Flow Experience in Information Systems Research: Revisiting its Conceptualization, Conditions, and Effects

Completed Research Paper

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Abstract

Despite strong interest in Csikszentmihalyi's flow theory to understand user behavior in information systems, existing literature shows significant inconsistencies on the conceptualization, conditions, and effect mechanisms of the flow construct. Reviewing extant literature in IS on the concept of flow, this paper discusses the most common theoretical and methodological shortcomings, drawing on current considerations of flow research in motivational psychology. We argue that widely proposed assumptions of IS flow research, such as the inclusion of intrinsic motivation and the exclusion of fluency to measure flow, the flow condition of balanced skills and demands, and the proposed direct effect of flow on continuance intention, should be revisited to fully account for the construct's nature. Reconceptualizing and validating the flow construct for IS flow research, we show that flow does not substantially depend on balanced demands and skills and that the effect of flow on continuance intention is mediated by enjoyment.

Keywords: Flow theory, flow measurement, user experience, human-computer interaction, post-adoptive behavior

Introduction

For more than two decades, information systems researchers have emphasized that information systems (IS) use can be a source of pleasure (e.g., Carroll and Thomas 1988; Lindgaard 1999; Van der Heijden 2004). Authors of human-computer interaction recently called for an extension of the classical usability term—originally describing an IS's ease of use (e.g., Nielsen 1994)—to the affective experience of an IS (Hassenzahl 2008; Mandryk et al. 2006). Similar to this discussion, current research models examining post-adoptive behavior have also been criticized for merely focusing on cognitive sources of customer satisfaction and continuance use (e.g., Deng et al. 2010). Considering the instrumental performance of an

IS, these models (Bhattacherjee 2001; Flavian et al. 2006; Thong et al. 2006) mainly seek to describe and explain *extrinsic motivation* of IS use. Since IS are offering multimedia-based user interfaces, they are however increasingly able to induce complex interactive user experiences, like the *flow* experience (Chen et al. 1999; Novak et al. 2000; Rettie 2001). While enjoyment in computer usage addresses "the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated" (Davis et al. 1992), the psychological theory of flow has been proposed by various authors as a useful framework to explain *intrinsically motivated* user behavior (Ghani et al. 1991; Hoffman and Novak 1996; Webster et al. 1993).

Starting with the MISQ article *Time flies when you're having fun* by Agarwal and Karahanna (2000), the flow construct gained wide acceptance in major IS journals. Flow describes the state of "self reflection-free immersion in a continual activity that one still has under control in spite of high stress levels" (Rheinberg 2010). Time and place, as well as an original external activity aim that has been present are forgotten, and the individual is totally absorbed by the activity (Csikszentmihalyi 1975a; Rheinberg and Vollmeyer 2003). The flow experience is related to pleasant activities, which are usually experienced as notably positive (Csikszentmihalyi 1975a; Massimini and Carli 1991). The theoretical and practical implications of examining the flow experience that accompanies IS use have been promising. If we take the example of websites, between 40% and 50% of surveyed web users report that they have had a distinct flow experience while using the web (Chen et al. 1999; Novak et al. 2000; Rettie 2001). The experience of flow on the web is positively related to the affect towards websites (Novak et al. 2000; Novak et al. 1997), the attitude towards websites (Sanchez-Franco 2006), the satisfaction with websites (Deng et al. 2010; Lin et al. 2005), and the evaluation of websites (Nel et al. 1999). E-Learning success (Guru and Nah 2001) can be explained via the flow experience. Flow is associated with websites' usefulness and ease of use (Agarwal and Karahanna 2000; Huang 2003; Sanchez-Franco 2006), as well as the intention to use websites (Sanchez-Franco 2006). Hoffman and Novak (1996) postulated that flow acts as "the 'glue' holding the consumer in the hypermedia Computer Mediated Environment." In general, the flow concept has been widely applied by various authors to explain user loyalty to websites (e.g., Koufaris 2002; Lin et al. 2005; Luna et al. 2003; Mahnke et al. 2012; Nel et al. 1999; Siekpe 2005). Hence, resulting in a win-win situation for users and website operators, flow seems to be an essential aspect of web-based business models (Veit et al. 2014).

However, the existing IS literature shows significant inconsistencies in the conceptualization, conditions, and effects of the flow construct (Finneran and Zhang 2005; Hoffman and Novak 2009). The low reliability of the flow constructs that are used is shown by Novak et al. (2000). The authors list a variety of 13 different flow constructs in their review; on average, only four of them are considered per study. Moreover, even the use of all these constructs overlaps only partially with the proposed constructs in the field of psychology (Csikszentmihalyi 1975a; Rheinberg 2008b). Conceptually, the inconsistencies are not limited to the construct components, but also concern the hypothesized relationships between flow and other variables. In some studies, the measurement of flow is bypassed altogether by measuring related constructs but not flow itself. Choi, Kim, and Kim (2007) express the flow research situation in the context of IS as follows: "*The construct of flow is, however, too broad and ill-defined due to the numerous ways it has been operationalized, tested, and applied.*" An overview of the diversity of flow concepts in IS research is provided in the literature review of this article. Given the inconsistencies in the prior usage of the flow concept in IS research and in order to gain a deeper understanding of the psychological phenomenon of flow in the IS context, the research objectives of this study were to (1) review the major literature on flow in the IS domain, (2) identify the most commonly proposed flow *conceptualizations*, *conditions*, and *effect mechanisms*, (3) draw on current flow research issues in motivational psychology, (4) transfer these to the IS domain to appropriately conceptualize flow in its broader nomological network, and (5) empirically test the revised network.

Our study of flow differs in many significant ways from prior research on this topic. First, we believe that the frequent inclusion of *intrinsic motivation* to measure flow in the IS literature (as we detail in our review below), may provide a limited perspective, since there are rarely solely intrinsically motivated activities, and flow can also occur while conducting predominantly extrinsically motivated tasks (Csikszentmihalyi and LeFevre 1989; Engeser and Rheinberg 2008). Therefore, we propose factors of positive valence (e.g., enjoyment) as constructs that are independent from flow. Second, we believe that both *absorption* and *fluency* should be incorporated in measuring flow, unlike the common practice of measuring flow only via absorption and related constructs (also detailed in our literature review below).

Third, flow might be related to not only *continuance intention*, as widely assumed in the IS literature (e.g., Lin et al. 2005; Luna et al. 2003; Siekpe 2005), but also to *discontinuance intention*, as the *paradox of work* in psychology shows (Csikszentmihalyi and LeFevre 1989; Rheinberg et al. 2007; Schallberger and Pfister 2001). Although work provides more flow experiences than leisure, workers may "*wish to be doing something else*", if negative activation is too high, resulting in low enjoyment scores. This has led us to propose a relationship that is partially mediated by enjoyment. Fourth, recent theoretical (Kehr 2004) as well as empirical research in psychology (e.g., Reinhardt et al. 2006; Stoll and Lau 2005) questions the widely held assumption that the balance of *demands* and *skills* on a subjectively high level (Csikszentmihalyi 1975b) is a basic flow condition. This has led us to propose that to experience flow merely the activity-related skills have to be perceived as individually sufficient.

