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Looking for Loss or Gain: Hedonic VS Cost Motivational
Orientation

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Viktoria Christina Urabl BA BSc

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Univ.-Prof. Dr. Veronika Job Sutnar

Abstract

Psychologists mostly assume an underlying cost-benefit analysis when people are faced with a decision about whether or not to take a certain action. Even in motivational psychology, a task of high difficulty must have a high subjective success importance to be worth pursuing. Fatigue is one factor that limits our mental and physical resources and makes actions feel costlier. This effect is limited by implicit theories about willpower, so the belief whether willpower is a limited (therefore costlier) resource or not. If decisions were only determined by this cost-focused analysis, how would people willingly seek resource-costly effort? Thus in certain situations maybe another focus occurs, one simply on the hedonic pleasure a task can bring (hedonic-focused). This study investigates the relationship between cost and hedonic motivational orientation, fatigue and willpower beliefs in two online studies ($N_{1/2} = 201$). Motivational orientation is assessed using a decision making task. Analysis using an exact binomial test and a two-sided one-sample t-test showed that the sample strongly preferred information about the monetary gain of a future task. Correlational analysis could show no strong directional relationship between decisions, fatigue and willpower beliefs. Exploratory analysis applying multilevel analysis finds that fatigue and willpower belief predict choosing a longer task when asking for time information. The results indicate a natural inclination for hedonic motivational orientation in an unmanipulated state and support the findings of Job et al. (2010). Based on this, future research could possibly uncover the mechanism that explains the effect of willpower beliefs on fatigue and therefore expand the model of the motivational intensity theory to include hedonic intentions.

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Looking for Loss or Gain: Hedonic VS Cost Motivational Orientation

To throw the can in the trash bin or to leave it in the grass; to walk to the store or take the car; to study or continue scrolling on your phone—before most actions, conscious or unconscious decisions take place that determine whether or not one takes said actions. Therefore, decision making lies at the heart of most psychological research, especially within social and motivational psychology. To understand and influence things like perseverance, effort and inaction, researchers investigate why and how we make certain decisions.

Early psychological theories that examine decision making behavior mostly operated under the assumption that under every decision lies a mental cost-benefit-analysis. Rational choice theories like the prospect theory, for example, put much emphasis on the value of gains and losses instead of the final outcome of a decision (Kahneman & Tversky, 1979). People's tendency to overweight low probabilities of outcome and general risk aversion leads to losses holding more value than gains. Gains and losses are also generally referring to the same thing: winning or losing money. In general, decisions made with a cost-benefit-analysis in mind are associated with economic decisions for example where to live and work or what groceries to buy. But behavioral research has shown that any action we decide to make can be based on a said cost-benefit analysis.

Expanding on this economic decision-making framework, theories like the law of less work assume that losing money is not the only cost a decision can have—effort is also costly and therefore seen as aversive. Under the law of less work, actions are chosen so as to minimize demands for (physical or cognitive) exertion or work (Kool et al., 2010; Hull, 1943). The dominating premise in this literature on decision making with researchers is that the potential gains need to outweigh the potential costs to make a decision. Any decision that does not fit these criteria at first glance must have been biased or made with wrong or insufficient information in the first place, according to these rational choice theorems.

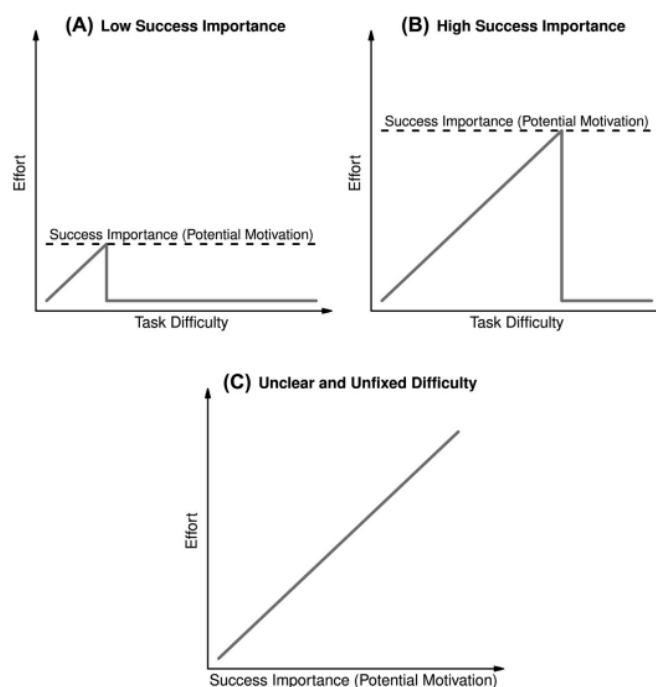
But most things we do in life require this costly effort, for example work, studying for a degree or even leisurely things like hiking. To still choose to do an effortful task despite it being costly one has to exert self-control. Self-control allows us to still choose the steep path even if, according to the law of less work, we really do not want to.

Motivational Intensity Theory

In 1998, Baumeister and colleagues proposed that self-control is a limited resource. This theory was later expanded in the motivational intensity theory (MIT; Wright & Brehm, 1989) to look further into which factors determine which and how many resources are invested to carry out behavior and effectively explain effort mobilization in goal pursuit. In MIT, the appropriate effort to sustain goal pursuit is determined by (known) task difficulty and subjective success importance. Generally speaking, the higher the difficulty, the higher the amount of required resources. Success importance mainly determines the rate of task engagement or the point at which the deployed effort outweighs any potential gain and would therefore be wasted (figure 1). When a task has unknown difficulty, success importance replaces difficulty as the determining factor for effort to avoid investing more resources than feel justified (figure 1 (C); Richter et al., 2016).

Figure 1

Motivational Intensity Theory's Predictions for Tasks with Known and Fixed Difficulty (Panels A and B) and for Tasks with Unknown and Unfixed Difficulty (Panel C).



Note. From “Three Decades of Research on Motivational Intensity Theory” by M. Richter, G. H. E. Gendolla, and R. A. Wright, 2016, *Advances in Motivation Science* 3, p. 152. (<https://doi.org/10.1016/bs.adms.2016.02.001>)

Fatigue, for one, leads people to perceive tasks as more difficult compared to a well-rested state and subsequently makes them perform worse. The extra effort requirements associated with fatigue need to be justified with high reward or success importance to make people exert the same amount of effort as when rested (Wright, 2014; Stewart et al., 2009). Furthermore, acts of self-regulation consume a resource that is limited, leaving people in a state of ego depletion and making them less able to exert self-control on a subsequent task (Baumeister, 1998). In conclusion, fatigue limits our mental and physical resources and makes us more focused on what we have to lose (Wright & Brehm, 1998).

