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Effects of Subjective Task Values and Information Processing on Motivation Formation

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Abstract

According to expectancy-value theory, achievement motivation depends on the intrinsic value and the utility value of a task. The authors hypothesized that utility value determines achievement motivation only when it is formed in a systematic way, because analyzing the utility of a task is a process requiring cognitive capacity as well as cognitive motivation. This was not assumed for intrinsic value, which was therefore hypothesized to determine achievement motivation independently from cognitive factors. As expected, the findings revealed that the utility value of a specific task predicted achievement motivation only for participants reporting high need for cognition (Study 1) and only when cognitive capacity was high (Study 2). By contrast, intrinsic value predicted motivation independently from those cognitive factors.

Keywords: achievement motivation, intrinsic value, utility value, need for cognition, cognitive capacity

1. Introduction

Past research in the field of motivational psychology has demonstrated the importance of subjective task values in explaining achievement motivation. According to theorists in the tradition of expectancy-value models, achievement motivation and performance in a given task depend on the individual's expectations of success and on subjective value-related variables (Atkinson, 1957; Bandura, 1997; Eccles, 1983; Eccles & Wigfield, 2002; Trautwein et al., 2012; Wigfield & Eccles, 2000). For example, a student may show more motivation to master a task when that task is fun or when its content is perceived to be useful. Because subjective task values play a crucial role in explaining the formation of motivation, it is important to ask which factors affect the use of such values. Assuming some values are easier to process than others, the present work stresses the idea that the use of subjective task values for the formation of achievement motivation partly depends on cognitive factors, such as need for cognition (NFC) and cognitive capacity.

Eccles (1983) defined different components of subjective task values: attainment value, cost, intrinsic values, and utility value (see also Eccles & Wigfield, 2002; Wigfield & Eccles, 2000). To our knowledge, no empirical study so far has directly investigated the question under which conditions those values play a stronger or weaker role in predicting the formation of achievement motivation. In other terms: are there moderating variables? As a start, we focused on the intrinsic and the utility value of a task (which was the focus of most previous empirical work, see Wigfield & Eccles, 2000). Intrinsic value is conceptualized as "the enjoyment one gains from doing the task" (Wigfield & Eccles, 2000, p. 72). That is, doing a task based on intrinsic motivation is likely to be associated with positive psychological consequences (see also Ryan & Deci, 2000). Furthermore, utility value or usefulness of a task refers to "how a task fits into an individual's future plans" (Wigfield & Eccles, 2000, p. 72), and therefore captures rather extrinsic reasons for engaging in a task. For instance, if a person wants to study the natural sciences, it seems useful to practice mathematical exercises. Thus, the utility value is connected to some kind of desired end state.

To determine achievement motivation and performance, the expectancy-value model not only refers to subjective task values but also to performance expectancies, meaning a subjective rating of how well one will perform a given task (Eccles, 1983). Previous research has investigated various factors influencing the formation of such expectancies: affective states (Reinhard & Dickhäuser, 2011), task experience (Dickhäuser, Reinhard, & Englert, 2011), and cognitive factors, such as the dispositional motivation to engage in cognitive processing (Dickhäuser & Reinhard, 2006, 2009, 2010; Reinhard & Dickhäuser, 2009). Reinhard and Dickhäuser (2009), for example, found that task difficulty affected performance expectancies only when cognitive motivation (i.e., need for cognition; Cacioppo & Petty, 1982) and cognitive capacity are high. The authors argued that analyzing task difficulty is a process requiring cognitive capacity as well as cognitive motivation.

