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Decision mode as an antecedent of flow, motivational interference, and regret

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ABSTRACT

The presented study evaluates whether the decision mode for engaging in a task is relevant not only for the quality of the experience during an activity, as reflected in the occurrence of motivational interference and the possibility to enter flow, but also for the experience of regret. Intuitive in contrast to deliberative decision mode is hypothesized as being beneficial for an increased focus on work and a reduced experience of regret with possible consequences for current and future learning behavior of students. In an online study (n = 149) these variables related to a performed task were measured. Deciding intuitively to engage in the task was associated with a higher level of flow and a reduced experience of motivational interference. Regression analysis showed that an intuitive decision and motivational interference was related with regret at least by trend. Mediation analyses showed that the experience during the task mediates the relationship between decision mode and regret. The paper concludes with a discussion of the findings and their educational implications.

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1. Introduction

Imagine Paula sitting at her laptop as she tries to write an essay for her university class while she is surrounded by many temptations. A friend is online and wants to chat with her, she wants to buy new shoes online, and maybe check the posted results of her mid-term exams. As a result, Paula's attention is torn between these options and she is not fully involved in her task. The use of computer and internet plays a substantial role in our daily life and students are especially susceptible to other alternatives as temptations are only a mouse click away (Crook & Barrowcliff, 2001).

Generally, the presence of attractive alternatives might have compromising effects on studying (Fries, Dietz, & Schmid, 2008) and any concentrated work on a task (Veling & van Knippenberg, 2006). In such situations, goal shielding is necessary to concentrate on work without interferences (Veling & van Knippenberg, 2006). In this article we propose that the intuitive in contrast to the deliberative decision mode may assist in shielding against temptations and help in focusing on the task at hand because of its association with motivational interference and flow. Research shows that the experience of motivational interference negatively influences the performance in a learning task (Fries & Dietz, 2007) while being in the flow during a task can have positive consequences for learning outcomes (Ho & Kuo, 2010). If an activity is accompanied by many distractions it is difficult to reach the state of flow and it is probable to experience motivational more likely. Due to a great number of choice possibilities present in today's society (Gilovich & Medvec, 1994), regret has been on the rise. As regret is expected to influence further decision making (e.g., Zeelenberg & Pieters, 2004) and potentially also learning behavior, the study aims to identify factors that possibly help to avoid regret. Decision making and regret research have been so far confined mainly to the field of management and consumer psychology. It seems valuable to extend the study of their relationship to contexts relevant for learning. In the following sections, the concepts of regret, decision mode, flow, and motivational interference are discussed separately; then the hypotheses concerning their relations are presented.

interference; because of this reduced quality of experience, regret is

1.1. Regret

Regret can be defined as a cognitively driven negative emotion (Gilovich & Medvec, 1995) which arises after the realization or anticipation that one could have done better by choosing other alternatives (Sagi & Friedland, 2007). It is related to self-blame and is experienced as unpleasant (Connoly & Zeelenberg, 2002), therefore individuals try to avoid it. Although one of the most frequently mentioned life regrets are missed opportunities in education, for example, not having studied enough (Roese & Summerville, 2005), the unpleasant experience of regretting a performed study activity can shape future learning habits of actual students negatively. For example, in order to avoid regret the student may favor a leisure activity. Thus detrimental effects on achievement and study motivation can occur whenever regret about a learning alternative is experienced. Such negative experiences should therefore be avoided especially in study

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situations. Based on these theoretical considerations, we propose that the intuitive in contrast to the deliberative decision mode is related to an enhanced quality of experience during a task and reduced regret afterwards.

