Chapter 3
Antecedents, Boundary Conditions and Consequences of Flow

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Abstract In this chapter, we analyze flow with respect to three aspects. *First*, we examine the basis for flow experiences to emerge. We focus our discussion on the situational *antecedents* of flow and emphasize the fact that the emergence of flow is basically dependent on a perceived fit of skills and task demands. Thereby we critically discuss the "above average" perspective and the related quadrant and octant models of flow highlighting the fact that the "above average" notion is based on problematic assumptions. Further, we discuss the concept of *flow intensity* and propose a revised flow model, which builds on the original notion of perceived fit of skills and task demands and includes the value attributed to the relevant activity as additional crucial factor. *Second*, we address *boundary conditions* of the flow experience, emphasizing the role of both personality and situational factors that qualify the relation between a perceived skills-demands fit and flow. *Third*, we critically review the available evidence on affective, cognitive and performance-related *consequences* resulting from flow or a compatibility of skills and demands. In addition, we highlight obstacles in the research exploring these consequences of flow and discuss first starting points to circumvent these.

Introduction

The state of flow has been studied academically for more than four decades (Csikszentmihalyi, 1975; see also Engeser, Schiepe-Tiska & Peifer, Chap. 1) and is present in the public mind, as well. Phrases like "I've been in a flow" or "I've been in the channel" found their way into everyday language and are used to describe

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experiences in various contexts, e.g., during a mountain bike trip, an intense period of work or while playing a challenging game. The aim of this chapter is to improve readers' comprehension of the flow experience by discussing three subtopics. The first part of the chapter (antecedents of flow) is devoted to the question of what builds the basis for flow experiences to emerge. Here, we systematically discuss the conditions under which an individual engages in an activity that have to be met in order to enable individuals to enter a state of flow. While this discussion specifically focuses on the situational conditions under which flow emerges, in the second part (boundary conditions of flow) we debate the role of personality and situational factors that qualify the relation between skills-demands compatibility and the experience of flow. After discussing these boundary conditions of the flow experience, we critically review empirical evidence regarding affective, cognitive and performance-related consequences of flow (part three; consequences of flow and the skill-demands-compatibility). While doing so, obstacles in the empirical analysis of flow-consequences become apparent (e.g., most of the evidence is limited to correlational findings) which we will discuss with the aim of providing first starting points to circumvent these obstacles.

This contribution is a revised and condensed version of the chapters from Johannes Keller (Keller & Landhäußer, 2012) and Anne Landhäußer (Landhäußer & Keller, 2012) published in the first edition of this book (Engeser, 2012). Consequently, the original chapters are more detailed and elaborated in some respect (e.g., in this edition we abbreviated paragraphs regarding the autotelic experience of flow, originally presented in Chap. 4; Landhäußer & Keller, 2012) and the interested reader can find additional information in the first edition of this book. However, we attempted to remain the crucial ideas of the original chapters while updating our discussion with new thoughts and recent empirical evidence.

Before we enter into the details of the discussion, three clarifications have to be made. These are necessary for (1) the term "challenge", (2) the term "flow experience" and (3) the measurement of flow experience.

The term "challenge" is frequently mentioned in the flow literature in the discussion of the notion that a perceived fit of skills and challenge builds the basis for the emergence of flow experiences. We want to clarify that we consider the term "demands" much more appropriate than the term "challenge" (for a detailed discussion of this conceptual aspect, see Rheinberg & Engeser, 2018).

Moreover, in line with the discussion of the flow phenomenon presented in Chap. 1 (Engeser, Schiepe-Tiska, & Peifer), we are referring to flow as a subjective experience that is characterized by the *combination* of distinct (experiential) states that co-occur during engagement in a skill-related activity, specifically (1) reduced reflective self-consciousness, (2) modified experience of time ("time stands still"), (3) involvement and enjoyment, (4) focused concentration, (5) a strong feeling of control, and (6) the activity is perceived as rewarding in and of itself. It is evident that each of these states can be experienced by individuals who are definitely not in a state of flow. For example, a person can experience a strong sense of control during routine activities (such as teeth brushing or setting the table) while none of the other flow-specific states are experienced. In addition, an individual sitting at the beach watching a sunset can experience a loss of self-consciousness and still be far from a state of flow given the lack of the characteristic strong sense of control that accompanies the execution of a skill-related activity in a state of flow. It is important to acknowledge the fact that flow experiences reflect a distinct *combination* of experiential states, particularly when one is considering the boundary conditions that enable (or prevent) the occurrence of the subjective experience.

In addition, it is necessary to clarify that flow is an experiential *state*. From our perspective, this implies that some methods are more suitable than others to assess flow experience (see also Box 3.1). In our opinion the experience sampling method (ESM; e.g., Engeser & Baumann, 2016) and the day reconstruction method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) are generally appropriate to examine flow in everyday life, as these techniques allow to capture fluctuation of experience by surveying participants *in situ* (ESM) or on basis of an elaborated diary reconstruction process (DRM). Examining flow in a more controlled (i.e., laboratory) setting, its assessment during a specific activity seems valid when directly applied after the activity (e.g., Keller & Bless, 2008). However, some studies attempted to measure the state of flow (or a skills-demands compatibility) in a retrospective manner, instructing participants to bring past episodes of flow to mind (e.g., Eisenberger, Jones, Stinglhamber, Shanock, & Randall, 2005; Olčar, Rijavec, & Golub, 2017; Rijavec, Golub, & Olčar, 2016). As there is reliable evidence that such assessments are prone to mental biases (e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), in our view, this method is less appropriate to examine the *state* of flow. Consequently, we will not discuss literature applying this retrospective approach (see also Peifer & Tan, Chap. 8 for a discussion on the conceptualization of flow as state versus trait).

Box 3.1 Restriction Regarding the Empirical Evidence We Consider in This Chapter

In our view, some methods are more suitable than others to study the experience of flow. Resting upon findings that retrospective recalls are prone to mental biases (e.g., Podsakoff et al., 2003), we conclude that approaches instructing participants to recall past flow episodes in a rather unsystematic way are suboptimal for examining flow *experience*. Consequently, we report only on studies that either used techniques that capture flow directly after a potential flow episode (which is possible in both a controlled laboratory setting and ecologically valid ambulatory studies) or enabled a systematic reconstruction process (cf. Kahneman et al., 2004) with the aim to reduce the influence of recall biases.

Part 1: Antecedents of Flow

Antecedent Factors Outlined in Flow Theory

Flow theory refers to three antecedents: (1) clear goals (in the sense of a clear understanding of the task structure, which is frequently based on clear *task instructions*), (2) immediate and unambiguous feedback (in terms of diagnostic information regarding one's progress or success in executing the activity), and (3) a balance of perceived skills and perceived task demands (Nakamura & Csikszentmihalyi, 2009). One aspect in this context is noteworthy: the activity has to be *skill-related* for the emergence of flow experiences (given the fact that a balance of *skills* and task demands represents one crucial antecedent; cf. the discussion of flow in non-achievement situations in Schiepe-Tiska & Engeser, Chap. 4). That is, activities that are passive in character (such as watching a sunset or taking a relaxing bath) and do not involve a skill-component cannot be associated with a flow experience.

Empirically, the important role of a perceived fit of skills and task demands for the experience of flow has been well documented in correlational research (cf. Bakker, 2005; Jackson & Marsh, 1996; Moneta & Csikszentmihalyi, 1996; Schiefele & Roussakis, 2006) and in experimental studies as well (cf. Baumann, Lürig, & Engeser, 2016; Engeser & Rheinberg, 2008; Harmat et al., 2015; Keller & Bless, 2008; Keller, Bless, Blomann, & Kleinböhl, 2011; Keller & Blomann, 2008; Yoshida et al., 2014). The relevance of a perceived fit becomes even more apparent when considering the interrelation of the three antecedent factors in some detail. Such an examination reveals that two of the antecedents (clear goals and feedback) are incorporated in the most crucial antecedent, the fit of perceived skills and perceived task demands. That is, we argue that the proposed antecedents of the flow experience can be simplified and reduced to a perceived skills-demands-compatibility which makes flow theory more parsimonious.

This notion rests on the insight that individuals can only attain a meaningful subjective construal of their level of skill and the level of task demands involved in the relevant activity if (a) the structure of the task is clear to them ("clear goals" in the terminology used in the flow literature; the goal concept is typically used differently in the psychological literature; cf. Austin & Vancouver, 1996) and (b) they can diagnose the degree to which they are successful in the execution of the activity (based on a clear feedback). It is evident that a meaningful evaluation of one's skill in executing an activity is hardly possible under conditions where the structure of the task is not clear. For example, how should one reasonably rate one's level of skill in playing cricket or the level of demands one is confronted with in a game of cricket without knowledge on the structure of this game? In parallel, how should one reasonably rate one's level of skill in playing cricket without diagnostic information (feedback) regarding the quality of one's actions? It seems also hardly possible to construct a meaningful judgment regarding progress or success in an activity when the structure of the task remains obscure.

In sum, we propose that the antecedents in the flow model can be reduced to the factor "perceived fit of skills and task demands" which implies "clear goals" and "immediate, unambiguous feedback" as crucial aspects that have to be met for flow experiences to emerge.

Antecedent Factors Beyond a Perceived Fit of Skills and Task Demands

In addition to the crucial factor of a perceived fit of skills and demands, other determinants of the flow experience can be derived from a consideration of the defining elements of the flow experience. As noted above, flow reflects a distinct *combination* of experiential states and this suggests that factors related to the specific elements of the flow experience may function as antecedents, too.

