Go with the Flow, but Keep it Stable?

The Role of Flow Variability in the Context of Daily Flow Experiences and Daily Creative Performance

Abstract

This study investigates the correlates ~~effects correlates~~ of daily flow experiences at work as well as flow variability (i.e., a person's level of variability in daily flow states) on daily levels of creative performance. Drawing from broaden and build theory, we hypothesized that higher levels of daily flow would be positively related to higher levels of daily creative performance. Extending research on within-person variability of flow experiences, we introduced the concept of flow variability; in particular, we hypothesized that flow variability would be negatively related to a person's creative performance at the day-level. In contrast, based on the notion of heightened reactivity in the context of intra-individual variability, we predicted that the relationship between daily flow and daily creative performance would be stronger among persons with high flow variability. We collected diary data from 44 full-time employees, who provided information on a total of 201 days. Results of multilevel analyses confirmed our predictions. Our study highlights the benefits of examining the different~~ial~~ correlates~~effects~~ of flow variability across levels, thus revealing an intricate web of cross-level linkages between daily flow states, flow variability, and daily creative performance at work.

Go with the Flow, but Keep it Stable? The Role of Flow Variability in the Context of Daily Flow Experiences and Daily Creative Performance

Flow refers to an enjoyable state of optimal experience and development (Nakamura & Csikszentmihályi, 2002). When being in flow, persons are totally absorbed and immersed in their current activities, combined with the feeling that time flies by. Over the years, flow has become a construct that has gained more and more relevance in the work context. For example, work-related flow has been shown to promote a number of favourable organisational outcomes, such as job performance, organisational citizenship behaviour, and wellbeing (Bakker, 2008; Fullagar & Kelloway, 2009). Interestingly, research has also demonstrated that flow experiences are highly volatile and fragile 'short-term peak experiences' (Bakker, 2008, p. 400). More specifically, flow states fluctuate considerably within persons and from moment to moment (Debus, Sonnentag, Deutsch, & Nussbeck, 2014; Fullagar & Kelloway, 2009), thus highlighting the dynamic nature of this state of being. Relatedly, Ceja and Navarro (2009, 2011, 2012) found that flow states within persons tend to follow a chaotic pattern; that is, flow experiences show constant within-day fluctuations and do not appear to stabilize over time.

Yet, despite the ephemeral nature of flow, there might still be some regularity in the way that persons experience fluctuations in this exceptional state of mind – which might additionally contribute to the prediction of positive organisational outcomes. In order to more systematically describe this aspect of flow, we introduce the concept of *flow variability*, defined as ~~inter-~~individual differences in the variability of flow states that persons experience across days. As such, the concept describes differences between persons concerning the stability of their flow experiences. In fact, there have been repeated calls in the literature to study ~~inter-~~individual differences in the temporal variability of feelings, attitudes, and behaviours (e.g., Beal, Trougakos, Weiss, & Dalal, 2013; Kernis, Cornell, Sun, Berry, &

Harlow, 1993; Scott, Barnes, & Wagner, 2012). Researchers have underscored the importance of studying these ~~inter-~~individual differences to better understand the composition of the dynamics inherent to a person's feelings and behaviours, thereby extending the study of predictors and outcomes of intra-individual fluctuations in these variables (Kernis, 2005; Ram & Gerstorf, 2009).

In the present study, we first examine the relationship between daily flow experiences and daily creative performance, defined as a product outcome that is both novel and useful (Amabile, 1983). Creative performance constitutes one of the most important determinants of organisational performance; it is thus vital for ensuring a company's long-term survival (Anderson, Potocnik, & Zhou, 2014). Furthermore, creative functioning has long been considered a key positive outcome of flow (Csikszentmihalyi, 1996). In addition, researchers have highlighted that creative performance results from dynamic processes that are subject to continuous change (e.g., Amabile, Barsade, Mueller, & Staw, 2005), thus further supporting the argument that daily creative performance may be a product of daily flow experiences.

Secondly, we investigate the correlates~~effects~~ of flow variability in relation to daily flow and daily creative performance. Specifically, we examine how flow variability is related to ~~affects~~ a person's creative performance at the day-level (i.e., whether flow variability explains between-person variance in a person's daily creative performance) as well as how it moderates ~~affects~~the daily flow-creative performance relationship.

