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Time is on my side: Optimism in intertemporal choice

Mariëtte Berndsen *, Joop van der Pligt

Department of Social Psychology, University of Amsterdam, Roetersstraat 15, 1018 WB Amsterdam, Netherlands

Abstract

The present research examines the role of optimism on time preferences for both losses and gains. It is argued that optimism has asymmetric effects on time preferences for gains versus losses: one reason why decision makers prefer immediate gains is because they are optimistic that these gains will be followed by additional gains in future. In contrast, decision makers prefer to delay losses because they are optimistic that losses are avoidable in the future. Optimism about outcomes affects time preferences for both gains and losses, such that low optimism reduces the discount rates while increased optimism is associated with higher discount rates. This prediction was supported in two different domains: monetary outcomes (Study 1), and health (Study 2). Implications of these results for both research practice and time preferences in the real world are discussed. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

In many situations, our decisions involve outcomes that take place at different points in time. For example, decisions about whether or not to stop smoking cigarettes involve trade-offs between the short-term pleasure of a cigarette and the

* Corresponding author.
E-mail address: sp_berndsen@macmail.psy.uva.nl (M. Berndsen).

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long-term benefits of improved health. Decisions about retirement savings involve trade-offs between current and future consumption. These decisions focus on trade-offs between immediate outcomes and delayed outcomes or on 'intertemporal choices'.

Discounted utility theory (Fishburn & Rubinstein, 1982; Samuelson, 1937) is the normative model to analyze intertemporal choices. According to this theory, the present value of an outcome, e.g., an amount of money, is equivalent to the value of a future outcome discounted or devaluated according to time delay. In general, decision makers expect a premium to *compensate* for delaying a desirable outcome, and they expect to *pay* a premium for delaying an undesirable outcome. This is expressed in the following equation:

$$V_{\mathrm{p}} = \frac{V_{\mathrm{d}}}{(1+r)^{d}}$$

In this equation, V_{p} is the present value, V_{d} is the delayed value, r is the annual discount rate and d is the delay length. The degree of discounting is called the temporal discount rate or rate of time preference. A positive time preference indicates a preference for an immediate gain or benefit over a delayed one. Thus, the value of the delayed outcome is diminished. A negative time preference indicates the reverse.

One reason for positive time preference is that the future is inherently uncertain; future outcomes are considered to be less certain than immediate ones. Roelofsma (1996) argued that uncertainty increases discount rates, and that uncertainty increases when the outcome takes place in the distant future as opposed to immediate outcomes. Unfortunately, the concept of uncertainty is not incorporated in the discounted utility model. The purpose of the present studies is two-fold. First, we examine whether uncertainty about the future leads to different beliefs underlying preferences for immediate gains and delayed losses. Second, we investigate the impact of these beliefs on time discounting.

A pilot study (Berndsen & Van der Pligt, 1999) dealing with health outcomes, revealed that preferences for delayed health *losses* were based on beliefs that the future will provide opportunities to avoid these losses. This finding is consistent with the work of Shelley (1994) who investigated time preferences in the domain of monetary outcomes. Given the inherent uncertainty of the future, Shelley hypothesized that decision makers would ignore uncertainties of future gains but not of losses. This idea is based on March and Shapira's (1987) view that decision makers are more concerned about the likelihood of negative outcomes than about the likelihood of positive outcomes. Shelly's results were consistent with her conjecture, indicating that future losses were seen as less certain than future gains. This suggests that beliefs about avoiding future negative outcomes might have played a role. It needs to be added that Shelley only provided indirect evidence for the relation between discount rates and uncertainty of future outcomes; i.e., she did not test whether discounting increases as a function of the perceived uncertainty of outcomes.

The finding that participants in Shelley's (1994) study were less concerned about (not) obtaining future gains, seems inconsistent with the belief that future gains (like

losses) involve some uncertainty, because there is always the risk that the delayed gain will not be obtained (see e.g., Chapman & Elstein, 1995). For example, one might prefer $100 right now over $150 in a year because one could get a severe illness or an accident, being unable to enjoy this future receipt of money. Another important belief for preferring immediate monetary gains is that these outcomes can be stored or invested for future consumption, and hence increase with time (see e.g., Chapman & Elstein, 1995). In other words, obtaining immediate gains might be accompanied by the hope of obtaining additional gains in future.