Regarding the reduced level of self-consciousness that is characteristic of flow experiences, we argue that situational influences that increase individuals' self-consciousness are likely to prevent flow experiences. For example, we suppose that the emergence of flow experiences should be hampered when individuals engage in the relevant activity in front of a mirror - a manipulation that is known to increase self-consciousness (Carver & Scheier, 1978; Wicklund & Duval, 1971). Similarly, we suppose that individuals suffering from depression, who are prone to an enhanced level of negative self-reflection in form of rumination (Nolen-Hoeksema, 1991), should experience flow to a smaller extent. Further, it seems plausible to assume that depressive symptoms are not only detrimental to this flow element, but also to 'enjoyment and involvement'. Given the loss of pleasure and interest as a cardinal symptom in depression (APA, 2013), it becomes apparent that individuals suffering from this disease should be less likely to experience flow.

With respect to the strong sense of control that typically emerges under conditions of flow we suggest that factors triggering an experience reflecting lack of autonomy (a basis for the experience of control) are likely to reduce the chances that an individual enters a state of flow. For example, it seems plausible to argue that employees in a work context characterized by low autonomy are less likely to experience flow (under conditions of a perceived fit of skills and task demands) than those working under high autonomy conditions. Support for this idea comes from a study by Kowal and Fortier (1999). Their study on swimmers included the question whether there is a relation between athletes' sense of autonomy in a specific training session and the experience of flow during this session. It turned out, that those who perceived the attendance at the training session as a free choice rather than an obligation, experienced more flow. Further, Bakker (2005) examined the relation of the job characteristics among music teachers and the flow experience among teacher and pupils. Besides evidence for a contagion of flow between pupils and teacher, teachers reported more flow experience when they experienced their job with a certain amount of autonomy.

Further, imagine a work process that is characterized by frequent interruptions e.g. due to phone calls or e-mails. With reference to the flow element “intensely focused concentration”, it seems apparent, that under such circumstances the experience of flow is less likely.

As flow episodes seem to be rewarding in and of itself, we suggest that a context which undermines this reward should be unconducive to the experience of flow. A potential scenario for inhibiting rewards is the occurrence of overjustification (e.g. Lepper, Greene, & Nisbett, 1973). Overjustification can occur when individuals are intrinsically motivated to perform a certain activity. When the activity is additionally rewarded by an extrinsic gratification this can result in a decreased intrinsic motivation to perform the activity (Lepper et al., 1973) as individuals may reattribute their motivation from intrinsic to extrinsic rewards (Bem, 1972). However, it seems, that overjustification occurs exclusively when the extrinsic reward is expectable beforehand and when a task-contingent (doing the task vs. not is the criteria for receiving the reward) and not a performance-contingent reward is applied (Harackiewicz, Manderlink, & Sansone, 1984).

Finally, the experience of a modulated time-perception could also be a factor that hinders or facilitates the experience of flow. In a series of studies, Christandl, Mierke and Peifer (2018) manipulated the subjective time progression by altering the ratio between the announced amount and the actual amount of time to work on a certain task. Participants were given 10 min to work on an anagram task, while half of the participants were told they would have 15 min to work on the task (time-flies condition), and the other half got the information that they would have 5 min (time-drags condition). Participants in the time-flies condition experienced more flow during the task (Study 1, 3 and 4), and also experienced more flow in a subsequent task without time-perception manipulation (Study 4). The studies provide also relevant information on the relation of flow and performance. We will discuss these results in the respective section in the third part of the chapter.

So far, these considerations suggesting additional antecedent factors beyond a skills-demands fit for the experience of flow come with empirical evidence only in part, while others stick to a theoretical level. A full empirical evaluation is lacking, but would be enlightening. Experimental tests of these potential antecedent factors would not only provide information on how to foster/hamper the experience of flow, but would also give further clarity concerning the identification of the defining elements of the flow experience.

Perceived Fit of Skills and Task Demands “Above Average”

Coming back to the role of the perceived fit of skills and task demands for the experience of flow, some flow researchers proposed revisions to the original flow model, basically driven by empirical findings that seemed incompatible with the original flow channel model (Csikszentmihalyi & Csikszentmihalyi, 1991; Csikszentmihalyi & Rathunde, 1993; Massimini & Carli, 1988; see also Moneta, Chap. 2). The basic notion according to which flow is most likely to emerge when individuals perceive a fit of skills and task demands (see the respective Figure depicting the flow channel model in Moneta, Chap. 2) has been qualified. Specifically, the notion was added that a perceived fit of skills and task demands is only likely to result in a flow experience when skills and demands are located *above the average level* of skills and demands across various activities the individual is engaging in. In line with this specification, a quadrant model (see the respective Figure in Moneta, Chap. 2, cf. Csikszentmihalyi & Csikszentmihalyi, 1991) and an octant model (see the respective Figure in Moneta, Chap. 2; cf. Massimini & Carli, 1988) have been proposed.

As depicted in the relevant figures in Chap. 2 (Moneta), both of the revised models differ from the original flow model in that the notion that a perceived fit of skills and task demands (challenge) is associated with flow experiences is substantially qualified. Both models assume that such a perceived fit is *not* associated with flow (but with apathy) when skills and demands are located *below* the average level of skills and demands across various activities the individual is engaging in. That is, these revised models introduce a further condition for flow experiences to emerge: perceived skills and demands have to be above the average level of skills and demands an individual experiences across the various activities he or she is engaging in.

At first sight, the "above average thesis" and the related models seem plausible. In fact, it seems fairly reasonable to assume that individuals are likely to feel largely apathetic when washing the dishes or in other activities that are low in the perceived skills and in the perceived demands involved in the activity ("low" meaning that perceived skills and demands are lower than those typically experienced in other activities). However, the "above average thesis" and the revised flow models (quadrant and octant model) rest on several assumptions that can be questioned.

First, it is questionable whether perceived demands (or "challenges") and perceived skills can be considered to represent orthogonal (independent) constructs (note that this problem is also relevant regarding the original flow channel model; cf. Pfister, 2002). In our view, individuals have to take the demands of the task into account to arrive at an evaluation of their skills in the task (and vice versa). Note that a demanding task is typically defined as one that requires much skill (similarly, a challenging task is typically defined as one that is testing one's abilities). That is, evaluating demandingness of a task requires a reference to skills (or abilities), with higher (lower) demandingness implying a higher (lower) level of skill. Stated differently, perceived skills and demands (or challenges) are confounded. Accordingly, we think it is not particularly meaningful to conceptualize the two constructs as orthogonal dimensions. We suggest to replace the "classic" flow channel concept with a uni-dimensional construct reflecting the perceived fit of skills and task demands (which can vary from low to high level; we will outline this idea in detail below).

Second, it is an open question whether it is meaningful to compute average levels of perceived skills and perceived demands across the various activities an individual is engaging in. Such a comparison across activities implies that individuals evaluate the perceived skills and demands with an absolute standard in mind (e.g., the *typical* levels of skills and demands they experience when engaging in activities). The computation of an average level is only meaningful if one assumes that the ratings of various activities (e.g., on seven point scales with endpoints labeled "very low" and "very high") are based on a general or absolute standard that the respondents have in their mind. We cannot be sure that this is actually the case when participants respond to questions regarding perceived skills and demands with respect to different activities. Given that we know from substantive research on survey methodology (cf. Sudman, Bradburn, & Schwarz, 1996) that responses are constructed on the spot and therefore heavily context dependent, it seems not particularly plausible to assume that questions regarding skills and demands levels and the related response scales are interpreted equivalently (i.e., with a general or absolute standard in mind) across activities.

Third, the "above average thesis" is also questionable in view of recent experimental findings based on fairly trivial activities (e.g., playing the computer game "Tetris"; Keller & Bless, 2008). These studies show that flow experiences can emerge even in situations where it seems not particularly plausible to assume that the levels of skills and demands involved in the activity (a simple computer game) were "above average."

In sum, we are skeptical regarding the "above average thesis". We suggest a different type of revision of the original flow channel model (diverging from the quadrant and octant model), which will be presented in the next paragraph.

The Revised Model of Flow Experiences

Considering the flow models proposed so far, they do not allow for predictions regarding the *intensity* of flow experiences that emerge under conditions of a perceived fit of skills and task demands. Accordingly, we think that an extension of the original flow channel model is meaningful. The graphical representation of the revised flow model in Fig. 3.1 reveals that we propose that flow intensity is a function of two factors: We stick to the basic idea that the perceived fit of skills and demands is the essential condition for flow to emerge and suggest the inclusion of a second dimension representing the subjective value assigned to (or perceived in) the relevant activity. Diverging from the original flow channel model, we do not consider perceived demands (or challenges) and perceived skill as orthogonal constructs but simply refer to perceived fit as crucial factor. We suggest to measure perceived fit with questions such as "To what degree did the demands of the task fit with your skills in the task?" rather than to measure perceived demands and perceived skills separately—since the latter method neglects the fact that perceived skills and perceived demands can hardly be considered as independent constructs.