Lay Beliefs About Willpower

Another factor influencing the decision to put effort into a task are different lay beliefs about willpower, as those seem to limit fatigue's effect on effort. Lay beliefs about willpower can lead in one of two directions: one can perceive willpower as a limited resource, like in the research of Baumeister (1998), that gets depleted with every act of self-control. Once this resource runs out, self-control is no longer possible and participants prioritize resting and replenishing their resources over goal-pursuit, for example by quitting an effortful task and taking longer breaks (Job et al., 2015). Alternatively, one can perceive willpower as a non-limited resource that does not run out or deplete. With this belief, people might be convinced that exerting self-control does not impair them and instead invigorates their ability to perform self-control. Research suggests that implicit theories changed how people responded to a task given their level of perceived fatigue (Job et al., 2010). People with a limited-resource theory like the muscle-analogy, where self-control gets depleted, performed worse the more exhausted they felt. But for people with a non-limited-resource theory, there was no relationship between perceived fatigue and subsequent performance (Job et al., 2010). For them, exhaustion was not a sign to reduce effort. This effect has been observed before, but as of right now it is unclear exactly how the implicit willpower theories affect the decision making behavior about effort, even though fatigue is objectively the same.

Motivational Orientation Theory

To cover this gap in the research, I propose the motivational orientation theory. This theory assumes that what changes with fatigue and subsequently implicit willpower beliefs is the motivational orientation. When confronted with the option to invest their time and energy into certain tasks, people need to know the

effort it is going to take and feel justly compensated to feel motivated (Richter et al., 2016). In this state people show a cost motivational orientation, and it is intent on managing our resources with the most gain and least loss. This is the kind of behavior the rational choice theorems above have observed. High fatigue or limited willpower beliefs lead to a cost motivational orientation according to this theory. However, this orientation does not account for hedonic and curious behavior that demands possibly uncertain resources without certain reward. Sometimes, the things we stand to gain feel much more important, even without knowing what we could lose. Explorers would never have discovered foreign islands and continents if they were only focused on what they stood to lose. In these types of situations, where fatigue is low or people adopt a non-limited willpower belief, they should show a hedonic motivational orientation. They should exhibit behavior that is intent on maximizing gain or value potentially independent of costs. This theory proposes that the mechanism behind the relationship of willpower beliefs and fatigue lies in the way people value and perceive information—either to control their resources or to explore hedonic intentions.

My overall research question for my master's thesis goes as follows: What information do people find personally valuable in their decision making? And does this change with the level of fatigue and the implicit theories about willpower?

Hypotheses

Based on this theoretical background, I will investigate whether participants differ in what information is important to them in decision-making and if that changes based on subjective fatigue and implicit theories of willpower. To assess the respective motivational orientations I will use a decision making task in which participants can choose between a potential cost option, which would signal a cost motivational orientation in that moment, and a potential gain option, which would reflect a hedonic motivational orientation. This task objectively measures subjective value in certain decisions. More specifically, participants will choose between wanting to know the potential cost of the next task or the potential gain.

Hence, I hypothesize the following:

H1. Overall, participants do not prefer the potential gain option over the potential cost option or vice versa.

H2. Higher fatigue scores in the Thayer's (1998) ADACL correlate positively with choosing the potential cost option.

H3a. Stronger limited willpower beliefs indicated in the Lay Beliefs of Willpower Scale (Job et al., 2010) correlate positively with choosing the potential cost option.

H3b. Stronger non-limited willpower beliefs indicated in the Lay Beliefs of Willpower Scale (Job et al., 2010) correlate positively with choosing the potential gain option.

Methods

Participants and recruiting

I tested this theory in two behavioral online studies. I recruited the participants through the online platform Prolific (<https://www.prolific.com>). An a priori power analysis performed with G*Power (Faul et al., 2007) resulted in a minimum number of participants of 200 for both studies, which I reached sufficiently (N = 201 in study 1 and 2). The participants were compensated for their time with monetary rewards (base 8 GBP plus task incentives equivalent to 2 GBP–5 GBP).

Study design

In the first online study I validated a method to measure motivational focus and estimate the predicted relationships I am interested in. For this, the participants answered questionnaires explained in the next section to measure their fatigue and implicit theories about willpower. To determine their current motivational orientation, I employed a decision making task, which objectively measures the subjective value of the information for an effort task. Using this method, I asked the participants to practice a cognitive effort task, specifically a 3-back version of the n-back task. After completing the practice, participants completed a series of decisions to choose between two potential versions of a subsequent 3-back version of the n-back task. However, participants were not provided with information concerning both the cost and value of each version of the n-back task. Instead, they had to decide if they wanted to know the cost, namely the duration or the value (money) they stand to gain from each version of the n-back task. After choosing to either learn the cost or value of each version of the n-back task, they were asked to choose the version they would like to complete without ever learning of the alternative information. This decision phase repeated 100 times creating a pool of 100 potential versions of the n-back task participants could complete for their subsequent 3-back version of the n-back task. In the final study, phase one of these 100 versions were randomly chosen for the participants completed for an additional monetary incentive. In the

second study, I replicated this exact design to ensure the validity and to see if the results are truly independent of the specific sample. I deemed this necessary as this method has never been tested in this way. Study 2 has been preregistered under AsPredicted.org #165852.

Questionnaires

The participants in both studies answered multiple questionnaires, two of which are relevant for my research question. To measure fatigue, I use the energy and tiredness subscales of Thayer's (1998) ADACL. The 11-point scale for energy includes items asking about the participants' level of activity, energy, vigor, liveliness, and how full-of-pep they are. Tiredness items include sleepiness, tiredness, drowsiness, wakefulness and how awake they felt, with the last two items being reverse coded. The questionnaire also asks participants to rate how mentally fatigued, physically fatigued, mentally sharp, fearful, nervous, challenged and threatened they felt (0 = not at all; 10 = extremely). To measure the participants' implicit willpower beliefs, I used the Lay Beliefs of Willpower Scale (LBW, Job et al., 2010). In this, they rated items including "After a strenuous mental activity your energy is depleted and you must rest to get it refueled again" (limited-resource theory) and "Your mental stamina fuels itself; even after strenuous mental exertion you can continue doing more of it" (non-limited-resource theory). Participants responded using a 6-point rating scale (1 = strongly agree, 6 = strongly disagree). Items were scored so that higher values represent greater agreement with the non-limited-resource theory. Additional questions included the 10-point subjective social standard ladder ("Where would you place yourself on this ladder?") and a question to measure objective socio economic status (SES) via income ("What was your total household income before taxes during the past 12 months?") with answers ranging from "Less than £25,000", "£25,000–£49,999", "£50,000–£74,999", "£75,000–£99,999", "£100,000–£149,999", "£150,000 or more" to "Prefer not to say".