By examining the aforementioned relationships, our study makes a number of contributions to the literature. First, our study extends the flow literature by introducing the concept of flow variability. T~~Although t~~he phenomenon of intra-individual variability in certain states has been studied in other fields of research (e.g., in the context of self-esteem, emotional labour, and affect; Beal et al., 2013; Kernis et al., 1993; Scott et al., 2012), and has contributed to a better understanding of how such variation helps explain important work-

related outcomes. ~~our study is the first to study this type of regularity in the flow context.~~ However~~Moreover~~, previous research has largely focused on strain-related or pathologic outcomes such as fatigue or depression (Beal et al., 2013; Kernis et al., 1993; Scott et al., 2012). Instead, our study~~-~~ examines the role of flow variability for creative performance as a key indicator of human flourishing (Seligman & Csikszentmihályi, 2000), thus shifting the focus towards more positive outcomes.

Second, our research builds upon the basic tenet of flow theory that flow experiences can foster creative performance (Csikszentmihályi, 1996). While there is ample evidence that a person's general level of flow is positively related to their general level of creative performance (Cseh, Phillips, & Pearson, 2015), our study is the first to test this relationship at the within-person level on a day-to-day basis. In the multilevel literature (e.g., Kozlowski & Klein, 2000), researchers have cautioned against generalization of ~~not to generalizeagainst generalization of~~ effects that were found at a certain level of analysis to other levels. Thus, by demonstrating that daily flow is equally relevant for daily creative performance, we also contribute to generalizing flow theory's predictions across levels.

Finally, and in a more general sense, our study contributes to the notion of whether certain constructs have ~~have~~ disparate versus equivalent correlates~~effects~~correlates, depending on where they are proposed to act in a given process (Kozlowski & Klein, 2000) More specifically, by building upon broaden and build theory (Fredrickson, 2001) we first postulate that flow variability is *negatively* related to a person's creative performance at the day level. Yet, based on theorizing around persons' reactivity to daily events (e.g., Kernis, 2005; Ram & Gerstorf, 2009), we then argue that flow variability should *boost* the positive relationship between daily flow experiences and daily creative performance.

The Relationship between Daily Flow States and Daily Creative Performance

Generally, flow is defined as a personal experience of deep enjoyment and total immersion in what one is doing (Csikszentmihályi, 1996). The following nine dimensions have been described to make up the flow experience (Csikszentmihályi, 1996; Nakamura & Csikszentmihályi, 2002): (a) a balance between challenges and one's skills, (b) the merging of action and awareness, (c) clarity of goals, (d) clear, immediate, and unambiguous task feedback, (e) concentration, (f) a sense of control over one's actions, (g) the loss of self-consciousness, (h) the transformation of time (e.g., persons feel that time passes faster than normal), and (i) the feeling that the experience becomes intrinsically rewarding (i.e., autotelic). Over the years, researchers have become more and more interested in flow experiences in the work context. Indeed, flow experiences even tend to occur more often at work than in leisure (Csikszentmihályi & LeFevre, 1989), thus pointing towards the potential for flow experiences to facilitate important work-related outcomes.

In this study, we explore the relationship between daily flow experiences and daily creative performance at work. Research has demonstrated that creativity-related constructs exhibit an impressive amount of variance within persons across days (e.g., Amabile, Barsade, Mueller, & Staw, 2005). In line with findings on the fluctuating nature of flow (e.g., Debus et al., 2014), we examine the flow-creative performance link on a day-to-day basis. In particular, we propose that the higher the flow levels a person experiences on a certain day (relative to his or her average level of flow), the more creative this person should be at work on that same day.

Fredrickson's (1998, 2001) broaden and build theory provides deeper insight into the potential creativity-relevant processes elicited by flow. The theory states that positive experiences, such as flow, broaden a person's thought-action repertoire, thereby building personal resources and skills that can contribute to increased resilience, functioning, and

survival. More specifically, Fredrickson (2001) argues that experiencing positive states widens persons' "array of thoughts and actions that come to mind" (p. 220). Thus, persons start to think and behave in ways that are 'off the beaten track'. As an example, Fredrickson and Branigan (2005) demonstrated that when persons were induced to experience positive emotions, they listed more activities to pursue in that situation compared to participants who were in a negative or a neutral control condition. Concerning the underlying neuropsychological processes, Ashby, Isen, and Turken (1999) have argued that positive states increase dopamine release in the anterior cingulate. This dopamine release, in turn, improves cognitive flexibility and facilitates the selection of cognitive perspectives, thus increasing creative functioning (for empirical evidence see Flaherty, 2005).

Accordingly, and in line with broaden and build theory, on days when persons experience higher levels of flow (relative to their average flow levels), they would benefit from a wider thought and action repertoire (e.g., Fredrickson & Branigan, 2005); hence, their cognitions and behaviours would be more flexible, unusual and novel (Fredrickson, 1998), making them more creative at work. In fact, Csikszentmihályi (1996) has theorized about a potential link between flow states and creative performance from early on. To date, however, only a few cross-sectional studies, predominantly in the artistic domain (e.g., Cseh et al., 2015; MacDonald, 2006), have tested this assumption. By examining the flow-creativity link at the day-level, we can examine whether predictions derived from broaden and build theory, as well as from Czikszentmihály's work (1996), can be likewise generalized to processes taking place *within* persons.