In short, the uncertain character of the future may have differential effects on beliefs about gains and losses: losses are believed to be avoidable and immediate gains are expected to be followed by further gains. These two beliefs have in common that they both refer to *optimism*; i.e., optimism about obtaining desirable outcomes and avoiding undesirable outcomes.

In the present research, the term 'optimism' refers to "an inclination to put the most favorable construction upon actions and happenings, to minimize adverse aspects, conditions, and possibilities or to anticipate the best possible outcome" (Babock Gove, 1981, pp. 1584–1585). We would argue that uncertainty about future outcomes provides a scope for optimistic beliefs about these outcomes. Indeed Shepperd, Ouellette and Fernandez (1996) found that delay can evoke optimism. People are more optimistic about their exams when these will take place in the future rather than in the next few weeks.

As far as we know, the role of optimism has not been investigated in the domain of intertemporal choice. In the present studies, we investigate how optimism involving outcomes affect time discounting. We expect that diminishing optimism will reduce time preferences. We test this expectation in the domain of monetary outcomes (Study 1) and in that of health-related outcomes (Study 2). We selected these domains because they are often used in research on intertemporal choice (see e.g., Chapman, 1996a,b; Chapman & Elstein, 1995; Chapman, Nelson & Hier, 1999b).

2. Study 1

In this study, we investigate how optimism about monetary outcomes affects discount rates. Uncertainty about the future is associated with a preference for obtaining gains as soon as possible (reflecting rational and adaptive behaviour). Moreover, having obtained outcomes now, does not preclude obtaining additional outcomes in the future. This optimism about obtaining *additional* gains in the future is assumed to result in a preference for immediate gains as opposed to delayed gains. We expect that diminishing optimism will reduce the positivity of the discount rates, reflecting lower preferences for immediate gains. It is important to note that the reduced positivity of discount rates does not mean that the gains will be delayed (i.e., a negative rate). The reduced rates indicate that people are less eager to obtain the gains immediately, but still prefer them sooner rather than later.

In contrast to gains, optimism about losses is assumed to result in an increased desire to delay such losses. We expect that diminishing optimism will reduce the

attractiveness of postponing these losses. In other words, reducing the optimism that future losses are avoidable should weaken the desire to postpone these losses, moreover, reduced optimism could lead to a desire "to get it over with" (i.e., a negative discount rate). This would be reflected by attenuated discount rates as compared to situations in which people are optimistic about avoiding future losses. In short, reducing optimism will lower discount rates for both gains and losses.

2.1. Method

2.1.1. Participants and design

Participants were 83 students at the University of Amsterdam who were paid 15 guilders (about $7) for their participation in the study. This study formed a 2 (sign of outcome: gain vs. loss) × 2 (optimism: high vs. low) between-subjects factorial design. Participants were randomly assigned to one of the four experimental conditions.

2.1.2. Stimulus materials and procedure

In this study, each participant sat in front of a personal computer and was presented various scenarios that differed in terms of optimism and outcome sign. In the gain scenarios, participants were required to imagine that they enjoyed working for a particular company. They were told that "because it is a prosperous company, the management will provide an attractive bonus which will be paid every month for a specific period of time. This bonus is the same for every month. The magnitude of the money to be received is expressed in terms of the duration of the monthly payments. This magnitude will vary with the delay of payment". For example, one can receive $70 each month for one year starting from now or one can receive $70 each month for three years starting in one year (in the experiment the duration is indicated by the participant). In the loss scenario, participants were also satisfied with their job. However, the company had severe financial problems and in order to prevent bankruptcy, management felt obliged to reduce monthly salaries by 10% for a specific time-span. Thus, there is a fixed monthly reduction, and the magnitude will vary with the delay of the payment to the company.

Optimism about obtaining gains was lowered by adding in the gain condition that the company remained prosperous, and also that one stayed in excellent health (thus, there is no risk of bankruptcy or illness leading to a preference for an immediate bonus). Second, we stated that the amount of money would be adjusted for interest rate changes and inflation. Furthermore, we also discouraged participants' potential hope of obtaining additional gains *after* receiving the present gain. We did this by explaining that employees had an agreement for 10 years and that breach of contract would cost $45.500. This was done to discourage thoughts of taking the immediate bonus and subsequently leaving the company for another job with a higher salary. Finally, it was clearly announced that the company would provide the bonus only once (avoiding the hope that after receiving the bonus, more premiums might be available in the future).

