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Individual Differences in the Use of Time Management Mechanics and in Time Discounting

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ABSTRACT - Behavioral decision-making research has shown that people generally discount future outcomes. This phenomenon is relevant for time management mechanics because their use usually implies immediate costs and only future benefits. If some people discount future outcomes more steeply than others, they should also discount the future benefits of using time management mechanics more steeply and consequently use time management mechanics less often. This hypothesis was tested among 153 German white-collar workers. The steepness of time discounting was inferred from two common behavioural tasks that are typically used to measure time discounting. The use of time management mechanics was assessed using the Mechanics subscale of the Time Management Behavior Scale. Results showed the expected negative correlation between the time discounting measures and the use of time management mechanics. It is argued that time discounting should therefore become a topic taught in time management training.

There is no doubt that people show individual differences in how they manage their time (e.g., Macan, Shahani, Dipboye, & Phillips, 1990). Some people plan their time carefully and use various time management techniques like writing lists, whereas others do not. So far, studies have described individual differences in time management (e.g., Macan et al., 1990), and researchers provided evidence for a relationship of time management with stress and performance (e.g., Barling, Cheung, & Kelloway, 1996; Nonis & Sager, 2003; Peeters & Rutte, 2005). However, hypotheses about the reasons for the individual

differences in the use of time management mechanics have not been explored yet. In this study, we argue and show that individual differences in the use of time management techniques are due to individual differences in time discounting.

Time discounting describes the finding that people discount future options (Frederick, Loewenstein, & O'Donoghue, 2002). This means that people attribute less value to options that are available only in the future than to options that are immediately available. As a consequence, people who have to make a decision between a smaller but sooner option and a larger but later option might prefer the sooner option even though it is smaller. The later option has subjectively less value because it is more delayed than the sooner option.

To give an example, in many time discounting studies (e.g., Rachlin, Raineri, & Cross, 1991) participants are asked whether they would prefer a smaller amount of money now or a larger amount later, both given with certainty. It has been found that on average, people are indifferent with regard to the choice between receiving \$68 immediately or receiving \$100 in 12 months' time (Green, Myerson, & McFadden, 1997). Such indifference can be well described by the following (hyperbolic) equation (Mazur, 1987):

$$V = \frac{A}{1 + kD} \quad (1)$$

V is the present, discounted value of a delayed outcome, A is the nondiscounted amount of the delayed outcome, D is the delay, and k is the discounting rate parameter. The k parameter is a free parameter that can vary between people. The more (or "steeper") someone discounts future outcomes the higher his or her k value. People with a high k parameter perceive \$100 in 12 months as having less worth than \$68 immediately, whereas people with a low k parameter perceive \$68 immediately as having less worth than \$100 in 12 months. The k parameter can thus be seen as a behavioural measure of impulsivity. Some support of this interpretation can be found in the literature: The k parameter correlates with questionnaire measures of impulsivity (e.g., Kirby, Petry, & Bickel, 1999; Richards, Zhang, Mitchell, & de Wit, 1999).

Time discounting has important implications for time management decisions (Koch & Kleinmann, 2002; O'Donoghue & Rabin, 1999). Due to time discounting, people tend to invest time in outcomes with high immediate benefits and low immediate costs but not in outcomes with high delayed benefits and low delayed costs. Such a strategy of time investment should be more pronounced among people who discount more steeply (i.e., people with a high k value). Based on this idea, Schouwenburg and Groenewoud (2001) argued that procrastinating students should have a high k parameter for time discounting because of their problems resisting temptations (e.g., resisting the immediate benefits of social interactions). Consistent with this argument, they found that the average k value in hypothetical studying scenarios of procrastinators is

higher than the *k* value of nonprocrastinators. In addition, König and Kleinmann (2005) showed that the rush before the end of a deadline can be well described by Mazur's (1987) hyperbolic time discounting equation (i.e., Equation 1).

The time discounting argument can also be applied to the use of time management techniques like writing reminder notes and using an appointment book because these behaviours require an investment of time in the present. The benefits of using time management techniques will come to fruition, but only in the future. The problem is therefore that while future benefits are discounted, the costs of using time management techniques can be experienced immediately. Imagine yourself following the advice of Stephen Covey, a time management "guru" (Jackson, 1999, p. 353). When you fill out his very detailed daily and weekly worksheets (see Covey, Merrill, & Merrill, 1994), you are most likely better organized and you will therefore experience long-term benefits, but you have to invest some planning time upfront. Subjectively, these long-term benefits will be less valuable to people who discount more steeply. Thus, people who discount future outcomes more steeply should use time management techniques less often. It is therefore an irony that those who are most in need of time management techniques may be the least likely to use them: Due to time discounting, people procrastinate and, at the same time, do not use time management techniques that could help against procrastination.

