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M A S T E R T H E S I S

Keep Cool and Protect Nature: Does Stress and its Interplay With Habits Influence Pro-Environmental Behavior?

submitted by

Annika Lutz

Faculty of Psychology and Human Movement

Study program: Psychology

Matriculation number: 7094810

Email: annika.e.lutz@gmail.com

Supervisor 1: Prof. Dr. Lars Schwabe

Supervisor 2: Florian Lange, Ph.D.

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Abstract

Background. The aim of the present thesis was to investigate the influence of acute, experimentally induced stress on pro-environmental behavior (PEB) in the laboratory. Stress was expected to decrease the amount of PEB, indicated by previous research (Sollberger, Bernauer, & Ehlert, 2016b) as well as by findings of stress decreasing self-control (Oaten & Cheng, 2005) and increasing delay discounting (Kimura et al., 2013). Furthermore, the interplay between stress and habits in predicting PEB was to be examined: Stress was expected to render PEB more habitual (Schwabe & Wolf, 2009). **Method.** The hypotheses were investigated by experimentally inducing acute psychosocial stress via the Trier Social Stress Test (Kirschbaum, Pirke, & Hellhammer, 1993) and measuring PEB with an adapted, shorter version of the Pro-Environmental Behavior Task (Lange, Steinke, & Dewitte, 2018). Additionally, several questionnaires assessing PEB were included to validate the adapted PEB and measure pro-environmental habits. **Results.** Women consistently displayed more PEB than men, while the factor stress did not significantly influence PEB. Moreover, stress did not modulate the influence of pro-environmental habits on PEB. However, an increased cortisol response after the experimental manipulation was associated with increased PEB. By contrast, negative mood was associated with decreased PEBT. The present experiment was furthermore part of a bigger study and thus entailed an additional factor "predictability" which interestingly influenced PEB: Participants who received little preliminary information about the upcoming TSST showed less PEB. **Conclusion.** Potential limitations and implications for future research are discussed in terms of processes leading to the observed behavioral pattern.

Key Words: *Social stress, salivary cortisol, pro-environmental behavior, ecological behavior, climate change, habits, Pro-Environmental Behavior Task, Trier Social Stress Test, Predictability*

1. Introduction

"Now that the physical science is clear,
the fundamental problem of climate change is psychological.
How will humans manage the largest social dilemma in history?"
(Brick & van der Linden, 2018, p. 35)

In an ideal world, humans would be able to immediately adjust their behavior towards enabling a sustainable future. However, the demands of everyday life are likely to interfere. In modern, industrialized nations, stressful events seem to be omnipresent and experiencing stress appears to be inevitable. Simultaneously, stress leads us to prioritize immediate problems over more distant concerns (Fields, Ramos, & Reynolds, 2015). Nonetheless, climate change is arguably one of the most urgent problems of our time. Even though the generation that is alive today may no longer experience the consequences of global warming, drastic behavioral change towards pro-environmental behavior is desperately needed.

1.1 Pro-Environmental Behavior

Pro-environmental behavior (PEB) can be defined as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world" (Kollmuss & Agyeman, 2002, p. 240). Steg and Vlek (2009) narrowed down this definition by referring to pro-environmental behavior as behavior that "harms the environment as little as possible, or even benefits the environment" (p. 209)[1]. When aiming towards understanding and changing a target behavior, Stern (2000) proposes to focus on the intention to benefit or harm the environment that underlies environmentally significant behavior. The author also emphasizes the importance of analyzing the impact of a target behavior and identifying the extent to which it influences ecosystems, the biosphere or the availability of resources from the environment.

Furthermore, what characterizes various environmentally relevant decisions in everyday life is a trade-off between personal consequences and environmental consequences (Gifford, 2011; Lange et al., 2018). Pro-environmental decisions are often costly for the individual, while being beneficial for the environment and the collective others (Steg, 2015).

[1] In the current thesis, the term "pro-environmental behavior (PEB)" refers to behavior that benefits the environment, while "environmental behavior" or "environmentally significant" is used to address behavior that affects the environment in one way or the other (whether harmful or beneficial).

More specifically, drawing on social dilemma literature, PEB can be defined as a *social fence* (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001). This term implies the immediate negative consequences that PEB has for an individual, while having long-term positive consequences for the individual and other people. By contrast, a *social trap* situation would emerge when a given behavior has immediate positive consequences for an individual, while resulting in negative long-term consequences for the individual and other people (Joireman et al., 2001). For example, when choosing to take the car instead of the bike to get to university, the reason being that a car ride is more convenient compared to other means of transportation, then this would qualify as a social trap.

Additionally, Stern (2000) differentiates between several types of environmentally significant behaviors: *Environmental Activism*, *Nonactivist Behaviors in the Public Sphere*, and *Private-Sphere Environmentalism*. Environmental Activism could mean, for example, participating actively in environmental groups or organizing collective actions. Nonactivists' support of movement objectives or signing petitions would qualify as nonactivist behavior in the public sphere. Private-sphere environmentalism refers to individual behavior, such as consumer or recycling behavior. The current study will mainly focus on private-sphere environmentalism since it can be easily studied in a laboratory setting. Furthermore, in this experimental set-up, the conflict between individual and environmental consequences receives special attention, as will be elaborated later.

PEB is furthermore often acknowledged to consist of a mixture of self-interest and more prosocial motives (Bamberg & Möser, 2007). Prosocial motives are generally summarized as the concern for others or the concern for nature. For example, when the main reason for PEB is the intention to prevent air pollution in order to not harm the climate or cause risks for people's health, this would be regarded as a mainly prosocial motive (Bamberg & Möser, 2007).

Self-interest can motivate PEB when, for example, minimizing one's own health risk is the main intention. According to Bamberg and Möser (2007), when self-interest is regarded as the more important motive, researchers often use rational choice models, like the Theory of Planned Behavior (Ajzen, 1985) to explain PEB. The Theory of Planned Behavior proposes that *attitudes toward the behavior*, a *subjective norm,* and *perceived behavioral control* predict the *intention* to execute a given behavior, which in turn influences the behavior itself (Ajzen, 1991). Intentions represent the motivational factors influencing behavior. While attitudes and subjective norms supposedly directly influence intentions and the link from attitudes and norms to behavior is only indirect, an additional direct link from perceived behavioral control towards the target behavior is assumed. Perceived behavioral control, in contrast to the actual behavioral control, represents the perception of people regarding the ease or difficulty of executing the behavior (Ajzen, 1991). Furthermore, according to the author, subjective norms refer to the perceived social pressure associated with performing a behavior. Environmental Attitudes, defined as "the collection of beliefs, affect, and behavioral intentions a person holds regarding environmentally related activities or issues" (Schultz et al., 2005, p. 458), are commonly treated as latent constructs that guide PEB. However, there seems to be heterogenous evidence concerning the influence of environmental attitudes on PEB.

While attitudes may not be the only force guiding PEB, several studies suggest that strong environmental attitudes do indeed predict PEB (Bamberg & Möser, 2007; Holland, Verplanken, & van Knippenberg, 2002). Scott and Willits (1994), additionally, found only modest relationships between environmental attitudes and behavior measures when both were examined through questionnaires. Nonetheless, Levine and Strube (2012) reported explicit environmental attitudes to be a strong predictor of environmental intentions and intentions predicting environmental behavior, while implicit attitudes were not related to intentions or behavior. Those ambiguous results suggest that the relationship between attitudes and PEB might be moderated by other factors.

Another factor influencing PEB across country and age is gender: Women generally report stronger environmental attitudes and especially more PEB than men. (Zelezny, Chua, & Aldrich, 2000). Those findings are supported by several other studies (Vicente-Molina, Fernández-Sainz, & Izagirre-Olaizola, 2018). For example, similar results could be replicated across 22 nations: Women tended to engage in more PEB than men (Hunter, Hatch, & Johnson, 2004). Furthermore, it appears that women and men become involved with preservation of the environment for different reasons (Borden & Francis, 1978). Presumably, this gender effect in PEB is due to higher levels of socialization for women to be other-oriented and socially responsible (Zelezny et al., 2000). However, the so-called socialization theory seems to not be fully applicable to students, and determinants leading to PEB are different for women and men (Vicente-Molina et al., 2018).

1.1.1 Regulatory Resources

As described above, PEB often goes hand in hand with a concern for others and generally prosocial motives (Bamberg & Möser, 2007). Furthermore, PEB is recognized to often be costly (e.g. in terms of money or time) for the individual (Steg, 2015), while serving long-term collective interests (Sollberger et al., 2016b). Thus, in order to carry out behavior which does not have any immediate benefits for the individual, it is likely that a certain amount of cognitive control is needed. Indeed, cognitive control was found to moderate the relationship between environmental attitudes and behavior (Langenbach, Berger, Baumgartner, & Knoch, 2019). The notion that limited, consumable resources are needed to regulate or control behavior is found in research about cognitive control, self-control or self-regulation, amongst other related concepts (Muraven & Baumeister, 2000; Muraven, Tice, & Baumeister, 1998; Vohs et al., 2008). *Ego depletion*, on the other hand, refers to a state of reduced self-regulatory powers that undermines intentions which would otherwise guide behavior (Baumeister, Sparks, Stillman, & Vohs, 2008). Those concepts all relate to cognitive resources, which are however limited (Kahneman, 2011). Several studies relate those concepts to environmental behavior: Self-control was positively associated with PEB (Kerret, Orkibi, & Ronen, 2016) and self-regulation is often acknowledged to play an important role in displaying PEB (Nielsen, 2017). Furthermore, an association between depletion of those regulatory resources and decreased prosocial behavior can frequently be observed (Gailliot, 2010; Kocher, Martinsson, Myrseth, & Wollbrant, 2017; Martinsson, Myrseth, & Wollbrant, 2014; Osgood & Muraven, 2015; Xu, Bègue, & Bushman, 2012).

1.1.2 Delay Discounting and Delayed Gratification

As important as considering self-control in relation to PEB is reviewing the ability to delay gratification in this context. *Delay discounting* or *temporal discounting* describes a phenomenon which leads to a decrease of the subjective value of future rewards if those rewards are delayed to a later point in time (Arbuthnott, 2010). When immediate small rewards consequently become more important than future large rewards, the ability to delay gratification is needed to keep targeting the future large reward (Arbuthnott, 2010).

PEB, being characterized as a social fence (Joireman et al., 2001), requires the sacrifice of short term interests, while positive consequences will only occur in a distant future (Carmi, 2013), maybe even only benefitting future generations. Arbuthnott (2010) also argues that environmentally significant decisions often carry an opportunity for immediate gratification when choosing the more environmentally harmful option. Thus, long-term positive consequences are devalued, and behavior becomes prone to counteract the initially pro-environmental intention. In fact, research demonstrates that air quality or respiratory health, which are consequences of emissions, are subject to delay discounting (Berry, Nickerson, & Odum, 2017), meaning those outcomes are often devalued due to taking place in the future.

Furthermore, other results indicate that participants who were concerned with immediate consequences of their behavior were less likely to behave pro-environmentally (Arnocky, Milfont, & Nicol, 2014). Additionally, the concern for an environmental disaster and the amount of time the participants were willing to sacrifice towards fixing it decreased with increased delay of the disaster into the more distant future (Kaplan, Reed, & McKerchar, 2014). In the same study, the results showed that ratings of willingness to act were even more discounted than ratings of concern.

1.1.3 Pro-Environmental Habits

Many pro-environmental behaviors are likely to qualify as habitual (Klöckner & Verplanken, 2013), by being performed frequently and under very stable situational circumstances (Wood, Quinn, & Kashy, 2002). Habits are driven by automated cognitive mechanisms and are furthermore triggered by a particular situation in which an individual has frequently acted in the same way (Steg & Vlek, 2009). Gifford (2011) describes habits as one of the most important barriers for mitigating climate change. While habits were found to greatly influence future behavior (Ouellette & Wood, 1998), many existing studies support this statement for prosocial behavior and PEB specifically, too (Carrus, Passafaro, & Bonnes, 2008a, 2008b; Eriksson, Garvill, & Nordlund, 2008; Welsch & Kühling, 2009). For example, past donation behavior was found to predict charitable donations (Verhaert & van den Poel, 2011), car use habits helped in predicting future car use (Bamberg & Schmidt, 2003; Verplanken, Aarts, van Knippenberg, & Moonen, 1998), and food waste habits predicted food waste behavior (Russell, Young, Unsworth, & Robinson, 2017).

A phenomenon which is frequently reported to render behavior more habitual and to impair self-control and the ability to delay gratification, is stress.

1.2 Stress – Defining the Concept

Stress can be understood as a “state of threatened or perceived as threatened homeostasis” (Charmandari, Tsigos, & Chrousos, 2005, p. 259). However, it is important to distinguish between *stressor* and *stress response*. Stressors are the extrinsic or intrinsic conditions that, when being evaluated as threatening to homeostasis, elicit stress (Chrousos, 1992). The stress response, on the other hand, describes the physiological and psychological response to the stressor that enables an adequate, rapid reaction and helps in detecting threats and restoring homeostasis (Hermans, Henckens, Joëls, & Fernández, 2014).

1.2.1 Physiological Stress Response

The physiological stress response aims at reallocating resources in order to ensure the energy supply needed to cope with the increased demands of the stressor (Hermans et al., 2014). Two major components constitute the essential mediators of the physiological stress response (Miller & O'Callaghan, 2002): The sympathetic adrenomedullar system (SAM) and the hypothalamic–pituitary–adrenal axis (Godoy, Rossignoli, Delfino-Pereira, Garcia-Cairasco, & Lima Umeoka, 2018). Those two systems are activated by brainstem and hypothalamic structures (Ulrich-Lai & Herman, 2009). The amygdala, furthermore, is highly sensitive to threatening stimuli (LeDoux, 2003) and activates the body's stress-reaction-systems via projections to the hypothalamus (Davis, 1992).

Sympathetic Adrenomedullar System. Shortly after being confronted with a stressor, the sympathetic branch of the autonomic nervous system stimulates the release of adrenaline (A) and noradrenaline (NA) in the medulla of the adrenal gland (Cannon, 1914; Ulrich-Lai & Herman, 2009) and the release of NA from sympathetic nerve endings (Kvetnansky, Sabban, & Palkovits, 2009). Within seconds after onset of the stressor, this leads to increased cardiovascular activity, for example, in the form of increased heart-rate, blood pressure or peripheral vasoconstriction, ultimately enabling energy mobilization in preparation of increased physiological demands (Ulrich-Lai & Herman, 2009).

Hypothalamic–Pituitary–Adrenal Axis. The hypothalamic–pituitary–adrenal (HPA) axis, on the other hand, is a more delayed stress response that, when activated, leads the paraventricular nucleus of the hypothalamus to release the corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP) (Gunnar & Quevedo, 2007). When reaching the anterior pituitary, they then bind to cognate receptors on corticotropes and in turn induce the secretion of adrenocorticotropic hormone (ACTH) (Herman et al., 2016), which is afterwards released into the bloodstream and initiates the production and secretion of the glucocorticoid cortisol in the cortex of the adrenal gland (Miller & O'Callaghan, 2002). Glucocorticoids can exert genomic and non-genomic influences on the body (Ulrich-Lai & Herman, 2009). 15 to 30 minutes after exposure to a stressor, blood concentrations of cortisol reach their peak level, while they decrease to baseline levels within 60 to 90 minutes (de Kloet, Joëls, & Holsboer, 2005). Cortisol exerts its fast, non-genomic effects within minutes through cell membrane receptors (Ulrich-Lai & Herman, 2009). This rapid cortisol secretion leads, in addition to generally enhancing the cardiovascular stress response of the SAM system, amongst other effects, to a suppression of inflammatory activity and to the mobilization of energy by the increase of glucose concentration (Sapolsky, Romero, & Munck, 2000). Secretion of cortisol is furthermore governed by a fast, non-genomic negative feedback loop at various stages of the HPA axis with high levels of cortisol inhibiting the stress response (Myers, McKlveen, & Herman, 2012).

Genomic effects of cortisol occur through cortisol binding to intracellular mineralocorticoid (MR) and glucocorticoid (GR) receptors (Joëls & Baram, 2009). MRs have a high sensitivity for endogenous glucocorticoids and play an important role in regulation of the circadian secretory rhythms. Even when circulating corticosteroid levels are low, those receptors are usually bound (de Kloet et al., 2005; de Kloet, Vreugdenhil, Oitzl, & Joëls, 1998). GRs, on the other hand, have a lower affinity and are only saturated when glucocorticoid levels are high, thus, they are able to respond to stress (Joëls & Baram, 2009). The GR furthermore contributes to a delayed, genomic feedback inhibition (Myers et al., 2012). When binding to the receptors, cortisol contributes to the regulation of gene transcription (de Kloet et al., 1998). Those genomic effects of cortisol take at least an hour to develop and can last several days (Joëls & Baram, 2009). The genomic effects of glucocorticoids can suppress noradrenergic activity (Joëls & Baram, 2009).

Moreover, secretion of CRH and cortisol follows a circadian rhythm. Therefore, directly after awakening, a high cortisol concentration can be observed, while over the course of the day and into the night cortisol concentration decreases gradually (Edwards, Clow, Evans, & Hucklebridge, 2001). Furthermore, stress has adverse effects on brain activity, as well. Catecholamines increase activity in the amygdala and basal ganglia, leading to a strengthened emotional and habitual response. Simultaneously, top-down cognitive functions of the prefrontal cortex (PFC) are inhibited (Arnsten, Raskind, Taylor, & Connor, 2015). More recent literature suggests furthermore that certain characteristics of stressors are associated with the different stress-systems: Psychosocial stressors were found to induce a particularly strong endocrine response when stressors involved novelty, unpredictability, uncontrollability, ego-involvement and social-evaluative threats (Dickerson & Kemeny, 2004; Mason, 1968). The autonomic stress response (SAM), on the other hand, was particularly activated when stressors were physically demanding (e.g. bicycle ergometer test) (Skoluda et al., 2015).

1.2.2 Psychological Processes During Stress

Cognitive resources are limited (Kahneman, 2011). Experiencing stress, however, was found to limit cognitive resources even further (Sato, Takenaka, & Kawahara, 2012). Stress is frequently associated with an impairment of various regulatory forces: Stress resulted in lower levels of psychological resources (Zeidner & Ben-Zur, 2014) and stress-related demands were shown to consume attentional resources (Sato et al., 2012; Tiferet-Dweck et al., 2016). Participants who underwent an academic examination period showed less self-control on various measures, such as performance during the Stroop task, as well as emotional control or healthy eating (Oaten & Cheng, 2005). This reduction of self-control under stress was found to be driven by an increased influence of immediately rewarding attributes and decreased effectiveness of brain regions which encourage behavior that is compatible with long-term goals (Maier, Makwana, & Hare, 2015). Findings on stress impairing emotion regulation are frequently reported (Raio, Orederu, Palazzolo, Shurick, & Phelps, 2013) and generally, coping with stress was found to require self-control (Muraven & Baumeister, 2000). Simultaneously, a meta-analytic review found significantly positive associations between stress and impulsivity (Fields, Lange, Ramos, Thamotharan, & Rassu, 2014). Another review article suggests a shift to a more immediate-oriented mindset under stress (Fields et al., 2015). Cortisol was furthermore reported to be associated with a shift from deliberative towards intuitive thinking (Margittai et al., 2016) and induced a preference for small immediate rewards while simultaneously discounting the subjective value of larger future rewards (Kimura et al., 2013). To summarize, several studies suggest that stress impairs self-control and promotes a preference for smaller immediate rewards at the expense of long-term goals in the distant future.

In addition to stress impairing self-control, stress was found to have substantial effects on habitual behavior, too (Schwabe & Wolf, 2011). Stress increased habitual behavior in instrumental learning tasks and reduced explicit knowledge on action-outcome contingencies (Schwabe & Wolf, 2009). Acute stress after learning and acquiring of habits proved to have the same effect (Schwabe & Wolf, 2010). This effect was promoted by combined glucocorticoid and noradrenergic activity, while neither glucocorticoid nor noradrenergic activity alone had this effect (Schwabe, Höffken, Tegenthoff, & Wolf, 2011; Schwabe, Tegenthoff, Höffken, & Wolf, 2010, 2012). In conclusion, stress was often reported to impair self-control and enhance impulsive and habitual behavior.

1.2.3 Stress and Prosocial Behavior

Potentially, the earliest association between stress and social behavior was made by Cannon (1914) in proposing that the purpose of the activation of the sympathetic adrenomedullar system was to initiate a *fight or flight* response. According to Cannon, when being confronted with a stressor, the physiological stress response prepares the individual for either attacking or fleeing a potential enemy. Which behavioral response (fighting or fleeing) results would therefore depend on the nature of the stressor (Taylor et al., 2000). However, *tend and befriend* was suggested as another response pattern to stress, originally proposed as "female stress responses" (Taylor et al., 2000, p. 5). According to the authors, nurturing offspring and strengthening social bonds would be a highly adaptive response to stress in women. Therefore, with regards to the influence of stress on PEB, the question arises whether stress renders people's behavior towards more individualistic and aggressive, as opposed to more caring and pro-social behavior.

According to recent literature, the tend and befriend behavioral pattern might not be limited to women: Stress was frequently found to increase prosocial and altruistic behavior in women, as well as in men (Takahashi, Ikeda, & Hasegawa, 2007; von Dawans, Ditzen, Trueg, Fischbacher, & Heinrichs, 2019; von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012). Furthermore, stress exposure was found to increase altruistic decision-making in everyday moral dilemmas, too (Singer et al., 2017). Increased cortisol response after a stressor was additionally related to increased prosocial motives towards the in-group in an intergroup social dilemma game (Schweda, Faber, Crockett, & Kalenscher, 2019). More specifically, directly after stress induction, men demonstrated higher generosity levels towards socially close others (Margittai et al., 2015). Moreover, Tomova et al. (2017) were able to replicate the findings of increased prosocial behavior under stress and - more importantly - demonstrated that stress increased activation in the empathy for pain network when viewing others in pain. If stress more broadly qualifies as a negative state (as suggested by N. Kaida & Kaida, 2019), this association can be further supported: Various studies indicated (induced) negative mood leading to more altruistic behavior in the dictator game[2] (Pérez-Dueñas et al., 2018; Tan & Forgas, 2010).