Theoretical Foundation and Hypotheses Development

Literature Review

We systematically reviewed prior research on flow in the IS domain, conducting full-text searches on "flow" and its closely related derivations, "cognitive absorption" and "cognitive engagement", in 10 major peer-reviewed IS outlets between 1977 and 2013 (see Table 1).

Table 1. Distributions of Flow Articles in Major IS Outlets

Sources	Years	Number of articles
European Journal of Information Systems	1993-2012	2
International Conference on Information Systems	1991-2012	8
International Journal of Electronic Commerce	2000-2012	4
Information Systems Journal	1998-2013	2
Information Systems Research	1990-2012	1
Journal of the AIS	2000-2012	1
Journal of Information Technology	1989-2012	0
Journal of Management Information Systems	1984-2012	3
Journal of Strategic Information Systems	1991-2012	0
MIS Quarterly	1977-2012	7
		28

After excluding papers that do not draw on the psychological phenomenon of flow experience, we filtered out studies where flow was referenced just as a background or peripheral phenomenon. Finally, we focused on articles that used flow experience in a hypothesis or where flow forms a substantial theoretical base, resulting in 28 published articles[1] for further analysis.

With regard to the conceptualization and measurement of flow, several different streams could be identified. In the first stream, almost half of the examined studies (13 articles) build on the concept of cognitive absorption (CA) by Agarwal et al. (2000; 1997). CA draws on a synopsis of dimensions comprising the flow experience in the context of IS usage, integrating the original concept of flow by Csikszentmihalyi (1975a), absorption (Tellegen and Atkinson 1974), and cognitive engagement (Webster and Ho 1997). The five utilized components are (1) temporal dissociation (the inability to register the passage of time), (2) focused immersion (the ignorance of stimuli not related to the activity), (3) heightened enjoyment during the activity, (4) control (being in charge of the activity), and (5) curiosity. The temporal dissociation dimension measure contains two items that might be interpreted as an additional dimension measuring self-control: "Most time when I get on to the Web, I end up spending

[1] An overview of these articles is provided in a separate references list at the end of the paper.

more time than I had planned" and "I often spend more time on the Web than I had intended" (Agarwal and Karahanna 2000). In some studies, these items were excluded (e.g., Lee et al. 2012). Half of the authors (7 articles) modify the proposed measure by dropping or modifying constructs and items (Goel et al. 2013; Goel et al. 2011; Hess et al. 2006; Lee et al. 2012) or combining it with related constructs (Guo and Poole 2009; Nah et al. 2011).

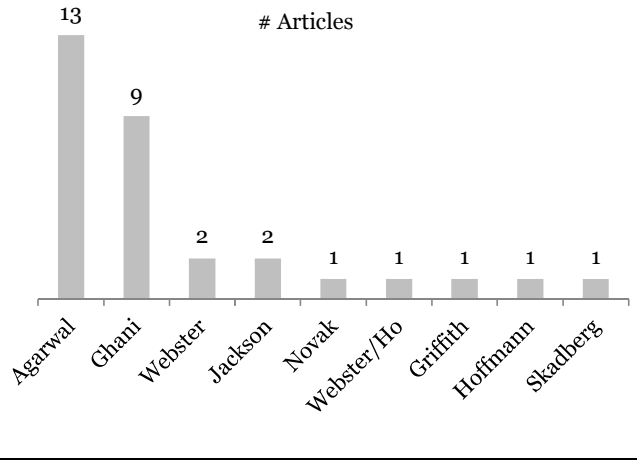

Figure 1. Diffusion of Flow Conceptualizations in IS Research

The second most common conceptualization of flow (9 articles) is based on the work of Ghani et al. (1995; 1994; 1991), who argue that "*two key characteristics of flow are (a) total concentration in an activity and (b) the enjoyment one derives from an activity*" (Ghani and Deshpande 1994). The authors support their conceptualization by arguing that these two characteristics have already been emphasized by various researchers in the learning context (Ghani et al. 1991). Two thirds of the studies in this stream used modified versions of Ghani's approach (Hampton-Sosa and Koufaris 2005; Kamis et al. 2008; Koufaris et al. 2001; Shun and Yunjie 2011) or combined it with other approaches (Guo et al. 2012; Nah et al. 2011).

Apart from the top two streams discussed above, seven articles drew on at least one of a variety of other approaches. Two papers are based on the approach of Webster et al. (1992; 1989; 1993) who suggest four dimensions of flow experience: (1) control over the interaction, (2) attention focus, (3) curiosity, and (4) intrinsic interest, which are measured using a one item measure for each dimension. Both papers vary the measures, adding additional items (Animesh et al. 2011; Zhenhui and Benbasat 2004) or omitting the first dimension (Animesh et al. 2011). Based on Csikszentmihalyi's eight dimensions of flow (1975a; 1990; 1994), Jackson et al. (1996) developed the flow state scale that includes nine dimensions: (1) challenge-skill balance, (2) action-awareness merging, (3) clear goals, (4) unambiguous feedback, (5) concentration on the task at hand, (6) sense of control, (7) loss of self-consciousness, (8) transformation of time, and (9) autotelic experience. Two articles borrowed components of Jackson's measure, combining these components with dimensions from Ghani et al. (Guo et al. 2012) or Agarwal et al. (Goel et al. 2013). Skadberg et al. (2004) argue that flow is characterized in the literature by focused attention, complete involvement, and an intrinsically enjoyable experience (Csikszentmihalyi 1975a; Ghani and Deshpande 1994; Privette and Bundrick 1987). Since focused attention and complete involvement are supposed to result in time distortion, the authors recommend measuring flow solely by time distortion and enjoyment. One article adopts this approach, but adds the dimensions of focused immersion and telepresence (Nah et al. 2010). Novak et al. (2000) operationalize flow as a criterion measure following a narrative description of the flow experience (describing the cases of a professional athlete, playing games, engaging in hobbies, etc.), including items such as "Do you think you have ever experienced flow on the Web?" and "Most of the time I use the Web I feel that I am in flow" (Novak et al. 2000). One study uses a shorter version of the scale (Theotokis and Doukidis 2009), measuring flow via three items representing curiosity, control, and absorption. The concept of cognitive engagement, introduced by Webster and Ho (1997), holds that

engagement in an activity is related to the state of playfulness, which might be identical to flow experience. Cognitive engagement encompasses dimensions of (1) intrinsic interest, (2) curiosity, and (3) attention focus without the notion of control. The authors note that future work should investigate whether flow and engagement are the same construct or whether they differ conceptually and empirically. In our literature review, this approach was applied by one article published by the same authors (Webster and Ahuja 2006). Finally, two articles use self-developed items based on existent theoretical literature on flow (Joon and Young-Gul 2003) or telepresence research (Franceschi et al. 2009).

