Master's Thesis

Exercise procrastination: Relation to Decreasing Impatience and Personality Factors.

Student:	Saartje Steins Bisschop
Study:	MSc Behavioral Economics
Student no:	578763
Supervisor:	Prof. K.I. Rohde
Final Version date:	June 25th, 2021

Abstract

Many papers have addressed exercise procrastination behavior in different ways. Economists explain this phenomenon by models of time preference, while psychologists address this topic by intrinsic personality features. Aiming to test both insights and the correlation between the two views, this thesis investigates whether DI-index by Rohde (2016) and the personality factors neuroticism and conscientiousness described by Steel (2007) are related to procrastination of exercising. For this research a survey was conducted with 92 valid responses. The subjects showed no sign of decreasing impatience. Instead, the majority satisfied increasing or constant impatience. Therewith, using ordered logit regressions as well as OLS regressions with robust standard errors, no significant relation between the DI-index and procrastination of exercising was found. Of the personality factors, however, results showed that people with more neurotic characteristics are more prone to procrastinate exercising. Conscientiousness was found to have a negative relation with exercise procrastination. There was found no prove of a relation between the personality factors and DI-indices.

Acknowledgements

I want to take this opportunity to thank my supervisor, prof. K. Rohde, for her support and guidance through this thesis process. Although it was a pity that we could not meet in person during these rare times, the Zoom sessions were always very helpful and motivating, making meeting online no limitation to my thesis experience. Furthermore, I would like to thank my family and friends for listening to my thesis stories and for testing my survey. I want to especially thank Hanne Kupers and Faye Fruitema for the likewise moral support in the library.

Table of Content

1. Introduction

Yesterday, my brother was determined to go for a run this morning. He has been part of a student association in Groningen for four years now and his health has significantly deteriorated during this time. After these four years of drinking beer and eating unhealthily, he found it was time to switch gears and start exercising again. He has always been a sportive person growing up and he knows he is most happy when he is fit and active, so it should not be too hard to start exercising again. However, this morning he slept in too long, so he did not have time left to go for a run before class. He plans to go for the run after class. When he comes back from class, all his ten roommates are sitting in the garden drinking beer. He thinks: 'Am I really going to leave the house again while I just got back from class? What is the harm of drinking one beer and then go for a run?'. One beer turns into two, and soon night falls in Groningen and his roommate is preparing dinner. He does not want to go running straight after dinner, so he decides to go for a run tomorrow. When tomorrow arrives, however, he also prefers other activities over the run, and he ends up not running at all.

My brother is a perfect example of the difference between intended behavior and actual behavior, and he is not alone. Although he prefers feeling fit over drinking one single beer, for my brother the instant reward of the beer dominates the later reward of feeling fit. In daily life there are many distractions that give instant rewards (e.g., watching Netflix, going out with friends, etc.) that time after time cause people to procrastinate tasks with later benefits such as exercising (Kroese & de Ridder, 2015). Reluctancy to exercise can be dangerous. Lack of physical activity increases the chance of gaining weight, resulting in a higher chance of obesity (Rippe el al., 1998). According to former research (e.g. Paluska & Schwenk, 2000; Landers & Arent, 2007), physical activity is positively related to mental wellbeing, as it reduces stress, anxiety and depression.

Procrastination of intended tasks is a widely discussed topic among both psychologists and economists. Psychologists explain procrastination by personal characteristics influencing self-control levels. Research on personality features has shown that people who have a high level of conscientious characteristics are less likely to procrastinate (Digman et al., 1990). On the other hand, neurotic people are often referred to as the ones who procrastinate most. Therefore, the personality characteristics that

describe neuroticism and conscientiousness are possible determinants of the level of exercise procrastination.

Economists use models of time-inconsistency and decreasing impatience as the explanation of postponing planned behavior. There are different models of time preference that explain decreasing impatience. In this thesis, I consider hyperbolic discounting models, CADI and CRDI models and the DI-index, which are all tools to measure the degree of (decreasing) impatience.

There has been much research on either psychologic or economic determinants of health procrastination (e.g. O'Donoghue & Rabin, 2001; Reuben et al. 1998; Ferrari & Ware, 1992; Schouwenburg & Lay, 1995). However, I have not found any research comparing the two views or tested both views for the same sample. In this thesis I consider both views to obtain clarification on the true determinants of exercise procrastination. Therefore, the research question of this thesis is:

'How does decreasing impatience, neuroticism and conscientiousness influence exercise procrastination?'

To answer this research question, an online survey was conducted through Qualtrics. The aim of this survey was obtaining the DI (Decreasing Impatience)-index constructed by Rohde (2016), the level of procrastination of exercising, personal characteristics on neuroticism and conscientiousness, and the demographics gender, age, and education level and lastly controlling for task characteristics and habit formation. I used statistical software (STATA) to analyze the results and to answer the research question and the underlying hypotheses that are formulated in the literature review.

2. Literature review

2.1 Definition: Procrastination

As earlier mentioned, procrastination can be referred to as the needless delay of things one intends to do (Steel, 2007). This behavior has been widely addressed since the earliest recorded literature. For example, the Greek Hesiod was in 800BC one of the first to advise not to put work off in general (Steel, 2007). The term procrastination derives from the Latin term 'pro crastinus', which literally means 'forward to tomorrow'.

However, since then, procrastination has been defined in different manners. Firstly, Lay & Silverman (1996) argue that one procrastinates when he delays beginning or completing an intended course of action. With this definition, they have a distinctive view compared to ancient writers such as Hesiod in the sense that the broad concept of procrastination is narrowed down to a particular action. Hesiod's definition could be interpreted as putting off work in general, while Lay & Silverman (1996) define procrastination as putting off one particular action (while other actions are still executed, or this action could be replaced by executing different tasks). Akerlof (1991) adds another feature to this definition, which is irrationality. This irrationality implies that a person who delays planned behavior has no proper reason for doing so. He thus calls delay of tasks only procrastination if the procrastination makes people worse off in the end. In other words, this person does not maximize their utility by procrastinating tasks. This utility can exist of material objects, such as money, or of intangible objects, such as happiness or health. Combining both views of Lay & Silverman (1996) and Akerlof (1991), Steel (2007) defines procrastination as voluntarily delaying an intended course of action despite the expectation to be worse off by this delay.

2.2. Psychological determinants of exercise procrastination

General procrastination behavior can be explained by the gap between intended behavior and actual behavior, or, planning and doing (Steel, 2007; Rhodes & De Bruin, 2012; Van Hooft et al., 2005). Kroese & De Ridder (2015) are some of the few researchers explaining procrastination of health behavior by the intention-behavior gap. They explain the gap between willingness to exercise and the action of exercising by self-regulatory failure rather than lack of motivation. One initial reason for failing to perform intended behavior could be the reluctance of clearly defining the goal. For example, a rather vague resolution such as 'I need to exercise more often' is expected to cause less of a change in behavior than the resolution 'I will exercise every Monday, Wednesday and Friday'. However, if goal setting was the only issue for not completing or delaying the completion of the goal, this could be easily solved. Kroese & De Ridder (2015) and Steel (2007) describe multiple other determining factors influencing procrastination behavior, which will be discussed in the next few sections.

2.2.1. Task characteristics

The first reason why people procrastinate going to the gym could be the characteristics of the task itself. Steel (2007) points out that tasks that are perceived as difficult or that require a lot of effort are more likely to be procrastinated opposed to tasks that are easy and quickly fulfilled. He mentions two environmental factors that are important for the attitude towards fulfilling planned behavior: task aversiveness and the timing of rewards and punishments.

Task aversiveness refers to actions that are perceived as unpleasant (Blunt & Pychyl, 2000). Blunt & Pychyl (2000) performed research among undergraduate students in which they found that tasks that were perceived as boring or frustrating were more likely to be procrastinated than other tasks. Furthermore, they also found significant importance of certain personality traits for procrastination behavior, which will later be discussed in more detail.

Timing of punishments and rewards can be viewed from a psychological perspective as well as from an economic perspective. Ainslie (1975), addressing the psychological side, investigates why most people are impulsive: they choose a poorer reward over another one, knowing that this reward is not as good as the alternative. He finds that delaying a reward from the moment of choice between two actions makes this reward less effective. Because of this, an impulsive person prefers short immediate rewards over long-lasting rewards in the future. Furthermore, Ainslie (1975) calls the negative result of not fulfilling tasks ‘punishment’ or ‘non-reward’. A delay in punishment has the effect of less perceived punishment in the beginning. A punishment can occur when a certain task is not executed, or when the wrong task is executed. A delay in punishment for not executed tasks makes a person less willing to execute this action opposed to actions that are immediately punished when not executed. An action that is not beneficial in its totality but that has small instant benefits and has later larger punishments can thus still be perceived as beneficial in advance. To explain this, Ainslie (1975) uses the example of an itchy skin. People often scratch their skin when it itches, knowing that in the end their skin will be worse and will start itching even more. However, the instant reward of lowering the itchy feeling for a short period of time makes people scratch regardless and, in the end, they will be worse off with an even more itchy skin. Concluding from Ainslie’s (1975) findings, we can assume that tasks with a reward in the future are more likely to be postponed than tasks with an immediate reward. Also, tasks with a later

punishment of not being executed (such as going to the gym) will be less likely to be executed than tasks that give immediate punishments. Economists explain the influence of timing of rewards and punishments by inconsistent time preference, which I will discuss in a later section.

Looking at the task characteristics of going to the gym, Kroese & De Ridder (2015) point out that for many people working out is not a pleasurable activity which according to Blunt & Pychyl (2000) is a reason for procrastination. They also mention the financial constraint that an individual might face. Not being able to pay for the gym or the necessary attributes (clothing, weights for working out from home, etc.) could retain people from being physically active. However, if there exists no financial barrier, someone might still perceive a barrier due to lack of skills, because of which they procrastinate physical activity. This brings forward the first hypothesis:

$$H1\text{: } People\ who\ perceive\ exercising\ as\ difficult\ procrastinate\ more\ often\ to\ exercise$$

To break the barrier of starting to go to the gym, Rohde & Verbeke (2017) proposed to use financial rewards for gym attendance as an incentive. They ought to create habit for the long future in this way, also after the incentives had stopped. These incentives then serve as 'habit formation': the incentives that serve as a tool for higher self-control have turned a non-habit into a habit. After this habit is formed, people are less reluctant to skip the gym than before. Although Rohde & Verbeke (2017) follow the strategy of Charness & Gneezy (2009) of a positive financial incentive to create habit formation, people can also self-commit by paying a monthly or yearly gym or sports club fee (Bryan, et al., 2010). Paying this fee beforehand would make them feel guilty if they do not make use of the facilitation they paid for. Therefore, I expect the following hypothesis:

$$H2\text{: } Habit\ formation\ or\ self-commitment\ towards\ exercising\ reduces\ the\ level\ of\ procrastination$$

Remarkably, people who face the same practical (non-)financial barriers and commitment devices can still behave differently. Kroese & De Ridder (2015) state that this difference exists due to a difference in intrinsic motivation but also because of ability to self-regulate: people who are motivated

and have good intentions to behave in a certain way still fail to do so due to a lack of self-regulation. Personality factors, or, as Steel (2007) pronounces, individual differences, are important indicators to estimate one's ability to self-regulate towards fulfilling intended tasks, which will be further explained in the next paragraph.

2.2.2. Personality factors

Individual differences in procrastination behavior are often explained by psychologists with use of the five-factor personality model of Digman (1990). This model groups many personality features into five main factors to better understand personalities and people's behaviors. The five factors that Digman (1990) constructed are neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. Watson (2001) investigated the relationship of certain facets that explained procrastination with these five personality factors. He found that neuroticism and conscientiousness show a significant relationship with procrastination. Steel (2007) and Sirois et al. (2003) both discuss the model of Digman (1990) as well, confirming the findings of Watson (2001) and proclaiming that procrastination can be partially explained by these two personality factors.