With respect to the loss condition, optimism was reduced as follows: Similar to the gain condition, we described the agreement and the costs resulting from a breach

of contract. This was expected to discourage delaying the reduction and looking for another job. Second, we assured participants that the company would not go bankrupt and that they would remain in excellent health (discouraging the idea that after delaying the reduction, dividend or benefit payments would cancel financial losses). Finally, we made it clear that banks were reluctant to provide further loans (discouraging the belief that postponing the reduction would be preferable because the company might look for other solutions).

We did not provide additional information in the conditions where optimism was not reduced. These conditions were thus, comparable to the task generally used in research on time preference. We assume that this task allows participants to generate optimistic beliefs and therefore, we refer to these conditions as 'high optimism'.

Next, participants in the loss conditions were asked to indicate the unpleasantness of the salary reduction described in the scenarios for a limited amount of time, and respondents in the gain conditions noted the pleasantness of receiving the bonus. They indicated their answers on five-point rating scales, ranging from 1 (*not at all*) to 5 (*very much*). This question serves as an outcome sign manipulation. The manipulation of optimism was checked by asking participants in the loss conditions whether they thought to prevent their financial loss, and whether their company could do this for them. Respondents in the gain conditions were asked whether they expected to keep their bonus in future (after receiving all outcomes from the chosen payment schedule), and whether their company could contribute to this. They indicated their opinions on five-point scales, ranging from 1 (*not at all*) to 5 (*very much*).

Finally, participants were presented with nine judgments. Each judgment involved an immediate outcome and a future outcome. Respondents were required to specify the magnitude of the future outcome in terms of years. Following Loewenstein and Prelec (1993) and Chapman et al. (1999b), we presented monetary outcomes as streams of outcomes. [1] For example,

> Monthly salary reduction [bonus] A for one year starting tomorrow,
> Monthly salary reduction [bonus] B for – years starting in one year.

Participants in the loss conditions were asked to make the two options equally unattractive, and in the gain conditions participants were asked to make the two options equally attractive.

The magnitude of the immediate salary reduction [bonus] was one year, two years and four years. The delays of the future outcome were the same. Thus, both magnitude and delay consisted of three levels, yielding nine judgments. The order (increasing vs. decreasing) of both magnitude and delay were counterbalanced.

[1] In the health domain (Study 2) outcomes are usually presented in streams as opposed to single outcomes. The latter is more common in the monetary domain. Because we would compare these domains, we believe that identical response formats are necessary. We will discuss this issue extensively in the Introduction of Study 2.

2.2. Results and discussion

2.2.1. Manipulations

Four participants were excluded from the analyses because of missing data. Before examining whether the manipulation of outcome sign was successful, we first recoded the scores in the gain conditions: higher ratings refer to more unpleasantness. As expected, losing money ($M = 3.41$) is more unpleasant than gaining money ($M = 1.31$) : $t(77) = 9.40$, $P < 0.001$.

With respect to the manipulation of optimism, a 2 (outcome sign) $\times$ 2 (optimism) ANOVA resulted in a significant main effect of optimism: $F(2, 74) = 7.96$, $P < 0.01$. Univariate tests showed that participants were more optimistic in the high optimism conditions (M's = 3.25 and 2.80 for loss and gain) than in the low optimism conditions (M's = 2.10 and 2.47 for loss and gain): $F(1, 75) = 9.90$, $P < 0.01$. Similarly, the perceived contributions of the company in avoiding losses and obtaining additional gains were greater in the high optimism conditions (M's = 3.70 and 3.60 for loss and gain) than in the low optimism conditions (M's = 2.60 and 3.26 for loss and gain): $F(1, 75) = 7.53$, $P < 0.01$. To summarize, the manipulations of both outcome sign and optimism were successful.