> **Hypothesis 1:** Day-level flow experiences will be positively related to day-level creative performance. That is, the higher the flow levels a person experiences on a particular day (relative to his/her average level of flow), the higher will be his/her creative performance on that day.

The Concept of Flow Variability and its Relationship with Daily Creative Performance

As mentioned above, flow states are short-lived, highly fragile peak experiences (e.g., Debus et al., 2014). Accordingly, studies have demonstrated that a considerable amount of variance in flow accrues from fluctuations within persons (e.g., up to 74%, see Fullagar & Kelloway, 2009, and Ceja & Navarro, 2009, 2011, 2012). Yet, beyond focusing on the momentary experience of flow, we suggest that persons may also differ in their general potential to experience stable vs. variable flow states. We refer to this person-related characteristic as *flow variability*. More specifically, we conceptualize flow variability as *fluctuations in day-to-day flow states*. Accordingly, a person low in flow variability would typically experience a relatively stable level of certain flow states across days. In contrast, a person high in flow variability would tend to experience ever-varying levels in his/her daily flow states. Such a person may therefore experience higher levels of flow on some days, whereas on others he/she would experience lower levels of flow (see Ram & Gerstorf, 2009, for a discussion on net intra-individual variability measures). In accordance with the idea that variability represents a trait-like individual difference (Fiske, 1961; Ram & Gerstorf, 2009), flow variability can thus be regarded as a measure of ~~inter-~~individual differences in a person's general potential for experiencing stable or variable levels of daily flow states.

Moreover, and as noted above, we focus on fluctuations in flow *between* days. Albeit flow also varies within days (e.g., Ceja & Navarro, 2009, 2011, 2012), the pattern of these fluctuations appears to be entrained to humans' circadian rhythm (e.g., Debus et. al., 2014). Within-day fluctuations thus appear to exhibit a time-structured pattern (i.e., time-structured intra-individual variability; Ram & Gerstorf, 2009), which is at least partly out of the person's control. Because our interest lies in variability in flow that is unstructured in relation to time (i.e., net intra-individual variability according to Ram & Gerstorf, 2009), we focus on variability between days. Furthermore, this approach is also in line with similar research on

the effects of intra-individual variability in other states and experiences, such as affect and self-esteem (e.g., Eid & Diener, 1999; Kernis et al., 1993; Scott et al., 2012).

Concerning the correlates~~effects~~ of flow variability, we suggest that persons who display high variability should experience lower levels of creative performance at the day level; statistically, this suggests a cross-level direct effect of flow variability predicting the between-person variance part in daily creative performance (i.e., the person intercept of daily creative performance is regressed onto that person's flow variability; Bliese & Jex, 2002). More specifically, it follows from broaden and build theory (e.g., Fredrickson, 2001) that if flow highly varies between days, the breadth of a person's daily thoughts and actions will likewise vary. Thus, the higher a person's flow variability, the more likely they are to unexpectedly shift between phases of higher and lower cognitive flexibility, divergent thinking, and novel behaviours. In other words, a person is less likely to progress with their creative work in a steady manner and instead display unstable and disruptive creative work progress across days. Specifically, scholars have argued that interruptions can impede work progress (e.g., Jett & George, 2003). Although research has demonstrated that creative performance may benefit from some disruptions (such as self-imposed breaks), non-controllable and unplanned interruptions hamper creative performance because they disrupt the creative problem solving process by prolonging task completion and increasing error rates (Beeftink, Van Eerde, & Rutte, 2008). In contrast, low flow variability would imply that a person typically experiences stable flow states across days, thus allowing them to more constantly engage in the creative problem-solving process and make better progress on day-to-day activities requiring creativity.

Taken together, we argue that, irrespective of a person's actual flow level, flow variability should impede creative performance at the day-level. Put another way, we suggest that different processes on different levels of analysis explain the direct effects of daily flow

versus flow variability on daily creative performance. Whereas we argued above (Hypothesis 1) that daily flow should be related to ~~influence~~ daily creative performance by broadening a person's daily thought-action repertoires (i.e., explaining within-person variance in daily creative performance), we suggest here that flow variability interrupts~~should exert its influence by interrupting~~ a person's creative work progress across days (i.e., explaining between-person variance in daily creative performance). Consequently, low flow variability should thus be beneficial for all persons alike, irrespective of their actual flow level, because consistency enables steady work progress and serves to avoid work interruptions that would otherwise hamper creativity across days (for a similar finding in the context of affect see Gruber, Kogan, Ouoidbach, & Mauss, 2013).