Nonetheless, the effect of stress on prosocial behavior is complex. For example, time pressure and cognitive load did not influence moral judgements or altruistic behavior (Tinghög et al., 2016). On the other hand, higher levels of acculturative stress are linked to prosocial tendencies among men, but they are also linked to lower levels of altruism for women and men (McGinley et al., 2010).

Contradictory to the previously mentioned results, a frequently cited study suggests that time pressure decreases helping behavior (Darley & Batson, 1973). In line with those findings, participants also showed less cooperative behavior under conditions of extreme time

[2] The dictator game is a paradigm, in which participants need to choose between sharing a monetary reward with others or keeping it to themselves (Pérez-Dueñas, Rivas, Oyediran, and García-Torres (2018).

pressure (Capraro & Cococcioni, 2016). When stress was operationalized as environmental overload with much noise being present, altruistic behavior proved to be less frequent under those conditions than in the absence of environmental overload (Moser, 1988). Various other studies support this association with specific regard to stress, too: For example, participants who just experienced stress induction donated significantly less money to a charitable organization, compared to a control group (Vinkers et al., 2013). Similarly, when faced with a highly emotional moral dilemma, a larger increase of cortisol following social stress was associated with more egoistical decisions (Starcke, Polzer, Wolf, & Brand, 2011). Moreover, stress was found to impair empathic processes in response to observed pain in another person (Buruck, Wendsche, Melzer, Strobel, & Dörfel, 2014).

Sollberger et al. (2016b) suggest to differentiate prosocial behavior depending on the recipients, especially when investigating the influence of stress on PEB. Nolan and Schultz (2015) argue as well, that prosocial theories need an extension including non-human beneficiaries of prosocial behavior. In line with the tend and befriend hypothesis, Sollberger et al. (2016b) propose that stress may have differential effects, depending on whether the recipient is a specific other person or an anonymous organization. Therefore, according to the authors, when individuals can expect the beneficiary of their behavior to support them under stress, they would be more likely to show prosocial behavior. This would occur when the recipient is a specific other individual, but not when an anonymous organization would benefit from the behavior. PEB, however, would rarely benefit a specific other person but more often it would benefit an organization, ecosystems, or the climate.

In another attempt to explain those frequently conflicting results, Steinbeis, Engert, Linz, and Singer (2015) investigated the influence of stress and affiliation on prosocial behavior. They demonstrated that stressed participants were less trusting and showed less altruistic punishment behavior[3], but no significant interaction effect of stress and affiliation was present: Thus, stress and the priming of affiliative tendencies did not interact in leading to tend and befriend behavior (Steinbeis et al., 2015). The authors propose that other studies may have been able to observe tend and befriend behavior as a response to stress because critical social confounds had been present when stress was induced. Namely, the social confounds in the experimental set-up would have been the use of the group version of the Trier Social Stress Test (TSST-G; von Dawans, Kirschbaum, & Heinrichs, 2011). Steinbeis et al. (2015) argue that this shared stress experience might prime affiliative feelings, rather than stress per

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[3] Altruistic punishment behavior is characterized by decisions in which non-cooperators are punished by the individual, even though its is costly for the individual (Steinbeis et al. (2015).

se having affiliative effects. In fact, this critique can be applied to some of the previously mentioned studies investigating the effect of stress on prosocial behavior: von Dawans et al. (2019; 2012), Margittai et al. (2015), Schweda et al. (2019) and Vinkers et al. (2013) did all use the TSST-G for stress induction. However, Tomova et al. (2017) did not use the group version of the TSST and still found increased prosocial behavior under stress.

PEB is often treated as conceptually similar to prosocial behavior. Indeed, the decision to engage in PEB can be seen as an example for prosocial behavior at the societal level (Joireman et al., 2001). Furthermore, evidence indicates that people's PEB is dominated by normative prosocial influences (Kaiser & Byrka, 2011). Additionally, existing research suggests PEB as an adequate operationalization of prosocial behavior (Sollberger et al., 2016b): According to the authors, due to serving long-term collective interests and not directly benefitting the individual, PEB is prosocial by nature.

1.2.4 Stress and Pro-Environmental Behavior

The *Terror Management Theory* (TMT; Greenberg & Kosloff, 2008) offers a framework to investigate social behavior in the presence of existential threats: The theory suggests that by identifying with larger groups or causes, an individual can reach symbolic immortality by meeting prescribed standards of value and therefore leaving a lasting mark even after physically dying. The authors therefore suggest that when reminded of their own mortality, people tend to defend their cultural worldviews and align their behavior to social norms. Koole and van den Berg (2005) investigated the influence of death reminders on the perception of nature and found that death reminders led participants to respond more positively to cultivated landscapes and led to reduced ratings of the perceived beauty of wilderness.

Fritsche, Jonas, Kayser, and Koranyi (2010) furthermore related the TMT to the concept of pro-environmental attitudes and behavior. They demonstrated by conducting three independent studies in different geographic and cultural contexts that when a pro-environmental norm is salient, existential threat can result in increased PEB. However, when confronted with a salient anti-environmental norm, decreased conservation behavior was shown. Thus, in the event of existential threat, pro- or anti-environmental norms seem to be an influential factor predicting PEB.

Buttlar, Latz, and Walther (2017) investigated the effect of a present existential threat and its interplay with pro-environmental norms and habits on the use of paper towels and napkins. In two experiments, after introducing a pro-environmental norm, participants used significantly less paper towels and napkins than compared to baseline-level. However, once reminded of a global threat (namely a potential nuclear power plant incident), this effect was eliminated, and participants went back to their previous, unsustainable behavior, even when the pro-environmental norm was still in place. The authors thus argued that when faced with existential threats, established environmentally significant habits become more important than social norms in influencing PEB. This result seems to be in line with the previously discussed effect of stress promoting habitual behavior. Nevertheless, it is possible that the effect of existential threats cannot be generalized to the influence of stress.

Until now, only a small number of studies explicitly investigated the influence of stress on PEB. Nonetheless, in various studies, stress was negatively associated with subjective well-being (Serrano & Andreu, 2015; Tran, Wright, & Chatters, 1991). Correlational results indicate a positive relationship between subjective well-being and PEB (Brown & Kasser, 2005). Thus, it is likely that stressed individuals show less PEB. The results of a correlational study by N. Kaida and Kaida (2019) support this argument: They reported negative associations between stress and PEB. Additionally, the authors found that sleepy people performed less PEB in several studies (K. Kaida & Kaida, 2017; N. Kaida & Kaida, 2019). Those results may seem counterintuitive regarding the likely differing arousal levels of stress and sleepiness. Nevertheless, the authors argue that both stress and sleepiness are negative states and were therefore negatively associated with PEB (N. Kaida & Kaida, 2019).

A few studies did, however, investigate the effect of experimentally induced stress and the effect of basal cortisol concentrations on PEB in men (Sollberger et al., 2016b, 2016a, 2017). In one particular study, the authors investigated the effect of pro-environmental orientation and stress on visual attention to climate change images (Sollberger et al., 2017). Pro-environmental orientation as a trait factor and stress as a state factor were expected to predict inter- and intra-individual differences in reaction to climate change. According to the authors, stress poses a very immediate problem and might therefore decrease the individual's interest in climate change. In line with this hypothesis, the participants did indeed spend less time looking at climate change images when they were influenced by acute stress, regardless of pro-environmental orientation (Sollberger et al., 2017). However, participants also spent less time looking at negative control images.

Another study by Sollberger et al. (2016b) investigated the effect of experimentally induced, acute psychosocial stress on pro-environmental donation behavior amongst men. In this study, stress was found to increase the probability to donate money to a pro-environmental organization in participants with low pro-environmental (LP) orientation. The authors concluded that for LP-participants, the *decision to donate money* was driven by the motive of mood enhancement of stress-induced negative emotions, since LP participants showed an increase in experienced calmness accompanying donation behavior. Thus, in LP participants, the decision to donate might be driven by the motivation to feel better about themselves, especially after the social evaluation experience during the stressor. Furthermore, the participants' cortisol response to the experimental manipulation was positively associated with the donation decision in stressed LP participants: Low pro-environmental individuals with a stronger cortisol response to the experimental manipulation were more likely to donate. However, the cortisol response was neither for high pro-environmental participants (HP) in the stress groups nor for LP or HP participants in the control group significantly associated with the donating decision. The authors interpreted this result as an indicator for the hypothesis that strong pro-environmental orientations are insensitive to mood changes (i.e. stress) in predicting PEB. Furthermore, the cortisol response to the experimental manipulation was not in any group significantly associated with the *amount of money* that was donated.

Moreover, individuals who previously underwent stress induction donated significantly less money than the participants in the control condition, regardless of pro-environmental orientation (Sollberger et al., 2016b). The authors interpreted this stress-induced decrease of the donated amount of money as an indicator for a tendency to think about one's own needs first instead of caring about charitable purposes when facing an immediate threat. According to the authors, the donated amount of money can be interpreted as the "actual extent or cost of pro-environmental behavior" (Sollberger et al., 2016b, p. 318). To summarize, Sollberger et al. (2016b) were able to demonstrate a differential influence of stress on the decision whether to donate money to an environmental organization and on the amount of money that was donated. However, according to the authors, the results for the donated amount of money might be the better indicator of PEB, thus, suggesting that stress decreases PEB.

In a third correlational study with male participants by the same authors (Sollberger et al., 2016a), a negative association between responses to a chronic stress questionnaire and responses to a questionnaire assessing everyday PEB was found. Therefore, high levels of chronic stress were associated with low levels of PEB and vice versa. Furthermore, in this study, the authors investigated the influence of basal cortisol and testosterone on self-reported PEB in men. The results suggested an interplay between both hormones influencing PEB: Neither testosterone nor cortisol alone affected PEB, but only for participants with low cortisol concentrations, a negative relationship between testosterone and PEB was found. However, since the stress response is not the only function of the HPA axis (Herman et al., 2016), those results should be cautiously interpreted with regards to indicating the influence of stress on PEB.

1.3 Integration and Hypotheses

The previous literature synthesis has shown that stress affects various processes that are associated with PEB. Stress was reported to limit diverse cognitive resources (Sato et al., 2012), as well as self-control (Oaten & Cheng, 2005). Additionally, stress was associated with impulsivity (Fields et al., 2014) and an immediate-oriented mindset (Fields et al., 2015). PEB, on the other hand, likely requires a certain amount of self-control, since it is often characterized by a trade-off between personal consequences and environmental consequences (Gifford, 2011) and furthermore positively associated with self-control skills (Kerret et al., 2016). At the same time, stress was found to induce a shift towards habitual behavior (Schwabe & Wolf, 2009), which is likely to affect PEB, too, since it is often driven by habits (Carrus et al., 2008b). Studies investigating the influence of stress on prosocial behavior yield mixed results: While stress was found to enhance prosocial behavior (von Dawans et al., 2012; von Dawans et al., 2019), it was also reported to decrease the donated amount of money to a charitable organization (Vinkers et al., 2013). For PEB, the influence of stress becomes even more complex, with stress being negatively associated with PEB (N. Kaida & Kaida, 2019), but also with PEB potentially serving as an instrument for mood-repairing directly after stress (Sollberger et al., 2016b).

1.3.1 Research Gap

Until now, there is not much research investigating the effect of stress on pro-environmental behavior, especially when considering the likely effect of gender on PEB (Hunter et al., 2004). So far, there are studies investigating the effect of stress on PEB in women and men, but they either applied correlational measures (N. Kaida & Kaida, 2019) or did not investigate stress directly (Buttlar et al., 2017). Studies that researched the effect of experimentally induced stress on PEB only investigated this effect in men (Sollberger et al., 2016a, 2016b, 2017). Thus, an experimental study investigating the influence of stress on PEB in women and men is necessary to be able to generalize results from previous studies.

Furthermore, research on PEB frequently uses self-report questionnaires or one-time measurements of PEB. This might pose a problem, since self-report questionnaires might not be the best choice for conclusions about behavior, while one-shot measurements are often susceptible to reliability issues (Lange et al., 2018). Therefore, the present study tries to address those issues by using a laboratory measurement of PEB with several trials.

Adding up to this lack of transparency is the role of habits. While one might conclude on the basis of prior evidence that PEB is susceptible to the influence of habits (Verhaert & van den Poel, 2011) and many studies support the notion that stress encourages habitual behavior (Schwabe & Wolf, 2011), few studies are explicitly investigating the interplay of all three variables.

1.3.2 Hypotheses

Stress Influences Pro-Environmental Behavior. Drawing on the theoretical implication of stress limiting cognitive resources, combined with the only experimental study which included women and men supporting this hypothesis, it is to be expected that stress decreases pro-environmental behavior. Thus, stressed participants, compared to participants in a control group, should yield lower scores on a PEB measure in the laboratory. Control measures assessing the success of the experimental manipulation should also be related to PEB. Therefore, the cortisol response to a stressor is expected to be negatively associated with the amount of PEB in the lab and measures of perceived subjective stress should be negatively associated with PEB, too: When participants show a larger cortisol response and higher levels of perceived stress, they are expected to show a decreased amount of PEB.

Stress and Habits Interact in Predicting Pro-Environmental Behavior. In line with previously presented research, stress is expected to amplify the effect of pro-environmental habits on PEB in the lab and to render PEB more habitual. Thus, stressed participants should be more likely than participants in the control group to demonstrate PEB that corresponds to their pro-environmental habits. Therefore, for the stress-group, a stronger association between pro-environmental habits and PEB is expected than in the control-group.

1.3.3 Design

The current study was part of a bigger study investigating the effect of predictability and stress on memory performance (“memory-study”). However, the present paper focused on the effect of stress only, and only analyzed predictability exploratively. Due to those specifications, a design with the between subject factors “stress” (stress vs friendly) and “predictability” (informed vs uninformed) resulted. Thus, four different experimental conditions with two of them inducing stress and two of them serving as control conditions for the stress-groups were obtained. Participants were randomly allocated to one of the four resulting experimental conditions: Stress uninformed (SU), stress informed (SI), friendly uninformed (FU) and friendly informed (FI). Due to the specifications of the memory study, the experiment was conducted on two different days, one week apart.

2. Method

2.1 Participants

Ninety-eight volunteers with a body mass index between 18 and 27 who spoke German at a native speaker level were recruited to complete the experiment. However, one woman decided to withdraw from participation at day 1 and thus needed to be fully excluded from all statistical analyses. Therefore, a sample size of n= 97 resulted and 51 women and 46 men (mean age 24.68 years, SD = 4.09, range 18 - 36) participated in the study. Individuals with any current medication intake or any past or current medical or mental condition which might affect stress reactivity were excluded after a telephone interview. To avoid changes in stress reactivity, people who smoked regularly (over 3 cigarettes per week) or consumed drugs, as well as women who were currently pregnant, breastfeeding, or using hormonal contraceptives were excluded from participation. Additionally, women were only tested outside the time of their menstruation. Furthermore, participants had to be naïve to the stress protocol and its control conditions and current or past Psychology students were excluded. In the resulting sample, a large proportion of participants were students (74,2%) and had a European ethnical background (83,5%). All participants provided written informed consent before the beginning of the experiment, received monetary compensation for their participation (25€ for approximately 2 hours) and could withdraw from the study at any time. The study protocol was approved by the ethics committee of the Faculty of Psychology and Human Movement, University of Hamburg.

2.2 Instruments

2.2.1 Stress Manipulation – the Trier Social Stress Test

To induce psychosocial stress, the Trier Social Stress Test (TSST; Kirschbaum et al., 1993), a standardized and widely used protocol to induce stress in a laboratory setting, was used. The TSST combines a social-evaluative threat through a free speech in front of an audience with a demanding mental arithmetic task. The TSST was shown to reliably activate the SAM and the HPA axis (Kirschbaum et al., 1993).

The TSST took approximately 15 minutes in total and consisted of three phases simulating a job interview. During all three phases of the stress induction protocol the participants were evaluated by a female and a male committee member who wore white laboratory coats and showed reserved and neutral behavior, not giving any signs of feedback on the participant's performance. Furthermore, during a substantial part of the protocol, participants were videotaped, while being able to see the videotaped material live on a screen behind the committee.

In the current experimental setting, before entering the room with the evaluation-committee, participants received instructions on the following task which depended on the experimental condition. After entering the room with the evaluation-committee, a preparation and anticipation period of three minutes followed. During that period, participants were allowed to take notes regarding the subsequent speech, however, using those notes during the speech was not permitted. Afterwards, the participants were instructed to position themselves on a designated location in front of the committee and video recordings started. The participants then were required to talk freely about their suitability for their dream job, while only referring to their personal characteristics and not mentioning professional experiences. If the participants stopped speaking before the designated time of five minutes ended, they were requested to continue talking about their characteristics after thirty seconds of silence. After this brief speech, the participants were required to loudly count backwards from 2043 in steps of 17, as fast as possible, for another five minutes. If the subjects made a mistake, they were instructed to start over again.

The control condition (friendly TSST, short: f-TSST), roughly based on Wiemers, Schoofs, and Wolf (2013), included a similar structure and comparable cognitive demands to the TSST. However, before the beginning of the task, participants were informed that the only purpose of the following task was to bridge some time. Participants were furthermore informed that during that task, they should spend time talking to laboratory employees and have an informal conversation with them during which they would be free to talk about any positive topic they like. They were explicitly informed that the conversation would not be analyzed and there were no hidden microphones or video cameras in the room. After a preparation and anticipation time of three minutes, the conversation with the laboratory employees started. The employees – not wearing laboratory coats – were specifically instructed to actively engage in the conversation, avoid pauses during the talk and to nod and smile in order to reinforce the participant. The second part of the f-TSST entailed the employees and the participant to play a simple counting game together, where the participant and the laboratory employees should count upwards and replace every number that is divisible by seven or contains the number seven with the word "forward" (German: "weiter"). In all experimental conditions, the actions of the male and female committee member were held constant.

In order to meet the demands of the second study that was making use of the experimental set-up, certain changes have been applied to the validated protocol. The room in which the TSST took place was enriched with various objects. Furthermore, at designated times, the committee members interacted with some of those objects and asked two previously specified and standardized questions during the speech/ the conversation. More importantly, for the aims of the second study, the degree of predictability of the TSST and f-TSST was manipulated as a second factor. Predictability of the stressor was manipulated by the instructions which the experimenter read to the participants before the (f-)TSST started. Therefore, participants received either very detailed instructions ("informed") or only the most necessary instructions ("uninformed") for either the stress or the friendly condition. For example, in the stress, informed (SI) condition, participants were informed that the committee would behave rather neutral and reserved and would not smile. Committee members were blind to the factor predictability, i.e. they did not know whether the participant was informed or uninformed. However, it is important to note that the research question in the current study mainly focuses on the factor *stress,* while the factor *predictability* is only analyzed for exploratory purposes.

2.2.2 The Pro-Environmental Behavior Task

As a measure for PEB, the Pro-Environmental Behavior Task (PEBT; Lange et al., 2018) was employed. The PEBT was one of the first standardized and validated paradigms to measure PEB in a laboratory setting. PEB was conceptualized by a series of choices regarding short virtual trips. For each particular trip, participants needed to decide whether they wanted to choose the car or the bicycle as a means of transportation. After choosing the mode of transportation for a given trial, a waiting period needed to be endured in order to be able to make the next decision. Each option entailed different consequences. The waiting period associated with the bicycle choice was generally longer than the one associated with the car choice. However, if participants chose the car option, USB-powered lights were illuminated for the duration of the waiting period. Additionally, prior to choosing, participants received details about the waiting times associated with both options and information on the estimated carbon dioxide (CO_2) emissions contingent with powering the lights during the waiting period of the car option. Therefore, each trial entailed a conflict between individual consequences (waiting time) and environmental consequences (CO_2 emissions). Furthermore, the trials differed in several features: The waiting time associated with the bike option, the waiting time associated with the car option and the waiting time difference between both options differed for each trial. In the original study, the resulting measure of PEB was highly reliable with a Cronbach's alpha of $\alpha = .97$ (Lange et al., 2018). Moreover, the outcome measure (proportion of bike choices/ total choices) was associated with other theoretically related questionnaire measures, indicating convergent validity.

The PEBT was adapted to fit the current experimental setting. Therefore, the same number of lights (3) were used in every trial and it was necessary to limit the maximum completion-time of the task to approximately 20 minutes. Participants completed two practice trials with distinct waiting time differences that were not used in any other trials. In this adapted task, participants completed 25 trials with different waiting times associated. Of those 25 trials, four trials with the same waiting times associated with the car and the bicycle option (= no waiting time difference) were used. Other test trials included waiting time differences of 15, 20, 25, 30 and 35 seconds (4 trials each), and one trial with no waiting time associated with the car option and 50 seconds associated with the bicycle option. Parameters for all trials can be found in appendix A.

Outcome measures were the ratio of bike choices compared to total choices (bike ratio), the additional waiting time that participants were willing to take when choosing the bike-option (waiting time bike) and the time during which the lights were switched on due to choosing the car-option (time lamps).

An original adapted version of the PEBT included 20 trials and two practice trials. However, after eight participants completed this version of the PEBT, there was little to no variance apparent in the response pattern and most participants chose the bicycle option for every single trial. Thus, in an attempt to avoid a ceiling effect of bicycle choices, the paradigm was extended and the first eight participants were excluded from analyses with PEBT outcome measures.

2.2.3 Pro-Environmental Behavior and Attitudes Questionnaires

Several questionnaires were used in order to relate the results of the PEBT with self-report measures of Pro-Environmental Attitudes and Pro-Environmental Behavior[4]. The choice of questionnaires included in the current study was based on the methodological approach of the original validation data of the PEBT by Lange et al. (2018). All questionnaires presented were adapted to the German sample by using the translation-backtranslation procedure (Brislin, 1976) and were presented consecutively. In order to assure consistency in the response format

[4] In the following, those questionnaires are summarized as "environmental questionnaires".

of all questionnaires, five-point Likert scales were used for all questionnaires assessing PEB and pro-environmental attitudes. Thus, for the attitudes questionnaires, scales ranged from "1 = strongly disagree" to "5 = strongly agree" and for the PEB questionnaires the scale ranged from "1 = never" to "5 = very often".