N-Back

After completing the questionnaires the participants completed the n-back (figure 2). The n-back is often used as a measure of working memory (Kane et al., 2007). For this study it is used as a cognitive effort task. During the task participants were shown a series of stimuli, or letters in this case. For each letter, the participants had to decide whether this letter corresponds to the letter that was shown n-stimuli, in this case 3 letters, before. During the practice rounds they got feedback on their

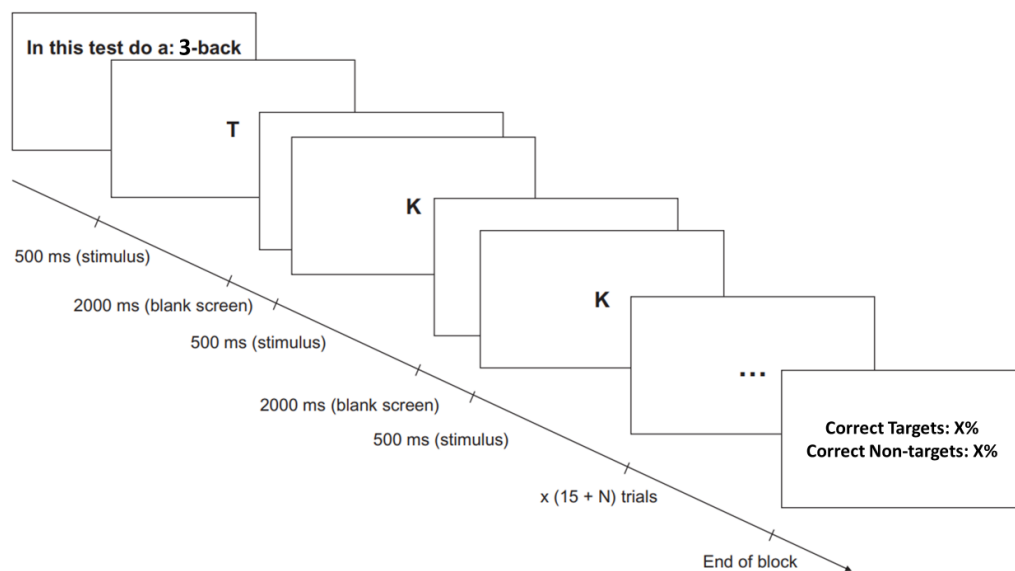
performance. Following the decision making task they once again did a 3-back task but they no longer got feedback on their performance and received monetary rewards in the end.

Cognitive Effort Discounting paradigm (COG-ED)

The COG-ED was developed to objectively measure decision making and the subjective value of cognitive effort (Westbrook et al., 2013). In the original study, participants decided on each trial which level of difficulty they wanted to do in the next task, with lower effort corresponding to lower reward and higher effort with higher reward (see figure 3). Based on this series of decisions, Westbrook and colleagues (2013) concluded a subjective value of effort that is sensitive to both within-individual factors, including objective load and reward amount, and between-individual factors, including age and trait cognitive engagement.

Figure 2

Illustration of a Trial Block of the N-Back



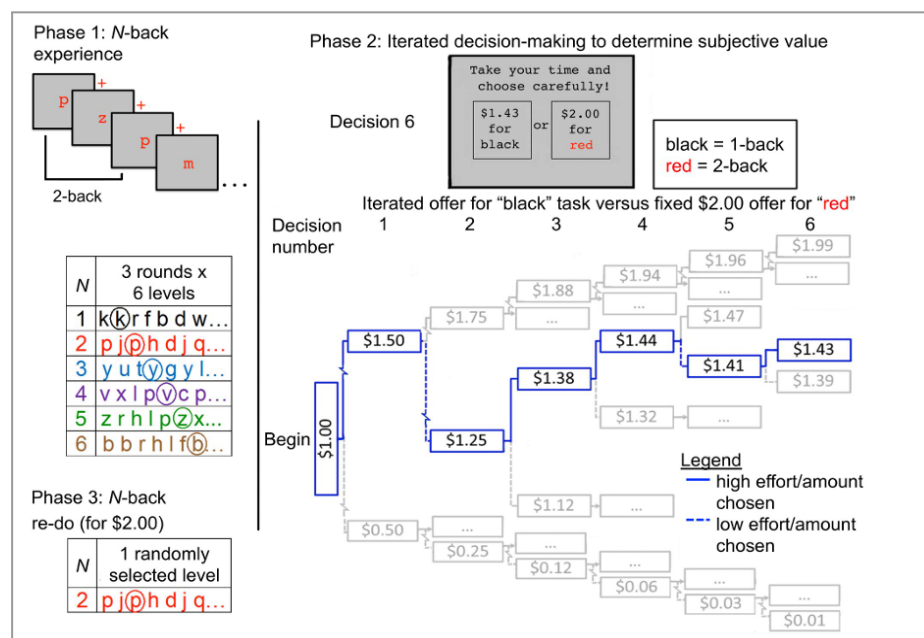
Note. From "Rewarding cognitive effort increases the intrinsic value of mental labor" by G. Clay, C. Mlynski, F. M. Korb, T. Goschke, and V. Job, V., 2022, *Proceedings of the National Academy of Sciences*, 119(5), p. 6,

