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Locus of Control and the Flow Experience: An Experimental Analysis

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Abstract

The present research addresses the notion that the compatibility of skills and task demands involved in a given activity elicits a flow experience that renders the respective activity rewarding. The study employed an experimental paradigm to document the causal impact of skills–demands compatibility on the emergence of flow and revealed that participants characterized by a strong internal locus of control (LOC) were most sensitive to the manipulation of skills–demands compatibility and experienced flow under conditions of a fit of skills and task demands, whereas individuals with a weak internal LOC did not enter the state of flow. In line with previous findings, this suggests that distinct personality attributes are of critical relevance for the experience of flow to emerge. Copyright © 2008 John Wiley & Sons, Ltd.

Key words: flow experience; intrinsic motivation; locus of control

INTRODUCTION

In the most general terms, the present work addresses the question of what makes people happy. More specifically, we refer to one established answer to this question, namely that an important source of happiness is the engagement in intrinsically rewarding *activities* (cf. Lyubomirsky, Sheldon, & Schkade, 2005). As a consequence, the crucial follow-up question that we addressed in the research presented below is this: what characterizes behavioural episodes that are experienced as intrinsically rewarding? Researchers addressing this question seem to agree upon the fact that some sort of a 'person-activity fit' is involved in intrinsically rewarding activities. Different groups of researchers have focused on specific types of 'person-activity fit', emphasizing distinct aspects of the person and the activity. Thus, researchers in the field have highlighted the compatibility of a variety of different factors that may render an activity intrinsically rewarding. For example, according to Harackiewicz and Sansone's (1991) 'matching hypothesis', individuals are most likely to experience an activity as intrinsically rewarding when their habitual goal

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orientation (mastery vs. performance goal orientation) fits with the relevant goal orientation that is relevant in the situation (e.g. due to a specific task framing referring to mastery or performance goals). In another line of research on regulatory focus theory (cf. Freitas & Higgins, 2002; Keller & Bless, 2006; Spiegel, Grant-Pillow, & Higgins, 2004), another 'person-activity fit' effect has been documented that is based on the compatibility of habitual self-regulatory orientations (promotion- vs. prevention-focused habitual self-regulatory style) and situationally induced self-regulatory mechanisms (promotion- vs. prevention-focused task framing). The relevance of the 'person-activity fit' phenomenon has also been extensively discussed and empirically analysed in personnel and organizational psychology with a special emphasis on the concept of 'person-job fit' (cf. Edwards, 1991, 1996; Kristof-Brown, Zimmerman, & Johnson, 2005).

In the present study, we focus on yet another 'person-activity fit' effect that has been extensively discussed and analysed by Csikszentmihalyi and colleagues (for an overview, see Nakamura & Csikszentmihalyi, 2002). This specific fit effect refers to the compatibility of individuals' level of skills in the execution of an activity and the level of task demands they are confronted with during engagement in the activity. According to Csikszentmihalyi's theorizing, such a skills–demands compatibility is most likely to result in the emergence of a so-called flow experience: the deep involvement in a task that is perceived as rewarding in and of itself. Exemplary cases where individuals typically enter such a 'flow experience' are (a) the artist who is fully absorbed in the activity of painting or playing an instrument, (b) the athlete performing at the limits of his or her capability or (c) the surgeon who is completely absorbed in his or her surgical activity. As is evident, the fit of skills and task demands is at the heart of the conceptualization of intrinsic motivation in flow theory. We set out to test this crucial causal assumption in an experimental study using a newly developed paradigm recently introduced by Keller and Bless (2008). The main goal of the present work was to make use of our experimental paradigm to test one prominent personality characteristic as a potential boundary condition of the emergence of flow: internal locus of control (LOC) orientation. Moreover, we put the assumption to the test that the moderating role of internal LOC is mediated via the perceived level of control during task engagement.

Core assumptions of flow theory

Flow theory (Csikszentmihalyi, 1975/2000) represents one distinct approach to the study of happiness and intrinsic motivation. In this framework, intrinsic motivation is conceptualized as the experiential state that arises when individuals engage in skill-related activities under conditions of clear goals, immediate unambiguous feedback and a perceived *fit of skills and task demands*. That the latter assumption is of particular importance in the flow model is reflected in the core assumption put forth in flow theory, according to which '[e]ntering flow depends on establishing a *balance* between perceived action capacities and perceived action opportunities' (Nakamura & Csikszentmihalyi, 2002, p. 90). This focus on the skills–demands compatibility reflects the conceptual consideration of 'person-activity fit' effects as outlined above.

According to Nakamura and Csikszentmihalyi (2002), flow is an experiential state that is characterized by the following aspects: (a) the individual is in a state of intense and focused concentration on what he or she is doing; (b) a merging of action and awareness takes place; (c) the individual experiences a loss of reflective self-consciousness; (d) the individual feels a deep sense of control; (e) the individual's temporal experience is

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distorted (hours seem to pass like seconds); (f) worries and ruminative thoughts disappear and (g) the individual enters a state of autotelic motivation indicated by the fact that engagement in the activity is perceived as rewarding in and of itself. Note that flow experiences involve aspects that need not necessarily be present in every case of intrinsic motivation (e.g. a loss of reflective self-consciousness or a distorted sense of time are not fundamental elements of intrinsic motivation in the more general sense of the term).

Moreover, the experience of flow can be differentiated from other positive, joyful experiences (e.g. watching a movie, listening to music, watching a sunset). These more inactive experiences might be conceptualized as peak experiences (Maslow, 1968) and tend to be perceptual, receptive and *passive*, whereas in a flow experience the individual participates in an active interaction with the environment that involves the execution of skill-related behaviours (Privette, 1983). Thus, the reference to *skills* and the *active* application of skills in a challenging environment are characteristic features of the flow experience (Csikszentmihalyi, 1988).