Sirois et al. (2003) describes neuroticism as the disability to cope with stress and experiencing negative emotions when exposed to a stressful task. The facets that describe neuroticism are anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability (Schouwenburg & Lay, 1995). Steel (2007) refers to fear of failure as an indicator of both low self-esteem and low self-efficacy, but also as a characteristic that can be associated with a neurotic person. Therewith, he argues that fear of failure might be a reason to procrastinate tasks, due to so-called self-handicapping. This self-handicapping is a manner of avoiding emotions that are perceived when one fails to complete a task. By placing unnecessary barriers, a person obstructs himself from completing the task. Because of this, one's self esteem is protected by an external reason why the task could not be executed and a certain point in time or at all. Therefore, the third hypothesis is:

$$H3: \textit{People with more neurotic characteristics are more likely to procrastinate exercising}$$

A conscientious person can be characterized by goal-directedness, persistency, and good organizational skills (Sirois et al., 2003). According to Steel (2007), people who are procrastinators show exact opposite characteristics to conscientious people, due to which there should exist a negative correlation between procrastination and a person being conscientious. A study by Lay & Schouwenburg (1995) on the relationship between personal features and academic procrastination amongst Dutch undergraduates confirms this expectation, showing indeed a significant negative correlation between conscientiousness and procrastination behavior. Additionally, Bogg & Roberts (2004) found that conscientiousness also is positively related to health-beneficial behavior such as a clean diet, being a non-smoker and physical activity. Based on these findings, I formulate the following hypothesis:

$H4$: *People with more conscientious characteristics are less likely to procrastinate exercising*

2.2.3. Demographics

Steel (2007) highlights the importance of gender and age as moderators for procrastination. Furthermore, Burks et al. (2009) claim that cognitive skills are related to procrastination behavior. This section discusses shortly these three demographic features that may influence procrastination of going to the gym.

Previous research shows mixed results on the influence of gender on procrastination behavior. For example, Özer et al. (2010) performed research on academic procrastination among Turkish undergraduate students. They found that males reported more procrastination behavior. However, females reported more procrastination behavior because of laziness and fear of failure, while males reported to delay tasks because of rebellion against authority and risk taking. This confirms the findings of Feingold (1994), stating that males are more assertive and have higher self-esteem than females, whereas females show higher levels of anxiety, trust, and extraversion. As earlier discussed, lack of self-esteem, fear of failure and anxiety are neurotic characteristics which will thus have an increasing impact on procrastination. That will predict females to procrastinate exercising more. On the other side, risk taking can be seen as impulsive, which would increase procrastination. From that point of view, men should be the ones who procrastinate more. Both genders thus entail certain personality traits that

can be influential on procrastination behavior and literature is inconclusive on which gender is more likely to procrastinate.

Steel (2007) mentions age as a second demographic that can be related to procrastination. He argues that younger people are more likely to procrastinate. He refers to O'Donoghue & Rabin (1999) who stated that more experienced people are less likely to procrastinate due to learning effects. Once this person has procrastinated before, he might have found a way to avoid procrastination, for example by developing a scheme.

Burks et al. (2009) performed research on the influence of cognitive skills on risk taking and (im)patience. They found a positive relationship between cognitive skills and patience, because of which the ability to plan and persist to this planning also shows a positive relationship with cognitive skills. Because of this, one could reason that people with higher cognitive skills will be less likely to procrastinate intended tasks. Many researchers used educational attainment as a measure of cognitive skills. This makes it possible to measure differences in cognitive skills in a simple manner. Therefore, there has been evidence of a negative relationship between education and procrastination (Steel & Ferrari, 2003).

Considering all above demographic studies, I propose the following three hypotheses:

$$H5: There\ exists\ a\ difference\ in\ procrastination\ of\ exercising\ between\ males\ and\ females$$

$$H6: Procrastination\ of\ exercising\ decreases\ with\ age$$

$$H7: Procrastination\ of\ exercising\ decreases\ with\ education$$

2.3. Economic explanation of exercise procrastination

Procrastination behavior is often explained by economists by inconsistent time preferences and decreasing impatience. A person acts time-inconsistently when their preferences for decisions or actions change over time (Hoch & Loewenstein, 1991).

The valuation of choices or the reward of actions can be measured in terms of utility. Utility is a concept that represents a hypothetical quantity, representing value that a person aims to maximize. The use of this hypothetical value allows us to measure both tangible and intangible costs and benefits

of actions or decisions into a function, giving the opportunity to predict a persons' actions in given circumstances (Friedman & Savage, 1952). An individual is expected to pick the choice that maximizes expected utility. However, actions that give future rewards in terms of utility are often perceived differently than actions that give instant rewards (Frederick et al., 2002). O'Donoghue & Rabin (1999) stated that impatient people weigh immediate costs higher than delayed benefits. Because of this, they procrastinate tasks that require instant effort and give future instead of immediate rewards. On the other side, an impatient person overindulges in activities that give instant rewards but of which the costs are incurred at a later point in time.

2.3.1. The Discounted Utility Model

While psychologists explained the phenomenon of intertemporal choice by conflicting psychological motives, Paul Samuelson introduced the Discounted Utility (DU) model in 1937 (Frederick et al., 2002). In this model, he specified intertemporal preferences of consumption profiles across time: $(c_t, \ldots, c_T)$ in which c_t denotes consumption at this point in time and c_T is consumption at the latest future point in time. The intertemporal utility function U^t consists of all utilities of consumption in point t (now) until point T, discounted at a certain rate based on the moment in time. Frederick et al. (2002) stated Samuelson's utility function as follows:

$$U^t(c_t, \ldots, \mathrm{cT}) = \sum_{k=0}^{T-t} D(k)u(c_{t+k}),$$

$$\text{where } D(k) = \left(\frac{1}{1+\rho}\right)^k.$$

In this function, $u(c_{t+k})$ is the utility perceived at point $t+k$ (k is the amount of time between now and the moment of utility). D is the discount function of this person, with ρ representing the individual rate or time preference or discount rate. Thus, following the DU model of Samuelson, constant discounting by a certain rate ρ is assumed. When looking at the discounted utility of one single future consumption stream instead of an accumulation of different consumption streams, we are left with the following equation for discounted utility:

$$U^t(c_{t+k}) = \left(\frac{1}{1+\rho}\right)^k u(c_{t+k}).$$

Time-consistency is assumed in this model, which implies that later preferences should confirm earlier set preferences (Frederick et al., 2002), in other words: the preference of the decision maker should remain unchanged at all points in time. Although the DU model provides the opportunity to estimate discount factors for people who satisfy constant discounting, many researchers found that people do not satisfy constant impatience and discount irrationally over time due to self-control problems (Bleichrodt et al., 2016). Their impatience is rather decreasing than constant.

2.3.2. Decreasing Impatience

Under decreasing impatience, individuals' preferences between two future rewards at different points in time can change once the moment of the first future reward has come (Frederick et al., 2002). For example, imagine someone who prefers going to the gym every day starting in 10 days, with the reward of feeling good about himself 10 days later (so in 20 days), over watching movies all day 10 days from now. The benefit of watching movies that will be incurred in 10 days is then initially perceived lower than the benefit of going to the gym in 20 days from now. Then, after the passing of 10 days, this person decides to watch movies all day with an instant reward instead of going to the gym which will be rewarded 10 days later. Thus, the preference shifts to the smaller and sooner reward while time passes. The weight of the instant reward has become larger once the moment of rewarding is closer, which is the definition of decreasing impatience. Following the theory of Frederick et al. (2002), I formulate the final (and most important) hypothesis:

$$H8: \textit{The higher degree of decreasing impatience, the more exercising is procrastinated.}$$

Bleichrodt et al. (2016) express decreasing impatience in parameters using monetary rewards. Consider someone with the following indifference equation: $(s : x) \sim (t : y)$, in which *s* is an earlier point in time than t, with *x* being a certain amount that is lower than amount *y* (assuming this person is impatient). If this person would satisfy constant impatience, a delay by time τ for both amounts would not matter, thus: $(s + \tau : x) \sim (t + \tau : y)$. However, if this person satisfies decreasing impatience, he will not be indifferent anymore between the two options: $(s + \tau : x) \prec (t + \tau : y)$. This person is more

willing to wait for the higher amount if there is an equal delay for both outcomes. The difference in preferences can also be measured in terms of the delay, keeping someone indifferent between two prospects: if $(s : x) \sim (t : y)$ holds, an individual with decreasing impatience should satisfy the following indifference equation: $(s + \sigma : x) \sim (t + \tau : y)$, with σ being smaller than τ.

2.3.3. Measuring decreasing impatience

2.3.3.1. (Quasi)hyperbolic discounting

Multiple earlier studies have found evidence of people satisfying decreasing impatience. Among those, there were several studies comparing the degree of decreasing impatience of different groups or individuals against each other using surveys or experiments. Most of them estimated parameters of generalized hyperbolic discount models (e.g. Cairns & van der Pol, 2000) or quasi-hyperbolic discount models (e.g. Andreoni & Sprenger, 2012).

Quasi-hyperbolic discounting, also called the beta-delta model was introduced by Phelps & Pollak (1968). This model captures the present bias (preference for instant benefits) as the reason for decreasing impatience as follows:

$$D(t) = \begin{cases} 1 & if\ t = 0 \\ \beta\delta^t & if\ t > 0. \end{cases}$$

In which δ is a constant discount factor that captures the difference between preferences between future moments in time, and β captures the difference between the present and the future. It captures the 'present bias': it is an additional discount factor that discounts the entire future against present prospects. If this β would be equal to 1, we would have constant impatience across all time periods. But, if β is smaller than 1, the entire future has an extra discount factor compared to the present and there exists decreasing impatience, which makes β the decreasing impatience parameter. This model thus predicts the following indifference equations: if $(0 : x) \sim (t : y)$, then $(\tau: x) \prec (t + \tau : y)$. However, this model only predicts decreasing impatience if there exists the option to receive prospect x immediately. If this is not the case, this model predicts constant impatience. Then, the

indifference equations look as follows: if $t > s > 0$ and $(s : x) \sim (t : y)$, then $(s + \tau : x) \sim (t + \tau : y)$, which is like constant discounting as predicted by the discounted utility model by Samuelson.

The generalized hyperbolic discounting model was introduced by Loewenstein & Prelec (1992). They assume that over every moment in time, people satisfy decreasing impatience. Their model for obtaining the discount factor looks as follows:

$$\varphi(t) = (1 + \alpha t)^{-\beta/\alpha}, \qquad with\ \alpha\ and\ \beta > 0,$$

with φ being the discount factor and in which t announces the period, α is a coefficient determining how much this function deviates from constant impatience (so the decreasing impatience parameter) and β is a constant discount factor. This model assumes decreasing impatience over all periods in time. This model predicts the following (in)difference equations: if $(0 : x) \sim (t : y)$ then $(\tau : x) \prec (t + \tau : y)$. Then, if the first prospect x changes from time 0 to future time s (with again $s < t$), the following (in)difference equations result: $(s : x) \sim (t : y)$, then $(s + \tau : x) \prec (t + \tau : y)$. This indicates that in contrast to quasi-hyperbolic discounting, this model assumes also decreasing impatience once the present is not involved, so we always have decreasing impatience.

Rohde (2010) introduced an alternative simplifying method that can be used to obtain the hyperbolic factor of decreasing impatience, using a changed time period (σ) in order to show the difference in impatience, using the following indifferences: if $(s : x) \sim (t : y)$ holds, an individual with decreasing impatience should satisfy the following indifference equation: $(s + \sigma : x) \sim (t + \tau : y)$, with σ being smaller than τ. Then, the hyperbolic discount factor H could be elicited by the following equation:

$$H = \frac{\tau - \sigma}{t\sigma - s\tau}\ .$$

The obtained H in this formula represents the discount factor α that is obtained in the formula by Loewenstein & Prelec (1992). This formula allows us to obtain a hyperbolic discount factor directly from the indifferences that are stated by an individual or group.