According to this revised model of flow, individuals experience a higher intensity of flow under conditions of a perceived fit of skills and task demands the more they are subjectively attached to the activity. For example, a guitar player who loves to

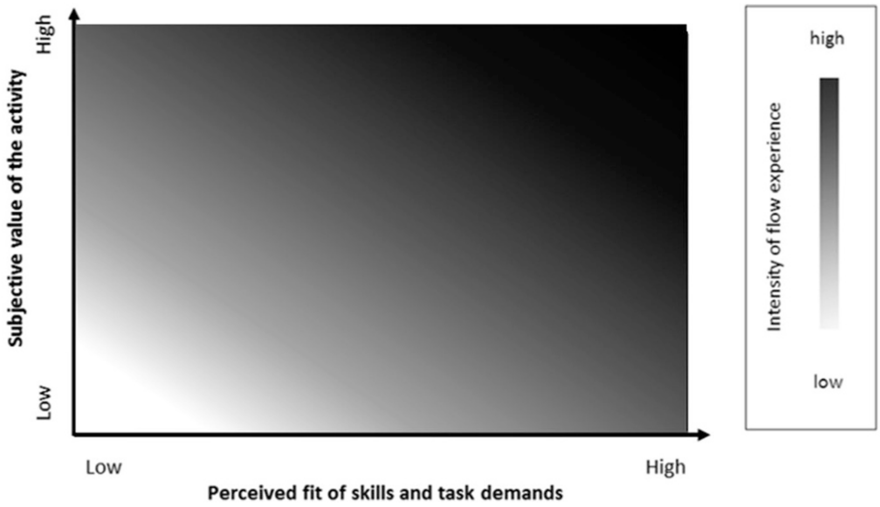

Fig. 3.1 The revised flow model: Flow intensity as a function of perceived fit of skills and demands and subjective value of the activity. Please see Box 3.2, for a detailed description of the assumed basis for the factor *subjective value.*

play (i.e., who perceives a large amount of value in guitar playing) experiences a higher intensity of flow under conditions of a perceived fit of skills and task demands than a guitar player who is not so enthusiastically attached to guitar playing (i.e., who perceives a lower amount of value in guitar playing).

Based on the revised flow model it is possible to derive predictions regarding the *intensity* of flow experiences. Flow intensity is implicitly already considered in the literature as flow is often treated as a continuous, rather than a categorical concept. However, this assumption is neither explicitly nor systematically addressed in current flow-models. In fact, flow theory is largely silent regarding the question of how differences in the intensity of flow experiences can be explained. Although the terms "deep flow" and "micro flow" that refer to variations in flow intensity have been briefly discussed by flow theorists (Csikszentmihalyi, 1975, 1992), a systematic theoretical perspective addressing the potential bases of such variations is missing so far. Some flow researchers referred to the absolute level of skills and demands in discussing this question (Percival, Crous, & Schepers, 2003; Privette, 1983) suggesting that flow intensity is a function of the level of skills and demands involved in the activity (such that "deep flow" is possible at high levels of skills and demands relative to some kind of an absolute standard). Given our skepticism regarding the interpretation of respondents' evaluations of perceived demands and skills across activities, we think it is problematic to answer the intensity question in this way. Instead, we propose that flow intensity is dependent on the subjective value individuals assign to an activity and/or the degree of the perceived fit of skills and demands in a specific situation (which could be higher or lower). To put it differently, the revised model implies the assumption that "deep flow" (i.e., high flow intensity) should be possible even in fairly trivial activities (e.g., when a person is setting the table) as long as the person perceives a fit between skills and demands or/and assigns a high level of subjective value to the activity (e.g., a passionate homemaker).

It is important to note that we refer to a conceptualization of "subjective value" proposed by Higgins (2006). According to this theoretical account, value is "an experience of strength of motivational force. It is an experience of how intensely one is attracted to or repulsed from something." (Higgins, 2006, p. 456). Value as motivational force is conceptualized as a result from two basic ingredients: (a) hedonic experience (pleasure/pain properties of the value target) and (b) engagement strength, which can be based on regulatory fit (cf. Higgins, 2000) or the use of proper means (for a detailed discussion of the various potential sources of engagement strength, see Higgins, 2006). Subjective value of an activity can be assessed based on free choice task engagement (higher subjective value is reflected in a stronger tendency to re-engage in a task with strong engagement, such as for a relatively long period of time, c.f., Higgins, Cesario, Hagiwara, Spiegel, & Pittman, 2010).

It should be noted that we refer to the subjective value assigned to the activity, *not* to the consequences of the activity (see also Schiepe-Tiska & Engeser, Chap. 4 and Peifer & Tan, Chap. 8 for a discussion of this issue). That is, deep flow cannot simply be fostered by way of announcing a (material) reward for the successful completion of an activity. Such a reward enhances the subjective value of the consequences of the activity which has to be distinguished from the subjective value of the activity itself.

It is also noteworthy that there is reason to assume a bi-directional relation between the value perceived in an activity and the intensity of flow experienced during engagement in the relevant activity. As outlined above, it is plausible to assume that individuals experience flow more intensely the more value they perceive in an activity. However, it is plausible to argue that a reverse causal pathway is possible as well. That is, individuals are likely to perceive more value in an activity the more intensely they experienced flow in previous episodes where they engaged in the relevant activity.

What Determines a Skill-Related Activity's Subjective Value?

Our revision of the original flow model which refers to the subjective value of activities raises the question of what determines an activity's subjective value. Given that the flow model focuses exclusively on skill-related activities, the question can be focused more specifically on factors that determine the subjective value individuals perceive in the execution of skill-related activities. In addressing this question, we refer to the general notion of regulatory compatibility (cf. Keller & Bless, 2008) defined as the *compatibility of person characteristics* (e.g., habitual goal orientation, personal needs or standards) *and* structural settings or *environmental characteristics* (e.g., task framing, availability of distinct means, salience of specific outcomes or incentives). That is, regulatory compatibility can be described as "a phenomenological experience that arises when individuals experience a compatibility of (personal and situational) factors that are involved in performing a task or activity" (Keller & Bless, 2008, p. 197; see Box 3.2).

An example illustrates this perspective. For example, starting from regulatory focus theory (Higgins, 2000), research on regulatory fit addresses the compatibility in the manner of goal pursuit (e.g., eager vs. vigilant strategies) and habitual or current regulatory orientations or goal standards (e.g., need for security or need for nurturance; ideals or oughts as relevant standards, gains or losses as relevant outcomes). Regulatory fit thus reflects a specific type of a regulatory compatibility that focuses on goal-related factors in the person and the environment. Regulatory fit has been studied extensively by Higgins and his colleagues as well as other researchers in the field (cf. Keller & Bless, 2006; for a review, see Higgins & Spiegel, 2004). In one exemplary study, Freitas and Higgins (2002, Study 3) activated distinct self-regulatory standards (ideals or oughts) and then asked participants to work on a visual search task that was framed with reference to either eagerness or vigilance. In the case of a regulatory fit (i.e., combining an ideal standard with eagerness framing and an ought standard with vigilance framing), participants reported significantly more task enjoyment than they did in other conditions.

Box 3.2 Regulatory Compatibility and Subjective Value of an Activity

Regulatory compatibility reflects "a phenomenological experience that arises when individuals experience a compatibility of (personal and situational) factors that are involved in performing a task or activity" (Keller & Bless, 2008). This experience can be based on various types of compatibilities, such as regulatory fit (Higgins, 2000), thematic endogeny (Kruglanski, 1975) or goal congruency (Harackiewicz & Sansone, 1991; please see Chap. 3 of the first version of this book for detailed discussion of these concepts). The flow experience reflects regulatory compatibility as well (compatibility of skills and task demands). Following the ideas proposed by Higgins (2006), we argue that the value assigned to an activity is not only determined by the hedonic quality (pleasure/pain; i.e. the direction of the motivational force) associated with the activity but reflects the repulsion or attraction force of the activity in a broader sense, which is also a function of the motivational force experience associated with the activity. We argue that regulatory compatibility is an important basis for the emergence of a pleasurable hedonic experience with a high level of motivational force. That is, regulatory compatibility can be understood as an important basis for the subjective value assigned to an activity.

In addition, we want to highlight the fact that regulatory compatibility may also emerge in the context of skill-related activities in individuals characterized by personality traits that are linked to the execution of skills and competencies.

Specifically, achievement motivation (McClelland, Atkinson, Clark, & Lowell, 1953), autonomy orientation (Deci & Ryan, 1985), internal locus of control (Rotter, 1966) as well as action orientation (Kuhl, 1994) seem to fit well with the competence aspect of skill-related activities. That is, we suppose that individuals with a strong (a) autonomy orientation, (b) internal locus of control or (c) action orientation are most likely to experience flow (given a perceived fit of skills and task demands) at a particularly high level of intensity based on the fact that these orientations are particularly well compatible with situations that require the execution of skills and competencies. First studies addressing these notions support this perspective (action orientation: Baumann et al., 2016; Keller & Bless, 2008; internal locus of control: Keller & Blomann, 2008).

In sum, we propose a revised flow model that explicitly considers the *intensity* of flow. Implicitly, empirical research has already reflected flow as dimensional, rather than a categorical construct, while flow models have been largely silent about this factor. We suggest that flow *intensity* is dependent on (a) the degree of the perceived fit between individual skills and task demands and (b) the subjective value assigned to this task. Based on the work of Higgins and colleagues (e.g., Higgins et al., 2010), we suggest that a regulatory compatibility can be understood as an important basis of this subjective value. We suggest, that the adaption of paradigms from regulatory focus research (e.g., the manipulation of the fit between ideal/ought standards with eagerness/vigilance framings; Freitas & Higgins, 2002) can be fruitful to empirically test our proposed model.