Overall, 75% of the authors in our sample of studies either modified the borrowed constructs (beyond adaptation to the research context) or combined constructs from different literature streams. Furthermore, flow is treated as a one-dimensional central component in some studies (e.g., Animesh et al. 2011; Hoffman and Novak 1996; Novak et al. 2000; Theotokis and Doukidis 2009; Zhenhui and Benbasat 2004) and as a multidimensional construct in others (e.g., Agarwal and Karahanna 2000; Ghani and Deshpande 1994; Ghani et al. 1991; Webster et al. 1993). To sum up, the reliability of flow constructs considered in our review is low. We identified 14 different flow constructs. On average, only 3.6 of these are considered per study. In some studies "based on flow theory," the measurement of flow is bypassed altogether by measuring related constructs (Hoffman and Novak 2009). Moreover, all these constructs overlap only partially with the proposed constructs in psychology (Csikszentmihalyi 1975a; Rheinberg 2008b). Conceptually, the inconsistencies also concern the hypothesized relationships between the constructs. For instance, articles following the stream of Ghani et al. (1995; 1994; 1991) regard the constructs concentration and enjoyment as describing the flow experience (e.g., Kamis et al. 2008; Koufaris 2002; Phang and Kankanhalli 2009), while other authors think of concentration as an antecedent of flow and enjoyment as its consequence (e.g., Chen et al. 1999; Novak et al. 2000; Wakefield and Whitten 2006; Weniger and Loebbecke 2011). Additional reviews showing the diversity of flow concepts in IS research are provided by Hoffmann and Novak (2009) as well as Finneran and Zhang (2005).

A Revised Flow Conceptualization

The state of flow was first described by Csikszentmihalyi (1975a) on the basis of qualitative research in which he conducted interviews with people who performed activities that do not directly lead to extrinsic rewards (e.g., money, reputation). Firstly, he studied the behavior of painters who worked with excessive commitment and feverishly towards the completion of a painting. However, once a painting was finished, it was usually disregarded and placed in a far corner of the studio next to other paintings. Subsequently, a new painting was begun (Csikszentmihalyi and Csikszentmihalyi 1988). Hence, activities were examined that have a self-purpose, which means that the experience of enacting is the reason for the action itself (so-called autotelic activities). During a large number of interviews, Csikszentmihalyi repeatedly found a state of mind he called "flow experience." Based on interviews, he captured experience and conditional components that constitute the flow state. According to Csikszentmihalyi, the occurrence of flow is not exclusive to any unique types of activities, but is a general phenomenon. Humans can experience flow when carrying out virtually any activity. In addition to creative activities (e.g., composing music, painting, and sport activities such as rock climbing, basketball, rock dancing (Csikszentmihalyi 1975a)), everyday activities were examined; these included university lectures (Engeser and Rheinberg 2008), computer games (Abuhamdeh and Csikszentmihalyi 2009), and internet usage (Novak et al. 2003; Novak et al. 2000). Flow can be experienced in various degrees of intensity, from micro flow to deep flow (Csikszentmihalyi 1975a). Examining more than three decades of qualitative and quantitative flow research in psychology, the individual components of flow have proved remarkably stable and consistent. Based on the findings of Csikszentmihalyi (1975a), Rheinberg (2008b) differentiates two factors of the flow experience that can be interpreted well: (1) deep concentration on the task (*absorption*) (blocking out irrelevant stimuli, leading to several phenomena such as time dissociation, loss of self-reflection, and loss of self-consciousness), while (2) being in fluent action (*fluency*), where knowledge of what to do in each step leads to a continual activity, which as a whole seems guided by an inner logic (i.e. thoughts and movements occur automatically). When this experience is described respondents almost invariably indicate that they recognize this state (AWA 1995-2000; Csikszentmihalyi 1994). Evidence of the two-factor structure of flow is provided in different contexts, such as university education (Rheinberg et al. 2003), marathon runners (Stoll and Lau 2005), treadmill runners (Reinhardt et al. 2006), computer games (Rheinberg and Vollmeyer 2003), or graffiti sprayers (Rheinberg et al. 2003). Moreover, different

manifestations of both factors in different flow activities seem to be possible (e.g., highest fluency values during sport activities, highest absorption values during sexual intercourse/intimacy) (Rheinberg et al. 2003). Hence, a separate interpretation of both factors seems to be reasonable so as to examine the internal structure of the flow phenomenon.

Though in psychology, *absorption* and *fluency* are considered the two main components of flow, our review of the IS literature shows a different picture. On the one hand, constructs related to the flow dimension of *absorption* are widely spread: 23 articles (82%) contain at least one of the following related constructs: focus on activity-related stimuli (e.g., focused immersion, concentration, attention focus), temporal dissociation (e.g., time distortion, transformation of time), mergence of action and awareness, and loss of self-consciousness (e.g., transcendence of self). However, constructs related to an activity's *fluency* (Rheinberg 2008b), as a distinct component of flow, are underrepresented. Only half of the articles (14 articles) contain at least one of the following related constructs or items: control over the interaction (e.g., control, perceived control), and knowledge of what to do at each step (e.g., sense of control, perceived control).

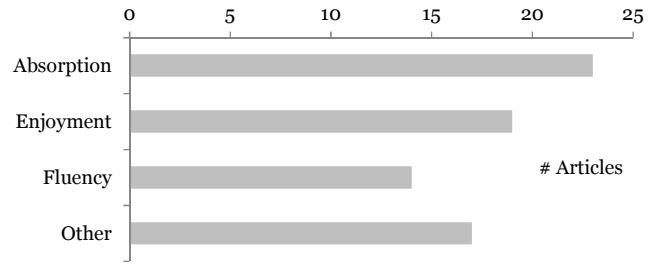

Figure 2. Distribution of Implicit Flow Constructs in IS Research

On the other hand, the conceptualization of flow as an *enjoyable experience* is widely used in the IS literature (68%, 19 articles), with constructs such as shopping enjoyment, perceived enjoyment, heightened enjoyment, and autotelic experience. Additionally, a variety of other tangentially related constructs are employed to measure flow in the IS literature; these include: curiosity (17 articles), self-control/addictive behavior (8 articles) as part of temporal dissociation as well as immersion, telepresence (2 articles), usage time (1 article), calm (2 articles), frustration (1 article), and satisfaction (1 article).