The Environmental Behavior Scale. The Environmental Behavior Scale (EBS Schultz; Schultz et al., 2005) was used as a measure for environmental habits. The scale assesses self-reported PEB during the past year. Participants should rate "how often you have done each of the following in the past year" on a scale ranging from "1 = never" to "5 = very often". Behavior that is assessed in the questionnaire covers various difficulties and domains. Items included for example "…looked for ways to reuse things" or "…voted for a candidate who supported environmental issues". The scale only assesses different *pro*-environmental behaviors and does not explicitly assess any behavior that is harmful to the environment. Thus, in the current study, the scale is used to measure the strength of pro-environmental habits, rather than distinguishing between sustainable and environmentally harmful habits. Although the scale originally entailed 12 items, the authors proposed excluding two items due to negative correlations with the item total. However, in the original paper, there is some ambiguity regarding which items to exclude. Due to these uncertainties, a solution with 11 items was chosen, which just excluded the item that was clearly mentioned to be excluded in further studies. In their study, a scale including 10 items (even though it is unclear, which items were included) was validated by the authors in several countries and had a reliability of .66 in Germany (Schultz et al., 2005).

The original scale additionally included the option to indicate "not applicable" when there was no opportunity to perform the behavior during the past year. The current study refrained from using this response option, due to the aim to focus on pro-environmental habits and thus the actual number of times when the behavior in question was carried out. Here, the reason for showing or not showing a given target behavior (e.g. that there was no opportunity to perform the behavior) was rather irrelevant.

The New Environmental Behavior Scale. Based on the EBS Schultz (Schultz et al., 2005), a new Environmental Behavior Scale (EBS New) was constructed. The EBS Schultz assesses different PEBs. Nonetheless, 7 out of 11 items included recycling or waste disposal behavior. Regarding the current public discourse on climate change, however, environmentally relevant behaviors have emerged that have not been included in the EBS Schultz. For example, research suggests that the consumption of red meat or milk products has a profound impact on greenhouse gas emissions (Westhoek et al., 2014). Therefore, 10 new items were used that aim to reflect those newly emerged relevant behaviors. Furthermore, two items (here: item 11 and item 12, compare table1) of the Consumer Behavior Subscale (Scott & Willits, 1994) were used. The third item from the scale was excluded, because it focused on recycling behavior ("I don't make a special effort to buy products in recyclable containers"). The EBS New used the same response format as the EBS Schultz and the difficulty of behaviours varied, too.

Table 1:

Items of the Newly Obtained Environmental Behavior Scale.

During the last year, I have…	
Item 1:	…refrained from the consumption of meat products to protect the environment
Item 2:	…refrained from the consumption of milk products to protect the environment
Item 3:	…deliberately bought seasonal products
Item 4:	…pointed out unecological behaviour to others
Item 5:	…spoken with friends/ family about environmental problems
Item 6:	…switched off the air conditioning/heating when I had left a place for a longer period of time
Item 7:	…made sure the lights were switched off when I left a room
Item 8:	…participated in demonstrations in favour of environmental protection
Item 9:	…decided to use public transport instead of the car in order to protect the environment
Item 10:	… decided not to travel by plane in order to protect the environment
Item 11:	…switched products for ecological reasons
Item 12:	…never actually bought a product because it had a lower polluting effect

The Revised New Ecological Paradigm Scale. The Revised New Ecological Paradigm Scale (NEP; Dunlap, van Liere, Mertig, & Jones, 2000) was used to validate the adapted version of the PEBT and the EBS New, since it was extensively used in relevant literature during the last years. The scale reflects beliefs on the relationship between humans and the environment and measures to what extent an ecological in contrast to an anthropocentric worldview is being endorsed (Dunlap, 2008). Here, the third revised version of the original scale by Dunlap and van Liere (1978) was used. Items were for example: "We are approaching the limit of the number of people the earth can support". According to

Milfont and Duckitt (2010), the NEP Scale offers an advantage to other questionnaires in not becoming outdated easily, since it does not measure specific ecological issues but a rather broad belief system regarding the environment. The Scale consists of 15 items which are forming a score that can be regarded an indicator of ecological worldview. The NEP scale reportedly possesses sufficient internal consistency with α = .83 in the original study (Dunlap et al., 2000), while the average internal consistency in a meta-analysis was α = .71 for 140 samples (Hawcroft & Milfont, 2010).

The Environmental Attitudes Inventory. The Environmental Attitudes Inventory (EAI; Milfont & Duckitt, 2010) was used in the current study to further validate the PEBT and the EBS New. The EAI entails 12 facets: *Conservation Motivated by Anthropocentric Concern*, *Confidence in Science and Technology*, *Environmental Fragility*, *Altering Nature*, *Personal Conservation Behaviour, Human Dominance Over Nature*, *Human Utilization of Nature*, *Ecocentric Concern* and *Support for Population Growth Policies*. Items were for example: "I really like going on trips into the countryside, for example to forests or fields". In the present study, the brief version of the EAI as proposed by Milfont and Duckitt (2010), which consists of 24 balanced items representing the twelve facets, was used. Following the methodological approach by Domingues and Gonçalves (2018), a 5-point response scale was used in order to secure a consistent response-format. The internal consistency of the EAI for the average value of the 24 items with the five-point Likert scale was α = .703 (Domingues & Gonçalves, 2018).

2.2.4 Baseline Measures & Manipulation Check

To make sure that all groups were comparable regarding characteristics such as depressive symptoms, chronic stress levels or state and trait anxiety, participants responded to the Trier Inventory for Chronic Stress (Schulz, Schlotz, & Becker, 2004), the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and the State-Trait Anxiety Inventory (Spielberger & Sydeman, 1994). Furthermore, as an indicator for physiological arousal, systolic and diastolic blood pressure and pulse were measured using Dinamap® from Critikon (Tampa, Florida, USA) at baseline-level for day 1 and day 2.

Subjective Stress Level. To be able to check whether the experimental manipulation of stress and predictability was successful, participants responded to two short questionnaires directly after the (f-)TSST. Directly after the experimental manipulation, participants furthermore responded to three short questions aiming to assess the subjective stress-level more directly. On a scale from 0 ("not at all") to 100 ("very"), participants should rate how stressful, difficult, and unpleasant the experience in the (f-)TSST had been for them. Additionally, participants should rate – based on the instructions beforehand – how unexpected, surprising and predictable the (f-)TSST was and how much the situation met their expectations on a scale from 0 ("not at all") to 100 ("very").

MDMQ. Furthermore, in order to investigate mood changes before and after the (f-)TSST, participants were required to provide responses to the Multi-Dimensional Mood Questionnaire (MDMQ; Steyer, Schwenkmezger, Notz, & Eid, 1994). The questionnaire assesses mood on three bipolar scales: Good mood/ bad mood, alertness/ tiredness and calmness/ restlessness. High scores represent tendencies towards the positive poles: Good mood, alertness, and calmness. In the present study, the version with 24 balanced positive and negative poled items was used. Participants were asked to indicate for each of the 24 adjectives on a five-point Likert scale ranging from 1 ("not at all") to 5 ("very") how they were feeling at the moment. Items included for example "nervous", "tired" and "good".

Trier Inventory for Chronic Stress. The Trier Inventory for Chronic Stress (TICS; Schulz et al., 2004; Schulz & Schlotz, 1999) furthermore served as a measure of chronic stress in analyses that investigated its effect on PEB. The TICS (Schulz et al., 2004) is a standardized questionnaire for various facets of perceived chronic stress, comprising 57 items. Each item was rated on a five-point Likert scale (''never" to "very often") regarding the experience in the last three months. Items were for example: "I make too many mistakes because I'm overwhelmed with what I have to do". The questions were not specific to any situation and therefore applicable to different fields of work and situations of life. The TICS entails nine scales which reflect different chronic stressors. It encompasses scales reflecting stress resulting from high demands, such as (1) *Work Overload (WO),* (2) *Social Overload (SO),* and (3) *Pressure to Perform (PP).* It furthermore entails stressors reflecting a lack of satisfaction of needs, namely: (4) *Excessive Demands at Work* (*EDW),* (5) *Work Discontent (WD)*, (6) *Lack of Social Recognition (LSR),* (7) *Social Tensions (ST),* and (8) *Social Isolation (SI)*. Additionally, (9) *Chronic Worrying (CW)*, which can be considered as a personality trait, is assessed. Moreover, a *Screening Scale for Chronic Stress (SSCS)* can be computed that consists of 12 items from five of the nine scales (WO, SO, EDW, LSR & CW). Internal consistency of the scales was reported to be between $\alpha = .82$ and .91 (Schulz et al., 2004).

Saliva Sampling. To further evaluate whether stress induction was successful, cortisol concentration (nmol/l) as a measure of the endocrine activation was assessed via saliva sampling at different times before and after the experimental manipulation. Saliva samples were taken at five different time points with salivettes (Sarstedt, Nümbrecht, Germany).

Baseline samples were taken at both test days and additional samples were taken 15 minutes, 30 minutes, and 45 minutes after onset of the stressor at day 1. At the end of the test day, the salivettes were frozen and stored at -20°C. After the last participant completed the experiment, cortisol samples were thawed and analyzed via luminescence assay (IBL, Germany)

2.3 Experimental Procedure

The experiment took place over a time span of 6 months on the premises of the Cognitive Psychology Department at the University of Hamburg. Participants were tested individually in experimental sessions, approximately taking 100 minutes at day one and 30 minutes at day two. In order to control for the strong circadian rhythm of cortisol secretion (Dallman et al., 1992), all sessions started between 12 p.m. and 5 p.m. Participants were instructed to not consume any food or caffeine and to avoid exercise two hours prior to the beginning of the experiment. All reported questionnaires were replied to on a tablet (day 1) or desktop (day 2) computer.

2.3.1 Day 1

Upon arrival, participants were introduced to the experiment and received written information about the study. They signed the written consent form and were requested to not drink or eat anything during the experiment. Next, they received the tablet computer, where they were required to complete the baseline-questionnaires for control measurements. Baseline-measurements of blood pressure, Saliva, and the MDMQ (pre-(f-)TSST) followed. Participants were then led to a second room[5], where instructions for the (f-)TSST were read to the participants and they signed a written consent form for video recordings. Subsequently, they entered a third room where the (f-)TSST took place. After the (f-)TSST, the participants went back to the second room and the second saliva sample (+15 minutes after the beginning of the experimental manipulation) was gathered. Participants then responded again to the MDMQ (post-(f-)TSST) and to the stress and predictability questionnaires and went back to the first room. Afterwards, they were required to complete the PEBT on a desktop-computer. Once the task started, the experimenter left the room and subsequently came back only to gather the third (+30 min.) and the fourth (+45 min.) saliva samples, while the participant was still responding to the PEBT. Upon completion of the task, the experimenter entered the room,

[5] The memory-study additionally required the participants to wear a functional near-infrared spectroscopy (fNIRS) device from the moment they entered the second room, until it was removed directly after the (f-)TSST.

the participants were debriefed regarding the experience in the stress-condition and were then released.

2.3.2 Day 2

At the beginning of the second day of the experiment, baseline measurements were gathered (saliva sample, blood-pressure, MDMQ)[6]. Afterwards, the participants completed the four environmental questionnaires (EAI, NEP, EBS Schultz, EBS New). At the end of the experiment, participants received their monetary compensation and were asked to report their hypothesis regarding the objective of the study before being released.

2.4 Statistical Analyses

All calculations were performed using SPSS Statistics 26 (IBM) software and all analyses were based on a significance level of $\alpha = .05$, while effects with $\alpha < .07$ were interpreted as marginally significant. When multiple tests (regression analyses, ANOVAs and correlations) were calculated, all significance levels were adjusted using the Bonferroni-Holm correction (Holm, 1979). Unless otherwise specified, significance levels of two-sided tests are reported. To analyze baseline measures, ANOVAs with the between-subject factor “group” (SU, SI, FU, FI) were calculated. The manipulation check of the stress-induction was analyzed via repeated measure ANOVAs of cortisol concentration[7] and the MDMQ-scales with the within-subject factor “time of measurement” (TOM) and the between-subject factors “stress” (stress vs. control) and “predictability” (informed vs. uninformed). TSST- and predictability-questions were analyzed via a two factor (stress; predictability) ANOVA. The assumption of sphericity for repeated measure analyses was examined via the Mauchly-test. If the Mauchly-test was significant, the degrees of freedom were adjusted via Greenhouse-Geisser. Post-hoc comparisons for more than two groups were calculated with the Tukey-test, while post-hoc t-tests were calculated for dichotomous factors. T-tests were examined for homoscedasticity with the Levene-test, while the applied ANOVAs can be considered robust against violations of the assumption of homogeneity of variance and normality (Blanca, Alarcón, Arnau, Bono, & Bendayan, 2017). Effect-size of the ANOVAs was the partial η^2 (η^2_p). Effects of $.01 \leq \eta^2_p \leq .06$ can be regarded as small, $.06 \leq \eta^2_p \leq .14$ as medium and $\eta^2_p > .14$ as large (Cohen, 1988).

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[6] The participants additionally completed a questionnaire regarding their sleep quality and quantity and rumination experiences during the last week, as well as several memory tests which were all only relevant to the memory-study.

[7] For the analysis of cortisol concentration, gender was furthermore included as a between-factor, since heterogenous effects of gender on cortisol concentrations in response to stress were frequently found (Liu et al. (2017).

The reported effect size for t-tests was Cohen's *d,* with *d* between .2 and .5 being regarded as small, *d* between .5 and .8 as medium and *d* over .8 being regarded as large (Cohen, 1988).

To compute an indicator for cortisol response in response to the (f-)TSST, values for baseline cortisol concentration on day 1 were subtracted from the peak in cortisol concentration post stress (+30 min). To investigate mood changes after the experimental manipulation, for each scale of the MDMQ, baseline responses to the respective scale on day 1 pre-stress were subtracted from responses post stress.

2.4.1 Validation of the Adapted PEBT Version and of the Newly Constructed EBS

The newly constructed EBS (EBS New) was analyzed via inter-item correlations, item-total correlations, and Cronbach's α. The PEBT outcome measures were analyzed regarding distributional parameters and correlations with environmental questionnaires (EBS New, EBS Schultz, EAI, NEP), to determine validity of the measure.

2.4.2 Correlational Analyses

Correlations were analyzed via the Pearson product-moment correlation. When the variables were not normally distributed, Spearman's nonparametric rank correlation coefficient was used. Correlation coefficients range from -1 to +1 and can be interpreted as representing an effect size. According to Cohen (1988) a correlation of $r = .1$ can be regarded as small, $r = .3$ as moderate and $r \geq .5$ as large associations.

2.4.3 Regression Analyses

To be able to generalize the results of a regression analysis from a sample to the underlying population, several assumptions must be met (Field, 2018).

Outliers in the regression model were analyzed via z-standardized residuals and Mahalanobis Distance (MD) values. Z-standardized residuals above z = 3 were excluded. The MD values were compared with the critical X^2-values for $p = .001$ and cases that exceeded this critical X^2-value were excluded. Independence of residuals was analyzed via the Durbin Watson value, which should be close to the value 2 in order to assume that no autocorrelation is present in the data. Homoscedasticity of the residuals was visually interpreted via a scatterplot of the z-standardized residuals and standardized predicted values. If the scatterplot with metric predictor variables suggested linear heteroscedasticity and residuals were normally distributed, the Breusch-Pagan-Test was used. If distribution of the residuals had a higher kurtosis, but was otherwise comparable to a normal distribution, the modified Breusch-Pagan-

Test was carried out. If the scatterplot suggested non-linear heteroscedasticity (e.g. the hour-glass shape) or residuals were not normally distributed, the White-Test was used. To evaluate whether residuals were normally distributed, the histogram and the P-P plot of standardized residuals were investigated. If deviance from a normal distribution was suggested, the Shapiro-Wilk test was furthermore interpreted (Yap & Sim, 2011). If the test yielded significant results, residuals possibly did not follow a normal distribution. However, the central limit theorem suggests that as long as a sample is large enough (roughly larger than 30), the estimate will have come from a normal distribution, regardless of how the population data is distributed (Field, 2018). When heteroscedasticity was present in the data, or when residuals were not normally distributed, bootstrapped p-values and standard errors were reported (BCa = bias corrected and accelerated, derived from 1000 bootstrap-samples.), thus, inferential statistical analyses could be interpreted, even when heteroscedasticity was present.

Furthermore, high correlations among the predictor variables (= Multicollinearity) should be avoided. Potential multicollinearity was therefore evaluated based on Tolerance values and the Variance Inflation Factor (VIF). Tolerance values for each predictor should be above 0.2, the largest VIF should be below 10, and the average VIF should not be substantially greater than 1 (Field, 2018). If Tolerance and VIF values were critical, theoretical considerations guided the decision which predictor(s) to remove from the model. Assumption tests were only reported if an assumption was violated. Thus, unless otherwise specified, assumptions were met.

To evaluate the model fit of regression analyses, the adjusted R^2 was used. R^2, the coefficient of determination, can assume values between 0 and 1 and represents the proportion of variance explained by the model. The *adjusted* R^2 (R^2_{Adjusted}) compensates in multiple regression models for the addition of variables by only increasing when the new predictor enhances the model above what would be expected by probability. To furthermore compare the effect of multiple predictors, standardized β was reported. Standardized β, as well as unstandardized B indicate to which degree the predictor influences the outcome variable if the effects of all other predictors are held constant.

3. Results

3.1 Missing Values

In most of the cases, missing data was excluded listwise, thus, the whole dataset of a given participant was excluded from the analysis if they had missing values in one variable of a given analysis. All missing values and descriptive data for the employed measures can be found in appendix B. Two participants were missing scores for one item of the NEP. Those item scores were predicted and filled in, based on regression analysis from the other 14 items for those two persons, respectively. 88 participants (exactly balanced for each group & gender) completed both days of the experiment with the adapted version of the PEBT. For analyses involving cortisol measures, a minimum of 57 participants was included. Moreover, in analyses that involved all 97 assessed participants, the ratio between genders per experimental group and the overall ratio between women and men can be regarded as balanced, with 11-13 participants for each experimental group and gender, respectively.

3.2 Baseline Group Differences

Since the main purpose of the current study was to investigate the effects of stress on pro-environmental behavior, the two stress groups were both conceptualized to effectively induce stress, while the two control groups were both conceptualized to be appropriate control manipulations, hence, not inducing stress. Therefore, all four groups were examined to make sure that no other group differences than the ones that were expected, were present. When investigating whether the groups were comparable regarding control measures and whether the manipulation worked, all four experimental groups that were used in practice (SU, SI, FU, FI) were analyzed.

In line with the inclusion criteria, the four experimental groups did not differ in age, BMI, alcohol consumption or consumption of cigarettes (all $F \leq 2.01$, all $p \geq .118$, all $\eta^2_p \leq .06$). Furthermore, before the beginning of the experimental manipulation, the four groups were comparable regarding various other control measures. There was no significant difference between the four groups for baseline cortisol concentration on day 1, as well as on day 2 (both $F \leq 1.50$, both $p \geq .223$, both $\eta^2_p \leq .08$). Similarly, no significant group differences could be found for baseline pulse, systolic and diastolic blood pressure on day 1 and on day 2 (all $F \leq 2.25$, all $p \geq .088$, all $\eta^2_p \leq .07$). Additionally, the groups did not differ in perceived chronic stress level: No significant differences were shown for all nine subscales of the TICS, as well as for the screening scale for chronic stress (all $F \leq 1.467$, all $p \geq .229$, all $\eta^2_p \leq .05$). Likewise, the groups did not differ regarding trait and state anxiety scores (STAI), depression scores (BDI), and scores on the three scales of the MDMQ, indicating baseline mood on day 1 (all $F \leq 1.139$, all $p \geq .337$, all $\eta^2_p \leq .04$).

Nonetheless, while there was no significant difference between groups for the wakefulness/ tiredness scale and the calmness/ restlessness scale of the MDMQ on day 2 (both $F \leq 1.97$, both $p \geq .124$, both $\eta^2_p \leq .06$), an ANOVA revealed that significant group differences for the good mood/ bad mood scale on day 2 were present, $F(3, 92) = 3.06$, $p = .032$, $\eta^2_p = .09$. Via post-hoc intergroup comparisons with the Tukey-HSD test, it could be demonstrated that people in the stress group with preliminary information (SI) reported statistically significant better mood on day 2 than people who underwent the friendly condition with preliminary information (FI; $M = 35.50$, $SD = 3.96$ vs. $M = 31.38$, $SD = 6.75$, $p = .047$, $d = .75$).

Furthermore, groups were comparable regarding their past pro-environmental behavior and their pro-environmental attitudes, as reported on day 2: Scores on the EAI, NEP, EBS Schultz and the EBS New did not differ depending on the group (all $F \leq 0.48$, all $p \geq .698$, all $\eta^2_p \leq .02$).

3.3 Effectiveness of the Experimental Manipulation

3.3.1 Physiological Measures

In line with expectations of a successful stress-induction, the cortisol response at the different times of measurements was modulated by stress: A significant interaction effect between time of measurement (TOM) and stress was found ($F(1.87, 95.36) = 6.75$, $p = .002$, $\eta^2_p = .12$). Post-hoc t-tests for independent samples with Bonferroni-Holm correction revealed that participants in the stress condition showed significantly higher cortisol concentrations than participants in the friendly condition 30 minutes after onset of the stressor ($t(58) = 3.49$, $p = .004$, $d = .90$), as well as 45 minutes post stress ($t(58) = 2.56$, $p = .039$, $d = .67$), while cortisol concentration at baseline and 15 minutes after the (f-)TSST did not statistically significantly differ between the stress- and control-groups (both $t \leq .99$, both $p = .654$, both $d \leq .25$). However, investigated via an ANOVA with stress, predictability, gender and TOM, predictability of the experimental situation affected cortisol concentrations, too (main effect predictability: $F(1, 51) = 9.31$, $p = .004$, $\eta^2_p = .16$). Participants who received much preliminary information showed higher cortisol concentrations than participants with little preliminary information ($M = 7.53$, $SD = 4.12$ vs. $M = 4.44$, $SD = 3.30$). This pattern did not differ for the different times of measurement: No significant interaction effect between predictability and time of measurement was observed ($F(1.87, 95.36) = 2.15$, $p = .125$, $\eta^2_p = .04$).