2.2.2. Discount rates

Common findings reported in the literature on time discounting are the *sign effect*, *magnitude effect* and the *delay effect* (see e.g., Chapman, 1998; Loewenstein & Prelec, 1992; Loewenstein & Thaler, 1989; Roelofsma, 1996). The sign effect [2] refers to lower discount rates for losses than for gains. For example, obtaining \$50 right now is often seen as equally attractive as receiving \$75 in one year (a discount rate of 50%). At the same time paying \$50 now is often seen as equally unattractive as paying \$60 in one year (a discount rate of 20%). The *magnitude effect* refers to lower discount rates for larger magnitude outcomes than for smaller outcomes. For example, one prefers \$50 now over \$100 in one year, but one might prefer \$1000 in one year over \$500 right now. Thus, despite a 100% discount rate in both options, the larger amount of money in the second choice makes it worthwhile to wait one year. The *delay effect* refers to higher discount rates for options with short delays than for options with long delays. For example, one may prefer \$100 now over \$150 in one year, but may prefer \$150 in five years over \$100 in four years. Thus, although both the delay and the magnitudes are the same between the payments, the discount rate

[2] This type of sign effect is due to the decisional framework. In our studies the decisions were framed as delayed outcomes. In such framework gains are discounted faster than losses which is called sign effect. One can also frame decisions as speed-up outcomes, for example:

> Monthly salary reduction [bonus] A for one year starting tomorrow,
> Monthly salary reduction [bonus] B for – years starting in one year.

In that case, discount rates are usually higher for losses than for gains (Loewenstein 1988; Shelley, 1993, 1994).

implied in by the second preference is lower than that implied by the first. We expect that these effects will also occur in our study.

For each of the nine judgments, a discount rate (r) was computed for each participant as follows:

$$r = \left(\frac{V_d}{V_p}\right)^{1/d} - 1$$

V_p is the present outcome, V_d is the delayed outcome and d is the delay length. At the end of the Section 2.1 we described an example of the judgments presented to participants. Given this example, V_p is equal to 'for one year', V_d is equal to '__years ' (i.e., participant's response), d is equal to 'starting in one year'. The mean discount rates are presented in Table 1.

We argued before that the scenario in the high optimism conditions is similar to the typical scenario used in previous research on time discounting. As expected, discount rates in these conditions were comparable to discount rates reported in the literature. Because the distributions of the discount rates were positively skewed, the discount rates were transformed to natural logarithms [ln (rate + 1)] for statistical analyses.

We predicted that reducing optimism about obtaining gains and postponing losses would lead to lower discount rates compared to the standard instructions that provide an opportunity to remain optimistic. A 2 (outcome sign) × 2 (optimism) × 3 (magnitude as within-subjects factor) × 3 (delay as within-subjects factor) ANOVA

Table 1
Mean discount rates as a function of outcome sign and optimism (study 1)

	Optimism			
	Loss (%)		Gain (%)	
	low ($n = 20$)	high ($n = 20$)	low ($n = 19$)	high ($n = 20$)
Magnitude immediate outcome: *1 year*				
Delay future outcome				
1 year	19	75	72	162
2 years	12	31	39	69
4 years	4	14	20	33
Magnitude immediate outcome: *2 years*				
Delay future outcome				
1 year	17	29	29	80
2 years	7	15	23	36
4 years	3	8	12	18
Magnitude immediate outcome: *4 years*				
Delay future outcome				
1 year	7	13	24	39
2 years	3	8	11	25
4 years	2	6	9	13

revealed the predicted main effect of optimism, $F(1,75) = 16.52$, $P < 0.001$. The decreased rates in Table 1 indicate substantial effects. Thus, reduced optimism makes immediate gains less attractive, and immediate losses less unattractive. Assuming that optimism is related to the concept of perceived uncertainty, this finding extends Shelley's (1994) work by showing how time discounting and perceived uncertainty are related.

Furthermore, ANOVA revealed significant effects of magnitude, $F(2,74) = 60.11$, $P < 0.001$ (higher discount rates for smaller magnitude outcomes than for larger outcomes), delay, $F(2,74) = 47.73$, $P < 0.001$ (higher discount rates for shorther delays than for longer longer delays), and outcome sign, $F(1,75) = 29.10$, $P < 0.001$ (higher rates for gains than for losses). As expected, these response patterns also occurred in the low optimism conditions. Both the optimism $\times$ magnitude and the optimism $\times$ delay interactions were significant. These interactions were due to the fact that differences in discounting between high and low optimism were more pronounced for small magnitude outcomes (or short delays) than for large outcomes (or long delays). However, these interactions are less relevant for our hypotheses.

Overall, the present data suggest that optimism plays an important role in intertemporal choice because reducing optimism resulted in attenuated discount rates for monetary losses and gains. In particular, it appears that discount rates are affected by the extent of optimism that the task allows. Thus, it seems that lack of awareness of one's optimistic beliefs about future outcomes has a significant effect on how people assess immediate versus future outcomes.

