Effects of acute stress exposure on decision-making in everyday moral conflict situations

Kumulative Inaugural-Dissertation
zur Erlangung der Doktorwürde
an der Fakultät für Humanwissenschaften
der Universität Regensburg

vorgelegt von

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geboren am 09. November 1991 in Donauwörth

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Januar 2021

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ACKNOWLEDGEMENTS

First and foremost, I would like to thank Prof. Dr. Brigitte M. Kudielka for her enduring support and supervision as well as her believe in me and my projects. Building on my master's thesis, she gave me the great opportunity to continue my research on stress and moral decision-making. I will be forever grateful for this chance and for all the important experiences that I could gather during the last years.

Moreover, I want to express my gratitude to Prof. Dr. Monika Sommer and Prof. (apl.) Dr. Stefan Wüst for making our research project possible. All of their helpful supervision significantly improved my research endeavors and allowed me to increase my horizon in many ways.

I would also like to thank Dr. Katrin Döhnel. Together with Prof. Dr. Monika Sommer, she inspired me in my way to combine science and psychotherapy. A decision that I will never regret. I am very grateful for the mentoring and assistance as well as for the optimism both of them offered whenever I needed it.

Further, I would like to thank my colleagues Christoph Bärtl, Marina Giglberger, Gina-Isabelle Henze, Heike Hochmuth, Julian Konzok, Dr. Ludwig Kreuzpointner, Hannah Peter, Dr. Babette Stadler-Werner, and Sandra Zänkert. They all created a diverse, creative, and inspiring working environment for me. I also want to thank all our research assistants and students for their help as well as all the participants in my studies. Moreover, I gratefully acknowledge the funding of our research project by the German Research Foundation (DFG).

Last but not least, I want to thank my family and friends who accompanied me on this scientific journey during the last years. A special word of thanks goes to my parents who always supported my professional steps and especially to my father who taught me that high aims are achievable (thanks for all of our half marathon experiences!). I would also like to thank our recently deceased Golden Retriever Sammy, who was my loyal companion during the last 14 years and gave me so much strength. And, in particular, I want to thank Florian for his love, support, and reassurance both in good and bad times. He came into my life and showed me that changes can really be a good thing. I am very excited for all our adventures that are yet to come.

PREFACE

The present work is a cumulative dissertation. All chapters were composed specifically for this dissertation. However, three chapters are based on original research articles that are already published (*Studies I, II,* and *III* in the *Chapters 4* to *6*). *Study I* was reproduced from the accepted journal version with permission from the publisher *Public Library of Science* under a Creative Commons Attribution (CC BY) License. For *Study II,* the right to include the article in this dissertation was given by the publisher *Taylor & Francis,* provided that prior publication in the journal is acknowledged (see pp. 5, 71). For *Study III,* the inclusion of this article in my dissertation was permitted by *Elsevier* (use of one's own article in a dissertation for non-commercial purposes). The three studies are listed below in order of appearance and are currently not used or designated for use in other dissertations. The contributions of the co-authors to the three studies are listed on p. 5.

For improved readability, the manuscripts of all three studies are formatted consistently and contents, tables, and figures are numbered continuously. Journal-specific reference styles are standardized according to the guidelines of the American Psychological Association (APA 7th edition) and merged into one combined reference section at the end of this dissertation. No other changes have been made to the manuscripts.

All three studies are part of the project "*Acute psychosocial stress and everyday moral decision-making: Behavioral effects, psychoneuroendocrinological responses, and neural activity*" funded by the German Research Foundation (DFG) (grant numbers DFG-KU 1401/10-1 and DFG-KU 1401/10-2).

CONTRIBUTIONS

Study I

Singer, N., Kreuzpointner, L., Sommer, M., Wüst, S., & Kudielka, B. M. (2019). Decision-making in everyday moral conflict situations: Development and validation of a new measure. *PLOS ONE*, *14*(4), Article e0214747. https://doi.org/10.1371/journal.pone.0214747

Nina Singer, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka developed the study concept and study design. Nina Singer performed data collection. Nina Singer and Ludwig Kreuzpointner performed data analysis. Nina Singer drafted the manuscript under the supervision of Ludwig Kreuzpointner. Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

Study II

Singer N., Binapfl, J., Sommer, M., Wüst, S., & Kudielka, B. M. (2020). Everyday moral decision-making after acute stress exposure: Do social closeness and timing matter? *Stress: The International Journal on the Biology of Stress*. https://doi.org/10.1080/10253890.2020.1846029

Nina Singer and Brigitte M. Kudielka developed the study concept and study design. Nina Singer and Julia Binapfl performed data collection and analysis. Nina Singer drafted the manuscript, and Julia Binapfl, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

Study III

Singer, N., Sommer, M., Wüst, S., & Kudielka, B. M. (2021). Effects of gender and personality on everyday moral decision-making after acute stress exposure. *Psychoneuroendocrinology*, *124*, Article 105084. https://doi.org/10.1016/j.psyneuen.2020.105084

Nina Singer, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka developed the study concept and study design. Nina Singer performed data collection and analysis. Nina Singer drafted the manuscript, and Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

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LIST OF ABBREVIATIONS

1 PL model	One parameter logistic model
ACTH	Adrenocorticotropic hormone
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
AUC	Area under the curve
AUC_G	Area under the curve with respect to ground
AUC_I	Area under the curve with respect to increase
AVP	Arginine vasopressin
BMI	Body mass index
CBG	Corticosteroid binding globulin
CI	Confidence interval
CIS	Correlated item score
CNI	Sensitivity to consequences (C), moral norms (N), and general preference for inaction (I)
CNS	Central nervous system
CRH	Corticotropin releasing hormone
CRT	Cathode ray tube
CV	Coefficient of variation
DELFIA	Dissociation-enhanced lanthanide fluorescence immunoassay
DPTMJ	Dual Process Theory of Moral Judgment
EMCS Scale	Everyday Moral Conflict Situations Scale
EMCS Score	Percentage of altruistic decisions in the EMCS Scale
EMCS SC Score	Percentage of altruistic decisions for scenarios involving only socially close protagonists in the EMCS Scale
EMCS SD Score	Percentage of altruistic decisions for scenarios involving only socially distant protagonists in the EMCS Scale
EMCS Total Score	Total percentage of altruistic decisions in the EMCS Scale

fMRI	Functional magnetic resonance imaging
GR	Glucocorticoid receptor
HPA axis	Hypothalamic-pituitary-adrenal axis
Infit MSQ	Mean-square information-weighted fit
IRT	Item Response Theory
LC	Locus coeruleus
Log	Logarithmized
LR-test	Likelihood-ratio test
MR	Mineralocorticoid receptor
MFT	Moral Foundations Theory
NEO-FFI	NEO Five-Factor Inventory
Outfit MSQ	Mean-square outlier-sensitive fit
PANAS	Positive and Negative Affect Schedule
PASA	Primary Appraisal Secondary Appraisal
PTSST	Placebo version of the Trier Social Stress Test
sAA	Salivary alpha-amylase
SAM system	Sympathetic adrenomedullary system
SD	Standard deviation
SDS-17	Social Desirability Scale-17
SE	Standard error
SEM	Standard error of the mean
SIDI	Stress Induced Deliberation-to-Intuition
SIP-MDM	Social Information Processing-Moral Decision-Making
TSST	Trier Social Stress Test

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0 SUMMARY

In everyday life, moral decisions must frequently be made under acute stress. Although there is increasing empirical evidence that both stress and stress hormones affect decision-making in various domains including economic, social, and abstract moral decision-making, surprisingly few attempts have been made to explore the effects of acute stress exposure on decision-making in everyday moral conflict situations. Therefore, the overarching aim of this dissertation was to experimentally investigate the thesis that exposure to acute psychosocial stress influences everyday moral decision-making.