Methodological practice in previous flow research

A substantial amount of research has addressed the experience of flow and the basic assumptions of flow theory seem empirically well established (for overviews see Csikszentmihalyi & Rathunde, 1993; Nakamura & Csikszentmihalyi, 2002). However, it is noteworthy that this previous research has been dominated by one specific methodological approach: the so-called experience sampling method (ESM). ESM involves signalling research participants at random times throughout the day and asking them to report on the nature and quality of their experience (such as the current level of perceived task demands etc.; cf., Csikszentmihalyi & LeFevre, 1989; Csikszentmihalyi & Rathunde, 1993; Nakamura & Csikszentmihalyi, 2002). In essence, this method is *correlational* in nature and findings obtained using the ESM are thus associated with the limitations regarding causality that typically accompany (cross-sectional) correlational data (for a more elaborate discussion of this methodological aspect see Keller & Bless, 2008). Thus, previous research on the flow experience can be characterized as almost exclusively non-experimental in character (the only two published studies we are aware of using an experimental approach are those reported by Mannell & Bradley, 1986 and Rheinberg & Vollmeyer, 2003).

In order to address this lack of experimental research on flow, we recently developed a new experimental paradigm in our lab (Keller & Bless, 2008). This paradigm involves the *manipulation* of the compatibility of skills and task demands based on a specific version of the computer game widely known under the name 'Tetris'. We developed three different versions of the game to manipulate the skills–demands compatibility. Specifically, the adapted version of the game (skills = demands) allows for a dynamic and automatic increase or decrease in task difficulty depending on participants' individual performance in the game. In the two non-adaptive versions, participants play the game under conditions of boredom (skills > demands) or overload (skills < demands). Based on this paradigm, we obtained empirical evidence documenting the causal impact of the skills–demands compatibility on the emergence of flow. Moreover, our findings revealed that individuals characterized by a strong habitual action-orientation (Kuhl, 1994) were most sensitive to the manipulation of the skills–demands compatibility (Keller & Bless, 2008). This latter finding reflects the fact that our paradigm can fruitfully be applied to systematically test the boundary conditions of skills–demands compatibility effects on the emergence of flow. The present work contributes to the analysis of boundary conditions with a focus on personal

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factors. Specifically, the experiment reported below was designed to test the potential moderating role of one specific and prominent personality characteristic: *internal LOC orientation*.

Internal locus of control and the flow experience

Based on previous theorizing and research on LOC and the experience of flow, we hypothesized that individuals characterized by a strong (rather than weak) internal LOC are more sensitive to variations in the compatibility of skills and task demands and more likely to enter a state of flow under conditions where they experienced a fit of skills and task demands. Furthermore, we argue that a strong internal LOC predisposes individuals to *perceive control* in situations where they experience a compatibility of skills and task demands, which is one important underlying mechanism of the moderating role of internal LOC orientation. In what follows, we elaborate on the theoretical underpinnings of these assumptions in somewhat greater detail.

The LOC concept was introduced by Rotter (1966) more than four decades ago and since then an enormous amount of research has addressed the role of this construct regarding affective, cognitive, behavioural and physiological (i.e. health) outcomes. In fact, LOC appears to be one of the most widely studied personality constructs in personality and applied psychology, only topped by self-esteem and neuroticism (cf. Judge & Bono, 2001). In general terms, LOC concerns the beliefs people hold regarding the relationship between actions and experienced outcomes. *Internal* LOC reflects the belief that outcomes are generally contingent upon the work and effort put into them. In contrast, *external* LOC reflects a belief that success in reaching a certain outcome is a function of luck or of being related to the right people (Lefcourt, 1991; Levenson, 1981; Rotter, 1966). Most important in the present context, previous research revealed that there is a reliable positive relationship between internal LOC and indicators of subjective well-being and happiness (cf. DeNeve & Cooper, 1998; Judge, Locke, Durham, & Kluger, 1998; Larson, 1989; Ng, Sorensen, & Eby, 2006), as well as a reliable negative relationship between internal LOC and indicators of psychopathology such as depression (Benassi, Sweeney, & Dufour, 1988; Mirowsky & Ross, 1990; Naditch, Gargan, & Michael, 1975; Presson & Benassi, 1996) and other personality disorders (Watson, 1998). In combination, there is consistent empirical evidence documenting a robust association of internal LOC with happiness and positive mental health. However, the specific *mechanisms underlying* this association are largely unknown at this time. That is, the question of why it is that we find the positive relationship between internal LOC and indicators of psychological well-being is an unresolved problem.

We suggest that reference to the concept of flow may be a fruitful approach in this context. Specifically, we suppose that individuals with a strong internal LOC are more predisposed and hence more likely to make flow experiences in their everyday life, which contributes to the relatively high level of well-being typically observed in individuals with a strong internal LOC orientation. If this assumption actually holds true, we should find that internal LOC represents a significant boundary condition that contributes to the ease with which individuals enter a state of flow under conditions of skills–demands compatibility. That is, individuals with a strong internal LOC should be found to be strongly affected by variations in the skills–demands compatibility, whereas individuals with a weak internal LOC should be affected much less and be less likely to experience flow under conditions of a fit of skills and task demands.

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The underlying logic of this supposition is based on two assumptions: (1) individuals with a strong internal LOC are particularly *sensitive* to the level of control they experience when they engage in an activity, and (2) individuals with a strong internal LOC are predisposed to enjoy challenging situations that require the active execution of skill-related behaviours. Note that according to Skinner's (1996) conceptual analysis of different constructs of control, sensitivity to the degree to which one's efforts and/or ability determine the experienced outcomes (i.e. sensitivity to means–end relations) is a key element of the LOC construct. As a consequence, individuals with a strong internal LOC are most likely to be sensitive to variations in the skills–demands compatibility because such variations are accompanied by the level of control that the individual experiences during engagement in the activity; this was empirically documented in a recent study in our lab (cf. Keller & Bless, 2008; Study 1).