NFC has been defined as the ability to engage in and enjoy effortful cognitive endeavors, and should be conceived as a cognitive motivation instead of as an intellectual capacity (Cacioppo & Petty, 1982). Additionally, Cacioppo, Petty, Feinstein, and Jarvis (1996), in their review of over 100 studies on individual differences in NFC and their consequences, found that differences in NFC (as measured on a scale developed by Cacioppo & Petty, 1982) correspond to behavioral differences regarding how people approach cognitive tasks. Individuals with higher NFC compared to lower NFC are better at remembering previously presented information (e.g., Boehm, 1994; Cacioppo, Petty, & Morris, 1983; Lassiter, Briggs, & Bowman, 1991), and they are more likely to be persuaded by strong arguments (e.g., Cacioppo et al., 1983; Priester & Petty, 1995). Furthermore, individuals high in NFC have been found to take greater pleasure in more challenging tasks, and they also show a stronger propensity to search for new information (Cacioppo et al., 1996). However, NFC is known only to be modestly related to intelligence (see Cacioppo et al., 1996, for a summary).

NFC is also known to be connected to how individuals process information, further affecting the intensity of cognitive endeavor. Those with higher NFC tend to intensively process information, which is characterized by an accurate balancing of all relevant information before a judgment is made. By contrast, those who are lower in NFC tend to less intensively process information, and to use less case-specific information and more peripheral cues (e.g., source characteristics, such as attractiveness; see Petty & Cacioppo, 1986).

To go beyond these findings on expectancy formation, and to extend information on the predictability of the value-expectancy model, we now investigate cognitive bounding conditions for the predictability of both intrinsic and utility value of a task on achievement motivation. Specifically, we argue that the predictability of utility value (but not of intrinsic value) depends on the degree to which individuals dispositionally enjoy thinking (i.e., NFC; Cacioppo & Petty, 1982) and the degree to which individuals are able to engage in intensive information processing (i.e., cognitive capacity). The reason for this assumption becomes evident when we conceptualize the process of using subjective task values as a cognitive activity: it is assumed that using intrinsic value and utility value require different levels of cognitive resources. Using utility value requires analyzing the specific requirements of the task and anticipating the potential future benefit. Processing elements of these knowledge structures requires cognitive capacity. The degree of cognitive effort individuals are willing, or able, to invest in this process may depend on situational variables (e.g., distraction) and on dispositional differences in cognitive motivation (e.g., NFC). By contrast, it is assumed that using the intrinsic value of a task requires much less cognitive effort. Usually a person knows immediately (without engaging in deep thinking) whether a task is fun or not, whereas this is not the case regarding the usefulness of a task. The formation of achievement motivation based on utility value might therefore require more cognitive activity compared to using a blanket rule of thumb, such as “Such tasks are fun to me”.

Based on this theoretical reasoning, we deduced the following hypotheses: First, the formation of achievement motivation is determined by the utility value of the task only for individuals with high NFC (Study 1) and with high cognitive capacity (Study 2). Second, the formation of achievement motivation is determined by the intrinsic value of the task, independent from NFC (Study 1) and cognitive capacity (Study 2).

2. Study 1

2.1 Method

2.1.1 Participants

We calculated the sample size to obtain sufficient power (80% to detect an effect if one exists; Cohen, 1988). Power analysis assuming an interaction effect with medium effect size of $r = .25$ revealed an N of 120. Participants in this study included 61 female and 58 male students ($M_{age} = 21.8$ years, $SD = 3.6$) recruited on the Campus of a German university (the population and recruitment was identical in Study 2). Participation was voluntarily and paid with 2 Euro (about 2.20 USD).

2.1.2 Material and Procedure

The study was conducted in a single-test situation. A computer was used to present the material and to record responses (the same setup was used in Study 2). First, participants entered their demographic data. Afterwards, they were introduced to a specific task (see also Reinhard & Dickhäuser, 2009, Study 1): participants were told that they would now receive ten mugs and that they would have to build a pyramid with four mugs in the bottom row, three mugs in the second row, two in the third row, and the last mug on the top of the pyramid. They further read that after completing the pyramid, they would have to take the mugs down and build a new pyramid. To assess participants' intrinsic value of this task, they were asked to respond to three questions: "I like to work on such tasks"; "I have fun working on such tasks"; "Such tasks are interesting to me". The utility value of the task was assessed with the following three questions: "The things I learn by working on tasks of Type A are useful for my life in general"; "Working on tasks of Type A are useful for my personal future"; "Someday, the content of the tasks of Type A will help me further in my life". These items were task-specific adaptations of items from a well-validated instrument assessing subjective educational task values developed by Steinmayr and Spinath (2010).