In *Study I* (see *Chapter 4*), we developed and validated in three independent paper-pencil validation surveys (N = 200) a new 40-items measure to assess decision-making in everyday moral conflict situations, the *Everyday Moral Conflict Situations (EMCS) Scale* (Singer et al., 2019). The EMCS Scale is characterized by preferable mean rates of altruistic decisions, clear representations of altruistic and egoistic response classes, unambiguousness of social closeness classifications (socially close versus socially distant protagonists), and high similarity to reality ratings. Classical and probabilistic test theory fit indices confirmed unidimensionality and the appropriateness of fragmentation into two parallelized item sets (e.g., for future use in within-subjects design studies). Moreover, there were neither effects of social closeness nor gender nor the actual existence of the socially close protagonists in the real lives of the participants on the percentage of altruistic decisions. Additionally, in a further methodological study (N = 100), we developed and validated a computer version of the EMCS Scale. Our results mainly indicated equivalence between the paper-pencil and the computer version of the EMCS Scale. Hence, the EMCS Scale can be broadly applied both as paper-pencil questionnaire and as computer paradigm in various research contexts.

Using our newly developed EMCS Scale, we then investigated in *Studies II* and *III* the effects of acute stress exposure on decision-making in everyday moral conflict situations. Building on the previous findings of my master's thesis (Singer et al., 2017), we hypothesized a higher percentage of altruistic decisions after acute stress exposure compared to a non-stress condition. Additionally, in *Study II* (see *Chapter 5*), we examined potential effects of social closeness and timing on everyday moral decision-making after acute stress exposure (Singer et al., 2020), due to empirical evidence that social distance and timing of the experimental paradigm relative to stressor onset affect the degree of prosocial behavior. Forty young healthy men were exposed to moderate psychosocial stress by the use of the Trier Social Stress Test (TSST) or its non-stressful

placebo version (PTSST) and then responded to the two parallelized item sets of the EMCS Scale at an early (+10 until +30 min) and at a late (+75 until +95 min after (P)TSST exposure) point of measurement. Our results revealed significantly higher percentages of altruistic decisions in the stress than in the control condition and for scenarios involving socially close (e.g., mother) compared to socially distant (e.g., stranger) protagonists, while the main effect of timing was nonsignificant. Only in secondary analyses, our data pointed to the idea that increased altruistic decision-making after acute stress might be restricted toward socially close protagonists at the early point of measurement. Moreover, psychological stress responses (changes in negative affect in response to the (P)TSST and anticipatory stress appraisals) as well as the personality traits agreeableness, empathy, and social desirability were significantly associated with *EMCS Scores*. Positive correlations between cortisol levels and altruistic decision-making were descriptively observable, but did not reach statistical significance.

In *Study III* (see *Chapter 6*), we finally investigated potential gender differences and effects of personality on everyday moral decision-making after acute stress exposure (Singer et al., 2021). In two within-subjects design studies, 179 healthy men and women were exposed to the TSST and a non-stress control condition (resting period) on two testing days in random order. At +10 until +30 min after stress/resting, the participants responded to the EMCS Scale. We explored the effects of acute stress, social closeness, participants' gender, and the a priori selected personality traits agreeableness, empathy, and social desirability on everyday moral decision-making. However, despite high statistical power, we could neither confirm the hypothesized effects of acute stress nor social closeness on *EMCS Scores* in both samples. Rather, our data revealed a prosocial impact of acute stress on *EMCS Scores* rather in females than males as well as effects of agreeableness and social desirability. Salivary alpha-amylase (sAA) levels in substudy 1 and cortisol levels in females in substudy 2 were significantly associated with higher *EMCS Scores* after acute stress exposure. Additionally, lower anticipatory subjective stress responses (negative affect scores and anticipatory stress appraisals) were correlated with more altruistic decisions. Moreover, we found positive relationships between hypothetical moral decision-making and real prosocial behavior (opportunity to make a charitable donation to *Strohhalm Regensburg e.V.*), which can be interpreted as further proof of external and ecological validity of the EMCS Scale.

In conclusion, the present dissertation describes the development and validation of the EMCS Scale, which is a promising new measure to assess decision-making in everyday

moral conflict situations (*Study I*; Singer et al., 2019). Moreover, it also contains empirical investigations on the effects of acute stress exposure on everyday moral decision-making. On the one hand, the data of the two included between-subjects design studies indicated a prosocial impact of acute stress exposure on everyday moral decision-making (Singer et al., 2017 and *Study II*; Singer et al., 2020). On the other, further within-subjects investigations in two independent study samples revealed a rather complex interplay between stress, stress hormones, and altruistic decision-making (*Study III*; Singer et al., 2021). These divergent findings can most likely be explained by methodological differences between the utilized study designs and experimental procedures. Hence, further and more large-scale studies on this research topic are required, and only a critical combination of the present and still outstanding future research will bring us closer to the truth.

CHAPTER 1

1 INTRODUCTION AND OUTLINE OF THIS DISSERTATION

The last year 2020 started with an unpredictable and still ongoing challenge – the COVID-19 pandemic. Since almost one year, the majority of society has waived liberty rights in order to protect their own health and the lives of population groups particularly at risk: the older and those with previous illnesses. This primarily unknown situation forces especially the younger generation to make difficult decisions: Shall one meet his/her friends at secret house parties or are the lives of other people more valuable than one's own pleasure? Or shall one wear the nose-and-mouth mask in public places that mainly protects other people and is at the same time uncomfortable for oneself? Furthermore, due to limited resources, medical professionals in crisis zones sometimes have to decide between refusing treatments to older patients and saving the lives of younger people instead.

All of these decisions involve a *moral conflict*, defined as "a situation in which the subject is pulled in contrary directions by rival moral reasons. It entails the awareness of the incompatibility of two courses of action and their subsequent outcomes" (Christensen & Gomila, 2012, p. 1251). According to these authors, moral conflicts can occur between personal interests and accepted moral values, different duties, sets of apparently incommensurable values, or stemming from unique moral principles.