Regarding the second assumption mentioned above, it should be noted that according to Rotter (1966) and other LOC theorists (cf. Lefcourt, 1991), the degree to which an individual endorses an internal LOC orientation determines whether people act or fail to respond in the face of a challenge. In view of the established fact that flow experiences typically emerge in challenging situations (cf. Nakamura & Csikszentmihalyi, 2002), it seems plausible to assume that persons high in internal LOC are most likely to enjoy activities in the face of challenges and experience the highest level of flow under the challenging condition of a skills–demands compatibility.

In sum, we argue that an internal LOC orientation fits well with characteristic features of the flow experience (i.e. the elements involved in the emergence and experience of flow), and as a consequence of this higher order fit effect (reflecting a fit effect involving a skills–demands compatibility as well as a third factor, in the present case the personality characteristic internal LOC) we expect that the experience of flow is most likely to be observed in individuals high in internal LOC. Stated differently, we assume that individuals who believe in personal control and engage in a task where they experience personal control over outcomes should 'feel right' and enjoy the situation more than individuals who do not believe in personal control and see no contingency between their actions and experienced outcomes. This line of reasoning is parallel to previous theorizing and research documenting increased intrinsic motivation under conditions where a personality trait was compatible with situational context factors (e.g. when achievement goals were compatible with specific task framings, cf. Harackiewicz & Sansone, 1991).

Interestingly, there is already some empirical evidence that (at least indirectly) supports our theoretical reasoning. Specifically, Haworth, Jarman, and Lee (1997) reported on correlational ESM findings (based on a small sample of working women) documenting that individuals with a high internal LOC reported higher enjoyment, interest and control in the activities they were engaged in when signalled to report on their momentary experiences. Also, individuals with a high internal LOC reported more of their activities as *intrinsically* motivated than did their external LOC counterparts (unfortunately, the role of skills–demands compatibility was not assessed in this previous study, that is, this previous study did not address our assumptions concerning the relationship between internal LOC and sensitivity to the level of skills–demands compatibility). The present study can be considered an extension of the previous work by Haworth et al. (1997) in that we look at the relationship between internal LOC and the mechanism of intrinsic motivation using an experimental paradigm designed to vary the experience of a skills–demands compatibility during task engagement.

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In sum, the present experiment was designed to test three basic assumptions: (1) variations in the compatibility of skills and task demands affect the level of flow experiences; (2) the internal LOC orientation is related to a special sensitivity to the skills–demands compatibility manipulation such that individuals with a strong internal LOC orientation experience the highest level of flow under conditions of a skills–demands compatibility, whereas individuals with a weak internal LOC orientation are much less sensitive to variations in the skills–demands compatibility; and (3) the relationship between internal LOC and the emergence of flow under conditions of a fit of skills and task demands can be explained, at least in part, with reference to the subjectively perceived level of control during task engagement.

METHOD

Design and participants

Participants were 122 undergraduate students (66 women) at the University of Mannheim who were offered 2 Euros for their participation. Participants played a computer game and were randomly assigned to one of three game conditions representing a boredom condition (low task demands), an adaptive condition (task demands automatically and continuously adapted to participants' level of skill) and an overload condition (very high task demands). Following the game-playing period of 8 minutes, participants completed a questionnaire designed to assess the different dimensions of flow experiences.

Procedure

At the outset of the study, participants were asked to fill in a brief personality questionnaire containing the LOC scale described below. Afterwards, participants were instructed to work on a computerized task, an adapted version of the Tetris computer game. The aim of this game is to arrange 'falling' objects so that they create completely filled lines at the bottom of the playing field on the screen. The falling objects can be moved to the right or left and rotated in 90° steps with assigned keys on the keyboard. The main idea underlying our experimental paradigm is to manipulate the fit between skills and demands by creating distinct playing modes. The game was therefore programmed in three playing modes. In the *'boredom' condition* the objects keep falling at a very slow rate, regardless of the player's performance, and the player has no tool available to accelerate the falling speed of the objects. We expected persons to experience a negative state of boredom in this playing mode condition. In the *'adaptive' (flow) condition* the speed with which the objects keep falling is adapted to the player's performance. If the player successfully fills five lines or more (using a maximum number of 30 consecutive objects), the speed is automatically increased by one step. If the player accomplishes only three lines or fewer (using a maximum number of 30 consecutive objects), the speed is decreased by one step. Thus, the speed is adapted to the player's performance to keep the player within the flow channel reflected in a fit between skills and task demands. We anticipated that persons in this playing mode would differ significantly from the other conditions with regard to the intensity and quality of their experiences while playing the game. In the *'overload' condition* objects initially start falling pretty fast and the speed is increased to an even higher level if the person manages to fill five lines (making it extremely difficult to fill any lines).

