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Are Personality Traits Related to how Healthy Adults Adjust Their Decision-Making Strategies Under Varying Levels of Reward and Loss Controllability?

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Master's thesis in Psychology PSY-3900 – May 2022

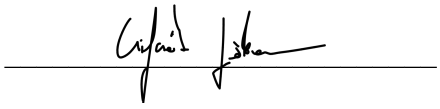
Foreword

To my supervisor, Associate professor Gábor Csifcsák. I remember two years ago; you were the only researcher that managed to impress me when I was choosing my theme for my bachelor thesis. Out of all, I experienced that you had the most enormous commitment to your research area. Despite feeling like the domain of decision-making was very complicated and hard to comprehend, I still went for it. When I delivered my thesis, I remember feeling so lucky and thankful that you ended up being my supervisor.

My interest for my master project started during the writing of my bachelor. I remember thinking I wish I could investigate how personality traits are related to how we adjust our decision-making strategies, and fast forward, here we are. This whole thesis is independent work done by me with supervision done by Gábor Csifcsák. I want to thank him for invaluable guidance on every aspect of this master thesis, and for being there for me every step of the way with either answering emails, overseeing my thesis and scheduling meetings. Last, I also want to thank my co-supervisor Mattias Mittner.

Celine Johanne Knapskog and Karen Sofie Ødegaard deserve gratitude for being amazing conversationalists who has provided me with tremendous amounts of motivational support throughout this process. Also, I want to thank Ina Klakegg and Anastasija Kuprejeva for the participation in developing our research design, and for their help with collecting participants. Without your effort we would not have finished the data collection as fast as we did.

Last, I want to thank my boyfriend Jørgen Haukeland, my family, and especially my parents Linda Therese Angen Andersen and Thomas Andersen for encouraging me to always do my best, work hard, and give me unconditional love. Your support has been extremely valuable throughout this master.



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Sammendrag

Forskning har foreslått et todelt system bestående av et Pavloviansk system og ett instrumentelt system når det kommer til menneskelig motivasjon i beslutningstaking. Disse påvirker hvordan vi responderer på trusler og belønninger i miljøet vårt, enten på en automatisk eller en saktegående måte. Menneske ser ut til å bruke, og, stole mer på den Pavlovianske verdivurderingen når kontrollerbarhet over hendelser i miljøet er svekket, til tross for at dette leder til feiltilpasset beslutningstaking. I denne studien forsker vi på hvorvidt personlighet er relatert til hvordan vi balanserer de to systemene og tar beslutninger under påvirkning av ulik grad av kontrollerbarhet. Til vårt kjennskap, har forskning ikke adressert dette domenet tidligere. Vi randomiserte friske voksne (N = 50) i 2 grupper og brukte en 5-blokk forsterkende læringsoppgave hvor vi manipulerte utfalls kontrollerbarhet i to av blokkene. Dette gjorde vi ved å presentere tilfeldige tilbakemeldinger uavhengig av responser ledsaget av lav belønning (30%) og høy tapsrate (70%). Manipulerte deltakere rapporterte lavere nivåer av opplevd kontroll og suksess, men manipulasjonen interfererte ikke kraftig nok med responsnøyaktigheten eller beslutningsstrategier (dvs. utfallet av Pavloviansk skjevhet) i ikke-manipulerte blokker. Men, når vi satt sammen de to datasettene fant vi en positiv sammenheng av Pavloviansk skjevhet og tendensen til å forfølge ønskede mål, samt utvikling av håpløshet i hverdagen vår. I tillegg, fant vi et negativt forhold mellom Pavloviansk skjevhet og tendensen til å oppsøke belønnende stimuli. Alt i alt, har studien funnet at personlighetstrekk kan påvirke hvordan vi styrer våre beslutninger under varierende nivåer av kontrollerbarhet.

Nøkkelord: beslutningstaking, Pavloviansk skjevhet, instrumentelt system, kontrollerbarhet og personlighet.

Abstract

Research suggests a dual-system theory of motivation on decision-making in humans, consisting of the Pavlovian and the Instrumental systems. These systems influence how we respond to environmental threats and rewards either in an automatic or in a more deliberate manner, and their interaction can either optimize or hinder decision-making. Importantly, humans seem to rely more heavily on their Pavlovian valuation when controllability over environmental events is compromised, even if this leads to maladaptive choices. In this study we investigate if certain personality traits are related to how we adjust our decision-making strategies under varying levels of outcome controllability. To our knowledge, no research has addressed this domain. We randomized healthy adults (N = 50) into 2 groups and used a 5-block reinforcement learning task where we manipulated outcome controllability in two blocks, by presenting random feedback irrespective of responses, accompanied by a low reward (30%) and high loss rate (70%). Manipulated participants reported lower levels of perceived control and success, but our manipulation did not interfere robustly with response accuracy or decision-making strategies (i.e., the magnitude of Pavlovian bias) in non-manipulated blocks. Importantly, when merging the dataset with another one, we found a positive relationship between the magnitude of Pavlovian bias and the tendency to pursuit desired goals and develop hopelessness in everyday life. Also, we found a negative relationship between Pavlovian bias and the tendency to approach rewarding stimuli. Overall, our study revealed that certain personality traits can determine how we govern our choices under varying levels of controllability.

Keywords: Decision-making, Pavlovian bias, instrumental system, controllability, personality.

Are Personality Traits Related to how Healthy Adults Adjust Their Decision-Making Strategies Under Varying Levels of Reward and Loss Controllability?

Making decisions is a big part of our everyday lives and thus inevitable and crucial for our well-being. Ernst and Paulus (2005) suggest that decision-making is a three-stage process consisting of evaluating: 1. options, 2. actions and 3. outcome. The evaluation of these three stages have been linked to the influence of a person's personality and feeling of control (Brand et al, 2008; Ly et al., 2019). We guide these behaviors through different neural systems, namely the Pavlovian system and instrumental systems. The Pavlovian system is primarily responsible for reward-approach and punishment-inhibition patterns, while instrumental systems are based on learning via trial-and-error, where any stimulus and outcome can be associated with any response (Csifcsák et al., 2020; Dorfman & Gershman, 2019; Ousdal et al., 2018). Research has suggested that in situations with reduced or no control over environmental events, we rely more on our Pavlovian system. In contrast, in situations with control, people will rely more on instrumental learning systems (Dorfman & Gershman, 2019). However, the question whether inter-individual differences in personality traits influence how we react in situations with or without control remains unclear, even though intuitively this seems obvious as not everyone reacts the same way to uncontrollable stressors (Cemalcilar et al., 2010; Vollrath, 2001). We assume that certain aspects of human personality are related to how we regulate the choice between Pavlovian vs. instrumental response strategies in situations with reduced control. In the present research we will try to uncover if certain personality traits are crucial for how healthy people make value-based decisions in situations with or without control. The aspects of personality being focused on are 1. our attitude to act upon reward and withdraw from punishment, 2. our tendency for developing feeling of hopelessness and low control, 3. attitudes to seek cognitively

challenging and conflicting situations that demand mental effort and require the implementation of cognitive control. This research will merge data from my bachelor thesis with data from this master thesis to assess personality correlates of performance change.

Pavlovian vs. Instrumental systems in decision-making

Contemporary research has made a distinction between two systems that governs our behavioral responses, namely the Pavlovian system and the instrumental system. These two systems help us in our everyday lives through different associative patterns (Rangel et al., 2008). The instrumental system is controlling our behavioral responses based on either stimulus-action or action-outcome associations, that are associated with the habitual and goal-directed systems, respectively both being regarded as instrumental. The Pavlovian system controls our behavioral responses based on stimulus-outcome associations (Dorfman & Gershman, 2019; Huys et al., 2011; Ousdal et al., 2018; Rangel et al., 2008). Contrary to the instrumental system, the Pavlovian system does not directly map actions to either stimuli or outcomes. This means that the once the Pavlovian systems understands that a stimulus is rewarding or might be rewarding, a stimulus-outcome association becomes learnt. When this association is learnt, the Pavlovian system governs approach actions towards that stimulus to harvest rewards (Rangel et al., 2008). This behavioral tendency is by Csifcsák et al. (2020) referred to as “Pavlovian Performance Bias in action selection” (PPB).

The Pavlovian and instrumental behavioral systems are evolutionary beneficial in both similar and different ways. The Pavlovian system helps us with acting or suppressing actions quick and cost-efficient in situations we do not have time to evaluate. This system produces behavioral tendencies to helps us with promoting approach actions towards rewarding-predicting stimuli and avoidance actions against punishment-predictive stimuli (Csifcsák et

al., 2020; Dorfman & Gershman, 2019). Because of this, the Pavlovian system is evolutionary beneficial as it can help govern our actions in situations we are not familiar with our not able to evaluate (Csifcsák et al., 2020).

The instrumental learning system is more complex than the Pavlovian system because it learns reward expectations of both stimuli and actions, and not only as a function of stimuli. In more detail, the instrumental system will map actions to either stimuli or outcomes based on recent reinforcement history (e.g., which actions in which contexts were followed by favorable/unfavorable outcomes in the past). Because of this, the instrumental system can capture all the patterns the Pavlovian system can capture, in addition to all the ones it cannot capture. This behavioral system makes us more robust in situations where the Pavlovian system fails (e.g., situations with low controllability), or possibly hinder optimal decision-making. Because of this, it is more slow-working and requires more cognitive effort compared to the Pavlovian system (Csifcsák et al., 2020; Dorfman & Gershman, 2019).

Maladaptive Decision-Making

The ability to balance between the Pavlovian vs. instrumental systems is generally not a problem for most people, however, for some it can be challenging. The bidirectional interactions between these two systems are very evident when the automatic Pavlovian responses interfere with the instrumental task requirements (Csifcsák et al., 2019; Huys et al., 2011). These behavioral tendencies can hinder participants performance under several different circumstances with a big chance of leading to conflict in decision-making (e.g., approaching a rewarding stimulus for short-term satisfaction, when the long-term goal is to avoid these stimuli). If these tendencies are prominent, it would be beneficial to suppress PPB via exerting top-down executive control to guide optimal choice behavior. In other words, one

should recruit cognitive control to hinder wrong/negative behavioral responses in decision-making under conflict situations (Csifcsák et al., 2019). These decision-making responses where Pavlovian influence of instrumental responses is called maladaptive decision-making and happens in our everyday life. This tendency can lead to psychopathology and is related to several different clinical conditions, such as depression, anxiety, and substance use disorder, either with increased avoidance behavior from otherwise harmless situations, or strong urges of reward seeking (Csifcsák et al., 2020; Day & Carelli, 2007; Martin-Soelch et al., 2007; Saunders & Robinson, 2013).

Controllability

During the last couple of years research has investigated the effect of intermittent absence of control over rewards and losses in decision-making. It has been highlighted that when balancing between the Pavlovian and instrumental system during decision-making, controllability is a key factor when it comes to our behavioral responses (Csifcsák et al., 2020; Dorfman & Gershman, 2019; Moscarello & Hartley, 2017; Pulcu & Browning, 2017).

Objective and Perceived Control

The two systems can be viewed as predictive models of behavior; however, as mentioned they are learned through different associative patterns and affected by controllability. When talking about the importance of control, it is crucial to separate between objective control and perceived control. Defined by Ly et al. (2019) perceived control is “the belief in one’s ability to exert control over situations or events”, while objective control is “the actual existence of action-outcome contingencies” (Ly et al., 2019, p. 1). For example, during an exam, students can feel confident the exam questions are answered correctly (i.e., high perceived control), but they get a bad grade regardless (i.e., meaning they

had low objective control). Interestingly, these two types of control affect our decision-making (balance between the Pavlovian and instrumental system) in different ways and can be viewed as predictive models of reward (Guitart-Masip et al., 2012; Ly et al., 2019). It is thought that in situations where rewards are sufficiently controllable the instrumental predictor will be favored over the Pavlovian predictor. However, when actions do not affect reward rate; if rewards are uncontrollable, the simpler and automatic Pavlovian predictor will be favored. The reason for the Pavlovian predictor being more adaptable in these uncontrollable situations is because the instrumental predictor does simply not pay off without controllable outcomes, in other words, it is pointless (Dorfman & Gershman, 2019).

The Power of Perceived Control

Perceived control is an important topic in decision-making because it is said to be more powerful than objective control in predicting behavioral responses (Ly et al., 2019). This means that perceived control, without any objective control, is enough to increase arousal and govern our behavioral responses (Fujiwara et al., 2013; Ly et al., 2019; Teodorescu & Erev, 2014). In other words, healthy individuals' perceived control can create an illusion of being in control without having objective control. On the other hand, having objective control but lacking perceived control can influence our future instrumental responding. It is still unclear what drives how agents perceive controllability (so that they can either judge it adequately or over/underestimate it), but while it seems that contingency between actions and outcomes is most important, some studies showed that other factors such as reward/loss frequency might be just as important. And, with low controllability in line with high reward rate, it might be easier to develop an illusion of control, which can result in maladaptive choice strategy (Ly et al., 2019; Teodorescu & Erev, 2014).

Learned Helplessness

Research has studied how punishment has affected perceived controllability, and further, how low perceived control can lead to maladaptive behavioral patterns that are especially common among patients with anxiety and depression (Ly et al., 2019; Teodorescu & Erev, 2014). These patients usually have the experience of low to a total loss of perceived control even with the presence of objective control. One of these maladaptive behavioral tendencies effected by low controllability is called learned helplessness (LH), which is described as an underlying automatic response, present in most situations, and leads to diminished instrumental responding (Csifcsák et al., 2020).

Animal Lab-Models of Learned Helplessness

Previously, research investigated this behavioral phenomenon of LH with animals such as dogs. They induced them with electrical shocks in addition to having no ability to escape. Later, they were induced again but had the ability to escape. Due to previous experience, they now think that they have no effect on the outcome (low perceived control), even though they do (presence of objective control). These past experiences result in passive behavior when it comes to trying to escape the shocks in the future (Maier & Seligman, 2016). Thus, the effect of having objective control but no perceived control is key to understanding different psychological disorders related to learned helplessness (Ly et al., 2019). For example, people with anxiety or depression often tend to suffer from learned helplessness, because they experience low perceived control that ultimately governs their decision-making (e.g., less exploratory behavior), and this happens in most situations even though it is not beneficial for oneself (Ly et al., 2019; Teodorescu & Erev, 2014). The reason for this might be because Pavlovian bias involves inhibition/passivity in aversive situations and is stronger

under low controllability. Because of this, it is proposed that learned helplessness is a manifestation of strong Pavlovian bias that might have been triggered by uncontrollable and aversive series of events or an event (Csifcsák et al., 2020; Ly et al., 2019). However, Pavlovian bias in these situations is not necessarily maladaptive, but it can become generalized and because of that, Pavlovian bias can dominate longer and thus be present in new situations with higher objective controllability (but persisting underestimated control/subjective helplessness). In such situations, Pavlovian bias will lead to impaired performance/coping (Ly et al., 2019). The over-employment of the Pavlovian predictor is hard to control because people with learned helplessness tend to think that nothing they do affect the outcome, engaging in instrumental responding is thus thought to only demand energy for no use (Ly et al., 2019; Maier & Seligman, 2016).

Human Lab-Models of Learned Helplessness

Despite the well-established animal model of LH, human lab-models are not available. One recent approach to investigate LH in humans is the orthogonalized Go-NoGo task combined with a controllability manipulation that involves presenting completely random outcomes to participants without warning, and thereby, dissociating actions from subsequent rewards and losses (Csifcsák et al., 2020). This task is a card game consisting of winning and avoid cards where you must actively pick up or avoid cards to gain points through several blocks of the task. In this task one can negatively manipulate the win rate on the cards to make the participants experience low perceived control. The idea is that in these blocks low perceived controllability will lead to switched choice behavior, which in some respects can resemble LH (e.g., such as stronger PPB). In the paper by Csifcsák et al. (2020) it is proposed as mentioned earlier, that when a person is affected by LH, the Pavlovian system tend to override the instrumental system. If experiencing threats, it

increases the likelihood of adapting LH, in other words referred to as "punishment-based suppression" (Csifcsák et al., 2020; Maier & Seligman, 2016). This happens automatic, even though it leads to maladaptive decision-making (e.g., non-exploratory behavior). In such cases, participants are more likely to give up (i.e., engage in staying passive and have more NoGo-responses) (Csifcsák et al., 2020).

Research on this topic is important, because we need more information on how intermittent absence of control over rewards and losses effect our decision-making strategies and how we balance between our instrumental system and Pavlovian systems. If we can gather scientific evidence for this matter, it would be of valuable use when treating and maybe also preventing the development of different mental disorders that these behavioral tendencies are a part of (e.g., depression and anxiety). More information on two of the studies conducted by Csifcsák and colleagues in both 2020 and 2021 can be found later (Csifcsák et al., 2020; Csifcsák et al., 2021).