Especially in everyday life, such moral decisions (like during the COVID-19 pandemic) must frequently be made under acute stress or can be stress inducing themselves (e.g., in emergencies; Kälvemark et al., 2004; Starcke et al., 2012). Although there is empirical evidence that acute stress and stress hormones elicited by the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic adrenomedullary (SAM) system affect decision-making in various domains including economic, social, and abstract moral decision-making (see Starcke & Brand, 2012 for review), surprisingly few attempts have been made to explore the effects of acute stress on everyday moral decision-making. Therefore, the overarching aim of the present dissertation was to experimentally investigate the thesis that exposure to acute psychosocial stress influences decision-making in everyday moral conflict situations.

To achieve this aim, we initially developed and validated a new measure to assess everyday moral decision-making in laboratory settings, the *Everyday Moral Conflict Situations (EMCS) Scale* (*Study I*). Using the newly developed EMCS Scale, we then examined the effects of acute stress exposure on everyday moral decision-making (*Studies II* and *III*). In addition, in *Study II*, we explored potential effects of social

closeness of the target persons as well as effects of timing of the moral decision-making task, and in *Study III*, we investigated potential gender differences and effects of personality on everyday moral decision-making after acute stress exposure.

The structure of this dissertation is as follows: After this short introduction (*Chapter 1*), *Chapter 2* provides background knowledge on the research topics stress and moral decision-making as well as an overview of the current state of research on the effects of acute stress exposure on moral decision-making. The presented definitions, concepts, and theories were selected specifically for this dissertation and make no claim to completeness. Building on this, *Chapter 3* introduces and elaborates the central research aims of the present dissertation and provides a study overview. The three included *Studies I*, *II*, and *III* are presented in the *Chapters 4* to *6*. Finally, a general, integrative discussion of the study results in the context of the current literature as well as a final conclusion are provided in the *Chapters 7* and *8*.

CHAPTER 2

2 BACKGROUND: STRESS AND MORAL DECISION-MAKING

This chapter presents background knowledge on the research topics stress (see Section 2.1) and moral decision-making (see Section 2.2) as well as the current state of research on the effects of acute stress exposure on moral decision-making (see Section 2.3).

2.1 Definition, concepts, and psychobiology of stress

This section gives an overview on the definition and concepts of stress (see Section 2.1.1) as well as on the psychobiology of stress (see Section 2.1.2).

2.1.1 Stress: Definition and concepts

Hans Selye (1907-1982), also known as the "father of stress" (Fink, 2017), proposed the first and most generic definition of stress as the non-specific response of the body to any demand made upon it (Selye, 1936, 1973). However, several researchers have challenged his postulated lack of specificity of stress responses. On the one hand, Mason (1968a, 1968b, 1975) reported that specific emotional reactions to novel, uncontrollable, unpredictable, or ambivalent situations elicit specific stress responses (see also Kudielka et al., 2007; Kudielka & Kirschbaum, 2001). On the other hand, for example Pacák and Palkovits (2001) observed that different stressors activate different biomarkers and brain regions.

Building on this, Levine and Ursin (1991) introduced stress as a process including the stimulus, the perceptual processing of this input, and the behavioral and physiological output (see also Koolhaas et al., 2011). Similarly, according to the transactional stress model of Lazarus and Folkman (1984), stress is conceptualized as a process initially triggered by situational demands, but then mainly influenced by the cognitive appraisal of these demands (as challenge, threat, or harm/loss), resulting in specific emotions and coping attempts (Kudielka & Kirschbaum, 2001). Accordingly, for example Gunnar and Quevedo (2007) defined stress as a "psychological condition in which the individual perceives or experiences challenges to physical or emotional well-being as overwhelming their ability and resources for coping" (p. 147).

Consistent with a modern psychobiological viewpoint, the term *acute stress* is restricted to "conditions where an environmental demand exceeds the natural regulatory capacity of an organism, in particular situations that include unpredictability and uncontrollability" (Koolhaas et al., 2011, p. 1291) in the context of the present

dissertation. Moreover, according to the idea of a multidimensional stress concept (Levine & Ursin, 1991), the effects of acute stress exposure are assessed via physiological and subjective stress markers in the experimental studies of this dissertation.

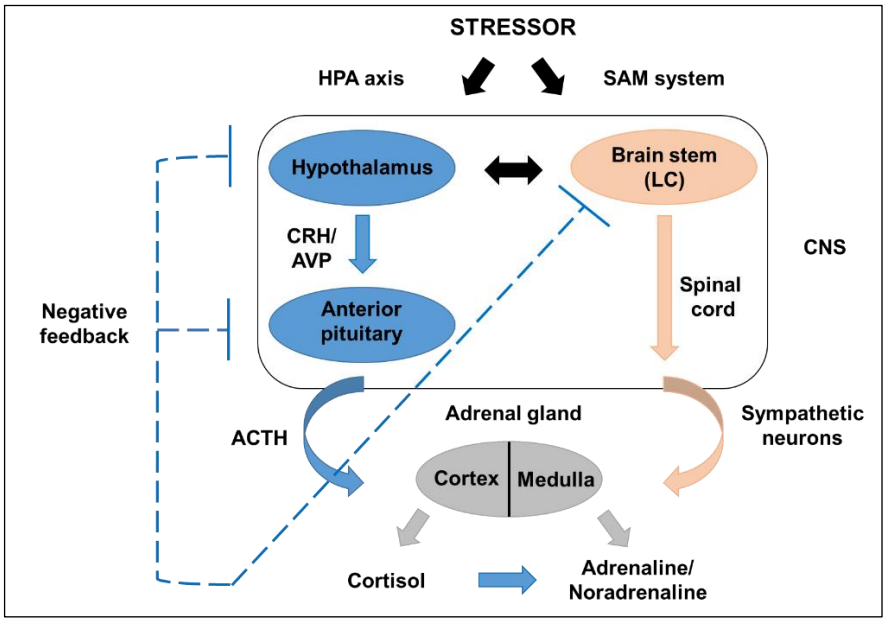
2.1.2 Psychobiology of stress

2.1.2.1 The SAM system and the HPA axis

The physiological stress response includes an activation of the sympathetic adrenomedullary (SAM) system, the hypothalamic-pituitary-adrenal (HPA) axis, and the immune system (Kudielka & Kirschbaum, 2001). The SAM system and the HPA axis are two distinct but interrelated systems (Gunnar & Quevedo, 2007). They can be activated via limbic brain circuits or ascending brain stem pathways that convey visceral and sensory stimuli (de Kloet et al., 2005). Figure 1 shows a simplified schematic representation of the actions of the SAM system and the HPA axis in the regulation of the human stress response.

Figure 1

Simplified schematic representation of the actions of the SAM system and the HPA axis in the regulation of the human stress response



Note. ACTH = adrenocorticotropic hormone; AVP= arginine vasopressin; CNS = central nervous system; CRH = corticotropin releasing hormone; HPA axis = hypothalamic-pituitary-adrenal axis; LC = locus coeruleus; SAM system = sympathetic adrenomedullary system. Modified after Baritaki et al. (2019) and Tsigos and Chrousos (2002).