<https://doi.org/10.1073/pnas.2111785119>

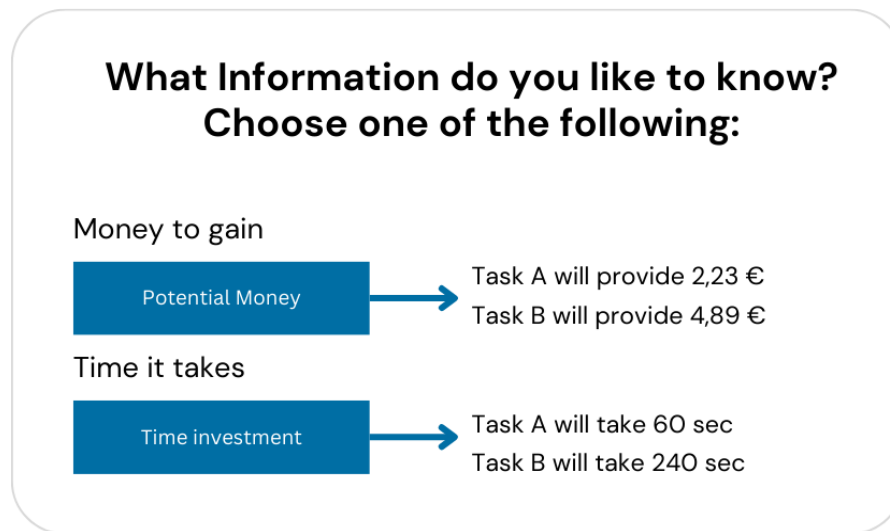
For my research purposes, I adapt the COG-ED to measure the subjective value of the information given for an effort task. In a series of decisions, the participants decided if they want to know the potential gain of a task, which I assume alludes to a dominant hedonic motivational orientation, or the potential cost of a task, associated with cost motivational orientation (depicted in figure 4). Potential gain could mean anything from money, experiences, pride, etc. Potential costs of an effort task could be duration of the task, difficulty, frustration, etc. The values for each decision were random within a range of 2 to 5 EUR for the money option and between 60 and 240 seconds for the time option. For the first experiment using this design, I choose money as the gain option and time as the cost option, as these seem to be universally understood as gains and losses without instructions or priming. To achieve higher data variance, participants did 100 decision making tasks in between the two n-back tasks.

Figure 3

Illustration of the Original COG-ED Task Structure Including N-Back Practice, Effort Discounting, and N-Back Re-Do



Note. From "What Is the Subjective Cost of Cognitive Effort? Load, Trait, and Aging Effects Revealed by Economic Preference" by A. Westbrook, D. Kester, and T. S. Braver, 2013, *PLoS ONE*, 8(7), p. 2, <https://doi.org/10.1371/journal.pone.0068210>

Figure 4*Illustration of the Decision Task**Note.* Own depiction.**Statistical analysis**

To test my hypotheses, I did four major analyses. I tested each hypothesis with the dependent variable being the decision made on the first trial (money or time) and with the dependent variable being decisions made over all 100 trials (percentage of money decisions over all 100 trials). This approach results from the repeated measurement design. Theoretically, only the first decision holds real ecological validity, as it reflects people's motivational orientation in the moment without any interfering factors. The multiple trials hold more statistical value and allow for more robust testing of the effects. Therefore, the results of both approaches should be interpreted together to form a clearer picture. For H1, I ran an exact binomial test on the number of money decisions made on the first trial as well as a one-sample t-test comparing the percentages of potential gain decision over all 100 trials with the hypothetical neutral or random mean of 0.5. Since this is a null hypothesis, a significant result means that it is very unlikely that the given sample does not have a preference for one of the motivational orientations and I need to reject this hypothesis. For H2, H3a and H3b, I did correlational analysis including Pearson's product-moment correlation between individual variables and the decision on the first trial as well as regression analysis with the percentages of money decision over all

trials to see if decision making behavior, fatigue and willpower beliefs interact like predicted. For exploratory analysis, I applied multilevel modeling to see if fatigue and willpower beliefs can predict the decision making behavior over multiple trials. All analysis control for SES if necessary. The data was analyzed by using RStudio (R Core Team, 2021).

Results

Sample Description

In both studies, 201 participants completed all tasks and surveys. The samples varied widely in age (Study 1: $M = 29.53$, $SD = 8.59$, 19–68; Study 2: $M = 30.99$, $SD = 9.09$, 17–72), gender (Study 1: 31% female; Study 2: 62% female), education (Study 1: 43% students; Study 2: 37% students) and country of origin (Study 1: 24 countries, 19.4% Poland; Study 2: 22 countries, 57.2% South Africa) due to the recruiting platform Prolific.

Since the sample was not manipulated in any way, mean fatigue and beliefs about willpower were fairly centralized in both samples (Study 1: Fatigue $M = 3.79$, $SD = 1.3$; Willpower beliefs $M = 3.33$, $SD = 0.72$; Study 2: Fatigue $M = 3.32$, $SD = 1.16$, Willpower beliefs $M = 3.58$, $SD = 0.76$). The scales measured sufficiently reliable (Study 1: ADACL alpha = .9, LBW alpha = .82; Study 2: ADACL alpha = .87, LBW alpha = .82).

Hypothesis 1

Hypothesis 1 set out to explore the basic tendency people have when choosing which information is important for them in a motivational task. With there being no prior research on this exact topic to date, H1 formulates as an undirected null hypothesis: people would not, by default, prefer one option over the other. I came to this conclusion because of the lack of any evidence in one direction or the other. Furthermore, the informational value should be the same on both sides, so the decision should be wholly based on personal preference and levels of fatigue and willpower beliefs. As these were not manipulated, there was no certain way to predict the outcome of the participants' decision making behavior. To test the hypothesis, I conducted exact binomial tests on the first decision trial for both studies, comparing it to a random expected frequency of 50% (Study 1: Prob. = .91, $p < .001$; Study 2: Prob. = .75, $p < .001$). For the exact results, see table 2.

Table 1*Results of Descriptive Analyses*

Variable	M_1	SD_1	M_2	SD_2
Age (17–72)	29.53	8.59	30.99	9.09
Gender	31% F	-	62% F	-
Education	43% Students	-	37% Students	-
Fatigue (0–10)	3.79	0.41	3.32	1.16
Willpower beliefs (1–6)	3.33	0.72	3.58	0.76

Note. Lowered numbers in the heading represent study 1 and study 2.

Table 2*Results of the Exact Binomial Tests*

	N	Nr. of money decisions on first trial	Probability of money decision	Probability 95% CI	p
Study 1	201	182	.91	[.86, .94]	< .001
Study 2	201	150	.75	[.68, .80]	< .001

Table 3*Results of the Two-Sided One-Sample T-Tests for Decisions Over All Trials*

	N	M	M 95% CI	t	df	p
Study 1	201	0.77	[0.73, 0.80]	14.55	200	< .001
Study 2	199	0.73	[0.69, 0.76]	12.74	198	< .001

Note. Mean is the mean of all decisions made over 100 trials, with money decision coded as 1 and time decision as 0.