1.2. Decision mode

Compared to research on cognition-based decision making (Meehl, 1957), the interest in affect and intuition in decision making is more recent (Dane & Pratt, 2007). The cognitive-experiential self-theory (Epstein, 1991) as a dual-process conception postulates that individuals process information in two interactive and parallel working systems. The rational system is conscious, comprising deliberation and analysis, whereas the experiential system operates holistically and non-consciously, based on intuition and affect. The rational or deliberative decision mode follows established rules, is more detail-oriented and works in a serial manner (e.g., Denes-Raj & Epstein, 1994). In contrast, the experiential or intuitive system includes affective elements which result in a confirmatory feeling that reaffirms the actual choice (Dane & Pratt, 2007; Langan-Fox & Shirley, 2003). Here the sense of direct knowing without any use of conscious reasoning arises (Sinclair & Ashkanasy, 2005).

1.3. Flow

Flow can be characterized as a state of complete engagement or absorption in an activity which is perceived as rewarding in and of itself (Csikszentmihalyi, 1991). In addition to a changed perception of time, individuals experience a great sense of control due to balance between skills and challenge (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005). Instead of ruminative thoughts or worries, there is an intense and focused concentration on what the individual is doing at the moment (Nakamura & Csikszentmihalyi, 2002). As flow is more often experienced during work than during leisure activities (Csikszentmihalyi, 1997), this leads to possibilities to increase satisfaction and quality of work. Beneficial effects of flow were identified on learning and acquisition of skills (Csikszentmihalyi, Rathunde, & Whalen, 1993). Thus it is plausible that a higher involvement and a lower disturbance during a performed task would be related to a reduced occurrence of regret because flow is a positive experience that evokes satisfaction.

1.4. Motivational interference

Motivational conflicts arise between interdependent goals that cannot be pursued at the same time due to limited resources (Hofer et al., 2007). They can trigger motivational interference which represents an affective, behavioral, and cognitive destabilization of a chosen activity due to the motivational features of the non-chosen option. The mere knowledge of another alternative can interfere with the performance of an activity. For example, when writing an assignment for school or university at home, the knowledge that friends are chatting on an internet platform may interfere with the task at hand. This is why motivational interference is described as a failure in shielding or in efficient self-regulation (Hofer et al., 2007). An impaired experience during an activity, measured in terms of motivational interference, should be related to a higher level of regret because this is an unsatisfying experience where individuals are torn between several alternatives and unable to pursue any goal thoroughly (e.g., Fries & Dietz, 2007).

1.5. Proposed relationships

We propose a model in which the decision mode is related to the experience *during* and *after* a task. In the deliberative decision mode a person analyzes the pros and cons of a decision without providing affective support for it. A larger pre-decisional mindset is likely to trigger interferences and a higher level of regret. This is in accordance

with the theoretical approach of option attachment which indicates that a close deliberation of the positive attributes of other alternatives can increase the attachment to non-chosen alternatives and result in the feeling of discomfort (Carmon, Wertenbroch, & Zeelenberg, 2003). As individuals develop a sense of prefactual ownership during the deliberation period, the non-chosen options seem more desirable (Carmon et al., 2003). The deliberative mode should therefore facilitate the occurrence of regret. The increased salience of the positive attributes of the rejected alternative can elicit distracting thoughts and interfering emotions. Experiments in learning settings show that performance is hindered when a person holds concurrently a competing intention (Cook, Marsh, Clark-Foos, & Meeks, 2007). We argue that the attachment to other alternatives leads to a reduced attention to the task. As a result, flow cannot be entered because reaching the state of flow requires undivided attention on the task at hand (Csikszentmihalyi, 1997).