Inter-Individual Differences

Research on behavioral decision-making is primarily focusing on how and why people make choices. The agreement on the two fundamental human motives that can be viewed in line with the Pavlovian system, is our desire to reduce and avoid unpleasant happenings and the desire to obtain pleasure and comfort (Csifcsák et al., 2020; Dorfman & Gershman, 2019; Ousdal et al., 2018; Threw, 2011). However, researchers should expand the research domain of decision-making that are under-explored, such as the role of personality. Thus, this master thesis will take a deep dive into how people perceive controllability, react to low control and/or changes in reward/loss frequency, and last, if the balance between Pavlovian and instrumental responding might be influenced by personality traits.

Behavioral Inhibition System and Behavioral Activation System.

Threw (2011) organized human behavior into two fundamental motivational principles, that is, our wish to approach positive outcomes and avoid negative outcomes. The theory of approach and avoidance is often mentioned in association to psychopathology, but it is just as relevant within the domain of normal psychology (Jasko et al., 2015; Threw, 2011). To uncover the personality aspect of approach and avoidance behavior, research on the behavioral inhibition system (BIS) and behavioral activation system (BAS) is perhaps the most widespread (Carver & White, 1994: Cognswell et al., 2006; Gray, 1970).

The two systems represent discrete structures of our nervous system in regards of involving brain regions and pharmalogical. They are also expected and presumed to be orthogonal, meaning they are different, and individuals will have different levels of the two systems and their combinations in the population (Gray, 1987; Quay, 1993). The BIS, also called the aversive motivational system, controls reactions to new, ambiguous, or conflicting stimuli (e.g., situations with potential threats). This system is thus responsible for the response in these situations (e.g., anxiety), which further helps us with increasing attention and arousal making us more likely to stop or inhibit what we are currently engaged in (Carver & White, 1994; Franken & Muris, 2005; Kim & Lee, 2011; Suhr & Tsanadis, 2007). The BAS, also referred to as the appetitive motivational system, controls reactions to rewarding situations such as our reward seeking, impulsive and goal-oriented behavior and is divided into three subscales. The subscales are “drive”, “reward responsiveness” and “fun seeking”. BAS-drive measures the motivation a person has towards their goals, BAS-reward responsiveness measures a person’s sensitivity to comfortable/pleasant reinforcers in one’s environment, while BAS-fun seeking measures the motivation

to harvest/collect rewards spontaneously (Carver & White, 1994; Gray, 1982; Suhr & Tsanadis, 2007).

Activation of the BIS and BAS systems has been related to a variety of different psychiatric disorders such as anxiety (high BIS) and depression (low BAS) (Carver & White, 1994; Gray, 1982). According to Gray´s neuropsychological theory of personality, it has been proposed that in general, people with high BAS are more sensitive to reward signals, and last, people with high BIS are more sensitive to punishment signals (Gray & McNaughton, 1996). Overall, these two systems help us govern our future actions in different settings and is thought to be affected by our previous experiences with reward and punishment (Franken & Muris, 2005). In respect, one can assume that Pavlovian bias can be related to both BAS and BIS. Because of the use of both reward and punishment in the orthogonalized Go/NoGo test, it is hypothesized that BIS/BAS scores mediate the participants' level of PPB throughout the task.

Beck's Hopelessness Scale

Hopelessness is closely related to BIS/BAS when it comes to psychopathology such as depression and anxiety. We measure people's level of hopelessness with Beck's Hopelessness Scale (BHS) (Beck et al., 1974; Kocalevent et al., 2017). Hopelessness is a clinical symptom present in clinical disorders and is explained to be an important component of depression. Even though the feeling of being hopeless about the future is not bound to be present among depressed patients, it is often a prominent feeling that is usually experienced (MacLeod et al., 1993; Steed., 2001). Hopelessness is described in more detail by Shea and Hurley (1964) as a feeling that whatever you do to change something is not going to affect the outcome before even attempting. As a result of this, hopelessness can be related to low

perceived controllability and exploration, so negative future outcomes are perceived to be outside the scope of one's influence. This can explain why this term, in addition to learned helplessness, are highly relevant in clinical disorders and might lead to suboptimal decision-making and less exploratory behavior in ambiguous situations (Shea & Hurley, 1964).

Need For Cognition

Need For Cognition (NFC) is considered a personality trait related to mental effort/executive control, which can be important to overcome generalization of strong PPB (and low accuracy on conflict cards) after manipulated blocks (low controllability) in our task. NFC got to light through Cacioppo and Petty´s (1982) proposal that humans have stable individual differences when it comes to people's tendency to enjoy and engage in activities that demands cognitive effort. As peoples need for cognition increase, they engage in more "thinking" activities. These thinking activities involve seeking thoughts on both occurring and past experiences. Scoring high on this trait means they tend to be more independent, engaged in what they are doing and little effected by biases. They also tend to have a more positive attitude or mindset towards stimuli (e.g., difficult tasks and technology) that requires more cognitive effort, reasoning and problem-solving (e.g., exams; Cacioppo et al., 1983). In addition, they seem to have broader knowledge in these topics of interests, in addition to having better performance in these activities compared to other people. When it comes to stimuli that are non-intellectual such as sports, they seem to have more of a comparable attitude. In general, scoring high on this trait is positively correlated with openness (exploratory behavior), and further, leads to a behavioral tendency of being more effective at problem-solving and more knowledgeable (Cacioppo et al., 1983; Cacioppo & Petty, 1984; Fleischhauer et al., 2010). In contrast, people who score low on this trait is more likely to rely on others (e.g., experts or role models; non exploratory behavior) and more affected by biases

and social comparisons. They seldom engage in cognitively demanding activities unless it is expected of them (e.g., school exam; Cacioppo et al., 1996; Cacioppo & Petty, 1984; Cacioppo et al., 1983).

The knowledge on behavioral tendencies related to peoples NFC score is highly relevant when exploring people's tendency to either stay passive or engage in exploration when trying to overcome conflict. Thus, it is important within the present research of decision-making, and more specifically related to the cognitive control one must engage in to suppress the Pavlovian bias in conflict trials in our decision-making task. In this respect, NFC might be negatively associated with BHS, so that under low outcome controllability, participants with high NFC would be expected to be more persistent and implement cognitive control instead of giving up and relying more heavily on PPB.

Previous Studies on the Pavlovian System Using the Go/NoGo Task

In order to study the balance between the Pavlovian and instrumental system the orthogonalized Go/No-go task is the most widespread one (Guitart-Masip et al., 2012).

Nine Blocks Go/NoGo Task

Csifcsák et al. (2020) used this task when trying to research how our choice behavior is affected by these two behavioral systems in situations with intermittent absence of control. Their task had nine blocks in total with four different cards in each block. The number one rule is to harvest as many points as possible through trial-and-error by either picking up a card or staying passive. There are two types of cards, winning cards or avoid cards and the participants job is to figure out which one is which and pick up and stay passive one the right ones. To pick up a card, also called go response, one must press a button.

To assess if people are governed by their Pavlovian system or their instrumental system the task has separated the cards into either Pavlovian congruent or incongruent. The Pavlovian congruent cards represent Go-to-win points and NoGo-to-avoid losing points. In contrast, incongruent cards foster a Pavlovian conflict forcing the instrumental system to become more dominant to get the correct response. These cards are NoGo-to-win points and Go-to-avoid losing points. These behavioral tendencies required to perform in a correct manner for the Pavlovian incongruent cards is not something that is automatic and natural, because of this it requires cognitive effort to learn.

Results. The results from this study showed that participants that could not rely upon their instrumental choices in several parts of the game had a more prominent Pavlovian bias compared to the ones who had control throughout the task. These where however mostly participants that experience intermittent absence of control (IAC) over rewards and losses (Csifcsák et al., 2020). This concludes that IAC indeed leads to stronger Pavlovian Bias, even though there was no transfer affect (not worse accuracy and not worse perceived controllability) in "normal blocks" with high controllability levels (Csifcsák et al., 2020). These results are in accordance with previous studies (Dorfman & Gershman, 2019; Maier & Seligman, 2016).

Two Blocks Go/NoGo Task

Later, Csifcsák et al. (2021) introduced the same exact task with the same conditions as the 2019 study, but with only 2 blocks instead of 9, and included transcranial direct current stimulation (HD-tDCS) above the medial prefrontal cortex (mPFC). Even though the results revealed stronger PPB with reduced control, the effect was not very strong, and was accompanied with the illusion of control (preserved subjective controllability despite the absence of objective controllability). The authors argued that their controllability manipulation

was probably not robust enough for the participants to detect it, and therefore, it was accompanied by illusions of control, which could not alter choice strategies robustly (Csifcsák et al., 2021).

Five blocks Go/NoGo Task

The previous paradigm was not good enough to induce behavioral alternations resembling LH. This is because the intermittent absence of control did not affect the participants decision-making with increased PPB in normal blocks, nor did they report that they felt a loss of control (Csifcsák et al., 2020). Because of this, my bachelor study (yet unpublished; Angen, 2020) tried to implement some changes to the controllability manipulation. The bachelor study used a modified version of the orthogonalized Go/NoGo task to study how controllability effects our decision-making strategies. We invented a new 5-block version for the bachelor thesis, where we manipulated not only control, but following Ly et al. (2019) and Teodorescu & Erev (2014), we also added low reward/high loss frequency to avoid the illusion of control and therefore, to induce a stronger reduction in performance under Pavlovian conflict (Angen, 2020).

We tried a stronger manipulation procedure to induce participants with the feeling of low perceived control that potentially could lead to a transfer effect from the manipulated blocks (i.e., 2 and 4) to the normal blocks (i.e., 3 and 5) of maladaptive decision-making, even though participants in these blocks have regained control. The manipulation is a standard response-feedback contingency of 70/30% correct/incorrect responses in the normal blocks. In manipulated blocks, participants were either getting "positively manipulated" (i.e., getting more positive feedback regardless of actions) or "negatively manipulated" (i.e., getting more negative feedback regardless of actions). Also, we added the "go-cost" (-1 points) for each time

a participant picks up a card. The rationale for introducing the go-cost was that it will modify neutral outcomes and reduce wins and increase losses by -1 points. This was for the purpose of trying to promote behavioral tendencies resembling learned helplessness, which would be reduced exploratory behavior and staying passive (Angen, 2020).

Results. The results from this study (Angen, 2020) showed that IAC had an impact on subjective ratings in the manipulated blocks, because people rated their success and control low if they were negatively manipulated and high if they were positively manipulated. Further, we saw that decision-making strategies in the negatively manipulated group was affected in a way where PPB was heavily modulated by reward rate, with a transfer effect onto block 3. Last, there was worse performance under Pavlovian conflict for the negatively manipulated participants. We concluded that the absence of outcome controllability induces subjective feelings of loss of control, and increases a generalized, maladaptive PPB when it is accompanied by low reward and high loss rates. In this respect, the negative manipulation protocol was found to be more potent in inducing behavioral patterns resembling LH (Angen, 2020).

The Present Master Study

In this master study I investigated the effect of personality on how healthy adults respond to intermittent absence of control over rewards and losses during decision-making. The task is inspired by the orthogonalized Go/NoGo task used in the previously conducted study by Csifcsák et al. (2020, 2021), and is the same as in my bachelor study (Angen, 2020). However, there are some details that are different in the current study compared to the bachelor study, that is: warm stimulation, no-response screen, no go-cost

(more detailed later). The negative manipulation protocol can be regarded as a human lab-model for learned helplessness.

The aims of this thesis are twofold: first, replication of bachelor effects on a new sample, and second, merging two data sets, one from the bachelor study and one from the master study to check for personality correlates.

First aim

The aims of this thesis are twofold: my first aim is using a slightly modified paradigm but keeping the "negative manipulation" from the bachelor identical, I wish to replicate the bachelor effects on a new sample. This is done by comparing success, control, accuracy and PPB to a control group (no manipulation of control or feedback rates) in the new sample. The reason for this is to check if the negative-manipulation protocol is effective.

Hypotheses. Hypotheses for the first part of this thesis are 1. the participants in the manipulated group will report their perceived level of Control and Success lower in the manipulated blocks compared to the control group, 2. Participants will have a reduction in Accuracy in block 2-5, 3. Participants will have higher accuracy on congruent cards versus incongruent cards, 4. PPB will increase in block 3 and 5 as a manipulation affect for the manipulated group.

Second aim

In the second aim of this thesis, I have merged the "negative manipulated" data from the bachelor with the "negative manipulated" data from the master in order to get a larger sample size and increase statistical power. This is done for the purpose of investigate personality correlates of performance change for the "negative manipulated" participants. These

personality traits are about 1. our attitude to act upon reward and withdraw from punishment (BIS/BAS), 2. our tendency for developing feeling of hopelessness and low control (BHS), 3. attitudes to seek cognitively challenging and conflicting situations that demand mental effort and require the implementation of cognitive control (NFC).

Hypotheses. The hypotheses for the second part of this thesis are 5. Participants with higher BIS/BAS scores having higher PPB in general, 6. People who score high on NFC will explore the environment more in challenging situations, such as manipulated blocks. Thus, they are expected to show less increase in PPB during these blocks, 7. Expect higher BHS to be related to higher PPB because they are thought to give up rather easily instead of trying when there is a conflict, due to generalized perceived low control.

Master and Bachelor Study Differences

Because of the thesis previously mentioned two aims, it is important to highlight some of the differences in the bachelor and master study that could have influenced the data.

In my bachelor study we tracked pupillary responses in addition to the card game. Also, the study had a go-cost (-1 point), for the purpose of promoting key features of learned helplessness, like behavioral passivity and reducing the chances of active exploration. Last, this study had a forced delay to the responses, meaning the participants had to wait with active responses until after the card was shown, when a cross appeared on the screen (Angen, 2020).

The Master study was conducted by three master students all collecting different aspects of the gathered data for their thesis. This study had a pain aspect to it, but this master thesis will only include the control group and the negatively manipulated group that was not experiencing pain. These participants only experienced warm stimulation as a control

intervention to the pain groups. The go-cost was excluded, and it was added speeded responses. Contrary to the bachelor study, this means the participants had to respond while the card was on the screen and not after. All details about the differences from my bachelor study and master study can be visually seen in Appendix A.

Method

Participants

The study investigated the effects of personality, controllability manipulation and experimental pain induction on task performance (response accuracy and Pavlovian Performance Bias). Based on a priori power analysis (G*Power, version 3.1.9.2), the critical interaction between within- and between-subject factors (i.e., task block * manipulation) in a repeated-measures ANOVA with a mild-to-moderate estimated effect size (Cohens f = 0.25), 90% statistical power and 5% Type-1 error rate, we determined to collect data from 100 participants in total (25 participants per group).

Participants were randomly recruited at the University of Tromsø and randomly divided into 4 experimental groups, out of which, data from 2 experimental groups are analyzed in the current thesis. For the first part of this thesis, the participant in the control group and "negative manipulated" group that underwent warm stimulation (42 degrees Celsius) are included (34 female, age: N = 50, *M* = 21.8, *SD* = 2.4), and the participants that underwent pain stimulation are excluded. For the second part of this thesis, the "negative manipulated" participants from both the bachelor and the master study were merged (32 female, N = 56, age: *M* = 22.1 *SD* = 2.18).

All participants in the data analysis passed the inclusion criteria (Appendix B), which was no neurological disorders (anxiety, depression, bipolar disorder, epilepsy, migraine, head

injury etc.), not previously taken part in the same task (orthogonalized Go/NoGo), enough sleep on the night before the experiment, not taken any pain medication the same day as the experiment and not affected by any psychoactive drugs (alcohol and narcotics).

Experimental Design

The experiment was double-blind meaning the experimenter and participants were unaware of group-membership, in addition, the participants are unaware of the existence of groups. The detailed study protocol was approved by REK and the Institutional Ethics Committee of the Department of Psychology, UiT-The Artic University of Norway, and complied with the Declaration of Helsinki (Appendix C).

Materials

Orthogonalized Go/NoGo Task. Since the primary aim of the research is to investigate if there are inter-individual differences in how healthy adults react to controllability over rewards and losses during decision-making, we used the orthogonalized Go/NoGo task which is a computerized card game. This task is separated into 5 blocks that last for 7.5 minutes each, out of the 5, blocks 2 and 4 were manipulated (see Appendix D for block manipulation details). For each block there are 4 different cards being shown in a random sequence, one at a time, and the point is for the participant to figure out which cards to pick up and which cards to withhold from. Every block has its own rules to which condition the cards belong. The cards can either be winning cards or avoid cards. Both cards can end in two outcomes, the win cards can either be “win” or “no win” (10 or 0 points), and for the avoid cards, the outcome can either be “losing” or “not losing” (-10 or 0 points). The purpose of the game is to earn as many points as possible by trial-and-error. It is done so by emitting active responses (key press) to certain card stimuli and withhold them for others (for

visual explanation, see Appendix E). The card game was run on a Dell computer with the PsychoPy software (Pierce, 2007).