Although both hyperbolic and quasi-hyperbolic discount factors are good measures for the degree of decreasing impatience and present bias, these models do not always capture the correct discount rate of every individual (Bleichrodt et al., 2016). For example, if someone satisfies increasing

impatience instead of constant or decreasing impatience, these models are unable to identify the correct discount factor. This can be shown by above formula: if someone satisfies increasing impatience and $x < y$, then σ will be larger than τ and thus the numerator will be negative in above equation. Because of this, the hyperbolic factor H reluctant to explain the real discount rate. Besides, these models can predict decreasing impatience up to a certain limit. If a person satisfies extremely decreasing impatience, both quasi- and general hyperbolic discount factures fail to capture this (Prelec, 2004). Another drawback is that (quasi-)hyperbolic models assume linear utility which is often not satisfied (Rohde, 2019). Lastly, the parameter β in the quasi-hyperbolic discount model is often used as a measure of the degree of decreasing impatience. However, Rohde (2019) stated that β combines the change in impatience with the level of impatience, which causes a lack of isolation of the change in impatience. Therefore, hyperbolic models make it difficult to compare levels of decreasing impatience between individuals or groups.

2.3.3.2. CADI & CRDI

In response to the inability of hyperbolic discount models to measure increasing impatience or strongly decreasing impatience, Bleichrodt et al. (2007) proposed two families of discounting (Constant Absolute Decreasing Impatience (CADI) discounting and Constant Relative Decreasing Impatience (CRDI) discounting) that can accommodate any degree of increasing or decreasing impatience. They are more flexible models than hyperbolic discounting and can fit data at the individual level. However, these discount functions are power functions that rely on logarithmic functions with unique calculation for each individual. This makes it hard to obtain a comparative measure between individuals in a simple way.

2.3.3.3. Decreasing Impatience (DI) index

To compare degrees of decreasing impatience, avoid restricting utility assumptions and capture increasing impatience, Rohde (2019) constructed an index of decreasing impatience, the DI index. This index measures how impatience changes over time (both increasing and decreasing), without the restriction of utility assumptions. It also provides the opportunity to compare levels of decreasing

impatience of individuals and groups. The index is computed from the same two indifferences as Rohde (2010) used for the simplifying formula of the hyperbolic discount factor:

$$(s, x) \sim (t, y) \qquad (1)$$

$$(s + \sigma, x) \sim (t + \tau, y), \qquad (2)$$

in which $x, y \neq 0, s < t, \sigma > 0$. The DI index then is constructed from the values of t, s, σ and τ with use of the following formula:

$$DI = \frac{\tau - \sigma}{\sigma(t - s)},$$

which was obtained from the formula by Rohde (2010) estimating the hyperbolic discount factor. In the equation above, the difference between t and s represents the level of impatience that s measured with use of the first indifference. The difference between τ and σ captures the degree of decreasing impatience. This formula thus divides the change in impatience $(\tau - \sigma)$ in the second indifference corrected by the instant levels of impatience $(t - s)$ in the first indifference. A positive DI-index corresponds with decreasing impatience, whereas a negative DI-index reflects increasing impatience. If the DI index is zero, constant impatience is satisfied.

Rohde (2019) proposes two ways to elicit the indifferences that are used to construct the DI-index. The first optional procedure is theoretically the best one, and therefore called procedure T. The proposition is to fix reward y, time points t and s and delay τ. The respondents elicit the corresponding reward x that makes them indifferent in the first indifference. After the elicitation of reward x, each individual elicits the delay σ that makes him or her indifferent in the second equation. So-called chaining is used in this method, in which x is first elicited, followed by σ. The second procedure, also called the practical procedure (P), is fixing both rewards x and y, time point s and delay σ. Now, the respondents elicit their corresponding time point t and delay τ that makes them indifferent in both equations. The disadvantage of this procedure is that for given rewards x and y, there might be no t and delay τ that makes people indifferent, which would make the entire procedure dysfunctional. However, procedure P also has three major advantages for practicality. The first advantage is this procedure is not chained. Therefore, both indifferences can be elicited independently from each other, which prevents

the elicited value in the first indifference from influencing the elicitation of the value in the second indifference. This gives the experimenter the option to choose incentives and prevents subjects from answering untruthfully to obtain the highest incentive possible. The second advantage of procedure P is that the respondent is asked to elicit both values in the same dimension, which is time, instead of one in the dimension of money and the other in the dimension of time as in procedure T. This minimizes the probability of overweighting one dimension over the other. The third advantage is that weighting in time is easy to understand for most participants. When prospects x and y are not measured in terms of money but rather complicated issues such as health status, it is easier for participants to have these matters fixed than to elicit them themselves. Because of these advantages, Rohde (2019) proposes to use procedure P in experiments.

3. Design

To test al eight hypotheses, I constructed a survey that exists of three parts. In this thesis I refer to those parts as 1) Personality factors, 2) procrastination of exercising, and 3) time preference for monetary values. I randomized within the personality factor part and the procrastination of exercising part, but I did not randomize between the three parts. The entire survey was conducted online through Qualtrics. For privacy reasons, the participants stayed anonymous during the entire survey.

3.1. Personality factors

The personality factors consisted of demographics, task aversiveness, and levels of neuroticism and conscientiousness. I tested these characteristics by survey questions, which I then transformed into variables. Some answers to these questions were merged into one variable, other answers are a variable on itself.

3.1.1. Demographics

As mentioned in the literature review, I expect age, gender, and education to be of importance for the degree of procrastination of exercising. Therefore, I asked all participants about these demographics in the beginning of the survey, summarized in table 1.

Demographics

Q1.1.-O1	What is your age?
Q1.2.-MC	What is your gender?
Q1.3.-MC	What is your highest level of educational degree you have received?

Table 1: Demographic questions

3.1.2. Conscientiousness and Neuroticism

To measure the degrees of conscientiousness and neuroticism, I used statements set up by John & Srivastava (1999) who formulated the Big Five Inventory (BFI) personality trait questionnaire. That questionnaire exists of 44 statements that are used to measure all five personality traits. Of these statements, the outcome of 8 statements apply to neuroticism (table 2), and 9 indicating conscientiousness (table 3). I used an equally weighted average to measure both personality traits, using a 7-point Likert scale from 'strongly agree' to 'strongly disagree'.

Neuroticism

Q2.1.	I often feel depressed or blue
Q2.2.-R[2]	I can handle stress well
Q2.3.	I am often tensed
Q2.4.	I worry a lot
Q2.5.-R	I am emotionally stable and not easily upset
Q2.6.	I can be moody
Q2.7.-R	I can remain calm in tensed situation
Q2.8.	I get nervous easily

Table 2: Neuroticism

Conscientiousness

Q2.9.	I do a thorough job
Q2.10.-R	I can be somewhat careless
Q2.11.	I am a reliable worker
Q2.12.-R	I tend to be disorganized
Q2.13.-R	I tend to be lazy
Q2.14.	I persevere until the task is finished
Q2.15.	I do things efficiently
Q2.16.	I make plans and follow through with them
Q2.17.-R	I am easily distracted

Table 3: Conscientiousness

[1] The abbreviation 'O' meaning open questions, 'MC' meaning Multiple Choice questions
[2] R meaning 'reversed': the question is measured in a reversed manner

3.1.3. Task Aversiveness

To obtain a measure of task aversiveness against exercising, I used three statements to indicate how task aversive people were against working out. I based these statements on the findings that were discussed in the literature review. These are illustrated in table 4. Like the questions for conscientiousness and neuroticism, the possible answers had a 7-point Likert Scale range from 'strongly disagree' to 'strongly agree'. Because there was no preset scale in existing literature measuring task aversiveness, I used the combination of questions that had the strongest Cronbach's alpha to estimate task aversiveness. The questions that were chosen based on this were equally weighted.

Task Aversiveness

Q2.18.-R	I like to work out or play sports
Q2.19.-R	I have a natural talent for playing sports or working out
Q2.20.	Lack of time or money makes it hard for me to exercise or play sports

Table 4: Task Aversiveness

3.2. Procrastination of exercising

To measure procrastination of exercising, I follow the insight by Ameriks et al. (2007), who use the expected-ideal (EI) gap as a measure of self-control. By asking questions about expected behavior and ideal behavior. Furthermore, I ask directly if these people procrastinate on a 7-point Likert scale. Table 5 represents the statement and questions that are used to obtain the dependent variable of exercise procrastination.

Lastly, to estimate whether people invest in habit formation, I would usually ask if they paid to go to the gym. However, during the time that this survey was sent out, the gyms were closed because of the COVID-19 pandemic. Although the gym was closed, it was still possible to train with sport teams/clubs. Therefore, I use 'being part of a team' as my variable that indicates habit formation or self-commitment.

Exercise Procrastination

and habit formation

Q3.1.	I find myself postponing exercising/doing sports often
Q3.3.-YN[3]	Are you a member of a team/club? (not gym)
Q3.4-O[4]	What type of sports do you do?
Q3.5-O	How many times per week do you exercise or play sports?
Q3.6-O	How many times per week would you ideally exercise or play sports?

Table 5: Exercise Procrastination

3.3. DI index

I used procedure P from Rohde (2019) to get every participant's DI-index and I made use of a choice list, as Rohde (2019) also suggested. With use of this procedure, I could make use of the direct method: I directly asked the participants to elicit indifference values and did not need to use any trade-off method. Also, using procedure P made the questions easier to understand for the subjects and made the survey also easier to program as there was no chaining involved. I used the following procedure to elicit the DI-index as described by Rohde (2019):

1. Fix two outcomes x and y, and verify that $y \succ x \succ 0$ or $0 \succ x \succ y$;
2. Fix time s;
3. Elicit time t such that $(s : x) \sim (t : y)$;
4. Fix $\sigma > 0$ such that $s + \sigma \in T$;
5. Elicit τ such that $(s + \sigma : x) \sim (t + \tau : y)$.

I elicited these values by giving the respondents each three indifference equations, in which they were asked to choose between receiving €40 at a fixed point s in time of €50 in a later point t. They had to complete the indifference equations such that the filled out t made them indifferent between the two prospects. I used the following three equations that were suggested by Rohde (2019):

€40 in 0 weeks + 1 day $\sim$ €50 in t_0 weeks + 1 day

€40 in 2 weeks + 1 day $\sim$ €50 in t_2 weeks + 1 day

[3] 'YN' meaning yes or no question
[4] 'O' meaning open question

€40 in 4 weeks + 1 day ~ €50 in t_4 weeks + 1 day

To make these questions as easy as possible for the participants, I did not randomize the questions for elicitation of t_0, then t_2 and then t_4 and presented them in above order to every participant. With use of a drop-down menu, they had the option to choose a value between 0 and 40 weeks for t_0, 2 and 42 for t_2, and 4 and 44 for t_4.

4. Research Method

After retrieving the results from the survey, I tested the hypotheses with use of both parametric and non-parametric tests. In the survey, I obtained two options for the dependent variable in the model: $Postponing$ or $AmountSportsGap$. The value for $Postponing$ is the answer to question Q3.1, measured on a Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The variable $AmountSportsGap$ represents the difference between ideal and actual amount of working out (Q3.5 and Q3.6) each week. I tested all hypotheses with both options as dependent variable. Furthermore, I tested whether different demographic groups (gender, education, age) differ in terms of DI-indices, conscientiousness, neuroticism, and task aversiveness.

4.1. Adjustments of independent variables

From the survey results, Likert scale answers to conscientiousness and neuroticism statements were merged into the variables $ConscientScore$ and $NeurScor$e reversing specific questions and taking means as described in the experimental design. For the calculation of task aversiveness, Cronbach's alpha showed that it was better to leave out Q2.20 (alpha with Q2.18; Q2.19; and Q2.18 & Q2.19 = 0.277; 0.004; 0.472) and calculate task aversiveness by reversing Q2.18 and Q2.19 (alpha = 0.769) and taking the mean of these two questions as indication of task aversiveness. $Education$ was transformed into a categorical variable on an ordinal scale, with the lowest category (1) being 'No high school degree' and the highest score (7) being 'Postdoctoral'.

From the number of weeks that were answered for t_0 , t_2 and t_4 in the indifference equations, I obtained two DI-indices for each observation: $DI02$ and $DI24$. $DI02$ was the level of decreasing

impatience resulting from the first two indifferences and $DI24$ was the level of decreasing impatience from the second two indifferences. Furthermore, I calculated monetary discount factors of every participant for each t_i, using the following formula by Rohde (2016):

$$md_i = \frac{40}{50}^{1/(7*t_i+1-7*i-1)},$$

in which i represents time 0, 2 or 4.