We would like to emphasize, that we are neither the first, nor the only ones who assume an additional *compatibility factor* besides the basic fit-perception of skills and demands that is relevant for the experience of flow. In short, Chap. 4 (Schiepe-Tiska & Engeser) outlines the idea that a perceived fit of skills and demands is only one way to satisfy basic human motives (like achievement, affiliation and power), i.e., in this case an achievement motive. The authors suggest and provide empirical evidence that only those individuals who have a high achievement motive do experience flow when a skills-demands compatibility is given. Further, they suggest that individuals holding a power motive or an affiliation motive should experience flow when the situation holds incentives that have the potential to meet the respective motive. In Chap. 8 (Peifer & Tan) a similar, but even more fine-grained motive concept is proposed to predict the experience of flow. This approach does not only distinguish between basic motives (like achievement, power and affiliation), but also considers the sub-dimensions of "approach—avoidance" and "self-determined—incentive focused" to qualify the dimensions of the autotelic personality. Both approaches contain appealing ideas, like a differentiation of implicit and explicit motives, which implies that some individuals might have a congruence of their implicit and their explicit motives, while others experience an incongruence. Schiepe-Tiska and Engeser (Chap. 4) provide first evidence that individuals with congruent motives are more likely to experience flow. However, the application of projective tests that are typically used to measure implicit motives is considered to be tricky (e.g., Lilienfeld, Wood, & Garb, 2000). One major concern about projective tests is the insufficient documentation of psychometric properties. No doubt, tests like the operant motive test (OMT; Kuhl & Scheffer, 1999) or the picture story exercise (PSE; Schultheiss & Pang, 2007) are more structured than the classic thematic apperception test (TAT; Murray, 1943) as they contain standardized task instructions and therefore mark an improvement. However, crucial psychometric aspects of these measurements seem not convincing to us, as commonly used tests to assess implicit motives do not show a convergent validity (Schüler, Brandstätter, Wegner, & Baumann, 2015; please note, this article also contains a discussion on the criterion-related validity of commonly used projective test).

Taken together, an additional *compatibility factor* besides the classic fit-perception of skills and demands is discussed in flow literature. We approach this factor by drawing on a regulatory compatibility/subjective value idea proposed by Higgins (2006) while other scholars refer to the compatibility of implicit motives and the situational incentives to satisfy these motives (see Schiepe-Tiska & Engeser, Chap. 4 and Peifer & Tan, Chap. 8). As already mentioned, none of these approaches is free from critique. With regard to our approach, one could question whether subjective value and perceived fit of skills and demands are orthogonal factors, or whether they can be condensed into an abstract compatibility dimension. Preliminary, we suggest to keep the differentiation of subjective value and skills demands fit until empirical evidence is available to evaluate the validity of the model.

Part 2: Boundary Conditions of Flow

As mentioned above, a fit of skills and demands is considered as the basic prerequisite of the experience of flow.[1] However, as several findings suggest that this relation is qualified by different factors (Baumann et al., 2016; Engeser & Rheinberg, 2008; Keller & Bless, 2008; Keller & Blomann, 2008; Kocjan & Avsec, 2017), we will discuss this evidence in the following paragraphs. We first focus on the role of personality factors in this context, before we highlight the influence of situational factors.

Personality Factors as Boundary Condition for Flow

By referring to the concept *autotelic personality,* it was postulated that certain personality qualities affect the frequency and intensity with that individuals experience flow (Csikszentmihalyi, Rathunde, & Whalen, 1993; see also Peifer & Tan, Chap. 8). For example, it was assumed that individuals characterized by a high level

[1] As there is no systematic work on the revised flow model (see Fig. 3.1) available to date and consequently no evidence on potential moderators in this model, we limit this discussion on studies referring to the basic flow channel model.

of openness to new challenges might be especially prone to experience flow. While empirical evidence for this specific idea is lacking, a study from Engeser and Rheinberg (2008) provided first evidence for the idea that another personality variable affects the experience of flow. The authors revealed that the assumed quadratic relation between a skills-demands fit and flow (i.e., the highest flow-scores were assumed to appear when skills and demands were in balance, while a mismatch of skills and demands was expected to result in less flow) was limited to individuals characterized by a low level of fear of failure. The concept fear of failure describes a habitual tendency to avoid failure in achievement settings, as failure is maladaptively associated with shame for those individuals (Elliot & Thrash, 2004). In their study, individuals reporting a high level of fear of failure experienced more flow when their skills exceeded the demands (Engeser & Rheinberg, 2008), highlighting the rationale that the relation between skills-demands fit and flow is not deterministic, but rather dependent on specific personality attributes.

In addition, individuals with a strong internal locus of control were found to experience enjoyment and involvement (i.e., central aspects of the flow experience) when skills and demands were in balance, while individuals with a weak internal locus of controls did not enter this state (Keller & Blomann, 2008). Locus of control describes the belief of how individuals' effort and work affect their experienced outcome. A person who is rather convinced that his/her action barely affects experiential outcomes holds an external locus of control. However, holding an internal locus of control, an individual typically perceives that outcomes are contingent upon his/her action (Rotter, 1966) which was associated with an enhanced tendency to experience flow (Keller & Blomann, 2008).

Further evidence suggests that action−/state-orientation also moderates the relation between skills-demands fit and the experience of flow. Action-state orientation (particularly the volatility-persistence component of action-orientation) describes individuals' tendency to maintain the focus on a task and to stay engaged in a task until it is completed (Diefendorff, Hall, Lord, & Strean, 2000). A high level of action-orientation was associated with a tendency to experience enjoyment and involvement under a skills-demands fit, while individuals with a low level of action-orientation did not enter the state of flow (Keller & Bless, 2008).

The important role of an action-orientation for the experience of flow was demonstrated in another more current study (Baumann et al., 2016). In an experimental flow-study three different conditions were established, all aiming for a fit of skills and demands in a computer-game. In the balance-condition a constant fit of skills and demands was realized. In the dynamic-medium-condition the pace of the game was increasing from a less demanding to a more demanding fit of skills and demands, and the game was interrupted by two short breaks. In the dynamic-high-condition the pace was hold at the maximum level, which was believed to still result in a fit of skills and demands. In this condition three short breaks were established. The authors hypothesized that a slight overload (i.e., the dynamic-high-condition) and a fluctuation of demands (i.e., the dynamic-medium-condition) result in more flow than a constant fit and found supporting evidence. Participants in the dynamic-high-condition reported the highest flow-scores, while participants in the dynamic-medium-condition reported the highest enjoyment scores. In contrast to the dynamic conditions, the balance-condition was interpreted as less optimal for experiencing flow and enjoyment. Interestingly, when individuals were holding a habitual action-orientation, they experienced flow regardless under which condition the game was played (Baumann et al., 2016). This result supports the view that action-orientation is a central personality factor that fosters the experience of flow, even under suboptimal conditions. In addition, the authors identified sensation seeking as another personality variable influencing the experience of flow. High (vs. low) sensation seekers experienced more flow in the dynamic-high-condition and showed less flow in the balance-condition. Possibly, the context of the dynamic-high-condition satisfied their urge for stimulation to a greater extent than the balance-condition.

Situational Factors as Boundary Conditions for Flow

It seems plausible to assume that besides personality factors also situational aspects beyond a skills-demands fit could have an impact on the experience of flow. One aspect that could function as a situational boundary condition of flow is the perceived importance of an activity (see also Abuhamdeh, Chap. 5). Engeser and Rheinberg (2008) hypothesized that a fit of skills and demands should facilitate the experience of flow exclusively when the task is perceived as rather unimportant (e.g., playing a computer game could be interpreted as rather unimportant as typically little is at stake; cf. Tozman & Peifer, 2016). The authors suggested that when an activity is perceived as important, flow experience should be facilitated under conditions where skills exceed situational demands. Following this reasoning, preparing for an exam could be interpreted as rather important as this has a long-term impact (i.e., failing an exam forces students to repeat the exam, while passing an exam enables individuals to continue their curriculum). Engeser and Rheinberg (2008) found empirical support for their idea: Relatively high flow-scores were obtained when skills and demands were in balance, but only when the importance[2] of the activity was evaluated as relatively low. However, and in line with their hypothesis, when the perceived importance was relatively high, highest flow-scores were reported when skills exceeded demands. Further evidence that the importance of an activity plays a role in experiencing flow was provided by a current ESM-study (Engeser & Baumann, 2016) which revealed that importance of an activity can partially explain differences in flow experience between work- and leisure-contexts.

[2]The items “something important to me is at stake here”, “I won’t make any mistakes here”, and “I am worried about failing” were used to measure *importance* (Engeser & Baumann 2016; Engeser & Rheinberg 2008). Focusing on the negative consequences of the activity, the concept of ‘importance’ can be clearly distinguished from the concept ‘subjective value’ (i.e., the value a person attributes to the activity per se) that we introduced in the first part of this chapter.