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Locus of control

The German version (Krampen, 1979) of the Internality, Powerful Others and Chance (IPC) Scale (Levenson, 1981) was applied to assess LOC. This is a self-report measure designed to assess the extent to which people believe that they have control over their own lives (internality), that other persons control the events in their lives (powerful others) or that their experiences and outcomes are merely affected by chance (chance). The 24-item IPC Scale comprises three subscales consisting of eight items each. Subjects responded to each item on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). One sample item of the internality subscale reads: 'My life is determined by my own behaviour'. The internal consistency of the scale was Cronbach's $=.70$. A sample item of the chance subscale reads: 'To a great extent my life is controlled by accidental happenings'. Reliability of this scale was $=.63$. A sample item of the powerful others subscale reads: 'I feel like what happens in my life is mostly determined by powerful people'. The internal consistency of the scale was $=.74$. The differentiation of several subcomponents of the LOC construct reflects the fact that distinct elements of internal and external control beliefs are not mutually exclusive and that individuals' beliefs about the determinants of experienced outcomes reflect the possibility of multi-causation of outcomes. Levenson (1981) discussed the issue of multidimensionality most systematically (cf. Levenson, 1974; Levenson & Miller, 1976) and developed the instrument to assess three subcomponents of the LOC construct that we used in this study. Note that our emphasis in the present context is on the *internality* component of the LOC construct because powerful others and chance are no relevant elements in the activity context that we focus on.

Assessment of dependent variables

The computer program assessed the number of lines participants were able to fill during engagement in the task which reflects the standard *performance level* in the Tetris game. Immediately after playing the game, participants received a questionnaire and responded to several items designed to assess specific dimensions of experiences during task engagement on response scales with end-points labelled (1) *not at all true* and (7) *completely true*.

The flow state is usually measured by self-reports concerning the level of involvement, concentration and enjoyment (Nakamura & Csikszentmihalyi, 2002). In the present research, we set out to focus on two distinct components of the flow experience that have been discussed as elements of this distinct type of intrinsic motivation: (a) a feeling of accelerated passing of time and (b) a deep involvement in and enjoyment of the activity.

Perception of time

To assess participants' sense of time we asked them to indicate, on a horizontal line (10 cm in length) with end-points labelled *very short* and *very long,* their subjective estimate of the length of time they spent playing the game. Note that previous work based on the experience sampling method revealed that higher intrinsic motivation is associated with a subjective experience of time passing more quickly (Conti, 2001). Accordingly, time perception seems to be a valid indicator of one distinct component of the experience of intrinsic motivation. In addition, we assessed time estimates by asking participants to indicate their subjective estimate of the length of time they spent playing the game *in minutes*.

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Involvement and enjoyment

Experiencing task engagement as rewarding in and of itself is the most crucial and characteristic feature of intrinsic motivation. We assessed this experience with 16 items designed to assess involvement in and enjoyment of the activity (three items of the initial questionnaire were excluded due to low internal consistency coefficients in the reliability analysis; the list of items included in the scale can be found in the Appendix). The 13-item scale was internally consistent with Cronbach's $=.94$. It is worth mentioning that the measure of involvement and enjoyment contains items that assess the desire to engage in the activity again in the future, which reflects the willingness to engage in the activity in a free choice setting. Thus, the scale seems to cover a dimension of intrinsic motivation that is often seen as a crucial component of the assessment of intrinsic motivation (willingness to engage in the relevant activity in a free choice time period). We acknowledge the fact that applying an actual free choice measure would have been a more stringent assessment of intrinsic motivation. Nonetheless, it seems fair to conclude that the self-report measure that we applied in the present research at least partially captures this component of intrinsic motivation.

Considering the list of items included in the involvement and enjoyment scale (see the Appendix), it is evident that we assessed several of the crucial elements of the flow experience as defined by Csikszentmihalyi (2000). Specifically, the scale comprises items related to joy and happiness (reflecting autotelic motivation as well as the counterpart to worries and negative thoughts), focused attention/concentration, involvement, interest and motivation to play the game again. In combination with the measures of time perception and feeling of control (see below), we attempted to address those aspects of the flow experience that can meaningfully be assessed using self-report items (it seems not particularly well feasible to assess loss of self-consciousness and merging of action and awareness using self-reports given that these aspects of the flow experience reflect phenomena that are more difficult to 'monitor' and to consciously observe during task engagement than the level of involvement, attention and enjoyment; accordingly, accurate self-reports of these experiences are most probably difficult to obtain which is why we refrained from an assessment of these aspects using self-report items).

Perceived fit of skills and task demands

Perceived fit of skills and task demands was assessed by asking participants to respond to an item that reads: 'To what degree did the demands of the game match your ability?' on a scale ranging from (1) *not at all* to (7) *completely.* A second item designed to measure perceived fit reads: 'Were the demands of the game too high or too low for you?,' with a response scale ranging from (1) *too low* to (7) *too high*. We recoded this latter item in a way that a score of 4 reflected highest fit (i.e. raw scores of 5, 6 and 7 were recoded into 3, 2 and 1, respectively). Both variables were significantly correlated, $r=.38$, $p<.001$. Accordingly, we computed a mean index averaging across both variables (z-standardized scores).

Feeling of control

Flow theorists argue that a sense of control reflects one crucial element of the flow experience. However, a sense of control can reflect different things (e.g. a sense of *control over outcomes* vs. a sense of control over how the game is proceeding [reflecting *procedural control*]; for a detailed discussion of the control construct, see Skinner, 1996). In the present study, we focused basically on the former component of control and the

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questionnaire included a 6-item scale designed to assess the perceived control over outcomes (sample items read: 'I had the necessary skill to play the game successfully', 'I realized that I acted skilfully in the game' and 'I think I performed well in the game'). This scale was internally consistent with Cronbach's $= .95$.