Conversely, deciding intuitively to engage in a task should be related to an increased quality of experience because of fewer distracting thoughts and emotions due to the shielding effect of the accompanying confirmatory feeling (Kuhnle & Sinclair, 2009; Shirley & Langan-Fox, 1996). Positive emotions related to the task at hand are shown as beneficial for students' motivation, cognitive resources, and achievement (Pekrun, Goetz, Titz, & Perry, 2002). A positive role could play also the non-conscious nature of intuitive processing (Sinclair & Ashkanasy, 2005), which is likely to minimize attention paid to the rejected alternatives, and thus reduce their salience (Carmon et al., 2003; Kuhnle, Sinclair, Hofer, & Kilian, submitted for publication). If full attention is directed to the performed task, as it is likely to occur after an intuitive decision (in contrast to a deliberative decision), a high quality of the activity is expected. Therefore a negative relationship to motivational interference (Hypothesis 1) and a positive relationship to flow (Hypothesis 2) is postulated. This decision is likely to be less questioned and less regret should arise (Hypothesis 3). Conversely, the diminished experience during an activity is expected to be related to a higher level of regret as a result of evaluating the quality of the task and challenging the decision (Hypothesis 4). Wherein flow is associated with positive experiences (Csikszentmihalyi, 1997), interference tends to leave a dissatisfying feeling that the time was not used adequately (Kuhnle, Hofer, & Kilian, 2010). Thus the experience during the task is expected to mediate at least partially the relationship between decision mode and regret (Hypothesis 5).

2. Method

2.1. Participants

The majority of the 149 participants were university students (89.9%) from a middle-sized German university. Most students were enrolled in psychology. The rest were employed persons (10.1%). The average age was 22.87 years (SD = 4.34), and 69.5% of the participants were female. Participation was voluntary and anonymous.

2.2. Procedure and measures

The data were collected in an online survey in a computer environment, representative of an omnipresent source of interferences which creates challenges to the focus on a learning activity (Crook & Barrowcliff, 2001). The survey was administered in respondents' daily environment with usual distractions to ensure external validity. Notably, 67.8% of the participants indicated that they interrupted university/work tasks to take part in the study and 32.2% interrupted leisure activities. Therefore, the participants decided to partake in the study after a likely motivational conflict. After accessing the questionnaire, participants were asked how they decided to take part in the study (decision mode). Then they were given a complex task that required them to concentrate on the information on the

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screen. This task is based on studies by Dijksterhuis (2004) where participants were given complex information about four apartments. They were told to concentrate on the alternatives and keep in mind the attributes because at a later stage they would be asked to rate the apartments. Each apartment was described by 12 attributes (e.g., "a nice area" and "nasty neighbors") varying in attractiveness. To assure the complexity of the task each attribute was presented for 3 s on the screen, followed by a 0.5 s pause before the next attribute was displayed. After that study phase the participants were asked to rate all apartments. The work on the task lasted about 10 min and the questions about motivational interference and flow referred to the experience during this task. Focusing on information on the screen and trying to keep it in mind is quite relevant in the learning context. It is not only comparable with a situation in the classroom where the teacher writes relevant information on the blackboard and asks the students to evaluate it later but it also reflects the fact that learning on the computer is on the rise (Becker, 2000).

The expectation-maximization-algorithm (SPSS17) was used for imputation of missing values. The proportion of missing values was rather low, ranging from 0.0 to 2.7% (although it was an online study, participants were not forced to answer all questions).

2.2.1. Regret

The degree of regret after the completed survey was measured with a validated German version (Greifeneder & Betsch, 2006) of the original regret scale (Schwartz et al., 2002). The five items were adapted to measure regret about the participation in the internet survey (e.g., "After the decision to take part in the survey, I was curious about what would have happened if I had chosen differently."). Participants responded on a seven-point Likert-Scale ranging from 1 (*completely disagree*) to 7 (*completely agree*).

2.2.2. Decision mode

We formulated six items measuring the intuitive decision style and four items measuring the deliberative decision style related to the decision to participate in the study (see Appendix A. Participants answered on a five-point Likert-Scale ranging from 1 (*don't agree at all*) to 5 (*totally agree*). These decision modes are often theorized as orthogonal when measured as a general preference (Betsch, 2004; Epstein, 1991), but since we asked the participants how they decided in a specific situation we analyzed the mode in an aggregated manner (e.g., Allinson & Hayes, 1996). Deliberative decision items were recoded and combined with intuitive items in the decision mode scale where high values indicate intuitive decisions.