There is one other study that examined the influence of situational aspects beyond a perceived fit of skills and demands on the experience of flow. In this study,[3] students rated their flow experience after participating in a 90 min long group-work (Kocjan & Avsec, 2017; Study 2). Afterwards, they filled out a Big 5 inventory and indicated how they perceived the situation, i.e., the group-work, with regard to the "situational 8 DIAMONDS: Duty, Intellect, Adversity, Mating, pOsitivity, Negativity, Deception and Sociability". Rauthmann et al. (2014) proposed this taxonomy in order to measure so-called situation characteristics (i.e., psychologically meaningful aspects of situations). *Intellect*, for example, captures the extent to which a situation is cognitively demanding, entails deep reflection and enables to show intellectual abilities. When flow was regressed on the Big 5 personality traits and the 8 DIAMONDS in a hierarchical regression, only the predictors *pOsitivity* and *Intellect* significantly explained variance in the experience of flow. However, these results must be treated with caution: The dimension *pOsitivity* is conceptionally extremely similar to the enjoyment/involvement element of flow. It seems not surprising that a scale comprising items like "the situation is enjoyable" and "the situation is playful" shows strong relations to flow, especially when the characteristics of the situation and the experience of the person are rated by the person involved in the activity (see Rauthmann, Sherman, & Funder, 2015, for a detailed discussion of this latter issue). One possibility to circumvent this problem in subsequent studies could be a research design that allows to gather information about situation characteristics not only by an *in situ* rater, but also from an *ex situ* rater who rates the situation characteristics on basis of written descriptions or videos of the situation. This approach would allow to clearly distinguish between the perceived potential of a situation to entail e.g., enjoyment (i.e., situation characteristic) and the actually experienced enjoyment (i.e., flow experience). In summary, it is possible that no effect of personality traits on flow was found in the present study, because the dimension *pOsitivity* accounted (due to its measurement) for an excessive amount of variance in flow. Even though the validity of the presented study is limited in this respect, the main idea to use a standardized framework to examine the influence of situation characteristics on the experience of flow is quite innovative and should be explored in further studies.

[3]The article from Kocjan and Avsec (2017) contained another study examining the relation between situational characteristics and the experience of flow. However, the assessment of flow was applied in a retrospective manner, therefore we do not discuss the study here. Problems concerning this approach of measuring flow are discussed in the introduction of this chapter.

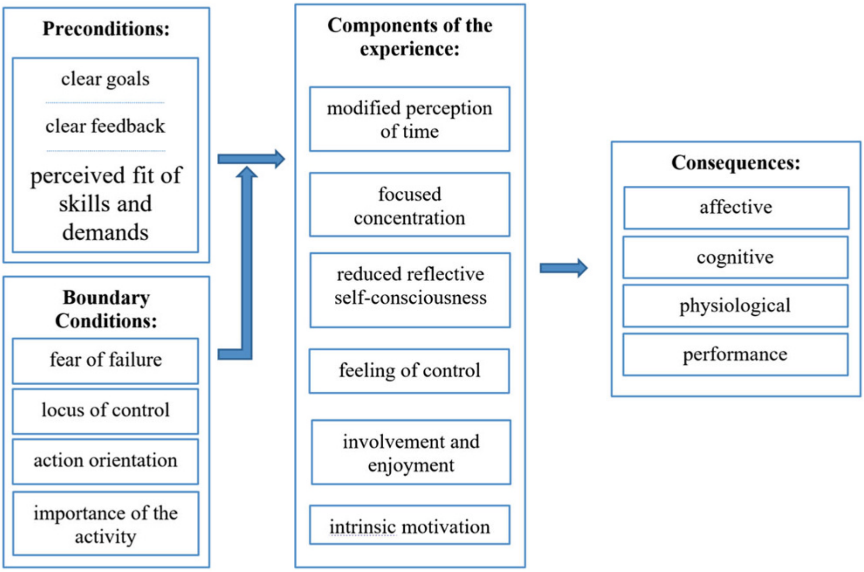

Fig. 3.2 Preconditions, boundary conditions, components, and consequences of the flow experience

Part 3: Consequences of Flow and a Skills-Demands Compatibility

We will now discuss possible consequences of flow experiences. On the one hand, a positive effect of flow experiences on performance is postulated (cf. Engeser & Rheinberg, 2008). On the other hand, flow should have an effect on affective, cognitive as well as physiological factors (see Fig. 3.2). Since the physiological consequences of flow are covered in Chap. 8 (Peifer & Tan), they will not be discussed here. Taking a close look into the literature on flow reveals that many studies do not investigate correlates or consequences of flow experience but those of a skills-demands-compatibility - which is its curial precondition. Further, there is a cognizable trend to equalize the precondition of flow with the experience itself (e.g., Csikszentmihalyi & LeFevre, 1989; Hektner & Csikszentmihalyi, 1996; Heo, Lee, Pedersen, & McCormick, 2010; Ilies et al., 2017; Nakamura, 1988; Wells, 1988). In their empirical work, these authors measure perceived challenges and skills and infer that participants experience flow in case both are above the individuals' mean and in balance (please note that the first part of this chapter contains a critical discussion of this "above average" perspective). This is problematic as the association between the precondition of flow and the experience itself is not deterministic (for further discussion see Keller & Landhäußer, 2011; Rheinberg & Engeser, 2018) and moderated by situational (Moneta & Csikszentmihalyi, 1996) as well as personality factors (Baumann et al., 2016; Engeser & Rheinberg, 2008; Keller & Bless, 2008;

Keller & Blomann, 2008). Consequently, a measure of skills-demands-balance should not be used (or interpreted) as a measure of the flow experience per se. As depicted in Fig. 3.2. when discussing possible consequences of flow experiences, it is essential to differentiate clearly between consequences of a specific skills-demands combination and consequences of the flow experience itself. For example, if a skills-demands fit leads to positive mood this could also be due to a feeling of self-efficacy and cannot automatically be attributed to the flow experience that typically emerges under conditions of a skills-demands-compatibility. We will therefore explicitly indicate if the presented evidence can be interpreted as a consequence of flow or as a consequence of skills-demands compatibility.

Affective Consequences of Flow and a Skills-Demands Compatibility

It appears intuitively plausible to assume that an experience so enjoyable as the flow experience should lead to positive affect and happiness. Csikszentmihalyi (1999) for example concluded that his studies "have suggested that happiness depends on whether a person is able to derive flow from whatever he or she does" (pp. 824f) and even goes as far as to term flow "the bottom line of existence (because) without it there would be little purpose in living" (Csikszentmihalyi, 1982, p. 13). He states that happiness is derived from personal development and growth—and flow situations (i.e., situations in which we are confronted with demands that can be handled) permit the experience of personal development. The feeling of progress should lead to positive affect after an experience of flow but also in the long run (Csikszentmihalyi, 1990). As Moneta (2004) wrote, additional to the postulated direct effect of flow on happiness, an indirect effect on general subjective well-being (see Box 3.3) is assumed:

> [F]low theory states that flow has an (. . .) indirect effect on subjective well-being by fostering the motivation to face and master increasingly difficult tasks, thus promoting lifelong organismic growth. In particular, flow theory states that the frequency and intensity of flow in everyday life pinpoint the extent to which a person achieves sustained happiness through deliberate striving, and ultimately fulfills his or her growth potential (p. 116).

Box 3.3 Subjective Well-Being

Subjective well-being comprises an affective as well as a cognitive component. Whereas pleasant and unpleasant affective states constitute the affective component, the cognitive component is *life satisfaction* (Pavot & Diener, 1993). Life satisfaction refers to a cognitive judgmental process and can be defined as "a global assessment of a person's quality of life according to his chosen criteria" (Shin & Johnson, 1978).

Thus, depending on frequency and intensity of the experience, flow should have a positive impact on affective states as well as life satisfaction, which would also correspond with the fact that a positive influence of intrinsic motivation on well-being has been documented (Sheldon, Ryan, Deci, & Kasser, 2004; see also Engeser et al., Chap. 1). However, a confusion of flow and happiness—as reflected in Csikszentmihalyi's (1999) description of flow as a "dimension of happiness" (p. 821)—in our opinion should rather be avoided since flow and positive affect are conceptually distinct states (cf. Engeser et al., Chap. 1). Surely, flow experiences are enjoyable and therefore positive. However, activity-specific enjoyment (i.e., one enjoys *doing* something) is not the same as the global state of happiness. In line with this consideration, in a representative sample in Germany only 17% of the respondents agreed with the statement "being completely absorbed by something and forgetting everything around" as their personal interpretation of happiness (Identity Foundation, 2002). Indeed, enjoyment of an activity can make one happy. But then, happiness is a consequence of a flow experience and not a component. More so, individuals may not reflect on their affective state while in flow. As Csikszentmihalyi (1999) stated: "[D]uring the experience people are not necessarily happy because they are too involved in the task (. . .) to reflect on their subjective states" (p. 825). Nonetheless, the enjoyment of the activity as well as the feeling of personal progress may result in a positive affective state.

We first take a look at correlational findings examining the proposed relationship between flow and positive affect. As expected, authors measuring the flow experience itself found positive relationships with positive affect (Fullagar & Kelloway, 2009; Rheinberg, Manig, Kliegl, Engeser, & Vollmeyer, 2007), even when former affect was controlled for (Schüler, 2007). Further, Engeser and Baumann (2016) reported flow to be positively related to valence and positive activation. Negative activation showed a negative relation to flow.[4] The idea that flow might lead to a more positive valance in a subsequent situation was not supported when controlling for previous valance (ruling out stability effects) and flow at the same time (ruling out intercorrelations of flow and affect). However, this result is not particularly surprising as valance was measured approximately 2 h after a preceding flow-episode and might have been influenced by other factors than flow.