It is important to differentiate between different facets of time management because not all facets are affected by time discounting. Macan (1994; see also Macan et al., 1990) makes a distinction between three time management facets: time management mechanics, setting goals and priorities, and preference for organization. The mechanics facet describes, for example, whether people carry a notebook to jot down notes and ideas, whether they make lists, or whether they keep a daily activity log. These time management behaviours typically require some time and are often carried out on a regular basis. An example of the setting goals and priorities facet is demonstrated by the question of whether people set priorities to determine the order in which they will perform tasks or whether they break down complex projects into smaller manageable tasks. These time management techniques can often be applied within a short period of time and in many cases are singular acts. Finally, the preference for organization facet captures the extent to which people prefer to work in an organized, structured environment. This preference should not be seen as related to time discounting because it is not a time management technique requiring a time investment but rather an attitudinal construct. It is therefore predominantly the use of time management mechanics that requires a great and immediate investment of time. Thus, we hypothesize that the use of time management mechanics should be negatively correlated with time discounting. We do not, however, expect to find correlations between time discounting and setting goals and priorities and between time discounting and the preference for organization.

Method

Participants

Participants were 153 German white-collar workers (44 women, 108 men, and 1 did not specify his or her sex). Ninety-six participants were employees of a financial consultancy and were approached during an internal meeting. Thirty-two participants were employed in different banks, and 25 worked in various other white-collar jobs. These participants were approached individually on their jobs. Nearly three quarters of the participants (73%) were in the age range of 26 to 45 years, 22% in the range of 46 to 65 years, and 5% in the range of 21 to 25 years. Two thirds of the participants (100) had left school after completing the German university entrance examinations ("Abitur"). The others had left school earlier with lower qualifications. With the exception of one participant, all had successfully completed some kind of tertiary education: 45 had obtained a university degree (roughly equivalent to a Master's degree), 27 a college degree (roughly equivalent to a Bachelor's degree), and 80 had undergone a two to three-year period of vocational training. To assess the test-retest reliability of the measures used we were able to approach 20 participants (11 female, 9 male) a second time 8 to 10 weeks after the initial study.

Time Discounting Tasks

Choice tasks are the most common method of measuring time discounting, with matching tasks the second most favoured method (Frederick et al., 2002). In a choice task (cf. Kirby et al., 1999), participants are required to choose between given amounts of delayed or immediate money. In a matching task (cf. Lázaro, Barberán, & Rubio, 2002), participants are asked to specify the amount of delayed money that is equivalent to a given sum that they could obtain immediately. Because different tasks might generate different results (Frederick et al., 2002; Roelofsma, 1996), we used both kinds of tasks. Even though they involve hypothetical money choices, such choices are known to serve as a valid proxy for choices with real money (Johnson & Bickel, 2002; Madden, Begotka, Raiff, & Kastern, 2003; Madden et al., 2004).

Choice task. An adapted version of the task of Kirby and colleagues (1999) was developed in the following steps. The task of Kirby et al. comprised seven trials with small amounts of money, seven with medium amounts, and seven with large amounts. Six choice trials with large amounts were adapted by replacing "$" with "DM", the abbreviation for the former German currency Deutsche Mark. The seventh trial was not used in the current study because all control participants in the Kirby et al. (1999) study chose the delayed amount in this choice trial. We added five further trials in order to obtain a finer grading. Table 1 shows the choice trials.

Table 1
Trials in the Choice Task and Their Associated Hyperbolic Discounting Parameter k

Trial number	Choice trial	Hyperbolic discounting parameter *k*
10	DM80 immediately or DM85 in 157 days	.0004
4	DM67 immediately or DM75 in 119 days	.0010
6	DM69 immediately or DM85 in 91 days	.0025
9	DM61 immediately or DM75 in 86 days	.0036
11	DM64 immediately or DM85 in 68 days	.0048
1	DM55 immediately or DM75 in 61 days	.0060
7	DM57 immediately or DM85 in 58 days	.0085
2	DM53 immediately or DM80 in 46 days	.0110
3	DM49 immediately or DM75 in 39 days	.0135
8	DM54 immediately or DM80 in 30 days	.0160
5	DM41 immediately or DM75 in 20 days	.0410

Note. The hyperbolic discounting parameters *k* in the last column are the *k* values at which the immediate and delayed amount or money are equivalent according to Equation 1. Trials are shown in increasing order of *k*.