RESULTS AND DISCUSSION

It seems reasonable to consider the relationship between the dependent variables that we assessed in our study in an initial step of the analysis in order to address the question whether the assessed factors (perception of time, perceived fit of skills and task demands, involvement and enjoyment, feeling of control and performance on the task) reflect one common dimension of participants' experience while working on the task or rather different dimensions. As the intercorrelations of the dependent variables (see Table 1) as well as the results of a principal components analysis with varimax rotation (see Table 2) reveal, the five assessed dependent variables represent two dimensions. Specifically, involvement and enjoyment as well as perceived fit loaded strongly on the first component and performance on the task and perceived control loaded strongly on the second component. Time perception seems to be related to both components as reflected in the fact that the primary loading on the first component was complemented by a substantial loading on the second component. From our perspective, these findings speak to the fact that the

Table 1. Intercorrelations between dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Performance (1)	—	.11	.14	.36**	−.19*	−.19*
Perceived fit of skills and demands (2)		—	.43***	.11	−.24**	−.15
Involvement and enjoyment (3)			—	.30**	−.44***	−.23*
Perceived control (4)				—	−.21*	−.13
Time perception (line judgment) (5)					—	.37***
Time perception (in minutes) (6)						—

Note:
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 2. Factorial structure of the dependent variables

	Components	
	(1)	(2)
Involvement and enjoyment	.81	.18
Perceived fit of skills and demands	.79	−.07
Time perception[a]	−.62	−.30
Performance	.04	.83
Perceived control	.18	.77
Eigenvalues	2.04	1.08

Note:
[a]Time perception = mean index across both items (z-standardized) assessing time perception; the analysis resulted in two components with eigenvalues greater than 1 which accounted for 62.4% of the variance.

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different aspects assessed in the present study reflect distinct components which can be empirically differentiated. Moreover, the results of the principal components analysis suggest that our measures seem to reflect a 'performance component' as well as a component reflecting 'positive experiences during task engagement'. Conceptually, the latter component represents the 'outcome variable' that is at the heart of flow theory and accordingly we focused our analyses (specifically, the moderation analysis) on the involvement and enjoyment scale as the crucial dependent variable.

Manipulation checks—perceived fit of skills and task demands and performance on the task

We first submitted participants' ratings of the perceived fit of skills and task demands to a one-factorial analysis of variance (ANOVA) testing the overall effect of the playing mode manipulation. As expected, the analysis resulted in a significant effect of the experimental manipulation, $F(2,\ 119) = 5.52,\ p < .01$. Participants in the adaptive playing mode condition report a higher mean fit score ($M = 0.36$, $SD = 0.63$) than those in the boredom condition ($M = -0.17$, $SD = 0.95$) and the overload condition ($M = -0.16$, $SD = 0.79$). This reveals that we were successful in manipulating the crucial factor in flow theory—the perceived fit of skills and task demands. A focused contrast analysis indicated that participants reported significantly higher perceived fit under the adaptive compared to the overload condition, $t(119) = 2.89$, $p < .01$, and significantly lower perceived fit under the boredom compared to the adaptive condition, $t(119) = 2.92$, $p < .01$.

Performance scores also indicated that our manipulation was effective. Specifically, the one-factorial ANOVA resulted in a significant effect of the experimental manipulation, $F(2, 118) = 5.17, p < .01$ (the data of one participant were lost due to a computer problem). Participants in the adaptive playing mode condition reached a higher performance level ($M = 18.8$, $SD = 7.9$) than those in the boredom condition ($M = 14.0$, $SD = 5.3$) and the overload condition ($M = 15.3$, $SD = 7.0$). Again, a focused contrast analysis indicated that participants reached a significantly higher performance level under the adaptive compared to the overload condition, $t(118) = 2.28$, $p < .03$, and a significantly lower performance level under the boredom compared to the adaptive condition, $t(118) = 3.12$, $p < .01$.

Perception of time

Next, we submitted participants' judgments of the length of time spent on the task (as assessed with the line judgment measure) to a one-factorial ANOVA, which revealed that there was a trend towards higher scores in the two non-adaptive playing conditions (boredom condition $M = 56.1$, $SD = 21.9$; overload condition $M = 63.5$, $SD = 21.4$) compared to the adaptive condition ($M = 54.6$, $SD = 21.4$; $F(2,\ 119) = 2.01$, $p < .14$). A focused contrast analysis indicated that participants tended to report shorter time estimates under the adaptive compared to the overload condition, $t(119) = 1.85, p < .07$.) The overall pattern suggests that the playing mode manipulation did affect time estimates in the expected direction, although participants in the boredom condition seemed to perceive the length of time spent on the task quite similarly to those in the adaptive playing mode condition. Given the relatively large variation observable in time estimation scores, it is not too surprising that the overall effect did not reach significance. On participants' judgments of the length of time spent on the task assessed in minutes we observed no meaningful effect of the experimental manipulation, $F < 1$.

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Perceived control

Replicating our previous results (Keller & Bless, 2008, Study 1), we found a significant effect of playing mode manipulation on perceived control scores, $F(2, 119) = 33.98$, $p < .001$, reflecting a linear trend: participants in the boredom condition reached highest scores ($M = 5.23$, $SD = 1.30$) and participants in the overload condition lowest scores ($M = 2.87$, $SD = 1.28$), with participants in the adaptive condition falling in between ($M = 4.52$, $SD = 1.46$). A focused contrast analysis indicated that participants reported significantly higher control under the adaptive compared to the overload condition, $t(119) = 5.49$, $p < .001$, and significantly lower control under the adaptive compared to the boredom condition, $t(119) = 2.36$, $p < .03$.

Involvement and enjoyment

In order to assess effects of the manipulation of the skills–demands compatibility on involvement and enjoyment scale scores, we first submitted the scores to a one-factorial ANOVA and found a significant impact of the experimental manipulation, $F(2, 119) = 8.97$, $p < .001$; participants in the adaptive playing mode condition ($M = 4.77$, $SD = 1.29$) reported higher levels of involvement and enjoyment than their counterparts in the boredom ($M = 3.97$, $SD = 1.46$) and overload condition ($M = 3.50$, $SD = 1.28$). Again, a focused contrast analysis revealed a significant difference between participants assigned to the adaptive compared to those assigned to the overload condition, $t(119) = 4.20$, $p < .001$. Also, a significant contrast effect emerged in the analysis comparing involvement and enjoyment scores of participants assigned to the adaptive and the boredom condition, $t(119) = 2.66$, $p < .01$. This pattern indicates that there is in fact a causal relationship between the (in-)compatibility of skills and task demands and the level of intrinsic motivation as reflected in the scores on the involvement and enjoyment scale. This supports the crucial balance hypothesis of flow theory.