To compare the decisions over all 100 trials, I applied a two-sided one-sample t-test comparing the percentages of all money decisions to a hypothetical mean of 0.5 (Study 1: $t = 14.55$, $p < .001$, Study 2: $t = 12.74$, $p < .001$). For the exact results, see table 3.

Both tests yielded significant results, meaning H1, a null hypothesis, needs to be rejected.

Hypothesis 2

Hypothesis 2 stated a positive relationship between fatigue scores in the Thayer's (1998) ADACL scale and choosing the potential cost option. For testing this hypothesis, I conducted correlation analysis with the variables fatigue and the decision making behavior. For the decision on the first trial, the decision making variable is dichotomous, therefore I applied Pearson's product-moment correlation, which showed weak negative but not significant correlations in both studies (Study 1: $r = -.12$, $p = .09$; Study 2: $r = -.06$, $p = .38$; See table 4). To analyze the decisions over all 100 trials, I applied a linear regression model in which the percentage of money decisions over 100 trials was predicted by fatigue scores (Study 1: $r = 0$, $p = .66$; Study 2: $r = 0$; $p = .59$; See table 5). These models were also not significant and could show no correlations. Therefore, Hypothesis 2 is not supported.

Hypothesis 3

Hypothesis 3a and 3b predicted the same relationship as Hypothesis 2, only with willpower as the variable in relation to the decision making behavior. Therefore, the same analyses were applied, namely Pearson's product-moment correlation for the first decision (Study 1: $r = .05$, $p = .46$; Study 2: $r = .05$, $p = .5$; See table 6) and linear regression modeling for all 100 decision trials (Study 1: $r = -.09$, $p = .22$; Study 2: $r = -.07$, $p < 0.01$; See table 7). For study 1, there was merely a weak correlation that was not significant. For study 2, the regression analysis showed a small negative and significant correlation.

Additionally, to evaluate the relationship between decision making behavior over all trials, fatigue and willpower beliefs (controlling for SES), I applied correlational analysis. There is a moderate negative and significant relationship between fatigue and lay beliefs about willpower in both studies (Study 1: $r = -.33$, $p < .05$; Study 2: $r = -.27$, $p < .05$; for details see table 8). The correlation matrix also depicts a similar moderate negative and significant relationship between willpower beliefs and decisions over all 100 trials as the regression model ($r = -.2$, $p < 0.5$). The

correlational analysis showed only small and not significant relationships between the other variables. Since higher scores in the LBW scale indicate more non-limited willpower beliefs and a taking the money option was coded as the higher value (1), a negative relationship in this sense does not support the hypotheses. Taken together, Hypotheses 3a and 3b are not supported.

Table 4

Pearson's Product-Moment Correlation of Decision on First Trial and Fatigue

	<i>r</i>	<i>r</i> 95% CI	<i>t</i>	<i>df</i>	<i>p</i>
Study 1	-.12	[-.25, .02]	1.67	199	.09
Study 2	-.06	[-.19, .08]	-0.88	199	.38

Table 5

Regression Results using Decision Over All Trials as the Criterion

	Predictor	<i>b</i>	<i>b</i> 95% CI	beta	beta 95% CI	<i>sr</i> ²	<i>sr</i> ² 95% CI	<i>r</i>	Fit
Study 1	(Intercept)	0.81**	[0.68, 0.94]						
	Fatigue	-0.01	[-0.03, 0.02]	-0.03	[-0.17, 0.12]	.00	[-.01, .01]	-.03	
	SES	-0.01	[-0.05, 0.02]	-0.05	[-0.20, 0.09]	.00	[-.01, .02]	-.06	
									R ² = .004 95% CI [.00,.03]
Study 2	(Intercept)	0.70**	[0.58, 0.82]						
	Fatigue	-0.01	[-0.04, 0.02]	-0.03	[-0.17, 0.11]	.00	[-.01, .01]	-.04	
	SES	0.03	[-0.00, 0.06]	0.13	[-0.01, 0.27]	.02	[-.02, .05]	.13	
									R ² = .018 95% CI [.00,.06]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. beta indicates the standardized regression weights. *sr*² represents the semi-partial correlation squared. *r* represents the zero-order correlation.

* indicates $p < .05$. ** indicates $p < .01$.

Table 6*Pearson's Product-Moment Correlation of Decision on First Trial and Willpower Belief*

	<i>r</i>	<i>r</i> 95% CI	<i>t</i>	<i>df</i>	<i>p</i>
Study 1	.05	[-.09, .19]	0.73	199	.46
Study 2	.05	[-.09, .18]	0.67	199	.5

Table 7*Regression Results Using Decision Over All Trials as the Criterion*

	Predictor	<i>b</i>	<i>b</i> 95% CI	beta	beta 95% CI	<i>sr</i> ²	<i>sr</i> ² 95% CI	<i>r</i>	Fit
Study 1	(Intercept)	0.90**	[0.71, 1.08]						
	Willpower Belief	-0.03	[-0.08, 0.02]	-0.09	[-0.24, 0.05]	.01	[-.02, .03]	-.09	
	SES	-0.01	[-0.05, 0.02]	-0.05	[-0.20, 0.09]	.00	[-.01, .02]	-.06	
									R ² = .011 95% CI [.00, .05]
Study 2	(Intercept)	0.92**	[0.75, 1.09]						
	Willpower Belief	-0.07**	[-0.11, -0.02]	-0.21	[-0.35, -0.07]	.04	[-.01, .10]	-.20**	
	SES	0.03*	[0.00, 0.06]	0.15	[0.01, 0.28]	.02	[-.02, .06]	.13	
									R ² = .061** 95% CI [.01, .13]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. beta indicates the standardized regression weights. *sr*² represents the semi-partial correlation squared. *r* represents the zero-order correlation.

* indicates *p* < .05. ** indicates *p* < .01.