Participants received the following instructions:

> The following 11 questions are about decisions regarding different amounts of money. In each question, two different amounts of money are specified. Imagine that you can obtain one of the two amounts in reality. You always have the choice between two alternatives: You can get one of the amounts immediately or the other after a certain amount of time that is indicated in the question. Please mark the alternative you personally prefer.
>
> Example: Would you prefer to get DM30 immediately or DM35 in 20 days?
>
> If you would prefer DM30 immediately, please mark the first alternative. If you would prefer to obtain DM35 after the delay of 20 days, please mark the second alternative.
>
> While making your choices, imagine that you could obtain the chosen amount of money in reality and that you are assured of receiving the

alternative that you have chosen.

Consider well which alternative you would prefer. Make your decisions for each choice independently from the decisions you made in the other questions. Each question is separate and there is no connection between the questions.

The *k* parameter describing the individual differences in discounting was calculated as suggested by Kirby and colleagues (Kirby & Maraković, 1996; Kirby et al., 1999; see also Kirby, 2000). First, Equation 1 was used to determine the *k* parameter for each trial as if people had stated that they were indifferent between the two options of each trial. For example, the first trial in our task offered a choice between DM55 immediately and DM75 in 61 days. Participants who are indifferent between both options would have a *k* of .0060. Table 1 shows the discounting parameter *k* for each choice trial.

However, as participants do not state whether or not they are indifferent between the two alternatives, but are rather required to mark the alternative they prefer, their discounting-rate parameter *k* can only be estimated. Kirby and colleagues (Kirby, 2000; Kirby et al., 1999) suggest using the geometrical mean between the *k*s of the two items between which a change in choice occurs. Table 1 shows the choice trials in increasing order of *k*. If people choose the immediate amount of money on the top six trials and the delayed amount from the seventh trial on, their *k* lies between .0060 and .0085. For such people, Kirby uses the geometrical midpoint between .0060 and .0085 as an estimate of *k*, which is .0071 in this case. Using the geometrical mean avoids assigning less weight to the smaller of the two *k* parameters. If people always choose the immediate amount, their *k* is .0410 or greater. Here, a conservative estimate of .0410 was taken. Similarly, if people always choose the delayed reward, their *k* is .0004 or smaller, and a conservative estimate of .0004 was taken.

Sometimes participants do not answer the trials in a consistent manner. For example, a participant might choose the immediate amount in trials 10, 4, and 9 (see Table 1) and the delayed amount in the other trials. In such a case, the participant can be assigned the *k* value that is most likely to bring about the observed choice pattern. To find this *k* value, Kirby (2000) suggested calculating the proportion of choices that are consistent with assignment to each of the *k* values defined by the choice trials. The *k* value that yielded the highest proportion of consistent choices was assigned to these participants. It can happen that two or more values yield an equal proportion of consistent choices. In such a case, the geometric mean of those values can be used as an estimate of *k* (Kirby, 2000).

Matching task. This task consisted of seven items in which participants compared an amount of DM1000 (around US $450 at that time) to an amount they could receive in one week, one month, in six months, in one year, in five years, in ten years, and in twenty-five years. They were told to imagine that they

were to choose between DM1000 that they could receive immediately and another amount of money that they could obtain at a later point of time. Then participants were asked, for example, how much money they should be given in one week's time if they were to choose this option over receiving DM1000 immediately. In the other trials, the expression "in one week's time" was substituted by the other points of time. Additionally, participants were told that each trial should be considered as independent from the other trials. Because the answers to these questions can vary considerably, a rank order of participants' answers was determined for each point of time. A higher rank means greater time discounting. The mean rank for each participant over all seven points in time was used for the further analyses.

The Use of Time Management Mechanics

The use of time management mechanics was measured with the Mechanics subscale from the Time Management Behavior Scale (Macan, 1994; Macan et al., 1990). We also included the subscales for setting goals and priorities and for preference for organization. The questionnaire was translated by the authors with the help of two native English speakers and three German graduates studying English. The resulting German version was back-translated by a native English speaker who studied German. The back-translation was used to modify some wording details. Participants responded using a five-point scale (1 = seldom true to 5 = very often true).

Results

One person did not answer the choice task and four people did not answer the matching task. These participants were excluded case-wise.

Time Discounting Tasks

Participants were very consistent in their choices in the choice task. On average, 98.4% of the choices were consistent with the overall discounting-rate parameter k to which participants were assigned. The mean discounting-rate parameter k was .0068, the median .0042, and the standard deviation .0085. Because the k parameters were not normally distributed, Spearman correlations were used in further analyses.

