Set them free!

Task-order autonomy fosters flow, self-efficacy, cognitive performance, and challenge-seeking in test situations

Katja Mierke, Sabine Scheidtmann & Dinara Ibrahimova
Hochschule Fresenius

ABSTRACT

Building upon prior findings on benefits of autonomy in task performance, we examined effects of free vs. strictly prescribed task order within an otherwise restricted test setting in two experiments, assessing flow, self-efficacy, performance, and challenge-seeking (Experiment 1) as well as self-handicapping behavior (Experiment 2) in a subsequent task. In Experiment 1 (N = 73) participants in the autonomy condition (as compared to a control group with strictly prescribed task-order) showed significantly enhanced self-efficacy and performance in cognitive tests, and more often chose presumably more difficult tasks for a subsequent task, in which effects on flow also reached significance. In Experiment 2 (N = 100), false negative feedback on performance in a self-relevant (vs. self-irrelevant) first task induced self-handicapping prior to a subsequent task. Compared to the control condition with strictly prescribed prior task order, this effect was eliminated when task-order could be chosen autonomously. Task-order autonomy thus fosters factors of psychological growth even in highly structured achievement test situations. The present findings bear practical implications for organizational and pedagogic settings, as well as for employer image resulting from applicant experience in personnel selection procedures.

Keywords: autonomy, flourishing, self-handicapping, challenge-seeking, applicant experience

1 Introduction

1.1 Autonomy and Flow at Work

Factors that enhance motivation, flow, self-efficacy, and growth at the workplace have long since been of vital interest in research, and increasingly so with the rise of positive organizational psychology (Luthans, 2002; Wright, 2003). According to Self-Determination Theory (Ryan & Deci, 2000) competence, relatedness, and autonomy constitute three fundamental needs that are considered vital for individual growth and well-being. Numerous studies have shown a positive relationship between need satisfaction and employees' work-related well-being and performance, autonomy yielding the strongest correlations of the three (for an overview, see Gagné & Deci, 2005). There is solid support for an impact of autonomy on self-efficacy, motivation, and performance in academic contexts or at the workplace (Bandura, 1989; Spector, 1986). More recently, research within the framework of the Job Demand Resources Model (Bakker & Demerouti, 2007; Bakker, Demerouti & Schaufeli, 2003) has shown that autonomy provides a valuable resource in coping with otherwise stressful situations at work (e. g. Van den Broeck, Vansteenkiste, De Witte & Lens, 2008; Zito, Cortese, & Colombo, 2016), and autonomy is considered the core counterpart of demands in Karasek's original Job Demand Control Model (Karasek, 1979). Here, so-called active jobs are characterized by high demands as well as high internal control, resulting in a motivation push, high productivity and task enjoyment (in contrast to stress).

In line with this reasoning, Csikszentmihalyi identified autonomous control as a central prerequisite for flow experiences in his seminal description of the phenomenon (1975), an idea valid until today (Csikszentmihalyi, 2014). Flow states are typically characterized by subjective enjoyment and effortlessness during task performance, a good balance between (high) skills and (high) requirements, feelings of absorption, and a loss of time-perception. Although flow has first been studied in the context of leisure time activities, it is by now well established that it is even more likely to emerge at work (Csikszentmihalyi & LeFevre, 1989; Peifer & Wolters, in press). Not surprisingly, control and autonomy in task performance also have repeatedly been shown to be positively related to flow (e. g., Fagerlind, Gustavsson, Johansson, & Ekberg, 2013; Fullagar & Kelloway, 2009; Kuo & Ho, 2010; Rau & Riedel, 2004), and flow, in turn, to be a covariate of performance (e. g., Demerouti 2006; Engeser, Rheinberg, Vollmeyer & Bischoff, 2005). These findings render flow a particularly interesting constituent of upward spirals of psychological growth, as for instance suggested by Fredrickson (2013): Building upon experimental evidence that positive emotions broaden the scope of perception and (social) behavior, she suggests that individuals, as consequence, explore their environment more intensely, and thereby build cognitive and social resources. These, in turn, enhance the actual likelihood of positive experiences (e. g., challenges actually mastered), again resulting in more positive emotions (e.g., fulfillment, pride, high self-efficacy), and so forth. Ideas of self-perpetuating growth have also been suggested in the context of theorizing and research on intrinsic motivation (e. g., Amabile, Hill, Hennessey & Tighe, 1994).