> **Hypothesis 2:** A person's flow variability will be negatively related to his or her creative performance at the day-level.

Flow Variability as a Cross-Level Moderator of the Relationship between Daily Flow Experiences and Daily Creative Performance

As suggested above, high flow variability persons should exhibit lower levels of creative performance at the day-level (i.e., a cross-level direct effect predicting the between-person variance part in daily creative performance). We argue that, because these persons unexpectedly shift between days with higher and lower available cognitive flexibility, their overall creative work progress should be interrupted. In the following, we will complement this perspective by exploring how flow variability moderates~~affects~~ the day-specific relationship between flow and creative performance (i.e., a cross-level interactive effect whereby flow variability at the person level explains variability of the daily flow-daily creativity relationship). In doing so, we propose differential effects of flow variability on daily creative performance when viewed from different perspectives (i.e., across days and day-specific).

As noted by broaden and build theory, (daily) positive experiences, such as flow, play an important role in regulating a person's cognitions, attention, and behaviour (Fredrickson, 1998). Specifically, whereas lower levels of positive experiences narrow a person's thought-action repertoires and facilitate more controlled and focused behaviour, higher levels broaden the thoughts and actions that come to mind, allowing for greater exploration and experimentation (Fredrickson, 2001). Theoretical arguments from the field of developmental psychology (e.g., Li et al., 2004; Ram & Gerstorf, 2009) suggest that the way these positive experiences translate into certain outcomes depends on the general within-person variability that is connected to those experiences. In particular, persons with a high intra-individual variability in their daily experiences, states and behaviours have been argued to be less robust, that is, they are more reactive to fluctuating daily events because they are more strongly affected by relevant internal and external factors. As an example from the self-esteem literature, Greenier and colleagues (1999) demonstrated that positive and negative daily events (e.g., social acceptance or rejection) had a more pronounced effect on self-feelings (i.e., if they felt better or worse) for those persons with high self-esteem variability, because the self-worth of such persons is more fragile and vulnerable.

In the context of our study, such a reasoning allows us to suggest that persons with a high (as opposed to low) flow variability would react more strongly to daily shifts in flow experiences with respect to their creative performance. As noted above, daily shifts in a person's levels of flow can be viewed as daily deviations from a person's average flow level (see Ohly, Sonnentag, Niessen, & Zapf, 2010). High flow variability, in turn, means that persons experience such shifts in their daily flow levels to a substantial degree. Consequently, if high flow variability persons experience higher daily flow levels (than they do on average), this is likely to represent a positively unusual experience for them due to their inconsistency in experiencing flow in general. In contrast, if low flow variability persons experience higher

levels of daily flow this would be a less unusual experience for them because they maintain a high consistency in flow experiences overall. Concerning the nature and directionality of shifts, Kuhl (2000) suggests in his personality systems interaction theory (PSI) that *upward* shifts, defined as increases in positive experiences (such as flow in the present case), allow persons to tap into their full creative potential (for a similar reasoning see also Bledow, Rosing, & Frese, 2013). In the current study, stronger upward shifts to higher levels of daily flow (relative to a person's average flow levels) might thus enable persons to better capitalize on the cognitive benefits of both low (i.e., controlled, focused) and high (i.e., broadened and exploratory) information processing with respect to daily creative performance (see Fredrickson, 2001). Based on the preceding arguments, we thus suggest that the relationship between daily levels of flow and creative performance are stronger for persons with high flow variability:

> **Hypothesis 3:** Flow variability will moderate the positive relationship between day-level flow and day-level creative performance. The relationship will be stronger among persons with high flow variability compared to persons with low flow variability.

Method

Sample and Procedure

We recruited our sample via StudyResponse, a nonprofit academic service designed to match researchers with persons interested in participating in scientific studies (Stanton & Weiss, 2002). Potential participants first received an introductory e-mail with information about the study and the data collection process. Data collection involved the completion of a *general survey* (to assess demographics and a person's general level of creative performance; see Measures section for more details on the assessed variables) as well as a diary period, in which we instructed respondents to complete *three daily surveys at 10am, 1pm, and 4pm* over

a period of five consecutive days (i.e., Monday to Friday). To reduce recall bias (Ohly et al., 2010), we assessed flow in all three daily surveys and later aggregated these scores to the day-level in order to obtain a representative daily flow score. Day-level creative performance was assessed in the last daily survey at 4pm. All surveys were administered online. Upon our request, StudyResponse specifically invited full-time employees to the study (e.g., part-time employees may not work on every weekday). In order to match survey responses to the respective persons, participants were provided with a personalized numerical code that they had to enter before each survey completion.