This picture might be a result of the early work on flow in psychology which also featured *enjoyment* as a component (e.g., Jackson and Eklund 2002). Some work also included happiness as a part of flow (Moneta and Csikszentmihalyi 1996). This is due to the fact that in early work in psychology, the state of flow was primarily related to and examined in fun and enjoyable activities (Csikszentmihalyi 1975a; Massimini and Carli 1991). In other words, flow was first described by examining intrinsically motivated activities (autotelic activities). However, later research showed that the experience of flow is not limited to intrinsically motivated activities. Flow can occur when carrying out virtually any everyday activity (e.g., the daily lives of teenagers, pensioners, assembly line workers, mountain farmers, etc.). Flow thus seems to occur also during some clearly extrinsically motivated tasks, such as at work (Csikszentmihalyi and LeFevre 1989), or in a statistics class (Engeser and Rheinberg 2008). Hence, in the recent psychological literature, forms of positive valence such as enjoyment, happiness, and satisfaction are proposed as constructs independent from flow, that can be inhibited through negative activation (being distressed, annoyed, nervous, etc.) during being in a flow state (Aellig 2004; Schallberger and Pfister 2001).

Addressing these issues, the status-quo of flow conceptualization in psychology offers a more thorough understanding of flow that needs to be integrated in IS flow research. It incorporates both factors (absorption and fluency) while it consciously does not include intrinsic motivation as a flow component. Equally, to measure the characteristics and intensity of flow, reliable scales have been developed in psychology, that have been applied and validated in a broad variety of contexts (e.g. Engeser and Rheinberg 2008).

Revised Flow Effects: Continuance Intention

Since Hoffman and Novak (1996) postulated flow as "*the 'glue' holding the consumer in the hypermedia Computer Mediated Environment*," the flow concept has been applied by various authors to explain loyalty to a variety of information systems (e.g., Koufaris 2002; Lin et al. 2005; Luna et al. 2003; Nel et al. 1999; Siekpe 2005). Based on our literature review, continuance intention is the most commonly examined flow consequence (9 articles, 32%), besides performance (8 articles, 28%), and intention to purchase (6 articles, 21%).

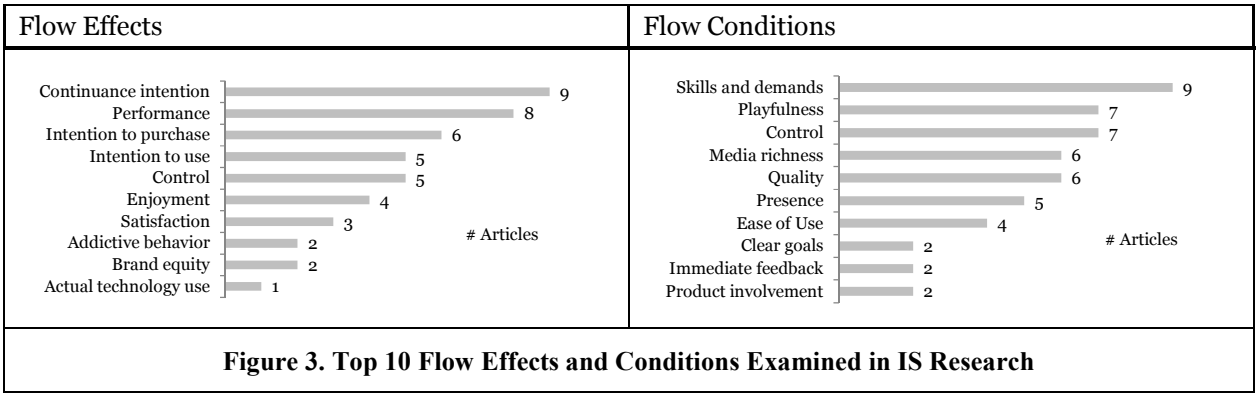

Figure 3. Top 10 Flow Effects and Conditions Examined in IS Research

However, we believe that the conceptual relationship between flow and continuance intention should be revisited. That is, because despite the widely held assumption in the IS literature that flow is *directly* related to continuance intention (e.g., Hoffman and Novak 1997; Koufaris 2002; Lin et al. 2005; Luna et al. 2002; Luna et al. 2003; Nel et al. 1999; Siekpe 2005), there is evidence from research on the *paradox of work* in psychology that shows that flow has a more complex relationship with continuance intention. Following workers with the experience sampling method (i.e., randomly sampling self-reports throughout the day), Csikszentmihalyi and LeFevre (1989) realized that although work provides more flow experiences than leisure, workers often "*wish to be doing something else.*" These results were replicated by Schallberger and Pfister (2001) and by Rheinberg et al. (2007). Employees reported higher flow scores during work, but scores for positive valence (measured as happiness and satisfaction) were higher during leisure time.

Initially, the reason for this paradoxical situation is identified by Csikszentmihaly and LeFevre as being due to a cultural prejudice: "*Apparently, the obligatory nature of work masks the positive experience it engenders. In whether they wish to work or not, people judge their desires by social conventions rather than by the reality of their feelings*" (Csikszentmihalyi and LeFevre 1989). Furthermore, recent psychological findings suggest that flow is a separate construct from happiness and satisfaction: On the one hand, the *context-independent* experience of flow inheres positive activation (energetic, wide awake, concentrated, enthusiastic) during work as well as during leisure activities (Aellig 2004; Pfister 2002; Schallberger and Pfister 2001). This result seems to be in accordance with numerous qualitative descriptions of flow experiences, clearly reminding of positive activation (e.g., Csikszentmihalyi 1975a). However, research on affective experience provides evidence that positive activation is not necessarily the mirror image of negative activation, but that both affective qualities constitute independent dimensions (Larsen and Diener 1992; Russell 1980; Russell and Carroll 1999; Watson and Tellegen 1985). Hence, in a *context-dependent* experience of flow (e.g., at work (Schallberger and Pfister 2001) or while rock climbing (Aellig 2004)), a high negative activation (distressed, annoyed, nervous, worried) might occur. Positive valence, on the other hand, seems to be a separate construct from flow, determined by positive activation as well as by the absence of negative activation (Schallberger and Pfister 2001). Transferring these assumptions to the context of IS continuance, they coincide with the evidence that enjoyment leads to higher continuance intention (e.g., Koufaris 2002). It is the enjoyment produced by flow experiences, and not flow itself, that can have a strong impact on continuance intention of information systems use whereas flow experiences in general may even have a negative impact on continuance intention,

depending on the specific context. For these reasons, we conceptualize enjoyment separately from flow, positively related to both factors of flow, and determining continuance intention. Additionally, we hypothesize the direct relationship between flow factors and users' continuance intention.