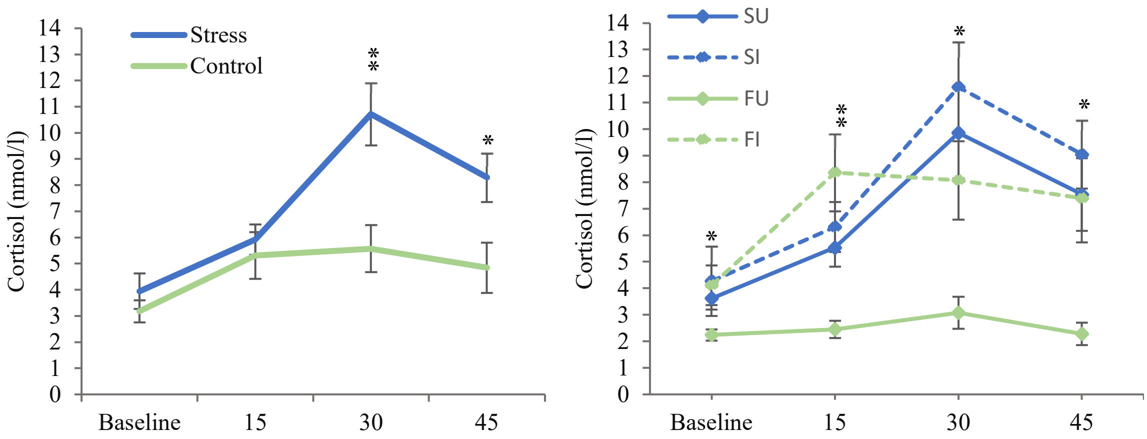
Furthermore, predictability of the situation did not modulate the cortisol responses of the stress and the control groups: An interaction effect between stress and predictability investigated via the same ANOVA was not statistically significant ($F(1, 51) = 3.23$, $p = .078$, $\eta^2_p = .06$). Nevertheless, explorative t-tests for independent samples with Bonferroni-Holm correction revealed a significant difference between the two control groups regarding their cortisol concentration at all four times of measurement (FI vs FU: all $t \geq -2.41$, all $p \leq .028$, all $d \geq -.85$), while the two stress-groups did not differ at any time of measurement (SI vs SU: all $t \leq -.47$, all $p = 1$, all $d \leq .30$; compare figure 1).

While there was a significant influence of stress on the cortisol concentration, as well as an effect of predictability on cortisol concentrations, gender did not affect the endocrine response overall: No main effect of gender was evident ($F(1, 51) = .15$, $p = .699$, $\eta^2_p \leq .01$). Furthermore, gender did not modulate the influence of stress, predictability, or the time of measurement: No significant interaction between gender and any other factor was observed (all $F \leq 2.11$, all $p \geq .131$, all $\eta^2_p \leq .04$).

The cortisol response was furthermore significantly positively associated with perceived difficulty, unpleasantness, and stressfulness (all $r_s \geq .29$, all $p \leq .025$) of the (f-)TSST. However, no statistically significant association between cortisol response and the change in calmness, good mood, or wakefulness in response to the (f-)TSST was present (all $r_s \leq -.21$, all $p \geq .105$). Additionally, the cortisol response was not statistically significantly associated with ratings of the (f-)TSST as unexpected, surprising, predictable and in line with expectations (all $r_s \leq .18$, all $p \geq .166$).

Figure 1:

Cortisol Concentration as a Function of Time of Measurement and Experimental Group.



Note. SU = Stress Uninformed, SI = Stress Informed, FU = Friendly Uninformed, FI = Friendly Informed. Significance levels: * < .05, ** < .01, *** < .001.

3.3.2 Subjective Measures: MDMQ

In line with the expectations, not only did cortisol concentrations differ depending on stress and the time of measurement, but the reported scores for calmness, good mood and wakefulness at the different times of measurements were modulated by stress, too: Significant interaction effects of stress and time of measurement were evident for each of the three scales (all $F \geq 4.79$, all $p \leq .031$, all $\eta^2_p \geq .05$). Post-hoc comparisons with an alpha corrected via Bonferroni-Holm for all three scales showed that scores for stressed and non-stressed participants were comparable at baseline (all $t \leq .44$, all $p \geq .658$, all $d \leq .09$), but stressed participants reported significantly more restlessness ($t(83.99) = -4.96$, $p < .001$, $d = -1.01$) and negative mood ($t(78.92) = -4.94$, $p < .001$, $d = -1.00$) as well as - after Bonferroni-Holm correction of alpha - marginally significantly more tiredness after stress-induction ($t(95) = -2.25$, all $p = .054$, $d = -0.46$).

Predictability alone did not influence the scores on all three scales (main effect predictability: all $F \leq .50$, all $p \geq .481$, all $\eta^2_p \leq .01$) and it did not modulate the effect of stress on all three scales (Predictability x Stress: all $F \leq 1.67$, all $p \geq .199$, all $\eta^2_p \leq .02$). Moreover, predictability did not modulate the effect of time of measurement (TOM) on good mood or calmness (Predictability x TOM; both $F \leq .90$, both $p \geq .347$, both $\eta^2_p \leq .01$). Nonetheless, ratings at the different times of measurement for the wakefulness/tiredness scale were influenced by the degree of predictability: A significant interaction effect between TOM and predictability was found ($F(1,93) = 8.21$, $p = .005$, $\eta^2_p = .08$). Participants who received much preliminary information about the (f-)TSST reported significantly decreased degrees of wakefulness after the experimental manipulation ($t(47) = 3.52$, $p = .002$, $d = .48$; Bonferroni-Holm corrected). On the contrary, participants who were uninformed about the upcoming experimental manipulation did not report differences in wakefulness before and after the (f-)TSST ($t(48) = -.37$, $p = .711$, $d = -.04$).

Furthermore, predictability, stress, and TOM did not interact in influencing good mood or wakefulness (both $F \leq .47$, both $p \geq .493$, both $\eta^2_p \leq .01$). Nevertheless, a statistically marginally significant interaction effect of stress, predictability and time of measurement was found for the calmness scale ($F(1, 93) = 3.50$, $p = .064$, $\eta^2_p = .04$): After Bonferroni-Holm correction, both stress-groups (SI & SU) reported statistically significantly less calmness after the experimental manipulation (both $t \geq 4.56$, both $p = .004$, both $d \geq .91$). Participants in the control-condition without preliminary information (FU) reported marginally significantly less calmness after the friendly-TSST ($t(23) =2.27$, $p = .066$, $d = .44$), whereas there was no change in calmness before and after the experimental manipulation for the informed control-group (FI: $t(23) = 1.68$, $p = .106$, $d = .22$).

3.3.3 Stress and Predictability Ratings

In line with the conceptualization, participants in the stress group rated the experimental manipulation to be more difficult, unpleasant and stressful (main effect stress: all $F \geq 83.03$, all $p <$ 001, all $\eta^2_p \geq .47$) than participants in the control condition. Predictability of the experimental manipulation, in contrast, did neither influence those ratings (main effect predictability all $F \leq .82$, all $p \geq .366$, all $\eta^2_p \leq .01$), nor did it modulate the effect of stress on those ratings (Stress x Predictability: all $F \leq 1.05$, all $p \geq .309$, all $\eta^2_p \leq .01$).

Likewise in line with the conceptualization, participants in the condition without preliminary information perceived the experimental manipulation to be more unexpected, more surprising, less predictable and less in line with their expectations than the people that received little preliminary information (main effect predictability: all $F \geq 6.56$, all $p \leq .012$, all $\eta^2_p \geq .07$).

However, for the predictability-ratings, no clear distinction between the effect of stress and predictability can be made: Participants who underwent the stress condition perceived the experimental situation as significantly more unexpected and more surprising than participants in the control condition (main effect stress: both $F \geq 23.32$, both $p < .001$, both $\eta^2_p \geq .20$), as well as marginally significantly less predictable ($F(1, 93) = 3.66$, $p = .059$, $\eta^2_p = .04$). Moreover, the perception that the situation was in line with their expectations was influenced by an interplay of stress and predictability (Stress x Predictability: $F(1, 93) = 4.82$, $p = .031$, $\eta^2_p = .05$). Post-hoc comparisons revealed that there was no difference regarding this rating amongst the people who were informed about the upcoming task for the stress and the control condition (SM vs FM; $M = 9.21$, $SD = 2.65$ vs $M = 9.00$, $SD = 2.47$; $t(46) = .28$, $p = .779$, $d = .08$). Within the groups that were uninformed about the upcoming (f-)TSST, on the other hand, stressed participants indicated that the situation met their expectations to a lower degree than non-stressed participants (SU vs FU; $M = 6.44$, $SD = 2.77$ vs $M = 8.46$, $SD = 2.02$; $t(47) = -2.90$, $p = .006$, $d = -.83$). Furthermore, substantial correlations between the three questions assessing subjective stressfulness and the four questions measuring predictability of the (f-)TSST-situation were present: Especially perceptions of the situation as difficult, unpleasant and stressful correlated highly with perceptions as unexpected and surprising (all $r_s \geq .39$, all $p < .001$).

3.4 Validation of the Adapted Version of the PEBT

Presumably, a ceiling effect occurred in the present data, since participants' scores clustered towards the high end of the Waiting Time Bike (WTB) scale (Garin, 2014). In the present study, the maximum waiting time associated with the bike option was 550 seconds. Regardless of the experimental condition, participants accepted on average 406 seconds of waiting time associated with the bike option ($M = 405.73$, $SD = 168.23$). However, 50% of participants had a WTB value lower than 500 seconds, whereas 50% of participants scored over or equal to the value of 500 seconds (*Mdn* = 500). Additionally, 36 participants (40.45 %) chose to accept the maximum waiting time of 550 seconds, resulting in 550 being the waiting time value that was most frequently chosen (modal value = 550). This ceiling effect of PEB occurred for all three outcome measures of the PEBT. Descriptive data on the proportion of bike choices (Bike Ratio), the waiting time that participants were willing to take into account by choosing the bicycle (Waiting Time Bike) and the time that the lights were switched on due to the choices of the participants (Time Lamps) can be found in appendix B.

The three outcome measures of the PEBT were furthermore highly correlated (all $r_s \geq .95$, all $p \leq .001$). To avoid alpha-inflation by multiple testing, in the following analyses Waiting Time Bike (WTB) was chosen to be the only PEBT outcome measure that was analyzed and reported, since it was the measure that most closely resembled a normal distribution (skewness = -.916, kurtosis = -.374) and was the only measure for which the entire range of possible values (0 – 550 seconds) was empirically exhausted. Waiting Time Bike correlated significantly with environmental attitudes (EAI; $r_s = .26$, $p = .008$), as well as with the EBS New (r_s = .18, p = .045) and the NEP (r_s = .18, p = .045), whereas it was not statistically significantly associated with EBS Schultz (r_s = .08, p = .224).

3.5 Validation of the New Environmental Behavior Scale (EBS New)

When analyzing the inter-item correlations for the EBS New scale, it was found that one item of the Consumer Behavior Subscale (Item 12: "I've never actually bought a product because it had a lower polluting effect.") correlated positively with the item total (r = .20), even though it was a negatively phrased item, which would suggest a negative correlation with the item total. Additionally, this item correlated only with two other items to a statistically significant degree (r = .26, p = .012 and r = .20, p = .50), while all other inter-item correlations for this item were not statistically significant (all $r \leq .16$, all $p \geq .127$). Moreover, while responding to the questionnaire, three participants noted that this item was especially difficult to understand, because it included the term "never" (compare table 1), which did not fit into the response format ("how often have you done each of the following in the past year?"). Hence, this item was excluded from further use of the scale and a questionnaire with 11 positively phrased items and high internal consistency (Cronbach's α = .82) resulted.

This final version of the new Environmental Behavior Scale (EBS New) correlated statistically significantly with all environmental questionnaires (table 2) indicating convergent validity of the EBS New. Due to the multiple comparisons, the Bonferroni-Holm correction was used to adjust significance levels.

Regarding the Environmental Behavior Scale by Schultz and colleagues (EBS Schultz; (Schultz et al., 2005), in contrast to the original study, no item was negatively correlated with the item total (all $r \geq .21$). Consequently, all 11 items were retained in following analyses. Internal consistency measures for the environmental questionnaires, derived from the present study, can be found in table 2.

Table 2:

Cronbach's Alpha and Correlations Between the Pro-Environmental Behavior and the Pro-Environmental Attitudes Questionnaires.

	1.	2.	3.	4.
1. Environmental Behavior Scale (EBS) New[a]	.82			
2. Environmental Behavior Scale (EBS) Schultz[a]	$.67^{***}$	.74		
3. Environmental Attitudes Inventory (EAI)[a]	$.58^{***}$	$.51^{***}$	.79	
4. New Ecological Paradigm (NEP)[b]	$.29^{**}$	$.32^{**}$	$.64^{***}$	.74

Note. Correlations (Pearson, two-tailed) are presented below the diagonal; Cronbach's α for each questionnaire is presented in the diagonal. [a] n = 96. [b] n = 88. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

3.6 The Influence of Stress and Habits on Pro-Environmental Behavior

To investigate the effect of stress and environmental habits on pro-environmental behavior in the PEBT, a multiple linear regression analysis with stress, habits and their interaction was calculated. As a measure for environmental habits, the new Environmental Behavior Scale (EBS New) and the Environmental Behavior Scale by Schultz and colleagues (EBS Schultz; (Schultz et al., 2005) were used. Reaction time for the PEBT-task was not analyzed as an indicator of habit strength, since the experimental set-up required two interruptions to gather saliva samples and thus, likely caused noise in the data.

Age and gender were considered as covariables in the regression model. The age range in the current study was limited to 18 – 36 years and was not significantly associated with either Environmental Behavior Scale (both $r \leq .12$, both $p \geq .246$), and not significantly associated with Waiting Time Bike ($r_s = .16$, $p = .143$). Since several meta-analyses furthermore only suggested a small association between age and PEB (Wiernik, Dilchert, & Ones, 2016; Wiernik, Ones, & Dilchert, 2013), age was not included as a covariable in the regression model.

Gender, however seems to exert a substantial influence on PEB: Women frequently reported more PEB and attitudes than men (Vicente-Molina et al., 2018; Zelezny et al., 2000) and across 22 countries, women engaged more in PEB than men (Hunter et al., 2004). In the current study, gender was not the main factor of interest and was balanced across the experimental groups. Nevertheless, the degree of pro-environmental habits and its interplay with stress was to be investigated as a predictor for PEB, too. Environmental habits were not randomly assigned to participants while, at the same time, habits were significantly associated with gender (EBS Schultz: $r = -.32$, $p = .001$; EBS New: $r = -.50$, $p < .001$). Therefore, to untangle the effect of environmental habits from the effect of gender, gender was included as the first variable in a hierarchical regression analysis. In a second step, stress, environmental habits, and their interaction were added, and the additional explained variance was analyzed. Hence, their influence beyond the effect of gender could be estimated.

To analyze both possible indicators of environmental habits, one model with the EBS Schultz as an indicator for environmental habits and one with EBS New as an indicator was investigated. The significance levels for those analyses were adjusted using Bonferroni-Holm correction.

For the EBS New, one multivariate outlier was identified via Mahalanobis Distance values ($p = .001$) and was excluded from the analysis. The histogram of standardized residuals, as well as the P-P-plot of standardized residuals suggested deviation from a normal distribution, which was confirmed by a significant Shapiro-Wilk test ($W(87) = .92$, $p \leq .001$). The results from the multiple linear regression analysis with bootstrapped (BCa) significance levels showed that gender significantly predicted Waiting Time Bike when it was used as the only predictor in a regression model ($\beta = -.36$, $t = -3.58$, $p_{BCa} = .004$): Women (on average) endured 119 seconds ($B = 119.36$) more waiting time than men, thus women showed more PEB than men. However, adding stress, habits and their interaction to the model did not significantly influence R^2 (change in $R^2 = .002$, change in $F(3,82) = .07$, $p_{(\text{change in F})} = .975$): When gender was already accounted for, neither stress ($\beta = -.02$, $t = -.18$, $p_{BCa} = .844$) nor environmental habits (EBS New; $\beta = .05$, $t = .39$, $p_{BCa} = .688$) significantly predicted the waiting time that participants were willing to accept for choosing the bike -option (WTB). Furthermore, opposing to the hypothesis, stress did not amplify the effect of environmental habits: Stress and habits did not show an interaction effect in predicting WTB (Stress x EBS New: $\beta = -.01$, $t = -.13$, $p_{BCa} = .886$).

Likewise, for EBS Schultz as an indicator for environmental habits, similar results were found. The histogram, P-P-plot and Shapiro-Wilk test suggested non-normality of standardized residuals ($W(88) = .91$, $p \leq .001$). In line with the results for the EBS New, gender was a statistically significant predictor ($\beta = .35$, $t = -3.50$, $p_{BCa} < .004$), while also for the EBS Schultz neither Stress ($\beta = -.03$, $t = -.26$, $p_{BCa} = 1$) nor environmental habits (EBS Schultz; $\beta = .03$, $t = .25$, $p_{BCa} = 1$) significantly predicted Waiting Time Bike. Furthermore, stress did not significantly influence WTB differentially for different degrees of environmental habits (Stress x EBS Schultz: $\beta = -.04$, $t = -.35$, $p_{BCa} = 1$).

3.6.1 The Influence of Control Measures for Acute Stress on Pro-Environmental Behavior

To investigate whether the change in control measures of stress predicted pro-environmental behavior in the PEBT, the cortisol response, as well as the change in the three MDMQ scales (good mood/ bad mood, wakefulness/tiredness, calmness/ restlessness) in response to stress were included as predictors in a multiple linear regression analysis. The total waiting time that was accepted and endured associated with choosing the bike-option (Waiting Time Bike) was to be predicted.

Even though in the present study, gender did not influence the cortisol response to the TSST, a meta-analysis suggests heterogenous results on sex differences for the cortisol response after the TSST (Liu et al., 2017). Additionally, gender is associated with PEB (Hunter et al., 2004). Therefore, gender was included as the first predictor in the hierarchical multiple regression analysis. After that, in a second step, the cortisol response was included as a predictor. In that way, it was investigated whether the cortisol response explained variance in PEB, that reached beyond the effect of gender. Finally, in a third step, the subjective stress response, as indicated by the three MDMQ scales (pre-stress scores subtracted from post-stress scores), was added to the regression model. The three MDMQ scales were entered in a separate step in order to be able to investigate whether subjective mood changes in response to stress could explain variance in PEB beyond the effect of cortisol and gender.

An analysis of outliers via the Mahalanobis Distance (MD) value identified one outlier (p = .001), which was subsequently excluded. The scatterplot of the z-standardized residuals and standardized predicted values suggested heteroscedasticity. However, this was not confirmed by the Breusch-Pagan test for homoscedasticity, X^2 (1) = .49, all p = .483. To make sure that standard errors and p-values were not distorted due to the sample size being relatively small (n = 59) and tests for homoscedasticity having a small power in small sample sizes, bootstrapped data was reported.

The multiple linear regression analysis indicated that gender, the cortisol response and the change in the three MDMQ scales in response to the experimental manipulation together significantly predicted the Waiting Time Bike (F(5,53) = 5.11, p = .001, R^2 = .33, R^2_{Adjusted} = .26). Furthermore, adding cortisol (change in R^2 = .051, change in F(1,56) = 3.46, $p_{(\text{change in F})}$ = .068) as well as the three MDMQ scales (change in R^2 = .158, change in F(3,53) = 4.12, $p_{(\text{change in F})}$ = .011) to a regression model with gender, (marginally) significantly increased the explained variance. Cortisol itself furthermore was a statistically significant predictor, too: An increase in cortisol after the experimental manipulation was associated with an increase in Waiting Time Bike, and thus, PEB (β = .23, t = 1.86, p_{BCa} = .033). In addition, an increase in good mood as a response to the experimental manipulation was associated with increased PEB (β = .49, t = 2.89, p_{BCa} = .011). When good mood decreased (thus, when negative mood increased), participants endured less waiting time associated with choosing the bike-option. To facilitate comprehensibility, this relationship will only be referred to in the following with regards to negative mood and decreased WTB choices. Wakefulness and calmness did not significantly predict Waiting Time Bike (compare table 3). Exploratory exclusion of three participants whose cortisol concentration was above z = 3 for either baseline, post-TSST (+30 minutes) or the cortisol response measure (baseline subtracted from post-TSST), did not change the results of the regression-analysis.

However, in a regression analysis that followed the same procedure, neither ratings of perceived difficulty, nor ratings of unpleasantness or stressfulness of the (f-)TSST were statistically significantly associated with Waiting Time Bike (all $\beta \leq -.21$, all $t \leq -.67$, all $p \geq .472$) and all three ratings together did not statistically significantly explain additional explained variance beyond the effect of cortisol response and gender (change in R^2 = .026, change in $F(3,53)$ = .57, $p_{(\text{change in F})}$ = .636).

Table 3:

Hierarchical Multiple Linear Regression Modell With Waiting Time Bike as the Criterion Variable and Gender, Cortisol Response and MDMQ-Scales as Predictor Variables.

	B	*SE(B)* $_{BCa}$	β	*t*	p_{BCa}	R^2	$R^2_{Adjusted}$
Model 1						.12	.10
Gender	-116.52	42.44	-.34	-2.74	.008		
Model 2							
Gender	-126.63	42.11	-.37	-3.01	.002	.17	.14
Cortisol response	6.85	3.51	.23	1.86	.033		
Model 3						.33	.26
Gender	-124.59	39.44	-.36	-3.17	.005		
Cortisol response	10.96	3.60	.37	2.98	.001		
Wakefulness	-8.53	5.02	-.26	-2.19	.078		
Good mood	13.99	5.15	.49	2.89	.011		
Calmness	-6.10	4.68	-.22	-1.36	.189		

Note: Gender: 0 = women, 1 = men; *B* = unstandardized beta, *SE(B)* = standard error of *B*, β = standardized beta; $_{BCa}$ = bias corrected and accelerated data, derived from 1000 bootstrap-samples; n = 59.

3.7 Exploratory Analyses

3.7.1 Basal Cortisol

To find out whether it was valid to use the relatively small sample of n = 57 participants to obtain a basal cortisol mean that can be further analyzed with regards to pro-environmental habits (EBS New & EBS Schultz), correlations between day 1 and day 2 baseline cortisol concentration was analyzed. Baseline cortisol concentrations on day 1 and day 2 were significantly associated, but to a low extent only ($r_s = .33$ $p = .012$, two-tailed). This moderate correlation was deemed not sufficient to obtain a reliable and meaningful basal cortisol mean value. Thus, the current study refrained from further analyzing baseline-cortisol scores in association with environmental questionnaire measures.