In the next study, we investigate whether optimism affects time preferences in the domain of health, and we compare these discount rates with discount rates for monetary outcomes.

3. Study 2

Research on time preferences has primarily concentrated on monetary outcomes. Work that examined discount rates for health outcomes focused on either obtaining bad health states (e.g., Chapman & Coups, 1999a; Christensen-Szalanski, 1984; Lipscomb, 1989; Redelmeier & Heller, 1993), or on obtaining good health states (Chapman & Elstein, 1995; Chapman et al., 1999b). Only Chapman (1996b, experiments 2 & 3) simultaneously investigated discount rates for both health gains and losses. She showed that discount rates were higher for health gains than for losses (sign effect), and that discount rates decreased with both magnitude and delay. These findings are consistent with those for monetary outcomes.

The present study investigates whether optimism affects time preferences for health losses and gains. One might argue that health, in contrast to money, cannot be saved or invested for future consumption and hence increase with time. On the other hand, health and money are not totally unrelated. For example, people can buy a health insurance and a more expensive insurance provides better protection than a cheaper insurance. Because health per se cannot be treated as a commodity, optimistic beliefs involving health outcomes might differ from those involving monetary outcomes. An

extensive pilot study (Berndsen & Van der Pligt, 1999) examined optimistic beliefs involving both the treatment of headaches (gain), and the onset of headaches (loss). Their pilot study revealed striking similarities between the content of beliefs about immediate gains and delayed losses. Moreover, these beliefs were quite similar to those found for monetary outcomes (e.g., Chapman & Elstein, 1995). We found three frequently used categories of beliefs for each health outcome. The first involved the preference not to delay the treatment to the future because one might not live to receive it. The same argument was also used as an argument to delay the headache onset (similar to those for monetary outcomes in Study 1). The second belief mentioned for both relief and onset of the headaches, referred to scientific progress with respect to effective medication and/or treatments. Thus, the belief that medical science will discover new remedies for headaches in the future was given as a reason to prefer immediate treatment or delayed headache onset. The third belief was different for each health outcome. Participants preferring immediate treatment mentioned the possibility of receiving more treatments in future if necessary (i.e., additional gains, similar to monetary outcomes). Participants preferring delayed headaches suggested alternatives such as relaxation techniques (for example, yoga), enabling them to avoid future headaches (similar to avoiding monetary losses in future).

Based on the similarities between optimistic beliefs for health and monetary outcomes, we predict the same effect of optimism as in Study 1. That is, we expect that reducing optimism about potential health gains and losses will lower the discount rates compared to higher levels of optimism. Furthermore, and in line with the first study, we expect effects of sign, magnitude and delay.

In addition, we investigate whether discount rates for monetary and health outcomes differ from each other. Chapman and colleagues (e.g., Chapman, 1996a,b; Chapman & Elstein, 1995) showed that discount rates for monetary outcomes are not significantly correlated with discount rates for health outcomes. According to Chapman (1996b) this might be a result of different scenarios employed for money and for health, which subsequently activates different schemes, resulting in different discount rates. We would argue that the different response formats could also be responsible for the low correlation observed between the monetary and health rates. For example, in the study of Chapman et al. (1999b) responses for expense reduction were given in terms of dollars and responses for headache reduction in terms of days. It might be that dollars and days are not comparable for participants. Therefore, participants in the present studies were asked to match the options in duration, which provides the same measure for all scenarios. Chapman (1998) used a similar response format for monetary and health gains, and did not report differences between the domains.

3.1. Method

3.1.1. Participants and design

Students at the University of Amsterdam ($N = 81$) participated in this study. They were paid 15 guilders (about $7) for their participation. This study formed a 2 (sign of outcome: gain vs. loss) $\times$ 2 (optimism: high vs. low) factorial design. Participants were randomly assigned to one of the four experimental conditions.

3.1.2. Stimulus materials and procedure

The procedure was identical to Study 1. All participants read a description about headaches involving their frequency and hindrance in daily activities. Respondents in the loss condition were asked to imagine getting such headaches for a limited amount of time. Respondents in the gain condition were required to imagine that they had these complaints and that treatment would lead to full health for a limited amount of time.