Note that the effect of the playing mode manipulation on involvement and enjoyment remained robust even when participants' performance on the task was controlled for (performance scores represent the number of lines participants were able to complete in the Tetris game). Specifically, an analysis testing the potential mediating role of performance on the task revealed that this variable had no mediating impact. To conduct this analysis, we first coded the adaptive playing mode +1 and both the boredom and the overload condition 0. Following the procedure proposed by Kenny, Kashy, and Bolger (1998), we then regressed the scores on the involvement and enjoyment scale on the playing mode condition. Playing mode emerged as a significant predictor, $\beta = .34$, $t(120) = 3.90$, $p < .001$. Next, we regressed the performance scores on the playing mode dummy variable and found that playing mode was a significant predictor, $\beta = .27$, $t(119) = 3.10$, $p < .01$. Finally, we entered both the playing mode and performance scores as predictors in the analysis and found that playing mode remained a strong predictor, $\beta = .33$, $t(118) = 3.66$, $p < .001$, whereas the coefficient for performance was non-significant, $\beta = .05$, $t < 1$. That is, the effect of the playing mode manipulation on involvement and enjoyment cannot be accounted for by participants' performance on the task, which indicates that (at least in the present context) flow is not merely a function of performance outcomes attained during task engagement.

In contrast to this null finding with respect to actual performance on the task, we found that perceived fit of skills and task demands functioned as a partial mediator of the playing

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mode manipulation effect. Specifically, when we entered both the playing mode and the perceived fit scale as predictors in the analysis, we found a meaningful reduction in the coefficient for playing mode, which was reduced from $\beta = .34$ in the bivariate analysis (see above) to $\beta = .23$, $t(119) = 2.74$, $p < .01$, in the multiple regression analysis, while the coefficient for perceived fit was significant, $\beta = .37$, $t(119) = 4.35$, $p < .001$. That is, the effect of the playing mode manipulation on involvement and enjoyment can partially be accounted for by participants' perceived fit of skills and task demands. This is consistent with our previous findings (cf. Keller & Bless, 2008). Applying the test developed by Clogg, Petkova, and Haritou (1995) to compute the significance level for changes in path coefficients[1] we found that the reduction in the playing mode coefficient was significant, $t(119) = 4.35$, $p < .001$. However, this mediating effect is only partial in nature (the playing mode effect is still significant), which is also consistent with our previous findings. Accordingly, other mechanisms need to be discovered that—combined with the perceived fit of skills and task demands—elicit the differences in involvement and enjoyment between adaptive and non-adaptive playing conditions.

Moderation analysis

In the analyses designed to assess the moderating role of internal LOC[2], we followed the analytical procedure applied by Keller and Bless (2008). That is, we first computed two dummy variables (one dummy for the boredom condition, coded 1 for participants in this condition and 0 for all others; and another dummy for the overload condition, coded 1 for participants in this condition and 0 for all others), thus defining the adaptive playing condition as a critical reference category. Next, we computed interaction terms multiplying the dummy variables with internal LOC scores. This allowed us to test the interplay of our continuous moderator variable with the categorical factor-playing mode.

The results of this analysis are summarized in Table 3 and graphically depicted in Figure 1. The analysis reveals the expected effect of the experimental manipulation for individuals with a high internal LOC (analysed at +1 SD), $B_{\text{overload dummy}} = -1.88$, $t = -4.43$, $p < .001$, $B_{\text{boredom dummy}} = -1.09$, $t = -2.57$, $p < .02$. In individuals with a low internal LOC (analysed at −1 SD), the experimental manipulation did not affect the task involvement and enjoyment ratings, both $t < 1.55$, n.s.

In sum, the results of the moderation analysis suggest that in the context of the present activity setting, internal LOC represents a crucial boundary factor that determines the degree to which individuals are sensitive to the compatibility of skills and task demands. This indicates that—above and beyond the crucial skills–demands compatibility effect—we obtained evidence in support of another type of regulatory compatibility effect in the present study: the compatibility of a personality trait (internal LOC) and structural characteristics of the task manipulated by the skills–demands (in-)compatibility.

[1]As MacKinnon, Lockwood, Hoffman, West, and Sheets (2002) noted, the most widely used Sobel test approach to testing for mediation has low statistical power and these authors discussed several alternative procedures that can be applied. One alternative type of analysis is the one introduced by Clogg et al. (1995), which has been used in the present case.

[2]Note that we focus on the *internality* subscale of the IPC instrument in the reported analyses. The other two subscales ('powerful others' and 'chance') did not show any meaningful moderating impact. Specifically, in the regression analyses testing the moderating effect of these subscales with involvement and enjoyment scores as dependent variable, both analyses revealed that all of the effects involving the subscale scores were far from significance, all t's < 1.