In general, a similar pattern emerges when looking at studies that report on correlations between skills-demands-compatibilities and positive affect. With some exceptions (e.g., Nakamura, 1988), studies using the ESM found significant associations between being in the flow quadrant or octant (challenges and skills above average) and experiencing positive affect (Clarke & Haworth, 1994; Csikszentmihalyi & LeFevre, 1989; Ilies et al., 2017; Massimini & Carli, 1988;

[4]The following bipolar items were used to measured *valance*: unhappy—happy and unsatisfied—satisfied, *positive activation*: shiftless—energetic, tired—wide awake, bored—elated, dull—highly motivated, and *negative activation*: relaxed—stressed, untroubled—annoyed, calm—nervous, secure—worried (Engeser & Baumann 2016).

Schallberger & Pfister, 2001; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

However, results of a study by Csikszentmihalyi and Rathunde (1993) suggest that the positive relationship between flow conditions and affect does not hold for every type of activity. They analyzed 20 types of activities their adolescent participants had reported in an ESM-study and found that only in seven of them happiness was significantly higher in the flow quadrant than in the other quadrants. When doing homework or studying for an exam, participants tended to be happiest when skills were high and challenges low (i.e., when being in the boredom-quadrant). This suggests that at least the relationship between skills-demands-compatibility and positive affect does not hold for every type of activity. The results is also well in line with findings from Engeser and Rheinberg (2008) who show that in actives that are perceived as rather important such as preparing for an exam, a slight dominance of skills over demands seems to be more flow inducing than a straight fit.

To our knowledge, there are two studies that tested the *causal* relationship between a skills-demands-compatibility and affect. While a first study did not find a significant effect of a skills-demands fit manipulation on affect within the game Tetris (Keller, Bless, & Blomann, 2011; experiment 2), a second study which was also using the game Tetris found higher positive affect ratings when skills and demands were in balance compared to two imbalance conditions (Harmat et al., 2015). In both studies, participants in the skills-demands fit condition expectedly reported higher flow-scores than participants in non-fit conditions, indicating that both studies were designed in a way which enabled the experience of flow. Keller, Bless, Blomann, and Kleinböhl (2011) used a between-design while Harmat et al. (2015) applied a within-design for the three experimental conditions (i.e., boredom, fit and overload), resulting in a higher statistical power for the latter study, which might be one reason for the different results. However, to draw final conclusions, further experimental analyses considering different task characteristics and personality factors as potential moderators of the affect-flow/skills-demands fit relation are necessary.

Taken together, empirical evidence indicates that both flow conditions and flow experiences coincide with positive affect under many circumstances (cf. Abuhamdeh, Chap. 6; Peifer & Engeser, Chap. 16). When individuals experience flow in a situation, they also tend to be happy afterwards. The same holds for the experience of a fit between high demands and skills. However, these relationships are possibly moderated by situational and personal factors that should be disclosed and analyzed in future research. In consideration of the fact that there seems to be mutual consent with respect to the notion that positive affective states and even life satisfaction are consequences of flow experiences, researchers should put more effort in the examination of the *causal* relationship to back up their assumption by empirical results. Schüler (2007) did a first step in this direction by using a longitudinal design and controlling for former affect and thus ruling out the possibility that the relationship is driven by a reverse effect (i.e., positive affect makes flow experiences more likely). Another appropriate way would be to test the relationship between a skills-demands-compatibility and positive affect in different experimental paradigms, examining a possible mediation of the skills-demands-compatibility effect on affect via experienced flow.

Cognitive Consequences of Flow and a Skills-Demands Compatibility

Flow as a specific state of consciousness may also trigger particular cognitive states and mechanisms, that is, it could have an influence on cognitive capacity and processing styles, at least directly after the experience (or even in the long term). Yet, there are only a few studies examining cognitive consequences of flow experiences. We will discuss these studies in the following and present additional theoretical ideas about how flow affects cognitive processes.

Cognitive Capacity

Deep concentration is a distinct attribute of the flow experience which may transfer to tasks and situations following a flow experience (e.g., Christandl et al., 2018). An individual who is engaging in a task in a deeply concentrated mode may maintain this working style even when the flow experience is over. Based on the rationale that a repeated activation of a cognitive strategy in situation A should foster its accessibility in a subsequent situation B (cf., Higgins, 1996) frequent flow experiences (and, thus, frequent episodes involving a deep concentration on a task) could enhance the likelihood to adapt this concentrated information processing during an episode following a flow state. However, besides this theoretical reasoning, no empirical evidence is available for this rationale.

As one aspect of flow is a reduced self-consciousness, individuals experiencing flow could have more self-regulatory resources available in a successive situation than individuals not in flow. That is, such individuals could be less depleted than individuals in non-flow (cf. Baumeister, Bratslavsky, Muraven, & Tice, 1998). First evidence for this idea comes from a study which found that flow (especially enjoyment) during work was associated with vigor and low exhaustion after work and at the end of the day (Demerouti, Bakker, Sonnentag, & Fullagar, 2012).

Another study in this context stresses a possible reciprocal relation between flow and recovery (Debus, Sonnentag, Deutsch, & Nussbeck, 2014). Among software professionals, those who reported to feel recovered in the morning, more flow was reported during the day. More specifically, not being recovered was associated with a low and decreasing level of flow over the course of a working day, while feeling recovered was related to flow experience that followed an U-shape: Relatively high flow scores were reported at the beginning and at the end of a working day, with a minimum of flow after lunch.

Processing Styles

Based on the assumption that flow experiences are characterized by a focusing of attention (that is, a narrowed focus on the details of the current task, rendering other information less important), one may assume that individuals in a flow state—and probably after, as well—adopt a processing orientation characterized by a focus on details, reflecting a "tunnel vision". Following the idea that processing orientation (i.e., global vs. local processing) could be manipulated and transferred from task to task (e.g., Macrae & Lewis, 2002) one could expect that flow experiences may foster bottom-up processing strategies.

However, if flow experiences indeed put individuals into a positive mood state (as described above), they also could foster top-down processing strategies. Note that a substantial amount of research indicates that positive mood states influence cognitive processing styles in a way that heuristic processing strategies (based on general knowledge structures) dominate individuals' information processing and judgments (e.g., Bless et al., 1996; Chartrand, van Baaren, & Bargh, 2006; Huntsinger, Clore, & Bar-Anan, 2010). Insofar as individuals after the experience of flow are indeed in a happy mood, flow should have an indirect effect on processing styles in such a manner that individuals *after* the experience of flow should tend to rely on top-down processing strategies. That is, there are contradictory hypotheses regarding the influence of flow experiences on processing styles.

There is only one single study analyzing cognitive consequences of flow experiences we know about. This experimental study found a significant relationship between a flow manipulation (i.e., skills-demands-compatibility in a computer task) and degree of clustering in a free recall task which is an indicator for level of processing (Keller, Bless, & Blomann, 2011). After a flow manipulation by means of a computerized knowledge task, participants were asked to learn 16 words (four words selected from each of the categories plants, furniture, animals, and vehicles) and had to recall as many words as possible after a delay of 5 min. The authors assessed the degree to which the recalled information was clustered based on the categories the words were selected from. The degree of clustering served as an indicator of how much participants encoded and recalled the presented pieces of information referring to higher-order categories (versus a lower level of abstraction; e.g., Hamilton, Katz, & Leirer, 1980). Participants in the flow condition showed a significantly lower level of clustering relative to their counterparts in two non-adaptive conditions (boredom and overload). This finding indicates that working under skills-demands-compatibility may trigger narrow, low-level categorization processes (reflecting a "tunnel" vision perspective as proposed by flow theory).

As one can see, elaborated analyses of the cognitive consequences of flow experiences could generate interesting findings, and different mechanisms are possible. As there is almost no research available in this field until now, we hope that research on cognitive consequences of flow will be more in the focus of attention in the next generation of flow research.

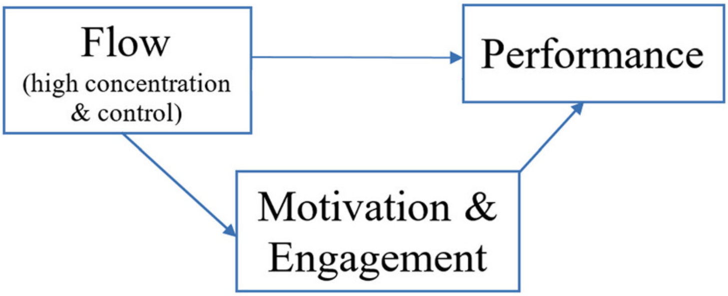

Fig. 3.3 Assumed direct and indirect relation of flow and performance

Flow and Performance

Since the beginning of flow research, a close relationship between flow experiences and performance has been postulated. This association has two plausible reasons. First of all, flow is characterized by high concentration and a sense of control, which are facilitators of performance (Eklund, 1996). As such, flow is a highly functional state and should result in better performance by itself. Second, flow could be seen as a motivating force for excellence (Engeser & Rheinberg, 2008). As the flow state is experienced as intrinsically rewarding, individuals seek to replicate flow experiences. This introduces a selective mechanism into psychological functioning that fosters personal growth. People develop greater levels of skills whenever they master challenges in an activity. To maintain the level of demands that fosters flow experiences, they must engage progressively in more complex tasks. Therefore, flow experiences imply a growth principle, whereby more complex demands are sought after and more complex abilities are likely to develop (Csikszentmihalyi, 1975; Nakamura & Csikszentmihalyi, 2009; Shernoff et al., 2003). That is, individuals who tend to experience flow in a special set of activities should be motivated to engage in those activities and therefore gain expertise, at least in the long run. Thus, flow should have a direct as well as an indirect effect on performance, which are both depicted in Fig. 3.3.