3.7.2 Gender Differences

Previously reported robust gender differences (e.g. Hunter et al., 2004) in PEB were found in the present study for all environmental measures, as well. In addition to the previously described influence of gender on behavior in the PEBT, significant negative associations between gender and the four environmental questionnaires (EAI, NEP, EBS Schultz, EBS New) were found (all $r \geq -.21$, all $p \leq .001$), reflecting that women scored higher (= more pro-environmental) in the questionnaires than men.

3.7.3 Chronic Stress

The TICS consists of 9 subscales and one screening scale for chronic stress. The authors suggest a differential impact of the 9 subscales for influencing stress (Schulz et al., 2004). Thus, to investigate the effect of chronic stress on PEB during the last year as assessed with the Environmental Behavior Scales (EBS New & EBS Schultz), the current study refrained from solely focusing on the Screening Scale for Chronic Stress (SSCS). However, a significant positive association between the SSCS and PEB was found in a previous study (Sollberger et al., 2016a). Hence, the SSCS was analyzed in the current study, too. Nevertheless, among most scales of the TICS, high correlations were present: Especially the Screening Scale for Chronic Stress (SSCS) correlated significantly with each scale (as to be expected) and correlated very highly with three scales especially: Work overload (WO; $r = .71$, $p < .001$), excessive demands at work (EDW; $r = .84$, $p < .001$) and chronic worrying (CW; $r = .88$, $p < .001$). Therefore, in order to avoid multicollinearity in the regression model, only the scales that had not been used to compute the SSCS score were included as additional predictors, since those scales were most likely to contribute additional explained variance beyond the effect of the screening scale (SSCS). To identify potentially relevant scales of the TICS in predicting PEB during the last year, the Screening Scale for Chronic Stress (SSCS) and the scales Pressure to Perform (PP), Work Discontent (WD), Social Tensions (ST) and Social Isolation (SI) were included as predictors in a backwards multiple linear regression model. Furthermore, to account for the two analyses of the EBS New and the EBS Schultz, reported significance levels were adjusted via Bonferroni-Holm correction. Gender was considered as a covariable but was not included in the model, since it was not significantly associated with any of the TICS scales (all $r \leq .18$, all $p \geq .740$).

For the new Environmental Behavior Scale (EBS New) as the criterion variable, one multivariate outlier was identified via Mahalanobis Distance ($p = .001$) and subsequently excluded. In this model, WD, SI and the SSCS concluded as significant predictors (all $\beta \geq$ -.28, all $t \geq 2.18$, all $p \leq .032$) for PEB (EBS New). However, while significantly explaining variance in the EBS New ($F(3, 91) = 5.04$, $p = .003$) the amount of variance that the three scales measuring chronic stress together explained was only 14% ($R^2 = .14$, $R^2_{\text{Adjusted}} = .11$). Furthermore, work discontent and social isolation were both negatively associated with EBS New (both $\beta \geq -.28$, both $t \geq -2.35$, both $p \leq .028$). Interestingly, the screening scale for chronic stress was positively associated with EBS New ($\beta = .29$, $t = 2.18$, $p = .032$): An increase in the screening scale statistically significantly predicted an increase in self-reported PEB during the last year.

The same procedure was followed to predict EBS Schultz scores: The scales PP, WD, ST and SI, as well as the SSCS were analyzed in a backwards multiple linear regression analysis. No multivariate outlier was identified. Here, only Work Discontent resulted as a significant predictor for PEB, assessed via the EBS Schultz ($\beta = -.25$, $t = -2.51$, $p = .028$), explaining 6 % of variance in EBS Schultz scores ($R^2 = .06$). In line with the results for EBS New, work discontent was significantly negatively associated with EBS Schultz: Increased scores on the work discontent scale predicted decreased PEB.

3.7.4 The Effect of Predictability and Gender on Behavior in the PEBT

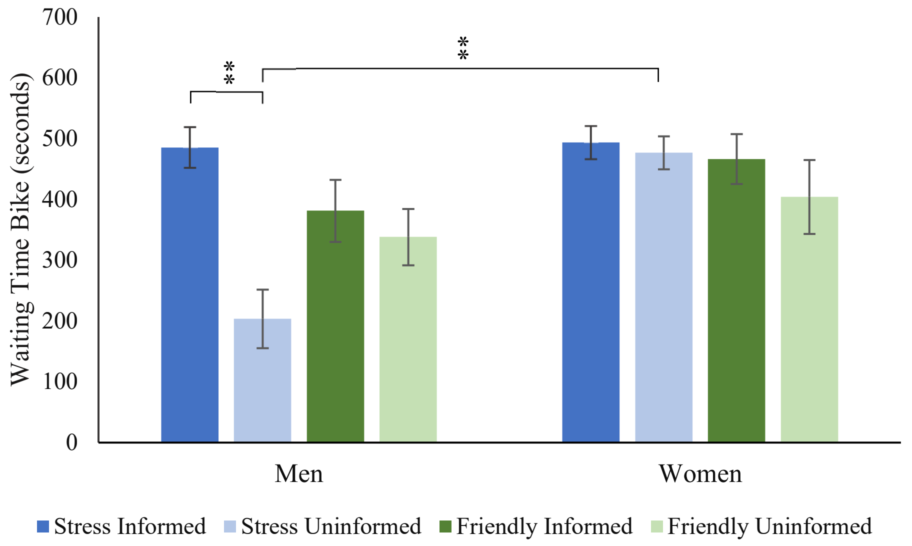
To investigate the influence of predictability and its interplay with stress and habits, a multiple linear regression analysis was calculated for EBS New and EBS Schultz, respectively. All reported significance values were adjusted via Bonferroni-Holm correction to account for the two regression analyses that were conducted for the two EBS questionnaires, unless otherwise specified. As mentioned before, a stable and substantial effect of gender on PEB was reported in various studies (e.g. Hunter et al., 2004) and in the current study, as previously noted, gender statistically significantly predicted Waiting Time Bike, too. Therefore, gender was included as a predictor in the same regression model and potential interaction effects of gender, stress, predictability, and the two EBS questionnaires were investigated.

A regression analysis to predict WTB with the predictor variables gender, stress, predictability, their two-and threefold interaction terms and EBS New and its interaction term with predictability was calculated. One multivariate outlier was identified via Mahalanobis Distance ($p = .001$) and in the following excluded. The histogram of standardized residuals, as well as their P-P-plot suggested a non-normal distribution, which was confirmed by a significant Shapiro-Wilk test ($W(87) = .95$, $p = .001$). Thus, bootstrapped p-values were reported.

The regression analysis revealed that gender, stress, predictability, EBS New and their interplay together significantly explained variance in Waiting Time Bike values ($F(9, 77) = 5.81$, $p = .002$, $R^2 = .40$, $R^2_{\text{Adjusted}} = .36$). Furthermore, predictability was a statistically significant predictor for Waiting Time Bike: Participants who received detailed information about the upcoming experimental manipulation (informed) behaved more pro-environmental – and waited on average 98.31 seconds more – than uninformed participants ($\beta = -.30$, $t = -3.38$, $p_{\text{BCa}} = .006$). Additionally, while gender did neither modulate the influence of stress alone, nor did it modulate the influence of predictability alone (both $\beta \leq -.12$, both $t \leq 1.15$, both $p_{\text{BCa}} \geq .292$), a statistically significant interaction-effect between gender, stress and predictability was found ($\beta = .22$, $t = 2.54$, $p_{\text{BCa}} = .050$). T-tests with Bonferroni-Holm correction revealed that women did not differ regarding PEB (Waiting Time Bike) in any of the four experimental groups (all $t \leq 1.34$, all $p = 1$, all $d \leq .55$). In contrast, as it can be seen in figure 2, men in the stress group who received prior information behaved more pro-environmental than men in the stress group without prior information (SI vs SU; $t(20) = -4.82$, $p = .006$, $d = -2.05$), while men did not show any other statistically significant group difference after Bonferroni-Holm correction (all $t \leq 2.58$, all $p \geq .090$, all $d \leq 1.10$). When comparing women and men among the four groups (and adjusting the significance level using Bonferroni-Holm correction), men only showed significantly less PEB than women in the stress group that was uninformed (SU; $t(20) = 4.94$, $p = .004$, $d = 2.11$), while there were no significant differences between women and men in any other of the three experimental groups (all $t \leq 1.30$, all $p \geq .624$, all $d \leq .55$).

Figure 2:

Waiting Time Bike as a Function of Experimental Group and Gender.



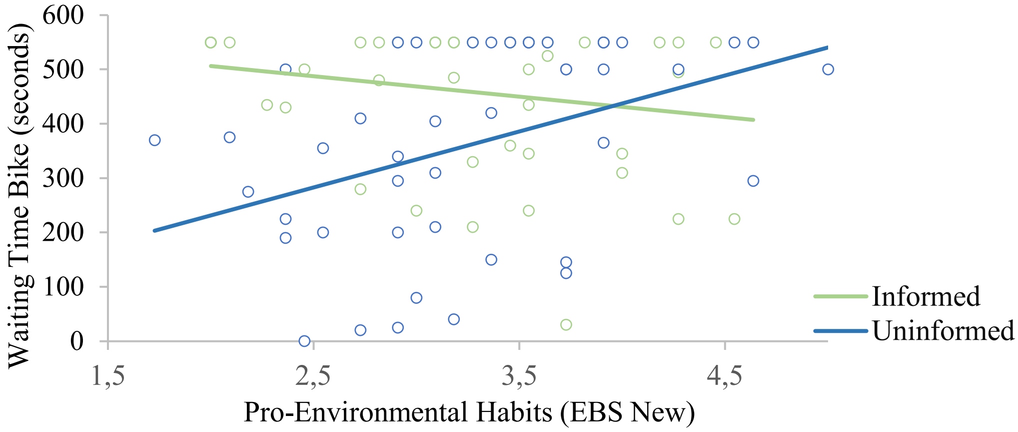
Note. Significance levels: * < .05, ** < .01, *** < .001.

The EBS New itself, furthermore, did not statistically significantly predict WTB (β = -.07, t = -.65, p_{BCa} = .1). A trend in the interaction between predictability and environmental habits was observed: Predictability modulated the effect of environmental habits, when they were assessed via the EBS New and the significance level was not corrected for multiple testing (Predictability x EBS New: β = .23, t = 2.15, p_{BCa} = .036). However, after Bonferroni-Holm correction, this effect was no longer statistically significant (p = .072). Explorative post-hoc correlational analyses, on the other hand, suggested that participants' waiting time choices were significantly positively associated with environmental habits (EBS New) when they did not receive preliminary information about the experimental manipulation (uninformed; compare figure 3: r_s = .46, p = .016)[8]. For participants who did receive preliminary information (informed), there was no statistically significant association (r_s = -.16, p = 1).

[8] Notably, this reported significance level was already corrected via Bonferroni-Holm for 8 tests (correlations between WTB and EBS New/ EBS Schultz/ EAI/ NEP for informed/ uninformed, respectively).

Figure 3:

Association Between Pro-Environmental Habits, Predictability and Pro-Environmental Behavior.



Note. Each dot represents an individual participant.

To enhance comparability of the results, the same procedure was applied for the Environmental Behavior Scale by Schultz and colleagues (EBS Schultz). No outlier was apparent (p = .001). Residuals were not normally distributed (W(88)=.930, p < .001), therefore bootstrapped significance levels were reported. Stress, predictability, gender, EBS Schultz and their interplay significantly explained variance in Waiting Time Bike values (F(9, 78) = 4.63, p = .002, R^2 = .40, $R^2_{Adjusted}$ = .36). The same effects that were found in the model with EBS New could be replicated (compare table 4). However, predictability did not modulate the influence of environmental habits assessed via EBS Schultz (Predictability x EBS Schultz: β = .16, t = 1.69, p_{BCa} = .094).

Table 4:

Multiple Linear Regression Models With Waiting Time Bike as the Criterion Variable.

Predictor Variables	B	$SE(B)_{BCa}$	β	t	p_{BCa}	R^2	$R^2_{Adjusted}$
Gender	-131.66	36.66	-.40	-3.79	.004	.40 [a]	.34 [a]
Stress	-6.10	29.83	-.02	-.21	1		
Predictability (Pred)	-98.31	29.83	-.30	-3.38	.006		
EBS New	-16.33	27.13	-.07	-.65	1		
Stress x Pred	120.15	59.65	.18	2.07	.106		
Stress x Gender	66.81	61.67	.10	1.15	.548		
Pred x Gender	-78.17	75.46	-.12	-1.13	.292		
Stress x Pred x Gender	294.77	122.36	.22	2.54	.050		
Pred x EBS New	108.04	53.11	.23	2.15	.072		
Gender	-114.58	32.51	-.35	-3.62	.004	.35 [b]	.27 [b]
Stress	-3.58	31.31	-.01	-.12	1		
Predictability (Pred)	-92.44	29.43	-.28	-3.07	.006		
EBS Schultz	12.93	28.02	.05	.47	1		
Stress x Pred	111.99	58.87	.17	1.85	.106		
Stress x Gender	53.72	64.11	.08	.89	.548		
Pred x Gender	-107.36	63.60	-.16	-1.70	.204		
Stress x Pred x Gender	282.38	125.93	.22	2.33	.050		
Pred x EBS Schultz	93.03	55.43	.17	1.69	.094		

Note. Gender: 0 = women, 1 = men; Stress: 0 = stress, 1 = control; Predictability: 0 = informed, 1 = uninformed; B = unstandardized beta, $SE(B)$ = standard error of B, β = standardized beta; $_{BCa}$ = bias corrected and accelerated data, derived from 1000 bootstrap-samples. [a] n = 87. [b] n = 88.

4. Discussion

The goal of the present thesis was to research the effect of acute, experimentally induced stress on pro-environmental behavior in the laboratory. Especially the interplay between stress and habits in predicting PEB was to be examined. Stress was expected to decrease the amount of PEB, indicated by previous research (Sollberger et al., 2016b) and findings of stress decreasing self-control (Oaten & Cheng, 2005) and increasing delay discounting (Kimura et al., 2013). At the same time, stress was expected to render PEB more habitual (Schwabe & Wolf, 2009). Those hypotheses were investigated by experimentally inducing acute psychosocial stress via the Trier Social Stress Test (Kirschbaum et al., 1993), a paradigm that imitates an important job interview. An equivalent control condition (friendly-TSST) included a friendly conversation with laboratory employees. The TSST was expected to influence behavior in the Pro-Environmental Behavior Task (Lange et al., 2018), a laboratory task measuring PEBT on several trials. The effectiveness of the stress manipulation was evaluated via salivary cortisol concentration and various subjective measures. Participants also responded to various questionnaires, amongst others the Trier Inventory for Chronic Stress (Schulz et al., 2004) and four questionnaires assessing PEB and pro-environmental attitudes (Dunlap et al., 2000; Milfont & Duckitt, 2010; Schultz et al., 2005).

4.1 Central Hypotheses

4.1.1 The Influence of Stress on Pro-Environmental Behavior

The results of the current study showed that the experimental manipulation of stress in the two stress groups can be considered successful. This conclusion was supported by an increase in cortisol concentration, restlessness, negative mood, and tiredness in response to stress and significant differences in ratings of difficulty, unpleasantness and stressfulness of the manipulation. In spite of the experimental manipulation of stress being successful, the current study was not able to demonstrate a significant influence of experimentally induced stress on PEB: Participants' travel choices in the stress group did not differ from choices in the control group. Those results are surprising regarding the current state of research. Other studies that investigated the influence of stress on PEB and related concepts reported significant influences of stress. In previous literature, experimentally induced stress with the TSST decreased the amount of donated money to an environmental organization in men (Sollberger et al., 2016b). Additionally, the TSST decreased the time men spent looking at negative images generally, but also at climate change images specifically (Sollberger et al., 2017). Moreover, stress as assessed by questionnaires was negatively associated with PEB in questionnaires (N. Kaida & Kaida, 2019; Sollberger et al., 2016a).

Another possible association is frequently discussed, too: Stress might increase PEB. The behavioral pattern *tend and befriend* was frequently related to the influence of stress on prosocial behavior (Taylor et al., 2000), with stressed individuals behaving more prosocial in order to ensure social support during stressful situations. However, this explanation seems to be inadequate for pro-*environmental* behavior since the environment unlikely offers social support. Nonetheless, another proposed mechanism draws on the idea of behavior under stress being instrumental in seeking to buffer the effect of stress: Increased PEB was proposed to reduce negative mood during stress and make people "feel better about themselves" (Sollberger et al., 2016b, p. 318). Therefore, participants would show more PEB under stress.

Nevertheless, those mentioned studies did either use one time measurements of PEB (Sollberger et al., 2016b), employed questionnaire measures, or investigated visual attention to climate change stimuli (Sollberger et al., 2017). The present thesis, on the other hand, employed a paradigm that measured PEB in the laboratory with several trials. As previously noted, only measuring PEB once might be susceptible to reliability issues. Furthermore, self-reported questionnaires might not be able to accurately reflect PEB outside the laboratory. While visual attention might be a predictor for PEB, it does not qualify as PEB itself: Visual attention does not seek to "minimize the negative impact of one's actions on the natural and built world" (Kollmuss & Agyeman, 2002, p. 240), since it does not have an impact on the natural world at all. Thus, the generalizability of results from visual attention paradigms to PEB is debatable. Therefore, PEB as assessed with the current study might be the first meaningful measure of PEB that was applied to stress. However, the current study still implemented a laboratory paradigm, which might also not be able to reflect PEB in everyday life and which possibly was not able to reflect the whole variance of potential PEB (as discussed later).

4.1.2 The Interplay between Stress and Habits in influencing Pro-Environmental Behavior

In addition to investigating the influence of stress alone, the current study furthermore aimed to investigate whether stress amplified the influence of pro-environmental habits on PEB. This hypothesis was supported by several previous studies suggesting stress to render behavior more habitual (Schwabe & Wolf, 2009) and PEB being influenced by habits (Klöckner & Verplanken, 2018). However, the present results do not suggest that stress modulates the influence of pro-environmental habits on PEB, since no significant interaction effect of both factors was found. Nonetheless, those results might be driven by conceptional problems: The situation in the PEBT possibly did not trigger pro-environmental habits. Habitual behavior is triggered by a particular situation during which behavior was previously frequently repeated (Steg & Vlek, 2009). Thus, the laboratory situation and the PEBT being responded to on a computer screen might have been too novel and unusual to trigger habits. Nevertheless, those results might be due to stress itself not significantly influencing PEB in the current study. To conclude, the methodological specifications of the present thesis was most likely the reason for the non-significant interaction effect. This is furthermore supported by past literature, since habitual travel mode choice was found to be less controllable under conditions of cognitive load than without cognitive load (Aarts & Dijksterhuis, 2000). Consequently, the interplay between stress and habits should be further investigated in future research.

4.1.3 The Influence of Cortisol and Mood on Pro-Environmental Behavior

Cortisol response. In the current study, as expected, an influence of the cortisol response on PEB was found. However, the direction of the association was opposed to what was expected: A high cortisol response in response to the experimental manipulation was associated with a high number of pro-environmental choices. Nonetheless, those results do align with an existing body of research: Singer et al. (2017) reported a significant positive association between cortisol concentrations and altruistic decisions. Furthermore, Sollberger et al. (2016b) found that participants with low pro-environmental (LP) orientation who were exposed to a stress-manipulation were more likely to donate money to an environmental organization. Interestingly, the authors demonstrated those findings in LP participants for the influence of the factor stress and for the influence of the cortisol response. In line with the results of the present thesis, a significant positive association between cortisol response and PEB was found. Sollberger et al. (2016b) interpreted those pro-environmental choices for stressed individuals as serving a mood-repairing purpose. However, to test this hypothesis for the present data, another MDMQ administration after responding to the PEBT would have been necessary.

Presuming that this cortisol response reflects stress-levels and presuming that stress is conceptually similar to existential threat, another approach should be discussed: Taking into account the Terror Management Theory (Greenberg & Kosloff, 2008) might explain the increased cortisol response leading to more PEB. The TMT would predict an individual under threat to behave more in line with social norms. However, for this theory to hold true for the current study, salient pro-environmental norms would have had to be present during the testing situation. Nonetheless, the presence of pro-environmental norms can be tentatively assumed when considering the place where the study was conducted. The study took place in a building of the University of Hamburg. Previous research in university students suggests that an increasing number of years students spent on campus is associated with increasing PEB (Meyer, 2016). This might reflect pro-environmental norms that are present amongst university students. Thus, a pro-environmental norm might have been primed when participants entered the university building. The idea of social norms being present might be supported considering that the experimenter interrupted the participants while answering to the PEBT in order to gather saliva samples. Therefore, social desirability might have influenced the PEBT choices, since the experimenter was able to see the choices of the participant on the computer screen when entering the room. The notion of participants with a high cortisol response behaving more pro-environmentally is consistent with robust findings of existential threat resulting in increased PEB when a pro-environmental norm is present (Fritsche et al., 2010). To conclude, the present finding of the cortisol response to be positively associated with PEB aligns with other research results and theoretical considerations.

Mood. The present study found a significant association between decreased good mood and decreased PEB. The MDMQ scale assessing mood was bipolar, thus the previously described association can be interpreted with regards to negative mood, too: Participants who showed high levels of negative mood after the (f-)TSST showed subsequently less PEB. This effect is in line with previous results reporting an association between negative mood and decreased PEB (Coelho, Pereira, Cruz, Simões, & Barata, 2017). Thus, the present thesis contributes additional validity to those findings by assessing PEB with a laboratory task, instead of a questionnaire. Nonetheless, negative mood was previously found to increase pro*social* behavior (Pérez-Dueñas et al., 2018). Prosocial and pro-environmental behavior were regarded as conceptually similar in past research (Sollberger et al., 2016b). However, the present results suggest distinguishing between prosocial and pro-environmental behavior in future studies. Therefore, the current results contribute to further understanding differential influential factors for prosocial and pro-environmental behavior.