Cards. We used 24 cards in total, 20 was used in the main task distributed into the 5 blocks (5 blocks x 4 cards in total), and the remaining 4 was used in the practice session. The cards have all different combinations of character from the alphabet, color, and symbols (Appendix F). The cards are assigned to one of the four different experimental conditions differently for each block. The conditions ("Go-to-Win", "NoGo-to-Avoid", "NoGo-to-Win" and "Go-to-Avoid") are separated into either "Pavlovian-congruent" or "Pavlovian-incongruent" cards. The Pavlovian-incongruent cards are thought to induce Pavlovian conflict and thus it demands more cognitive control relative to the Pavlovian-congruent cards to be able to make the correct response. The Pavlovian-congruent cards are the "Go-to-Win" and "NoGo-to-Avoid" because these responses make sense to our Pavlovian system, we approach rewards and avoid threats. The Pavlovian-incongruent cards are thus the "NoGo-to-Win" and "Go-to-Avoid". The points received from the cards are either 10, 0 or -10 (for visual explanation, see Appendix G).

In the master study, the go-cost is not included as it was in the bachelor study. The main reason for the removal of the go-cost is that we realized that even though participants in the manipulated group was manipulated in two blocks, the presence of the go-cost provided a small amount of control for the participants in outcomes (-1 point when performing a Go response), and therefore, controllability is not completely absent. Therefore, now we removed it in hope that this will make the manipulation procedure more efficient. All other details were the same as in the EEG study and the bachelor study (Angen, 2020; Csifcsák et al., 2020).

Procedure

The data collection was at The Artic University of Tromsø scheduled for one day, and to last for approximately 1,5 hours. The participants were told to receive a gift card worth 300 kroner when they have successfully completed the experiment. In addition, they were told that if their task performance exceeds a predefined threshold and performance were satisfactory, they would receive an additional 100 kroner, and thus, a total of 400 kroner all together. Before the experiment started each participant read the information sheet and signed if agreed to the inclusion criteria (see Appendix B). The experiment involves a computerized card game, evaluation tasks and answering mood and personality questionnaires.

Positive and Negative Affect Schedule

After reading the information and signing the informed consent they completed the Norwegian version of the Positive and Negative Affect Schedule (PANAS) to assess their momentary mood. We had two PANAS schedules in the beginning of the experiment, one called the PANAS-Present-1 asking about their mood right now, and PANAS-Past asking about their mood in the past 30 days. The data from the PANAS questionnaires will not be analyzed or discussed further in this master thesis.

Practice Task

First, they read information regarding the concept and rules of the card game (details about the information sheet, see Appendix H). After this, they did a practice task which is a short mini version of the actual orthogonalized Go/NoGo task.

Quiz

A quiz with questions regarding the practice task to check if they understood the concept and rules of the task (Appendix I). Quiz items that were wrongfully answered were further discussed until the participant fully understood it.

Heat Stimulation

The participants included in this master thesis received non-painful heat stimulation, aiming to induce warm skin sensation only (42 degrees Celsius) in block 2 and 4 with a Medoc PATHWAY model CHEPS (contact heat-evoked potential stimulator, Medoc Advanced Medical Systems, Israel). Before the experiment started, we performed a pain tolerance test. This was a procedure that had a purpose in the pain group but had to be done for experimental purposes for the control group only, and thus will not be further discussed. In total, the heat thermode was placed in one out of two different places for each block, starting randomly either at the proximal or distal area of their underarm (Appendix J).

Main Task

The primary aim of this study is to investigate the inter-individual differences and controllability on decision-making. To be able to do so we use the orthogonalized Go/NoGo task ran on a Lenovo computer with the PsychoPy 2 software (Pierce, 2007).

Evaluation Task

At the end of each block, two questions had to be answered. We used a visual analogue scale to rate between 0 to 100 their success and control score. The control score was to which degree they felt they could control the outcomes by choosing the appropriate response at each card trial, and the success score was to which degree they felt successful in collecting points.

In addition, after block 2 and 4 (manipulated blocks) they had to answer two more questions regarding their experienced “mean” and “peak” pain in these blocks. Data from these pain ratings are of no relevance to the current study and will not be further discussed.

Questionnaires

Last, the participants were given four different questionnaires to answer, PANAS-Present-2, BIS/BAS, BHS, and NFC.

The PANAS-Present-2. Asking about their mood “right now”, following the end of the main task.

BIS/BAS. It is a self-report questionnaire with 24 items that measures personality attitudes towards approach versus avoidance behavior in appetitive and aversive situations, respectively. The participants respond to each item from 1 (i.e., very true for me) to 4 (i.e., very false for me). Factor analysis has led to four subscales from this scale. One subscale corresponds to the BIS and has seven items that contributes to this score (e.g., criticism), however the remaining three subscales corresponds to BAS and its three components drive, reward responsiveness and fun seeking. There are four items each contributing to the drive score and reward responsiveness score, whereas there are five items that contributes to the fun seeking score. The BIS/BAS questionnaire can be seen in Appendix K.

BHS. Measures people’s tendency to become or feel hopeless in different real-life situations, with 20 dichotomous items that either can either be answered true or false depending on the persons agreement to the personal statement of behavioral tendencies. The items are separated into three aspects of hopelessness, that are; feelings related to the future, expectations, and loss of motivation (Steed, 2001; Young et al., 1992). Hopelessness is a

psychological construct which is thought to be closely related to helplessness (Shea & Hurley, 1964). The BHS questionnaire can be seen in Appendix L.

NFC. Measures a personality attribute that is reflecting to which extent people are inclined towards hard working cognitive activities. It is a quantitative questionnaire consisting of originally 34 questions but has later been shorten to an 18-item format (Cacioppo & Petty, 1983; Cacioppo et al., 1984). The scale consists of 18 statements about their satisfaction when it comes to thinking. The participants are rating their agreement to each statement from a 9-point scale from +4 (i.e., very strong agreement) to -4 (i.e., very strong disagreement). The NFC questionnaire can be seen in Appendix M.

Debriefing

After the experiment we had a debriefing with each participant, asking how the task went and if they found it difficult (Appendix N).

COVID-19 Guidelines

In the laboratory we followed COVID-19 guidelines (Appendix O).

Statistical Analysis

All statistics are performed with the statistical software JASP (2022, version 0.16.1).

First aim: Repeated Measures ANOVAs

To analyze the first main aim of this thesis, namely, whether we could replicate the effect of our negative controllability manipulation on self-reported control and success levels, as well as response accuracy and the magnitude of Pavlovian bias in the current study, relative to the bachelor study, we performed a series of repeated measures ANOVAs. The study was a

between-group design with group as a between-subject factor. The aim for the ANOVA model is to analyze how our independent variables influence each of our dependent variables. For the mixed ANOVA, the manipulated variable is group membership (either control group, or negative manipulated group referred to as "manipulated group"). The dependent variables are Accuracy (ratio of correct responses, ACC), Pavlovian Performances Bias (PPB is calculated as the mean of Punishment Based Suppression/PBS, and Reward Based Invigoration/RBI. PBS is calculated as the number of NoGo responses on Avoid trials/total NoGo, and RBI is calculated as the number of Go responses on Win trials/total Go). Both PBS and RBI (as well as their mean, PPB) varies between 0 and 1 and represent different levels of PPB. The value of 0 represents the complete suppression of PPB, emitting NoGo on Win only and Go on Avoid only. The value of 0,5 represents no Pavlovian bias, that is, equal probability of emit Go and NoGo on both Win and Avoid trials, and last, the value of 1 represents excessive Pavlovian bias, emitting Go on Win and NoGo on Avoid trials only. For these dependent variables, we have different within-subject factors. For ACC we have Block (5 levels: 1-5), Congruency (2 levels: Pavlovian-congruent and Pavlovian-incongruent), and Valence (2 levels: Win cards and Avoid cards). For PPB we have Index type (2 types: PBS and RBI), and last, we have Block and Group (control versus negative manipulated) as between-subject factors. For Success and Control we have Block as within-subject factor and Group as a between-subject factor.

For the analysis, we set the alpha level at 0.05 and were primarily interested in interactions that included Group. If the assumption of sphericity is violated, we report the Grennhouse-Geisser corrected *p*-values in addition to the corresponding epsilon value (ε). If the assumption of equality of variances is violated, we report Welch corrected *p*-values. Last, I report partial eta-squared (η_p^2) as a measure of effect size for ANOVA.

Second aim: Linear Regression Analysis

As for the second main aim of this thesis, we also performed linear regression analysis to assess if scores on personality trait scales could predict changes in PPB over the task. For this purpose, we merged the data from the bachelor study with the master study (only participants from the bad-yoking groups) and performed hierarchical multiple linear regression consisting of two models. The first model had Block as predictor, and the second model had Block x BIS/BAS, BHS, NFC scores as predictors. For the analysis we used centered values for the Personality questionnaires. The first model has Block as a predictor, the second model has Personality (BAS-D, BAS-F, BAS-R, BIS, NFC, BHS) x Group as predictors.

For the analysis, we set the alpha level at 0.05 and were interested in Personality traits effect on PPB. Also, I reported Cohen's f^2 as a measure of effect size.

This master thesis will first analyze the results from the master study before merging the data with the bachelor study to assess for personality as a predictor for PPB.

Results

First aim

Control

For the analysis of perceived feeling of control, main effects of Block ($F(3.424,164.337) = 1.627$, $p = .179$, $\eta_p^2 = .033$) and Group ($F(1,48) = 1.507$, $p = .226$, $\eta_p^2 = .030$) were not significant. However, we found a significant interaction effect of Block x Group ($F(3.424,164.337) = 7.007$, $p < .001$, $\eta_p^2 = .127$). We performed a Post hoc independent sample t-tests with Bonferroni-adjusted alpha levels ($\alpha = .01$) to see what

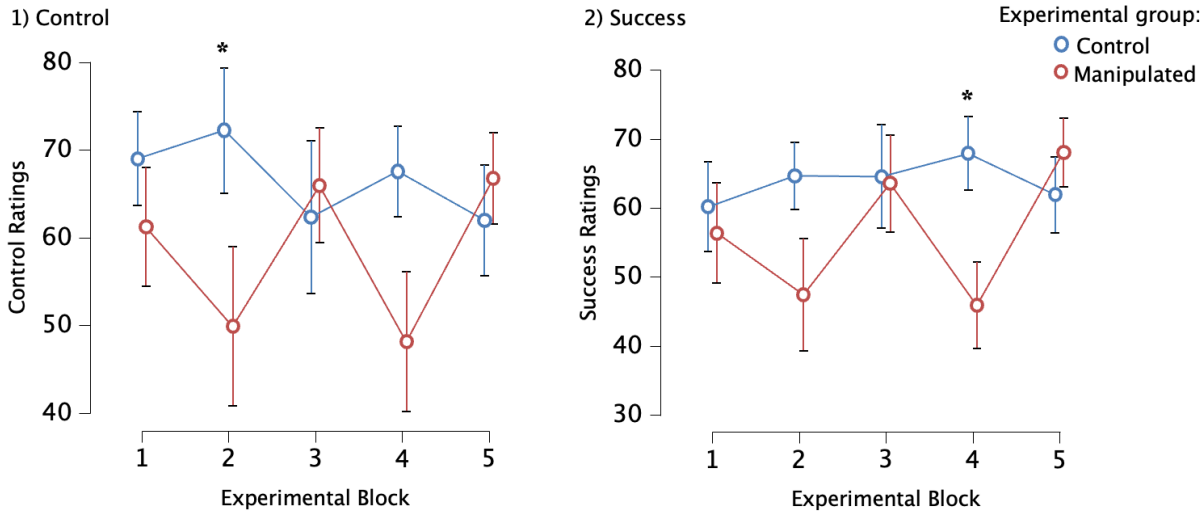
information this interaction provides us. The post-hoc test showed that the reports in level of perceived control were significantly different between the two groups in Block 2, whereas the results from Block 4 did not survive the correction for multiple comparisons (Block 2: $t(48) = 2.801$, $p = .008$, d = .792; Block 4: $t(48) = 2.273$, $p = .028$, d = .643). The reported values from Block 2 are from the Welch´s test row because the assumption of equality of variances was violated, and values from Block 4 is from the Student´s test row. This indicates that the negative manipulation played a crucial role when it came to perceived level of control in the first manipulated block. If looking at the descriptive plots, the differences for the manipulated group in the two manipulated blocks are visually present, were the manipulated group reports lower perceived control compared to the control group (figure 1).

Success

For the analysis of perceived success, the main effect of Group ($F(1,48) = 1.534$, $p = .222$, $\eta_p^2 = .031$) and Block ($F(4,192) = 3.568$, $p = .008$, $\eta_p^2 = .069$) were not significant. However, the interaction between Block x Group ($F(4,192) = 7.019$, $p < .001$, $\eta_p^2 = .128$) was significant. The post-hoc test showed that the reports in level of perceived success were significantly different between the two groups in Block 4, whereas the result from Block 2 did not survive the correction for multiple comparisons (Block 2: $t(48) = 2.259$, $p = .028$, d = .639; Block 4: $t(48) = 2.845$, $p = .007$, d = .805). The reported values from both blocks are from the Student´s test row. This means that the manipulation of reward rate, when repeated for the second time, modulates our perceived level of success (Figure 1).

Figure 1

Changes in (1) Control and (2) Success ratings for the different groups across blocks



Note. * = Significant difference between control and manipulated group (Bonferroni-corrected post-hoc test and presented with a 95% confidence interval).

Accuracy

For the analysis of response accuracy, the main effect of Group ($F(1,48) = 3.047$, $p = .087$, $\eta_p^2 = .060$) and Block ($F(3.237,155.38) = 0.656$, $p = .592$, $\varepsilon = .809$, $\eta_p^2 = .013$) was not significant, meaning that the two groups (i.e., control and manipulated) did not generally differ in terms of accuracy across blocks. The main effect of Valence ($F(1,48) = 7.311$, $p = .009$, $\eta_p^2 = .132$) and Congruency ($F(1,48) = 87.030$, $p < .001$, $\eta_p^2 = .645$) was significant, which means the response accuracy for congruent cards were significantly better compared to the incongruent cards. This makes sense because learning the correct responses to incongruent cards are more difficult than congruent cards.

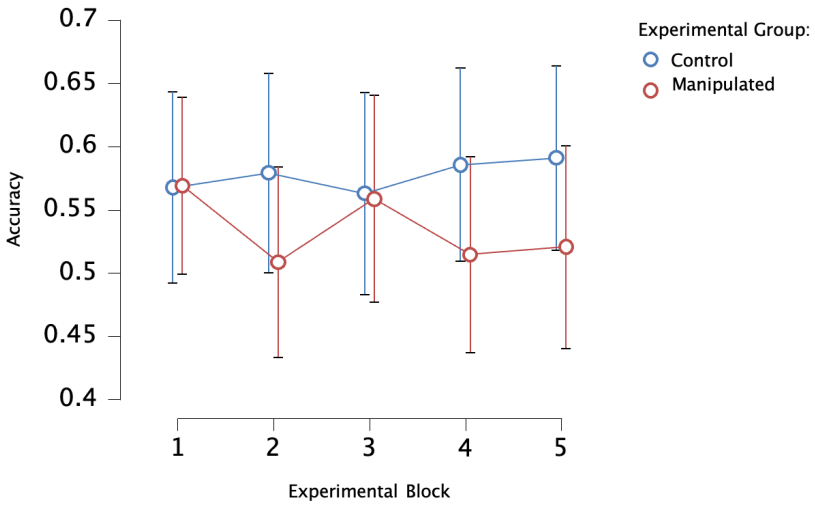
The interaction between Block x Group ($F(3.237, 155.383) = 2.655$, $p = .046$, $\eta_p^2 = .053$) was significant, indicating that the two groups' level of Accuracy differed across blocks (figure 2). Five independent sample t-tests for all 5 blocks were conducted. In Block 1, 3 and 5 (Block 1: $t(48) = -0.05$, $p = .960$, d = -.014; Block 3: $t(48) = 0.127$, $p = .899$, d = .036; Block 5: t(48) = 2.067, $p = .044$, d = .585) values from the students row test was reported and values were not significant except for Block 5. For Block 2 and 4 (Block 2: $t(31.718) = 2.106$, $p = .043$, d = .596; Block 4: $t(35.151) = 2.420$, $p = .021$, d = .685) the reported values are significant and from the Welch´s test row because the assumption of equality of variances was violated. The significant differences in Blocks 2 and 4 are not surprising (because this is by design of the task), but in 5 it indicates a transfer effect. However, because these t-tests follow-up the significant interaction from the main analysis, after doing Bonferroni adjustments and adjusting the alpha level to reduce type-1 error rate, the adjusted significance level will be 0.01 (because the study has five tests, the new significance level is 0.05/5 = 0.01). As of this, none of the above effects are significant due to all values being between 0.01 and 0.05. Overall, we can conclude that we found some evidence for a transfer effect in Block 5 after the manipulation, but it is not very convincing.

Also, the interaction between Valence x Congruency ($F(1,48) = 14.958$, $p < .001$, $\eta_p^2 = .238$) was significant, meaning that participants scored different in terms of Win or Avoid cards in line with congruent or incongruent cards. When looking at the simple main effects of congruency, we see that both Win cards ($F(1) = 120.363$, $p < .001$) and Avoid cards ($F(1) = 32.708$, $p < .001$) are significant. In addition, when looking at the simple main effect of Valence, we see that both Congruent cards ($F(1) = 8.788$, $p = .005$) and Incongruent cards ($F(1) = 18.340$), $p < .001$) is significant. To get a better understanding of this we can look at Figure 3 that show the participants having generally better Accuracy for Congruent

cards compared to Incongruent cards. In addition, they have better Accuracy for congruent Win cards compared to Congruent Avoid cards, and better Accuracy for Incongruent Avoid cards compared to the Incongruent Win cards.