The SAM system provides the most immediate (within seconds) human stress response (Ulrich-Lai & Herman, 2009). Acute stress exposure leads to a prompt activation of the locus coeruleus (LC) in the brain stem, which is the brain's primary source of noradrenaline (Hermans et al., 2014; Morilak et al., 2005). Moreover, the LC stimulates adrenergic receptors on preganglionic sympathetic neurons in the spinal cord, which then trigger the adrenal medulla to produce the catecholamines adrenaline and noradrenaline (Baritaki et al., 2019). Both catecholamines bind to various adrenoreceptors in multiple target organs. Centrally, noradrenaline enhances vigilance, arousal, and narrowing of attention. Peripherally, the catecholamines cause a rapid mobilization of metabolic resources and (among others) the acceleration of heart rate and stroke volume as well as the dilatation of muscles' blood vessels (Gunnar & Quevedo, 2007; see also the *fight-or-flight response* proposed by Cannon, 1932). Moreover, noradrenaline is involved in processes that activate the HPA axis through a positive bidirectional feedback loop (Baritaki et al., 2019).

The (slower) cascade of events of the HPA axis begins with the release of corticotropin releasing hormone (CRH) and arginine vasopressin (AVP) by the hypothalamus (Gunnar & Quevedo, 2007; Tsigos & Chrousos, 2002). CRH and AVP travel to the anterior pituitary through small blood vesicles, where they stimulate the secretion of adrenocorticotropic hormone (ACTH). ACTH then interacts with receptors on the cortex of the adrenal gland to produce and release glucocorticoids (cortisol in humans, corticosterone in rodents; Ulrich-Lai & Herman, 2009). After their release into the blood stream, 90-95% of the glucocorticoids are bound to corticosteroid binding globulin (CBG) and other carrier molecules, and only approximately 10% circulate freely in the body (Foley & Kirschbaum, 2010). Free glucocorticoids exert their effects on target tissues mainly via changes in gene transcription, which is why their effects take minutes to hours to evolve (Gunnar & Quevedo, 2007; Hermans et al., 2014). They can bind to two types of receptors, namely high affinity mineralocorticoid receptors (MR) and low affinity glucocorticoid receptors (GR; see de Kloet et al., 2018, 2019; Gunnar & Quevedo, 2007; Joëls et al., 2018). In the brain, 80-90% of MRs are occupied under basal conditions, while GRs are only occupied under stressful circumstances and during the peak of the circadian rhythm of the HPA axis (Gunnar & Quevedo, 2007). MRs play important roles in maintaining (1) the responsiveness of neurons to their neurotransmitters, (2) the circadian rhythm of the HPA axis, and (3) blood pressure as well as in (4) facilitating cerebral glucose availability. By contrast, GRs inhibit glucose

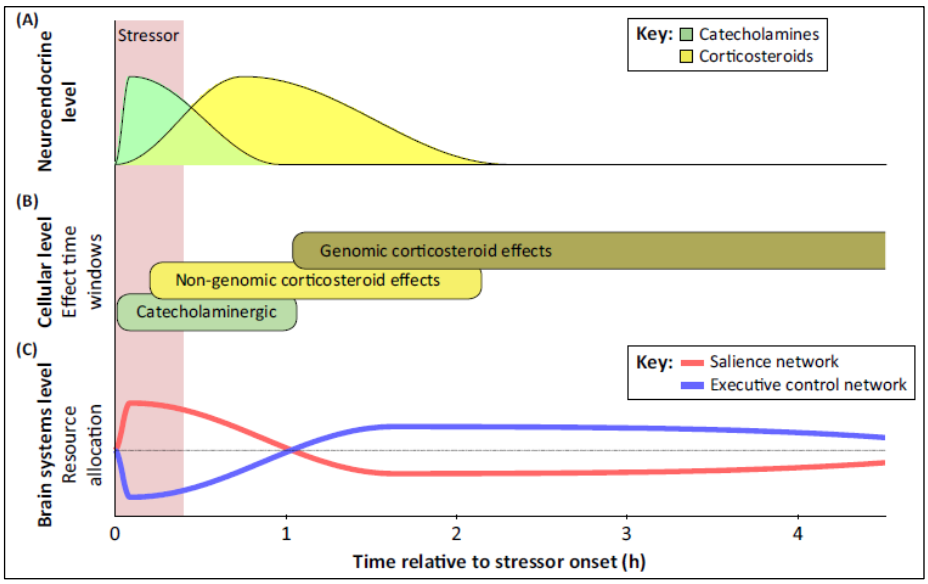
utilization in the brain and activate brain pathways that result in downregulation of CRH production and finally in termination of the activities of the HPA axis and the SAM system through negative feedback loops (Gunnar & Quevedo, 2007; Tsigos & Chrousos, 2002). Hence, the actions of GRs mainly contribute to reversing acute stress responses and facilitating the recovery of homeostasis (Sapolsky et al., 2000).

2.1.2.2 The temporal course of the human stress response

Physiological stress responses evolved in order to react quickly and adequately in situations of acute need (Buchanan & Preston, 2014). However, the initiated processes are resource consuming and it would be detrimental for the organism if physiological stress responses persisted for a too long time after cessation of the stressor. Figure 2 illustrates the time-dependent effects of acute stress exposure at the neuroendocrine (A), cellular (B), and brain systems (C) levels according to the *Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress* (Hermans et al., 2014).

Figure 2

Time-dependent effects of acute stress exposure at the neuroendocrine (A), cellular (B), and brain systems (C) levels according to the Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress (Hermans et al., 2014)



Note. Reprinted from *Trends in Neurosciences*, *Vol. 37*, No. 6, Hermans, E. J., Henckens, M. J., Joëls, M., & Fernández, G., Dynamic adaptation of large-scale brain networks in response to acute stressors, pp. 304-314, https://doi.org/10.1016/j.tins.2014.03.006. Copyright 2014, with permission from Elsevier (license number 4923530095099, license date 07.10.2020).

On the neuroendocrine level (A), catecholamines rise quickly and normalize soon after termination of the stressor, while glucocorticoids increase more slowly and remain on a high level for a considerably longer amount of time (see also Section 2.1.2.1). Typically, cortisol levels gradually increase within a few minutes after stressor onset and reach peak concentrations 10-30 min after cessation of the stressor (Foley & Kirschbaum, 2010; Kudielka et al., 2007). On the cellular level (B), catecholamines similarly exert immediate effects on their target tissues through G protein-coupled receptors (Hermans et al., 2014). Glucocorticoids deploy non-genomic corticosteroid effects primarily via MR and in interaction with catecholamines at an early time window (< 1 h relative to stressor onset), while at a late time window (> 1 h relative to stressor onset), they express genomic corticosteroid effects via GR. On the brain systems level (C), these changes are supposed to cause a reallocation of neural resources to a network that increases attention and vigilance (salience network) at the cost of executive control (executive control network) in the first hour relative to stressor onset. At the late time window (> 1 h after stressor onset), this shift is postulated to be reversed in order to restore homeostasis.

