, all interviews were transcribed. During the transcription, the interviews were made anonymous and were adjusted from a grammatical perspective while ensuring that the meaning was not changed. Afterwards, each transcript was sent to the corresponding participant for review. No participant expressed any wish for correction. To conduct the analysis, we rely on the prepackaged solution NVivo Version 8.0.

FINDINGS

The initial findings of this research support the major propositions about the role and structure of motivation in the search process and its influence on stopping.

Perceived Task Complexity and Motivation

The tasks the participants referred to were new development or software configuration management tasks, considered common in software engineering. The relationship between perceived task complexity and motivation to search became evident. If a task is easy and no information gap can be identified, the engineers tend not to perform any search. With increasing task complexity the demand of relevant information rises, pressuring engineers to search for information online. As expected, task complexity is a motivational trigger for software engineers in their goal-directed behavior directed at closing the gap between their knowledge and perceived task requirements. A higher complexity results in a larger gap, leading to a more intensive search with a higher motivation level and desire to close the gap – that is, to successfully solve a task. However, when the level of task complexity is too high, the motivation to search for information decreases.

Perceived Need Satisfaction and Motivation Internalization

In general, the environment within the company does not have any critical limitations for self-determined behavior. The underlying business environment, such as software development methodology, infrastructure, or technology, defines the existing limitations. Usually, software engineers can decide on their own on how they perform and terminate their search. Still, they have various views on *autonomy*. Three engineers had a high general demand for autonomy. For them, autonomy was strongly related to motivation, and a self-driven experience was a major prerequisite for a motivation to search. The second need, the need for *competence,* can be satisfied when a person executes a challenging but achievable task and feels responsible for the successful outcome (Gagne and Deci 2005; Ryan 1982). This need is essential for any kind of motivation (Deci and Ryan 2000), and most of the engineers could satisfy their need for competence within the selected tasks. Only one subject had a decreased internalization level of motivation owing to missing internal API information, so that he had to rely on trial and error to solve the task. The assessing of the third need – the need for *relatedness* – is the most difficult one to judge in terms of its satisfaction level. For three engineers this need was especially significant and was represented by the overall feeling of relatedness to their colleagues or developed products. Relatedness also depends on the type of task or the level of knowledge. In line with the assumptions of SDT, the satisfaction of the needs was important for a more self-determined (internalized) motivation to search.

Motivation and Stopping

We found evidence for the major assumption that information search behavior is extrinsically motivated. Although search was sometimes intrinsically driven in task accomplishment, most of the time participants regarded search as a means to an end. Furthermore, the proposed presence of different regulatory styles and a variance in the level of need satisfaction could be identified. We also found evidence for a relationship between the motivation to search and late stopping, as different regulatory styles caused different durations of information search. Less internalized styles caused earlier stopping, and more internalized styles fostered a later search termination. We focus on the regulatory styles of extrinsic motivation. The overall results are listed in Table 2.

Three participants were characterized having an *integrated* regulatory style. Integrated regulation is self-determined extrinsic motivation with a very high degree of self-regulation. Not only does it include identification of the importance and value of a behavior, but it also assimilates them to the other aspects of the self (Deci and Ryan 2000; Standage et al. 2005). These software engineers treated information search as highly

important and usually an unavoidable part of solving tasks. It was absolutely natural for them to look for the information they needed to achieve high quality in their solutions. The importance and value of high quality information, knowledge, and solutions were integral parts of their working styles.

Two subjects of the study were allocated to the *identified* regulatory style. In this regulation, people recognize the underlying value of a behavior and accept it as their own. The action is personally accepted and important, but can still be isolated from other identifications or aspects of personal experience (Deci and Ryan 2000; Ryan and Deci 2000). The major difference to the individuals with the identified regulation style is that these engineers would prefer to accomplish tasks without any search or with moderate but successful search procedures. Furthermore, for them it was important that the task related to their existing knowledge to make the search less exhausting. Within this type of regulation both early and late stopping-behaviors became visible.

Table 2: Summarized results, including independent variables, level and
regulation of motivation and tendency to stop

Subject	Task Complexity	Motivation Level	Autonomy	Competence	Relatedness	Motivation Regulation	Stopping
Subj #1	high	high	high	high	high	integrated	late
Subj #3	high	high	high	high	high	integrated	late
Subj #5	medium	medium	high	high	medium	integrated	late
Subj #4	medium	medium	medium	high	high	identified	late
Subj #6	low	medium	medium	high	medium	identified	early
Subj #2	medium	medium	medium	medium	medium	introjected	early

One participant was identified as being directed by an *introjected* regulatory style. People try to seek for self- and others-approval and avoid disapproval in order to be able to maintain the feelings of self-worthiness and to avoid negative feelings (Deci and Ryan 2000; Malhotra and Galleta 2003). This subject referred to external sources of control throughout the interview. For example, when asked about the importance of working together with others, he answered that it would be inappropriate if he did not. This participant terminated his search as soon as possible.

Surprisingly, no participants were allocated to the *external* regulatory style. This is an important finding for software development in general, as it implies that the values of software development are to a certain extent integrated into the individual value systems of software developers. Table 3 provides coding examples from the cross-case analysis showing the interplay of self-determination and search termination.