Figure 2

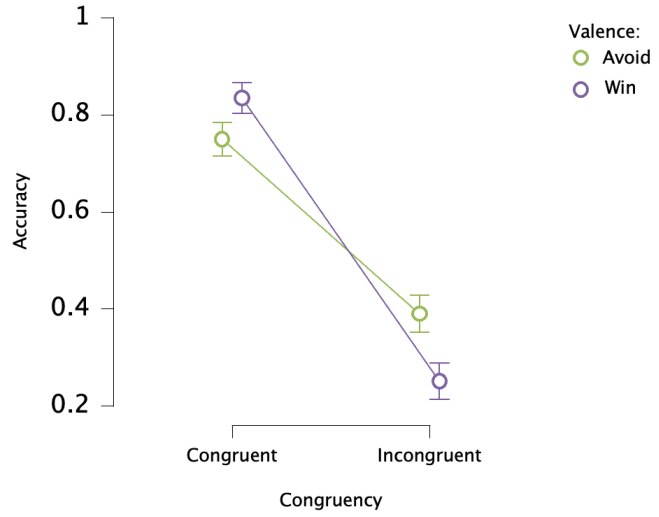
Changes in Accuracy across blocks for the different groups



Note. Plots are presented with a 95% Confidence Interval

Figure 3

Differences in Accuracy between Valence and Congruency levels



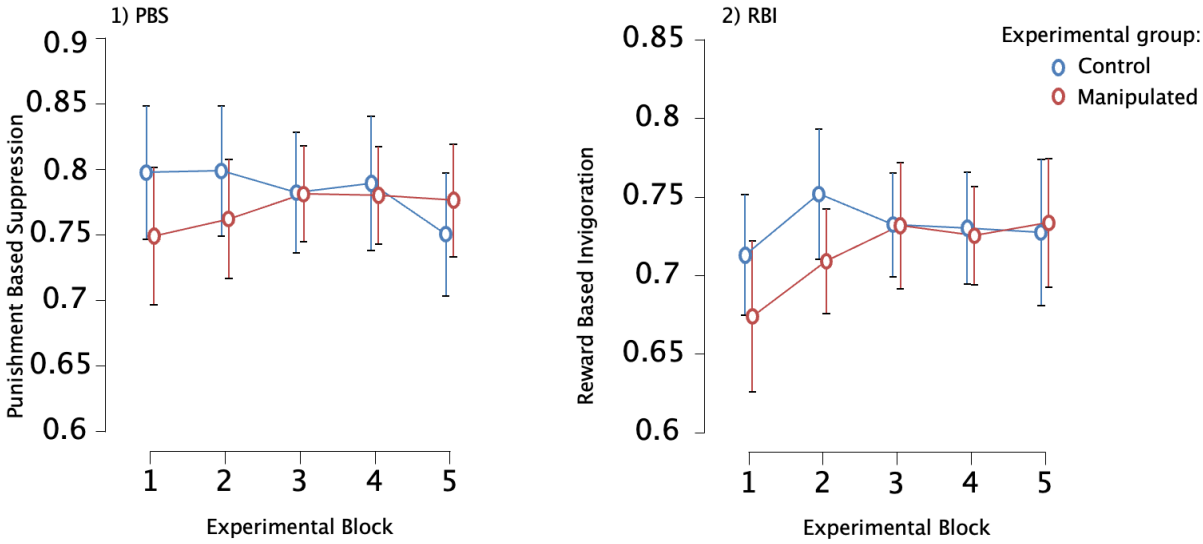
Note. The general difference in Accuracy for congruency x Valence (with 95% Confidence Interval and Bonferroni-corrected post-hoc tests).

Pavlovian Performance Bias

The analysis showed a that the main effect of Group and Block were not significant (Group: $F(1,48) = 0.088$, $p = .768$, $\eta_p^2 = .002$; Block: $F(3.322,159.451) = 0.664$, $p = .591$, $\varepsilon = .830$, $\eta_p^2 = .014$). The interaction between Block x Group ($F(3.322,159.451) = 1.104$, $p = .352$, $\eta_p^2 = .022$) was unexpectedly not significant, meaning that PPB was not significantly influenced by manipulation. Nevertheless, we found a significant Block x Index interaction effect ($F(3.226,154) = 2.628$, $p = .048$, $\varepsilon = .807$, $\eta_p^2 = .052$). In Figure 4 you can see how the two groups score in PBS and RBI through blocks.

Figure 4

Differences in Index, 1) PBS and 2) RBI between groups across all five blocks



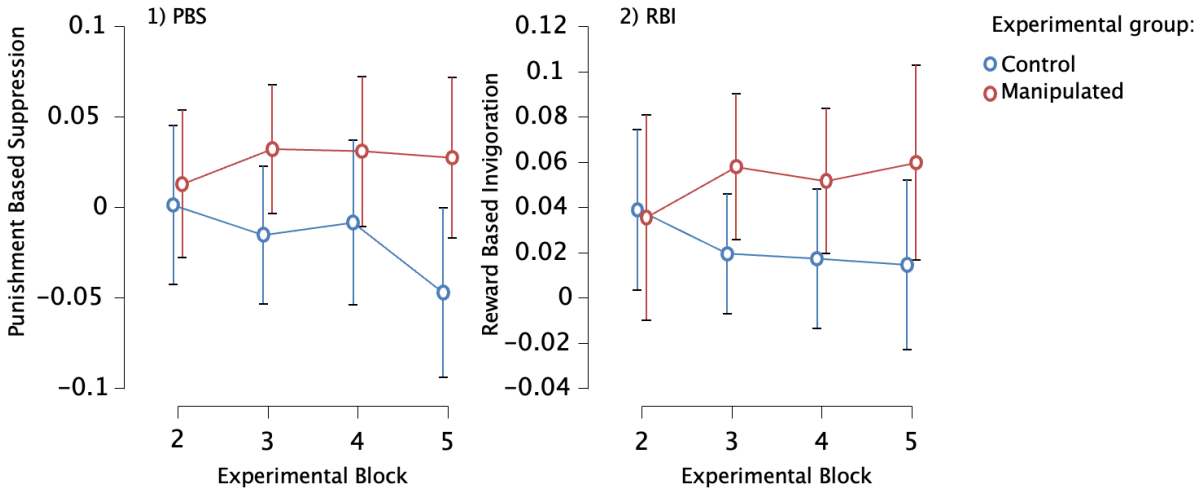
Note. Plots presented with 95% Confidence Intervals.

Given that our groups also differed in their Pavlovian bias in block 1 (Figure 4), we also created other variables for the RBI and PBS values (RBI_REL and PBS_REL) in our analysis that represented normalized RBI and PBS values for Blocks 2-5 relative to the values of Block 1, by calculating difference scores (e.g., Block 2 – Block 1). This way, we could analyze if the two groups differed in how Pavlovian bias changed during the task relative to the first experimental block. For the REL values, the main effect of Group and Block was not significant (Group: $F(1,48) = 1.112$, $p = .297$, $\eta p2 = .023$; Block: $F(2.664, 127.860) = 0.174$, $p = .895$, $\eta_p^2 = .004$). The interaction between Block x Group ($F(2.664, 127.860) = 1.099$, $p = .348$, $\eta_p^2 = .022$) was not significant either. However, the Block x Index interaction effect ($F(2.529, 121.407) = 1.055$, $p = .363$, $\eta_p^2 = .022$) was significant.

There are some patterns in the data that indicating that both RBI and PBS increased from block 1 in the manipulated group meaning that their NoGo responses became more specific for Avoid cards, and their Go responses became more specific for Win cards. But since the 2-way Block x Group or the 3-way Block x Index x Group was not significant, we conclude that the manipulation did not influence PPB.

Figure 5

Differences in Index, 1) PBS and 2) RBI between groups across all blocks relative to the first block.



Note. Plots presented with 95% Confidence Intervals.

Second aim

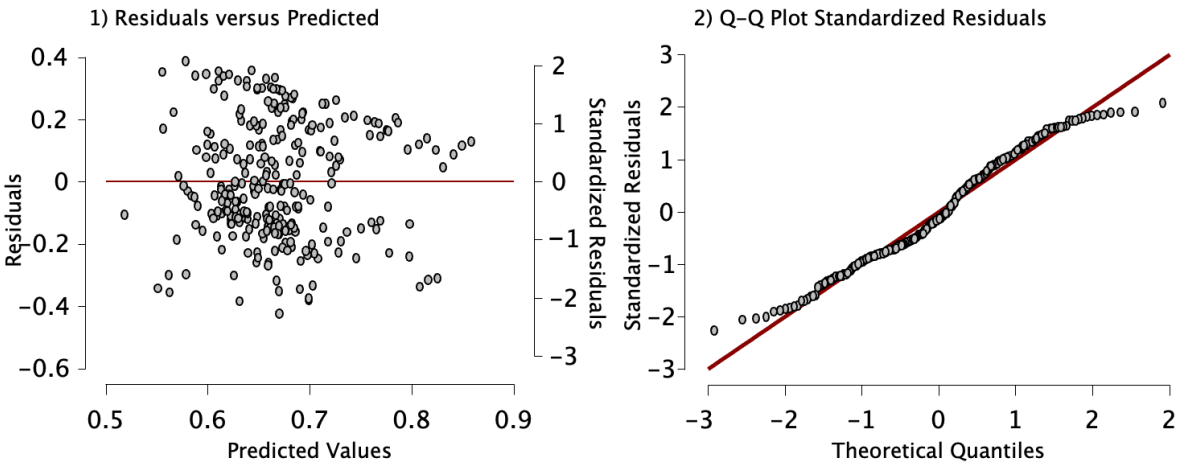
Personality and Behavior Relationship

For the linear regression analysis, the model with PPB as outcome variable was built hierarchically. The first regression model with Block as a predictor (factor) was not significantly better in accounting for variance in PPB than the intercept-only model (R^2

= .011, $F(4.279) = 0.791$, $p = .532$, $f^2 = .011$). For the second model we included all 6 Personality scores (BAS-D, BAS-F, BAS-R, BIS, BHS and NFC) as additional predictors (covariates) that explained the variance significantly better ($R^2 = .089$) than the first model ($R^2 = .011$) with only Block as predictor (R^2 change = .079, F Change = 3.839, $p = .001$). This model was significant ($R^2 = .089$, $F(9, 279) = 2.838$, $p = .003$, $f^2 = 8.09$). The Dublin-Watson statistic (1.721) is close to the value of 2 which indicates that there is no correlation between residuals and that it can be accepted for independence of errors. In addition, it has a positive (.130) autocorrelation. The assumptions of independence, normality, linearity, and homoscedasticity were assessed and was found to be met, as shown in Figure 6. Also, there was no collinearity in the data with all VIF values being < 10, last, casewise diagnostics showed that there were no outliers found in the data.

Figure 6

Plot with predicted versus residual values (left) and Q-Q plot (right) from the regression diagnostics

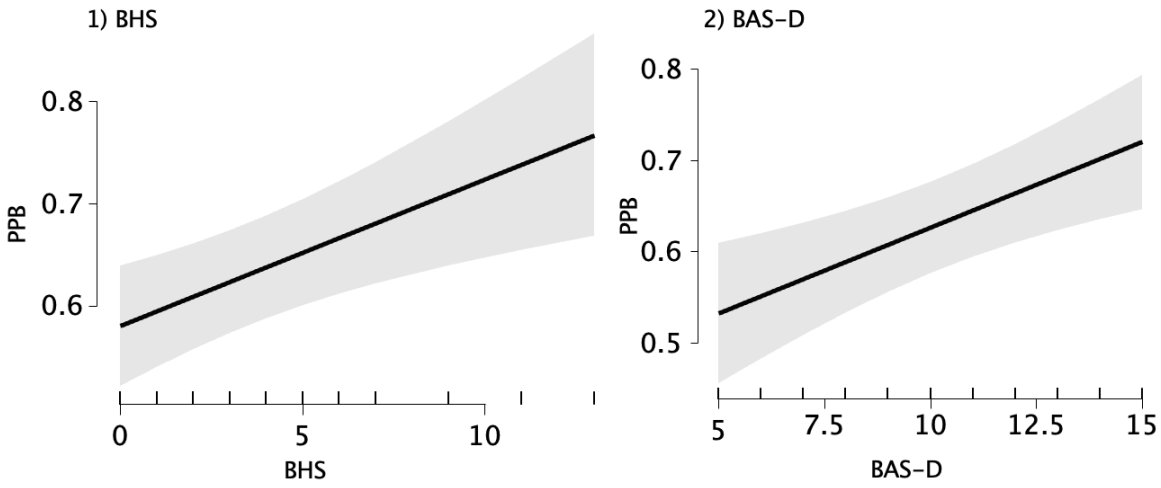


Note. The assumption of homoscedasticity is accepted with looking at the residuals (error of prediction) are equal across the standardized predicted values.

The linear regression coefficients were only significant for BAS-D (b = .018, *t*(10,264) = 3.142, *p* = .002, BAS-F (b = -.015, (*t*(10,264) = -2.329, *p* = .021) and BHS (b = .014, *t*(10,264) = 3.12, *p* = .002). The regression coefficient for BAS-D and BHS were both positive, meaning they have positive linear relationships with PPB, the higher people score on these traits, the higher PPB they will experience. More specifically, every increase in BAS-D score will lead to an increase of .018 in PPB, and further, every increase in BHS will result in an .014 increase in PPB, while keeping all other personality scores at their mean values (Figure 7). However, for BAS-F, the relationship with PPB is negative, meaning for every increase in BAS-F leads to a decrease in PPB (Figure 8). The remaining coefficients for the other personality traits was not significant and can be found in the regression table (Table 1).

Figure 7

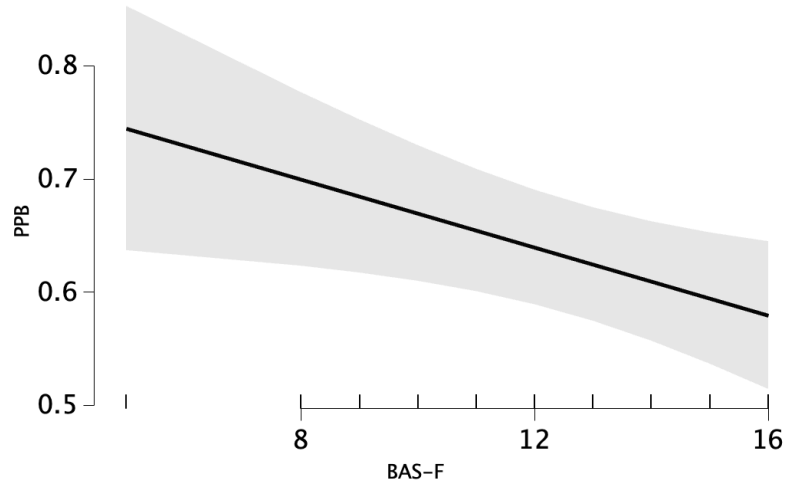
Marginal effect of 1. BHS on PPB and 2. BAS-D on PPB



Note. Both personality traits BHS and BAS-D has a positive linear relationship with PPB.

Figure 8

Marginal effect of BAS-F on PPB



Note. BAS-F has a negative relationship with PPB.

Table 1

Coefficients for the different personality traits

Model		Unstandardized	Standard Error	Standardized	t	p	95% CI Lower	95% CI Upper
M_1	(Intercept)	0.630	0.026		24.092	< .001	[0.578,	0.681]
	Block (2)	0.033	0.037		0.880	0.380	[-0.04,	0.105]
	Block (3)	0.060	0.037		1.626	0.105	[-0.013,	0.133]
	Block (4)	0.051	0.037		1.386	0.167	[-0.022,	0.124]
	Block (5)	0.043	0.037		1.162	0.246	[-0.03,	0.116]
M_2	(Intercept)	0.614	0.115		5.333	< .001	[0.388,	0.841]
	BAS-D	0.019	0.006	0.214	3.282	0.001	[0.008,	0.030]
	BAS-F	-0.015	0.006	-0.157	-2.364	0.019	[-0.028,	-0.003]
	BAS-R	-5.804	0.007	-0.006	-0.088	0.930	[-0.013,	0.012]
	BIS	-0.001	0.003	-0.028	-0.466	0.641	[-0.007,	0.004]
	BHS	0.014	0.005	0.196	3.167	0.002	[0.005,	0.023]
	Block (2)	0.033	0.036		0.907	0.365	[-0.038,	0.103]
	Block (3)	0.060	0.036		1.677	0.095	[-0.01,	0.131]
	Block (4)	0.051	0.036		1.429	0.154	[-0.019,	0.122]
	Block (5)	0.043	0.036		1.198	0.232	[-0.028,	0.114]

Note. N = 56. CI = Confidence interval; Lower = lower limit; Upper = upper limit.
M_1 = first model with Block as predictor, M_2 = second model with personality as predictor.
The regression coefficients describe the direction of the relationship between each independent variable (blocks and personality traits) and the dependent variable (PPB).