Table 8*Means, Standard Deviations, and Correlations with Confidence Intervals*

	Variable	<i>M</i>	<i>SD</i>	1	2	3
Study 1	1. Fatigue	3.79	1.30			
	2. Willpower Beliefs	3.33	0.72	-.33** [-.45, -.20]		
	3. Decision over All Trials	0.77	0.26	-.03 [-.17, .11]	-.11 [-.24, .03]	
	4. SES	1.92	1.05	.06 [-.09, .20]	.05 [-.10, .19]	-.06 [-.20, .09]
Study 2	1. Fatigue	3.32	1.16			
	2. Willpower Beliefs	3.58	0.76	-.27** [-.39, -.13]		
	3. Decision over All Trials	0.73	0.25	-.04 [-.18, .10]	-.20** [-.33, -.06]	
	4. SES	1.83	1.18	-.05 [-.19, .09]	.08 [-.06, .21]	.13 [-.01, .26]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Exploratory Analysis

After the first decision between money or time information for the task, participants were then asked which task they want to do: a more or less profitable one when asking for money information or a shorter or longer one when asking for time information. I was exploratively interested in whether the variables fatigue or willpower beliefs had any relationship with this decision as well. To test this, I applied multilevel modeling to the data, as it was nested within decisions as well as within trials. Since the decision is a dichotomous variable, I choose a GLM with a binomial logistic function. The subscales Energy (ENG) and Tiredness (TIR) of the fatigue questionnaire ADACL (Thayer, 1998) and the subscales Mental Activity (LBW-M) and Temptation (LBW-T) for the Lay Beliefs about Willpower questionnaire (Job, 2010) acted as the predictor for the respective models. The models included random intercepts and random slopes. When fitted separately for each subscale, the scores in the LBW-T (Study 1: OR = 1.88, $p = .026$, 95% CI [1.08, 3.26]; Study 2: OR = 1.87, $p = .035$, 95% CI [1.04, 3.37]), ENG (Study 1: OR = 1.99, $p = .013$, 95% CI [1.16, 3.42]; Study 2: OR = 1.49, $p = .072$, 95% CI [0.96, 2.30]) and TIR (Study 1: OR = 0.49, $p = .033$, 95% CI [0.25, 0.94]; Study 2: OR = 0.57, $p = .043$, 95% CI [0.33, 0.98]) made the decision for the longer task at least marginally significantly or significantly more likely or, in the case of TIR, less likely. The scores for the LBW-M subscale did not predict the decision for a longer task significantly (Study 1: OR = 1.41, $p = .26$, 95% CI [0.78, 2.56]; Study 2: OR = 1.12, $p = .62$, 95% CI [0.71, 1.76]). For exact results, see table 9 for study 1 and table 10 for study 2. Figure 5 depicts the prediction plots for the significant models with blue graphs showing the association with willpower beliefs and red with fatigue.

Figure 5

Prediction Plots with Standardized Subscales on the X-Axis And Probability of Choosing the Longer Time Option on the Y-Axis.

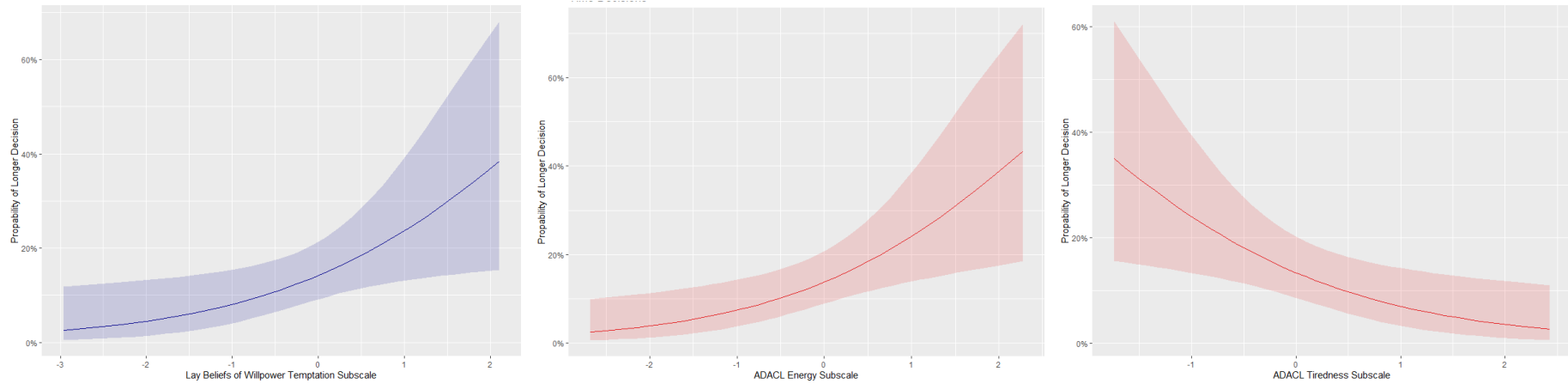
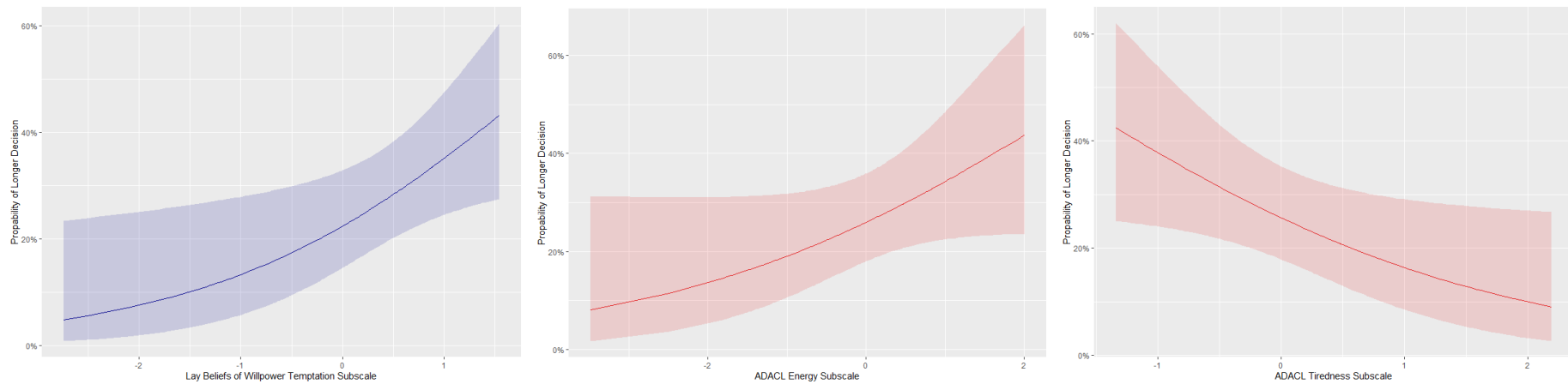
Study 1**Study 2**