Participants received the general survey link as part of the aforementioned introductory e-mail. During the diary study week, participants then received the links to the three daily surveys on the eve of the respective previous day. We chose this approach to ensure that participants had a higher chance of meeting the required daily time points for survey completion (instead of missing online surveys because they did not notice them in their e-mail inbox). We checked survey compliance by carefully examining the time stamps which were collected in tandem with survey responses. We considered a time difference of one hour between intended time points and actual survey completion as acceptable (e.g., Niessen, Sonnentag, & Sach, 2012). In exchange for participation, respondents received $10 Amazon gift vouchers upon study completion.

Initially, 60 persons registered for study participation; of these, 44 persons successfully completed the general survey and were subsequently invited to the diary part of the study (response rate 73%). Following this procedure, 220 daily (i.e., 660 momentary) responses were collected, which, after accounting for missing data, resulted in 201 daily and 602 momentary reports. The age of participants ranged from 23 to 69 years (M = 44.2, SD = 11.4), with a mean job tenure of 14 years (SD = 9.2). A total of 59% of the respondents were female, and 48% of respondents indicated that they had children. On average, respondents

had 3.9 years of higher education (*SD* = 2.6) and worked 41 hours per week (*SD* = 7.6). Respondents worked in a broad range of sectors, including business (48%), administrative services (20%), finance (9%), education (9%), as well as skilled labour (5%). Thus, our sample was demographically diverse.

Measures

As alluded to above, data were collected both at the day level (i.e., Level 1) and the person level (i.e., Level 2).

Day-level variables.

Daily flow. We assessed a person's level of flow three times a day (i.e., in all three daily surveys) by using nine items of the Flow State Scale-2 (FSS-2; Jackson & Eklund, 2004; see also Fullagar & Kelloway, 2009). Items were preceded by the following statement: "Please answer the following questions in relation to your experience in the work activity you were just engaged in." A sample item is "My abilities matched the high challenge of the situation". The items were scored on a 5-point rating scale, ranging from 1 = *strongly disagree* to 5 = *strongly agree*. As noted above, we averaged the three momentary flow measurements to the day-level. Average Cronbach's α was .82 (Ranging from .76 to .87).

Daily creative performance. A person's day-level creative performance was assessed in the third (i.e., last) daily questionnaire at the end of each working day. To do so, we used a three-item scale by Oldham and Cummings (1996), adapted to the day-level. A sample item was "How original and practical was your work *today*? Original and practical work refers to developing ideas, methods, or products that are both totally unique and especially useful to the organisation." The items thus referred to a respondent's rating of creative performance

across the entire working day. Answers were scored on a 7-point rating scale, ranging from 1= *not at all* to 7= *very*. Average Cronbach's α was .89 (Ranging from .86 to .93).

Person-level variables.

Flow variability was operationalized by computing the standard deviation of each person's daily flow scores over the survey period (see Eid & Diener, 1999; Scott et al., 2012, for a similar approach).

Control variables.

Day-level control variable. Due to previous research showing a negative day-level relationship between exhaustion and flow (Demerouti et al., 2012), we controlled for *day-level emotional exhaustion*, which was assessed as part of the last daily survey. The construct was measured via a four-item subscale of the Oldenburg Burnout Inventory (Demerouti, Mostert, & Bakker, 2010). A sample item is "Today, during my work, I often felt emotionally drained". Items were scored on a 5-point scale, ranging from 1 = *strongly disagree* to 5= *strongly agree*. Average Cronbach's α was .88 (Ranging from .83 to .92).

Person-level control variables. We controlled for a person's *general level of creative performance* because this may relate to~~affect~~ his or her respective daily creative performance. General creative performance was assessed using the same three-item scale by Oldham and Cummings (1996) as in the daily measurements, but adapted to the person-level. A sample item was "How original and practical is your work in general? […]. Cronbach's α was .86. In line with previous diary research, we further controlled for *gender*, *age*, *job tenure*, and the *presence of children*. Gender was included because it has been associated with creative performance (Amabile et al., 2005), and age as well as tenure have been shown to predict innovative work behaviours (Madrid, Patterson, & Birdi, 2014). Additionally, past research

indicated that the presence of children at home may relate to ~~influence~~ creative performance at work (Tang, Huang, & Wang, 2017).