The *Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress* (Hermans et al., 2014) is supported by several empirical studies that identified the timing of laboratory paradigms relative to stressor onset as important factor influencing the direction of results (e.g., Margittai et al., 2015; Pabst et al., 2013; Schwabe et al., 2010; Schwabe & Wolf, 2014; Vinkers et al., 2013). For instance, Margittai et al. (2015) observed increased generosity in men tested 20 min after stressor onset compared to men tested 90 min after stressor onset or non-stressed men, while Vinkers et al. (2013) reported that men acted more consistent with their self-interests at +75 min after acute stress exposure than directly afterwards. Therefore, the model proposed by Hermans et al. (2014) also constitutes an important framework for the present dissertation.

2.1.2.3 The Trier Social Stress Test (TSST) and markers of stress reactivity

In laboratory settings, acute stress can be reliably induced through pharmacological stimulation, physical activity, cognitive demand, or social-evaluative threat (Starcke & Brand, 2012). However, Dickerson and Kemeny (2004) showed in a huge meta-analysis based on 208 studies that motivated performance tasks containing both uncontrollability and social-evaluative threat were associated with the largest cortisol responses and longest recovery times. The combination of these components is realized within the *Trier Social Stress Test* (TSST; Kirschbaum et al., 1993). The TSST consists of a brief

preparation period followed by a free speech (mock job interview) and a mental arithmetic task in front of a panel that is trained to withhold verbal and non-verbal feedback (see Kudielka et al., 2007 for a detailed description). Het et al. (2009) additionally developed a placebo version of the TSST (PTSST), which contains a free speech and a simple mental arithmetic task (i.e., it is comparable to the TSST with regard to cognitive load), but does not include uncontrollability and social-evaluative threat (i.e., there is no panel and the participant gets time specifications from the experimenter). Hence, the PTSST can be used as adequate non-stress control condition in experimental studies applying the TSST.

Since its development in 1993, the TSST has been repeatedly shown to reliably activate the SAM system and the HPA axis (Narvaez Linares et al., 2020). Physiological markers of the SAM system include the above mentioned catecholamines adrenaline and noradrenaline, salivary alpha-amylase (sAA; see Nater & Rohleder, 2009 for review and Strahler et al., 2017 for measurement recommendations), blood pressure, heart rate, and heart rate variability (e.g., Kudielka, Buske-Kirschbaum, et al., 2004a; Mohammadi et al., 2019). Concerning HPA axis reactivity, the levels of the hormones ACTH, AVP, and CRH can be analyzed in blood samples, but the typical biomarker in TSST studies is the steroid hormone cortisol (measurable in blood plasma, saliva, urine, and hair; see Staufenbiel et al., 2013). Salivary cortisol measurements entail the great advantages to collect the samples stress-free, without medical personnel, and in many different environments (Hellhammer et al., 2009). Moreover, according to the multidimensional stress concept of Levine and Ursin (1991; see Section 2.1.1), psychological stress responses assessed via self-report questionnaires can be utilized as further markers of stress reactivity (Gaab et al., 2005).

In sum, the TSST produces a two- to threefold rise in salivary cortisol levels in 70-85% of subjects (Foley & Kirschbaum, 2010). Moreover, total plasma cortisol levels, ACTH, catecholamines (adrenaline, noradrenaline), growth hormone, prolactin, testosterone, several immune parameters, sAA, blood pressure (systolic, diastolic), and heart rate significantly increase following TSST exposure (Kudielka et al., 2007). Thus, in the context of this dissertation, the TSST was used to induce acute psychosocial stress in laboratory settings (see *Studies II* and *III* in the *Chapters 5* and *6*).

2.1.2.4 Sources of inter- and intraindividual variability in HPA axis stress responses

HPA axis responses to acute psychosocial stress are characterized by distinct inter- and intraindividual variability (for reviews see Foley & Kirschbaum, 2010; Kudielka et al., 2009; Zänkert et al., 2019). However, not even reviews dedicated solely to this topic are able to present all influential factors exhaustively. Hence, in the following, selected key factors that are important to understand the exclusion criteria of *Studies II* and *III* (see *Chapters 5* and *6*) are described.

One key influential factor is the participants' gender. It has been repeatedly demonstrated that men display higher salivary cortisol stress responses than females (Kirschbaum et al., 1999; Liu et al., 2017; Stephens et al., 2016; Zänkert et al., 2019). Additionally, circulating sex hormones (e.g., testosterone, progesterone), menstrual cycle phase, and oral contraceptive use have to be considered. Concerning sex hormones, for example Stephens et al. (2016) observed that testosterone levels were negatively associated with salivary cortisol responses in men, while progesterone levels correlated negatively with ACTH and cortisol responses in women. With regard to menstrual cycle phase and oral contraceptive use, Kirschbaum et al. (1999) found that females in the luteal phase showed salivary cortisol responses comparable to males, whereas the salivary cortisol responses of females in the follicular phase and oral contraceptive users were significantly lower. Moreover, Entringer et al. (2010) reported blunted salivary cortisol stress responses during pregnancy, and breastfeeding shortly before TSST exposure has also been shown to significantly reduce salivary cortisol responses in lactating women (Heinrichs et al., 2001). In addition, investigating the interplay of age and gender, Kudielka, Buske-Kirschbaum, et al. (2004b) observed no gender differences in young adults or children, but significantly higher cortisol responses in elderly men than elderly women. Thus, it is strongly recommended to control for menstrual cycle phase, oral contraceptive use, pregnancy, and lactation when investigating HPA axis stress reactivity in female participants. Moreover, it is advisable to predefine an age range before participant recruitment (Zänkert et al., 2019).

A further influential factor is smoking. Nicotine is known to be a potent stimulator of the HPA axis through CRH release after binding to cholinergic receptors in the LC and the hypothalamus (Kudielka et al., 2009). Accordingly, mean salivary cortisol levels have been shown to increase after smoking of only two cigarettes (Kirschbaum et al., 1992). Thus, in habitual smokers, chronically elevated salivary cortisol levels might result in dampened HPA axis responses to acute stressors (Rohleder & Kirschbaum, 2006).

Similar influential lifestyle factors that should be controlled for are caffeine and alcohol consumption as well as the intake of dietary energy supplies (see Kudielka et al., 2009).

Another relevant factor is the nutritional state of the participants (Strahler et al., 2017; Zänkert et al., 2020). Kirschbaum et al. (1997) reported larger stress-induced cortisol increases in glucose-treated subjects compared to controls. Similarly, Zänkert et al. (2020) found significantly enhanced cortisol stress responses in two sugar conditions (grape juice and glucose, but not maltodextrin) compared to a control condition (no sugar administration). Moreover, von Dawans et al. (2020) recently compared the effects of standardized glucose, artificial sweetener, and water drinks in a male sample and found that even after a fasting timeframe of four hours, higher glucose availability resulted in significantly higher cortisol stress responses to the TSST. Therefore, it is recommended to standardize blood glucose levels, for example by administrating a sugar containing drink about 45 min before stress exposure (Zänkert et al., 2019).