H1a. Absorption is positively related to enjoyment.
H1b. Fluency is positively related to enjoyment.
H1c. Enjoyment is positively related to continuance intention.
H2a. Absorption is positively related to continuance intention.
H2b. Fluency is positively related to continuance intention.

Revised Flow Conditions: The Interaction between Demands and Skills

The *balance of demands and skills*, i.e., the subjective perception of the match between demands and skills related to an activity, is one of the most widespread components of flow theory in psychology (Csikszentmihalyi 1975a; Csikszentmihalyi 1990). Our review of the IS literature shows that the balance of demands and skills is the most common flow condition examined (9 articles, 32%), followed by playfulness (7 articles, 25%) and control (7 articles, 25%) (see Figure 3).

In fact, flow was initially *defined* by Csikszentmihalyi as the balance between perceived skills and challenges (1975a). Csikszentmihalyi justified this approach by referring to his qualitative interviews, where balance was the most frequently observed flow condition (Csikszentmihalyi and Rathunde 1993). However, the equating of a multifaceted experience such as flow with a single theoretical triggering condition proved problematic. Consequently, Schallberger (1999) distinguished two approaches in flow research: the *phenomenological* approach, measuring all flow components and Csikszentmihalyi's *theoretical* approach, where flow is defined as a causally ordered state of consciousness that only exists if perceived information (demands) is balanced with the information processing capacity (skills). However, based on the phenomenological approach, even if flow is characterized by the balance of demands and skills, it might not be necessary for the reverse to be true, that is, that flow is always experienced when there is a demand-skill balance (Rheinberg 2008a; Rheinberg et al. 2003). For example, Moneta and Csikszentmihaly (1996) found significant inter-individual differences regarding the association of flow and demand-skill balance, showing a positive effect in some contexts and little or no effect in others. Furthermore, even the common consideration of demand-skill balance as a triggering condition for flow has recently been called into question. A series of sport psychology studies has shown that under field conditions, balanced activity demands and personal skills do not have to be necessarily present for flow to be experienced (Reinhardt et al. 2006; Schüler 2004; Stoll and Kiefer 2003; Stoll and Lau 2005). Similarly, recent theoretical literature assumes that activity-related skills should be just perceived as individually sufficient. As long as implicit motives (unconscious, recurrent preferences for affectively rewarding experiences) are activated, skills that are too high for the task do not compulsively lead to boredom (Kehr 2004; Schattke and Kehr 2009). This is important, since many affectively rewarding flow activities that use information systems may be associated with relatively low cognitive demands (e.g., entertainment activities). Hence, we want to investigate whether demand-skill balance is an IS flow condition, following the phenomenological approach, and to measure both flow factors. As such, we hypothesize that:

H3a. Demand-skill balance is positively related to absorption.
H3b. Demand-skill balance is positively related to fluency.

Furthermore, Csikszentmihaly proposed in a reformulated model that beyond being balanced, both skills and demands must be *high* (compared to other activities the individual normally undertakes) for flow to take place. Otherwise, if skills and demands are balanced but low, this might result in "apathy" (Csikszentmihalyi and Csikszentmihalyi 1988). However, this additional assumption might originate in a methodical artifact due to the synonymous usage of *challenge* (e.g., Moneta and Csikszentmihalyi 1996) and *demand* (task difficulties). From a motivation theoretical perspective, a challenge is experienced when the demands of an activity are compatible with the skills of the person performing it. Challenge is thus the result of a demand-skill balance. To diagnose flow, Csikszentmihalyi again relates challenge (demand-skill balance) to the skills in an activity. Hence, it is hardly surprising that flow is barely observed at low challenge scores, even if skills are balanced at the same low level (Rheinberg 2008a). Rheinberg et al. (2003) argue that this definitional fuzziness profoundly affects the explanatory power of the related empirical results. Since the depicted usage is widely apparent in IS flow research that has

adopted these concepts (e.g., Novak et al. 2000), we want to test whether demands and skills above the individual average are conditional for flow using IS, measuring both flow factors. Thus, we hypothesize that:

H4a. Demands are positively related to absorption.
H4b. Demands are positively related to fluency.
H4c. Skills are positively related to absorption.
H4d. Skills are positively related to fluency.

Research Method

Study Design

To date, a wide variety of qualitative and quantitative methods have been applied in studying the experience of flow. Three criteria in particular received attention in selecting the data collection method in this study. First, there should be a minimal time delay between the experience to be examined and data collection (see Pearce et al. 2005; Rettie 2001). Second, it should be possible to capture gradual flow experiences, and third, the method should be applicable from the perspective of economically efficient research to survey an approximately representative cross-section of flow activities. Considering these constraints, a retrospective online survey was chosen for our study. Contrary to former studies, no primary introduction to the flow concept is provided to respondents so as to minimize social desirability and common method bias. To improve survey efficiency, we created a scenario where respondents were asked to remember an activity they conducted on the internet during the past 30 days, where as many as possible but at least one item from the flow short scale (see Table 3) was applicable. The activity should be described in an open question and the URL of the visited web page(s) should be named. In the course of the survey, the relevant constructs were measured, referring back to the individually stated activity.

Constructs and Measurement

The survey instrument used well-established and validated scales for all the constructs, with minor wording changes (see Table 2). For the purposes of our study, we propose using the flow short scale (FSS) developed by Rheinberg et al. (2003) and translated into English by Engeser and Rheinberg (2008), as a complete way to measure the characteristics and intensity of the flow experience. The FSS has been applied and validated in a broad variety of contexts (Engeser and Rheinberg 2008). FSS measures have been shown to be a performance predictor of statistical education (Engeser et al. 2005), computer games (Rheinberg and Vollmeyer 2003; Vollmeyer and Rheinberg 2003; Wendland et al. 2003), and the inbox task (Rheinberg et al. 2003). Furthermore, prior research has established benchmark values of flow for different activities (e.g., high flow values during sexual intercourse/intimacy (M = 63.00), low values for musing/ennui (M = 36.10) (Rheinberg 2008a)). Addressing some of the issues we mentioned previously, the FSS incorporates both factors of flow (absorption and fluency) while, it does not include, intrinsic motivation as a flow component. The two factor structure of flow is originally measured with 10 items (7-point Likert scales ranging from 1 (*not at all*) to 7 (*very much*). However, owing to theoretical considerations, and since we wanted to test whether demand-skill interactions are conditional to flow experiences on the web, we did not include one item ("I felt just the right amount of challenge") to measure flow, as proposed for the absorption construct of the original FSS. To measure enjoyment, we used a three-item scale (9-point Likert scales ranging from 1 (*not at all*) to 9 (*very much*)) adapted from Abuhamdeh and Csikszentmihalyi (2009). Continuance intention was measured via three items (7-point Likert scales ranging from 1 (*not at all*) to 7 (*very much*)) adapted from Bhattacherjee (2001). The subjective demand-skill balance was measured by asking whether the web activity's demands were too low, just right, or too high (9-point Likert scale). To measure if demands and skills regarding the web activity were above or below individual averages, we asked how easy or difficult the activity was compared to all other activities the respondent undertook in the last 30 days and how the individual competence in this area is assessed (low, high) (9-point Likert scales). The three single item measures of skills, demands, and demand-skill balance were equally adapted from the well validated FSS by Engeser and Rheinberg (2008) and have already been used and validated in current studies in psychology that focus on skills and demands of flow activities (Reinhardt et al. 2006; Schüler 2004; Stoll and Kiefer 2003; Stoll and Lau 2005). Previous studies comparing single-item and multiple-item measures could also show that the