Within the present work, we were interested in investigating potential positive effects of autonomy not only on flow, self-efficacy and performance, but also on choice-behavior in subsequent achievement situations, such as moderate challenge-seeking and refraining from self-handicapping behavior. In the next section, it will be outlined why we assume that participants provided with autonomy in a first task might become more inclined to decide for a moderate challenge in a similar follow-up task (Experiment 1), and also become less prone to self-handicapping (Experiment 2).

1.2 Decision making, challenge-seeking and self-handicapping

Following Atkinson's (1956) classic model of risk choice, individuals striving for success should choose moderately challenging tasks of medium difficulty. In contrast, people primarily motivated to avoid failure should either choose extremely easy or extremely difficult tasks. Extremely easy tasks almost guarantee them to succeed, whereas the extremely difficult ones inherently allow for an external attribution of failure, as hardly anyone would have mastered such a challenge. Thus, avoidance-driven task choices protect self-esteem, as one does not have to consider lack of ability as a potential cause for one's failure. In contrast to an explorative pursuit of mastery goals, however, avoidance-driven task choices will hardly contribute to learning and growth (cf. Higgins, 1998; Schwinger & Stiensmeier-Pelster, 2011a). In the present context, and given that autonomy during task performance does foster flow, self-efficacy and achievement, it should also make individuals more inclined to make more explorative choices that challenge their skills in a moderate way, as part of a positive upward spiral of broadening and building (Fredrickson, 2013). This idea will be tested in Experiment 1.

Another, somewhat similar strategy to protect self-esteem in performance-related decision-making situations is the phenomenon of self-handicapping behavior, as first described by Berglas and Jones (1978) and thoroughly studied since (for a meta-analytic review on academic self-handicapping, see Schwinger, Wirthwein, Lemmer & Steinmair, 2014). Self-handicapping behavior refers to some people's tendency to actively create obstacles when facing a task they expect to fail in (e. g., take performance-inhibiting drugs, or procrastinate until last minute). This strategy allows them to attribute eventual failure to external factors instead of to an internal lack of ability, thereby protecting their self-esteem (Arkin & Baumgardner, 1985). Accordingly, self-handicapping has been found to primarily occur when task outcomes are self-relevant, i.e., when poor performance should really threaten self-esteem (Greenberg, Pyszczynski & Paisley, 1984; Shepperd & Arkin, 1989). In addition, some people seem to show a disposition for self-handicapping across situations, and Knee and Zuckerman (1998) report a strong negative correlation between such habitual self-handicapping and autonomy-orientation: The more autonomy-oriented, the less prone participants were to self-handicapping behavior. In their work, however, both factors were assessed via self-report, leaving causal relationships between the two open to speculation. Following the idea that autonomy fosters self-efficacy and a "positive", explorative orientation to achieve success (rather that to avoid failure), we hypothesize that it should also protect from self-handicapping behavior in a subsequent task. This assumption will be tested in Experiment 2.