Subsequently, we assessed participants' NFC. We used the German version of the NFC scale (Bless, Wänke, Bohner, Fellhauer, & Schwarz, 1994). This version contains 33 items, including "I prefer my life to be filled with puzzles that I must solve," and "The notion of thinking abstractly is appealing to me." All items were answered on a 7-point scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). All three scales exhibited a high internal consistency (intrinsic value: $\alpha = .78$; utility value: $\alpha = .86$; NFC: $\alpha = .91$). Higher values on the scale was an indication of higher intrinsic value, higher utility value, and higher NFC.

We included several distraction tasks to achieve a clearer separation between items for assessing the intrinsic and utility value and general motivation to perform the task. The first distraction task (labeled as "TASK B") required the participants to rate their ability in verbal exercises. Afterwards, participants were shown videos before rating the credibility of the actors in the video. Together, the distraction tasks lasted about thirty minutes, but this data is not relevant to the present study. By administering them, we tried to ensure that neither intrinsic nor utility value was salient in the participants' minds when assessing their general motivation to perform the task. To measure motivation, participants completed the sentence "For working on the following exercise of Type A, I have … " by indicating a number from 1 (*very low motivation*) to 5 (*very high motivation*). However, participants were not asked to actually do the task. Participants were debriefed at the end of the test.

2.2 Results

Utility value was postulated to determine motivation, depending on the level of NFC. By contrast, intrinsic value was postulated to determine motivation independent from NFC. Intercorrelations of NFC, intrinsic value, utility value, and motivation can be seen in Table 1.

Table 1. Bivariate correlations of NFC, intrinsic value, utility value and motivation

	2.	3.	4.
1. NFC	.258*	.198*	.192*
2. Intrinsic Value	/	.335*	.578*
3. Utility Value		/	.395*
4. Motivation			/

Note. * $p < .05$.

By applying a multiple linear regression, we used NFC, intrinsic value, utility value, and both two-way-interaction terms NFC × Intrinsic value and NFC × Utility value to predict motivation. All predictors were z-standardized. Results of the regression analysis can be seen in Table 2.

Table 2. Regression analysis for motivation formation

	b	LL	UL	SE	β
Constant	2.97	2.79	3.78	0.10	
NFC	.04	-.19	.26	.11	.03
Intrinsic Value	**.70**	**.49**	**.91**	**.11**	**.52***
Utility Value	**.23**	**.02**	**.45**	**.11**	**.17***
NFC × Intrinsic Value	-.16	-.34	.03	0.09	-.16

NFC × Utility Value	**.27**	**.04**	**.49**	**.11**	**0.21***

Note. * $p < .05$. Significant predictors are marked in bold face.

R ($R^2 = .41$, $R^2_{adj} = .39$) for the regression was statistically significant different from zero, F (5, 113) = 15.77, $p < .001$. Both coefficients of utility value, $p = .036$, and intrinsic value, $p < .001$, were found to be statistically significant. Most importantly and as expected, the interaction term NFC × Utility value showed a statistically significant effect, $p = .021$.