However, a reciprocal relationship has to be assumed between flow and performance. Consequently, in a correlational study, it remains unclear whether flow leads to a better performance or a good performance makes flow experiences more probable. The central precondition of flow experiences is a perceived fit between skills and demands. But such a fit should only be perceived in case the individual has the competence to deal with the demands of the situations. And obviously, an association between competence and performance can be postulated. In other words: In a correlational design perceiving a fit between skills and demands can hardly be detangled from perceiving oneself as competent and thus, increasing the likelihood of performing well on this task.

To show positive correlations between skills-demands-compatibility and performance seems even more trivial because the specific skills-demands-constellation has a built-in effect on performance—independent of the flow experience. When flow is operationalized as “challenges and skills above average”, the independent and the dependent variables are confounded as high skills (above average) make good performance quite likely. For this reason, only studies measuring components of the flow experience itself (instead of challenges and skills) will be discussed in the following. Reported results were obtained in diverse areas, such as academics, music, sports and computer games.

Academic Performance

In the academic context correlational studies indeed found significant associations between flow experiences and performance. Schüler (2007) for example conducted a study with students of a psychology course and found a positive relation between flow experiences in a typical learning situation and final grades. However, as former performance was not measured, one cannot draw conclusions about the direction of the relationship. Engeser and Rheinberg (2008; see also Engeser, Rheinberg, Vollmeyer, & Bischoff, 2005) report on two studies in which they confronted this problem. In a first study, students in a voluntary French course rated their actual flow experiences after 60 min of class time at two points during the semester. These ratings correlated significantly with self-assessed learning progress after class as well as with the final marks which were based on oral participation and results of the final exam. In a second study, more than 250 psychology students reported on their level of flow experiences whilst working on a statistical task 1 week prior to the final statistics exam. Again, a positive relationship between flow and final grades was found. Moreover, the effect of flow on grades (both in the French course and in the statistics course) was small but remained significant when previous knowledge was controlled for. Thus, the authors conclude that “flow can be seen as a predictor of performance rather than just being part of high performance” (Engeser & Rheinberg, 2008, p. 161).

Demerouti (2006) investigated the effect of flow experiences on performance in the work context and found first evidence that the association between flow and performance may be moderated by personality characteristics. Employees in ten companies completed the work-related flow scale (WOLF; Bakker, 2008). Their job performance was rated by participants’ colleagues. Whereas flow at work did not significantly correlate with peer-ratings of job performance, an interaction term between flow and conscientiousness did. Participants who had high scores on conscientiousness *and* flow experiences at work achieved the highest ratings regarding in-role as well as extra-role performance (see Peifer & Wolters, Chap. 11, for a detailed analysis of flow at work and Baumann, Chap. 9 for an analysis of flow and personality).

In the field of music, there is first evidence that flow experiences and creativity in group-composition go hand in hand (MacDonald, Byrne, & Carlton, 2006). Students had to meet in groups of three to work on group compositions and were asked to report on flow experiences every time they met. The creativity of their compositions was rated by lecturers and postgraduates, and interestingly a significant correlation between group levels of flow and rated creativity emerged, suggesting that skilled music students tend to experience flow and/or flow experiences lead to creative compositions (see Harmat, de Manzano & Ullén, Chap. 14, for a detailed analysis of flow in music and arts).

A hint, suggesting that flow is associated with performance in teams, comes from a study investing the experience of students during a project management simulation (Aubé, Brunelle, & Rousseau, 2014). Meeting in teams of four to six, students were instructed to build a scale model of a goods vehicle. After 6½ h, the vehicle had to be able to successfully travel two routes varying in difficulty. Team performance, which was measured on a scale from 1 = *the vehicle did not* start to 6 = *the vehicle completed two routes,* was predicted by flow experienced in the team during the construction. Interestingly, members' commitment to the team goal fully mediated this path supporting the idea that flow has an indirect impact on performance via motivation and engagement (see the indirect path in Fig. 3.3). In the context of flow in teams, the finding that information exchange moderated the relation between flow and team performance is especially interesting: In teams that reported a high (vs. low) information exchange the positive relation between flow and performance was stronger.

Performance in Sports

An area where the relationship between flow and performance is frequently assumed is the domain of sport. In this context, the flow experience is often related to the concept of peak performance (cf., Jackson & Roberts, 1992; McInman & Grove, 1991). Most flow studies in the context of sports and performance have limitations as some studies did not assess flow as state, but used a retrospective approach (e.g., Jackson & Roberts, 1992) and others measured perceived success in competition (e.g., Jackson, Kimiecik, Ford, & Marsh, 1998) or satisfaction with performance (e.g., Stein, Kimiecik, Daniels, & Jackson, 1995) instead of capturing performance per se.

However, there are some exceptions: Jackson, Thomas, Marsh, and Smethurst (2001) let participants rate their flow experience directly after a competition and found a small but significant relation between flow experiences and finishing position. Further, soccer players' performance was associated with flow experience during the game (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011). Interestingly, this relation was found both when performance was rated by the soccer players and by the coach (limiting the possibility that a common-method bias accounts for the relation). In addition, social support from the coach and performance feedback for the players were related with more flow experience, which in turn partially mediated the relation between social support/performance feedback and performance.

In marathon races, no relationship between flow experience and performance in the race (i.e., running time) was found by Stoll and Lau (2005) as well as Schüler and Brunner (2009). Yet, the latter showed that flow during the training fostered pre-race training behavior which again predicted race performance. This provides further evidence for an indirect effect of flow on performance, mediated by motivation to exercise (see Chap. 14, for a detailed analysis of flow in sports).

Performance in Experimental Studies

The few experimental flow studies that involve the measurement of performance, found mixed evidence for a flow and performance relation. Engeser and Rheinberg (2008) who instructed their participants to play "Pacman" at different difficulty levels found that flow experiences at medium difficulty level (flow condition) explained a small amount of the variance of the performance in this playing mode (when controlling for baseline performance). Schiefele and Roussakis (2006; using the game Roboguard) as well as Keller and colleagues (Keller & Bless, 2008; Keller & Blomann, 2008; using the game Tetris) did not find an association between flow experiences and performance when controlling for the different playing modes. The differences in results may be due to different measures of flow experiences. Whilst the Flow Short Scale used by Engeser and Rheinberg (2008) included sense of control and smooth action, which can be presumed to be facilitators of performance, the flow measures applied in the other studies concentrated on other components of the experience (as involvement and enjoyment). Therefore, it would be helpful to clarify which components of the flow experience yield a positive effect on performance and which components do not play an important role in this context. Christandl and colleagues (2018) provided the most recent study to understand the influence of flow on performance by examining spillover effects between two subsequent tasks. As outlined in part 1 of this chapter, the authors examined the influence of subjective time progression on the experience of flow across four studies. Focusing on performance, they found that perceiving time to fly in task was associated with a better performance in a subsequent similar task (Study 2, 3 and 4). In Study 3 and 4, the authors were able to show that recalled flow in the first task partially mediated the effect on performance in the second task, while several alternative mediators were controlled for. Hence, these results provide supporting evidence for a causal positive relation between flow and performance.

Towards a Better Understanding of the Relationship Between Flow and Performance

As we have seen, even in correlational studies, evidence regarding better performance in flow situations is mixed. Flow experiences and performance seem to go hand in hand, at least during music composition, in sports and in learning settings, but the association probably is a reciprocal one and studies using a longitudinal design, which also controls for prior performance (Engeser et al., 2005; Engeser & Rheinberg, 2008) suggest that the causal effect of flow experiences on performance is, if existent, of small magnitude. Therefore, when evaluating correlational data in a cross-sectional design, one should consider that a positive association may be basically driven by the influence of good performance on flow experiences, and not the other way around.

Besides, the association does not hold for every kind of activity. While it has been observed in some activities (academics, music, sports), there was no correlation between flow and performance observable in participants playing different computer games (Keller & Bless, 2008; Keller & Blomann, 2008; Schiefele & Roussakis, 2006). It is possible that the relationship only holds for activities that are perceived as important (cf. Engeser & Rheinberg, 2008). Especially regarding meaningful activities, such as learning statistics as a psychology student, flow should have an indirect effect on performance, mediated by enhanced exercising behavior. This is what Schüler and Brunner (2009) found for marathon runners.

Also, other researchers (Delle Fave & Bassi, 2000; Nakamura, 1988; Shernoff et al., 2003) note that flow experiences may influence learning behavior in high school students and Lee (2005) found a substantial negative correlation between flow in learning situations and procrastination. But as all those studies are correlational in nature, the data do not suit for conclusions regarding the direction of the relationship. However, an indirect effect of flow experiences on performance, mediated by motivation to exercise, seems very likely (cf. Aubé et al., 2014). Considering the implications for practice (e.g., organizing learning environments in a way that fosters flow experiences; see Shernoff et al., 2003), further longitudinal studies should examine this proposed mediation to come to a better understanding of the relationship between flow and performance.

It has to be noted that even the classic experimental paradigms that have been developed in flow research cannot test for causality regarding performance as flow usually is induced by a manipulation of task difficulty. Therefore, the best strategy to test for a causal relationship between flow and performance seems to be a longitudinal design and the usage of promising variations of experimental flow paradigms (e.g., Christandl et al., 2018).