1.3 Task-order autonomy

Taken together, there is sound evidence for positive effects of autonomy on a wide range of factors that affect human well-being, learning, productivity and growth in academic contexts and at the workplace. In some applied settings, however, options for providing autonomy are limited, e. g., when tasks just have to be completed in a certain manner, or must be kept strictly comparable, as it is the case in exam situations, personnel selection procedures, and the like. Still, we suggest that even "minimal" task-autonomy can suffice to yield the positive effects outlined above, as it symbolically shows respect towards individuals' according need (cf. Van den Broek, Vansteenkiste, de Witte, Soenens, & Lens, 2010). Amabile and Gitomer (1984), for instance, could show that the artwork created by children allowed to freely choose materials for their collage was rated significantly higher in creativity as compared to children who had been handed over the materials by the experimenter (in a paired matching procedure that kept materials constant across experimental conditions; raters were unaware of experimental condition). According to Langfred and Moye (2004), task-autonomy can be defined as "the degree to which an individual is given substantial freedom, independence, and discretion in carrying out a task, such as scheduling work and determining procedures to follow (Hackman, 1980)" (p. 935). In the present context, task-autonomy is referred to as subjective psychological freedom, as can also emerge while one follows others' requests (Van den Broek et al., 2010). Providing employees with task autonomy can be expected to yield higher motivation, satisfaction, and performance (Argote & McGrath, 1993; Dwyer, Schwartz, & Fox, 1992; Loher, Noe, Moeller & Fitzgerald, 1985), even though the tasks themselves are set.

This could, for instance, be realized by letting employees, students, or applicants choose the *order* in which the single tasks of a standardized task-set are completed, which we will call task-order autonomy. Provided that task-order autonomy does foster flow, self-efficacy, and performance, it may also enhance enjoyment and acceptance of the test procedure or institution as a whole, and thus potentially contribute to a positive institutional image, including employer branding in times of shortage of specialist and managerial talent (Kersting, 2010).

We wish to go beyond prior findings by investigating spill-over effects of autonomy in one task on challenge-seeking and performance-related decision making (i. e., self-handicapping) in a subsequent task. Somewhat similar spill-over effects have been shown recently in a series of experiments by Christandl, Peifer and Mierke (2017), who report effects of experimentally induced flow in a first task on performance in a follow-up task. Assuming to replicate that task-autonomy does induce flow (Czikszentmihalyi; 1975, 2014; Fagerlind et al., 2013; Rau & Riedel, 2004), enhance self-efficacy (Bandura, 1989; Spector, 1986), and performance (Gagné & Deci, 2005) as compared to participants in a control condition with low task autonomy, we further hypothesize that autonomous participants should be more inclined to seek more difficult follow-up tasks (Experiment 1), and be less prone to self-handicapping choices prior to a subsequent achievement situation (Experiment 2).

2 Exp. 1: Flow, self-efficacy, performance and challenge-seeking

In Experiment 1, we tested the hypotheses that giving participants task order autonomy within an otherwise restricted setting will lead to higher flow, self-efficacy, and performance, and enhance the likelihood to choose challenge rather than the easy way, as compared to participants in a control condition where task-order is strictly prescribed.

2.1 Method

A convenience sample of N = 73 students (61 female, age M = 21.88 (SD = 1.80) was recruited in December 2014 on campus of Fresenius University of Applied Sciences Cologne for a "study on Assessment Center validation including different cognitive tasks". For a MANOVA with two levels and three dependent variables, G*Power (Faul, Erdfelder, Lang & Buchner, 2007) determined N = 74 as the optimal sample size for detecting a medium effect size (f2 = 0.16; Cohen, 1988) with a power of 1-ß = 0.80, accepting the conventional α-error probability of .05.

2.2 Procedure and Materials

After having consented to participate, subjects were scheduled in small groups of a maximum of ten per appointment, and as a small group assigned to the autonomy (n = 35) vs. control condition (n = 38) by systematically alternating conditions in order to yield approximately similar sample sizes for both conditions. Sessions were conducted in a standard lecture room. Participants were instructed that the aim of the study was to validate different task types for Assessment Centers, namely a concentration task (marking particular letters in rows of similar letters), a visuo-spacial task (identifying the mirrored version of a target figure among tilted ones serving as distractors, five items), and a verbal task (finding analogies, ten items). Tasks were adapted from text book examples. Participants were asked to complete as many items as possible in the eleven minutes provided. Pretests had shown that it was possible to complete the whole task-set within eleven minutes, so that the task-set represents a power- rather than a speed-test. Following this general introduction, participants in the experimental condition were told that task order was up to their choice, and that they were to free to switch back and forth between items. In the control condition, the experimenter stressed that all tasks must please be processed exactly as stapled, and that scrolling backwards or jumping between tasks was not permitted. For both conditions, all tasks were provided in paper-pencil-versions, and the task order as stapled was 1) concentration task, 2) mirrored figures, and 3) verbal analogies. When time was over, the experimenter asked participants to stop and fill in a short questionnaire (see below), also provided as paper-pencil version.