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Table 3. Regressing scores on the involvement and enjoyment scale onto internal locus of control (LOC), experimental condition and interaction terms

	B	*SE B*	β	*t*	*p*
Constant	4.77	0.22	—	22.01	.000
Internal LOC	0.47	0.22	.33	2.15	.033
Boredom dummy	−0.80	0.30	−.27	−2.69	.008
Overload dummy	−1.27	0.30	−.42	−4.25	.000
Boredom × Internal LOC	−0.29	0.30	−.12	−.96	.341
Overload × Internal LOC	−0.61	0.30	−.25	−2.02	.045

To put the assumption to the test that the relationship between internal LOC and the emergence of flow under conditions of a fit of skills and task demands can be explained, at least in part, with reference to the subjectively perceived level of control during task engagement, we ran additional regression analyses to see whether controlling for perceived control indeed explains the difference in involvement and enjoyment observable between individuals with a strong versus weak internal LOC under adaptive playing mode conditions. In these analyses focusing on participants in the adaptive condition, we found that involvement and enjoyment scores were a function of the level of internal LOC, $\beta = .37$, $t(36) = 2.35$, $p < .03$. When we entered both internal LOC and perceived control scores as predictors in the analysis, we found a substantial reduction in the coefficient for internal LOC, which was reduced to $\beta = .27$, $t(35) = 1.74$, $p = .09$, in the multiple regression analysis, while the coefficient for perceived control was significant, $\beta = .34$, $t(35) = 2.19$, $p < .04$. That is, the relationship between internal LOC and the experience of flow under adaptive playing mode conditions can partially be accounted for by participants' perceived control. The significance of the mediational effect was again assessed using the procedure by Clogg et al. (1995). Results indicated that the reduction of the path from internal LOC to involvement and enjoyment scores was significant, $t(35) = 2.20$, $p < .04$.[3]

GENERAL DISCUSSION

The results of the present study may be summarized as follows. First, the obtained evidence supports the notion that the compatibility of skills and task demands is a crucial causal factor that determines the level of enjoyment and involvement experienced by individuals

[3]In additional analyses we tested the potential mediating role of performance regarding the relationship between internal LOC and flow experience as assessed with the involvement and enjoyment scale (separately under the three different playing mode conditions) and found that the significant relation between internal LOC and involvement and enjoyment scores under adaptive playing mode conditions was *not* reduced (and remained almost perfectly identical to the bivariate relation) when we controlled for performance on the task (in the two non-adaptive conditions there was no meaningful relationship between internal LOC and flow observable and accordingly a mediator analysis was out of place). This indicates that performance did not function as a mediator of the link between internal LOC and the flow experience in the present study.Moreover, we also tested the potential moderating role of performance regarding the relationship between internal LOC and flow experience under the three different playing mode conditions. The respective analyses (regressing involvement and enjoyment scale scores onto internal LOC, performance scores as well as the interaction involving the latter two factors separately for the three playing mode conditions) did not result in meaningful effects of the performance factor or the interaction term in any of these analyses, all t's < 1.

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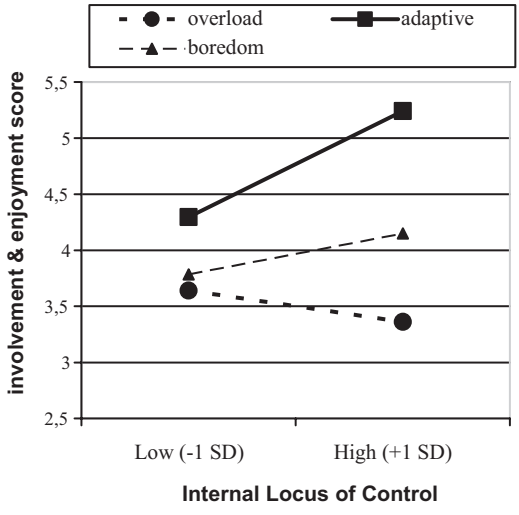

Figure 1. Graphic representation of the moderating effect of internal locus of control (LOC).

when they engage in a skill-related activity. This bolsters the balance hypothesis entailed in the flow theory of intrinsic motivation and indicates that this particular instantiation of a 'person-activity fit' (i.e. the fit of the personal aspect 'skills' and the activity aspect 'task demands') is of critical relevance with respect to the emergence of intrinsic motivation. The fact that we made use of an experimental paradigm to test the balance hypothesis renders the obtained evidence particularly compelling.

Second, the analyses testing the potential impact of objective performance scores and perceived fit of skills and task demands revealed that the latter factor partially explains the positive effect of skills–demands compatibility on enjoyment and involvement whereas objective performance scores cannot account for the observed effects of the skills–demands compatibility manipulation. This evidence regarding the mediating role of perceived fit is well in line with our previous findings (Keller & Bless, 2008) and supports the theoretical notion entailed in flow theory that the subjective experience of skills–demands compatibility is a crucial factor with respect to the emergence of intrinsic motivation.

Third, the reported results speak to the fact that internal LOC is a crucial moderating factor with respect to the impact of variations in the skills–demands compatibility. Specifically, we observed that participants with a strong habitual internal LOC were strongly affected by the experimental variation of the skills–demands compatibility, whereas participants with a weak internal LOC were hardly affected. This extends our knowledge on personal boundary conditions that may affect the emergence of intrinsic motivation and speaks to the fact that individuals with a strong internal LOC are particularly likely to enter a state of flow under conditions of skills–demands compatibility. This is well in line with previous findings documenting that working women with a strong internal LOC reported higher levels of enjoyment and interest in their daily activities and experienced more of their activities as intrinsically motivated (Haworth et al., 1997). This evidence documenting internal LOC as a personal boundary condition of the effects of variations in skills–demands can be considered as a particularly important aspect of the

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present study, because there is little empirical evidence concerning the characteristics of the so-called 'autotelic personality'. Csikszentmihalyi, Rathunde, and Whalen (1993) defined the autotelic personality as the conjunction of receptive qualities (i.e. openness to new challenges) and active qualities (i.e. readiness to engage and persist in high-challenge activities). That is, flow theorists explicitly posited a positive relationship between certain personality variables and the frequency, intensity as well as the ease with which individuals experience flow in daily life. However, up to now little has been known about the role of such personality factors with respect to flow experiences. Accordingly, the insight that internal LOC is a powerful personality characteristic with respect to the experience of flow is an important contribution to the field. It is also noteworthy that the experimental approach as pursued in our research is particularly compelling in this context because it allows for an appropriate examination of the role of personality factors by inducing compatibility of skills and demands independently of personality factors. It is our hope that the application of this experimental paradigm in future studies will contribute to the systematic analysis of the autotelic personality as well as the underlying mechanisms of flow experiences.