2.2.3. Motivational interference

Thirteen items measuring motivational interference were employed to gauge the recently experienced situation during the task. These items assess several aspects of failure of self-regulation during the task (e.g., "I had the feeling that because I have done the task I missed out another important thing.") (Hofer et al., 2007). Answers were given on a fourpoint Likert-Scale ranging from 1 (*not true at all*) to 4 (*totally true*).

2.2.4. Flow

The Flow Short-Scale (Rheinberg, Vollmeyer, & Engeser, 2003) was used to measure flow during the task on the computer. It consists of ten items (e.g., "I have not noticed time passing by.") that were answered on a seven-point Likert-Scale ranging from 1 (*no agreement*) to 7 (*full agreement*).

3. Results

3.1. Basic analyses

Descriptive statistics are displayed in Table 1. The means show that the participants decided more intuitively to participate, experienced a

Table 1Descriptive statistics.

	Mean	SD	Scale	α	Items
Decision mode	3.99	0.72	1-5	.87	10
MI during the task	1.91	0.52	1-4	.85	13
Flow during the task	4.37	1.04	1-7	.85	10
Regret after the survey	2.07	0.99	1-7	.73	5
Age	22.87	4.34	18-42	-	-
Gender	1.71	0.46	1-2	-	-

Note. Male = 1, female = 2, MI = Experience of motivational interference, Decision mode = High values indicate intuitive decisions.

medium level of interference, had quite considerable flow-experiences and showed a low degree of regret.

The correlations in Table 2 confirm the expected pattern of relationships. Hypotheses 1 and 2 are supported by the negative correlation of the decision mode with interference and the positive correlation with flow respectively.

3.2. Regression analyses

A multiple regression analysis was conducted to test Hypotheses 3 and 4. Deciding intuitively was negatively related to regret by trend (p<0.1; Hypothesis 3). Hypothesis 4 postulating that the experiences during the task are related to regret was supported for motivational interference (see Table 3).

3.3. Mediation analyses

In order to test motivational interference and flow as potential mediators between decision mode and regret we used the bootstrapping methodology for indirect effects for multiple mediator models recommended by Preacher and Hayes (2008). As illustrated in Table 4, the effect of the decision mode on regret was mediated by motivational interference. The specific indirect mediation by flow, however, was not significant. Hypothesis 5 was thus supported for motivational interference.

Table 2 Correlations.

	1.	2.	3.	4.	5.
1. Decision mode	-				
2. MI during the task	23**	-			
3. Flow during the task	.32**	55**	-		
4. Regret after the survey	23**	.47**	26**	-	
5. Age	03	03	.08	07	-
6. Gender	.23**	04	.07	.02	12

Note. Male = 1, female = 2, MI = Experience of motivational interference, Decision mode = High values indicate intuitive decisions. **p<.01.

Table 3 Regressio

ssions.	
erion	Prec

Criterion	Predictor	В	SE B	β	\mathbb{R}^2
Regret after the survey					.23
	Decision mode	-0.18	.10	13^{+}	
	MI during the task	0.87	.17	.46**	
	Flow during the task	0.03	.09	.04	

Note. MI = Experience of motivational interference, Decision mode = High values indicate intuitive decisions, we verified that using gender and age as control variables had no significant effect in the regression analyses. $^+p < .01$.

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Table 4

Mediation of the effect of decision mode on regret through motivational interference and flow.

	Point estimate	Bootstrapp	Bootstrapping 95% CI		
		Lower	Upper		
Decision mode					
Flow during the task	.0161	0778	.1039		
MI during the task	1457	3357	0286		
Total	1295	2927	0159		

Note. MI = Experience of motivational interference, Decision mode = High values indicate intuitive decisions, Bootstrapping 95% Confidence intervals (CI) bias corrected and accelerated (Preacher & Hayes, 2008), significance is given when zero is not in the 95% CI, 5000 bootstrap samples.