Table 3: Excerpt on the regulation of motivation and the tendency to stop

Regulatory Style	Stopping	Sample quotes
Integrated	Late	"[I search] longer anyway. [...] It could be possible to simply solve [...]. The most important thing is it works somehow. [...] [But] this is not my standard (Subj #1)
		"[...] For me information search [is] something [...], where I have the urge to find something. If I commit myself to a certain task [...], then I really want to find [the information], even if sometimes it takes two days" (Subj #3)
		"It [motivation] has an effect [on search], namely on the duration and continuance of my search. If I don't search it because I want to […], then I don't search for a long time […]" (Subj #5)
Identified	Late	"I wanted to find a good solution, and it motivated me to search more carefully and longer" (Subj #4)
	Early	"When I find something I can copy and paste or some kind of a solution [...] I am [...] happy [...] to read it [...] and to apply it immediately" (Subj #6)
Introjected	Early	It [motivation] is a drive to finalize something [search] […] to pass it [the work] to others […]. I search until it […] works somehow […] (Subj #2)

Potential Moderators

Three additional constructs became prominent through the interviews. *Interest* was mentioned often by the participants. This potential moderator can help to describe diverse reasons for a preference of a certain task within software engineering or of a certain technology or topic. A construct of *perceived task importance* for an

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engineer was also mentioned frequently and seems to play a moderating role between task complexity and the motivation to search. Engineers tend to be motivated by complex tasks if they consider these tasks important. Finally, most engineers raised the issue of *time pressure*. This exogenous variable could moderate the relationship between the motivation and the de facto executed search. Even when properly motivated, an engineer will conduct an extended search only if time to do it is available. Additional research is necessary to understand the role of these constructs.

DISCUSSION AND FUTURE RESEARCH

This article derives a theoretical framework to address the role of extrinsic motivation in information-stopping behavior during information search within the software engineering context. The motivation in this framework consists of two components: the level of motivation and the self-determination of its regulation. Situational and human innate needs-related mechanisms were proposed from the literature, and an understanding of these mechanisms was further deepened in a multiple-case study in the software industry.

Our theoretical contribution is twofold. On the one hand, we address a motivation-oriented perspective in stopping-behavior. We explore the structure of extrinsic motivation, showing that more self-determined regulation leads to search continuance. On the basis of the SDT, we address the underlying motivational mechanisms beyond extrinsic and intrinsic and high and low conceptualizations of motivation. This allows a better understanding of mechanisms facilitating a postponement of search termination (late stopping). We also keep the construct of autonomous extrinsic motivation separate from intrinsic motivation, which is critical for studying motivation in organizational settings (Gagne and Deci 2005). On the other hand, this investigation reveals a difference in the importance of certain needs for the engineers. In general, findings show that competence and autonomy play a more important role than relatedness. It could be that by its nature, software engineering often requires a deep dive into a topic without external help. It would be interesting to know whether such preferences are due to the personal characteristics of the professionals or are related to the nature of software development tasks.

Our research has several implications for practitioners. Generally, an insufficient amount of information can cause design and implementation problems during the development of information systems. From a managerial perspective intensive search and higher search scrutiny are desirable behaviors for software engineers. Our research showed that more internalized motivation to leads to these desirable behaviors. For project managers this implies that software engineers need to be empowered to self-determine the overall process of information-seeking. Furthermore our findings on identified motivation could help to reduce investing too much time on information search, and the effects of information overacquisition. These factors can incur additional costs and cause delays in software development projects.

Limitations of this research-in-progress lie in the compromises made for its exploratory nature. First, only six engineers participated with the study, a number insufficient to completely understand motivational structures of stopping behavior. However, this study was the first step toward integrating motivation into stopping behavior in general. We were still able to discover significant differences in motivation with different underlying processes even though not all four regulatory styles emerged from the interviews. Also, the relative homogeneity of the participants (company culture, gender, and national culture) could affect our results. Future research should address these weaknesses by relying on a larger and more diversified population. Second, although established scales exist for most constructs of SDT, we applied only qualitative methodology. This design decision was motivated by the question of whether SDT is applicable to the context of software engineers in general. Although we assumed that extrinsic motivation plays an important role in this context, most of the research on software development is related to intrinsic motivation. With the knowledge of the current research, it would be possible to extend our approach through the use of existing scales. Finally, we conducted retrospective interviews, relying on memory, which may not always be accurate and can sometimes raise issues of social desirability.

Our exploratory study also opens opportunities for future research. First, more precise measurements of involved constructs could improve the validity of the findings. For example, with existing scales it could be possible to quantify the motivation in SDT (Prenzel 1996; Vallerand et al. 1992), to measure the motivation to learn (Müller and Louw 2004), or to account for personal preferences on complexity (Richer and Vallerand 1998). It could also be analyzed, whether a broader classification Second, our research has revealed some potential moderators that future research could address to better understand the role of interest, perceived task importance, and time in information-stopping behavior. These factors could help in developing precise motivational stopping rules. Third, it appears likely that cognitive and motivational stopping rules interplay. For example, less autonomous extrinsic motivation could lead to an application of simpler cognitive rules to terminate the search as soon as possible. Finally, personal characteristics could moderate the relationship between the motivation to search or become an independent variable, influencing motivation to search, or even an additional mediator, which did not

become apparent in the current research. Explaining a relationship between independent and dependent variables by a single mediator is often not realistic owing to the variety of causes within psychological behavior (Judd and Kenny 1981).

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