Afterwards, participants were explained that there was a second, similar task-set readily prepared on their table. This consisted of indeed similar task types, but different tasks: again, there was 1) a concentration task (this time marking a different letter type), 2) a visuo-spacial task (identifying the sculpture figure resulting from a folding model amongst distractor figures), and 3) a verbal task (finding an applicable common category label for two exemplars amongst distractor labels). Participants were told that they had the choice between an easier and a more difficult version as compared to the first task-set. In fact, both task-sets were identical inside and participants' choice served as the dependent measure of challenge-seeking behavior. Both staples were available on each table from the beginning of the experimental session, the "easier" one marked with a little green, and the "difficult" with a little red flag. Participants thus did not have to proclaim their choice in front of the group, but could just discretely make their "private" choice by taking one of the two stacks, in order to minimize social pressure. Again, they were given eleven minutes for completion, followed by another questionnaire (see below). If required, participants received partial course credit, were thanked and debriefed. The procedure took 45 minutes.

2.3 Dependent measures

Performance was scored by first determining the number of correct responses for each task in the first and second trial, respectively. For the concentration tasks, this was the number of correctly marked target letters (hits) minus falsely marked non-target letters (false alarms), the maximum score being 55. For the visuo-spacial tasks, the maximum number of correct responses per trial was five, for the verbal tasks ten. Detailed descriptive statistics for each subtest and trial are reported in Table A1. For hypothesis testing, all three values were z-transformed to account for different scaling, and a mean performance score was calculated per participant for each of both trials. Self-report measures administered after each task-set include ten items of the Flow Short-Scale (Rheinberg, Vollmeyer & Engeser, 2003) assessing feelings of fluency and immersion during task completion (e.g. "I am totally absorbed in what I am doing right now.") on a 7-point Likert scale (1 = does not apply, 7 = does apply, as suggested by the authors). This measure turned out to be of high internal consistency in the first (Cronbach's α_{t1} = .86) as well as the second trial (α_{t2} = .92) within the present sample, so that, as intended, mean indices could be computed for each trial for further analyses. Finally, participants filled in the Allgemeine Selbstwirksamkeitskurzskala (ASKU; Beierlein, Kovaleva, Kemper & Rammstedt, 2012), a three item short scale assessing general self-efficacy (e. g. "In difficult situations, I can rely on my abilities") on 5-point Likert scales (1 = does not apply at all, 5 = does fully apply, as suggested by the authors). The ASKU also yielded satisfactorily homogenous responses in the first (Cronbach's α_{t1} = .80) as well as the second trial (Cronbach's α_{t2} = .89), and a mean index was computed for each trial. All statistical analyses were conducted using IBM SPSS 24, level of significance is the conventional $p < .05$.

2.4 Results and Discussion

As predicted, a MANOVA shows that participants in the autonomy condition yielded higher values than the control group across all dependent measures in the first trial (Wilk's Lambda, $F(3, 69) = 3.65$, $p = .02$, partial eta² = .13). Effects were significant for performance and self-efficacy, but showed only a small, non-significant tendency for flow (see Table 1). Moreover, and as hypothesized, participants in the autonomy condition were more likely to choose the presumably more difficult subsequent task-set than participants in the control condition (31/35 vs. 23/38; $\chi^2(1) = 7.44$, $p < .01$). A MANOVA for the second trial also yields an overall positive effect of autonomy (Wilk's Lambda, $F(3, 69) = 3.67$, $p = .02$, partial eta² = .14). This time, however, effects were statistically significant for self-efficacy and flow, but not for performance (see Table 1).