4. Discussion

Generally speaking, our hypotheses were supported indicating that the decision mode is indeed related to the experienced quality *during* and *after* the presented task. Deciding intuitively was positively related to flow and negatively to motivational interference. The intuitive decision mode was shown to be negatively related to regret by trend. Additionally, motivational interference, as an impaired experience of the activity, seems to have a strong relation with regret, while flow appears to have no buffering effect in the regression analysis. Results showed that interference serves as a mediator between decision mode and regret.

Our study suggests that the superior function of deliberative reasoning could be questioned under certain conditions (Dane & Pratt, 2009). The intuitive decision mode in a complex task condition seems to be quite beneficial also in the learning context. Furthermore, it might be helpful to encourage flow-like states in order to increase satisfaction (Csikszentmihalyi et al., 1993), which is especially relevant for teenagers because in flow they learn to enjoy challenges (Csikszentmihalyi & Schneider, 2001). Motivational interference during an activity should be reduced because it has negative consequences for learning behavior (Hofer et al., 2007) and is associated with an increased level of regret. Regret is more than an unpleasant feeling people try to avoid, it can be counterproductive for future behavior (Zeelenberg & Pieters, 2007). More research is needed to determine whether regret experienced during or after a learning activity has indeed diminishing effects on learning behavior which affects school grades.

The relationships found in this study were obtained in a typical study situation when students have to concentrate on information on the computer screen (Crook & Barrowcliff, 2001), which is comparable to learning vocabularies. We set up an externally valid environment by having individuals participate from home via internet. Nevertheless, we used self-reports that may be prone to social desirability, making the validity for actual behavior questionable. A further point is that although we found only marginally smaller values on motivational interference than measured with a scenario technique (Hofer et al., 2007), we cannot ensure that conflicting action tendencies are given for all participants in this measurement situation. Additionally, we based our conclusions on a correlative design; experimental designs are needed to establish causal implications and verify our results in future research. Furthermore, the results should be validated for other tasks in order to be generalizable.

Our findings indicate that excessive contemplation whether to study or not could have negative effects on a performed task, even if the individual decides for the study activity. In such instances, the reliance on one's current intuition can help to stay concentrated on task, as thoughts and emotions will be directed to the activity at hand. Although non-conscious or intuitive decisions cannot be seen as a panacea to increase work or study satisfaction, a greater emphasis on intuitive decision making, especially in complex decision sets, is recommended. An intuitive decision to study could be combined with a deliberative approach to the overall study plan in accordance with the recommendation that students should structure their day more clearly (Hofer et al., 2007). That way an integrative approach could be used in school context in a similar way as suggested in management (Blattberg & Hoch, 1990). For example, to combine the advantages of both decision modes in their daily practice, Paula could be encouraged to structure a day or a week deliberatively but then decide more intuitively which activity to choose in a particular moment according to her current affective and mental state. Following this approach, Paula could keep long-term goals in mind while current opportunities are utilized. Further research in this area is needed in order to develop implementable strategies for educational practice.

Appendix A

Decision mode items (translated from German)

Intuitive decision mode

I decided rather intuitively to participate in this study.

I decided rather spontaneously to participate in this study without comparing it at length with another task.

I felt like participating in this survey in that moment and I decided spontaneously to do so.

After the decision to participate I felt that I made the right decision. The idea to take part in this survey in that moment was rather spontaneous.

When deciding to participate in this survey I relied on my feeling.

Deliberative decision mode

I considered in-depth whether I should take part in this survey or whether I should do another activity.

Before taking the survey I thoroughly analyzed the advantages and disadvantages of my participation.

I considered in-depth which activity would be meaningful at the moment.

When deciding whether to take part in this survey, I considered the pros and cons.

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