I computed the answers for gender (that were only male and female) into a dummy variable $Female$. I also created a dummy variable $Team$ for habit formation or the social-commitment in the sense that people were part of a sports team. A list of all the variables that were used in this research can be found in Appendix B.

4.2. Correlations and non-parametric tests

For relations between all variables of interest, I used Spearman rank correlations. I chose the Spearman correlations because opposed to the Pearson correlation, the assumption of linearity is not needed, and it allows to estimate relations between variables on the ordinal scale. This correlation tests whether there exists a monotonic relationship between two variables.

I used Wilcoxon signed rank tests for estimation of deviations from the middle Likert scale score (4) in general and constant discounting (DI index of 0) for $DI02$ and $DI24$. Also, Mann-Whitney U tests were conducted for gender differences in postponing, conscientiousness, neuroticism, task aversiveness, discount factors and the DI-indices. For differences in the latter variables between different groups of education, I used a Kruskal-Wallis test.

4.3. Testing the hypotheses

With the decision between two possibilities as a dependent variable measuring procrastination of exercising, I chose to test all hypotheses against both possible dependent variables with use of regressions. Because $AmountSportsGap$ is a continuous value, I used an OLS regression with robust standard errors when estimating the effect on procrastination. I used robust standard errors to avoid an overestimated significance level due to outliers. When testing the scaled dependent variable

$postponing$, I used ordered logit regressions to test the hypotheses. I also tested all variables of interest against two additional variables, adding the variable $Team$ as a control representing habit formation or social/self-commitment and $TaskAversiveness$ as a control for all other hypotheses than Hypothesis 1.

5. Data Analysis

5.1. Subjects and descriptive statistics

The participants of this research were recruited through text message, Facebook, LinkedIn, and Instagram. A total of 115 participants finished the survey. Of these 115 participants, 23 were excluded from analysis because they violated impatience: their t_0 was larger than t_2 and/or t_4, or their t_2 was larger than t_4. After dropping those participants, 92 subjects were left for analysis, of which 41 were male and 51 females. The mean age was 35.3 years old, with the youngest participant being 15 years old and the oldest being 77 years old. $Education$ was measured in terms of the level of the highest obtained degree. There were seven possible answers, rated from 1 to 7. The frequency table in table 7 shows that most participants were highly educated people, with the highest frequencies for people who had obtained university degrees (Bachelor's and Master's).

Descriptive Statistics

Variable	Obs	Mean
Female	92	55.4%
Age	92	35.29
Education	92	4.89
NeurScore	92	3.19***
ConscientScore	92	4.91***
ActualAmount	92	2.67
IdealAmount	92	3.55
AmountSportsGap	92	.88***
Postponing	92	3.92
TaskAversiveness	92	2.54***
Team	92	52.2%

*** Wilcoxon test: the response deviates significantly ($p<0.01$) from 4 (for NeurScore, ConscientScore, Postponing and TaskAversiveness) or from 0 (for amountsportsgap).

Table 6: summary statistics

Tabulation of Education

	Freq.	Percent	Cum.
1 No High School Degree	2	2.17	2.17
2 High School Degree	9	9.78	11.96
3 Post-Secondary Vocational education (MBO)	2	2.17	14.13
4 Applied Sciences (HBO)	13	14.13	28.26
5 Bachelor (WO)	27	29.35	57.61
6 Master (WO)	36	39.13	96.74
7 Postdoctoral (PhD)	3	3.26	100.00

Table 7: Education frequency

The outcome of a Wilcoxon sign rank test shown in descriptive statistics in table 6 tells that the mean of $ConscientScore$ is significantly above the middle (4) score. The mean of $NeurScore$ is significantly below the middle value, which tells us that people reported less neuroticism than the midpoint on the 7-point Likert scale. The average amount of times that people ideally work out but do not do so ($AmountSportsGap$) is .88 times a week. The outcome of the Wilcoxon test for $TaskAversiveness$ shows a significant outcome below the middle score (4), meaning that on average, people do not perceive exercising as a difficult or frustrating task.

5.2. Impatience levels

With use of the three indifferences for which the participants elicited their t_0, t_2, and t_4, two DI-indices were computed. The first one for difference in impatience between t_0 and t_2 ($DI02$), and the second one was the difference between t_2 and t_4 ($DI24$). The number of weeks were multiplied by 7, having the units of time for t_0, t_2, and t_4, in days.

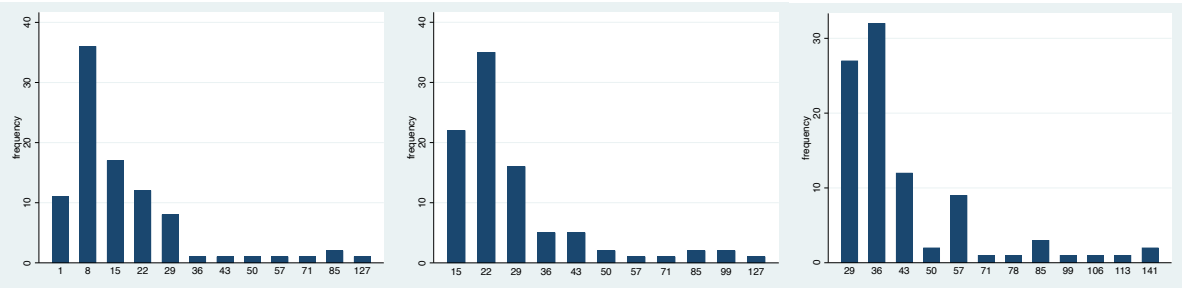

Figure 1: Frequency graphs of t_0, t_2, and t_4, all the answers that were given. Note: the x-axis shows only the observations that were observed.

5.2.1.DI-indices

From the 92 subjects that satisfied impatience, there were several for whom the DI-indices $DI02$ and $DI24$ could not be computed. This was since these people elicited the same value for t_i as s_i for a certain indifference. Therefore, the denominator in the DI-index became 0 due to which the index could not be computed and was reported as missing. For $DI02$, there were 11 people left out because of this problem. For $DI24$ there were 22 people that did not switch preferences. For 69 people I was able to compute both the DI02 and the DI24. Table 8 shows the number of subjects for who the DI-indices could be computed.

Table 8 illustrates the fact that most people (more than 50%) satisfied constant impatience. After that, most people satisfied increasing impatience and only a few satisfied decreasing impatience.

Furthermore, for the ones I could compute both $DI02$ and $DI24$, there was no significant correlation (p=.3098) between both indices. The scatterplot in figure 1 shows the distributions between $DI02$ and $DI24$.

	DI02	**DI24**
Decreasing Impatience (DI > 0)	7	12
Constant Impatience (DI = 0)	41	36
Increasing Impatience (DI < 0)	33	22
Total	**81**	**70**

Table 8: Tabulation of DI02 and DI24 and type of impatience

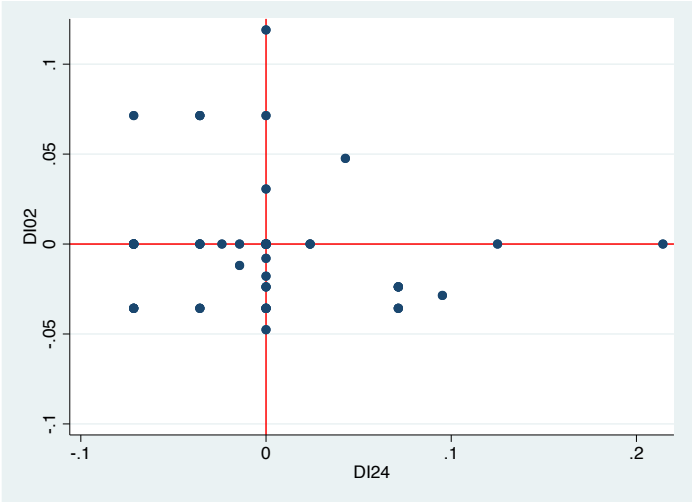

Figure 2: Scatterplot of DI-indices

A Wilcoxon sign test indicated increasing impatience (p-value 0.001) for t_0 to t_2. For $t_2$to t_4 the same test showed no significant deviation from constant impatience (p-value = 0.755). This would indicate the opposite of a present bias: people are more willing to wait for instant monetary values, while for income in the later future they are less patient.

5.2.3. DI-indices and other variables

Ordered logit regressions as well as OLS regressions with robust standard errors did not indicate any relation between the DI-indices and any behavioral or demographic variables.

Of the people for who $DI02$ could be computed, 47 were female and 34 were male. In the group for who $DI24$ could be computed, 41 were female and 29 were male. Spearman rank correlations between Age ($DI02$: p=0.197, $DI24$=0.917) and $Female$ ($DI02$: p=0.717, $DI24$: p=0.601) and the DI-indices confirmed that there was no relation between indices and these variables. Furthermore, there was no significant relation between any of the DI-indices and the variables $TaskAversiveness$, $Team$, $NeurScore$ and $ConscientScore$ (Appendix C).

Lastly, there was found no significant correlation between the DI-indices and any dependent variable measuring procrastination ($Postponing$ and $AmountSportsGap$). Therefore, my last hypothesis is not confirmed. All the Spearman correlations with DI-indices can be found in Appendix C.

5.2.3. Monetary discount factors

As expected from the DI-indices, the calculated discount factors md_0 at t_0 are significantly smaller than md_2at t_2 (Wilcoxon sign test two-sided: p=0.0125), indicating increasing impatience. The discount factors md_4 do not significantly deviate from md_2in t_2 (p=0.8218). There was found no significant relation between any of the monetary discount factors and behavioral or demographical variables.

5.3. Relations between behavioral variables (Spearman rank correlations)

Table 9 gives Spearman Rank correlations between all variables except the DI-indices. It shows that variables $AmountSportsGap$ and $Postponing$ are (highly) significantly positively related. This means that overall people who postpone exercising more have a higher gap between their ideal and actual number of times working out in a week, corresponding to the expectations. However, these two variables are not perfectly correlated, meaning that the decision on which variable to use as dependent variable for analysis could matter for the outcome of this research. It stands out that $AmountSportsGap$ is negatively correlated with $Team$. This could be because the social commitment and habit formation of participating in a team lowers the gap between actual and ideal amount of playing sports. However, $Team$ does not have a significant correlation with $Postponing$, indicating that being in a team does not influence the reported rate of postponing.

Spearman's rank correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) AmountSportsGap	1.000								
(2) Postponing	0.283***	1.000							
(3) NeurScore	0.276***	0.280***	1.000						
(4) ConscientScore	-0.173*	-0.333***	-0.390***	1.000					
(5) Female	0.030	0.104	0.016	0.190*	1.000				
(6) Age	-0.112	-0.067	-0.499***	0.346***	-0.037	1.000			
(7) Team	-0.282***	-0.166	-0.099	0.046	-0.246**	0.093	1.000		
(8) TaskAversiveness	0.152	0.379***	0.180*	-0.317***	0.205*	-0.059	0.433***	1.000	
(9) Education	0.075	-0.115	-0.252**	0.411***	0.155	0.477***	-0.096	-0.202*	1.000

Spearman rho = -0.162 *** p<0.01, ** p<0.05, * p<0.1

Table 9: Spearman Rank correlations between variables

5.3.1. Personality factors and demographics

Table 9 indicates a significant negative relation between $NeurScore$ and $ConscientScore$, meaning that people with higher neuroticism seem to be less conscientious and vice-versa. Also, a negative correlation between Age and $NeurScore$ and a positive relation between Age and $ConscientScore$ was found, meaning that older people report less neuroticism and more conscientiousness than younger people.

The variable $Female$ is positively correlated with $ConscientScore$. Also, a Wilcoxon rank sum test shows that females are more conscientious than males (p=0.070) at a 10% confidence level. The positive relation between $Female$ and $TaskAversiveness$ and the negative relation between $Female$ and $Team$ is confirmed by a Wilcoxon rank sum test (p=0.050 for task aversiveness and p=0.031 for team) that also found that females are more task aversive than males at a 10% significance level and are less likely to participate in a sports team at a 5% significance level. For all other variables, ($NeurScore$ included) there is no prove that females are different from males.