Table 9

Multilevel Models and Random Effect Parameters for Exploratory Analysis for Study 1

Predictors	Decision for Longer Time											
	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>
(Intercept)	0.17	[0.10, 0.28]	<.001	0.16	[0.09, 0.27]	<.001	0.16	[0.09, 0.27]	<.001	0.15	[0.09, 0.26]	<.001
LBW-T	1.88	[1.08, 3.26]	.026									
LBW-M				1.41	[0.78, 2.56]	.260						
ENG							1.99	[1.16, 3.42]	.013			
TIR										0.49	[0.25, 0.94]	.033
Random Effects												
σ^2	3.29			3.29			3.29			3.29		
T_{00}	7.49 _{ID}			6.76 _{ID}			7.37 _{ID}			6.28 _{ID}		
T_{11}	0.00 _{ID.LBWT}			0.99 _{ID.LBWM}			0.00 _{ID.Energy}			1.62 _{ID.Tired}		
ρ_{01}	1.00 _{ID}			-0.17 _{ID}			0.48 _{ID}			0.13 _{ID}		
ICC	0.70			0.70			0.69			0.70		
<i>N</i>	144 _{ID}			144 _{ID}			144 _{ID}			144 _{ID}		
Observations	4678			4678			4678			4678		
Marginal R^2	0.030			0.011			0.041			0.038		
Conditional R^2	0.704			0.704			0.704			0.711		

Note. LBW-T and LBW-M refer to the Lay Beliefs of Willpower (LBW) subscales Temptation (T) and Mental Activity (M). ENG and TIR refer to the ADACL subscales Energy (ENT) and Tiredness (TIR).

Table 10*Multilevel Models and Random Effect Parameters for Exploratory Analysis for Study 2*

Predictors	Decision for Longer Time											
	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>	Odds Ratios	95% CI	<i>p</i>
(Intercept)	0.29	[0.16, 0.51]	<.001	0.35	[0.22, 0.57]	<.001	0.35	[0.22, 0.56]	<.001	0.35	[0.22, 0.55]	<.001
LBW-T	1.87	[1.04, 3.37]	.035									
LBW-M				1.12	[0.71, 1.76]	.620						
ENG							1.49	[0.96, 2.30]	.072			
TIR										0.57	[0.33, 0.98]	.043
Random Effects												
σ^2	3.29			3.29			3.29			3.29		
τ_{00}	8.13 _{ID}			8.04 _{ID}			8.03 _{ID}			5.61 _{ID}		
τ_{11}	1.78 _{ID.LBWT}			0.24 _{ID.LBWM}			0.03 _{ID.ENG}			2.62 _{ID.TIR}		
ρ_{01}	-0.64 _{ID}			-0.33 _{ID}			-1.00 _{ID}			-0.03 _{ID}		
ICC	0.74			0.71						0.72		
<i>N</i>	163 _{ID}			163 _{ID}			163 _{ID}			163 _{ID}		
Observations	5445			5445			5445			5445		
Marginal R ² / Conditional R ²	0.028 / 0.743			0.001 / 0.713			0.045 / NA			0.029 / 0.727		

Note. LBW-T and LBW-M refer to the Lay Beliefs of Willpower (LBW) subscales Temptation (T) and Mental Activity (M). ENG and TIR refer to the ADACL subscales Energy (ENT) and Tiredness (TIR).

Discussion

Interpretation of results

In the analysis for hypothesis 1, I found a significant difference between a random chance distribution of 50% between money and time decisions and the two samples' actual decisions, which leaned heavily towards money in the first as well as in all 100 trials. Hypothesis 1 was non-directional and a null hypothesis that stemmed from the unprecedented nature of this study design. Going forward, any studies using this design should be aware that the population, at least according to these samples, has a strong inclination to prefer information about monetary gain. This might also hint at a stronger Hedonic Motivational Orientation in a non-fatigued setting without any strong limited or non-limited willpower beliefs. This could be tested by substituting money as the gain option with for example points as this might be perceived more neutral and less tied to the monetary incentive of the study. The fact that the participants' socio economic status did not play a significant role in any of the analysis on the other hand speaks for continuing to use money or money-like information in future studies applying this design.

For hypothesis 2, I found no strong or significant correlation between decision making behavior and fatigue. It should be noted that both samples were not very fatigued all together and the hypothesis assumed a relationship with higher fatigue scores and choosing the cost option. So even if there was a relationship, this study would not have been able to reliably find one without manipulating fatigue.

Furthermore, I found a moderate negative relationship between the decision between money over all 100 trials and willpower beliefs in study 2, but not in study 1. This indicates that in study 2, people with more non-limited willpower beliefs (higher scores in the LBW scale) choose money slightly less frequently over all 100 trials. This effect does not show up on the first trial and there is no strong or significant correlation with willpower beliefs and decision making behavior on the first trial in both samples. In a similar fashion as with fatigue and hypothesis 2, neither sample had a strong tendency towards limited or non-limited willpower beliefs. Showing a relationship according to hypothesis 3a and 3b in this setting was not ideal. The negative relationship partially found in study 2 could be a result from people holding more limited willpower beliefs and preferably choosing money in general. The result that more non-limited willpower beliefs are associated with choosing the time option leads to the exploratory analysis.

The exploratory analysis indicated that the participants who leaned towards non-limited willpower beliefs in the temptation subscale and were less fatigued tended to choose a longer task when asking for information about time. This result remarkably replicated in both samples. With the conditional R^2 being so much larger than the marginal R^2 , most of the variance in the data could stem from the ID level of participants, so participants seem to be consistent in choosing the same options. Studies going forward should try to calibrate a trial number that is statistically sufficient while still yielding the necessary information. In all, the exploratory analysis could at least show support for the idea that non-limited willpower beliefs and less fatigue led to being willing to put in more effort. The cost-focused mindset and effort-averse behavior seems to be state dependent as proposed by the cost motivational orientation and not generally applicable as has been assumed so far. This is in line with prior research on the topic of ego-depletion and lay beliefs about willpower outlined in the introduction (Job et al., 2010).

Limitations

As the interpretation of results already alluded, this study design and its potential results are not without their limitations. Firstly, by the nature of the study design, the results are purely correlational and can offer no real insight into potential causation. Future researchers interested in this topic will need to fill this gap by manipulating fatigue and willpower beliefs before the decision making task. This way, the relationships that hypothesis 2, 3a and 3b were trying to show might be better depicted, if they exist.