It is important to note that, originally, the intention to measure mood changes in response to the experimental manipulation was to reflect a subjective stress response. In the present thesis, the factor stress significantly decreased positive mood and increased negative mood. Those results are interesting, since stress significantly increased negative mood and negative mood was associated with fewer pro-environmental choices, while the factor stress itself did not predict pro-environmental choices.

To summarize, the current study found negative mood to be significantly associated with decreased PEB. Whether this effect is replicable for different forms of PEB or for prosocial behavior, as well as the processes leading to this effect, however, remains to be identified in future research.

4.2 Exploratory Results

4.2.1 The Association between Chronic Stress and Pro-Environmental Behavior

The present thesis found the Screening Scale for Chronic Stress (SSCS) to significantly predict PEB during the last year: Participants who reported a high amount of chronic stress did also report a high amount of PEB. This result is opposed to previously reported small, but negative associations between the SSCS and PEB in questionnaires (Sollberger et al., 2016a). Additionally, also contradicting the present results, N. Kaida and Kaida (2019) found a significant negative association between a stress questionnaire for everyday life and a PEB questionnaire. Tentative interpretations of the present, opposing results would suggest a mood-repairing effect of PEB for chronic stress. Thus, in an attempt to improve the negative mood that is induced by chronic stress, people would show more PEB. However, this effect was only significant when PEB was assessed with the newly constructed Environmental Behavior Scale (EBS New).

Compared to the other results that were found when analyzing the TICS scales, the mood-repairing hypothesis for the SSCS becomes less likely, because high levels of Work Discontent were associated with low levels of PEB during the last year on both scales. In addition, high levels of Social Isolation were associated with low levels of PEB on the EBS New. Those results are in line with negative mood and decreased PEB being associated which was reported earlier in the present study. Thus, Work Discontent and Social Isolation might be characterized by high levels of persistent negative mood and would therefore decrease PEB.

4.2.2 The Influence of Predictability on Pro-Environmental Behavior

In the current study, preliminary information about the (f-)TSST influenced PEB in the same way that stress was expected to influence it, while stress itself did not influence PEB at all.

Therefore, participants who were uninformed about the upcoming experimental manipulation behaved less pro-environmentally. This effect was especially evident for the PEBT choices of men and for the differences within stress-groups. Men predominantly showing this effect might be due to women being more affected by a potential ceiling effect. This interpretation is supported by women consistently showing more PEB and pro-environmental attitudes on all environmental measures (PEBT, EBS Schultz, EBS New, EAI, NEP) that were applied. Additionally, considering the pattern of PEB choices in men, the only significant difference was found between the stress informed (SI) and the stress uninformed (SU) conditions. This suggests the interpretation that only *unpredictable* stressors (SU) decrease PEB, while the rest of the groups (FI, FU, SI) might have been comparable.

Findings that an efficient psychosocial stressor is characterized by novelty, unpredictability, uncontrollability, ego-involvement, and social-evaluative threats seem to support the notion that unpredictability is needed to evoke perceived stress (Dickerson & Kemeny, 2004; Mason, 1968). However, trying to induce stress, while at the same time giving participants detailed information about the stressful situation (SI) might decrease the credibility of the stress-induction. Knowing beforehand that the committee will act reserved and cold and that it will not reply to questions might increase the feeling that the whole situation is staged. If the individual knows beforehand that he/she can not do anything to change the behavior of the committee, the behavior of the committee will not be related to the individual's performance. Thus, important other characteristics of a successful stressor (ego-involvement and social-evaluative threat), in addition to unpredictability might be extinguished, while the situation is likely still perceived as awkward and unpleasant. Nonetheless, this consideration is not supported by the cortisol response or the stress-questionnaire: Participants in both stress groups showed increased cortisol concentration after stress, and participants in both stress groups perceived the situation as substantially more difficult, unpleasant, and stressful.

Supposing that (un-)predictability is conceptually different from stress leads to several theoretical considerations. Firstly, considering the Theory of Planned Behavior (Ajzen, 1985, 1991), it might be possible that the amount of information given beforehand substantially influences the perceived behavioral control. When participants are well-informed about the upcoming situation, they therefore would gain a greater sense of controllability of the situation, since they know exactly what is about to happen. This increased sense of controllability in the (f-)TSST situation potentially generalizes towards a global feeling of being able to control situations or behavior, as opposed to not being able to control it. Thus, participants who were uninformed about the (f-)TSST might have experienced low perceived behavioral control in the (f-)TSST situation: Even though the situation might not have been stressful or aversive (as in the friendly TSST), participants were still not able to predict the situation and had to react to what was coming, instead of being able to proactively control the situation. This experience might subsequently generalize to situations that follow directly to the (f-)TSST situation of deprived perceived behavioral control. Those considerations would align with previous research, since perceived behavioral control is frequently related to PEB (Ando, Ohnuma, Blöbaum, Matthies, & Sugiura, 2010; Han, 2015). The notion of a generalized sense of low perceived behavioral control is furthermore supported by findings about self-efficacy and PEB. Several studies suggest that perceived self-efficacy is substantially related to PEB (Huang, 2016; Kim, Kim, Han, & Holland, 2016).

To summarize, the present results of low predictability (instead of stress) leading to decreased PEB contributes interesting approaches for further research. Possibly, different characteristics of stressors exert different influences on PEB. At the same time, low predictability decreasing PEB aligns with findings from research about perceived behavioral control and self-efficacy.

The Interplay between Predictability and Habits. In the regression models involving all potentially relevant factors and interaction terms, predictability did not significantly modulate the association between EBS New/ EBS Schultz and waiting time choices (both $p \geq .072$). Nevertheless, when investigated via separate correlational analysis, a significant moderate association between EBS New and PEBT choices was found for participants who were uniformed about the subsequent experimental manipulation, but not for informed participants. This effect of unpredictability would be equivalent to the previously assumed effect of stress to enhance pro-environmental habits. Thus, a high unpredictability of a subsequent situation would lead PEB to become more habitual. However, this effect was only marginally significant at best and was furthermore susceptible to some potential limitations.

4.3 Limitations

4.3.1 Challenges Regarding Measurements with the Adapted Version of the PEBT

The adapted version of the PEBT that was employed in the current study entailed 25 trials of different characteristics regarding the associated waiting times of the bike and the car option. This adapted version of the PEBT was significantly associated with some measures of pro-environmental attitudes and behavior (EAI, NEP, EBS New) and not significantly associated with others (EBS Schultz), indicating a certain degree of validity. While this version of the PEBT was more feasible and economic than the original PEBT when used as a dependent variable in an experimental set-up, the present data suggested another potential challenge with the employed version. All three PEBT outcome measures showed remarkable deviations from a normal distribution, which likely occurred due to a ceiling effect in pro-environmental choices. Hence, it is possible that independent variables no longer influenced behavior in the PEBT because the maximum possible value had been reached. In the current study, this effect might have distorted the results regarding the influence of stress and predictability and their interplay with gender: Women in all four groups scored very highly towards the end of the waiting time scale. Possibly, the same pattern of predictability that was evident for men would have been shown for women, too, if women had not potentially reached the end of the scale. The same doubt remains unanswered for the interaction effect of predictability and habits: No significant association between pro-environmental habits (EBS New) and PEBT choices was present for participants in the informed condition, while this association was significant for participants in the uninformed condition. At the same time, informed participants showed significantly more PEB in the PEBT than uninformed participants. Thus, it is possible that the observed, at best marginally significant interaction effect between predictability and habits (EBS New) is driven by the circumstance that many informed participants already scored towards the high end of the PEBT scale, even when they had low pro-environmental habits. Therefore, informed participants with high pro-environmental habits might not have been able to show even more PEB. However, this adapted version of the PEBT seemed to be appropriate to reflect men's PEB, since different results in each of the four groups were shown for men. Thus, the employed PEBT version should possess some degree of sensitivity.

4.3.2 Differences Between the EBS New & EBS Schultz

The newly composed Environmental Behavior Scale (EBS New), which was constructed to be used as a measure of environmental habits, was found to be significantly associated with the other environmental questionnaires, and therefore, reliably assessing PEB. Nonetheless, the present study found differing results for analyses involving the two versions of the Environmental Behavior Scale. One of the striking differences is the EBS New being significantly associated with the adapted PEBT, while the EBS Schultz was not significantly associated with the PEBT. Those results differ from the results that were reported by Lange et al. (2018), which demonstrated EBS Schultz and PEBT measures to be associated. Possibly, the PEBT was not suitable to validate the EBS New, since it was subject to influences from the four differing experimental groups. However, the association between the EBS New and the PEBT being significant, in spite of those influences, might add to the conclusion that the EBS New, in the current study, proved to be a more sensitive and more adequate measure for PEB during the last year, compared to the EBS Schultz. This is furthermore supported by more TICS scales being significant predictors for EBS New than for EBS Schultz and the interaction effect of predictability and EBS New being closer to showing significance than the interaction effect of predictability and EBS Schultz. However, all results involving the EBS New should be interpreted with caution, since a separate study to validate the EBS New would be necessary to draw meaningful conclusions. Nonetheless, the present study provides interesting approaches to expand the recent validity of the EBS Schultz questionnaire by adding questions that are more up-to-date and applicable to currently debated PEBs.

4.4 Summary and Implications

The nature of the influence of stress on PEB remains to be heterogenous. Experiencing the induction of psychosocial stress did neither influence PEB, nor did it modulate the relationship between pro-environmental habits and PEB. Contradicting the initial hypothesis, stress did not render PEB more habitual or enhanced the effect of habits on PEB. Interestingly, opposing to the original hypothesis, the cortisol response to the experimental manipulation was found to be *positively* associated with behavior in the PEBT: A high cortisol response was associated with a high amount of pro-environmental travel choices. This finding was discussed in terms of a potential mood-enhancing effect of behaving pro-environmentally and the influence of existential threats and pro-environmental norms. Moreover, mood predicted PEB, with more negative mood after the experimental manipulation being associated with less PEB, which is in line with previous research. Adding to those mixed results, while the factor stress did not influence PEB, the factor predictability exerted a substantial influence on PEB: Participants to whom the (f-)TSST was unpredictable (uninformed) showed less PEB than participants who were informed about the upcoming manipulation. Those results were discussed within the influences of perceived behavioral control and perceived self-efficacy. The differing effect of the experimental manipulation for women and men might be caused by a ceiling effect which did not allow women to show their whole range of behavior.

Furthermore, substantial gender differences were replicated for all applied pro-environmental measures: Women consistently showed more pro-environmental attitudes and PEB than men. In addition, predictability marginally significantly modulated the relationship between habits and PEB: Participants to whom the experimental manipulation was surprising (uninformed) showed a significant association between pro-environmental habits and PEBT choices, while habits and PEBT-choices were not significantly associated for informed participants.

Moreover, influences on PEB during the last year, as measured with the EBS Schultz and EBS New, were exploratively investigated. While basal cortisol concentrations were not reliable enough to be analyzed as a potentially associated factor, other factors being associated with EBS measures could be demonstrated. Gender was significantly associated with all environmental questionnaires. In addition, chronic stress level and social isolation, but especially work discontent predicted pro-environmental habits (EBS Schultz, EBS New).

4.4.1 Implications for Future Research and Conclusion

The present thesis offered some distinguishing features compared to previous research: This study was one of the first that investigated the influence of experimentally induced stress on PEB in women and men. Furthermore, in assessing PEB via a more valid procedure than questionnaire responses, the results of the present study might offer enhanced validity. Thus, the study offered contributions to the generalizability of results from previous research on stress and PEB as well as implications for further research.

The high cortisol response being associated with increased PEB aligns with findings of previous research. However, which processes mediate those findings (e.g. mood repairing, TMT) remains to be identified in future research. The likely enhanced validity of the current results compared to questionnaire measures was especially relevant for the finding of negative mood to be associated with decreased PEB. While previous literature yielded differing results, the current results contribute to literature replicating this effect for PEB and furthermore suggest differentiating between PEB and prosocial behavior in future studies. Additionally, the opposite associations of cortisol response and negative mood with PEB suggest that the endocrine response to stress and the perceived mood changes exert differential influences on PEB. However, whether this is true should be further explored in studies that experimentally stimulate the HPA axis and induce negative mood separately from one another.

Another interesting notion is contributed by the experimental design to encompass predictability, even though predictability being investigated was a result of coincidence. Nonetheless, the question whether a potential effect of stress on pro-environmental behavior is driven by stress itself or characteristics of stressors to be unpredictable, should be further explored. Moreover, the present results suggest differential effects of stress on PEB depending on the nature of the stressor.

Furthermore, this thesis was one of the first studies to investigate not only the role of acute psychosocial stress, but also the role that the interplay between stress and environmental habits has in influencing PEB. However, even though this study yielded many interesting implications, the effect of stress and its interplay with habits in predicting pro-environmental behavior was not significant and still remains to be further investigated in future research. To conclude, the current study contributes substantially to further research regarding the influence of stress on PEB. Besides from the sole purpose of gaining knowledge and therefore only being important for the scientific community, investigating the influence of stress on PEB has an impact outside the laboratory, too. Previous research showed that by reducing stress in participants, moral reasoning and decision-making was enhanced (Shapiro, Jazaieri, & Goldin, 2012). In addition, non-surprisingly, reducing stress positively influenced subjective well-being. Studying the influences of stress on PEB and ultimately being able to effectively reduce potential negative consequences of stress for pro-environmental behavior seems to be a promising agenda. Therefore, by reducing stress, we might be one step closer to the ideal world in which people have higher levels of well-being while at the same time behaving more sustainable.

References

Aarts, H., & Dijksterhuis, A. P. (2000). The automatic activation of goal-directed behaviour: The case of travel habit. *Journal of Environmental Psychology*, *20*(1), 75–82. https://doi.org/10.1006/jevp.1999.0156

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11–39). Springer.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ando, K., Ohnuma, S., Blöbaum, A., Matthies, E., & Sugiura, J. (2010). Determinants of individual and collective pro-environmental behaviors: Comparing Germany and Japan. *Journal of Environmental Information Science*, *38*(5), 21–32.

Arbuthnott, K. D. (2010). Taking the Long View: Environmental Sustainability and Delay of Gratification. *Analyses of Social Issues and Public Policy*, *10*(1), 4–22. https://doi.org/10.1111/j.1530-2415.2009.01196.x

Arnocky, S., Milfont, T. L., & Nicol, J. R. (2014). Time Perspective and Sustainable Behavior. *Environment and Behavior*, *46*(5), 556–582. https://doi.org/10.1177/0013916512474987

Arnsten, A. F. T., Raskind, M. A., Taylor, F. B., & Connor, D. F. (2015). The Effects of Stress Exposure on Prefrontal Cortex: Translating Basic Research into Successful Treatments for Post-Traumatic Stress Disorder. *Neurobiology of Stress*, *1*, 89–99. https://doi.org/10.1016/j.ynstr.2014.10.002

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology*, *27*(1), 14–25. https://doi.org/10.1016/j.jenvp.2006.12.002

Bamberg, S., & Schmidt, P. (2003). Incentives, Morality, Or Habit? Predicting Students' Car Use for University Routes With the Models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, *35*(2), 264–285. https://doi.org/10.1177/0013916502250134

Baumeister, R. F., Sparks, E. A., Stillman, T. F., & Vohs, K. D. (2008). Free will in consumer behavior: Self-control, ego depletion, and choice. *Journal of Consumer Psychology*, *18*(1), 4–13. https://doi.org/10.1016/j.jcps.2007.10.002

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 561–571. https://doi.org/10.1001/archpsyc.1961.01710120031004

Berry, M. S., Nickerson, N. P., & Odum, A. L. (2017). Delay Discounting as an Index of Sustainable Behavior: Devaluation of Future Air Quality and Implications for Public Health. *International Journal of Environmental Research and Public Health*, *14*(9). https://doi.org/10.3390/ijerph14090997

Blanca, M. J., Alarcón, R., Arnau, J., Bono, R., & Bendayan, R. (2017). Non-normal data: Is ANOVA still a valid option? *Psicothema*, *29*(4), 552–557. https://doi.org/10.7334/psicothema2016.383

Borden, R. J., & Francis, J. L. (1978). Who cares about ecology? Personality and sex differences in environmental concern 1. *Journal of Personality*, *46*(1), 190–203.

Brick, C., & van der Linden, S. (2018). Yawning at the apocalypse. *The Psychologist*, *31*, 30–35.

Brislin, R. W. (1976). Comparative research methodology: Cross-cultural studies. *International Journal of Psychology*, *11*(3), 215–229.

Brown, K. W., & Kasser, T. (2005). Are Psychological and Ecological Well-being Compatible? The Role of Values, Mindfulness, and Lifestyle. *Social Indicators Research*, *74*(2), 349–368. https://doi.org/10.1007/s11205-004-8207-8

Buruck, G., Wendsche, J., Melzer, M., Strobel, A., & Dörfel, D. (2014). Acute psychosocial stress and emotion regulation skills modulate empathic reactions to pain in others. *Frontiers in Psychology*, *5*, 517. https://doi.org/10.3389/fpsyg.2014.00517

Buttlar, B., Latz, M., & Walther, E. (2017). Breaking Bad: Existential Threat Decreases Pro-Environmental Behavior. *Basic and Applied Social Psychology*, *39*(3), 153–166. https://doi.org/10.1080/01973533.2017.1296360

Cannon, W. B. (1914). The Interrelations of Emotions as Suggested by Recent Physiological Researches. *The American Journal of Psychology*, *25*(2), 256. https://doi.org/10.2307/1413414

Capraro, V., & Cococcioni, G. (2016). Rethinking spontaneous giving: Extreme time pressure and ego-depletion favor self-regarding reactions. *Scientific Reports*, *6*, 27219. https://doi.org/10.1038/srep27219

Carmi, N. (2013). Caring about tomorrow: future orientation, environmental attitudes and behaviors. *Environmental Education Research*, *19*(4), 430–444. https://doi.org/10.1080/13504622.2012.700697

Carrus, G., Passafaro, P., & Bonnes, M. (2008a). Emotions, habits and rational choices in ecological behaviours: The case of recycling and use of public transportation. *Journal of Environmental Psychology*, *28*(1), 51–62. https://doi.org/10.1016/j.jenvp.2007.09.003

Carrus, G., Passafaro, P., & Bonnes, M. (2008b). Emotions, habits and rational choices in ecological behaviours: The case of recycling and use of public transportation. *Journal of Environmental Psychology*, *28*(1), 51–62.

Charmandari, E., Tsigos, C., & Chrousos, G. (2005). Endocrinology of the stress response. *Annual Review of Physiology*, *67*, 259–284. https://doi.org/10.1146/annurev.physiol.67.040403.120816

Chrousos, G. P. (1992). The Concepts of Stress and Stress System Disorders. *JAMA*, *267*(9), 1244. https://doi.org/10.1001/jama.1992.03480090092034

Coelho, F., Pereira, M. C., Cruz, L., Simões, P., & Barata, E. (2017). Affect and the adoption of pro-environmental behaviour: A structural model. *Journal of Environmental Psychology*, *54*, 127–138. https://doi.org/10.1016/j.jenvp.2017.10.008

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences–Second Edition. 12 Lawrence Erlbaum Associates Inc. *Hillsdale, New Jersey*, *13*.

Dallman, M. F., Akana, S. F., Scribner, K. A., Bradbury, M. J., Walker, C.-D., Strack, A. M., & Cascio, C. S. (1992). Stress, feedback and facilitation in the hypothalamo-pituitary-adrenal axis. *Journal of Neuroendocrinology*, *4*(5), 517–526.

Darley, J. M., & Batson, C. D. (1973). "From Jerusalem to Jericho": A study of situational and dispositional variables in helping behavior. *Journal of Personality and Social Psychology*, *27*(1), 100–108. https://doi.org/10.1037/h0034449

Davis, M. (1992). The role of the amygdala in fear and anxiety. *Annual Review of Neuroscience*, *15*, 353–375. https://doi.org/10.1146/annurev.ne.15.030192.002033

De Kloet, E. R., Joëls, M. & Holsboer, F. (2005). Stress and the brain: From adaptation to disease. *Nature Reviews. Neuroscience*, *6*(6), 463–475. https://doi.org/10.1038/nrn1683

De Kloet, E. R., Vreugdenhil, E., Oitzl, M. S., & Joëls, M. (1998). Brain corticosteroid receptor balance in health and disease. *Endocrine Reviews*, *19*(3), 269–301.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*(3), 355–391. https://doi.org/10.1037/0033-2909.130.3.355

Domingues, R. B., & Gonçalves, G. (2018). Assessing environmental attitudes in Portugal using a new short version of the Environmental Attitudes Inventory. *Current Psychology*, *75*(11), 3. https://doi.org/10.1007/s12144-018-9786-x

Dunlap, R. E. (2008). The New Environmental Paradigm Scale: From Marginality to Worldwide Use. *The Journal of Environmental Education*, *40*(1), 3–18. https://doi.org/10.3200/JOEE.40.1.3-18

Dunlap, R. E., & van Liere, K. D. (1978). The "New Environmental Paradigm": A proposed measuring instrument and preliminary results. *The Journal of Environmental Education*, *9*(4), 10–19. https://doi.org/10.1080/00958964.1978.10801875

Dunlap, R. E., van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues*, *56*(3), 425–442. https://doi.org/10.1111/0022-4537.00176

Edwards, S., Clow, A., Evans, P., & Hucklebridge, F. (2001). Exploration of the awakening cortisol response in relation to diurnal cortisol secretory activity. *Life Sciences*, *68*(18), 2093–2103. https://doi.org/10.1016/S0024-3205(01)00996-1

Eriksson, L., Garvill, J., & Nordlund, A. M. (2008). Interrupting habitual car use: The importance of car habit strength and moral motivation for personal car use reduction.

Transportation Research Part F: Traffic Psychology and Behaviour, *11*(1), 10–23. https://doi.org/10.1016/j.trf.2007.05.004

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th edition). Los Angeles, London, New Delhi, Singapore, Washington DC, Melbourne: SAGE.