Analytical Strategy

Because of the nested data structure (i.e., days at Level 1 were nested within persons at Level 2), we applied multilevel modelling using the MLwiN 2.28 software. In line with methodological recommendations for conducting diary studies, we centered person-level variables at the grand mean and day-level variables at the person mean (Ohly et al., 2010). Additionally, we aggregated daily flow to the person-level and entered it in all models to control for the between-person average of daily flow. This was done in order to fully disentangle within- and between-level effects of our Level 1 predictor (i.e., daily flow) on the Level 1 outcome variable (i.e., daily creative performance), thus arriving at an unconflated multilevel model (Preacher, Zyphur, & Zhang, 2010).

Following recommendations by Snijders and Bosker (2012), we adopted a bottom-up approach to multilevel modelling that involved, first, examining hypotheses at the within-person level (i.e., Hypothesis 1) and subsequently at the between-person level (i.e., Hypotheses 2 and 3). Specifically, we started with a null model that only included the intercept. After this, Hypothesis 1 was tested in Model 1, in which we entered control variables as well as the day-level predictor daily flow. In Model 2, we added the person-level predictor flow variability to test whether individual differences in flow variability were negatively related to a person's creative performance at the day-level (i.e., Hypothesis 2). This model also included a random slope for daily flow due to the later test of a cross-level interaction (Snijders & Bosker, 2012). In Model 3, we tested Hypothesis 3 by adding the cross-level interaction between day-level flow and flow variability.

Results

Descriptive Statistics

Means, standard deviations, and intercorrelations among study variables are displayed in Table 1. Based on the null models, we first calculated the amount of variance in day-level flow and creative performance accounted for by differences between vs. within persons (i.e., ICCs, Snijders & Bosker, 2012). In the case of day-level flow, 42% of the variance was due to differences within persons, while the remaining 58% of the variance were due to differences between persons. For day-level creativity, within-person differences accounted for 33% of the total variance. Because our main study variables vary between as well as within persons our multilevel approach is justified (Snijders & Bosker, 2012).

INSERT TABLE 1 ABOUT HERE

Hypothesis 1: Daily Flow Experiences and Daily Creative Performance

Table 2 presents the results of our multilevel regression analysis. The table also includes Snijders and Bosker's (2012) R^2 to assess explained variance, as well as Akaike's Information Criterion (AIC), the Bayes Information Criterion (BIC), and the deviance statistic (- 2LL) as indicators of model fit. In Model 1, daily flow states positively predicted daily creative performance ($\gamma = 1.14$, $SE = .26$, $t = 4.38$; $p < .001$). This result implies that if persons experienced higher than average flow states on a certain day, this sparked their daily creative performance. Thus, Hypothesis 1 was supported.

Hypothesis 2: Flow Variability and Daily Creative Performance

Adding the person-level predictor flow variability to Model 2 revealed a negative effect on day-level creative performance ($\gamma = -1.85$, $SE = .85$, $t = -2.18$; $p < .05$). This finding implies that persons with highly varying flow states display lower levels of creative performance at the day-level (i.e., flow variability explains between-person variance in a person's daily creative performance). Thus, Hypothesis 2 was supported. Before testing the relationships with~~influence of~~ Level 2 variables (e.g., cross-level interactions), we first added

a random slope for daily flow to Model 2 in order to determine whether the daily flow-daily creative performance relationship did vary between persons (see Snijders & Bosker, 2012). This parameter, however, was not significant ($\gamma = 0.55$, *SE* = .36, $t = 1.53$; *ns*).

Hypothesis 3: The Cross-Level Interaction between Daily Flow and Flow Variability

Although we reported a non-significant random slope for daily flow in Model 2, tests of slope variability are highly conservative and cross-level interactions have been demonstrated to also occur in the absence of significant random slopes (LaHuis & Ferguson, 2009). Because we had theoretical reasons to expect a cross-level interaction, we proceeded with the analysis in line with methodological recommendations (e.g., Snijders & Bosker, 2012). We thus added the cross-level interaction between daily flow and person-level flow variability to Model 3 to test Hypothesis 3. The interaction term proved to be statistically significant ($\gamma = 6.12$, *SE* = 1.74, $t = 3.52$; $p < .001$). Figure 1 displays the respective interaction effect. Simple slope tests (Preacher, Curran, & Bauer, 2006) revealed a positive relationship between daily flow and daily creative performance for persons with *high (*+1 *SD* above the mean; $\gamma = .92$, *SE* = .31, $t = 2.94$; $p < .01$*)*, but not for persons with *low (*-1 *SD* below the mean; $\gamma = -.80$, *SE* = .52, $t = -1.53$; *ns)* levels of flow variability. Because a positive relationship between daily flow and daily creative performance only emerged among persons with high flow variability, Hypothesis 3 is partly supported.