Discussion

The two main aims of this thesis were to investigate if 1. The bachelor results could replicate in a new sample and 2. If personality traits are related to how healthy adults adjust their decision-making strategies under varying levels of reward and loss controllability. We were able to show that some personality traits modulate the magnitude of Pavlovian bias, despite the manipulation not being powerful enough to modulate the magnitude of Pavlovian Bias. However, intermittent absence of control did modulate the subjective ratings of both perceived-control and success. These results will now be discussed in detail.

First aim

Control and Success

The hypothesis for Control and Success was that manipulated participants would report their perceived level of control and success lower in block 2-5 as a transfer effect due being manipulated with low reward rate in block 2 and 4.

Manipulated Blocks. The analysis for Control and Success were somehow similar but significant in different blocks. The analysis for Control revealed that the manipulated group only rated their perceived level of control significantly lower in block 2. But in block 4, even if it was a minor difference between the groups, the manipulated participants ratings on success were numerically decreased. The analysis for Success revealed the same pattern but

for opposite blocks, that is, that the manipulated group only rated their perceived level of success significantly lower than the control group in block 4. But in block 2, we see that the manipulated participants ratings on success were numerically decreased compared to the control group. For a visual representation of these findings, see figure 1.

We can conclude that the manipulated participants seem to have a more accurate representation of the true controllability level preventing them to develop an illusion of control. These results are in line with findings on perceived level of control being a predictor of behavior, and, that reward rate is effective and important when it comes to manipulation procedures (Ly et al., 2019; Teodorescu & Erev, 2014).

Transfer Effect. However, the participants do not seem to be affected by the "downfall" of being negatively manipulated and "losing" control and experiencing less success in the manipulated blocks. The analysis revealed no transfer affect onto subsequent non-manipulated blocks, and their ratings on control and success can be seen in figure 1 to be restored. In addition, we see that the manipulated participants ratings for control and success is numerically increased compared to control ratings in block 5. These results could be due to the research group being healthy adults and thus not being overly affected by the manipulation in terms of low reward rate.

Learned Helplessness. The results on control and success does not support the idea that the manipulation protocol led to learned helplessness among participants. The participants that were manipulated was not affected negatively by their negative experience of control and success in the manipulated blocks onto their subsequent blocks, as they regained control and success. In addition, the manipulated participants ratings on their control and

success numerically increased compared to the controls. This strengthens the statement that they did not experience feelings resembling learned helplessness.

Accuracy

We hypothesized that generally, participants would have higher accuracy for congruent cards versus incongruent cards, and that the manipulated group would have worse accuracy in the manipulated blocks compared to the control group. The analysis revealed that generally, participants had an overall better accuracy for congruent cards over incongruent cards as expected. Surprisingly, there were no differences between the groups on their accuracy level after adjusting for multiple comparisons, indicating that the reward manipulation did not affect the accuracy level for the manipulated group strong enough. In the bachelor analysis we found a transfer effect onto block 3 for the manipulated group as they had better accuracy for congruent cards and worse accuracy for incongruent cards (Angen, 2020). We expected that manipulated participants would rely more on PPB, even after the manipulation (block 3 and 5), and as a result they would show worse performance for Pavlovian incongruent cards, but this was not the case. There was no Group x Congruency or Group x Block x Congruency interaction, so the participants did not show worse responding to Pavlovian Incongruent cards. Last, all participants had the best accuracy for congruent win cards.

The current results on the absence of this anticipated effect are in line with the null results on PPB (see later). The correction of multiple comparisons might have been too conservative (two-tailed test). Therefore, there is still some indication in the data that the manipulation could work for at least block 2 and 4, the transfer effect in block 5 with the

uncorrected p-value of .044 is indeed not very convincing. This suggests that the manipulated group seem to adapt properly to the task and managed to override their PPB under conflict.

Pavlovian Performances Bias

Our hypothesis for PPB was that yoked participants would have an increase in PPB in block 3 and 5 following the manipulated blocks as a transfer effect. In addition, that people will score better on Pavlovian congruent cards compared to incongruent cards. In the bachelor study we saw a transfer effect from block 2 to block 3. Surprisingly, we did not find any effect from either of the two manipulated blocks onto the next blocks. This means that for this study PPB was not significantly influenced by manipulation. But in general, PPB was much stronger in the master data compared to the bachelor data (Angen, 2020), so maybe it was close to ceiling, and therefore, this could have masked the manipulation we saw in the bachelor data. In addition, the reason for the difference in PPB might be due to removing the response screen (Appendix A and E), so people could respond immediately without much deliberation (in addition, they were also asked to respond as fast and accurately as possible). Because of this PPB was much stronger due to its automatic nature, which is also in line with the previously mentioned congruency effect on accuracy. Thus, this might be the main reason for the strong PPB, which in turn might have prevented the effect of manipulation on PPB.

Nevertheless, we found that generally people score better on Pavlovian congruent cards compared to incongruent cards (Appendix F). Further, we see that the manipulated group has generally stronger PBS and RBI through the task compared to the control group (Appendix G). In addition, we see that the pattern for the manipulated group is increasing from block 1, while for controls it was reducing. The reduction in controls is in line with earlier findings (people learn how to recruit cognitive control and suppress PPB over time) (Alexander &

Brown, 2010; Ridderinkhof et al., 2004), but it seems like the manipulated participants did less so. This means that the manipulated participants have more Go responses for Win cards and more NoGo responses for Avoid cards. This can be due to them being negatively manipulated and feeling more insecure and thus more focused on approaching the win cards and staying passive on the avoid cards.

Second aim

Personality and Behavior Relationship

The hypothesis for the relationship between personality and decision-making, was that 1. Higher BAS and BIS would result in higher PPB in general, 2. Higher BHS would result in higher PPB as a result of our controllability manipulation, and 3. High NFC would result in less PPB in manipulated blocks. The analyses revealed that BAS-D and BHS has a positive relationship with PPB, as expected. However, BAS-F had a negative relationship with PPB. The data did not provide any significant findings on BIS, BAS-R and NFC in relation to PPB. The significant results are further discussed below.

BHS and PPB. As expected, there was a positive relationship between BHS and PPB. Since a high level of hopelessness is related to the feeling of low perceived control and less exploratory behavior, our results indicate that participants with higher BHS scores were indeed relying more on their Pavlovian bias, leaving less room for exploratory behavior in our task.

Based on previous research PPB gets stronger with less controllability, which can be related to the behavioral manifestation of learned helplessness, especially in the loss domain, for avoid cards (Csifcsák et al., 2020; 2021; Dorfman & Gershman, 2019; Maier & Seligman, 2016). Our current result on the relationship between BHS and PPB points towards this,

namely, that healthy adults who show a tendency to give up more easily and develop negative affective state combined with an underestimation of controllability, indeed show stronger PPB while their controllability levels are manipulated without their knowledge. This is an important finding, and points towards the notion that PPB is indeed related to the tendency of hopelessness, and probably also to helplessness as they are closely related constructs (Shea & Hurley, 1964). If this is the case, then it follows that people with higher BHS, even without manifest psychopathology, are more sensitive to unexpected changes in the environment and the contingency between actions and outcomes, leading to stronger PPB that can be maladaptive in nature. Since excessive PPB can be suppressed by cognitive control, an effective preventive measure in these individuals can be cognitive training that facilitates the recruitment and implementation of inhibitory mechanisms that counteract Pavlovian response tendencies.

BAS-D and PPB. The analysis revealed that BAS-D has a positive relationship with PPB, as expected. Gray's theory purposes that people who are sensitive to rewards, such as people who score high in BAS-D are more prone to engage in illegal or harmful (e.g., smoking) activities compared to other rewarding activities. We can assume that this is due to high BAS being related to impulsiveness (Gray et al., 1983; Newman et al., 1985; Quay, 1993; Wallace et al., 1991) and to stronger PPB as the person is strongly attracted and drawn to desired stimuli. It has been long proposed that one key feature to developing addiction is that people can get sensitized to neutral cues that predict reward via Pavlovian conditioning, and that this will lead to strong (Pavlovian) approach tendencies, which, when combined with weak cognitive control will lead to irresistible drive to seek reward (Carver & White, 1994; Day & Carelli, 2007; Martin-Soelch et al., 2007; Quay, 1993; Saunders & Robinson, 2013).

Even though the results from this master thesis is performed in a laboratory setting which is limited, the results points in the same direction in our healthy adult sample.

BAS-F and PPB. Surprisingly, there was a negative relationship between BAS-F and PPB. We expected the association to be in the opposite direction, because the BAS is generally sensitive to rewards and more connected to impulsivity and approach behavior. In this respect, BAS-F was also first anticipated to show a positive relationship with PPB, like BAS-D. However, since BAS is sensitive to signals of reward and escape from punishment as relates to PPB, it is also associated with extraversion and novelty seeking, in addition to the experience of positive feelings such as happiness and hope (Carver & White, 1994; Gray 1990). Novelty seeking is a personality trait that refers to people's tendency to enjoy pursuing new experiences (Carver & White, 1994). We can argue that this can manifest in people enjoying the challenges with learning a new card game, and thus better at recruiting cognitive control so that they can achieve the best score possible and get the 100 kroner extra for good performance. Further, regarding novelty seeking, we can argue that the people who score high on this trait, will most likely have higher exploratory behavior and thus not be affected by PPB in the same way as the other BAS structures (Carver & White, 1994).

In addition, BAS-F can also be related to "not giving up" even when control is withdrawn, and loss frequency is high. Therefore, they can adopt behavior that utilizes immediate feedback for optimizing future choice, a feature of the instrumental system. Thus, BAS-F can shift the so-called "exploration-exploitation" tradeoff towards the former (Cohen et al., 2007), and therefore, result in weaker PPB in this manipulated experimental setting. Opposite, Pavlovian tendencies are more about "exploitation", that is relying on choice behavior that "harvest" the environment, instead of exploring for alternative decision-making strategies that might lead to more lucrative outcomes (Cohen et al., 2007).

Research has found that locus of control (LOC) is linked to dopamine and exploitation-exploration (Kayser et al., 2014). LOC is explained to be either internal or external. People with internal LOC is thought to have high perceived control, opposite, with high external LOC people is thought to have low perceived control (Kayser et al., 2014; Ly et al., 2019). It is though that people who have high external LOC are less likely to explore (Kayser et al., 2014; Ly et al., 2019), which could have resulted in stronger PPB in our experimental task. In addition, high external LOC has also been associated with reduced dopaminergic activity in prefrontal cortex (Kayser et al., 2014), which in turn is related to valuation of reward, fun and pleasure (Sabatinelli et al., 2007; Salimpoor et al., 2011; Berridge, 2003). So, the results on BAS-F being negatively correlated to PPB can be argued to be due to people with high BAS-F having more internal LOC and thus more exploratory behavior due to higher dopamine levels. Opposite, would people who score low on BAS-F have the opposite effect, namely having high external LOC, lower dopamine levels which is thought to result in stronger PPB (Kayser et al., 2014). Unfortunately, at the time of planning the master study, we did not consider adding LOC to the questionnaires which could have been valuable.

Overall, the results on BAS-F having a negative relationship with PPB, can be explained through the relation between BAS-F, novelty seeking and allocation of LOC. The higher the BAS-F, the more healthy adults might be prone to novelty seeking and exploratory behavior. In turn, research suggests that strong exploration tendencies are related to high perceived level of control, and thus, high internal LOC. While this proposal is very speculative and is clearly a post hoc attempt for explaining the surprising finding, it could be tested in the future more systematically (e.g., by collecting data on self-reported LOC), as well as using computational modeling to extract latent behavioral parameters of exploratory behavior (randomness of choice, see Csifcsák et al., 2020; Csifcsák et al., 2021).

Limitations and Future Research

Participants

Sample Size. This research has some limitations worth highlighting. First, despite that our sample size was based on a priori power analysis, it was determined for the whole study, involving the other 2 groups of participants who received not only controllability manipulations but also experimental pain. Therefore, it can be assumed that for this subset of data (N = 50), we did not have sufficient power to detect changes in PPB as a result of manipulation.

Second, our participants were people from the age of 18 and upwards, however we got mostly university students and participants were in their 20´s. In addition, many participants were psychology students which could mean they have more knowledge on psychological experiments and relates differently to the experiment. It is important that future studies recruit a bigger variety of participants when it comes to age and a mixture of both students with different fields of study in addition to working people.

Study Population. Third, the study population was healthy adults and did not include any participants who are clinically diagnosed with depression or anxiety etc. that would be relevant for this topic. To get an overview of the differences with a healthy population versus a clinical population would be very interesting and valuable. For example, information on how healthy adults and depressed patients balance between the two systems during decision-making while their controllability is being manipulated can potentially give new information important for developing new clinical interventions.

For future studies to include a satisfactory sample size, a good variety of research participants, they should also try to continue research on this topic to hopefully get stable

results. This is important because only then, can research be more safely generalized to the healthy population, and further information on this topic can be used to assess the underlying cognitive characteristics of disorders related and associated to learned helplessness (e.g., depression and anxiety).

Experimental Setting

To uncover aspects of our decision-making we used the orthogonalized Go/NoGo task. Even though the task matches up on the uncontrollability aspect, it seems to not resemble our everyday environment good enough. The research is conducted through an experimental context which makes it artificial and not realistic as an everyday life experience of uncontrollability. It would be interesting to develop an observational study to investigate uncontrollability and decision-making under the influence of real-life events.

Merging Data

Since we merged the data from the negative manipulated groups in the bachelor and master study to check for personality correlates with Pavlovian Performances Bias, its necessary to highlight some things. The two experiments from the bachelor and master-study are extremely similar in some terms but there are some additional things that could have affected their decision-making results.

First, the potential differences in the research groups from the two studies are important to highlight. Participants in the master study agreed to participate in a “pain-study”, indicating that they do not fear the potential risk of experiencing pain enough to not participate. This could lead to the experiment group being more similar when it comes to personality traits and how they respond to potential threats and rewards in our environment.

Warm Stimulation. The participants included in this master thesis who participated in the master study experienced warm stimulation (42 degrees Celsius), it's fair to say that 42 degrees Celsius can be experienced differently for each individual when it comes to their skin temperature and heat tolerance levels. It might be more disturbing for some compared to others and thus lead to differences in participants decision-making. Future research should try to replicate studies in a more similar "environment" to check if it is possible to get the same experimental results. So, in the future, it would be interesting to perform a study without the addition factors that might influence, or disrupt the decision-making (e.g., pupillometry and pain/warm stimulation).

Task Differences. Last, I want to highlight some additional factors that could have influenced participants decision-making during the task. First, I want to point out the absence of the "response screen" in the master study, which facilitated in speeded responses. Because of this, less deliberation could have resulted in stronger PPB in general, which could have "masked" the influence of manipulation on PPB. Second, for this master study, the go-cost was removed. This could have resulted in less "passivity" in manipulated blocks, again, leading to stronger PPB, at least for win cards. While it is thought that these differences are minor and would not compromise the comparability of the 2 datasets, this has not been systematically tested. All differences between the bachelor study and the master study are shown in Appendix A.

Replication. Last, these previously mentioned differences could have contributed to the "failed replication" of the bachelor thesis results. In psychology, advanced knowledge has come to light through the testing of hypothesis with focus on data and empirical observations. It is expected that significant findings can be replicated, but this is unfortunately not always possible. This has led to what is called a replication crisis within the domain of psychology

(Shrout & Rodgers., 2018). This master study had somehow the same experimental method as the bachelor study, but with the small differences, the results failed to replicate. Therefore, the data collected within the master project cannot be considered as a direct replication of my bachelor project, but only a conceptual replication. This shows the importance of direct replications in psychology, and that it is transparent and possibly pre-registered protocols available. As mentioned earlier, future studies should replicate earlier findings with the same experimental method as the one it replicates, for the purpose of being able to strengthen the generalization of the results to the representative population studied on.

Personality and Accuracy

Last, since we try to research on how people with different personality traits react to uncontrollability in our environment, it would be interesting to further investigate if there are specific combination of personality traits that has some say in our decision-making strategies and accuracy of the task. And last, to uncover these aspects in a more natural experimental setting. For example, peoples' individual differences when it comes to personality traits such as BIS and BAS, the sensitivity (high or low) may predict different results in an experimental situation compared to other natural events. People who are high in BIS or BAS sensitivity will not experience positive (e.g., joy) or negative affect (e.g., anxiety) if the environment does not facilitate or contain BIS and BAS activation events (Gable et al., 2000). Because of this, it might be more valuable and a great complement to already conducted laboratory studies, to study individual differences in people's natural habitat.