Secondly, the question remains how valid the decision making task is for measuring information processing and the subjective value of said information for motivational decisions. Looking at the chosen informational categories for example, one could argue that most people are just primed to pick the option with the word “money” on it whenever it is offered. I have already suggested using the more neutral word “points” instead. Another option would be to use even less obvious gain/loss options like “interesting/boring”, “difficulty/familiarity” or “social benefits/risk”. Participants might not universally perceive these options in the same manner though and would need priming to ensure validity. This last argument is primarily why I opted for the “money” option in this first trial of this experiment, as it is universally understood as a gain. This still does not guarantee that all participants consistently choose their information based on what is important to them. Other factors like

boredom, spontaneity and personal preferences might also factor into the COG-ED task. This might be especially the case with this study, as it is a correlational online study with no way of randomizing or manipulating the factors of fatigue and willpower beliefs. Experimental studies that manipulate the variables should suffer less from these limitations and therefore hold more explanatory power.

Furthermore, since this is the very first time these methods are applied in this manner, the question of reliability arises. Thorough testing, like with the replication for example, is necessary to ensure reliability. The fact that most results replicated almost identically does suggest that the results are not completely random and sample dependent. This is further supported by the fact that both samples are fairly heterogeneous in their demographic categories. All in all, the results of this method seem, for now, sufficiently reliable.

The effect sizes of the effects I did find are, as mentioned in the section before, comparatively small and mostly explained by individual consistency. While the fit of the models is satisfactory, the effects currently exist in a very narrow setting and could only be found for questions not part of the original hypothesis for this thesis, but in line with the general theory behind it. In general, further research will need to evaluate and expand on the findings of this master's thesis.

Conclusion

While I could not find support for my main hypothesis within the study, I could gain valuable insight regarding people's preferred information when it comes to motivational choices. When people are not very fatigued and not strongly inclined to a limited or non-limited willpower belief, they are just interested in what they could gain. It is interesting that they are not really neutral in this state, which would lead to a 50/50 distribution of choices, theoretically, but very much inclined towards one option. This finding does challenge some of the prominent theories mentioned in the introduction and their assumption that most people are more interested in the costs that certain decisions or actions will cause them. When nothing is really at stake, most people seem more interested in what there is to gain before looking at what they could lose. This is largely in line with the theory behind the hedonic motivational orientation outlined in the introduction of this thesis. The question remains if this mindset truly does change when fatigue rises and remains hedonic as long as the person holds a non-limited willpower belief.

At the very least, this thesis provides a robust statistical analysis for a new methodological approach in motivational psychology. By replicating the results of the very first study almost identically, the decision making task seems to produce above random results. Hopefully, this can be used and expanded upon in future studies.

As for now, this study shows some support for the Hedonic VS Cost Motivational Orientation theory. The exploratory findings are also in line with the idea that effort becomes less aversive with a non-limited willpower belief and more aversive when fatigued and is not in general wholly aversive. The effect of willpower beliefs on fatigue that started this whole avenue of research does show up even here already. It is not unreasonable to believe that continuing this research with experimental design in the future might lead us to the mechanism behind this effect. I have laid the first brick for others to hopefully build upon in the future and better our understanding of motivational decisions and to further explain the mechanism behind ego depletion and the effect of willpower beliefs on fatigue. This and further research question the assumption that effort is truly always aversive and that costs are the only main deciding factor when making motivational decisions. Effort is not always avoided on principle and under some circumstances, what we want and stand to gain is not limited by what we stand to lose.

Project Schedule

Table 1

Project schedule.

Milestones	Time period
Planning data collection	October–November 2023
Study 1 (Prolific)	December 2023
Study 2 (Prolific)	April 2024
Data analysis	June 2024
Presenting data analysis and results	June 2024
Writing thesis	July–August 2024

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Appendix

German Abstract

Psycholog*innen gehen meist von einer zugrundeliegenden Kosten-Nutzen-Analyse aus, wenn Menschen vor der Entscheidung stehen, ob sie eine bestimmte Handlung vornehmen sollen oder nicht. Selbst in der Motivationspsychologie muss eine Aufgabe mit hohem Schwierigkeitsgrad eine hohe subjektive Erfolgsbedeutung haben, damit es sich lohnt, sie zu verfolgen. Müdigkeit ist ein Faktor, der unsere geistigen und körperlichen Ressourcen einschränkt und dazu führt, dass Handlungen als kostspieliger empfunden werden. Dieser Effekt wird durch implizite Theorien über die Willenskraft begrenzt, d. h. durch die Überzeugung, dass die Willenskraft eine begrenzte (und daher teurere) Ressource ist oder nicht. Wenn Entscheidungen nur durch diese kostenorientierte Analyse bestimmt werden würden, wie könnten Menschen dann bereit sein, ressourcen- und kostenintensive Anstrengungen zu unternehmen? So kann in bestimmten Situationen vielleicht ein anderer Fokus auftreten, einer, der einfach auf dem hedonischen Vergnügen liegt, das eine Aufgabe bringen kann (hedonisch-fokussiert). Diese Studie untersucht die Beziehung zwischen kosten-fokussierter und hedonischer motivationaler Orientierung, Ermüdung und Willenskraftüberzeugungen in zwei Online-Studien ($N_{1/2} = 201$). Die motivationale Orientierung wird anhand einer Entscheidungsaufgabe gemessen. Die Analyse mit einem exakten Binomialtest und einem zweiseitigen t-Test für eine Stichprobe ergab, dass die Stichprobe Informationen über den monetären Gewinn einer zukünftigen Aufgabe stark bevorzugte. Die Korrelationsanalyse konnte keinen starken directionalen Zusammenhang zwischen Entscheidungen, Müdigkeit und Willenskraftüberzeugungen aufzeigen. Eine explorative Analyse mit Hilfe einer Mehrebenenanalyse ergab, dass Müdigkeit und Willenskraftüberzeugung die Wahl einer längeren Aufgabe vorhersagen, wenn nach Zeitinformationen gefragt wird. Die Ergebnisse deuten auf eine natürliche Neigung zur hedonischen motivationalen Orientierung im unmanipulierten Zustand hin und unterstützen die Ergebnisse von Job et al. (2010). Auf dieser Grundlage könnte zukünftige Forschung möglicherweise den Mechanismus aufdecken, der die Wirkung von Willenskraftüberzeugungen auf die Ermüdung erklärt, und somit das Modell der Theorie der motivationalen Intensität um hedonische Absichten erweitern.