predictive validity of single items is comparable to multi-item measures (e.g., Bergkvist and Rossiter 2007; Sarstedt and Wilczynski 2009), in particular, when the rating object and the rating attribute are sufficiently concrete (e.g., when raters receive a common definition of the rating attribute).

Table 2. Survey Instrument

Fluency	FLU1	My thoughts/activities ran fluidly and smoothly.
	FLU2	I had no difficulty concentrating.
	FLU3	My mind was completely clear.
	FLU4	The right thoughts/movements occurred of their own accord.
	FLU5	I knew what I had to do each step of the way.
	FLU6	I felt that I had everything under control.
Absorption	ABS1	I didn't notice time passing.
	ABS2	I was totally absorbed in what I was doing.
	ABS3	I was completely lost in thought.
Enjoyment	ENJ1	The activity was interesting.
	ENJ2	The activity was exciting.
	ENJ3	The activity was fun.
Continuance Intention	CON1	I intend to continue using the visited website(s) rather than discontinue the use.
	CON2	My intentions are to continue using the visited website(s) than use any alternative means.
	CON3	My intentions are to continue using the visited website(s) in the future, at least as active as today.
Demand-skill balance	DSB	For me personally, the demands were … [too low, just right, too high].
Demands	DEM	Compared to all other activities which I partake in, this one was … [easy; difficult].
Skills	SKI	I think that my competence in this area is … [low, high].

Data Analysis

Sample Descriptives

The online questionnaire was distributed via email to 3,868 students and employees of two large public universities in Germany. A total of 456 respondents (11.8%) answered the questionnaire, resulting in a final sample size of n = 260 respondents who completed the questionnaire. Ages range from 17 to 67 years (mean age 26.7). Typical for a student sample, over three-quarters of our subjects were between 20 and 30 years. Likewise, 60.1% of the respondents are female, the reported level of education is very high (57.6% undergraduates, 35.4% graduates), and participants use the internet for about three hours per day (median). Nonresponse bias was assessed by verifying that early and late respondents were not significantly different (Armstrong and Overton 1977). Comparing both samples based on their socio-demographics, t-tests between the means of the early (first 50) and late (last 50) respondents showed no significant differences ($p > 0.05$). This result indicates that nonresponse bias was unlikely to have affected the results.

Measurement Characteristics

Construct validity is the key property of any measurement method. This study's reflective measurement models were validated using standard procedures from current literature (Chin 1998). While convergent validity was determined both at the individual indicator level and at the specified construct level, discriminant validity was assessed by analyzing the average variance extracted and interconstruct correlations (Chin 1998; Fornell and Larcker 1981). Furthermore, the partial least squares (PLS) data analysis technique was used to validate the measurement model. SmartPLS 2.0 M3 (Ringle et al. 2005) was chosen owing to its robustness with regard to assumptions and requirements for data analysis. PLS allows for simultaneous testing of the measurement model (the psychometric properties of the scales used to measure a variable) and the estimation of the structural model (the strength and direction of the relationship between the variables). PLS has an added advantage over covariance-based methods (e.g., LISREL) in that (1) it maximizes the explained variance of endogenous variables in the structural model (Chin 1998; Gefen et al. 2000), which enables us to understand the amount of variance explained in the flow constructs, such as enjoyment and absorption, and (2) PLS does not make distributional assumptions for the data (Chin 1998; Gefen et al. 2000). *Convergent validity* is achieved when measurement items exhibit significant loadings on their respective latent constructs. The t-values are estimated using a nonparametric bootstrapping resampling procedure using 1,000 iterations. All standardized factor loadings were significant ($p < 0.001$), suggesting convergent validity (Bagozzi et al. 1991). Owing to theoretical considerations, we did a priori exclude the single item "I felt just the right amount of challenge," assigned to the factor absorption of the original flow short scale. This decision can be strengthened using the data at hand, since including this item would result in a loading of 0.479 on absorption, which is below the proposed threshold in the literature. *Construct reliability* is evaluated by calculating the composite reliability and Cronbach's alpha for each construct. All constructs have a composite reliability significantly above the cut-off value of 0.707 (Bearden et al. 1993; Hair et al. 1998) and Cronbach's alpha values greater than 0.6 (Anderson and Gerbing 1988). Further, all reflective constructs met the threshold value for the average variance extracted (AVE > 0.50). The factor loadings, values for composite reliability, Cronbach's alpha, and average variance extracted of all constructs can be seen in Table 3.

Table 3. Factor Loadings and Quality Criteria

Latent construct	# of indicators	Range of factor loadings*	Composite reliability	AVE	Cronbach's alpha
Absorption	3	0.727-0.852	0.835	0.629	0.706
Fluency	6	0.667-0.833	0.889	0.573	0.850
Enjoyment	3	0.721-0.906	0.865	0.683	0.775
Continuance intention	3	0.723-0.901	0.882	0.715	0.804

Note: All factor loadings are significant at least at the $p < 0.001$ level.

With regard to *discriminant validity*, the square roots of AVEs exceeded the interconstruct correlations among the independent constructs. Thus, the scales demonstrate sufficient discriminant validity (see Table 4). Furthermore, given that all of our items were measured with the same method, we tested for common method variance using Harman's one-factor test (Podsakoff et al. 2003). We performed an exploratory factor analysis (principal components) on all the variables, but found multiple factors with eigenvalues greater than one, and no single factor was observed, which accounted for a majority of the variance in the variables. Therefore, it is suggested that common method bias is unlikely to have significantly affected our results.