In the gain condition, optimism about gains was reduced by telling participants that the treatment was the only remedy against their headache and that alternative methods would not help. Moreover, medical progress was not likely because other treatments had produced detrimental side-effects, prompting the Government to prohibit more than one treatment (discouraging the belief to have more treatments in future). Finally, we added that there was consensus about the impossibility of discovering an effective medicine in the next decades (reducing the hope for scientific progress). Despite these headaches, no other serious illness or accidents were expected to occur (discouraging a preference for immediate treatment based on the possibility that one might not live until the future treatment).

In the loss condition, optimism about losses was reduced by telling participants that their headache was genetically based (indicating that the headache is inevitable, even in future) and that alternative treatments or medication would not help (discouraging the idea that the future headaches might be avoidable because of alternative relaxation techniques). Despite the headaches, they were told that they would live a long life (thus, discouraging the idea that they might not live until the headache onset). We also added that scientists were convinced that effective medicine would not be discovered in the next decades (discouraging hope for scientific progress).

After reading the scenarios, the effect of the sign manipulation was checked by asking participants in the loss conditions to indicate the unpleasantness of headaches for a limited amount of time, and respondents in the gain conditions noted the pleasantness of the treatment that would bring full health. The effect of the optimism manipulation was examined by asking participants in the loss conditions whether they could avoid the headaches, and whether science could do this for them. Respondents in the gain conditions were asked whether they expected to maintain full health in future (after the treatment), and whether science could contribute to this. All ratings were given on five-point rating scales, ranging from 1 (*not at all*) to 5 (*very much*). Finally, participants were presented with nine judgments, and the magnitude outcomes are specified in terms of years, similar to Study 1. For example,

> Headache [treatment] A for one year starting tomorrow,
> Headache [treatment] B for – years starting in one year.

In the loss conditions, participants were asked to make the two options equally unattractive, and in the gain conditions they were asked to make them equally attractive. As in the first study, both the magnitude and the delay consisted of three levels: one year, two years and four years. The order (increasing vs. decreasing) of both magnitude and delay were counterbalanced.

3.2. Results and discussion

3.2.1. Manipulations

Three participants were excluded from the analyses because of missing data. First, we recoded the ratings for pleasantness in the gain conditions such that higher ratings indicate more unpleasantness. The manipulation of outcome sign was succesful: $t(76) = 20.04$, $P < 0.001$, showing that headaches are more unpleasant ($M = 4.50$) than treatments bringing full health ($M = 1.35$).

The manipulation of optimism was also successful: $F(2, 73) = 23.51$, $P < 0.001$. Participants were more optimistic in the high optimism conditions (M's = 3.30 and 3.95 for loss and gain) than in the low optimism conditions (M's = 1.94 and 2.95 for loss and gain): $F(1, 74) = 35.02$, $P < 0.001$. A similar result was found for the perceived contributions of science in avoiding losses and obtaining additional gains. This was greater in the high optimism conditions (M's = 3.50 and 3.80 for loss and gain) than in the low optimism conditions (M's = 1.61 and 2.90 for loss and gain): $F(1, 74) = 38.74$, $P < 0.001$.

3.2.2. Discount rates

As in Study 1, for each of the nine judgments, a discount rate (r) was computed for each participant. These rates are presented in Table 2.

We predicted that low optimism would result in reduced discount rates compared to high optimism about both gains and losses. After transforming the rates to

Table 2
Mean discount rates as a function of outcome sign and optimism (study 2)

	Optimism			
	Loss (%)		Gain (%)	
	low ($n = 18$)	high ($n = 20$)	low ($n = 20$)	high ($n = 20$)
Magnitude immediate outcome: 1 year				
Delay future outcome				
1 year	13	24	182	955
2 years	8	13	77	207
4 years	5	8	48	87
Magnitude immediate outcome: 2 years				
Delay future outcome				
1 year	8	17	97	611
2 years	5	9	48	128
4 years	4	6	33	50
Magnitude immediate outcome: 4 years				
Delay future outcome				
1 year	4	7	80	288
2 years	2	5	37	101
4 years	1	3	23	45

natural logarithms, a 2 (outcome sign) × 2 (optimism) × 3 (magnitude as within-subjects factor) × 3 (delay as within-subjects factor) ANOVA revealed the predicted effect of optimism, $F(1,74) = 4.32$, $P < 0.05$. As in Study 1, the analysis also showed significant main effects of magnitude: $F(2,73) = 22.98$, $P < 0.001$, delay: $F(2,73) = 9.11$, $P < 0.001$ and sign: $F(1,74) = 25.75$, $P < 0.001$.