Additional Analyses

We re-ran all analyses (a) including only those control variables that significantly correlated with our outcome variable daily creative performance (i.e., general creative performance, job tenure, and presence of children) as well as (b) without control variables (see Becker, 2005). Neither analysis changed the pattern of results.

INSERT TABLE 2 AND FIGURE 1 ABOUT HERE

Discussion

Our results show that daily flow experiences are positively related to daily creative performance. Furthermore, we find that (regardless of a person's overall flow levels) flow variability explains between-person variance in daily creative performance, such that persons with a higher flow variability display lower creative performance at the day-level. Finally, we demonstrated that only persons with high flow variability benefitted from daily flow in terms of increased daily creative performance. In sum, we theorized and found evidence to suggest that different processes related to flow variability play out at different levels of analysis.

Theoretical Implications

The findings of our study have theoretical implications for the study of flow variability, as well as the literatures on flow and creativity. First, by introducing the concept of flow variability, we highlight the importance of considering a person's intra-individual variability in flow over time, beyond overall flow levels. Although previous studies ~~(e.g., Debus et al., 2014; Demerouti, Bakker, Sonnentag, & Fullagar, 2012)~~ have revealed that daily fluctuations in flow ~~influence~~are characterized by dynamic patterns (i.e., chaotic and abrupt; Ceja & Navarro, 2011, 2012) and relate to ~~influence~~ wor~~wor~~k outcome~~s~~ ~~s~~(e.g., vigour; Demerouti, Bakker, Sonnentag, & Fullagar, 2012), these studies nonetheless utilized discrete reports of flow from day-to-day, rather than considering the composition of these fluctuations over time (see Scott et al., 2012, for a similar approach in the context of emotional labour variability). Our findings underscore the notion that flow experiences are subject to daily fluctuation, and that flow variability as *fluctuations in day-to-day flow states* reliably captures individual differences in flow across days (Fiske, 1961; Ram & Gerstorf, 2009).

Second, our study contributes to flow theory that has previously suggested that certain individual difference factors would allow some persons to more deliberately enter flow

experiences (e.g., Nakamura & Csikszentmihályi, 2002) – thus highlighting the role of trait-like individual differences. In the present study~~Thus~~, we complement and extend prior theorizing~~work~~ concerning a trait approach to flow research and demonstrate the usefulness of an intra-individual variability measure to study the correlates~~effects~~ of individual differences in experiencing flow. More generally, by testing the functional (dis)similarity of flow variability across levels we also contribute to a better multilevel validation of the flow construct (Kozlowski & Klein, 2000).

Finally, we contribute to the creativity literature by suggesting~~highlighting suggesting~~ that high~~the effects of~~high flow variability may ~~may~~ represent a double-edged sword. We found that although high flow variability is related to lower ~~hampers a person's~~is related to ~~lower~~ creative performance at the day-level, it is ~~can is~~ also related~~related lead~~ to outbursts of creativity on days where persons with high flow variability experience flow. The latter result underscores the developing viewpoint in the creativity literature that dynamic experiences characteristic of both controlled and flexible information processing are instrumental in achieving superior creative outcomes (Anderson et al., 2014; Bledow et al., 2013). Thus, our results highlight the distinctive correlates~~effects~~ of flow variability when viewed from different perspectives (i.e., across days and daily) and extend the within-person lens thus far adopted in creativity research. A~~Interestingly, s~~ noted above, Hypothesis 3 received partial support. In fact, simple slope analysis reveals that there was a slight trend towards a *negative* relationship between daily flow and creative performance among persons low in flow variability (exact $p = .13$), perhaps indicating~~thus even contributing to~~ a slight reversion of the daily flow-creativity relationship.

Limitations and Directions for Future Research

Our study is not without limitations. We utilized self-report data which may increase the likelihood of common method variance (CMV; Podsakoff, MacKenzie, Lee, &

Podsakoff, 2003). However, CMV cannot generate cross-level interaction effects in multilevel modeling analyses and in fact tends to suppress their detection (Snijders & Bosker, 2012). In fact, scholars have suggested using self-reports in the study of within-person relationships between experiential states (e.g., flow) and creative performance; this is because supervisors or peers are not able to accurately monitor transient states or creative behaviour on such a short-term basis (Ng & Feldman, 2012).

Given that this is the first study on flow variability, future research may benefit from examining this construct in more detail, such as by examining personal and situational predictors. With regard to personal factors, it might be the case that neurotic persons exhibit a higher flow variability, because they are generally predisposed to higher affective reactivity (Gross, Sutton, & Ketelaar, 1998). With regard to situational factors, role ambiguity might increase flow variability because it creates goal-related uncertainty and diverts attention away from job tasks (Harris, Artis, Walters, & Licata, 2006) thereby being more likely to undermine regular flow experiences.