Conclusion

In the present study we investigated if we could replicate my bachelor results, and if personality traits and controllability over rewards and losses, influenced our decision-making

strategies in terms of increased Pavlovian Performance Bias. The current thesis failed to replicate earlier findings in my bachelor thesis. The negative task manipulation failed to foster PPB for the manipulated participants. They seem to adapt properly to the task and managed to override their PPB under conflict, thus ended up having no different accuracy for Pavlovian Incongruent cards compared to controls. This means that the task manipulation failed to induce people with learned helplessness. Further, we found indications that healthy adults' decision-making and reaction to uncontrollability is predicted by individual differences, and in this case by the BAS-D and BAS-F sub-scales of the BIS/BAS, as well as the BHS. We found a positive correlation between BAS-D and BHS with PPB, and a negative correlation between BAS-F and PPB. Future research should replicate earlier findings on this domain of psychology to be able to uncover how personality traits affect our decision-making strategies under varying levels of controllability, in addition to the underlying cognitive characteristics psychopathology related to learned helplessness (e.g., depression and anxiety).

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Appendix A

The differences between the bachelor- and master study

Bachelor study

- Go-cost (-1 point)
- Delayed response (fixation cross after card is shown)
- No warm-stimulation
- Pupillometry

Master study

- No go-cost
- Speeded response (responding to the card when it is shown)
- Warm-stimulation
- No Pupillometry

Appendix B

Study information and Inclusion criteria

VIL DU DELTA I FORSKNINGSPROSJEKTET – *«Om eksperimentell smerte påvirker beslutningstaking hos friske voksne»*?

Institutt for Psykologi ved UiT - Norges arktiske universitetet

Utført av:
Caroline Alexandra Grant Angen (can050@uit.no) | Anastasija Kuprejeva (aku037@uit.no) | Ina Klakegg (ikl020@uit.no)

Under oppsyn av:
Førsteamanuensis Gábor Csifcsák (gabor.csifcsak@uit.no) | Professor Matthias Mittner (matthias.mittner@uit.no)

FORMÅLET MED PROSJEKTET OG HVORFOR DU BLIR SPURT

Vi spør deg om å delta i et forskningsprosjekt der vi studerer hvordan eksperimentell smerte påvirker beslutningstaking i et databasert kortspill. Utfallet fra denne studien kan hjelpe oss å få en bedre forståelse om samspillet mellom smerte og sentralnervesystemet, som videre kan føre til en bedre forståelse av kognitive utfordringer og problemer hos mennesker med kroniske smertelidelser.

Til tross for at dette prosjektet handler om smerte og kognisjon, vil vi trenge en kontrollgruppe som gjennomfører kortspillet uten at de får smertestimulering. Du blir tilfeldig puttet inn i enten en smertegruppe (høyere varme) eller en varmegruppe (lavere varme) når du ankommer laboratoriet. Vi vil estimere de individuelle smerteopplevelsesnivåene for begge gruppene.

Vi ser etter friske voksne mennesker innenfor aldersgruppen 18-50 år

- Du bør ha godt eller korrigert syn, kan ikke ha noen nåværende/tidligere psykiske, nevrologiske eller kronisk smertesykdommer (f.eks. depresjon, bipolar lidelse, epilepsi, migrene, alvorlig hodeskade, hjernekirurgi) og kan ikke ta medisiner som påvirker sentralnervesystemet (f.eks. antidepressiva, anti-epileptika). I tillegg er det viktig at du ikke har tatt noen analgetiske midler (smertestillende, f.eks. Paracet) samme dagen som forsøket skal gjennomføres
- Det er viktig at du får nok søvn på nettene før dagen, må ikke være under påvirkning av psykoaktive stoffer (f.eks. alkohol, narkotika) og at du ikke lider av bakrus
- Du har lov til å innta koffein (f.eks. kaffe, energidrikk) og nikotin (f.eks. røyk, snus) i henhold til dine vanlige rutiner
- Vi ber deg om å ikke ta på parfyme eller kosmetikk (f.eks. krem, anti-bac) på innsiden av begge for-armene

HVA INNEBÆRER PROSJEKTET FOR DEG?

I prosjektet vil vi innhente og registrere opplysninger om deg. Vi kommer ikke til å samle inn informasjon som gjør det mulig å identifisere deg som person. Vi kommer bare til å spørre deg om alder, kjønn og din dominante hånd samt estimere ditt smerteoppfattelsesnivå. Vi skal samle inn data om responsene dine under kortspillet for å lære mer om dine beslutningstakingsstrategier. Til slutt, vil vi samle inn spørreskjemaer som omhandler ditt humør og personlighet, ved bruk av validerte og velbrukte standardiserte spørreskjemaer.

- Du vil bli bedt om å komme til vårt laboratorium på Instituttet for Psykologi ved UiT - Norges Arktiske Universitet og signere informert samtykke ved ankomst. Datainnsamlingen vil vare i omtrent **90** minutter. En av våre forskere kommer til å instruere deg på veien
- Først vil du bli bedt om å fullføre ulike spørreskjema som omhandler ditt humør
- Videre, vi kommer til å estimere ditt individuelle smerteoppfattelsesnivå for å kunne finne ut av hvilken stimuleringsintensitet du skal ha under selve kortspillet. Vi vil estimere det på innsiden av din dominante for-arm
- Når dette er kartlagt, vil du bli bedt om å spille et datastyrt kortspill. Den vil bestå av 5 blokker, hvorav hver av dem varer i 7.5 minutter. Etter at du har spilt ferdig hvert av de fem rundene av kortspillet vil du bli spurt om å svare på to skalaer som måler (1) hvor suksessfullt du følte at din prestasjon var og (2) hvor mye kontroll du følte at du hadde under kortspillet. I blokk 2 og 4, vil vi introdusere varmebasert smerte (moderat intensitet) til huden på innsiden av for-armen på den ikke-dominante armen din som vil vare i 7.5 minutter (med en pause fra smerte i blokk 3). Etter begge stimuleringsperiodene vil du bli spurt om å rangere (3) toppnivået av smerte du følte og (4) gjennomsnittsnivået av smerte du følte i blokk 2 og 4 . Prosedyren er helt trygg, og blir brukt verden rundt av forskere for å bedømme hvordan smerte påvirker kognisjon i friske deltakere og i pasienter med varierende lidelser
- Etter kortspillet vil du bli informert til å besvare fire spørreskjemaer som omhandler ditt humør og andre aspekter av din personlighet ("PANAS" og "BHS" som spør om humør, "BIS / BAS" som handler om generelle holdninger og "NFC" Need for Cognition, som handler om hvor villig man er til å bruke mentale krefter)
- På slutten av eksperimentet vil du få et gavekort til Jekta Storsenter med en verdi av enten **300** eller **400 NOK**, avhengig av din prestasjon på kortspillet

MULIGE FORDELER OG ULEMPER

- Fordelen ved å delta på dette prosjektet er at du lærer mer om hvordan man måler påvirkningen av smerte på ens kognisjon i et laboratorium samt bidra til forskningen og samfunnet. I tillegg, vil du få et gavekort på **300 NOK** på Jekta Storsenter for din deltakelse. Ved tilstrekkelig prestasjon på kortspillet vil du kunne motta en bonus på **100 NOK**
- Vi induserer varmebasert smerte på huden av innsiden av for-armen din for 7.5 minutter, 2 ganger. Her forsøker vi å nå målet om å indusere et moderat nivå av smerte, som vil være ukomfortabelt. Vi tar i bruk et PATHWAY-system av bedriften Medoc (www.medoc-web.com/pathway), som er en veldokumentert og mye brukt enhet for å indusere varmebasert smerte på både friske voksne mennesker og andre pasientgrupper. Stimuleringsintensiteten vil bli avklart før vi starter selve kortspillet, slik vi finner en varme som er tilpasset akkurat deg og som er tolerabel over lengre tid. Vi kommer bare til å ta i bruk enheten innenfor dens trygge sikkerhetshetsrammer
- Du kan alltids stoppe smertestimuleringen i løpet av kortspillet hvis du føler at smerten er for intens og du ønsker at den skal stoppe. Det vil alltid være en knapp ved siden av deg som terminerer stimuleringen helt
- Som en etter-effekt av å ha blitt påført varmebasert smerte på huden vil du kunne oppleve rødhet og sensitivitet i disse områdene. Denne effekten er ikke farlig og er helt normal og vil vanligvis vare i og forsvinne etter ca. 12 timer. Skulle dette vedvare i over 24 timer, ber vi deg om å ta kontakt med forskningsansvarlig Gábor Csifcsák som har medisinsk kompetanse og er alltid tilgjengelig for kontakt (s. 4)

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE DITT SAMTYKKE

- Det er frivillig å delta i prosjektet
- Dersom du ønsker å delta, undertegner du samtykkeerklæringen (s. 5) når du får tildelt ditt deltakelsestidspunkt og kommer til vårt laboratorium
- Du har rett til å avbryte datainnsamlingen til enhver tid og å trekke din samtykke om studiedeltakelse uten å oppgi en grunn for din beslutning. I dette tilfellet blir data som er samlet hittil ødelagt og ikke brukt på noen som helst måte. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg
- Du kan kreve innsyn i opplysningene som er lagret om deg, og opplysningene vil da utleveres innen 30 dager
- Du kan kreve at dine helseopplysninger i prosjektet slettes
- Adgangen til å kreve destruksjon, sletting eller utlevering gjelder ikke dersom materialet eller opplysningene er anonymisert eller publisert. Denne adgangen kan også begrenses dersom opplysningene er inngått i utførte analyser, eller dersom materialet er bearbeidet
- Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder (s. 4)

HVA SKJER MED OPPLYSNINGENE OM DEG?

- Opplysningene som registreres om deg skal kun brukes slik som beskrevet under formålet med prosjektet
- Eventuelle utvidelser i bruk og oppbevaringstid kan kun skje etter godkjenning fra REK og andre relevante myndigheter
- Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert
- Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene. Du kan klage på behandlingen av dine opplysninger til Datatilsynet og institusjonen sitt personvernombud
- Alle data blir samlet inn anonymt, og er kun merket med en spesiell kode. Nøkkelen som knytter den anonyme koden til personopplysninger vil være låst inne på kontoret til Gábor Csifcsák
- Du har rett på tilgang til dine data (smertepersepsjonsnivå, ytelse på beslutningstakingsoppgaven, resultatene av spørreundersøkelsene) ved forespørsel, men du må selv huske din deltakelsesdato og din deltakerkode
- Siden vi ikke samler inn personlig identifiserbar informasjon om deg som deltaker av studien, vil dataen vi samler inn under eksperimentet forbli 100% anonymt. Denne innsamlede dataen vil bli brukt for den hensikt å publisere resultater av vår studie i et vitenskapelig tidsskrift. Den innsamlede dataen vil bli presentert på gruppenivå og ikke på individnivå, noe som betyr at ingen individuelle data vil bli presentert i vitenskapelige publikasjoner eller universitetsoppgaver, bare resultater som ble oppnådd for hele gruppen av deltakere
- Publisering av resultater er en nødvendig del av forskningsprosessen. All publisering skal gjøres slik at enkeltdeltakere ikke skal kunne gjenkjennes, men vi plikter å informere deg om at vi ikke kan utelukke at det kan skje

- Vi vil også dele dataene med andre forskere for å legge til rette for vitenskapelig utvikling innenfor dette forskningsdomenet

DELING AV OPPLYSNINGER OG OVERFØRING TIL UTLANDET

Ved å delta i prosjektet, samtykker du også til at kodede opplysninger om dine smerterapporteringer, intensitet av smertestimuleringer, prestasjon på kortspillet og spørreskjema om humør og personlighet kan overføres til utlandet som ledd i forskningssamarbeid og publisering i tråd med formålet angitt innledningsvis. Disse anonyme, kodede dataene vil bli gjort tilgjengelig for andre forskere over hele verden for vitenskapelige hensikter. På bakgrunn av dette, vil vi bruke non-profitt Open Science Framework (osf.io), som er en plattform kun med hensikt å dele vitenskapelig forskningsdata og promotere transparens og et åpent forskningsnettverk.

- Ved å signere informert samtykke (s. 5), sier du deg enig i at data fra deg som deltaker kan bli delt med andre forskere. Andre forskere kan også ta i bruk denne dataen til å finne ut mer om eksperimentell smerte og dets påvirkning på beslutningstaking, og/eller hvorfor effekten av eksperimentell smerte på beslutningstaking blir påvirket av humør og personlighet. Vi planlegger å dele datainnsamlingen for en ubegrenset tidsperiode

- Vi ønsker også om å informere om at det er lovverket i det landet opplysningene oppbevares i som er gjeldene

FORSIKRING

Produktansvarsloven gjelder for dette prosjektet.

ØKONOMI

Du vil motta et gavekort på Jekta Storsenter i Tromsø av en verdi på 300 eller 400 NOK avhengig av din prestasjon. Dette forskningsprosjektet er finansiert av IPS, ved UiT og har ingen eksterne sponsorer. Forskerne og forskningsansvarlige på dette prosjektet har ingen interessekonflikter.

GODKJENNINGER

Regional komité for medisinsk og helsefaglig forskningsetikk har gjort en forskningsetisk vurdering og godkjent prosjektet **284408.**

Instituttet for Psykologi og prosjektleder Gábor Csifcsák er ansvarlig for personvernet i prosjektet.

Vi behandler opplysningene på linje med Personvernombud.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet eller ønsker å trekke deg fra deltakelse, kan du kontakte:

Forskningsansvarlig, Gábor Csifcsák | gabor.csifcsak@uit.no

+47 776 46 776

Dersom du opplever etter-effekter etter gjennomført studie som ikke går over etter 24 timer, kontakt:

Forskningsansvarlig, Gábor Csifcsák | gabor.csifcsak@uit.no

+47 776 46 776

Dersom du har spørsmål om personvernet i prosjektet, kan du kontakte personvernombudet ved institusjonen:

Personvernombud ved UiT, Joakim Bakkevold | personvernombud@uit.no

https://uit.no/om/art?p_document_id=594059&dim=179007

Samtykke

Jeg erkjenner herved at jeg forstår all informasjon beskrevet ovenfor, og jeg gir mitt samtykke til å delta i studien.

Jeg forstår at det er min rett til å avbryte studien når som helst, uten å måtte oppgi en grunn for min beslutning. I dette tilfellet vil alle data som allerede har blitt samlet bli ødelagt, og ingen av dataene vil bli brukt på hvilken som helst måte.

Alle data vil bli samlet inn og holdes anonymt og vil være tilgjengelig for de ansvarlige for denne studien. Resultatene av denne studien vil kun bli presentert i vitenskapelige publikasjoner eller på et universitet avhandling på gruppenivå.

Jeg forstår at dataene som blir samlet inn i denne studien samles inn for et forskningsformål og er ikke samlet inn for å etablere noen kliniske diagnoser. Derfor vil jeg ikke be om noen diagnostisk mening.

JEG SAMTYKKER TIL Å DELTA I PROSJEKTET OG TIL AT MINE PERSONOPPLYSNINGER BRUKES SLIK DET ER BESKREVET

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Appendix C

The REK Approval

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK nord	Susanne Ramstad	77660388	08.09.2021	284408

Gabor Csifcsak

Prosjektsøknad: Hvordan eksperimentell smerte og lav kontroll påvirker beslutningstaking hos friske voksne?
Søknadsnummer: 284408
Forskningsansvarlig institusjon: UiT Norges arktiske universitet

Prosjektsøknad godkjennes

Søkers beskrivelse

Formålet med prosjektet er å finne effekten av eksperimentelt-indusert termisk smerte og lavt/høyt nivå av kontroll på verdi-basert beslutningstaking hos friske voksne. Formålet er å etterligne den nedsatte beslutningstakingen i pasientene med kroniske smerter ved å utvikle en eksperimentell atferdsmodell ved å indusere smerte i friske voksne samt eksponere de for lav/høy kontroll. Ved å gjøre dette, kan vi komme et skritt nærmere mot å finne ut av hvordan verdi-basert beslutningstaking er hos individene som lever med kroniske smerter på daglig basis. Samt bidra med en studie som kan være hjelpsom i utviklingen av effektive intervensjoner som bidrar i forbedring av pasientenes liv.

Oppgaven som tester beslutningtaking i møte med gevinst og tap (verdi-basert) er kamuflert som et datastyrt kortspill der kontrollerbarheten over gevinst og tap er manipulert avhengig av hvilken eksperimentell gruppe deltakeren hører til. Smerteinduseringen (termisk varme-smerte) skjer også avhengig av hvilken eksp. gruppe deltakeren hører til. Vi har 4 eksperimentelle grupper, hver blir utsatt for en eksperimentell betingelse (mellom-gruppe design): 1. Kontroll (høy kontroll, ingen smerte), 2. Smerte (høy kontroll, smerte), 3. Kontrollerbarhet/lav kontroll (lav kontroll, ingen smerte), 4. Kombinert (lav kontroll, smerte).

Alle deltakere skal gå gjennom smertekalibleringen som har blitt utviklet og standardisert. Hver eneste individ skal få estimert sin individuelle maksimale smerteoppfattelsenivået ved å stoppe den gradvise temperaturstigningen 8 ganger (starter ved 32C og kan stige til maksimalt 50C) på rad. En aluminiumtermode blir plassert på innsiden av den dominante armen. Deltakeren blir instruert om å trykke en knapp for å stoppe stigningen når smerten er intens og man vil at den skal stoppe.