In sum, optimism is an important determinant of time preference for health gains. This finding has clear implications for programs that aim to increase preventive health behaviour: it seems essential to assess which beliefs hinder preventive health behaviours.

3.2.3. Domain effects

We analyzed differences between monetary and health domains in a 2 (outcome sign) × 2 (optimism) × 2 (domain) × 3 (magnitude as within-subjects factor) × 3 (delay as within-subjects factor) analysis of variance (ANOVA). The analysis revealed a significant main effect of domain, $F(1,149) = 4.25$, $P < 0.05$, and an interaction between outcome sign and domain, $F(1,149) = 10.11$, $P < 0.01$. Planned comparisons demonstrated that for gains health discount rates are higher than monetary discount rates, $F(1,149) = 14.08$, $P < 0.001$. In case of losses, there was no significant effect of domain, $F(1,149) = 0.42$, *ns*. These results partly replicate the findings of Chapman (1996b). She also found that for gains, health discount rates are larger than those for monetary outcomes.

We argued that different response formats might be responsible for the differences observed in time preferences between health and monetary domains. Our results showed that this is the case for losses but not for gains. It needs to be added, however, that the absence of a significant domain effect for losses might be due to a floor effect. The discount rates for losses were very low in both domains. Furthermore, the high rates for health gains compared to monetary gains might be due to the current state of the decision maker. That is, getting treatment for headaches assumes that one is suffering now. In contrast, getting a bonus does not imply that one's current financial state is bad. The stronger the suffering now, the higher the discount rates because gains (e.g., treatment) are becoming increasingly attractive. Thus, the difference in current-state suffering might account for the different discount rates between monetary and health gains.

4. General discussion

The contribution of the present research is that it shows that optimism involving outcomes is an important determinant of intertemporal choice. Uncertainty about the future allows for optimism, and this optimism underlies the strong preferences for immediate gains in both the monetary and health domain. We showed that time preferences decreased when optimism of obtaining additional gains was reduced.

With respect to losses, the uncertain character of the future also allows for optimism; i.e., the hope that future losses will be avoided. As a consequence, one is more inclined to delay losses. The prediction that diminished optimism about the

avoidability of losses would attenuate discount rates was supported for both monetary and health losses.

We reasoned that different response formats for monetary and health outcomes might be responsible for differences observed between these domains. This expectation was partly supported; identical response formats diminished the domain effect for losses, but not for gains. However, a floor effect might have prevented finding differences for losses. More research using similar response formats is needed to verify this finding.

What do these findings on time preferences contribute to understanding time preferences in the real world? Two aspects in our studies seem particularly important for both researchers and decision makers: people are willing to delay gains, and also to speed up losses. Knowing which optimistic beliefs underlie people's choices might contribute to an understanding of time preferences, and also provide the opportunity to influence their choices. Likewise, it might be helpful for decision makers to assess whether their optimism is realistic. For example, realizing that one cannot easily avoid future losses might help to pay off debts as soon as possible. Similarly, acknowledging an illness sooner rather than delaying this by neglecting symptoms, could prevent more harm.

With respect to research practice, the present research addresses both theoretical and methodological issues. On a methodological level, Chapman (1996b) suggested that decision makers might consider different scenarios facilitating their decisions, and that large individual differences in these scenarios might be responsible for differences in discount rates. Related to this, we emphasize that not all scenarios will provoke the same beliefs to the same extent. That is, in some scenarios optimism will play a more pronounced role than in other scenarios, which might give rise to different discount rates.

On a theoretical level, we believe that it is fruitful to examine psychological processes underlying intertemporal choices. The present research shows how decisions are affected by optimism about outcomes. This optimism enables decision makers to make particular choices. This is not to say that such psychological processes are confined to research on time preferences. We expect that they occur whenever experimental settings induce beliefs or thoughts (other than those conceived by the researchers) which affect the psychological reality of the task and consequently the responses. The impact of underlying beliefs is demonstrated in different areas of psychology (see for example, research on illusory correlations by (Berndsen, Spears, McGarty, & Van der Pligt, 1998), and research on the availability bias by Stapel, Reicher, & Spears, 1995). In general, the point to make here is that examining psychological processes can contribute to an understanding of intertemporal choice.

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