In a similar vein, it may be worth exploring whether within-day flow variability is~~is~~ comparably ~~y~~related to~~related to~~ daily creative performance as is ~~as is~~between-day flow variability. Although accounting for within-day flow variability in supplemental analyses neither changed the direction or significance of our results, it may be the case that a more fine-grained experience sampling approach is needed to detect such effects (see e.g., Ceja & Navarro, 2011, 2012). These and other possibilities could be addressed by future research.

Practical Implications

Our results suggest that flow variability is a double-edged sword. Managers of departments with goals that require consistent creative output from their employees (e.g., R&D departments; Unsworth, 2001) would benefit from working with persons with low flow variability. Because their work progress is likely to vary less between days, managers can

rely on their creative output in the long term. However, in work contexts that benefit more from short-term creative outbursts such as the arts or design industries (Wijngaarden, Hitters, & Bhansing, 2019), our findings suggest that managers may want to employ persons with high flow variability and nurture their daily flow experiences as this can serve to ignite their daily creative spark.

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Table 1
Means, standard deviations, and zero-order correlations among study variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. General creative performance	4.90	1.35	—								
2. Gender	0.59	0.50	-.22	—							
3. Age	44.20	11.36	-.04	.16	—						
4. Job tenure	14.19	9.24	-.12	.15	.64**	—					
5. Presence of children	0.52	0.51	.34*	.04	-.17	-.17	—				
6. Flow variability	0.23	0.14	.02	.08	-.30*	-.11	.15	—			
7. Day-level emotional exhaustion	2.50	1.12	.10	-.05	-.14	-.07	.08	.15	—	-.14*	-.09
8. Day-level flow	3.89	0.54	.46**	.15	.19	.33*	.24	-.06	-.09	—	.63**
9. Day-level creative performance	4.99	1.57	.57**	.00	.30	.38*	.34*	-.17	-.04	.70**	—

Note. Correlations below the diagonal are person-level correlations *(N* = 44*),* with day-level measures aggregated to person level. Correlations above the diagonal are day-level correlations (*N* = 201).

* $p < .05$ level (two-tailed).

** $p < .01$ level (two-tailed).

Table 2
Results of Multilevel Regression Analyses

Variable	Model 1			Model 2			Model 3		
	γ	*SE*	*t*	*γ*	*SE*	*t*	*γ*	*SE*	*t*
Level 2 predictors									
General creative performance	0.36	0.11	3.27**	0.33	0.11	3.00**	0.33	0.11	3.00**
Person-level flow	1.14	0.32	3.56***	1.16	0.30	3.87***	1.17	0.30	3.90***
Gender	-0.11	0.26	-0.42	-0.09	0.25	-0.36	-0.11	0.25	-0.44
Age	0.01	0.01	1.00	0.00	0.01	0.00	0.00	0.01	0.00
Job tenure	0.04	0.02	2.00*	0.04	0.02	2.00*	0.04	0.02	2.00*
Presence of children	0.50	0.26	1.92	0.52	0.25	2.08*	0.53	0.25	2.12*
Person-level flow variability				-1.85	0.85	-2.18*	-1.40	0.87	-1.61
Level 1 predictors									
Day-level emotional exhaustion	-0.14	0.09	-1.55	-0.07	0.08	-0.88	-0.03	0.08	-0.38
Day-level flow	1.14	0.26	4.38***	0.55	0.36	1.53	0.06	0.35	0.17
Cross-level interaction									
Person-level flow variability × Day-level flow							6.12	1.74	3.52***
-2*Loglikelihood		561.22			540.02			530.37	
Differential -2*Log		75.84***			21.20***			9.65**	
△df		8			1			1	
Pseudo -R within		0.54			0.15			0.00	
Pseudo -R between		0.68			0.06			0.00	
AIC		583.22			568.02			560.37	
BIC		619.56			614.27			609.92	
Within-person (L1) variance	0.73	0.08		0.56	0.07		0.56	0.07	
Between-person (L2) variance	0.44	0.13		0.44	0.12		0.44	0.12	

Note. Model 1 was compared with a null model with the intercept as the only predictor *(*γ = 4.95; *SE* = 0.21; *t* = 24.15; Level 1 variance = 0.84; *SE* = 0.10; Level 2 variance = 1.69; *SE* = 0.40*)*. *p < .05. **p < .01. ***p < .001. Within-person (L1) variance refers to variance between days. Between-person (L2) variance refers to variance between persons.