Etter at den maksimale gjennomsnittlige smerteoppfattelsenivået er estimert, trekker vi 2 grader Celsius fra den estimerte verdien. Denne temperaturverdien skal brukes i 2 av 5 blokker i 7.5 minutter mens deltakeren spiller kortspillet på PC-en. Denne temperaturverdien kan ikke overstige 46,5 grader Celsius og ikke være lavere enn 44C, fordi vi sikter mot å ha et moderat smertenivå og unngå hudskader. Termoden skal plasseres på innsiden av den ikke-dominante armen, først på den distale posisjonen og så

på den proksimale posisjonen. Viktig å merke seg at denne stimuleringen skjer i blokk 2 og 4, så deltakeren får en ca 7.5 minutters pause fra smertestimuleringen. På grunn av pausen og de forskjellige stimulasjonsplasseringene av termoden, vil vi unngå summeringseffekter.

I de to gruppene uten smerte skal de ha temperatur på 42C, mens de to gruppene med smerte vil ha smertestimulering på mellom 44C og 46,5C avhengig av deres maksimale smertenivå-estimatet.

Alle deltakere vil før eksperimentet besvare spørreskjemaet: Positive and Negative affect Schedule.
Etter kortspillet vil deltakerne besvare spørreskjemaer: Positive and Negative affect Schedule, Need for Cognition, Becks hopelessness Scale, Behavioral Inhibition System og Behavioral Activation System. Dette vil kunne belyse informasjon om eventuelle forskjeller i humør og personlighet spiller en rolle i hvordan man responderer på smerte og hvordan en blir påvirket av det i beslutningstaking.

Søknaden ble behandlet av REK nord i møte 26.08.2021. Vurderingen er gjort med hjemmel i helseforskningsloven § 10.

REKs vurdering

Søknaden ble behandlet av REK nord i møte 26.08.2021. Vurderingen er gjort med hjemmel i helseforskningsloven § 10.

Data/materiale

Det samles inn data fra spørreskjema/smertetest/kortspilloppgave.

Deltakere 100 friske voksne mellom 18-50 år, uten tidligere psykiske/nevrologiske/kroniske smertesykdommer, og som ikke tar medisiner som påvirker sentralnervesystemet.

Rekruttering

Rekruttering av deltakere vil skje via sosiale medier, verbale invitasjoner og plakater hengt opp på UiT sin campus. Potensielle deltakere som tar kontakt vil motta et informasjonsskriv. Hvis de fortsatt er interesserte, opprettes et tidspunkt for deltakelse. Deltakere vil bli gitt omtrent 1 måned for å bestemme om de vil delta eller ikke. Deltakere mottar et gavekort på kr. 400,-

Forespørsel/informasjon/samtykkeerklæring

I søknaden og i protokollen beskrives at deltakerne får utdelt et kodenummer som brukes under forsøket, og at underskrevet samtykkeskjema ikke kan kobles til de kodede dataene.

I informasjonsskrivet under avsnittet «hva skjer med opplysningene om deg», står det også i punkt 7 : *« Siden vi ikke samler inn personlig identifiserbar informasjon om deg som deltaker av studien, vil dataen vi samler inn under eksperimentet forbli 100% anonymt»* . Men i punkt 5 står det at prosjektleder har nøkkel som kobler den anonyme koden til personopplysninger. e. Så lenge det finnes en koblingsnøkkel er data ikke anonyme.

Det må avklares hvorvidt data er anonymet eller ikke. Informasjonen som gis i informasjonsskrivet må tilpasses til det valgte alternativet. Et avidentifisert datasett/anonyme data skal oppbevares i fem år etter prosjektslutt av kontrollhensyn.

Sekretariatet vurderer ellers informasjonsskrivet som dekkende for studien.

Vedtak

REK har gjort en helhetlig forskningsetisk vurdering av alle prosjektets sider og godkjenner det med hjemmel i helseforskningsloven § 10. Før prosjektet kan igangsettes må avklaringene det bes om over sendes REK. Skrivet sendes via prosjektmappen i REK-portalen.

Prosjektet er godkjent frem til omsøkt sluttdato 01.09.2023.

Av dokumentasjonshensyn skal opplysningene oppbevares i fem år etter prosjektslutt. Enhver tilgang til prosjektdataene skal da være knyttet til behovet for etterkontroll. Prosjektdata vil således ikke være tilgjengelig for prosjektet. Prosjektleder og forskningsansvarlig institusjon er ansvarlige for at opplysningene oppbevares indirekte personidentifiserbart i denne perioden, dvs. atskilt i en nøkkel- og en datafil.

Etter denne femårsperioden skal opplysningene slettes eller anonymiseres. Komiteen gjør oppmerksom på at anonymisering er mer omfattende enn å kun slette koblingsnøkkelen, jf. Datatilsynets veileder om anonymiseringsteknikker.

Vi gjør oppmerksom på at før prosjektet igangsettes må det foreligge et behandlingsgrunnlag for behandling av personopplysninger. Dette må forankres i egen institusjon.

Sluttmelding

Prosjektleder skal sende sluttmelding til REK på eget skjema via REK-portalen senest senest 6 måneder etter sluttdato 01.09.2023, jf. helseforskningsloven § 12. Dersom prosjektet ikke starter opp eller gjennomføres meldes dette også via skjemaet for sluttmelding.

Søknad om endring

Dersom man ønsker å foreta vesentlige endringer i formål, metode, tidsløp eller organisering må prosjektleder sende søknad om endring via portalen på eget skjema til REK, jf. helseforskningsloven § 11.

Klageadgang
Du kan klage på REKs vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes på eget skjema via REK portalen. Klagefristen er tre uker fra du mottar dette brevet. Dersom REK opprettholder vedtaket, sender REK klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering, jf. forskningsetikkloven § 10 og helseforskningsloven § 10.

Med vennlig hilsen

May Britt Rossvoll

sekretariatsleder

Kopi til:

UiT Norges arktiske universitet
Anastasija Kuprejeva

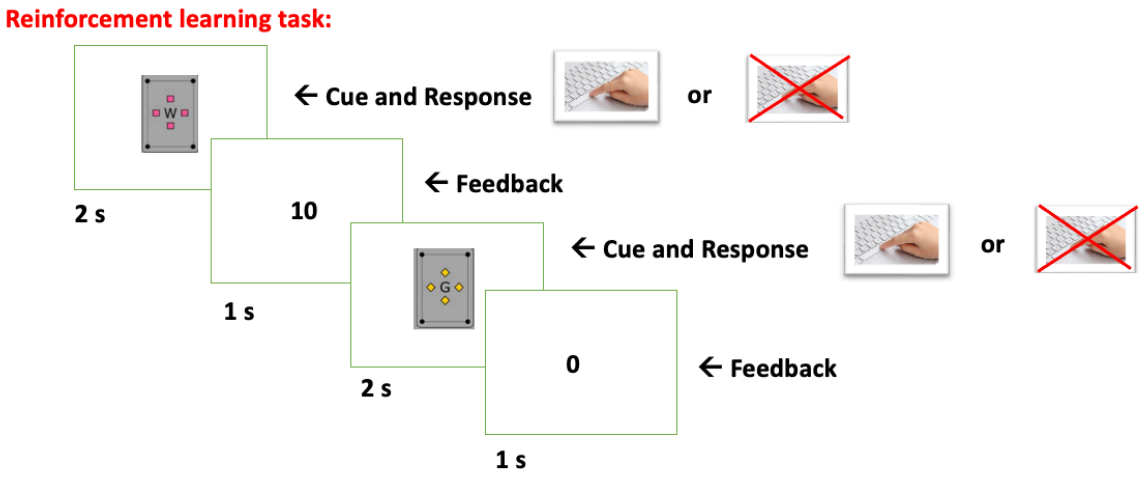
Appendix D

The Block Details

Experimental block	1 Normal	2 Induction	3 Normal	4 Induction	5 Normal
Group: Control	Response-feedback contingency: 70-30%	Response-feedback contingency: 70-30%	Response-feedback contingency: 70-30%	Response-feedback contingency: 70-30%	Response-feedback contingency: 70-30%
Group: Bad outcome manipulation	Response-feedback contingency: 70-30%	Feedback: Random, with 70% unfavorable outcomes	Response-feedback contingency: 70-30%	Feedback: Random, with 70% unfavorable outcomes	Response-feedback contingency: 70-30%

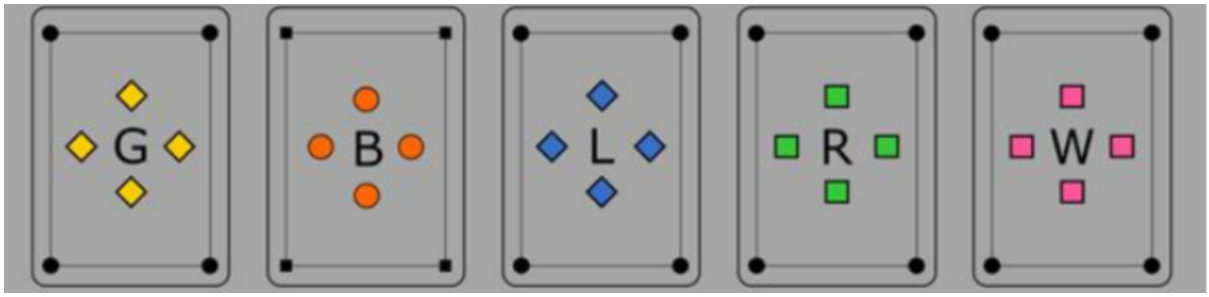
Appendix E

The Orthogonalized Go/NoGo Task



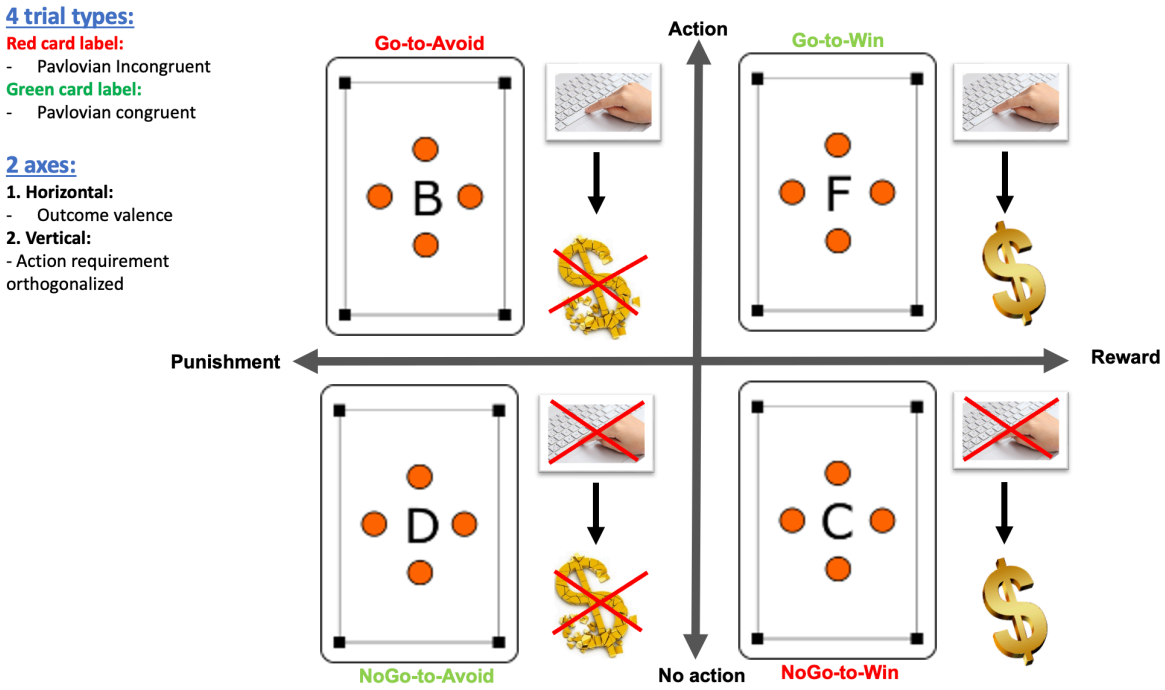
Appendix F

The Card Stimuli



Appendix G

The Different Card Types (Congruency, Valence and Response)



Appendix H

Information Sheet of the Card Game

Velkommen til dette eksperimentet!

I dette eksperimentet skal du spille med en serie av kort og målet dit er å samle så mange poeng som mulig. Avhengig av den totale summen med poeng som du samler, vil du få gavekort (verdi 300 eller 400 kroner) på slutten. Hele eksperimentet består av 5 runder med de samme reglene, men med et nytt sett med kort. Det er ingen sammenheng mellom de forskjellige kortene i hver runde, så i hver runde så starter man på nytt.

I hver runde vil du se 4 forskjellige kort, men alltid bare en om gangen. Din oppgave er å bestemme om du skal «plukke» opp kortet fra «bordet» eller ikke. Du vil se kortet på skjermen i 2 sekund. Hvis du bestemmer deg for å plukke opp kortet så må du trykke på SPACE bar ila de 2 sekundene kortet vises på skjermen. Hvis du ikke vil plukke det opp så trenger du ikke å trykke noe. Etter at kortet forsvinner, vil du få en tilbakemelding på hvor mye poeng du har fått eller tapt på den handlingen du valgte for kortet. Det er tre mulige utfall du kan få: Vinne (10 poeng), ingenting (0 poeng) og å tape (-10 poeng).

For hver av de fire kortene så er det en «riktig» respons, som kan enten være å plukke den opp eller å la den ligge på bordet. Så i hver av de 5 seriene så er den beste strategien å finne ut (ved å teste begge responsene for alle de 4 kortene) hvilke av kortene som burde plukkes opp og hvilke som man burde la ligge på bordet. Innen hver serie så endres IKKE reglene for hva som er den «korrekt» handlingen, men når du starter en ny serie med kort så endres reglene. Derimot selv om du velger den «riktige» responsen på et kort så betyr ikke det at du er garantert å få det beste utfallet, om du velger «riktig» eller «feil» respons bestemmer kun hvor stor sannsynlighet du har for å motta det beste eller verste utfallet. Så selv om du har valgt «riktig» respons så kan det være en liten sannsynlighet for at du taper poeng, men det kan også være at du får poeng når du velger «feil» respons, selv om sannsynligheten for det er relativt lav. På flertallet av kort så vil du vinne om du velger den «riktige» responsen og tape hvis du velger «feil» respons.

Av de 4 kortene, så vil det alltid være 2 kort hvor du kan enten vinne 10 poeng eller få ingenting (0 poeng). Disse 2 kortene kalles «vinnende kort» siden du aldri taper på dem.
De to andre kortene kalles «tapende» kort fordi du kan tape poeng (-10) eller ikke få poeng. Dette betyr at på de 2 «tapende» kortene så blir det beste utfallet om du får «ingenting» (0 poeng), avhengig av om du har trykt på space eller ikke).
For å oppsummere så er din oppgave å lære deg hvilke kort som burde plukkes opp for å vinne og for å unngå å miste poeng, og finne ut hvilke kort som du burde la bli liggende på bordet for å vinne og for å unngå å miste poeng på flest mulig av kortene.

Oppgaven er vanskelig, men du må aldri gi opp. Prøv å finne best mulig strategi for å samle så mange poeng som mulig. Ikke glem at etter hver serie vil det være en liten pause og neste serie vil inneholde 4 nye kort som da betyr at du må begynne å bygge opp en ny strategi på hver serie.

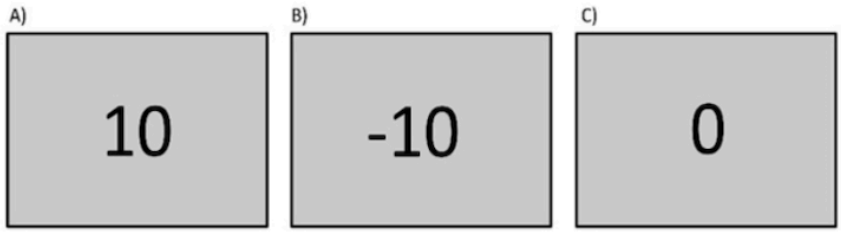
Hvis du har noen spørsmål så er det bare å spørre.