Table 1. Means, standard deviations, and MANOVA statistics for mean performance (z-scores), self-efficacy (scale range 1-5) and flow (scale range 1-7) as a function of experimental condition in trial 1 and trial 2 of Experiment 1.

		Autonomy high Mean (*SD*)	Autonomy low Mean (*SD*)	*F*	*df*	*p*	η²
Trial 1	Performance	0.19 (0.51)	-0.18 (0.71)	6.28	3,69	< .01	.08
	Self-efficacy	4.07 (0.52)	3.75 (0.52)	6.88	3,69	< .01	.08
	Flow	5.05 (0.93)	4.68 (1.16)	2.19	3,69	.14, *ns.*	.04
Trial 2	Performance	0.03 (0.71)	-0.03 (0.68)	0.14	3,69	.71, *ns.*	< .01
	Self-efficacy	4.16 (0.56)	3.75 (0.50)	10.85	3,69	<.01	.13
	Flow	5.25 (1.35)	4.64 (1.28)	4.04	3,69	<.05	.05

Taken together, the data support prior findings on autonomy as enhancing performance in the first trial, and self-efficacy in both trials (Bandura, 1989; Spector, 1986). Now one could argue that better performance of participants provided with task-order autonomy in trial one may simply go back to higher scores in later tasks. These might have been objectively easier or subjectively less aversive, and thus been worked on with priority (an option the control group did not have). However, as can be seen in Table A1 in the appendix, better overall performance in the experimental condition was predominantly due to higher scores in the tasks stapled first and second in the set, rendering such an explanation unlikely. Effects of autonomy on flow failed statistical significance in the first trial, but were significant in the second trial. However, despite enhanced self-efficacy and flow, performance did no longer differ between conditions in the second task-set. Participants in the experimental condition may have been suffering from fatigue, as they had performed better in the first trial, potentially having invested more effort there. Alternatively, participants in the control group might have been more motivated in the second trial to give their best, because more of them had chosen the "easier" version.

More important to our central research question here, and as expected, autonomous participants were more likely to seek challenge and choose the "more difficult" follow-up task-set, as compared to participants in the control group. Thus, they decided to accept higher requirements, and therefore the chance to meet or fail them. In Experiment 2, we sought to further investigate effects of autonomy on achievement related decision-making behavior in terms of self-handicapping.

3 Exp. 2: Self-efficacy, performance, and self-handicapping behavior

The aim of Experiment 2 was to replicate Knee and Zuckerman's (1998) findings of a negative relationship between autonomy-orientation and self-handicapping in an experimental setting. It is hypothesized that providing participants with task-order autonomy should prevent self-handicapping behavior in an achievement situation that was otherwise liable to self-handicapping. Further, we aim to replicate the positive effects of task-order autonomy on self-efficacy and performance found in Experiment 1. Flow was not assessed for reasons of overall length of the procedure. As a second independent variable next to task-order autonomy, self-relevance of the task was manipulated in order to explore if the hypothesized positive effects of autonomy differ accordingly, i.e., if the hypothesized protective effect is stronger in the condition with high self-relevance where likelihood of self-handicapping is particularly high.

3.1 Sample and Overview

A convenience sample of $N = 100$ students was recruited in June 2015 on campus of Fresenius University of Applied Sciences Cologne (89 female, age $M = 21.85$, $SD = 0.18$) and scheduled for appointments in small groups of a maximum of seven. Small groups were assigned to one of the four conditions resulting from a 2 (self-relevance: high vs. low) x 2 (autonomy: high vs. low) between subjects design by alternating conditions over appointments. The last small groups were composed such that sample sizes equalized to $n = 25$ per condition in the end. In order to induce self-esteem threat as a general prerequisite to self-handicapping, all participants first completed a set of three tasks (comparable to the task sets used in Experiment 1) under one of the four conditions, and were given a standardized negative feedback on their performance. Afterwards, they were asked to choose a piece of music to listen to (reflecting self-handicapping) during the subsequent concentration task, and finally filled in a brief questionnaire on self-efficacy and general self-esteem before being thanked and thoroughly debriefed.