Lastly, people with higher education reported more conscientiousness and less neuroticism, which is in line with the discussed literature (Burks et al., 2009). Kruskal-Wallis tests for $NeurScore$ (p=0.009) and $ConscientScor$e (p<0.001) by education confirm the relation between the behavioral variables and education that was found by the Spearman correlations.

5.4. Effect of behavioral variables on procrastination

Because the gap between actual and ideal times a week working out was measured in absolute numbers instead of percentages, analyzing this can give biased results for people who work out a lot or very little. For this reason, analyzing the other option for my dependent variable, $Postponing$, is preferred. Another reason for analyzing $Postponing$ instead of $AmountSportsGap$ was that, based on scatterplots between $AmountSportsGap$ and all other variables (Appendix F), there probably existed no prove of linear relationships between the variable $AmountSportsGap$ and all other variables which made an OLS regression with robust standard errors less trustworthy. Instead, I chose to use an ordered logistic regression model with the variable $Postponing$ as the dependent variable measuring the procrastination level. However, all OLS regressions with robust standard errors with $AmountSportsGap$ as dependent variable can be found in Appendix E. These results differ slightly, but do not contradict the significant findings with $Postponing$ as dependent variable.

5.4.1. Task Aversiveness

The variable $TaskAversiveness$ had high correlation with $Postponing$ ($p<0.001$). However, there was no correlation with $AmountSportsGap$ ($p=0.148$). Furthermore, $TaskAversiveness$ was positively correlated with $NeurScore$ and negatively correlated with $ConscientScore$, meaning that conscientious people were less task aversive towards exercising and neurotic people were more task aversive. I ran an ordered logit regression with $Postponing$ as dependent variable with $TaskAversiveness$ as variable of interest, controlling for Age, $Female$, and $Education$. In a second regression I added an extra control variable, $Team$, as Spearman correlation showed a significant negative correlation between task aversiveness and being of a team ($p<0.001$). In both regressions (Appendix E) there was a significant positive relation ($p<0.001$ in both regressions) found between $TaskAversiveness$ and $Postponing$. The same significance was found when controlling for conscientiousness and neuroticism, displayed in table 10. Therefore, we can argue that a higher task aversiveness relates to more procrastination of exercising, confirming the first hypothesis.

5.4.2. Neuroticism and Conscientiousness

Because the Spearman rank correlation between $NeurScore$ and $ConscientScore$ is significant ($p<0.001$), I chose to run ordered logit regressions for both scores separately but also one regression in which both variables were included. The coefficients in the ordered log-odds scale of all three regressions are illustrated in table 10.

VARIABLES	(1) Postponing	(2) Postponing	(3) Postponing
ConscientScore	-0.664**		-0.776***
	(0.309)		(0.298)
NeurScore	0.332*	0.471**	
	(0.249)	(0.238)	
Age	0.0269*	0.0270*	0.0170
	(0.0156)	(0.0155)	(0.0137)
1.Female	0.561	0.312	0.569
	(0.441)	(0.419)	(0.437)
2.education	1.794	1.245	2.255
	(1.809)	(1.922)	(1.660)
3.education	1.567	0.953	1.803
	(2.046)	(2.122)	(1.947)
4.education	0.618	-0.195	1.069
	(1.794)	(1.889)	(1.639)
5.education	1.431	0.832	1.840
	(1.740)	(1.854)	(1.591)
6.education	1.291	0.278	1.825
	(1.799)	(1.869)	(1.636)
7.education	0.911	-0.176	1.269
	(2.045)	(2.109)	(1.918)
1.Team	-0.0632	-0.0777	-0.0182
	(0.438)	(0.438)	(0.437)
TaskAversiveness	0.584***	0.650***	0.616***
	(0.195)	(0.191)	(0.194)
/cut1	-1.648	1.388	-2.994
	(2.443)	(2.121)	(2.133)
/cut2	0.608	3.592*	-0.779
	(2.419)	(2.113)	(2.087)
/cut3	1.368	4.326**	-0.0303
	(2.421)	(2.125)	(2.085)
/cut4	1.774	4.709**	0.368
	(2.420)	(2.131)	(2.080)
/cut5	3.801	6.672***	2.365
	(2.461)	(2.200)	(2.110)
/cut6	5.655**	8.519***	4.224*
	(2.535)	(2.293)	(2.195)
Observations	92	92	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: ordered logit with NeurScore and ConscientScore as variables of interest.

The results of the regressions in which $NeurScore$ are included show a significant positive effect of the variable $NeurScore$ on postponing at a 10% significance level, meaning that people with more neurotic characteristics are more likely to postpone exercising. Vice versa, the regressions containing $ConscientScore$ show a significant negative relation with $Postponing$ at a 5% significance level, meaning that higher conscientiousness does indeed decrease the probability that this person is someone who postpones exercising. It should be noted that the OLS regressions with robust standard error in Appendix E show no significant sign of a relation between $ConscientScore$ and $AmountSportsGap$. However, from the ordered logit regressions in table 10, the results for conscientiousness and neuroticism are in line with the hypotheses set for these variables. Ordered logit models with DI-indices included gave no different estimations and can be found in Appendix D.

5.4.3. Demographics

The demographic variable age shows significant results as well in above regressions. In the models including $ConscientScore$, a significant positive effect of Age on $Postponing$ was found, indicating that older people procrastinate exercising more than younger people at a significance level of 10% when controlling for the variables $Female$, $Team$, $TaskAversiveness$ and $Education$. For the regressions with $NeurScore$, the variable Age shows a significant positive effect on $Postponing$ as well, but when both $NeurScore$ and $ConscientScore$ were included in the regression, Age was not significant. The categorical variable $Education$ has no significant relation with $Postponing$ according to all ordered logit and OLS regressions. Also, Kruskal-Wallis tests did not indicate any significant relation between $Education$ and $Postponing$ (p=0.477) or between $Education$ and $AmountSportsGap$ (p=0.525).

6. Conclusion and discussion

This paper explored the determinants of exercise procrastination in depth. Both economic models for impatience and psychological theory on personality factors were reviewed and tested with use of a survey. For testing the influence of impatience on procrastination, a direct method for procedure P to obtain the DI-index by Rohde (2016) was employed. While most subjects of Rohde (2016) satisfied decreasing impatience, the participants of this research contradicted the findings by Rohde (2016) as they satisfied mostly increasing or constant impatience. Furthermore, there was found no evidence for a relation between the two DI-indices and procrastination or any of the other variables, including conscientiousness and neuroticism. This corresponds to Rohde's (2016) results as she also found no evidence for a relation between the DI-index and self-control problems. It was a pity that the DI-index calculation for some indifferences caused some observations to be impossible to analyze. It might have been better to give subjects the option values for indifferences in terms of days instead of weeks and give them the opportunity to pick a broader range of time for their indifferences (now the maximum option for number of weeks was 40 from every t_0, t_2 and t_4).

Also, from the people that were dropped because their answers did not satisfy impatience in the first place it became clear that some did not read the instructions clearly or were reluctant to take time to thoroughly think about their preferences. It would have been better to implement a time lock in the survey of a certain number of seconds to make sure that people took the time to carefully read the instructions. It became clear from interviewing people with no economic background (friends and family) who took the survey that many found the questions for indifference elicitation hard to think about. Especially the addition of 'and 1 day' to the indifference equations seemed to cause confusion. This unforeseen problem could be a disadvantage of taking this survey online without any additional guidance. Therewith, while the direct method of obtaining indifference values might be the quickest- and possibly the only- manner for obtaining results, it could be interesting to see what the same group of participants had answered when confronted with a choice list instead of direct value elicitation.

In line with the findings of Blunt & Pychyl (2000), this research also found significant evidence for a positive relation between task aversiveness and exercise procrastination, meaning that people who have less affinity with working out are more likely to postpone doing so. The predicted negative influence that habit formation or the commitment by the responsibility of being part of a sports team should have on postponing was not confirmed in this research. However, there was found a significant influence on the gap between ideal and actual times a person exercises in a week. A reason for this difference in outcomes could be that some people did not consider the times they played sports with their team as a possibility to postpone. This would then prove that being part of a sports team is a proper way of social-commitment or habit formation to decrease the gap between ideal and actual number of times working out in a week.

Confirming the findings of Steel (2007), Watson (2001), Digman (1990) and Bogg & Roberts (2004), this research also found prove for the negative relation between conscientiousness and procrastination, indicating that people with more organizational skills, goal-directedness and persistency procrastinate exercising less. The positive relation between neuroticism and procrastination also corresponds to the findings of Steel (2007), Watson (2001), Digman (1990) and Bogg & Roberts (2004). This is in line with the findings of Schouwenburg & Lay (1995), who claimed that impulsivity, fear of failure and depression are features that increase the degree of procrastination. Furthermore, the

significantly negative correlation between conscientiousness and neuroticism indicates that people who reported higher neurotic characteristic reported lower conscientious characteristics, which is in line with the five-factor personality model as described by Digman (1990). While literature was inconclusive about the importance of gender for conscientiousness and neuroticism, this research found a weakly significant sign that females are more conscientious than males. Gender was not found to be determining for the level of neuroticism. The negative relation between age and neuroticism that was found, could be justified by the fact that people took the survey during the COVD-19 pandemic. Varma et al. (2021) found that younger people are more vulnerable to stress, anxiety, and depression during this pandemic than older people. As neurotic people are characterized as more stressed, anxious and more likely to be depressed, this could be the explanation for younger people reporting more neuroticism than older people.

The self-reporting of personality features can be an issue for the trustworthiness of the results. Although people were assured of anonymity during the entire survey, there exists the possibility that people did still not answer all personality questions truthfully. Also, it would be interesting to let the participants undergo a full personality test by Digman (1990) to get a better notion of the true personalities, but this was not possible due to time constraints.

Although females reported higher conscientiousness levels, there was not found evidence for less procrastination with females. Education and age were highly correlated with each other, however, there was not found a relation between exercise procrastination and education, while age had a weakly negative relation with procrastination. This relation could be explained by the fact that older people reported significantly less neuroticism than younger people, and neuroticism was positively related to procrastination.

This research has some additional limitations. First, of course, the sample size could be an issue. 92 respondents should be enough, but a larger sample size provides more power to statistical tests and could give more meaningful results. Second, the participants existed mostly of people in my direct surroundings or fellow students. Therefore, the subjects were mostly high-educated people and play a lot of sports or like to exercise. It stood out in the results that age had a very significant positive correlation with education. This could be since most participants were intelligent, however, some were

older and thus were further in their education careers. It could have been interesting to perform an intelligence test instead of asking for the highest obtained degree for these subjects to see if intelligence influences procrastination. Third, I took the liberty to use an equally weighting method for statements indicating task aversiveness, conscientiousness and neuroticism. The possibility exists that certain statements should have been weighted more than others as they are of more importance for measuring a certain variable.

The last, but probably of high importance, limitation is that people took the survey in times of a pandemic (COVID-19). There exists evidence (e.g. Pan et al., 2021) that people were more depressed and anxious during this time. Therewith, gyms and other sport facilities were closed due to which it was harder to exercise. These rare circumstances could have substantially influenced the reported amount of exercising, as well as the levels of delay. An inexistence of facilities as gyms that function as habit formation or self-commitment devices demands more self-control and discipline from people to go exercise. On the other hand, as most events, cinemas, and other 'distracting' activities were absent, people might have experienced less lack of time to work out.

The outcome of this research shows that neurotic people are more reluctant to stick to exercising. Also, people who are more task aversive towards exercising are more likely to procrastinate going to the gym or doing other sports. The health objective by policy makers can therefore be ameliorated if the focus of campaigns incentivizing physical activity lies on people with neurotic characteristics and people who do not have a natural pleasure or talent in doing sports. Therefore, it would be interesting to further investigate which incentivizing methods work best for people who have no affinity or drive towards exercising.