Summary and Conclusion

The first part of the present chapter was devoted to the question of what builds the basis for flow experiences to emerge and what may determine the of flow experiences. First, we addressed the *antecedents* of flow and highlighted the fact that the emergence of flow is basically dependent on a perceived fit of skills and task demands. By regarding the specific components of flow experience, we then identified additional situational factors beyond a perceived fit of skills and demands that could be relevant for the experience of flow. Then, we critically discussed the "above average" perspective and the related quadrant and octant models of flow. We argue that the "above average" notion is based on assumptions that seem quite problematic. We further addressed determinants of *flow intensity* that have not been systematically discussed so far. In this context, we propose a revised flow model which builds on the original notion of perceived fit of skills and task demands and includes the value attributed to the relevant activity as additional crucial factor. In this regard, we highlighted the concept of regulatory compatibility as important theoretical construct in the analysis of the determinants of flow intensity.

In the second part of the chapter, we focused on boundary conditions of the flow experience. Here, we presented empirical evidence suggesting the so called *autotelic personality* (which is predisposed to experience flow) is characterized by a low level of fear of failure, a strong internal locus of control and a habitual action-orientation. With a side-glance to more distal situational aspects that might qualify the experience of flow (beyond a fit of skills and demands) we reported empirical evidence revealing that the perceived importance of an activity influences flow experience. Further, we presented a promising taxonomy that allows the examination of psychologically meaningful aspects of situations and their impact on the flow experience.

In the third part of the chapter, we analyzed the empirical evidence regarding affective, cognitive and performance-related consequences of flow. The current literature suggests that flow and a skills-demands compatibility coincide with increased positive affect. However, most of the evidence arises from cross-sectional correlational studies while longitudinal and experimental results are scarce, which does not put us in a strong position to draw final inferences about the flow-affect relation. Regarding the cognitive consequence of flow, there is much to be done as almost no empirical evidence is available. However, first studies suggest a bidirectional relation between flow and recovery. The relation between flow and performance has been examined in several contexts (e.g., in academics, music and sports). Also between these two constructs a bidirectional relation is likely. Longitudinal studies and recent experimental evidence suggest that the causal effect of flow experiences on performance seems to be small, but present. Hence, associations in cross-sectional correlational studies may basically reflect the influence of good performance on flow experiences, and not the other way around.

From these deliberations it becomes apparent that many questions in flow research are still unsolved. With this chapter we aimed to introduce the reader to our view on the current flow literature from which several research intentions can be derived. We hope to encourage others to contribute to the process to close these gaps in research step by step. From our point of view, this process should especially focus on the following aspects: (1) The proposed revised flow model, presented in the first part of the chapter, is based on an elaborated theoretical foundation. However, an empirical test analyzing the critical role an activity's *subjective value* for the experience of flow remains to be done. (2) As there is increasing evidence that personality traits function as boundary condition for the experience of flow in terms of an *autotelic personality,* studies should evaluate further personality concepts that might be critical for the experience of flow. (3) Promising frameworks like the 8 DIAMONDS (Rauthmann et al., 2014) are now available in order to study the influence of psychologically meaningful aspects of situations on experience and behavior. These new approaches should also be used to examine the experience of flow with the aim to identify situational boundary conditions beyond a skills-demands compatibility.

As repeatedly mentioned in the chapter, the experimental analysis of flow is rare (an exception is the line of research focusing on the physiological correlates o flow experience; see Chap. 7). Therefore, we strongly encourage researchers to apply experimental designs to analyze flow, which allows drawing causal inferences about this state. However, even an experimental analysis of flow is tricky sometimes, due to the hazard to differentiate between consequences of flow and consequences of a skills-demands compatibility. The application of mediation analysis might provide a remedy, as it can provide information, whether the effect of a skills-demands compatibility on certain criteria (e.g., affective consequences) is caused via the experience of flow or not. In addition, in cases where classic experimental designs are not suitable (e.g., when analyzing the performance-related consequences of flow), appropriate longitudinal designs should be applied.

Study Questions

- Describe the antecedents of flow experiences proposed in flow theory and how these factors are conceptually linked to each other.
  According to flow theory, a state of flow emerges when three antecedents are met: (1) clear goals in the sense of clear task instructions, (2) immediate, unambiguous feedback reflecting diagnostic information regarding one's progress or success in executing the activity, and (3) a balance of perceived skills and perceived task demands. Antecedents (1) and (2) can be considered to be incorporated in antecedent (3) because individuals can only arrive at a meaningful evaluation of their skills and the task demands to the degree that they (a) understand the nature of the task (based on clear task instructions) and (b) can diagnose whether they are successful in their task execution or not.
- Explain the "above average" thesis introduced by the proponents of the quadrant and octant model of flow. Discuss the problematic assumptions that are entailed in the "above average" thesis.
  The "above average" thesis holds that individuals can only enter a state of flow when the perceived level of skills and task demands is above the average level across various activities the individual is engaging in. This thesis can be considered as problematic for three main reasons: (1) It is questionable whether perceived demands (or "challenges") and perceived skills can be considered to represent orthogonal (independent) constructs. It is evident that individuals have to take the demands of the task into account to arrive at an evaluation of their skills in the task (and vice versa) and accordingly measuring perceived skills and demands separately and considering the constrictions as orthogonal in nature seems not particularly meaningful. (2) Comparing the evaluations of skills and task demands involved in different activities (e.g. washing the dishes and playing chess) would only be meaningful if respondents had in mind an absolute

comparison standard when editing their responses (such as measuring the length of a table and comparing the resulting value with the value obtained when measuring the length of a bed is only meaningful when both measurements refer to the same measurement standard). Such a standard is typically not available when individuals evaluate the skills and task demands of different activities they are engaging in. Individuals construe their evaluations of skills and task demands on the spot and it is highly likely that evaluations of skills and task demands involved in one and the same activity vary substantially depending on contextual factors. (3) If the "above average" thesis was correct, individuals should not be able to experience flow when they engage in activities that are not particularly demanding (such as playing a trivial board game such as Ludo) where skills and demands are definitely not "above average." Empirical studies based on fairly trivial activities are not consistent with this perspective because individuals were found to enter a state of flow even under conditions where skills and demands were most likely clearly "below average."

- Specify the revised flow model and exemplify the reasoning concerning the intensity of flow experiences contained in the theoretical perspective underlying the revised flow model.

  The revised flow model builds on the original notion of perceived fit of skills and task demands and refers to subjective value of the activity as a crucial second factor. That is, the model rests on the "classic" notion that flow can emerge under conditions where individuals perceive a balance between skills and task demands in an activity. Moreover, the intensity of flow experienced under such conditions is conceptualized as a function of the subjective value the individual assigns to the relevant activity. Subjective value is defined with reference to the perspective outlined by Higgins (2006) who noted that value is resulting from two basic ingredients: (a) hedonic experience (pleasure/pain properties of the value target) and (b) engagement strength, which can be based on regulatory fit or the use of proper means (among other factors). It can be assumed that regulatory compatibility—a phenomenological experience that arises when individuals experience a compatibility of (personal and situational) factors that are involved in performing a task or activity – builds one important basis for the subjective value individuals assign to activities and hence serves as a basis for the intensity of flow experiences.

- Specify the factors that can qualify the relation between a fit of skills and demands and the experience of flow

  The factors qualifying this relation can be divided into two categories. (1) The idea that certain personality characteristics influence the easiness with which individuals experience this state was formulated in the autotelic personality hypothesis. Empirically, a low level of fear of failure, a strong internal locus of control and a habitual action-orientation were identified as fostering personality characteristics of flow. (2) Less intensively examined is the idea that situational characteristics have an impact on the experience of flow. First evidence suggests that there is a stronger relation from a skills-demands compatibility to flow when the consequences of the performed activity is perceived as rather unimportant.

Further, activities that entail intellectually demanding features seem to enhance the chance to experience flow.

- Which problem is there in analyzing consequences of flow experiences?

  The main part of flow research is correlational in nature and does not allow for causal inferences. In experimental studies, flow usually is manipulated by establishing a skills-demands-compatibility, which is the central precondition of flow. Hence, it seems possible to draw causal conclusions about the consequences of a skills-demands-fit. It seems much more complex to analyze causal consequences of the flow experience itself because skills-demands-compatibility could have consequences independent of flow. One possibility to overcome this problem is to measure the experiential components of flow and to check whether the effect of skills and demands on supposed consequences is mediated by the experience of flow.
- Does flow experience/skills-demands-compatibility lead to positive affect?

  A definite conclusion regarding the relationship between skills-demands-compatibility and positive affect is currently not possible. So far, we only can conclude that there is a positive association between flow preconditions as well as flow experiences and positive affect that is also supported by qualitative results but we cannot draw causal inferences. Even though a causal relationship between flow and affect would make sense, it may be suggested that neither the relationship between skills-demands-compatibility and positive affect nor the relationship between flow experience and positive affect is a deterministic one but qualified by characteristics of the individual, the situation, and the task.
- Describe the proposed relationship between flow and performance.

  A positive relationship between flow experiences and performance is postulated because of two reasons. First, flow is characterized by high concentration and a sense of control, which were found to be facilitators of performance. Second, flow could be seen as a motivating force for excellence which fosters personal growth. Individuals who tend to experience flow in a special set of activities should be motivated to engage in those activities and therefore gain expertise, at least in the long run. Therefore, flow experiences imply a growth principle, whereby more complex challenges are sought after and more complex abilities are likely to develop. Thus, flow should have a direct as well as an indirect positive effect on performance. However, one has to keep in mind that the relationship between flow and performance is a reciprocal one in all likelihood.

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