Moreover, it is known that several somatic as well as psychiatric diseases come along with dysregulations of the HPA axis (hypo- or hyperresponsiveness; Chrousos, 2009; Zorn et al., 2017) and that various medications interact with HPA axis regulation (Van Hedger et al., 2017). Additionally, obese participants have been shown to display significantly enhanced cortisol stress responses (Benson et al., 2009; Incollingo Rodriguez et al., 2015). Consequently, it is advisable to exclude subjects with acute or chronic diseases, medication intake, recent vaccinations, and profound obesity (body mass index (BMI) > 30 kg/m^2).

Finally, to avoid any interference with the cortisol awakening response (Stalder et al., 2016) and to account for diurnal changes in cortisol levels, test sessions should preferably be scheduled in the afternoon or at least at the same time of day for all participants (Kudielka, Schommer, et al., 2004; Zänkert et al., 2019). Moreover, since there is empirical evidence for a habituation of cortisol responses to repeated TSST exposure (Wüst et al., 2005), all study participants should be as naïve as possible to the TSST protocol.

2.2 Moral decision-making

This section provides an overview on definitions and theories of moral decision-making (see Section 2.2.1) as well as on experimental paradigms in moral decision-making research (abstract and everyday moral dilemmas; see Section 2.2.2).

2.2.1 Definitions and theories of moral decision-making

In the last decades, different theories, perspectives, and research approaches led to a variety of definitions and terminologies in the field of moral psychology (e.g., moral judgment, moral reasoning, or moral cognition). However, in the context of the present dissertation, the broader term *moral decision-making* will be used according to Garrigan et al. (2018), which refers to decisions including judgments, evaluations, and response choices in the field of morality. A *moral decision* is defined as a "response decision about how to behave in a real or hypothetical moral dilemma" (Garrigan et al., 2018), with a *moral dilemma* being "a short story about a situation involving a moral conflict" (Christensen & Gomila, 2012, p. 1251; for the definition of a *moral conflict* see *Chapter 1*). According to the *Moral Foundations Theory* (MFT), there are five domains of morality, namely harm/care, fairness/reciprocity, ingroup/loyalty, authority/respect, and purity/sanctity (Graham et al., 2011, 2013; Haidt & Graham, 2007).

The origins of moral decision-making research can be traced back to the famous historical moral philosopher Immanuel Kant (1724-1804) and to the developmental psychologists Jean Piaget (1896-1980) and Lawrence Kohlberg (1927-1987). One of the most prominent theories in the field of moral decision-making is the *Dual Process Theory of Moral Judgment* (DPTMJ; Greene et al., 2001, 2004). Within dual process theories, two types of processes in cognitive systems are postulated: fast, affective, associate processes and slow, analytical, rule-based processes (Brand, 2016). Based on the degree of activation of brain regions in fMRI studies, Greene et al. (2001, 2004) made assumptions about the cognitive and affective processes involved in moral decision-making. They introduced the DPTMJ by postulating that both cognitions and emotions play important roles for making moral decisions. More specifically, an automatic affective bottom-up system is supposed to lead to fast, intuitive, and heuristic moral decisions, whereas a controlled cognitive top-down system is hypothesized to cause slow, rationale, and deliberate moral reasoning (Greene & Haidt, 2002; Greene et al., 2008).

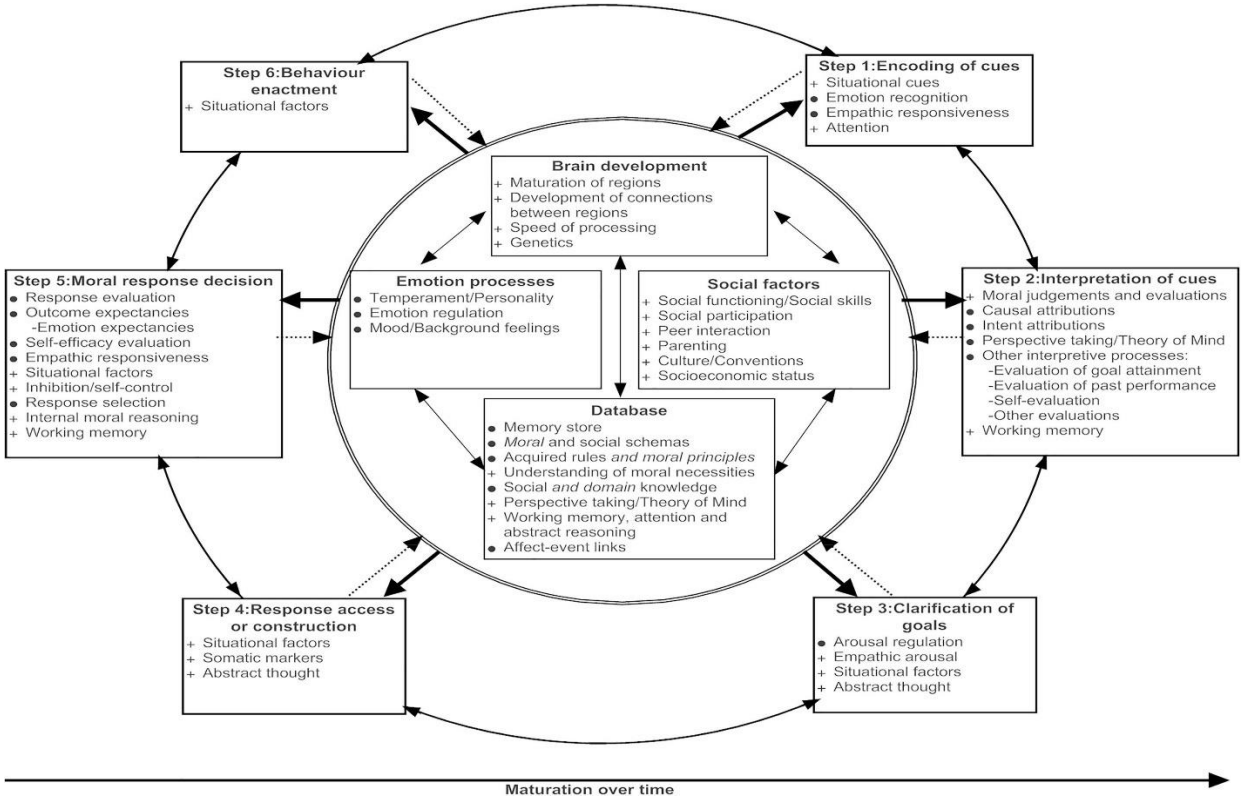
However, in recent years, Van Bavel et al. (2015) suggested a shift from dual process to more dynamic system models of moral decision-making. They argued that the underlying mental processes are diverse (e.g., including personal goals, representations of others' mental states, and social norms) and widely distributed across the brain, which is why they require more than two (dual) processes (for a review on the neural network during moral decision-making see FeldmanHall & Mobbs, 2015). Instead, Van Bavel et al. (2015) proposed that moral decision-making is based on different and flexible

component processes depending on a particular moral dilemma and emerges from the integration of different brain regions (including neural, social, and temporal dynamics).