References

Ainslie, G. (1975). Specious reward: a behavioral theory of impulsiveness and impulse control. *Psychological bulletin*, *82*(4), 463.

Akerlof, G. A. (1991). Procrastination and obedience. *The American Economic Review*, *81*(2), 1-19.

Ameriks, J., Caplin, A., Leahy, J., & Tyler, T. (2007). Measuring self-control problems. *American Economic Review*, *97*(3), 966-972.

Andreoni, J., & Sprenger, C. (2012). Estimating time preferences from convex budgets. *American Economic Review*, *102*(7), 3333-56.

Benjamin, D. J., Heffetz, O., Kimball, M. S., & Rees-Jones, A. (2012). What do you think would make you happier? What do you think you would choose? *American Economic Review*, *102*(5), 2083-2110.

Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health-related behaviors: a meta-analysis of the leading behavioral contributors to mortality. *Psychological bulletin*, *130*(6), 887.

Bleichrodt, H., Gao, Y., & Rohde, K. I. (2016). A measurement of decreasing impatience for health and money. *Journal of Risk and Uncertainty*, *52*(3), 213-231.

Blunt, A. K., & Pychyl, T. A. (2000). Task aversiveness and procrastination: A multi-dimensional approach to task aversiveness across stages of personal projects. *Personality and Individual Differences*, *28*(1), 153-167.

Bryan, G., Karlan, D., & Nelson, S. (2010). Commitment devices. Annu. Rev. Econ., 2(1), 671-698.

Burks, S. V., Carpenter, J. P., Goette, L., & Rustichini, A. (2009). Cognitive skills affect economic preferences, strategic behavior, and job attachment. *Proceedings of the National Academy of Sciences*, *106*(19), 7745-7750.

Cairns, J., & van der Pol, M. (2000). Valuing future private and social benefits: The discounted utility model versus hyperbolic discounting models. *Journal of Economic Psychology*, *21*(2), 191-205.

Charness, G., & Gneezy, U. (2009). Incentives to exercise. *Econometrica*, *77*(3), 909-931.

Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual review of psychology*, *41*(1), 417-440.

Ferrari, J. R., & Ware, C. B. (1992). Academic procrastination: personality. *Journal of social Behavior and personality*, *7*(3), 495-502.

Feingold, A. (1994). Gender differences in personality: a meta-analysis. *Psychological bulletin*, *116*(3), 429.

Friedman, M., & Savage, L. J. (1952). The expected-utility hypothesis and the measurability of utility. *Journal of Political Economy*, *60*(6), 463-474.

Frederick, S., Loewenstein, G., & O'donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of economic literature*, *40*(2), 351-401.

Hoch, S. J., & Loewenstein, G. F. (1991). Time-inconsistent preferences and consumer self-control. *Journal of consumer research*, *17*(4), 492-507.

John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), Handbook of personality: *Theory and research* (Vol. 2, pp. 102–138). New York: Guilford Press.

Kroese, F. M., & de Ridder, D. T. (2016). Health behaviour procrastination: a novel reasoned route towards self-regulatory failure. *Health psychology review*, *10*(3), 313-325.

Landers, D. M., & Arent, S. M. (2007). Physical activity and mental health.

Lay, C., & Silverman, S. (1996). Trait procrastination, anxiety, and dilatory behavior. *Personality and Individual Differences*, *21*(1), 61-67.

Loewenstein, G., & Prelec, D. (1992). Anomalies in intertemporal choice: Evidence and an interpretation. *The Quarterly Journal of Economics*, *107*(2), 573-597.

O'Donoghue, T., & Rabin, M. (1999). Doing it now or later. *American economic review*, *89*(1), 103-124.

O'Donoghue, T., & Rabin, M. (2001). Choice and procrastination. *The Quarterly Journal of Economics*, *116*(1), 121-160.

Ozer, B. U., & Ferrari, J. R. (2011). Gender orientation and academic procrastination: Exploring Turkish high school students. *Individual Differences Research*, *9*(1), 33-40.

Pan, K. Y., Kok, A. A., Eikelenboom, M., Horsfall, M., Jörg, F., Luteijn, R. A., ... & Penninx, B. W. (2021). The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: a longitudinal study of three Dutch case-control cohorts. *The Lancet Psychiatry*, *8*(2), 121-129.

Phelps, E. S., & Pollak, R. A. (1968). On second-best national saving and game-equilibrium growth. *The Review of Economic Studies*, *35*(2), 185-199.

Prelec, D. (2004). Decreasing impatience: a criterion for Non-stationary time preference and "hyperbolic" discounting. *Scandinavian Journal of Economics*, *106*(3), 511-532.

Rippe, J. M., Price, J. M., Hess, S. A., Kline, G., DeMers, K. A., Damitz, S., ... & Freedson, P. (1998). Improved psychological well-being, quality of life, and health practices in moderately overweight women participating in a 12-week structured weight loss program. *Obesity Research*, *6*(3), 208-218.

Reuben, E., Sapienza, P., & Zingales, L. (2007). *Procrastination and impatience* (No. w13713). National Bureau of Economic Research.

Paluska, S. A., & Schwenk, T. L. (2000). Physical activity and mental health. *Sports medicine*, *29*(3), 167-180.

Prelec, Drazen, 2004. Decreasing impatience: A criterion for non-stationary time preference and 'hyperbolic' discounting. Scand. J. Econ. 106, 511–532.

Rhodes, R. E., & de Bruijn, G. J. (2013). What predicts intention-behavior discordance? A review of the action control framework. *Exercise and sport sciences reviews*, *41*(4), 201-207.

Rippe, J. M., & Hess, S. (1998). The role of physical activity in the prevention and management of obesity. *Journal of the American Dietetic Association*, *98*(10), S31-S38.

Rohde, K. I. (2010). The hyperbolic factor: A measure of time inconsistency. *Journal of Risk and Uncertainty*, *41*(2), 125-140.

Rohde, K. I., & Verbeke, W. (2017). We like to see you in the gym—A field experiment on financial incentives for short and long term gym attendance. *Journal of Economic Behavior & Organization*, *134*, 388-407.

Rohde, K. I. (2019). Measuring decreasing and increasing impatience. *Management Science*, *65*(4), 1700-1716.

Schouwenburg, H. C., & Lay, C. H. (1995). Trait procrastination and the big-five factors of personality. *Personality and Individual differences*, *18*(4), 481-490.

Sirois, F. M. (2004). Procrastination and intentions to perform health behaviors: The role of self-efficacy and the consideration of future consequences. *Personality and Individual differences*, *37*(1), 115-128.

Steel, P. (2007). The nature of procrastination: a meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological bulletin*, *133*(1), 65.

Steel, P., & Ferrari, J. (2013). Sex, education and procrastination: An epidemiological study of procrastinators' characteristics from a global sample. European Journal of Personality, 27(1), 51-58.

Taylor, C. B., Sallis, J. F., & Needle, R. (1985). The relation of physical activity and exercise to mental health. *Public health reports*, *100*(2), 195

Van Hooft, E. A., Born, M. P., Taris, T. W., van der Flier, H., & Blonk, R. W. (2005). Bridging the gap between intentions and behavior: Implementation intentions, action control, and procrastination. *Journal of Vocational Behavior*, *66*(2), 238-256.

Varma, P., Junge, M., Meaklim, H., & Jackson, M. L. (2021). Younger people are more vulnerable to stress, anxiety and depression during COVID-19 pandemic: A global cross-sectional survey. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *109*, 110236.

Watson, D. C. (2001). Procrastination and the five-factor model: A facet level analysis. *Personality and individual differences*, *30*(1), 149-158.

Appendix

A. Survey

Welcome to this Master thesis survey!
This survey takes approximately 10 minutes.
Of all participants that finished this survey and left their e-mail address at the end of this survey, one will win €20!

Please make sure that you fill in all the questions truthfully.
For privacy reasons, all data that is obtained will remain anonymous.

Note: filling in your e-mail address does not harm your anonymity as your answers are separated from the e-mail address.

Thank you for participating!
Saartje Steins Bisschop
MSc Behavioral Economics (Erasmus School of Economics)

Q.1
The first three questions of this survey need some explanation. Do you want to do them in English or Dutch?
- English → A
- Dutch → B

Q.EXPLANATION A
Please read the instructions carefully:
In the first part of this survey, you will be asked 3 questions that take the following form:

Example:
'When do you value both options equally:
Receiving €25 today or €35 in 't' weeks?'

As you can see, you can choose between receiving two amounts of money at different points in time.
The monetary amounts are fixed, but you are able to choose the amount of weeks (t) in which you receive the larger amount.
I ask you to indicate the level of t (measured in amount of weeks) where you are indifferent* between immediately receiving 25 euros or waiting (the amount of weeks you indicated as your t) for the 35 euros.
*Being indifferent means that you do not care whether you receive the first or the second option.

It is easiest for yourself if you ask yourself whether you prefer the sooner smaller amount or the later larger amount for every t starting at t=0.

Example: at t=0 you ask yourself:
'Would I rather have €25 today or €35 in 0 weeks (so today)?'

If you prefer the €35 over the €25, you move on to the next t (t=1) and ask yourself the question:
Would I rather have €25 today or €35 in 1 week?
etc.

In a dropdown menu, you fill in the amount of weeks (t) for which you do not have a preference for 1 option, or where your preference shifts from the larger to the smaller option.

Note: there are no right or wrong answers, please fill in your preferences truthfully.

Click on proceed only if you fully understand. Otherwise, re-read the instructions

Q.EXPLANATION.

Lees de volgende instructies goed:
Het eerste deel van deze enquête bestaat uit vragen die er als volgt uit zien:

Voorbeeld:
'Wanneer vindt u beide opties even aantrekkelijk:

25 euro vandaag ontvangen, of 35 euro over 't' weken ontvangen?

Zoals u kunt zien, kunt u kiezen tussen twee verschillende bedragen ontvangen op verschillende momenten. De bedragen zijn vooraf vastgesteld, maar het aantal weken (t) waarin u het grotere bedrag (in bovenstaand voorbeeld 35 euro) ontvangt kunt u zelf aanpassen.
Ik vraag u het aantal weken (t) aan te geven waarin het u niet uitmaakt of u meteen 25 euro krijgt of dat u wacht voor de 35 euro. Het is voor uzelf het makkelijkst als u vanaf t=0 steeds ten rade gaat of u liever het eerste kleinere bedrag op een vroeger moment heeft of dat u nog bereid bent te wachten voor het hogere latere bedrag.

VB: bij t=0 is de vraag:
Wilt u liever 25 euro vandaag ontvangen of 35 euro over 0 weken (dus ook vandaag)?

Als u liever 35 euro vandaag heeft dan weet u dat u nu door moet naar t=1:
Wilt u liever 25 euro vandaag ontvangen of 35 euro over 1 week?
etc.
U vult het aantal weken in voor t wanneer u niet een voorkeur heeft voor 1 optie, of wanneer uw voorkeur van opties wisselt van het grote naar het kleine bedrag.

Er zijn geen goede of foute antwoorden, het gaat erom dat u nagaat wat uw eigen preferentie is

Klik op doorgaan als u de instructies begrijpt. Als dit niet het geval is, lees alstublieft nog een keer bovenstaande instructie

Q.2A

[Explanation repeated]
[*You can choose between receiving two amounts of money at different points in time.*
The monetary amounts are fixed, but you are able to choose the amount of weeks (t) in which you receive the larger amount.
I ask you to indicate the level of t (t is the amount of weeks) where you are indifferent between receiving €40 or waiting (the amount of weeks you indicated as your t) for the €50.*
**Being indifferent means that you do not care whether you receive the first or the second option.*

Note: there are no right or wrong answers, please fill in your preferences truthfully.]

Please select the number of weeks (t) that makes you value both options equally:

€40 **in 1 day** or €50 in **t weeks and 1 day**
t=...{dropdown}

Q.2B

[UITLEG HERHAALD]
[U kunt kiezen tussen twee verschillende bedragen ontvangen op verschillende momenten.
De bedragen en het moment van het eerste bedrag zijn vooraf vastgesteld, maar het aantal weken (t) waarin u het grotere bedrag (€50) ontvangt kunt u zelf aanpassen.