Table 4. Latent Variable Correlation Matrix							
Latent construct	1	2	3	4	5	6	7
Absorption	(0.793)						
Fluency	-0.204**	(0.757)					
Enjoyment	0.283**	0.146*	(0.826)				
Continuance intention	-0.181*	0.231**	-0.313**	(0.846)			
Balance	0.030	-0.022	-0.088	-0.043	(1.000)		
Demands	0.095	-0.226**	-0.010	-0.102	-0.289**	(1.000)	
Skills	-0.101	0.345**	-0.072	0.185**	-0.126	-0.209**	(1.000)

Note: Diagonal elements in brackets are the square root of average variance extracted (AVE). These values should exceed interconstruct correlations (off-diagonal elements) for adequate discriminant validity.
* $p < 0.05$, ** $p < 0.01$

Test of Hypotheses

The model was tested via partial least squares analysis using SmartPLS 2.0 M3 (Ringle et al. 2005). As shown in **Error! Reference source not found.**, the path coefficients between both flow factors—absorption ($\beta = 0.326$, $p < 0.001$) and fluency ($\beta = 0.213$, $p < 0.001$)—and the enjoyment construct are positive and significant. Likewise, the results show the proposed positive relationship between enjoyment and continuance intention ($\beta = 0.368$, $p < 0.001$). Therefore, hypotheses H1a, H1b, and H1c are supported. Hypotheses H2a and H2b, representing the widely proposed direct relationship between flow factors and continuance intention, could only partially be supported. Fluency seems to have a positive impact on continuance intention ($\beta = 0.124$, $p < 0.05$), supporting H2b, while absorption even shows a negative and significant effect on continuance intention ($\beta = 0.124$, $p < 0.05$); H2a is therefore rejected.

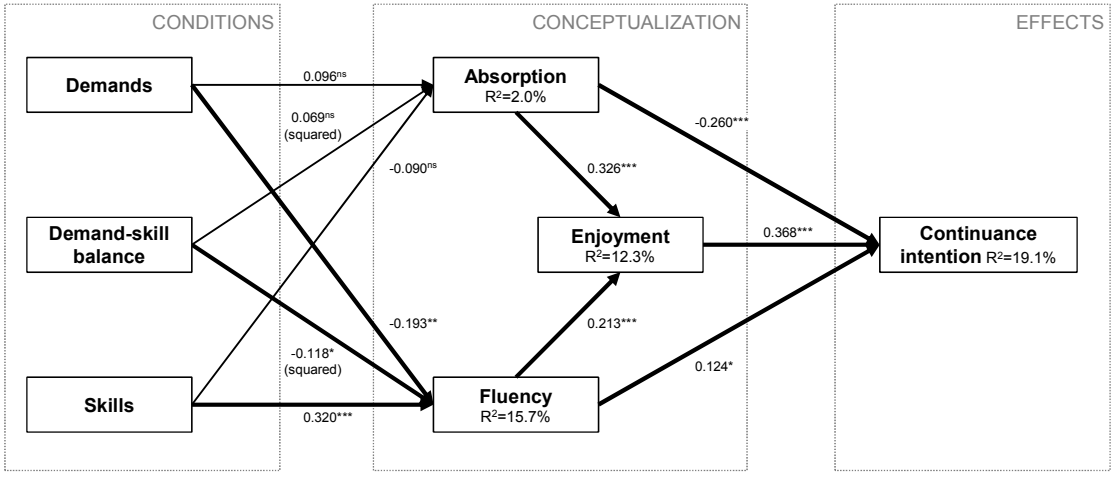

Figure 4. Results (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$)

Testing the hypothesis on demand-skill balance as a flow condition on the web, square balance was used as a predictor (balance was centered before being squared, resulting in highest values for balanced demands and skills). In this regard, we found a reliable quadratic relationship for fluency ($\beta = -0.118$, $p < 0.05$), supporting hypothesis H3b. Moreover, to account for the possibility that flow is still high when task demands are too low, we further did a curve fitting for demand-skill balance and both flow factors. Considering fluency, the best fit was achieved for a quadratic function ($F[2,233] = 5.380$, $p < 0.005$). As shown in **Error! Reference source not found.**, the curve is clearly shifted towards low demand levels (negative values of demand-skill balance). However, we could not find a significant influence of balanced skills/demands on absorption while using websites. Thus, we had to reject H3a.

As expected, the reformulated model (Csikszentmihalyi and Csikszentmihalyi 1988) is equally not fully supported. Demands as well as skills seem to have no significant influence on absorption conducting web activities. The path coefficient between demands and fluency is even negative and significant ($\beta = -0.193$, $p < 0.01$). Only the positive significant relationship between skills and fluency lends support to the reformulated model ($\beta = 0.320$, $p < 0.001$). Hypothesis H4d is accepted, whereas H4a, H4b, and H4c are rejected.

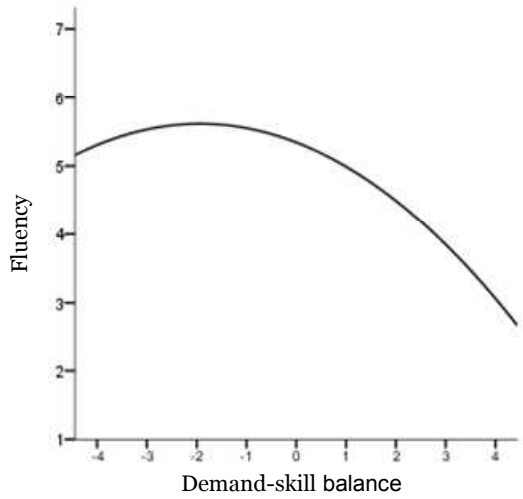

Figure 5. Fluency vs. Demand-Skill Balance

Discussion

Key Findings and Implications for Research and Practice

Motivated by the inconsistencies in the prior usage of the flow concept in IS research, and drawing on current flow research issues in motivational psychology, this study sought to gain a deeper understanding of the psychological phenomenon of flow in the IS context.

First, we have demonstrated an adequate conceptualization of flow, including both factors absorption and fluency, but separate from enjoyment. Moreover, we have empirically validated an appropriate flow measure in the IS context.

Second, it was revealed that flow might be seen as "the 'glue' holding the consumer in the hypermedia Computer Mediated Environment" (Hoffman and Novak 1996), but enjoyment is a separate construct to flow, mediating the effect of flow on continuance intention. Website users who experience flow-induced enjoyment develop a higher intention to continuously use these sites. This result is in line with theoretical

considerations, where enjoyment is only experienced when positive activation overcomes negative activation, both induced by flow (Aellig 2004; Pfister 2002; Schallberger and Pfister 2001). Moreover, these results might explain the "paradox of work" (1989) in the web context. However, flow's direct effect on continuance intention is proved to exist, but ambiguously: On the one hand, fluency still has a significant direct positive effect on continuance intention, independently from perceived enjoyment. In this regard, fluency might be seen as the functional part of flow on the web. Websites that can be used fluidly and effortlessly, for instance realizing good usability, might still be used for merely functional reasons in the future, independently from enjoyment. However, absorption shows, independently from enjoyment, an unexpected general negative effect on continuance intention. Thinking about cases where forgetting about time and losing track might lead to discontinuance intention, this might be a typical phenomenon in the IS/web context. Prolonged web usage, that is, spending more time than originally intended, might induce a mental resistance to dive into absorption again in future. For instance, prolonged entertainment usage that is retrospectively not enjoyed might induce a bad conscience and negative emotions, leading to discontinuance intention. Recent empirical results show that extreme cases of such behavior, where flow, mainly measured as absorption, result in addiction and addictive web usage behavior (Chou and Ting 2003; Park and Hwang 2009). However, a high discrepancy between respondents' individually and socially desirable statements and real behavior might exist. One may assume that consumers will continue to act in a certain way even when they feel and state that it is not in their best interests.