It was hypothesized that participants in the high self-relevance (in contrast to those in the low self-relevance) condition will exhibit self-handicapping behavior more often, but that this effect is buffered or even eliminated if they had been given task-order autonomy in the first task. Also, as for Experiment 1, it is assumed that task order autonomy leads to an increase in self-efficacy and eventually performance in the second task.

3.2 Procedure, materials, and dependent measures

Following Pyszczynski and Greenberg (1983), self-relevance of negative feedback was induced by claiming that the task-set to be completed was "a well-established measure of general intelligence and a very good predictor of academic and even professional success in the social sciences and economics". In the two control conditions with low self-relevance of failure, participants were told that the test was "just generally assessing some mental abilities providing a rough overview, but scores are not predictive of general intelligence or academic achievement". The second independent factor, autonomy, was manipulated by means of the same instructions as in Experiment 1: Half of the participants in each self-relevance condition were free to choose in which order they worked on the items forming the three different tasks-types, the other half was asked to strictly follow the order of tasks and items as stapled, and not to scroll back or jump. Again, the set consisted of three, yet different subtasks (30 anagram word puzzles, ten items on verbal analogies, and six figural matrices, the latter two representing a sample from the according IST 2000-R subscales (Amthauer, Brocke, Liepmann & Beauducel, 2001). Tasks were chosen such that it should be difficult for participants to determine their actual performance level. Differing from Experiment 1, participants were provided plenty 30 minutes for completion in order to prevent an external attribution of their failure to scarce time.

This first task-set served only to threaten self-esteem by means of the false negative feedback, so after completion, participants were asked to leave the room for a short break and presumable scoring of the test as to be left at their seat. The experimenter then filled in a simple "result section" on each test sheet, with three partial scores summing up to ten out of 30 points for each participant, and added the annotation "below average", irrespective of experimental condition and actual performance. When she invited participants back to the room, she asked them to briefly take a look at their results as noted on the last page of the task set, but not to talk about it or ask further questions until the end of the session. It was announced that they will receive more elaborate feedback at the end of the session.

Then, all participants were invited to choose between listening to either a presumably performance-enhancing or a presumably performance-inhibiting piece of music during the next task, a letter-marking concentration task. They were handed over a one-page leaflet stating that many prior studies had shown the respective effects on achievement tasks and illustrating these in a colored bar chart. At the bottom of the page, participants were asked to mark whether they chose the enhancing or the inhibiting piece of music. The songs were two slow instrumentals with electronic elements, „Breathe" by Seabound, and „Invert" by Gridlock. Both pieces can be assumed not to differ in their effect on performance due to rather similar structure and style, and have already been successfully used in prior studies on self-handicapping by Schwinger (2008, Study 4). Spontaneously recruited participants were provided with MP3-players and headphones, but for practical reasons, pre-scheduled participants had been asked to download both pieces on their smartphone or a similar suitable device in advance and to bring it with them (including headphones, if available). Thus, it would not have been credible to keep music constant and use the same piece regardless of participants' choice. We do not consider this problematic, as the central dependent variable of interest here was the choice itself, with presumably performance-inhibiting music representing self-handicapping behavior.