Ik vraag u het aantal weken (t) aan te geven waarvoor het u niet uitmaakt of u de eerste (€40) of de tweede optie (€50) ontvangt.
Er zijn geen goede of foute antwoorden, het gaat erom dat u nagaat wat uw eigen preferentie is]

Selecteer het aantal weken (dus vul een aantal weken in voor t) waarin u beide opties even aantrekkelijk vindt:

€40 **over 1 dag** of €50 over **t weken en 1 dag**
t = ... {dropdown}

Q.3A
Please select the number of weeks (t) that makes you value both options equally:

€40 **in 2 weeks and 1 day** or €50 in **t weeks and 1 day**
t=... {dropdown}

Q.3B
Selecteer het aantal weken (dus vul een aantal weken in voor t) waarin u beide opties even aantrekkelijk vindt:

€40 **over 2 weken en 1 dag** of €50 over **t weken en 1 dag**
t = ... {dropdown}

Q.4A
Please select the number of weeks (t) that makes you value both options equally:

€40 in **4 weeks and 1 day** or €50 in **t weeks and 1 day**

Q.4B
Selecteer het aantal weken (dus vul een aantal weken in voor t) waarin u beide opties even aantrekkelijk vindt:
let op: het eerste bedrag is nu weer 4 weken en 1 dag

€40 **over 4 weken en 1 dag** of €50 over **t weken en 1 dag**
t = ... {dropdown}

[EVERYONE GOES BACK TO ENGLISH}

Q5
What is your gender?
*** Male**
*** Female**
*** Non-binary**
*** Prefer not to say**

Q.6
What is your age?
{dropdown}

Q.7
What is your highest obtained degree?
* No high school degree
* High School
* Post-secondary vocational education (MBO)
* Applied sciences (HBO)

* Bachelor (WO)
* Master (WO)
* Postdoctoral (PhD)

Q.8

All these statements are about playing sports/working out. Please select the level of agreement that applies to you

- I like to workout/play sports
- I have a natural talent for playing/doing sports
- Lack of time or money makes it hard for me to exercise or play sports
- I find myself postponing
- exercising (or doing sports) often

Q.9

Are you member of a sports team/club? (IMPORTANT: not a gym, but for example a soccer team, tennis club etc.)
* yes
* no

Q.10

What type of sports do you play/exercise do you do? Multiple answers are possible
{open}

Q.11

How many times a week do you usually exercise or play sports?
{open}

Q.12

How many times a week would you ideally (but realistically in terms of time) plan to exercise or play sports?
{open}

Q.13

These questions are about your personality. Please answer them as truthful as possible.
Reminder: Your answers will stay anonymous
{7-point scale statements: strongly agree to strongly disagree}

- I often feel depressed or blue
- I can handle stress well
- I am often tensed
- I worry a lot
- I am emotionally stable and not easily upset
- I can be moody
- I can remain calm in a tensed situation
- I get nervous easily
- I do a thorough job
- I can be somewhat careless
- I am a reliable worker
- I tend to be disorganized
- I tend to be lazy
- I persevere until the task is finished
- I do things efficiently
- I make plans and follow through with them
- I am easily distracted

Thank You!
Please fill in your e-mail address if you want to be part of the lottery in which you can win €20
{open}

B. List of variables

Procrastination	
Amount sports gap	Ideal amount sports-actual amount sports
Postponing	Measured on 7-point Likert scale
Impatience Variables	
t0	Measured in number of days
t2	Measured in number of days
t4	Measured in number of days
md0	Monetary discount factor for t0
md2	Monetary discount factor for t2
md4	Monetary discount factor for t4
DI02	Index for difference in impatience between t0 and t2
DI24	Index for difference in impatience between t2 and t4
Demographic variables	
Education	Highest obtained degree
Female	1 if female, 2 if male
Age	In years
Behavioral variables	
ConscientScore	Measured on 7-point Likert scale
NeurScore	Measured on 7-point Likert scale
Extra variables (sports)	
TaskAversiveness	Mean of statements on 7-point Likert scale
Team	1 if part of a sports team, 0 if not

C. Spearman Correlations with DI-indices

Spearman's rank correlation coefficients

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) AmountSportsGap	1.000										
(2) Postponing	0.283***	1.000									
(3) NeurScore	0.276***	0.280***	1.000								
(4) ConscientScore	-0.173*	-0.333***	-0.390***	1.000							
(5) Female	0.030	0.104	0.016	0.190*	1.000						
(6) Age	-0.112	-0.067	-0.499***	0.346***	-0.037	1.000					
(7) Team	-0.282***	-0.166	-0.099	0.046	-0.246**	0.093	1.000				
(8) TaskAversiveness	0.152	0.379***	0.180*	-0.317***	0.205*	-0.059	-0.433***	1.000			
(9) Education	0.075	-0.115	-0.252**	0.411***	0.155	0.477***	-0.096	-0.202*	1.000		
(10) DI02	0.045	0.069	0.078	-0.130	-0.041	-0.145	-0.065	0.023	-0.127	1.000	
(11) DI24	-0.013	-0.089	-0.084	0.041	-0.064	-0.013	-0.035	-0.106	0.150	-0.124	1.000

Spearman rho = -0.162 *** p<0.01, ** p<0.05, * p<0.1

Table 9: Spearman Rank correlations between variables

D. Ordered Logit Regressions

Ordered logit regressions with ‘postponing’ as dependent variable (DI index excluded)

VARIABLES	(1) postponing	(2) postponing	(3) postponing	(4) postponing	(5) postponing	(6) postponing
ConscientScore	-0.641***	-0.811***	-0.896***	-0.869***	-0.665**	-0.664**
	(0.246)	(0.263)	(0.270)	(0.303)	(0.309)	(0.309)
NeurScore	0.315	0.268	0.439*	0.405*	0.330*	0.332*
	(0.202)	(0.204)	(0.232)	(0.246)	(0.248)	(0.249)
1.Female		0.789*	0.868**	0.903**	0.571	0.561
		(0.407)	(0.408)	(0.423)	(0.435)	(0.441)
age			0.0212	0.0256*	0.0265*	0.0269*
			(0.0138)	(0.0151)	(0.0154)	(0.0156)
2.education				1.164	1.779	1.794
				(1.568)	(1.821)	(1.809)
3.education				1.622	1.548	1.567
				(2.086)	(2.057)	(2.046)
4.education				0.246	0.616	0.618
				(1.557)	(1.809)	(1.794)
5.education				0.939	1.432	1.431
				(1.498)	(1.756)	(1.740)
6.education				0.718	1.301	1.291
				(1.563)	(1.813)	(1.799)
7.education				0.300	0.915	0.911
				(1.818)	(2.059)	(2.045)
TaskAversiveness					0.594***	0.584***
					(0.182)	(0.195)
1.team						-0.0632
						(0.438)
/cut1	-5.207***	-5.806***	-4.948***	-4.047*	-1.603	-1.648
	(1.640)	(1.679)	(1.775)	(2.146)	(2.436)	(2.443)
/cut2	-3.112**	-3.668**	-2.764	-1.839	0.652	0.608
	(1.574)	(1.607)	(1.715)	(2.106)	(2.411)	(2.419)
/cut3	-2.429	-2.965*	-2.044	-1.117	1.411	1.368
	(1.561)	(1.593)	(1.704)	(2.104)	(2.415)	(2.421)
/cut4	-2.074	-2.601	-1.670	-0.739	1.816	1.774
	(1.553)	(1.583)	(1.698)	(2.100)	(2.415)	(2.420)
/cut5	-0.393	-0.877	0.0911	1.064	3.843	3.801
	(1.542)	(1.564)	(1.694)	(2.105)	(2.456)	(2.461)
/cut6	1.184	0.741	1.723	2.715	5.700**	5.655**
	(1.599)	(1.615)	(1.747)	(2.148)	(2.528)	(2.535)
Observations	92	92	92	92	92	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ordered logistic regression with postponing as dependent variable (DI02 and DI24)

VARIABLES	(1) postponing	(2) postponing	(3) postponing	(4) postponing
DI02	4.646	5.984	9.472	8.467
	(7.325)	(7.547)	(7.661)	(7.489)
DI24	-2.438	-1.434	0.840	-1.274
	(4.043)	(4.333)	(4.455)	(4.565)
1.Female		0.453	0.313	0.770
		(0.474)	(0.495)	(0.532)
age		0.0203	0.0330*	0.0526**
		(0.0177)	(0.0183)	(0.0212)
2.education		-0.738	-0.940	-1.503
		(1.700)	(1.800)	(2.053)
3.education		-0.456	-1.574	-1.926
		(2.029)	(2.119)	(2.248)
4.education		-1.619	-2.380	-2.564
		(1.709)	(1.814)	(2.070)
5.education		-1.101	-1.497	-1.945
		(1.593)	(1.680)	(1.906)
6.education		-2.014	-2.275	-2.340
		(1.716)	(1.781)	(2.085)
7.education		-3.151	-3.258	-2.974
		(2.030)	(2.132)	(2.367)
1.team			0.213	0.218
			(0.504)	(0.502)
TaskAversiveness			1.042***	0.893***
			(0.255)	(0.258)
ConscientScore				-0.691*
				(0.370)

NeurScore				0.521*
				(0.343)
/cut1	-3.533***	-4.225**	-2.000	-3.771
	(0.719)	(1.692)	(1.826)	(2.568)
/cut2	-0.993***	-1.570	0.808	-0.757
	(0.272)	(1.551)	(1.713)	(2.482)
/cut3	-0.341	-0.862	1.643	0.173
	(0.246)	(1.542)	(1.716)	(2.475)
/cut4	0.0751	-0.422	2.176	0.804
	(0.243)	(1.537)	(1.717)	(2.463)
/cut5	1.466***	1.030	4.022**	2.850
	(0.310)	(1.541)	(1.770)	(2.490)
/cut6	4.236***	3.839**	7.874***	6.665**
	(1.008)	(1.827)	(2.329)	(2.831)
Observations	69	69	69	69

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ordered logistic regression with postponing as dependent variable (DI02)

VARIABLES	(1) postponing	(2) postponing	(3) postponing	(4) postponing	(5) postponing	(6) postponing	(7) postponing
DI02	1.366	1.493	0.176	0.721	0.264	1.615	1.454
	(5.483)	(5.435)	(5.632)	(5.883)	(5.826)	(5.940)	(6.031)
1.Female		0.284	0.250	0.352	0.184	0.0780	0.431
		(0.402)	(0.405)	(0.444)	(0.461)	(0.463)	(0.486)
age			-0.0101	0.000792	0.00500	0.00669	0.0262
			(0.0119)	(0.0146)	(0.0149)	(0.0151)	(0.0175)
2.education				0.929	1.271	1.683	1.467
				(1.435)	(1.414)	(1.670)	(1.900)
3.education				1.183	1.455	1.216	1.478
				(1.802)	(1.731)	(1.915)	(2.103)
4.education				0.338	0.518	0.897	1.093
				(1.418)	(1.386)	(1.650)	(1.894)
5.education				0.606	0.758	1.263	1.241
				(1.334)	(1.297)	(1.574)	(1.788)
6.education				0.0641	0.141	0.977	1.202
				(1.371)	(1.335)	(1.610)	(1.891)
7.education				-0.838	-0.637	0.195	0.861
				(1.712)	(1.666)	(1.920)	(2.154)
1.team					-0.697	-0.0857	-0.0571
					(0.433)	(0.465)	(0.462)
TaskAversiveness						0.721***	0.604***
						(0.199)	(0.204)
ConscientScore							-0.633*
							(0.335)
NeurScore							0.497*
							(0.285)
/cut1	-3.275***	-3.122***	-3.504***	-2.778*	-2.989**	-0.466	-1.548
	(0.593)	(0.629)	(0.777)	(1.451)	(1.419)	(1.817)	(2.599)
/cut2	-0.939***	-0.777**	-1.154**	-0.371	-0.555	2.002	1.075
	(0.253)	(0.341)	(0.561)	(1.361)	(1.327)	(1.751)	(2.564)
/cut3	-0.337	-0.171	-0.548	0.263	0.0971	2.699	1.847
	(0.232)	(0.330)	(0.552)	(1.363)	(1.328)	(1.760)	(2.571)
/cut4	0.0108	0.177	-0.198	0.622	0.472	3.109*	2.323
	(0.229)	(0.328)	(0.549)	(1.362)	(1.327)	(1.765)	(2.571)
/cut5	1.389***	1.557***	1.187**	2.040	1.925	4.804***	4.180
	(0.284)	(0.373)	(0.570)	(1.378)	(1.341)	(1.821)	(2.612)
/cut6	2.945***	3.116***	2.750***	3.614**	3.516**	6.717***	6.114**
	(0.515)	(0.571)	(0.712)	(1.447)	(1.411)	(1.944)	(2.699)
Observations	81	81	81	81	81	81	81