Fields, S. A., Lange, K., Ramos, A., Thamotharan, S., & Rassu, F. (2014). The relationship between stress and delay discounting: A meta-analytic review. *Behavioural Pharmacology*, *25*(5-6), 434–444. https://doi.org/10.1097/FBP.0000000000000044

Fields, S. A., Ramos, A., & Reynolds, B. A. (2015). Delay discounting and health risk behaviors: the potential role of stress. *Current Opinion in Psychology*, *5*, 101–105. https://doi.org/10.1016/j.copsyc.2015.07.003

Fritsche, I., Jonas, E., Kayser, D. N., & Koranyi, N. (2010). Existential threat and compliance with pro-environmental norms. *Journal of Environmental Psychology*, *30*(1), 67–79. https://doi.org/10.1016/j.jenvp.2009.08.007

Gailliot, M. T. (2010). The effortful and energy-demanding nature of prosocial behavior. *14338054*, 169–180. https://doi.org/10.1037/12061-009

Garin, O. (2014). Ceiling Effect. In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research* (pp. 631–633). Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_296

Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *The American Psychologist*, *66*(4), 290–302. https://doi.org/10.1037/a0023566

Godoy, L. D., Rossignoli, M. T., Delfino-Pereira, P., Garcia-Cairasco, N., & Lima Umeoka, E. H. de (2018). A Comprehensive Overview on Stress Neurobiology: Basic Concepts and Clinical Implications. *Frontiers in Behavioral Neuroscience*, *12*, 127. https://doi.org/10.3389/fnbeh.2018.00127

Greenberg, J., & Kosloff, S. (2008). Terror Management Theory: Implications for Understanding Prejudice, Stereotyping, Intergroup Conflict, and Political Attitudes. *Social and Personality Psychology Compass*, *2*(5), 1881–1894. https://doi.org/10.1111/j.1751-9004.2008.00144.x

Gunnar, M., & Quevedo, K. (2007). The neurobiology of stress and development. *Annual Review of Psychology*, *58*, 145–173. https://doi.org/10.1146/annurev.psych.58.110405.085605

Han, H. (2015). Travelers' pro-environmental behavior in a green lodging context: Converging value-belief-norm theory and the theory of planned behavior. *Tourism Management*, *47*, 164–177. https://doi.org/10.1016/j.tourman.2014.09.014

Hawcroft, L. J., & Milfont, T. L. (2010). The use (and abuse) of the new environmental paradigm scale over the last 30 years: A meta-analysis. *Journal of Environmental Psychology*, *30*(2), 143–158. https://doi.org/10.1016/j.jenvp.2009.10.003

Herman, J. P., McKlveen, J. M., Ghosal, S., Kopp, B., Wulsin, A., Makinson, R., . . . Myers, B. (2016). Regulation of the Hypothalamic-Pituitary-Adrenocortical Stress Response. *Comprehensive Physiology*, *6*(2), 603–621. https://doi.org/10.1002/cphy.c150015

Hermans, E. J., Henckens, M. J., Joëls, M., & Fernández, G. (2014). Dynamic adaptation of large-scale brain networks in response to acute stressors. *Trends in Neurosciences*, *37*(6), 304–314.

Holland, R. W., Verplanken, B., & van Knippenberg, A. (2002). On the nature of attitude-behavior relations: the strong guide, the weak follow. *European Journal of Social Psychology*, *32*(6), 869–876. https://doi.org/10.1002/ejsp.135

Holm, S. (1979). A Simple Sequentially Rejective Multiple Test Procedure. *Scandinavian Journal of Statistics*, *6*(2), 65–70. Retrieved from www.jstor.org/stable/4615733

Huang, H. (2016). Media use, environmental beliefs, self-efficacy, and pro-environmental behavior. *Journal of Business Research*, *69*(6), 2206–2212. https://doi.org/10.1016/j.jbusres.2015.12.031

Hunter, L. M., Hatch, A., & Johnson, A. (2004). Cross-National Gender Variation in Environmental Behaviors *Social Science Quarterly*, *85*(3), 677–694. https://doi.org/10.1111/j.0038-4941.2004.00239.x

Joëls, M., & Baram, T. Z. (2009). The neuro-symphony of stress. *Nature Reviews Neuroscience*, *10*(6), 459–466. https://doi.org/10.1038/nrn2632

Joireman, J. A., Lasane, T. P., Bennett, J., Richards, D., & Solaimani, S. (2001). Integrating social value orientation and the consideration of future consequences within the extended norm activation model of proenvironmental behaviour. *The British Journal of Social Psychology*, *40*(Pt 1), 133–155. https://doi.org/10.1348/014466601164731

Kahneman, D. (2011). *Thinking, Fast and Slow.* London, UK: Penguin Books Ltd.

Kaida, K., & Kaida, N. (2017). Wake up for the environment: An association between sleepiness and pro-environmental behavior. *Personality and Individual Differences*, *104*, 12–17. https://doi.org/10.1016/j.paid.2016.07.014

Kaida, N., & Kaida, K. (2019). Positive associations of optimism-pessimism orientation with pro-environmental behavior and subjective well-being: A longitudinal study on quality of life and everyday behavior. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, *28*(12), 3323–3332. https://doi.org/10.1007/s11136-019-02273-y

Kaiser, F. G., & Byrka, K. (2011). Environmentalism as a trait: Gauging people's prosocial personality in terms of environmental engagement. *International Journal of Psychology : Journal International De Psychologie*, *46*(1), 71–79. https://doi.org/10.1080/00207594.2010.516830

Kaplan, B. A., Reed, D. D., & McKerchar, T. L. (2014). Using a Visual Analogue Scale to Assess Delay, Social, and Probability Discounting of an Environmental Loss. *The Psychological Record*, *64*(2), 261–269. https://doi.org/10.1007/s40732-014-0041-z#Sec4

Kerret, D., Orkibi, H., & Ronen, T. (2016). Testing a model linking environmental hope and self-control with students' positive emotions and environmental behavior. *The Journal of Environmental Education*, *47*(4), 307–317. https://doi.org/10.1080/00958964.2016.1182886

Kim, S.-H., Kim, M., Han, H.-S., & Holland, S. (2016). The determinants of hospitality employees' pro-environmental behaviors: The moderating role of generational differences. *International Journal of Hospitality Management*, *52*, 56–67. https://doi.org/10.1016/j.ijhm.2015.09.013

Kimura, K., Izawa, S., Sugaya, N., Ogawa, N., Yamada, K. C., Shirotsuki, K., . . . Hasegawa, T. (2013). The biological effects of acute psychosocial stress on delay discounting. *Psychoneuroendocrinology*, *38*(10), 2300–2308. https://doi.org/10.1016/j.psyneuen.2013.04.019

Kirschbaum, C. Pirke, K. M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test'--a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology*, *28*(1-2), 76–81. https://doi.org/10.1159/000119004

Klöckner, C. A., & Verplanken, B. (2013). Yesterday's Habits Preventing Change for Tomorrow? About the Influence of Automaticity on Environmental Behaviour. In L. E. Steg, Van Den Berg, Agnes E, & J. de Im Groot (Eds.), *Environmental psychology: An introduction* (Vol. 1, pp. 238–250). BPS Blackwell. https://doi.org/10.1002/9781119241072.ch24

Klöckner, C. A., & Verplanken, B. (2018). Yesterday's habits preventing change for tomorrow? About the influence of automaticity on environmental behaviour. *Environmental Psychology: An Introduction*, 238–250.

Kocher, M. G., Martinsson, P., Myrseth, K. O. R., & Wollbrant, C. E. (2017). Strong, bold, and kind: Self-control and cooperation in social dilemmas. *Experimental Economics*, *20*(1), 44–69. https://doi.org/10.1007/s10683-015-9475-7

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Koole, S. L., & van den Berg, A. E. (2005). Lost in the wilderness: Terror management, action orientation, and nature evaluation. *Journal of Personality and Social Psychology*, *88*(6), 1014–1028. https://doi.org/10.1037/0022-3514.88.6.1014

Kvetnansky, R., Sabban, E. L., & Palkovits, M. (2009). Catecholaminergic systems in stress: Structural and molecular genetic approaches. *Physiological Reviews*, *89*(2), 535–606. https://doi.org/10.1152/physrev.00042.2006

Lange, F., Steinke, A., & Dewitte, S. (2018). The Pro-Environmental Behavior Task: A laboratory measure of actual pro-environmental behavior. *Journal of Environmental Psychology*, *56*, 46–54. https://doi.org/10.1016/j.jenvp.2018.02.007

Langenbach, B. P., Berger, S., Baumgartner, T., & Knoch, D. (2019). Cognitive Resources Moderate the Relationship Between Pro-Environmental Attitudes and Green Behavior.

Environment and Behavior, *16*, 001391651984312. https://doi.org/10.1177/0013916519843127

LeDoux, J. (2003). The emotional brain, fear, and the amygdala. *Cellular and Molecular Neurobiology*, *23*(4-5), 727–738. https://doi.org/10.1023/A:1025048802629

Levine, D. S., & Strube, M. J. (2012). Environmental attitudes, knowledge, intentions and behaviors among college students. *The Journal of Social Psychology*, *152*(3), 308–326. https://doi.org/10.1080/00224545.2011.604363

Liu, J. J. W., Ein, N., Peck, K., Huang, V., Pruessner, J. C., & Vickers, K. (2017). Sex differences in salivary cortisol reactivity to the Trier Social Stress Test (TSST): A meta-analysis. *Psychoneuroendocrinology*, *82*, 26–37. https://doi.org/10.1016/j.psyneuen.2017.04.007

Maier, S. U., Makwana, A. B., & Hare, T. A. (2015). Acute Stress Impairs Self-Control in Goal-Directed Choice by Altering Multiple Functional Connections within the Brain's Decision Circuits. *Neuron*, *87*(3), 621–631. https://doi.org/10.1016/j.neuron.2015.07.005

Margittai, Z., Strombach, T., van Wingerden, M., Joëls, M., Schwabe, L., & Kalenscher, T. (2015). A friend in need: Time-dependent effects of stress on social discounting in men. *Hormones and Behavior*, *73*, 75–82. https://doi.org/10.1016/j.yhbeh.2015.05.019

Margittai, Z. , Nave, G., Strombach, T., van Wingerden, M., Schwabe, L., & Kalenscher, T. (2016). Exogenous cortisol causes a shift from deliberative to intuitive thinking. *Psychoneuroendocrinology*, *64*, 131–135. https://doi.org/10.1016/j.psyneuen.2015.11.018

Martinsson, P., Myrseth, K. O. R., & Wollbrant, C. (2014). Social dilemmas: When self-control benefits cooperation. *Journal of Economic Psychology*, *45*, 213–236. https://doi.org/10.1016/j.joep.2014.09.004

Mason, J. W. (1968). A Review of Psychoendocrine Research on the Pituitary-Adrenal Cortical System. *Psychosomatic Medicine*, *30*(5), 576–607. https://doi.org/10.1097/00006842-196809000-00020

McGinley, M., Carlo, G., Crockett, L. J., Raffaelli, M., Torres Stone, R. A., Iturbide, M. I., & Stone, R. A. T. (2010). Stressed and helping: The relations among acculturative stress, gender, and prosocial tendencies in Mexican Americans // Stressed and helping: The relations among acculturative stress, gender, and prosocial tendencies in Mexican

Americans. *The Journal of Social Psychology*, *150*(1), 34–56. https://doi.org/10.1080/00224540903365323

Meyer, A. (2016). Heterogeneity in the preferences and pro-environmental behavior of college students: the effects of years on campus, demographics, and external factors. *Journal of Cleaner Production*, *112*, 3451–3463. https://doi.org/10.1016/j.jclepro.2015.10.133

Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, *30*(1), 80–94. https://doi.org/10.1016/j.jenvp.2009.09.001

Miller, D. B., & O'Callaghan, J. P. (2002). Neuroendocrine aspects of the response to stress. *Metabolism: Clinical and Experimental*, *51*(6 Suppl 1), 5–10. https://doi.org/10.1053/meta.2002.33184

Moser, G. (1988). Urban stress and helping behavior: Effects of environmental overload and noise on behavior. *Journal of Environmental Psychology*, *8*(4), 287–298. https://doi.org/10.1016/S0272-4944(88)80035-5

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, *126*(2), 247–259. https://doi.org/10.1037/0033-2909.126.2.247

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, *74*(3), 774–789. https://doi.org/10.1037/0022-3514.74.3.774

Myers, B., McKlveen, J. M., & Herman, J. P. (2012). Neural Regulation of the Stress Response: The Many Faces of Feedback. *Cellular and Molecular Neurobiology.* Advance online publication. https://doi.org/10.1007/s10571-012-9801-y

Nielsen, K. S. (2017). From prediction to process: A self-regulation account of environmental behavior change. *Journal of Environmental Psychology*, *51*, 189–198. https://doi.org/10.1016/j.jenvp.2017.04.002

Nolan, J. M., & Schultz, P. (2015). Prosocial behavior and environmental action. *01953998*.

Oaten, M., & Cheng, K. (2005). Academic Examination Stress Impairs Self–Control. *Journal of Social and Clinical Psychology*, *24*(2), 254–279. https://doi.org/10.1521/jscp.24.2.254.62276

Osgood, J. M., & Muraven, M. (2015). Self-Control Depletion Does Not Diminish Attitudes About Being Prosocial But Does Diminish Prosocial Behaviors. *Basic and Applied Social Psychology*, *37*(1), 68–80. https://doi.org/10.1080/01973533.2014.996225

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*, *124*(1), 54–74. https://doi.org/10.1037/0033-2909.124.1.54

Pérez-Dueñas, C., Rivas, M. F., Oyediran, O. A., & García-Torres, F. (2018). Induced Negative Mood Increases Dictator Game Giving. *Frontiers in Psychology*, *9*, 1542. https://doi.org/10.3389/fpsyg.2018.01542

Raio, C. M., Orederu, T. A., Palazzolo, L., Shurick, A. A., & Phelps, E. A. (2013). Cognitive emotion regulation fails the stress test. *Proceedings of the National Academy of Sciences of the United States of America*, *110*(37), 15139–15144. https://doi.org/10.1073/pnas.1305706110

Russell, S. V., Young, C. W., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions into food waste behaviour. *Resources, Conservation and Recycling*, *125*, 107–114. https://doi.org/10.1016/j.resconrec.2017.06.007

Sapolsky, R. M., Romero, L. M., & Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine Reviews*, *21*(1), 55–89. https://doi.org/10.1210/edrv.21.1.0389

Sato, H., Takenaka, I., & Kawahara, J. I. (2012). The effects of acute stress and perceptual load on distractor interference. *Quarterly Journal of Experimental Psychology (2006)*, *65*(4), 617–623. https://doi.org/10.1080/17470218.2011.648944

Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their Relationship to Environmental Concern and Conservation Behavior. *Journal of Cross-Cultural Psychology*, *36*(4), 457–475. https://doi.org/10.1177/0022022105275962

Schulz, P., & Schlotz, W. (1999). Trierer Inventar zur Erfassung von chronischem Streß (TICS): Skalenkonstruktion, teststatistische Überprüfung und Validierung der Skala Arbeitsüberlastung. *Diagnostica*, *45*(1), 8–19. https://doi.org/10.1026//0012-1924.45.1.8

Schulz, P., Schlotz, W., & Becker, P. (2004). Trierer Inventar zum Chronischen Stress (TICS)[Trier Inventory for Chronic Stress (TICS)].

Schwabe, L., Höffken, O., Tegenthoff, M., & Wolf, O. T. (2011). Preventing the stress-induced shift from goal-directed to habit action with a β-adrenergic antagonist. *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience*, *31*(47), 17317–17325. https://doi.org/10.1523/JNEUROSCI.3304-11.2011

Schwabe, L., Tegenthoff, M., Höffken, O., & Wolf, O. T. (2010). Concurrent glucocorticoid and noradrenergic activity shifts instrumental behavior from goal-directed to habitual control. *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience*, *30*(24), 8190–8196. https://doi.org/10.1523/JNEUROSCI.0734-10.2010

Schwabe, L., Tegenthoff, M., Höffken, O., & Wolf, O. T. (2012). Simultaneous glucocorticoid and noradrenergic activity disrupts the neural basis of goal-directed action in the human brain. *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience*, *32*(30), 10146–10155. https://doi.org/10.1523/JNEUROSCI.1304-12.2012

Schwabe, L., & Wolf, O. T. (2009). Stress prompts habit behavior in humans. *The Journal of Neuroscience : The Official Journal of the Society for Neuroscience*, *29*(22), 7191–7198. https://doi.org/10.1523/JNEUROSCI.0979-09.2009

Schwabe, L., & Wolf, O. T. (2010). Socially evaluated cold pressor stress after instrumental learning favors habits over goal-directed action. *Psychoneuroendocrinology*, *35*(7), 977–986. https://doi.org/10.1016/j.psyneuen.2009.12.010

Schwabe, L., & Wolf, O. T. (2011). Stress-induced modulation of instrumental behavior: From goal-directed to habitual control of action. *Behavioural Brain Research*, *219*(2), 321–328. https://doi.org/10.1016/j.bbr.2010.12.038

Schweda, A., Faber, N. S., Crockett, M. J., & Kalenscher, T. (2019). The effects of psychosocial stress on intergroup resource allocation. *Scientific Reports*, *9*(1), 18620. https://doi.org/10.1038/s41598-019-54954-w

Scott, D., & Willits, F. K. (1994). Environmental Attitudes and Behavior. *Environment and Behavior*, *26*(2), 239–260. https://doi.org/10.1177/001391659402600206

Serrano, C., & Andreu, Y. (2015). Perceived Emotional Intelligence, Subjective Well-Being, Perceived Stress, Engagement and Academic Achievement of Adolescents // Inteligencia emocional percibida, bienestar subjetivo, estrés percibido, engagement y rendimiento académico en adolescentes. *Revista De Psicodidactica / Journal of Psychodidactics*, *21*(2), 357–374. https://doi.org/10.1387/RevPsicodidact.14887

Shapiro, S. L., Jazaieri, H., & Goldin, P. R. (2012). Mindfulness-based stress reduction effects on moral reasoning and decision making. *The Journal of Positive Psychology*, *7*(6), 504–515. https://doi.org/10.1080/17439760.2012.723732

Singer, N., Sommer, M., Döhnel, K., Zänkert, S., Wüst, S., & Kudielka, B. M. (2017). Acute psychosocial stress and everyday moral decision-making in young healthy men: The impact of cortisol. *Hormones and Behavior*, *93*, 72–81. https://doi.org/10.1016/j.yhbeh.2017.05.002

Skoluda, N., Strahler, J., Schlotz, W., Niederberger, L., Marques, S., Fischer, S., . . . Nater, U. M. (2015). Intra-individual psychological and physiological responses to acute laboratory stressors of different intensity. *Psychoneuroendocrinology*, *51*, 227–236. https://doi.org/10.1016/j.psyneuen.2014.10.002

Sollberger, S., Bernauer, T., & Ehlert, U. (2016a). Salivary testosterone and cortisol are jointly related to pro-environmental behavior in men. *Social Neuroscience*, *11*(5), 553–566. https://doi.org/10.1080/17470919.2015.1117987

Sollberger, S., Bernauer, T., & Ehlert, U. (2016b). Stress influences environmental donation behavior in men. *Psychoneuroendocrinology*, *63*, 311–319. https://doi.org/10.1016/j.psyneuen.2015.10.017

Sollberger, S., Bernauer, T., & Ehlert, U. (2017). Predictors of visual attention to climate change images: An eye-tracking study. *Journal of Environmental Psychology*, *51*, 46–56. https://doi.org/10.1016/j.jenvp.2017.03.001

Spielberger, C. D., & Sydeman, S. J. (1994). State-trait anxiety inventory and state-trait anger expression inventory. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcome assessment* (292-231). Hillsdale, NJ: Erlbaum.

Starcke, K., Polzer, C., Wolf, O. T., & Brand, M. (2011). Does stress alter everyday moral decision-making? *Psychoneuroendocrinology*, *36*(2), 210–219. https://doi.org/10.1016/j.psyneuen.2010.07.010

Steg, L. (2015). Environmental psychology and sustainable consumption. In L. Reisch & J. Thøgersen (Eds.), *Handbook of Research on Sustainable Consumption* (pp. 70–83). Edward Elgar Publishing. https://doi.org/10.4337/9781783471270.00012

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Steinbeis, N., Engert, V., Linz, R., & Singer, T. (2015). The effects of stress and affiliation on social decision-making: Investigating the tend-and-befriend pattern. *Psychoneuroendocrinology*, *62*, 138–148. https://doi.org/10.1016/j.psyneuen.2015.08.003

Stern, P. C. (2000). New Environmental Theories: Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues*, *56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Steyer, R., Schwenkmezger, P., Notz, P., & Eid, M. (1994). Testtheoretische Analysen des Mehrdimensionalen Befindlichkeitsfragebogen (MDBF). *Diagnostica*.

Takahashi, T., Ikeda, K., & Hasegawa, T. (2007). Social evaluation-induced amylase elevation and economic decision-making in the dictator game in humans. *Neuroendocrinology Letters*, *28*(5), 662–665.