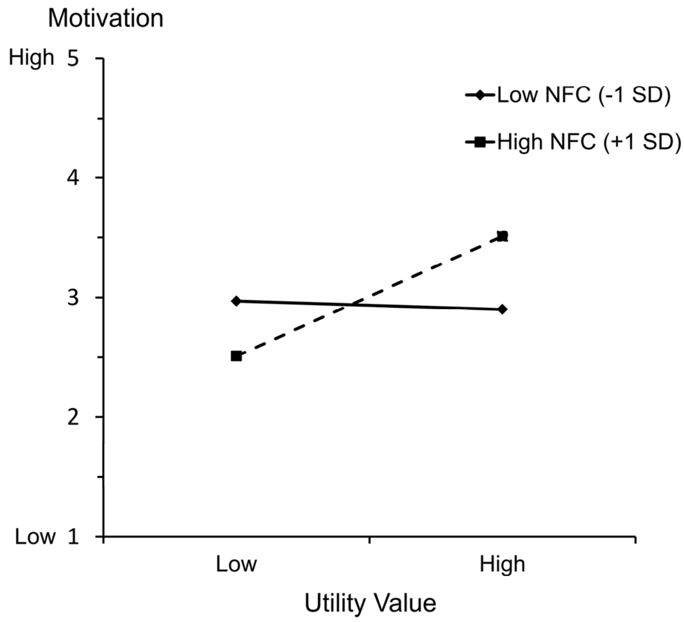

Figure 1. Motivation predicted by NFC and Utility Value

Statistical testing (Aiken & West, 1991) revealed the simple slope of utility value for individuals with high NFC (1 *SD* above the mean) to be positive and statistically significant different from zero, $b = .50$, $SE\ b = .13$, $\beta = .37$, $p < .001$, that is, motivation rose with increasing utility value (see Figure 1). By contrast, for individuals with low NFC (1 *SD* below the mean), there was no statistically significant change in motivation with increasing utility value, $p = .847$. In line with our hypothesis, the coefficient of the interaction term NFC × Intrinsic motivation was not statistically significant, $p = .094$ (Note 1).

2.3 Discussion

The results confirm the hypotheses that NFC moderates the predictability of the utility value of a task on the formation of achievement motivation. Individuals with lower NFC are less likely to engage in effortful information processing (see Cacioppo et al., 1996). This may keep them from considering the specific requirements of the task, and also from anticipating the potential future benefit. By contrast, the predictability of intrinsic value was not affected by participants' NFC. This was expected because people quickly realize without much cognitive activity whether they will enjoy a task or not.

In our second study, we wanted to test directly our assumption that using utility value requires more intensive information processing compared to using intrinsic value. Therefore, we used a secondary task technique that induced high cognitive load (see Paas, Tuovinen, Tabbers, & van Gerven, 2003) to limit cognitive capacity. In Study 2, we tested the following hypotheses: first, the formation of achievement motivation is determined by the utility value of the task only when cognitive capacity is high. Second, the formation of achievement motivation is determined by the intrinsic value of the task, independent of cognitive capacity. Notably, by manipulating cognitive load experimentally, we directly tested the causal effect of the amount of intensive information processing on using task values for motivation formation.

3. Study 2

3.1 Method

3.1.1 Participants

Power analysis assuming am interaction effect with medium effect size of $r = .25$ revealed an N of 120. A total of 86 female and 68 male students ($M_{age} = 21.2$ years, $SD = 3.8$) participated in this study.

3.1.2 Material and Procedure

The participants were randomly assigned to one of two experimental between-subjects conditions in which either high ($n = 77$) or low ($n = 77$) cognitive load was induced. As a cover story, participants were instructed that the study was would be about the personality traits and memory. Then, they received a separate sheet entitled "TASK A", which contained an analogy task including figural material that was taken from a German scholastic aptitude test (Heller, Gädicke, & Weinläder, 1985). They next were given a pair of figures as an example, and were tasked with matching another figure to one from a set of five options, using the example as the analogy. They received the example together with a written explanation and the solution. After looking at the task and the solution, intrinsic value ($\alpha = .66$) and utility value ($\alpha = .86$) was assessed with the items used in Study 1.

The procedure was the same as in Study 1, except for the following: first, a different distraction task was given before assessing motivation. This task was irrelevant to the hypotheses and contained questions about personal perceptions and judgments about commercial advertising. The task took about 30 minutes. Second, two different instructions were used to induce high or low cognitive load. All participants were reminded that the present study was about the interplay between personality traits and memory. Then, the participants in the high cognitive load group read that they would see a nine-digit number on the next screen for 60 seconds. During the following questions, they were asked to keep this number in mind. They were further told that they should recall number the later and that we would compare it with the actual number. On the following screen, the number 825698147 occurred for 60 seconds. This task was absent in the low cognitive load condition (for a detailed description of secondary task techniques and cognitive load, see Paas et al., 2003). Motivation for working on Type A was then assessed in the same way as in Study 1 for both conditions. Finally, in the high cognitive load condition, participants then recorded the number they had been asked to remember.