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ordered logistic regression with postponing as dependent variable (DI24)

VARIABLES	(1) postponing	(2) postponing	(3) postponing	(4) postponing	(5) postponing	(6) postponing	(7) postponing
DI24	-2.420	-2.488	-2.413	-1.450	-1.681	0.370	-1.688
	(3.947)	(3.961)	(3.956)	(4.125)	(4.177)	(4.251)	(4.339)
1.Female		0.176	0.182	0.367	0.245	0.192	0.677

		(0.434)	(0.435)	(0.461)	(0.473)	(0.483)	(0.522)
age			-0.00495	0.0172	0.0207	0.0282	0.0476**
			(0.0128)	(0.0172)	(0.0175)	(0.0178)	(0.0206)
2.education				-0.504	-0.0406	-0.690	-1.139
				(1.668)	(1.710)	(1.770)	(1.976)
3.education				-0.328	0.0670	-1.380	-1.627
				(2.032)	(2.027)	(2.109)	(2.227)
4.education				-1.474	-1.166	-2.110	-2.169
				(1.701)	(1.719)	(1.802)	(2.030)
5.education				-1.047	-0.751	-1.380	-1.712
				(1.595)	(1.615)	(1.681)	(1.893)
6.education				-1.924	-1.704	-2.114	-2.027
				(1.714)	(1.727)	(1.778)	(2.059)
7.education				-2.995	-2.669	-3.001	-2.567
				(2.023)	(2.028)	(2.122)	(2.329)
1.team					-0.588	0.163	0.170
					(0.460)	(0.501)	(0.498)
TaskAversiveness						1.013***	0.869***
						(0.250)	(0.253)
ConscientScore							-0.758**
							(0.363)
NeurScore							0.483*
							(0.336)
/cut1	-3.530***	-3.431***	-3.603***	-4.273**	-4.283**	-2.116	-4.200*
	(0.718)	(0.757)	(0.878)	(1.697)	(1.702)	(1.826)	(2.545)
/cut2	-1.001***	-0.896**	-1.065*	-1.627	-1.618	0.662	-1.209
	(0.270)	(0.372)	(0.573)	(1.556)	(1.560)	(1.711)	(2.447)
/cut3	-0.357	-0.250	-0.420	-0.926	-0.902	1.484	-0.289
	(0.244)	(0.357)	(0.564)	(1.547)	(1.552)	(1.712)	(2.437)
/cut4	0.0533	0.159	-0.0106	-0.489	-0.451	2.015	0.341
	(0.240)	(0.354)	(0.562)	(1.542)	(1.546)	(1.714)	(2.424)
/cut5	1.487***	1.593***	1.424**	1.007	1.072	3.897**	2.430
	(0.308)	(0.406)	(0.594)	(1.545)	(1.550)	(1.764)	(2.446)
/cut6	4.248***	4.355***	4.186***	3.795**	3.881**	7.584***	6.100**
	(1.008)	(1.043)	(1.130)	(1.829)	(1.835)	(2.261)	(2.766)
Observations	70	70	70	70	70	70	70

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Ordered logit regression for task aversiveness

VARIABLES	(1) postponing	(2) postponing
TaskAversiveness	0.712***	0.708***
	(0.175)	(0.189)
age	0.0121	0.0122
	(0.0134)	(0.0136)
1.Female	0.269	0.266
	(0.409)	(0.414)
2.education	1.780	1.787
	(1.719)	(1.717)
3.education	1.145	1.153
	(1.954)	(1.954)
4.education	0.275	0.277
	(1.684)	(1.678)
5.education	1.288	1.289
	(1.653)	(1.646)
6.education	0.813	0.810
	(1.661)	(1.656)
7.education	0.0627	0.0634
	(1.940)	(1.934)
1.team		-0.0251
		(0.438)
/cut1	0.110	0.0873
	(1.803)	(1.839)
/cut2	2.244	2.221
	(1.775)	(1.812)
/cut3	2.952*	2.930
	(1.784)	(1.819)
/cut4	3.319*	3.297*
	(1.789)	(1.823)
/cut5	5.221***	5.199***
	(1.850)	(1.883)
/cut6	7.066***	7.044***
	(1.956)	(1.988)

Observations	92	92

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

E. OLS Regressions with robust standard errors

Linear regression without DI indices

VARIABLES	(1) amountsportsgap	(2) amountsportsgap	(3) amountsportsgap	(4) amountsportsgap	(5) amountsportsgap	(6) amountsportsgap
ConscientScore	-0.0894	-0.0994	-0.114	-0.185	-0.145	-0.151
	(0.111)	(0.117)	(0.119)	(0.154)	(0.151)	(0.147)
NeurScore	0.217**	0.212**	0.246**	0.240**	0.221*	0.232**
	(0.0902)	(0.0949)	(0.102)	(0.115)	(0.117)	(0.109)
1.Female		0.0616	0.0663	0.0954	0.0281	-0.0267
		(0.204)	(0.204)	(0.205)	(0.212)	(0.204)
age			0.00455	0.00102	0.000719	0.00342
			(0.00645)	(0.00665)	(0.00664)	(0.00710)
2.education				-0.596	-0.501	-0.388
				(0.384)	(0.378)	(0.392)
3.education				-1.548***	-1.590***	-1.463**
				(0.352)	(0.498)	(0.565)
4.education				-0.189	-0.115	-0.118
				(0.327)	(0.331)	(0.328)
5.education				-0.185	-0.119	-0.125
				(0.284)	(0.293)	(0.300)
6.education				0.0164	0.102	0.0415
				(0.347)	(0.359)	(0.375)
7.education				0.00506	0.111	0.0837
				(0.480)	(0.513)	(0.535)
TaskAversiveness					0.0997	0.0229
					(0.0838)	(0.0969)
1.team						-0.440*
						(0.240)
Constant	0.627	0.657	0.456	1.103	0.684	1.051
	(0.677)	(0.701)	(0.759)	(0.783)	(0.784)	(0.767)
Observations	92	92	92	92	92	92
R-squared	0.075	0.076	0.081	0.157	0.172	0.212

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Linear regression with robust standard errors DI02

VARIABLES	(1) amountsportsgap	(2) amountsportsgap	(3) amountsportsgap	(4) amountsportsgap	(5) amountsportsgap	(6) amountsportsgap
DI02	0.656	0.703	0.207	1.739	1.416	1.446
	(2.661)	(2.619)	(2.714)	(3.260)	(2.989)	(2.931)
1.Female		0.114	0.105	0.190	0.0571	0.0323
		(0.224)	(0.227)	(0.256)	(0.260)	(0.257)
age			-0.00559	-0.00640	-0.00355	-0.00368
			(0.00649)	(0.00772)	(0.00764)	(0.00773)
2.education				-0.607	-0.374	-0.331
				(0.413)	(0.469)	(0.416)
3.education				-1.787***	-1.627**	-1.663**
				(0.459)	(0.675)	(0.727)
4.education				-0.479	-0.383	-0.316
				(0.446)	(0.482)	(0.429)
5.education				-0.139	-0.0584	-0.00114
				(0.280)	(0.360)	(0.308)
6.education				-0.114	-0.0450	0.0469
				(0.341)	(0.416)	(0.386)
7.education				-0.424	-0.286	-0.171
				(0.386)	(0.461)	(0.452)
1.team					-0.491**	-0.408*
					(0.233)	(0.276)
TaskAversiveness						0.0782
						(0.107)
Constant	0.897***	0.831***	1.034***	1.299***	1.427***	1.138**
	(0.114)	(0.173)	(0.308)	(0.310)	(0.390)	(0.484)

Observations	81	81	81	81	81	81
R-squared	0.001	0.004	0.013	0.105	0.160	0.167

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Linear regression with robust standard errors DI24

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap
DI24	-0.618	-0.620	-0.652	-1.562	-1.756	-1.566
	(2.065)	(2.065)	(2.044)	(2.045)	(2.134)	(2.104)
1.Female		0.0993	0.105	0.198	0.0815	0.0597
		(0.243)	(0.243)	(0.267)	(0.269)	(0.265)
age			-0.00368	-0.00537	-0.00208	-0.00159
			(0.00700)	(0.00953)	(0.00945)	(0.00934)
2.education				-0.351	0.0432	-0.00632
				(0.433)	(0.455)	(0.451)
3.education				-1.637***	-1.339*	-1.463*
				(0.502)	(0.685)	(0.788)
4.education				-0.319	-0.0832	-0.121
				(0.444)	(0.440)	(0.441)
5.education				0.0219	0.275	0.241
				(0.290)	(0.308)	(0.320)
6.education				0.0394	0.242	0.212
				(0.448)	(0.440)	(0.421)
7.education				-0.302	-0.0323	-0.0314
				(0.490)	(0.508)	(0.510)
1.team					-0.479*	-0.409*
					(0.253)	(0.292)
TaskAversiveness						0.0707
						(0.119)
Constant	0.884***	0.826***	0.953***	1.080***	1.031***	0.847***
	(0.118)	(0.187)	(0.318)	(0.143)	(0.142)	(0.311)
Observations	70	70	70	70	70	70
R-squared	0.001	0.003	0.007	0.101	0.152	0.158

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
p<0.01, ** p<0.05, * p<0.1

Linear regression with robust standard errors DI24

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap	amountsportsgap
ConscientScore	-0.119	-0.146	-0.166	-0.223	-0.205	-0.207
	(0.139)	(0.148)	(0.152)	(0.196)	(0.195)	(0.194)
NeurScore	0.190	0.184	0.257*	0.238	0.220	0.225
	(0.119)	(0.125)	(0.131)	(0.163)	(0.171)	(0.175)
DI02	0.278	0.530	1.144	2.077	2.190	1.876
	(3.243)	(3.116)	(3.199)	(3.722)	(3.710)	(3.566)
DI24	-0.505	-0.534	-0.416	-1.746	-1.598	-2.000
	(2.145)	(2.098)	(2.179)	(2.183)	(2.203)	(2.332)
1.Female		0.198	0.211	0.313	0.275	0.209
		(0.262)	(0.262)	(0.262)	(0.266)	(0.266)
age			0.00853	0.00397	0.00415	0.00618
			(0.00798)	(0.0103)	(0.0102)	(0.0107)
2.education				-0.740	-0.712	-0.388
				(0.645)	(0.635)	(0.672)
3.education				-1.781***	-1.841***	-1.503**
				(0.587)	(0.648)	(0.715)
4.education				-0.476	-0.474	-0.262
				(0.558)	(0.559)	(0.601)
5.education				-0.214	-0.196	0.0206
				(0.513)	(0.528)	(0.544)
6.education				-0.0278	-0.0283	0.151
				(0.708)	(0.707)	(0.697)
7.education				-0.193	-0.177	0.0284
				(0.795)	(0.809)	(0.809)
TaskAversiveness					0.0577	-0.00900
					(0.104)	(0.120)
1.team						-0.428*
						(0.290)

Constant	0.871	0.905	0.465	1.178	1.008	1.142
	(0.889)	(0.931)	(1.008)	(0.952)	(0.964)	(0.956)
Observations	69	69	69	69	69	69
R-squared	0.068	0.077	0.091	0.197	0.201	0.236

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

F. Scatterplots as check for linearity