Building on these and other theories from developmental psychology and social neuroscience, Garrigan et al. (2018) introduced the *Social Information Processing-Moral Decision-Making (SIP-MDM) Framework*. Assuming moral decision-making as a complex and multifaceted process, the authors aimed at integrating all relevant components into one descriptive framework (see Figure 3).

Figure 3

The Social Information Processing-Moral Decision-Making Framework (Garrigan et al., 2018)



Note. Reprinted from *Developmental Review, Vol. 49*, Garrigan, B., Adlam, A. L. R., & Langdon, P. E., Moral decision-making and moral development: Toward an integrative framework, pp. 80-100, https://doi.org/10.1016/j.dr.2018.06.001. Copyright 2018, under a creative commons (CC BY-NC-ND) license and with permission from Elsevier (order license ID 1071254-1, license date 19.10.2020).

The *SIP-MDM Framework* shows that moral decision-making is a complex process involving many components (including brain development, social factors, emotion processes, and database) and six steps (encoding of cues, interpretation of cues,

clarification of goals, response access or construction, moral response decision, and behavior enactment; Garrigan et al., 2018). As depicted in Figure 3, situational factors have been incorporated into several steps of the *SIP-MDM Framework* (steps 1, 3, 4, 5, and 6). The authors emphasized in their manuscript that especially the situational factors require further investigation in order to improve the predictive power of the *SIP-MDM Framework*. The present dissertation aims at contributing to this research endeavor by empirically examining the impact of the situational factor *acute stress exposure* on moral decision-making in laboratory settings.

2.2.2 Experimental paradigms in moral decision-making research

2.2.2.1 Abstract moral dilemmas

The traditional approach to investigate moral decision-making in the laboratory is by the use of *abstract moral dilemmas* (see for example Greene et al., 2001, 2004, 2008; Kossowska et al., 2016; Li et al., 2019; Paxton et al., 2012; Starcke et al., 2012; Youssef et al., 2012). One famous example of an abstract moral dilemma is the *trolley problem* (Thomson, 1985). The trolley problem is a so-called *harm-to-save* moral dilemma, where the participant is prompted to decide whether one person should be sacrificed in order to save the lives of a greater number of people. The response alternatives are typically utilitarian (approving harmful actions in order to maximize overall benefit) versus non-utilitarian/deontological (refusing to harm another person, irrespectively of the consequences; Szekely et al., 2015). Abstract moral dilemmas can be further subdivided into personal versus impersonal dilemmas with hypothesized dissociable neural networks (Greene et al., 2001, 2004; Youssef et al., 2012). A popular example of a personal dilemma is the *footbridge dilemma* (Foot, 1967; Thomson, 1976), where an individual has to be actively harmed by a personal action (e.g., pushing a stranger in front of a runaway trolley in order to save the lives of five people). An example of an impersonal moral dilemma is the *switch dilemma*, where damage can be averted through an impersonal action (e.g., flipping a switch to divert the trolley).

Over the last decades, research using abstract moral dilemmas yielded important and fascinating insights into the cognitive, emotional, and neural processes involved in moral decision-making (e.g., Greene et al., 2001, 2004). Moreover, several studies revealed gender differences in abstract moral decision-making (e.g., Armstrong et al., 2018; Friesdorf et al., 2015; Fumagalli et al., 2010; Youssef et al., 2012), which is in accordance

with the historical proposal of Gilligan (1982), suggesting that males differ from females in their approach to moral reasoning (justice focused versus care focused).

However, in a reanalysis of the Greene et al. (2001, 2004) data, McGuire et al. (2009) queried the subdivision of abstract moral dilemmas into personal and impersonal dilemmas. Moreover, in the last few years, concerns about the interpretability, validity, and generalizability of abstract moral dilemmas have been accumulatively raised (Bauman et al., 2014; FeldmanHall, Mobbs, et al., 2012; Kahane, 2015; Kahane et al., 2015; Sommer et al., 2010). Recent attempts to transfer trolley-style moral dilemmas to real-life behavior (deciding about administering a (bogus) electroshock to one mouse versus allowing five other mice to receive a shock) showed that responses to hypothetical moral dilemmas did not predict real-life behavior, but only affective (degrees of doubt and discomfort with decisions) and cognitive (reaction times) aspects of the real-life decisions (Bostyn et al., 2018). Thus, abstract moral dilemmas with dead-or-life choices lack external and ecological validity and do not adequately represent moral decisions that have to be made in everyday life situations.

2.2.2.2 Everyday moral dilemmas

To overcome these shortcomings, several researchers (e.g., Rosen et al., 2015; Sommer et al., 2010; Starcke et al., 2011) recently developed so-called *everyday moral dilemmas*, which are short vignettes describing hypothetical everyday life situations. Everyday moral dilemmas require decisions between the fulfilment of a moral standard or a social obligation toward another person versus a personal-oriented hedonistic behavior that would explicitly not cause serious bodily harm or legal consequences (Sommer et al., 2010). Typically, the presented response alternatives are altruistic (e.g., helping an old woman who is in distress) versus egoistic (e.g., catching the waiting bus home; further examples can be found in Singer et al., 2017, Sommer et al., 2010, 2014, or Starcke et al., 2011). Starcke et al. (2011) and Rosen et al. (2015) additionally subdivided their scenarios into high- versus low-emotional dilemmas. However, several of their high-emotional dilemmas do not describe common everyday life situations (e.g., deciding about leaving your partner who is suicidal or telling your marriage partner that you had a one-night stand during a business trip), which is a potential constraint of these paradigms.

By contrast, the scenarios of Sommer et al. (2010) do rather resemble typical everyday life situations and have already been successfully applied in several experimental studies (Singer et al., 2017; Sommer et al., 2010, 2014). Though, since in a systematic review of

19 experimental design parameters of moral dilemmas, Christensen and Gomila (2012) have pointed out the importance of considering several influential variables in moral dilemma research, a more comprehensive validation of such everyday moral dilemmas would be highly desirable. The proposed experimental design parameters range from dilemma formulation (e.g., presentation format, type of question) to relatedness of the participant to the story characters (e.g., ingroup/outgroup, kinship/friendship), and dilemma conceptualization (e.g., intentionality, directness of harm; Christensen & Gomila, 2012). So far, most of these experimental design parameters have not been systematically investigated for everyday moral decision-making.