Appendix I

Quiz

QUIZ **CODE:** _____

1. **Sett en ring rundt bokstaven under hvert utsagn som korresponderer med den korrekte tallboksen**



- «Ikke vinne» eller «ikke tape»

  A B C

- Å tape

  A B C

- Å vinne

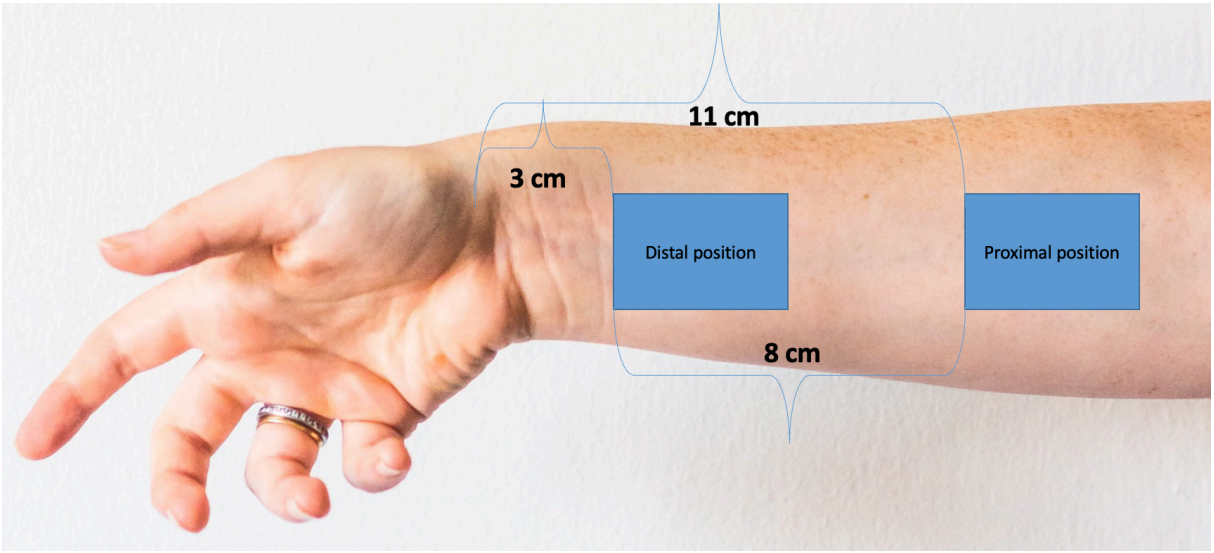
  A B C

2. **Bestem om utsagnet er riktig eller feil**

- Hvis jeg svarer riktig vil jeg alltid vinne ☐RIKTIG ☐FEIL
- For et «vinn-kort», er et utfall på «0» et dårlig utfall ☐RIKTIG ☐FEIL
- Det er alltid verdt å plukke opp et kort ☐RIKTIG ☐FEIL
- For et «tap-kort», er et utfall på «0» et dårlig utfall ☐RIKTIG ☐FEIL
- Hvis jeg svarer feil vil jeg alltid tape ☐RIKTIG ☐FEIL
- Noen ganger kan jeg få «-10» etter et «vinn-kort» ☐RIKTIG ☐FEIL
- Hvis jeg svarer feil, har jeg gode sjanser for å oppnå best mulig utfall ☐RIKTIG ☐FEIL
- Noen ganger kan jeg få «0» etter et «tap-kort» ☐RIKTIG ☐FEIL
- Noen ganger kan jeg få «10» etter et «tap-kort» ☐RIKTIG ☐FEIL
- Hvis jeg svarer riktig, har jeg gode sjanser for å oppnå best mulig utfall ☐RIKTIG ☐FEIL
- Noen ganger kan jeg få «0» etter et «vinn-kort» ☐RIKTIG ☐FEIL
- Det er aldri verdt å plukke opp et kort ☐RIKTIG ☐FEIL

Appendix J

Heat Thermode Placement on the Underarm



Appendix K

Questionnaire: Behavioral Inhibition and Activation System

BIS/BAS Code:_____

Hvert punkt av dette spørreskjemaet er en påstand en kan enten være enig eller uenig i. Hvert punkt indikerer hvor mye du er enig eller uenig med hva punktet sier. Vennligst svar på alle punktene og ikke la noen av boksene stå tomme. Velg kun et svar til hver påstand. Vennligst svar så presist og ærlig som mulig. Svar på hvert punkt som om det er det eneste punktet. Det betyr at du burde ikke tenke på å være konsis i svarene dine. Velg et svar fra de oppgitte fire alternativene og kryss av en boks.

		veldig sant for meg	delvis sant for meg	delvis usant for meg	veldig usant for meg
1.	Familien er det viktigste i et menneskes liv	☐	☐	☐	☐
2.	Selv når noe ille er i ferd med å skje med meg blir jeg sjelden redd eller nervøs	☐	☐	☐	☐
3.	Jeg gjør alt jeg kan for å få det jeg vil ha	☐	☐	☐	☐
4.	Nå jeg gjør noe bra, liker jeg veldig godt å fortsette med det	☐	☐	☐	☐
5.	Jeg er alltid innstilt på å prøve noe nytt hvis jeg tror det kommer til å bli gøy	☐	☐	☐	☐
6.	Det er viktig for meg hvordan jeg kler meg	☐	☐	☐	☐
7.	Når jeg får noe jeg vil ha, føler jeg meg oppstemt og full av energi	☐	☐	☐	☐
8.	Kritikk eller kjeft sårer meg ganske mye	☐	☐	☐	☐
9.	Når det er noe jeg vil ha, gjør jeg vanligvis mitt ytterste for å få det.	☐	☐	☐	☐
10.	Ofte gjør jeg ting uten noen annen grunn enn at det kan være gøy	☐	☐	☐	☐
11.	Jeg synes det er vanskelig å finne tid til å gjøre slikt som å gå til frisøren	☐	☐	☐	☐
12.	Hvis jeg ser en mulighet til å få tak i noe jeg vil ha, handler jeg umiddelbart	☐	☐	☐	☐
13.	Jeg føler meg temmelig urolig og engstelig når jeg tror eller vet at noen er sinte på meg	☐	☐	☐	☐
14.	Når jeg ser en mulighet som jeg liker, blir jeg straks opprømt	☐	☐	☐	☐
15.	Ofte handler jeg ut fra hvordan jeg føler meg i øyeblikket	☐	☐	☐	☐
16.	Hvis jeg tror at noe ubehagelig kommer til å skje, blir jeg vanligvis temmelig opprørt.	☐	☐	☐	☐
17.	Jeg lurer ofte på hvorfor mennesker oppfører seg som de gjør	☐	☐	☐	☐
18.	Når fine ting hender meg, går det sterkt inn på meg	☐	☐	☐	☐
19.	Jeg føler meg urolig når jeg tror jeg har gjort det dårlig på noe som er viktig	☐	☐	☐	☐
20.	Jeg føler et sug etter spenning og nye opplevelser	☐	☐	☐	☐
21.	Når jeg legger meg etter noe jeg vil ha, lar jeg ingenting hindre meg	☐	☐	☐	☐
22.	Jeg har veldig mange færre ting jeg er redd for, sammenlignet med mine venner	☐	☐	☐	☐
23.	Å vinne en konkurranse ville gjøre meg opprømt	☐	☐	☐	☐
24.	Jeg bekymrer meg for å gjøre feil	☐	☐	☐	☐

Appendix L

Questionnaire: Becks' Hopelessness Scale

BHS Code:_____

Dette spørreskjemaet inneholder en liste med tjue påstander. Vennligst les hver påstand nøye en etter en.

Hvis påstanden beskriver din holdning den siste uken, inkludert i dag, så krysser du av i ruten for "Riktig".
Hvis påstanden ikke stemmer overens med din holdning den siste uken, inkludert i dag, så krysser du av for "Galt".

Husk å les hver setning nøye.

		Riktig 1	*Galt* 2
1.	Jeg ser på fremtiden med håp og entusiasme	☐	☐
2.	Jeg kan like godt gi opp fordi jeg ikke kan gjøre ting bedre for meg selv	☐	☐
3.	Når ting går dårlig, hjelper det meg å vite at de ikke kan forbli slik bestandig	☐	☐
4.	Jeg kan ikke forestille meg hvordan livet mitt vil være om 10 år	☐	☐
5.	Jeg har nok tid til å gjennomføre de ting jeg ønsker	☐	☐
6.	I fremtiden forventer jeg å lykkes med det som opptar meg mest	☐	☐
7.	Fremtiden min ser mørk ut	☐	☐
8.	Jeg forventer å få mer ut av de gode ting i livet enn en gjennomsnittsperson	☐	☐
9.	Jeg sitter bare ikke i hell og det er ingen grunn til å tro at jeg gjør det i fremtiden	☐	☐
10.	Mine tidligere erfaringer har forberedt meg godt for fremtiden min	☐	☐
11.	Alt jeg kan se foran meg er ubehageligheter heller enn behageligheter	☐	☐
12.	Jeg forventer ikke å oppnå det jeg virkelig ønsker	☐	☐
13.	Når jeg ser på fremtiden, forventer jeg at jeg vil være lykkeligere enn jeg er nå	☐	☐
14.	Ting vil bare ikke ordne seg på den måten jeg ønsker det	☐	☐
15.	Jeg har stor tro på fremtiden	☐	☐
16.	Jeg oppnår aldri det jeg ønsker så det er dumt å ønske seg noe i det hele tatt	☐	☐
17.	Det er svært lite trolig at jeg blir tilfreds i fremtiden	☐	☐
18.	Fremtiden ser uklar og usikker ut for meg	☐	☐
19.	Jeg kan se frem til flere gode stunder enn vanskelige	☐	☐
20.	Der er ingen nytte i å virkelig prøve å oppnå noe jeg ønsker, fordi jeg sannsynligvis ikke vil klare det	☐	☐

Appendix M

Questionnaire: Need for Cognition

NFC Code:

Under finner du en del spørsmål om hvordan du vanligvis arbeider, og forholde deg til ulike oppgaver, og hvordan du takler utfallet av ulike hendelser. Gi din ærlige og oppriktige mening. Det er ingen rette eller gale svar. Det er viktig at du angir hva du vanligvis gjør - hva som er typisk for deg.

Sett kryss i den boksen som beskriver best i hvilken grad du er enig i påstandene nedenfor.

	Passer svært dårlig				**Passer svært bra**
	1	**2**	**3**	**4**	**5**
1. Jeg foretrekker komplekse fremfor enkle oppgaver/problemer.	☐	☐	☐	☐	☐
2. Jeg liker å ha ansvar for situasjoner som krever mye tenkning.	☐	☐	☐	☐	☐
3. Tankevirksomhet er ikke det jeg synes er mest gøy.	☐	☐	☐	☐	☐
4. Jeg gjør heller noe som krever lite tankearbeid, fremfor noe som utfordrer min tankekapasitet (evne).	☐	☐	☐	☐	☐
5. Jeg prøver å forutse og unngå situasjoner hvor det er en sjanse for at jeg må tenke grundig/i dybden om noe.	☐	☐	☐	☐	☐
6. Jeg finner det tilfredsstillende å fundere og "gruble" lenge og grundig på problemer/ oppgaver jeg kan løse.	☐	☐	☐	☐	☐
7. Jeg tenker bare så "hardt" og grundig som det kreves i situasjonen.	☐	☐	☐	☐	☐
8. Jeg foretrekker å tenke på mindre, daglige prosjekter fremfor oppgaver/ prosjekter som tar tid.	☐	☐	☐	☐	☐
9. Jeg liker oppgaver som krever lite tankearbeid når en først har lært det.	☐	☐	☐	☐	☐
10. Ideen om å bruke min intellektuelle kapasitet til å komme meg til topps virker fristende for meg.	☐	☐	☐	☐	☐

Appendix N

Debriefing

- ask participant how the task went, if they found it difficult

- after this, you can say something like: «You might have noted, that some parts of the task were more difficult than other parts. This is because we did not tell you at the start, but the difficulty level of the task (how easy it was to find out the optimal level) was changing, and some blocks were much more difficult. We did this to find out how people react when the difficulty of the task changes, because such unexpected changes in difficulty also happen in real life. Therefore, if you have experienced lots of bad outcomes (little wins, many losses), it is not because of your performance, but because of the way the task was designed, so don't take it personally.»

- "Hvordan gikk kortspillet, var oppgaven vanskelig for deg?"

- "Du har kanskje lagt merke til at noen av delene I oppgaven var vanskeligere enn andre deler. Det er fordi vi har ikke fortalt deg på starten, men vanskelighetsgraden på oppgaven endret seg, og noen av blokkene var mye vanskeligere enn andre. Vi gjorde det for å finne ut av hvordan du reagerer når vanskelighetsgraden av oppgaven endrer seg, fordi slike uforventede endringer I vanskelighetsgrad også skjer I det virkelige liv. Derfor, hvis du har opplevd mange dårlige utfall, lite vinn og mange tap, det var ikke på grunn av prestasjonen din, men på grunn av hvordan kortspillet var designet, så ikke ta det personlig"

Appendix O

COVID-19 Guidelines

COVID-19 Informasjonsskriv

Dette forskningsprosjektet er utført av Gabor Csifcsak og Matthias Mittner. Utførelsen av selve eksperimentet blir gjennomført av med-forskerne; Caroline Alexandra Grant Angen, Anastasija Kuprejeva og Ina Klakegg.

Denne forskningen er en del av et forskningsprosjekt ved IPS, UiT og vil foregå på lab 5.387. Utstyret brukt i dette eksperimentet er følgende:

- Tastatur og dataskjerm
- Medoc PATHWAY *(modell chep: contact heat-evoked potential stimulator)* og tilhørende termode
- Pen og papir for utfyllelse av spørreskjema (og samtykkeskjema)

Eksperimentet vil bli utført av enten Caroline, Anastasija eller Ina på maks en deltaker av gangen (maks 1 medforsker + 1 deltaker tilstede i labben av gangen). Deltakerne skal være mellom 18-50 år og friske.

Design (Avstand, kontaktområder og behandling av utstyr)

- Under hele eksperimentet vil det være minst 1 meter mellom medforsker og deltaker. Medforsker vil også bruke ansiktsmaske dersom dette er nødvendig eller kreves av gjeldende restriksjoner eller forskrifter.
- Det vil være en deltaker tilstede i labben om gangen. Deltakeren skal sitte på en stol foran en pc skjerm og tastatur mens en termode er festet til innsiden av forarmen.
- Medforsker vil desinfisere alt utstyr (spesielt termoden som er i direkte kontakt med hud) med desinfiseringsmiddel både før eksperimentet begynner og etter det er fullført. Deltakeren vil bruke engangshanske i kontakt med tastaturet for å unngå overføring av potensiell smitte mellom deltakere. Dersom border eller noe av utstyret må justeres, vil justerings-knappene også bli desinfisert.

Forebyggende tiltak:

- Rengjøring og desinfisering:
    - ❖ Bord, stol, dør håndtak og andre kontaktoverflater i labben vil bli desinfisert med desinfiseringsmiddel før og etter hver deltaker.
    - ❖ ALT av utstyr som pc skjerm, tastatur og termode vil bli desinfisert før og etter bruk.
- Beskyttende utstyr (engangshansker, maske og plastikkpose):
    - ❖ Masker og hansker vil bli brukt under rengjøring og desinfisering av utstyr før og etter hver deltaker.
    - ❖ Deltakerne vil bli tildelt hansker og maske umiddelbart etter å ha entret labben. De vil bli spurt om å ta i bruk hansker under hele eksperimentet mens masker kun under klargjøringen av den kognitive oppgaven (instruksjoner,

spørreskjema). Selve oppgaven vil bli utført i et separat rom i labben og vil vare ca 35 minutter (5x7 minutter per blokk). Under denne oppgaven vil deltakerne være alene i rommet mens medforskeren befinner seg på utsiden i rommet ved siden av. I løpet av disse øktene (5 blokker) vil masken bli tatt av for den grunn at den ikke skal være til bry og forstyrre følelser under den kognitive oppgaven. Etterfulgt av denne oppgaven vil deltakerne bli bedt om å ta i bruk en ny maske under utfylling av nye spørreskjema (vil foregå i rommet ved siden av). *Krav om maskebruk kan variere basert på reguleringer og regler gjeldende når eksperimentet gjennomføres.*

- ❖ Hvis deltakeren ikke har mulighet til å lagre personlige eiendeler utenfor labben vil en plastikkpose for oppbevaring bli tatt i bruk. Denne vil kastes umiddelbart etter bruk. Deltakerne vil også bli bedt om å slå av mobilen og plassere den med sine personlige eiendeler under hele eksperimentet.

- Øvelse av bruk og prosedyrer angående beskyttelses utstyr og vasking av overflater.
  - ❖ Forskere og medforsker vil utføre øvelser i håndtering og bruk av beskyttelses utstyr samt hvordan labben rengjøres og desinfiseres før og etter testing. Avstand blant forsker/medforsker og deltaker bestående av 1 meter vil opprettholdes under hele eksperimentet
- Symptomer hos deltaker før/under/etter deltakelse av eksperiment:
  - ❖ Om deltakeren skulle oppleve noen form for symptomer før, under eller etter deltakelse av eksperimentet, eller skulle ha noen spørsmål angående tema før eller etter testing er det bare til å ta kontakt med på email (se nederst på arket)
  - ❖ Det vil bli skrevet ned kontakt informasjon slik at det vil bli enklere å informere mennesker en har vært i kontakt med eller som har vært i labben de siste to ukene. Denne informasjonen vil bli oppbevart og sikret på en trygg plass. Kontakt informasjonen vil bestå av deltakerens nummer og dato for deltakelse, personlig navn vil ikke bli nedskrevet.
  - ❖ Deltakerne vil bli informert om å forlate eksperimentet om det skulle oppstå symptomer på COVID-19 under deltakelse (feber, tung pust, hoste eller andre symptomer som krever isolasjon eller karantene).

Kontaktinformasjon	
Forskningsansvarlig	**Medforskere**
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