3.2 Results

We postulated that the patterns for the prediction of motivation differ depending on cognitive load. By contrast, intrinsic value was postulated to determine motivation independent from cognitive load.

By applying a multiple linear regression, we used load (coded "0" for high load and "1" for low load), intrinsic value, utility value, and both two-way-interaction terms Load × Intrinsic value and Load × Utility value to predict motivation. Results can be seen in Table 3.

Table 3. Regression analysis for motivation formation

	b	LL	UL	SE	β
Constant	3.46	3.25	3.66	.10	
Load	-.18	-.47	.11	.15	-.09
Intrinsic Value	**.45**	**.23**	**.67**	**.11**	**.46***
Utility Value	-.207	-.43	.01	.11	-.21
Load × Intrinsic Value	-.22	-.54	.10	.16	-.16
Load × Utility Value	**.39**	**.06**	**.70**	**.16**	**.27***

Note. * $p < .05$. Significant predictors are marked in bold face. High load condition = 1, low load condition = 0.

R ($R^2 = .16$, $R^2_{adj} = .13$) for the regression was statistically significant different from zero, F (5, 148) = 5.76, $p < .001$. As expected, the term intrinsic value predicted motivation, $p < .001$. Most importantly, the term Load × Utility value was a statistically significant predictor of motivation, $p = .020$.

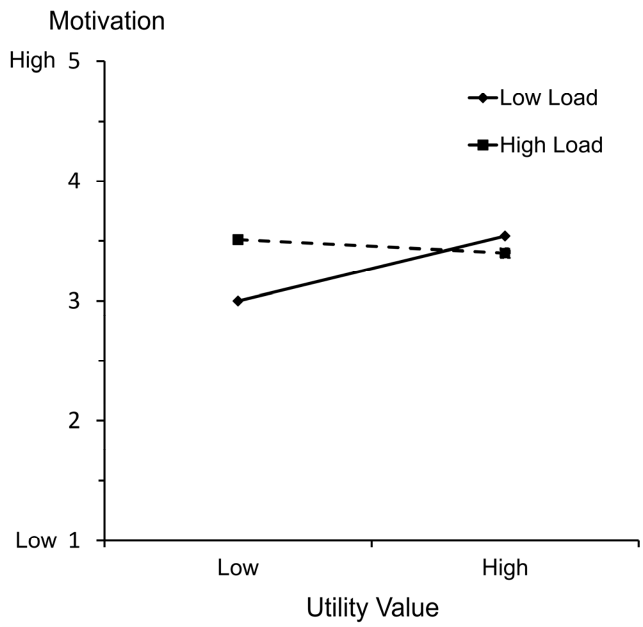

Figure 2. Motivation predicted by Load and Utility Value

To investigate the nature of this interaction, the recentering procedure was used (Cohen, Cohen, West, & Aiken, 2003). In a separate regression, we included load, utility value, and the two-way interaction term Load × Utility value to predict motivation. The influence of utility value on motivation for the high-load condition could be seen when high load was coded to be "0" and low load to be "1". As expected, the interaction term Load × Utility value was statistically significant, $b = .33$, $SE\ b = .16$, $\beta = .24$, $p = .038$, but the effect of utility value was not statistically significant, $p > .601$, indicating that participants under the high load condition did not use utility value for their motivation formation (see Figure 2). The influence of utility value on motivation for the low-load condition could be seen when low load was coded to be "0" and high load to be "1". In this case, the variable utility value was statistically significant, $b = .27$, $SE\ b = .11$, $\beta = .27$, $p = .016$, indicating that under the low-load condition, participants' motivation rose with higher utility value perception (Note 2).