For the retest subsample, the k parameters from the first and the second testing were correlated, $r = .54$, $p < .01$. For the matching task, a Spearman correlation between the mean rank of the first testing and the second testing in the matching task (i.e., the retest reliability) was .77, $p < .01$. As expected, k parameters from the choice task and the mean ranks in the matching task are closely related, $r = .66$, $p < .01$.

Time Management Behavior Scale

The responses were subjected to an exploratory factor analysis. As expected, a scree plot suggested three factors. These factors were rotated using a varimax rotation. The three-factor structure accounted for 35.2% of the common variance. Table 2 shows the factor loadings and eigenvalues.

Table 2

Factor Loadings and Eigenvalues for the German version of the Time Management Behavior Scale (n=153)

Question	Item	Factor 1	Factor 2	Factor3
16	Carries notebook	.773		
32	Carries appointment book	.651		
28	Uses waiting time	.578	.311	
25	Schedules events a week in advance	.565		.349
24	Makes list of things to do	.558	.317	
12	Writes reminder notes	.423		
4	Sets priorities		.669	
13	Reviews goals		.668	
20	Keeps long-term goals		.601	
3	Reviews activities		.561	.401
5	Breaks down tasks		.493	
11	Increases task efficiency		.481	
23	Evaluates daily schedule	.378	.468	.368
26	Sets deadlines		.455	
22	Believes days to be too unpredictable (reverse coded)			.643
7	Is more creative when disorganized (reverse coded)			.543
31	Adjusting to events easier when disorganized (reverse coded)			.540
15	Finding things on desk more easily when desk messy (reverse coded)			.488
14	Leaves clean work space			.477
21	Organizes tasks by preference (reverse coded)			.422
18	Forgets lists made (reverse coded)			.417
2	Practices record-keeping [a]	.355		.331
1	Keeps daily log [b]			.350
9	Completes priority tasks first [b]	-.497		.302
29	Scheduling is wasted time (reverse coded) [b]	.442		
30	Organizes paperwork [b]		.380	
33	Avoids interruptions [b]		.328	
27	Schedules time daily [c]			
	Eigenvalues	3.567	3.342	2.933

Note. Factor 1=Mechanics; Factor 2=Setting Goals and Priorities; Factor 3=Preference for Organization. The labels are adapted from Macan (1994). Only loadings greater than |.3| are shown.

[a] Excluded because it loaded very similar on two factors.

[b] Excluded because of stronger loadings on a wrong factor.

[c] Excluded because it loaded less than .3 on the intended factor.

Seven items were deleted for the following reasons: Their factor loadings were incongruent with the hypothesized factor (five items); they loaded very similarly on two factors (one item); they loaded less than .30 on the intended factor (one item). For the time management mechanics scale ($M = 3.42$; $SD = .92$), Cronbach's alpha was .75 and the retest reliability .90 ($p < .01$). For the setting of goals and priorities scale ($M = 3.09$; $SD = .68$), Cronbach's alpha was also .75 and the retest reliability was .62 ($p < .01$). For the preference for organization scale ($M = 3.77$; $SD = .67$), Cronbach's alpha was .62 and the retest reliability was .85, $p < .01$.

Relationships Between Variables

Table 3 shows the correlations between the two measures of time discounting and the time management scales. The k parameter from the choice task and the mean rank in the matching task both showed a similar and significant negative relationship with the use of time management mechanics (-.25 and -.24, respectively). This supports the prediction that time discounting is negatively related to the use of time management mechanics. Neither time discounting measure was significantly related to the other two time management facets (setting goals and priorities and preference for organization).

Table 3

Intercorrelations Among Variables

Variable	1	2	3	4
1. k parameter in choice task				
2. Rank in matching task	.66**			
3. Time Management Mechanics	-.25**	-.24**		
4. Setting Goals and Priorities	-.12	-.03	.39**	
5. Preference for Organization	-.02	.04	.17*	.37**

Note. Correlations are Pearson correlations, apart from the correlations with the variables "k parameter in choice task" and "Rank in matching task", which are Spearman rank correlations. n=149-153.
*p<.05. **p<.01 (2-tailed).

Discussion

This study showed that individuals who discount future options more steeply than others use fewer time management mechanics. This was expected on the basis of the argument that the use of time management mechanics, such as

writing lists, means an immediate investment of time that pays off only in the future. People who attribute less value to future benefits (i.e., who discount more steeply) should therefore care less about the benefits of using time management mechanics than people with less steep time discounting. Thus, the current study offers the first empirical evidence favouring a time discounting explanation of individual differences in the use of time management mechanics.