After the feedback on the first task-set, they were instructed to work on the revised version of the classic d2-R concentration task (Brickenkamp, Schmidt-Atzert & Liepmann, 2010). Following the standard procedure suggested by the authors, they were given 20 seconds for each of 14 rows of 57 letters to mark all occurrences of a target letter among similar distractor letters, while listening to the music chosen. The so-called *Fehlerprozentwert* served as dependent variable for performance, which is determined by the proportion of false alarms and misses relative to the number of correctly marked letters times 100, a higher value thus reflecting worse performance. After completion of the d2-R, participants were asked to switch off the music and fill in a short version of Jerusalem and Schwarzer's (1981) self-efficacy scale, consisting of ten statements reflecting general self-efficacy (e.g., "I have no difficulties to realize my purposes and goals"). Items were to be responded on a 4-point Likert scale with 1 = does apply, 4 = does not at all apply) and turned out to be of sufficient homogeneity within the present sample (Cronbach's $\alpha = .81$) in order to allow for summarizing them in a mean index. Finally, participants were asked to indicate their age, gender, study programme, and suspected purpose of the experiment. They were thanked for their participation, offered a sweet and partial course credit, and thoroughly debriefed, with particular emphasis on the mock nature of the negative feedback provided. The whole procedure took about 60 minutes per session. Statistical analyses were conducted using IBM SPSS 24, level of significance is the conventional $p < .05$.

3.3 Results and Discussion

As expected, music choices were strongly affected by self-relevance and autonomy (χ^2 (1) = 7.64, $p = .006$; see Table 2): When self-relevance of prior negative feedback was low, only few participants chose the performance-inhibiting music, and autonomy made no difference here. Under high self-relevance, however, self-handicapping emerged in the control condition with low task autonomy, but was prevented when task-order autonomy condition, resulting in a proportion of self-handicappers similar to those in the low self-relevance groups. The data thus lend further support to our assumption that autonomy has positive spill-over effects on challenge-seeking (as opposed to self-handicapping) decision behavior in subsequent achievement situations.

Table 2. Frequencies for choice of performance-enhancing vs. performance-inhibiting music (= self-handicapping) in Experiment 2 as a function of experimental conditions.

	Self relevance high		Self-relevance low	
	Autonomy high	Autonomy low	Autonomy high	Autonomy low
Enhancing	19	10	21	17
Inhibiting	6	15	4	8

Performance in the concentration-task did not follow a normal distribution (K-S-Test $p < .01$), so that non-parametric Mann-Whitney-U-tests were conducted. Participants previously provided with autonomy yield a lower *Fehlerprozentwert* (Md = 3.13) compared to those in the control condition (Md = 5.51, U = 1.548, p = .02). Whether self-relevance was high (Md = 3.75) or low (Md = 4.06) did not affect performance (U = 1.214, p = .94, *ns*.). Thus, autonomy in a previous task did enhance performance in a follow-up task in Experiment 2. This suggests that the absence of such an effect in Experiment 1 may indeed have been due to less effort as resulting from the belief to face a very difficult task-set in the control condition, or from fatigue in the experimental condition. Alternatively, it may be that participants in Experiment 2 profited from a self-fulfilling prophecy induced by the belief to listen to performance-enhancing music.

The self-efficacy scores followed a normal distribution, so that an ANOVA was conducted to test differences across experimental conditions. Replicating findings from Experiment 1, participants in the autonomy condition report higher self-efficacy ($M_{\text{high self-relevance}}$ = 3.19, SD = 0.73, $M_{\text{low self-relevance}}$ = 3.05, SD = 0.37) as compared to the control condition ($M_{\text{high self-relevance}}$ = 2.96, SD = 0.31, $M_{\text{low self-relevance}}$ = 2.80, SD = 0.47), and this main effect is statistically significant (F(1, 96) = 5.12, p = .02, partial eta² = .05). Neither the main effect of self-relevance (F(1,96) = 1.15, p = .29, *ns.*) nor the interaction (F < 1) approached significance.