Tan, H. B., & Forgas, J. P. (2010). When happiness makes us selfish, but sadness makes us fair: Affective influences on interpersonal strategies in the dictator game. *Journal of Experimental Social Psychology*, *46*(3), 571–576. https://doi.org/10.1016/j.jesp.2010.01.007

Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., & Updegraff, J. A. (2000). Biobehavioral responses to stress in females: tend-and-befriend, not fight-or-flight. *Psychological Review*, *107*(3), 411. https://doi.org/10.1037/0033-295X.107.3.411

Tiferet-Dweck, C., Hensel, M., Kirschbaum, C., Tzelgov, J., Friedman, A., & Salti, M. (2016). Acute Stress and Perceptual Load Consume the Same Attentional Resources: A Behavioral-ERP Study. *PloS One*, *11*(5), e0154622. https://doi.org/10.1371/journal.pone.0154622

Tinghög, G., Andersson, D., Bonn, C., Johannesson, M., Kirchler, M., Koppel, L., & Västfjäll, D. (2016). Intuition and Moral Decision-Making - The Effect of Time Pressure and Cognitive Load on Moral Judgment and Altruistic Behavior. *PloS One*, *11*(10), e0164012. https://doi.org/10.1371/journal.pone.0164012

Tomova, L., Majdandžić, J., Hummer, A., Windischberger, C., Heinrichs, M., Lamm, C., . . . Majdandžic, J. (2017). Increased neural responses to empathy for pain might explain how acute stress increases prosociality. *Social Cognitive and Affective Neuroscience*, *12*(3), 401–408. https://doi.org/10.1093/scan/nsw146

Tran, T. V., Wright, R., & Chatters, L. (1991). Health, stress, psychological resources, and subjective well-being among older Blacks. *Psychology and Aging*, *6*(1), 100–108. https://doi.org/10.1037/0882-7974.6.1.100

Ulrich-Lai, Y. M., & Herman, J. P. (2009). Neural regulation of endocrine and autonomic stress responses. *Nature Reviews Neuroscience*, *10*(6), 397–409. https://doi.org/10.1038/nrn2647

Verhaert, G. A., & van den Poel, D. (2011). Empathy as added value in predicting donation behavior. *Journal of Business Research*, *64*(12), 1288–1295. https://doi.org/10.1016/j.jbusres.2010.12.024

Verplanken, B., Aarts, H. , van Knippenberg, A., & Moonen, A. (1998). Habit versus planned behaviour: A field experiment. *The British Journal of Social Psychology*, *37 (Pt 1)*, 111–128. https://doi.org/10.1111/j.2044-8309.1998.tb01160.x

Vicente-Molina, M. A., Fernández-Sainz, A., & Izagirre-Olaizola, J. (2018). Does gender make a difference in pro-environmental behavior? The case of the Basque Country University students. *Journal of Cleaner Production*, *176*, 89–98. https://doi.org/10.1016/j.jclepro.2017.12.079

Vinkers, C. H., Zorn, J. V., Cornelisse, S., Koot, S., Houtepen, L. C., Olivier, B., . . . Joëls, M. (2013). Time-dependent changes in altruistic punishment following stress. *Psychoneuroendocrinology*, *38*(9), 1467–1475. https://doi.org/10.1016/j.psyneuen.2012.12.012

Vohs, K. D., Baumeister, R. F., Schmeichel, B. J., Twenge, J. M., Nelson, N. M., & Tice, D. M. (2008). Making choices impairs subsequent self-control: A limited-resource account of decision making, self-regulation, and active initiative. *Journal of Personality and Social Psychology*, *94*(5), 883–898. https://doi.org/10.1037/0022-3514.94.5.883

Von Dawans, B., Ditzen, B., Trueg, A., Fischbacher, U., & Heinrichs, M. (2019). Effects of acute stress on social behavior in women. *Psychoneuroendocrinology*, *99*, 137–144. https://doi.org/10.1016/j.psyneuen.2018.08.031

Von Dawans, B., Fischbacher, U., Kirschbaum, C., Fehr, E., & Heinrichs, M. (2012). The social dimension of stress reactivity: Acute stress increases prosocial behavior in humans. *Psychological Science*, *23*(6), 651–660. https://doi.org/10.1177/0956797611431576

Von Dawans, B., Kirschbaum, C. & Heinrichs, M. (2011). The Trier Social Stress Test for Groups (TSST-G): A new research tool for controlled simultaneous social stress exposure in a group format. *Psychoneuroendocrinology*, *36*(4), 514–522. https://doi.org/10.1016/j.psyneuen.2010.08.004

Welsch, H., & Kühling, J. (2009). Determinants of pro-environmental consumption: The role of reference groups and routine behavior. *Ecological Economics*, *69*(1), 166–176. https://doi.org/10.1016/j.ecolecon.2009.08.009

Westhoek, H., Lesschen, J. P., Rood, T., Wagner, S., Marco, A. de, Murphy-Bokern, D., . . . Oenema, O. (2014). Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. *Global Environmental Change*, *26*, 196–205. https://doi.org/10.1016/j.gloenvcha.2014.02.004

Wiemers, U. S., Schoofs, D., & Wolf, O. T. (2013). A friendly version of the trier social stress test does not activate the HPA axis in healthy men and women. *Stress (Amsterdam, Netherlands)*, *16*(2), 254–260. https://doi.org/10.3109/10253890.2012.714427

Wiernik, B. M., Dilchert, S., & Ones, D. S. (2016). Age and Employee Green Behaviors: A Meta-Analysis. *Frontiers in Psychology*, *7*, 194. https://doi.org/10.3389/fpsyg.2016.00194

Wiernik, B. M., Ones, D. S., & Dilchert, S. (2013). Age and environmental sustainability: a meta-analysis. *Journal of Managerial Psychology*, *28*(7/8), 826–856. https://doi.org/10.1108/JMP-07-2013-0221

Wood, W., Quinn, J. M., & Kashy, D. A. (2002). Habits in everyday life: Thought, emotion, and action. *Journal of Personality and Social Psychology*, *83*(6), 1281–1297. https://doi.org/10.1037/0022-3514.83.6.1281

Xu, H., Bègue, L., & Bushman, B. J. (2012). Too fatigued to care: Ego depletion, guilt, and prosocial behavior. *Journal of Experimental Social Psychology*, *48*(5), 1183–1186. https://doi.org/10.1016/j.jesp.2012.03.007

Yap, B. W., & Sim, C. H. (2011). Comparisons of various types of normality tests. *Journal of Statistical Computation and Simulation*, *81*(12), 2141–2155. https://doi.org/10.1080/00949655.2010.520163

Zeidner, M., & Ben-Zur, H. (2014). Effects of an experimental social stressor on resources loss, negative affect, and coping strategies. *Anxiety, Stress, and Coping*, *27*(4), 376–393. https://doi.org/10.1080/10615806.2013.862523

Zelezny, L. C., Chua, P.-P., & Aldrich, C. (2000). New Ways of Thinking about Environmentalism: Elaborating on Gender Differences in Environmentalism. *Journal of Social Issues*, *56*(3), 443–457. https://doi.org/10.1111/0022-4537.00177

Appendix

Appendix A: Trials of the Adapted PEBT-Version

Waiting Times Associated with the two PEBT-Options in Seconds per Trial.

Car	Bike	WTD	
5	10	5	Practice trials
10	55	45	
5	5		
10	10	0	
15	15		
20	20		
5	20		
10	25	15	
15	30		
20	35		
5	25		
10	30	20	
15	35		
20	40		
5	30		
10	35	25	
15	40		
20	45		
5	35		
10	40	30	
15	45		
20	50		
5	40		
10	45	35	
15	50		
20	55		
0	50	50	

Note. WTD = Waiting time difference between car and bike options in seconds

Appendix B: Missing Values and Descriptive Statistics

					Missing values	
		N	Mean	SD	Number	%
	Age	97	24.68	4.092	0	0.0
Behavior PEBT	Reaction time	97	669.37	234.42	0	0.0
	Time Lamps	89	49.10	67.79	8	8.2
	Bike Ratio	89	20.10	6.10	8	8.2
	Waiting Time Bike	89	405.73	168.23	8	8.2
Environmental Questionnaires	NEP	88	3.79	0.43	9	9.3
	EAI	96	3.83	0.40	1	1.0
	EBS Schultz	96	3.25	0.61	1	1.0
	EBS New	96	3.23	0.70	1	1.0
Physiological Control Measures	Cortisol Baseline	60	3.540	3.007	37	38.1
	Cortisol +15	59	5.603	4.158	38	39.2
	Cortisol +30	60	7.980	6.226	37	38.1
	Cortisol +45	60	6.450	5.448	37	38.1
	Cortisol Day 2	57	3.460	2.504	40	41.2
	Day 1 SBD	97	131.31	20.18	0	0.0
	Day 1 DBD	97	76.26	9.65	0	0.0
	Day 1 Pulse	97	75.34	11.05	0	0.0
	Day 2 SBD	95	125.71	11.63	2	2.1
	Day 2 DBD	95	74.54	8.54	2	2.1
	Day 2 Pulse	95	80.09	12.46	2	2.1
Subjective Control Measures	Good Mood D1[a]	97	34.55	4.20	0	0.0
	Wakefulness D1[a]	97	29.36	5.99	0	0.0
	Calmness D1[a]	97	33.24	4.91	0	0.0
	Good Mood[b]	97	30.03	7.44	0	0.0
	Wakefulness[b]	97	28.20	5.67	0	0.0
	Calmness[b]	97	27.92	7.79	0	0.0
	Good Mood D2[a]	96	33.77	5.58	1	1.0
	Wakefulness D2[a]	96	29.69	6.25	1	1.0
	Calmness D2[a]	96	32.64	5.99	1	1.0

Rating of the (f-)TSST	Difficult	97	5.74	3.19	0	0.0
	Unpleasant	97	5.63	3.29	0	0.0
	Stressful	97	5.52	3.03	0	0.0
	In Line w/ Exp.[1]	97	8.26	2.70	0	0.0
	Unexpected	97	6.05	3.45	0	0.0
	Surprising	97	5.94	3.26	0	0.0
	Predictable	97	5.66	2.97	0	0.0
Measures for Group Differences	STAI State	97	36.32	7.18	0	0.0
	STAI Trait	97	36.73	9.14	0	0.0
	BDI	97	6.37	6.19	0	0.0
	TICS WO	97	12.14	6.16	0	0.0
	TICS SO	97	7.38	4.36	0	0.0
	TICS PP	97	15.34	5.90	0	0.0
	TICS WD	97	11.64	6.06	0	0.0
	TICS ED	97	6.10	4.01	0	0.0
	TICS LSR	97	4.31	2.77	0	0.0
	TICS ST	97	5.79	3.92	0	0.0
	TICS SI	97	7.18	4.68	0	0.0
	TICS CW	97	6.09	3.42	0	0.0
	TICS SSCS	97	15.37	7.98	0	0.0

Note. Cortisol concentration in nmol/l. [a] = Baseline. [b] = Post (f-)TSST. [1] = in line with expectations.

Appendix C: Instructions for the Four Experimental Conditions (German)

Appendix C1: Stress Uninformed

Für den Versuchsleiter: Instruktion Stress ohne Vorabinformation

Im Hormon-Labor (4031):

„Ich führe Sie jetzt in den Raum, in dem Sie einen Belastungstest machen werden. Könnten Sie mir sagen, was für einen Job Sie nach dem Studium ergreifen möchte oder was Ihr Traumberuf ist?"

(Unterschrift Einverständniserklärung Bild+Ton unterschreiben lassen!)

„Im Raum nebenan wird sie ein Auswahl-Gremium erwarten. Diese Dame und dieser Herr sind zwei in der Verhaltensbeobachtung geschulte Psychologen, die gleich Ihr Verhalten analysieren werden. Außerdem wird später mit Hilfe der Videoaufzeichnung auch Ihre Stimmfrequenz und Körpersprache in dieser Bewerbungssituation von dem Gremium beurteilt werden.

Stellen Sie sich nun bitte folgende Situation vor: Sie bewerben sich auf eine Stelle als XY ***(hier Berufswunsch der VP einsetzen)***, die Sie unbedingt haben möchten. Das Gremium soll anhand Ihres Vortrags beurteilen, ob und wie gut Sie für diese Stelle geeignet sind. Stellen Sie sich vor, dass dem Gremium Ihre Bewerbungsunterlagen wie Lebenslauf und Zeugnisse bereits vorliegen, deshalb sollen Sie in Ihrem Vortrag nur die persönlichen Eigenschaften vorstellen, die Sie für den Job gegenüber Ihren Mitbewerbern besonders geeignet machen. Wichtig ist, es handelt sich hierbei um eine freie Rede.

Nach Ihrem Vortrag haben Sie noch eine weitere Aufgabe zu lösen. Worum es sich dabei genau handelt, wird Ihnen jedoch das Gremium erst nach Ihrem Vortrag mitteilen.

Im TSST-Raum (4033):

„Sie haben jetzt bis zu Ihrem Vortrag noch eine kurze Vorbereitungszeit, während der Sie die Möglichkeit haben, sich an diesem Tisch ***(auf den Tisch deuten)*** Notizen zu Ihrem Vortrag zu machen. Beginnen Sie bitte jetzt damit."

(Versuchsleiter gibt Zettel mit Stift und Klemmbrett in die Hand und startet die fNIRS Aufzeichnung bzw. setzt den Marker)

Appendix C2: Stress Informed

***Für den Versuchsleiter*: Instruktion Stress mit Vorabinformation**

Im Hormon-Labor (4031):

„Sie werden nun gleich einen Belastungstest durchlaufen. Könnten Sie mir vorab bitte kurz sagen, was für einen Job Sie nach dem Studium ergreifen möchte oder was Ihr Traumberuf ist?

Ok, danke. Sie werden in dem Belastungstest gleich ein nachgestelltes Bewerbungsgespräch vor einem Auswahlgremium durchlaufen. Das Auswahlgremium besteht aus einer Dame und einem Herrn, die in Verhaltensbeobachtung geschult sind und Ihr Verhalten analysieren werden. Das Gremium trägt weiße Kittel und sitzt an einem Tisch. Sie werden an einer festgelegten Stelle vor diesem Tisch stehen, die mit einem „X“ markiert ist. Zudem werden Sie von einer Videokamera aufgezeichnet. Hierfür wird die Kamera sehr nah auf Ihr Gesicht zoomen. Mit Hilfe der Videoaufzeichnung werden später auch Ihre Stimmfrequenz und Körpersprache in dieser Bewerbungssituation von dem Gremium beurteilt werden. Die Aufzeichnung der Videokamera werden Sie „live“ auf einem Fernsehbildschirm sehen, der schräg links hinter dem Gremium steht.

Stellen Sie sich hierbei bitte folgende Situation vor: Sie bewerben sich auf eine Stelle als XY ***(hier Berufswunsch der VP einsetzen)***, die Sie unbedingt haben möchten. Das Gremium soll anhand Ihres Vortrags beurteilen, ob und wie gut Sie für diese Stelle geeignet sind. Stellen Sie sich vor, dass dem Gremium Ihre Bewerbungsunterlagen wie Lebenslauf und Zeugnisse bereits vorliegen, deshalb sollen Sie in Ihrem Vortrag nur die persönlichen Eigenschaften vorstellen, die Sie für den Job gegenüber Ihren Mitbewerbern besonders geeignet machen. Wichtig ist, es handelt sich hierbei um eine freie Rede, das heißt, Sie dürfen hierbei keine Notizen nutzen.
Für die freie Rede haben Sie 5 Minuten Zeit. Wenn Sie vorher fertig sind, wird das Gremium schweigen und darauf warten, dass Sie fortfahren. Erst zum Ende der 5 Minuten hin wird Ihnen das Gremium Fragen zu Ihrer persönlichen Eignung für den Job stellen.

Nach diesem Redeteil haben Sie noch eine weitere Aufgabe zu lösen. In dieser Aufgabe sollen Sie von der Zahl 2043 so schnell wie möglich und laut in 17er-Schritten rückwärts zählen. Wenn Sie hierbei einen Fehler machen, wird das Gremium Sie darauf aufmerksam machen und Sie müssen von vorn beginnen. Auch diese Rechenaufgabe wird insgesamt 5 Minuten dauern.

Eine kurze Erläuterung zu der Aufgabe wird Ihnen von dem Gremium vor Beginn dieser zweiten Aufgabe nochmal gegeben.

Insgesamt wird sich das Gremium während des Belastungstests sehr neutral und eher distanziert und kühl verhalten. Sie werden beim Betreten des Raumes nicht begrüßt. Das Gremium wird Sie auch nicht anlächeln, Ihnen nicht zunicken oder ähnliches. Zudem wird sich das Gremium kontinuierlich Notizen machen und Ihnen wiederholt direkt in die Augen schauen. Das Gremium wird Sie zudem eventuell anweisen, es anzusehen.

Wenn wir gleich den Raum betreten, haben Sie noch eine Vorbereitungszeit von 3 Minuten, während der Sie die Möglichkeit haben, sich Notizen zu Ihrem Vortrag zu machen. Hierfür werde ich Ihnen Zettel und Stift reichen. Das Gremium wird Sie nach Ablauf der 3 Minuten auffordern, mit Ihrem Vortrag zu beginnen. Die Vorbereitungszeit kann nicht verkürzt werden, d.h. Sie können nicht vor Ablauf der 3 Minuten beginnen. Die Notizen, die Sie sich machen, dürfen Sie für den eigentlichen Vortrag nicht nutzen. Während des Belastungstests im nächsten Raum dürfen Sie nicht sitzen.

Haben Sie noch Fragen hierzu?“

(Unterschrift Einverständniserklärung Bild+Ton unterschreiben lassen!)

<u>Im TSST-Raum (4033):</u>

(Versuchsleiter gibt Zettel mit Stift und Klemmbrett in die Hand und startet die fNIRS Aufzeichnung bzw. setzt den Marker)

„Ihre Vorbereitungszeit beginnt jetzt“

Appendix C3: Friendly Uninformed

Friendly-TSST ohne Vorabinformation: ***Instruktionen für den Versuchsleiter***

Im Hormonlabor (Raum 4031):

- der Versuchsperson NICHT die Einverständniserklärung für Bild- und Tonaufnahmen vorlegen.
- auf dem Weg zum Raum explizit sagen, dass es gleich eine kurze, formlose „Füllaufgabe" gibt, die nur dazu dient, etwas Zeit zu überbrücken.
    - dabei sollte auch nichts von Stress- oder Kontrollbedingungen erwähnt werden.

„Im Raum nebenan werden dich Mitarbeiter des Fachbereichs erwarten. Du wirst gleich ein kurzes informelles Gespräch mit ihnen führen. Anschließend soll noch ein kurzes Zählspiel gespielt werden. Die Regeln erklären die beiden dann, bevor es losgeht.

Du kannst Dir überlegen, mit welchem Thema Du das Gespräch beginnen möchtest. Such Dir gern ein Thema aus, das Du mit etwas Positivem verbindest, wie z.B. Dein letzter Urlaub, Dein Hobby, Sport oder Deine Lieblingsfilm oder -buch. Das Gespräch ist jedoch völlig frei und Ihr könnt später auch über andere Themen sprechen.

Wie bereits erwähnt, dient das Gespräch nur dazu, etwas Zeit zu überbrücken. Das Gespräch und sein Inhalt werden nicht analysiert. Es gibt auch keine versteckten Kameras, Mikrofone oder ähnliches."

Im TSST-Raum (Raum 4033):

„Bevor es gleich losgehen kann, muss noch einige Minuten abgewartet werden. In dieser Zeit kannst Du Dir gern etwas aufschreiben, musst Du aber auch nicht. Die beiden werden sich ebenfalls Gedanken über mögliche Themen machen. Gut, dann geht's los."

Appendix C4: Friendly Informed

Friendly-TSST mit Vorabinformation*: Instruktionen für den Versuchsleiter*

Im Hormonlabor (Raum 4031):

- Der Versuchsperson NICHT die Einverständniserklärung für Bild- und Tonaufnahmen vorlegen.

„Du wirst nun gleich eine kurze, formlose Füllaufgabe durchlaufen. Hierbei wirst Du zunächst für 5 Minuten ein formloses Gespräch mit zwei Mitarbeitern des Fachbereichs führen. Die beiden sitzen hinter einem Tisch und Du stehst davor. Wegen der fNIRS-Messungen darfst Du leider nicht sitzen. Du kannst Dir vorab überlegen, mit welchem Thema Du das Gespräch beginnen möchtest. Such Dir gern ein Thema aus, das Du mit etwas Positivem verbindest, wie z.B. Dein letzter Urlaub, Dein Hobby, Sport oder Dein Lieblingsfilm oder -buch. Das Gespräch ist jedoch völlig frei und ihr könnt später auch über andere Themen sprechen. Unsere beiden Mitarbeiter werden sich auch Gedanken über mögliche Gesprächsthemen machen und eventuell Nachfragen stellen. Es ist auch möglich, dass sie Beispiele aus ihrem eigenen Leben einbringen.

Nach Ablauf der 5 Minuten werdet ihr zu Dritt noch ein kurzes Zählspiel machen. Hierbei zählt ihr der Reihe nach aufwärts und ersetzt alle Zahlen, die eine 7 enthalten oder aber durch 7 teilbar sind durch das Wort „weiter“. Sobald irgendjemand von euch einen Fehler macht, fängt das Spiel wieder von vorne an. Fehler sind jedoch erlaubt und werden nicht notiert. Vielleicht kennst Du dieses Spiel ja noch aus Deiner Kindheit. Die Regeln werden Dir später aber auch nochmal kurz beschrieben.

Wie bereits erwähnt, dient das Gespräch nur dazu, etwas Zeit zu überbrücken. Das Gespräch und sein Inhalt werden nicht analysiert. Es gibt auch keine versteckten Kameras, Mikrofone oder ähnliches.

Bevor es damit losgehen kann, müssen noch drei Minuten abgewartet werden. In dieser Zeit kannst Du Dir gern etwas aufschreiben, musst Du aber auch nicht. Die beiden werden sich ebenfalls Gedanken über mögliche Themen machen.

Hast Du bis hierhin noch irgendwelche Fragen?“

Im TSST-Raum (Raum 4033):

„Okay, jetzt sind, wie gesagt, noch 3 Minuten Zeit, in denen Ihr 3 Euch Gedanken über mögliche Themen für das anschließende Gespräch machen könnt. Los geht's"

(VPN Stift, Zettel und Klemmbrett geben, Marker für fNIRS setzen)

Eidesstattliche Erklärung

Ich versichere, dass ich die beigefügte schriftliche Abschlussarbeit selbstständig angefertigt und keine anderen als die angegebenen Hilfsmittel benutzt habe. Alle Stellen, die dem Wortlaut oder dem Sinn nach anderen Werken entnommen sind, habe ich in jedem einzelnen Fall unter genauer Angabe der Quelle deutlich als Entlehnung kenntlich gemacht. Dies gilt auch für alle Informationen, die dem Internet oder anderer elektronischer Datensammlungen entnommen wurden. Ich erkläre ferner, dass die von mir angefertigte Arbeit in gleicher oder ähnlicher Fassung noch nicht Bestandteil einer Studien- oder Prüfungsleistung im Rahmen meines Studiums war. Mir ist bewusst, dass die nachgewiesene Unterlassung der Herkunftsangabe oder die Nutzung als parallele Prüfungsleistung als Täuschungsversuch bzw. als Plagiat gewertet und mit Maßnahmen bis hin zur Zwangsexmatrikulation geahndet wird.

Die von mir eingereichte schriftliche Fassung entspricht jener auf dem elektronischen Speichermedium.

Hamburg, 07.05.2020, Annika Lutz

Ort, Datum Unterschrift