The correlation between time discounting and the use of time management mechanics was smaller than expected (-.25). However, a look at the literature reveals that the magnitude of this correlation is within the range that is typically found between time discounting and personality constructs measured with questionnaires. For example, Kirby et al. (1999) reported a correlation of .27 between time discounting and impulsivity, and Richards et al. (1999) found a correlation of .14 with one impulsivity scale and .35 with another. Low correlations of time discounting with other constructs might be likely to occur due to the lack of common method variance. Whereas choice tasks require participants to choose between immediate or delayed amounts of money, personality questionnaires use Likert scales, so that method variance attenuates relationships ("downward method bias", Conway, 2002, p. 359). In addition, the unreliability of the measures has to be taken into account. If the correlations are corrected for attenuation by using the test-retest reliabilities, the use of time management mechanics correlate at -.35 with the discounting-rate parameter k from the choice task and at -.28 with the mean rank in the matching task. However, the test-retest reliability was assessed with a small subsample and the corrected correlations should thus be considered only as rough estimates.

An alternative explanation for the low correlation is that individual differences in time discounting might not be consistent across different domains (e.g., Chapman & Coups, 1999; Chapman & Elstein, 1995). Chapman and her colleagues have found that time discounting in the monetary domain (i.e., choices for hypothetical amounts of money) and the health domain (e.g., choices between immediate and delayed hypothetical health benefits) correlates only weakly. Perhaps a higher correlation between time discounting and the use of time management mechanics would have been found if time discounting had been measured not within the monetary domain, but within the time management domain (e.g., by letting participants decide between immediate and delayed hypothetical benefits of time management mechanics). This might have eliminated the domain effect. However, measuring time discounting in the time management domain would make it impossible to compare our results to previous studies (e.g., Kirby et al., 1999), which predominantly measured time discounting within the monetary domain.

This study is limited by the use of correlational data. We follow others who argue that time discounting is a very basic process, while behaviours like accepting vaccination (Chapman & Coups, 1999) or taking drugs (e.g., Kirby et al., 1999) are the consequences of time discounting. The same can be argued for

the use of time management mechanics. Yet only experimental manipulations of time discounting can provide evidence for a causal link between time discounting and the use of time management mechanics.

A strong feature of this study is the use of two measures for the individual differences in time discounting. Different measures of time discounting can produce different results (cf. Roelofsma, 1996), yet the two measures were highly correlated in this study. If the correlation is corrected for unreliability, it becomes 1. More importantly, both measures yielded the same relationship with the use of time management mechanics. In other words, it did not matter how time discounting was measured. This supports the credibility of the results.

Another strong feature of this study is the link between a concept that is rooted deeply in economical and psychological decision making literature (i.e., time discounting) and an applied problem (i.e., time management). Even though time discounting is mostly studied by people who are interested in basic processes (e.g., Green et al., 1997), time discounting is more and more recognized as an important phenomenon by more applied researchers (e.g., Hantula & Bryant, 2005; Kirby et al., 1999; Soman, 2004). This study contributes to this growing literature.

Future research could try to explain further variance in the extent to which people use time management mechanics. In particular, broader approaches should also include organizational variables because it is unlikely that all jobs require the same amount of time management. For example, it could be argued that some jobs put employees under such a heavy workload that all employees will use management mechanics. This should be especially important for less homogenous samples like ours, which consisted predominantly of white-collar workers in the financial sector. However, for this research project we followed Cohen's (1990, p. 1304) "less is more" advice and focused on only one new concept that can be derived from the emerging behavioural decision making view on time management, namely time discounting.

Future research should also examine the Time Management Behavior Scale further. Even though we replicated the factor structure with a German sample, seven items had to be deleted because of wrong or unsatisfactory factor loadings. In addition, the Cronbach's alpha for the preference for organization scale was only just satisfactory. However, problems with the internal consistency of scales can also be found in the original scale (Macan, 1994). The test-retest reliabilities we found were good (larger than .61 over 8-10 weeks), but they should be viewed with caution due to the small retest sample.

This study has practical implications for time management training, which has been found to be sometimes effective (e.g., van Eerde, 2003) and sometimes not (e.g., Slaven & Totterdell, 1993). In view of our results, it is important to make people aware of the problem that the benefits of using time management mechanics can only be experienced in the future. People who expect immediate benefits of time management might be disappointed. This should be especially

true for people with steep time discounting because even if they expect some distant benefit, they will not care very much about it. Consequently, time management training should also incorporate time discounting as a concept.

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Before his marriage, C.J. König published under the name of C.J. Koch.

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