Finally, our results suggest that the greater tendency of participants with a strong internal LOC to experience the activity as enjoyable and involving under adaptive playing mode conditions can at least partially be explained with reference to the fact that these participants showed a special tendency to experience control under conditions of a skills–demands compatibility. This reflects the conceptual notion that internal LOC reflects a special sensitivity to the degree to which one's effort and/or capabilities determine experienced outcomes (Skinner, 1996).

In sum, the reported findings extend our knowledge on the boundary conditions and underlying mechanisms of skills–demands compatibility effects on intrinsic motivation and the presented work speaks to the fruitfulness of applying our experimental paradigm to the study of intrinsic motivation.

Implications

Several interesting implications of the reported findings are noticeable. Specifically, the results suggest conclusions regarding potential pragmatic applications as well as conclusions regarding the role of internal LOC with respect to positive life aspects such as job satisfaction and subjective well-being. Regarding potential pragmatic applications, two conclusions seem apparent. First, providing individuals with opportunities to make the experience that observable outcomes are contingent on their efforts and engagement in skilful action seems to be a promising strategy to foster the development of intrinsic motivation. Second, if it is possible to establish a skills–demands compatibility in the activity context, it seems promising to take actions in order to help individuals to actually *realize* that experienced outcomes are contingent on the efforts they put into the task and their engagement in skilful action. That is, increasing individuals' sensitivity to the level of control they can exert during the engagement in a task seems to be a promising strategy given the results obtained in the current study which suggest that there is a close association between perceived control and experienced enjoyment and involvement (under conditions of skills–demands compatibility).

The reported results also suggest conclusions regarding the role of internal LOC with respect to positive life aspects such as job satisfaction and subjective well-being. As

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already noted in the Introduction section, internal LOC is an established correlate of life-satisfaction, happiness and job satisfaction (Benassi et al., 1988; DeNeve & Cooper, 1998; Judge et al., 1998; Larson, 1989; Mirowsky & Ross, 1990; Naditch et al., 1975; Ng et al., 2006; Presson & Benassi, 1996; Watson, 1998). However, the question of *how* internal LOC might influence life-satisfaction, happiness and job satisfaction is an unresolved problem. In light of the present findings, it seems plausible to argue that one possible underlying mechanism is the fact that individuals with a strong internal LOC are more likely to experience flow compared to their low internal LOC counterparts. Since flow experiences can be considered one important element of human happiness and a powerful source of life satisfaction and general well-being (Csikszentmihalyi, 1975/2000), it stands to reason that the relationship between internal LOC and indicators of subjective well-being can be explained, at least partially, with reference to the positive relationship between internal LOC and the readiness to experience flow as observed in the present study.

The same logic can be applied to the relationship between internal LOC and job satisfaction. Specifically, it seems reasonable to argue that the higher level of job satisfaction that is typically observable in individuals with a strong internal LOC is at least partly due to the fact that these individuals are predisposed to experiencing flow in challenging situations. Moreover, as Spector (1982) noted in discussing the role of LOC in the organizational context, individuals with a strong internal LOC are more likely to be satisfied with their job because they are less likely to stay in unsatisfying (e.g. boring) jobs. Accordingly, individuals with a strong internal LOC are more likely to work in jobs under conditions where they feel optimally challenged. This line of reasoning also supports our supposition that mechanisms and factors explicated in flow theory are most likely involved in the mechanisms resulting in a positive relationship between internal LOC and job satisfaction.

From our perspective, it seems a promising avenue for future research to extend the analysis of the role of flow experiences to other factors that are established correlates of well-being and job satisfaction (e.g. neuroticism, self-efficacy, self-esteem; cf. Judge & Bono, 2001; DeNeve & Cooper, 1998). For example, one might argue that the negative relationship between neuroticism (emotional instability) and well-being and job satisfaction may be at least partially due to the limited potential of neurotic individuals to enter and experience flow in their daily lives. Moreover, it stands to reason that self-efficacy and self-esteem are positively related to well-being and job satisfaction because these personality aspects might contribute to the ease and/or intensity with which individuals experience a state of flow.

Of course, these considerations are largely speculative at present and a systematic empirical analysis is necessary to test if they actually hold true. Nonetheless, our discussion reveals that theorizing and research on the flow experience has the potential to contribute to the resolution of important unresolved questions in the broad and expanding field of research addressing the question of what makes people happy.

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APPENDIX

Items included in the involvement and enjoyment scale:

My concentration was completely focused on the game. (CONC)
The game had a great entertainment value. (ENJ)
I enjoyed playing the game very much. (ENJ)
I had fun. (ENJ)
I was thrilled. (ENJ)
I was strongly involved in the game. (INV)
I got bored by the game. (INV—reverse coded)
I was bored. (INV—reverse coded)
I felt the desire to do something else during the game. (MOT—reverse coded).
I would like to play the game again. (MOT)
I noticed that the game triggered my interest. (MOT)
I was interested in the game. (MOT)
I can imagine myself taking action to obtain the game for private use. (MOT)

Note: Item content: CONC = focused concentration; ENJ = enjoyment; INV = involvement; MOT = motivation to play the game (again) and interest in the game.

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