3.3 Discussion

The results confirm the hypotheses that cognitive capacity moderates the predictability of the utility value of a task on the formation of achievement motivation. Utility value did not determine motivation when high cognitive load was induced experimentally, but only when cognitive load was low. We assume that those individuals were not able to process the specific requirements of the task and its potential future benefit. As expected, the predictability of intrinsic value was not affected by cognitive load.

4. General Discussion

In this article, we investigated the underlying processes of the formation of achievement motivation. Based on the expectancy-value model (Eccles, 1983), we focused on subjective task values, namely the intrinsic and the utility value of a task, which have been demonstrated to play a crucial role regarding motivation and performance (e.g., Wigfield & Eccles, 2000). Specifically, we referred to cognitive bounding conditions for the predictability of both values on the formation of achievement motivation. In line with our hypotheses, we found utility value to determine motivation only when participants reported high NFC (Study 1) or when they had high cognitive capacity (Study 2). This effect was expected because processing utility value was assumed to require cognitive effort; for example, analyzing the specific requirements of the task or anticipating the potential future benefit. We showed that the degree of cognitive effort individuals are willing or able to invest in this process depends on dispositional differences (i.e., NFC) and situational variables (i.e., distraction). By contrast, processing the intrinsic value of a task (e.g., fun) was assumed to require much less cognitive effort. In line with this reasoning, both studies revealed the influence of intrinsic value on motivation to be independent of NFC and cognitive capacity.

These findings expand our knowledge on the predictability of the value-expectancy model by showing that the influence of subjective task values on achievement motivation is complex and is affected depending on cognitive factors—at least when processing the values requires high cognitive effort. As mentioned at the beginning, beside both utility and intrinsic value, the model also includes cost (Eccles, 1983; Wigfield & Eccles, 2000). Cost refers to "how the decision to engage in one activity (e.g., doing schoolwork) limits access to other activities (e.g., calling friends), assessments of how much effort will be taken to accomplish the activity, and its emotional cost" (Wigfield & Eccles, 2000, p. 72). In our study, costs were not assumed to play a crucial role because participants were not given the possibility to detract from the task. It seems reasonable, however, that cognitive factors might also affect the effect of costs on motivation because it requires cognitive activity to anticipate potential costs.

The results of Study 1 show that for individuals with high NFC, utility value determined achievement motivation. However, Reinhard and Dickhäuser (2009, Study 2), for example, showed that individuals with high NFC do not always infer expectancies of success from their specific academic self-concept (a process requiring high cognitive effort), but do so only if the situation allows for intensive processing (i.e., low cognitive load). Parallel to this finding, one could expect that the effect of utility value and motivation might be diminished in a situation with high cognitive load.

We further like to make a comment on our single-item measurement of motivation. As we were interested in predicting self-attributed motivation (see McClelland, Kosetner, & Weinberger, 1989), we had to develop a task-specific measure assessing this motivation. Recent approaches for assessing task-specific self-attributed motivation often distinguish between different motivational components (like task appraisals, learning intentions or emotions in the online-motivation questionnaire; Boekaerts, 2002). However, we were interested in an aggregate rating of task-specific self-attributed motivation. Therefore, we decided to use this single item.

Finally, in the present studies, we did not assess actual task performance, but only achievement motivation. However, previous research revealed that the motivation to work on a task is strongly related to a subsequent task performance (e.g., Guay, Ratelle, Roy, & Litalien, 2010; Wolters, Yu, & Pintrich, 1996; for an overview, see Alderman, 2013). Thus, it can be assumed that high motivation is likely to be followed by better performance.

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Notes

Note 1. In a further analysis, we also include the 3-way interaction term of NFC × Utility value × Intrinsic value. As expected, the 3-way interaction term was not a statistically significant predictor of motivation, $t\ (113) = -1.18$, $p = .24$.

Note 2. In a further analysis, we also include the 3-way interaction term of Load × Utility value × Intrinsic value. As expected, the 3-way interaction term was not a statistically significant predictor of motivation, $t\ (146) = 0.57$, $p = .57$.

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