Third, regarding the most widespread flow conditions, based on the demands and skills of flow activities, we could equally reveal that the proposed models – the original flow model (Csikszentmihalyi 1975a) as well as the reformulated model (Csikszentmihalyi and Csikszentmihalyi 1988) – could only be partially supported in the context of the web. The original flow model assumes that demand-skill balance causes flow. We found that the perceived balance between demands and skills using websites leads to fluency, but follows a quadratic relationship that is clearly shifted towards low demands. This is in line with theoretical considerations that assume that activity-related skills must be perceived as merely individually sufficient to experience flow. As long as implicit motives are activated, too high skills are supposed to not compulsively lead to boredom (Kehr 2004; Schattke and Kehr 2009). Likewise, recent empirical results support this viewpoint in the sport context (Reinhardt et al. 2006; Schüler 2004; Stoll and Kiefer 2003; Stoll and Lau 2005). This effect seems to be even stronger regarding the absorption construct. Here, we could not find a significant influence of balanced skills/demands on absorption during website usage. High absorption on the web seems to be equally experienced while conducting very demanding activities as well as activities with low demands (e.g., mainly passive activities such as watching videos, reading for entertainment, etc.). Hence it is hardly surprising that the reformulated quadrant model could not gain full support. In the quadrant model, cases of low demands and high skills (related to individual average) were assigned to the *boredom* quadrant (Csikszentmihalyi and Csikszentmihalyi 1988). As a result of studies finding that people also experience flow in this quadrant (e.g., Clarke and Haworth 1994; Csikszentmihalyi and Csikszentmihalyi 1988; Ellis et al. 1994), this area has recently been renamed by Csikszentmihalyi (1997) as the *relaxation* quadrant. Nevertheless, our results show that high skills do lead to fluency on the web. This might be related to an expertise effect that can be applied to web activities, necessary to achieve effortlessness and smoothness typical of fluent action. But, since fluency can reliably be induced in absolute beginners in simply structured activities, such as some computer games (Rheinberg and Vollmeyer 2003), this expertise effect might not count as evidence for universal validity of the quadrant model on the web. Moreover, contrarily to the quadrant model, above-average demands show a negative effect on fluency on the web, supporting the assumption that flow on the web corresponds with low demands.

Consequently, we showed how flow can serve as a reliable theoretical concept to explain post-adoptive behavior from a relational perspective, which might complement existing concepts aiming at instrumental and utilitarian website performance (Benlian et al. 2012). Beyond these theoretical implications, understanding how to conceptualize and measure flow informs managers about how to diagnose user experience from the perspective of flow. Moreover, understanding how the interplay between skills and demands, flow experience, and enjoyment affects the continuance intention of using IS can inform managers about how to design the interactions between users and IS to increase continued usage. Flow is not a sufficient condition for continuance intention, but flow's effect on continuance intention is partially mediated by enjoyment. Hence, to induce continuance intention, the experience of using a website should

incorporate flow as well as enjoyment. Since high absorption on the web is equally experienced while conducting activities with low demands, optimizing flow by just increasing demands, even if they are balanced with individual skills, seems to be a two-edged sword.

Limitations and Avenues for Future Research

Some limitations to the present study need to be acknowledged. First, since we provide data based on real usage behavior in the individual context, the activities conducted on the web by our respondents differ in various characteristics. Therefore, a variety of possible attributes could account for our results. Hence, the results should be replicated in experimental settings in which specific web activities are controlled. Second, we surveyed students who might not be representative for the basic internet user population. Nonetheless, the examined section of reality might be considered as indicative.

In recognition of our findings, which only partially support the original and the reformulated flow model, the inclusion of a variety of individual differences as moderators that have already been used in psychology might be suggested for future studies of flow on the web. For example, intrinsic motivation orientation (Abuhamdeh and Csikszentmihalyi 2009; Abuhamdeh 2008), habitual action orientation (Keller and Bless 2008), perceived importance (Engeser and Rheinberg 2008), explicit achievement motive (Eisenberger et al. 2005; Engeser and Rheinberg 2008), and implicit achievement motive (Engeser and Rheinberg 2008; Schüler 2007). Especially two moderators seem to serve as a promising alternative explanation for flow experience under low demands on the web. First, Engeser and Rheinberg (2008) suggest that it depends on task aspects, whether or not demand-skill balance leads to flow. Perceived importance could serve as a moderator, arguing that when success or failure has important consequences (important purpose-related incentives), individuals should prefer an imbalance and experience flow when skills exceed demands. Moreover, Atkinson's (1957) risk-taking model might provide a suitable theoretical link between the demand-skill balance, the achievement motive and its consequences regarding flow. The core of the risk-taking model is the assumption that some people experience balance as positive and some as negative. Achievement-related, challenging conditions can lead to hope of success as well as to fear of failure (Atkinson 1957; Brunstein and Heckhausen 2008). Therefore, highly achievement-motivated individuals prefer tasks of medium difficulty (hope of success). However, people that are less motivated by achievement avoid tasks of medium difficulty (fear of failure). In this regard, fear of failure evoked by demand-skill balance, subjectively high demands, or subjectively low skills might hinder fluent action and mental focus on an activity, which might result in lower flow scores.

Conclusion

Faced with the inconsistencies in the flow concept's prior usage in IS research, this paper manages to show not only that widely proposed assumptions of IS flow research might have to be revisited, but to provide solutions to these issues. The main contribution of this paper is the reconceptualization and empirical validation of the flow construct for IS flow research, based on the status-quo of psychology. Building on this, we reveal that relationships between flow conditions, the multifaceted flow experience and its effects seem to be a lot more complex than proposed in the IS literature, requiring further examination. Furthermore, our paper adds to the body of knowledge of motivational psychology, confirming effects of the "paradox of work" and testing the effects of skill-demand interactions in the IS context. We hope that it will serve as a springboard for future research on flow experience in the information systems discipline and also aids managing the design of optimal user experience from the perspective of flow.

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