4 General Discussion

Taken together, the present results are in line with decades of research showing a positive relationship between autonomy and intrinsic motivation, flow, and performance, as briefly reviewed in the introduction. We could show here that even minimal and experimentally induced autonomy within an otherwise restricted setting, namely free choice of task-order, can have positive effects on participants' subjective flow experience, self-efficacy, and objective performance. In particular, we were interested in how far such positive effects spill over to achievement-related decision-making when facing subsequent tasks, thereby potentially triggering positive upward-spirals of positive learning experiences and growth (Fredrickson, 2013). Accordingly, we could show that experimentally induced autonomy did enhance challenge-seeking (Experiment 1), and even prevent self-handicapping behavior (Experiment 2) in a follow-up task. Moderate challenge-seeking is typically regarded as an important constituent for further flow experiences (Csikszentmihalyi, 1975; 2014), as well as for building future competences (cf. Amabile, Hill, Hennessey & Tighe, 1994), thereby promoting upward spirals of flourishing. Self-handicapping, in contrast, can in the long term trigger a downward spiral of low performance, self-esteem-threat, and further self-handicapping (Zuckerman, Kieffer & Knee, 1998). Therefore, any intervention that may prevent such vicious cycles is of high practical impact, and task-order autonomy does seem to have this potential.

External validity of both studies is obviously rather limited due to sample as well as laboratory characteristics, and results need to be replicated in field settings. Future research should focus on longitudinal effects of mutual promotion among the variables involved here, as longitudinal studies in the field are still scarce. In addition, it would further our theoretical understanding of the underlying processes to experimentally manipulate other variables known to relate to flow and states of broadened attention, intrinsic motivation, creativity and other performance (Amabile, 1988; Fredrickson, 2013), including hard data, such as physiological measures (Peifer, 2012).

However, it seems promising to further investigate in how far results generalize to real-life situations, as this would bear powerful potential for a broad range of applied settings: Task-order autonomy may affect employees' as well as students' or pupils' working style, foster feelings of flow and self-efficacy, and last but not least enhance performance. One simple application of task-order autonomy is realized in some schools by no longer giving homework on a day-to-day basis, but providing the kids with a task-set for a whole week. Thus, they can freely choose whether to do the beloved or the less beloved subjects first, whether to make little packages of equal work-load, or to get done with it in one or two hard days and have free afternoons for the rest of the week (alternatively, of course, to procrastinate and finish the pile on the last day). Accordingly, to provide employees with autonomy is a core issue of most concepts of modern leadership. Even or in particular when tasks themselves are highly standardized, explicit free choice of task order may be an effective tool to show respect towards the human need for autonomy (Van den Broek et al., 2010), and thereby enhance intrinsic motivation. The same holds for test sets as used in personnel selection procedures, where explicit task order autonomy may just as well affect applicants' experience and evaluations of employer attractiveness, still an underestimated issue in times of shortage of professional and managerial talent.

Taken together, by providing simple task-order autonomy wherever possible, leaders, teachers, or HR professionals may contribute significantly to foster positive upward spirals of growth (Fredrickson, 2013) as built of positive emotions and engagement such as flow, enhanced self-efficacy and better objective performance, including spill-over to moderate challenge-seeking and less self-handicapping in future achievement situations.

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6 Appendix

Table A1. Task-wise means and standard deviations for Experiment 1 per trial and condition.

		Autonomy high (*n* = 35)	Autonomy low (*n* = 38)
Trial 1	Concentration task	25.11 (1.73)	23.34 (4.63)
	Visuo-spacial task	3.86 (1.56)	3.16 (1.73)
	Verbal task	8.86 (0.91)	8.66 (1.15)
Trial 2	Concentration task	32.97 (5.15)	33.63 (5.07)
	Visuo-spacial task	3.86 (1.40)	3.84 (1.15)
	Verbal task	8.14 (2.37)	7.32 (3.10)

Note. The theoretical maximum score was 55 in the concentration tasks, 5 in the visuo-spacial tasks, and 10 in the verbal tasks.

Corresponding author:
Prof. Dr. Katja Mierke
Hochschule Fresenius
Im MediaPark 4c
50670 Köln
GERMANY
mierke@hs-fresenius.de