The present dissertation focuses on examining the impact of the closeness of relationship with the target persons (*social closeness*). For abstract moral dilemmas, several studies have demonstrated differences in decision-making depending on social closeness (Kossowska et al., 2016; Kurzban et al., 2012; Linke, 2012; Tassy et al., 2013). With regard to everyday moral dilemmas, so far only Zhan et al. (2018) examined the effects of the protagonists' social closeness. Their results revealed that participants made less altruistic decisions, displayed longer reaction times, and rated the situations as emotionally more negative in moral conflicts involving strangers versus friends and acquaintances. However, Zhan et al. (2018) stated in their manuscript that they "developed 30 common moral dilemmas in daily life, some of which were adapted from Greene et al., 2008" (p. 16). This rather seems contradictory because Joshua D. Greene is known to use abstract moral dilemmas in his studies (see Section 2.2.2.1). Further, Zhan et al. (2018) did not provide item examples of their moral conflict scenarios, which makes it hard to draw clear conclusions from their findings. Thus, the impact of the experimental design parameter *social closeness* on decision-making in everyday moral dilemmas still remains to be investigated more accurately.

Moreover, all of the above-mentioned everyday moral dilemmas were developed for the application in between-subjects design studies. Hence, no parallelized item set of everyday moral dilemmas for use in within-subjects designs is available to date. Such a parallelized item set could, for example, be administered before and after an experimental manipulation like acute stress induction, and would prove very useful to hold constant interindividual variability in trait variables (e.g., personality; Oda et al., 2014). Another positive consequence would be the higher statistical power of within-subjects designs compared to between-subjects designs (Charness et al., 2012).

Finally, gender differences in everyday moral dilemmas have not been systematically examined so far. However, at least related research in the area of social decision-making suggests that females are more altruistic than males (see Brañas-Garza et al., 2018 and Rand et al., 2016 for two recent meta-analyses). Moreover, Eagly (2009) proposed that while both genders tend to exhibit prosocial behavior in general, females engage more in close relationships and males provide more help to strangers.

2.3 Effects of acute stress exposure on moral decision-making

Although there is empirical evidence that both stress and stress hormones affect decision-making in various domains, to date, only a few research groups investigated the effects of acute stress exposure on moral decision-making. This section summarizes the current state of research on this topic. Section 2.3.1 focuses on abstract moral dilemmas, and Section 2.3.2 concentrates on everyday moral dilemmas. In Section 2.3.3, the previous findings of my master's thesis, where I also investigated stress effects on everyday moral decision-making (Singer et al., 2017), are integrated into the broader field of research on stress and social decision-making.

2.3.1 Effects of acute stress exposure on abstract moral decision-making

Applying a between-subjects design, Youssef et al. (2012) assigned 65 undergraduate volunteers (30 males and 35 females) to a stress (TSST exposure) or control condition (neutral reading material). Directly afterwards, an abstract moral decision-making paradigm with each ten personal moral, impersonal moral, and non-moral dilemmas was administered (duration: 30-45 min). Both decisions and reaction times were recorded. Using a binary logistic model, the authors observed that the stressed group and female gender predicted utilitarian responses to personal moral dilemmas. Both, the stressed group and females made significantly fewer utilitarian decisions to personal moral dilemmas compared to the control group, respectively males. Moreover, the cortisol stress response (area under the curve, AUC) was negatively correlated with utilitarian responses. For impersonal moral and non-moral dilemmas, there were no significant predictors of utilitarian responses. Reaction times did also not differ between conditions.

Starcke et al. (2012) aimed at replicating the results of Youssef et al. (2012) using a different kind of stressor (anticipated speech instead of an actual speech and mental arithmetic) and a different kind of stress measurement (questionnaires and heart rate

increase instead of cortisol). In their data, Starcke et al. (2012) observed that the participants in the stress condition made fewer utilitarian decisions in personal and impersonal moral dilemmas and displayed longer reaction times than the participants in the control condition. Moreover, the individual physiological stress response (heart rate increase) was negatively correlated with the percentage of utilitarian decisions.

Kossowska et al. (2016) hypothesized different relationships between stress and abstract moral decision-making depending on which goals are accessible. More specifically, the authors examined in 70 male participants whether the goal to achieve certainty (operationalized via measurement of the personality trait *need for closure*) moderated the relationship between cortisol and abstract moral decision-making. In subjects with high *need for closure* levels, Kossowska et al. (2016) found that higher cortisol levels were associated with more utilitarian decisions, but only in dilemmas when ingroup was involved. In subjects with low *need for closure*, higher cortisol levels were correlated with more deontological decisions, but only when ingroup was not involved.

Li et al. (2019) expanded previous data by additionally applying a new approach, the CNI model (Gawronski et al., 2017), which disentangles the effects of three determinants of abstract moral decision-making, namely sensitivity to consequences (C), moral norms (N), and general preference for inaction (I). Participants in a stress group (TSST exposure) again made more deontological decisions than participants in a control group (PTSST exposure). Moreover, process dissociation analysis revealed that acute stress exposure increased deontological inclinations rather than decreasing utilitarian inclinations or influencing both. Additionally, a CNI model analysis showed that acute stress exposure increased sensitivity to moral norms and general preference for inaction, but did not affect sensitivity to consequences.

In sum, it can be concluded from the studies described in this section that acute stress exposure influences abstract moral decision-making by increasing deontological decisions (Starcke et al., 2012; Youssef et al., 2012), probably due to an enhanced sensitivity to moral norms and general preference for inaction (Li et al., 2019). Moreover, the study of Kossowska et al. (2016) provided first evidence that personality traits might moderate the effects of stress on moral decision-making. Further, their data supported the claim of Christensen and Gomila (2012) that the relatedness of participants to story characters might be an important influential factor in moral decision-making research.

2.3.2 Effects of acute stress exposure on everyday moral decision-making

To the best of my knowledge, the effects of acute stress exposure on everyday moral decision-making have only been investigated so far by Starcke et al. (2011) and in my master's thesis, which has been successfully published as a research paper in *Hormones and Behavior* (see Singer et al., 2017).

Applying a between-subjects design, Starcke et al. (2011) confronted male and female participants (N = 40) with 20 everyday moral dilemmas (each ten high- and low-emotional dilemmas) directly after TSST (stress condition, n = 20) or PTSST exposure (control condition, n = 20). Stress levels were assessed with endocrine markers (salivary cortisol, sAA) and questionnaires. Starcke et al. (2011) did not observe significant effects of acute stress exposure on everyday moral decision-making, but a correlation between stress-related cortisol increases and the percentage of egoistic decisions in high-emotional dilemmas. Moreover, higher positive affect ratings at the end of the experimental procedure were associated with higher percentages of altruistic decisions in high-emotional dilemmas. However, the significance and generalizability of their findings is limited by the use of high-emotional dilemmas, which do rather not reflect typical everyday life situations (see Section 2.2.2.2). Furthermore, Starcke et al. (2011) investigated a mixed-sex sample, but did not control for menstrual cycle phase in females, which might have confounded their results (see Kirschbaum et al., 1999 and Section 2.1.2.4).

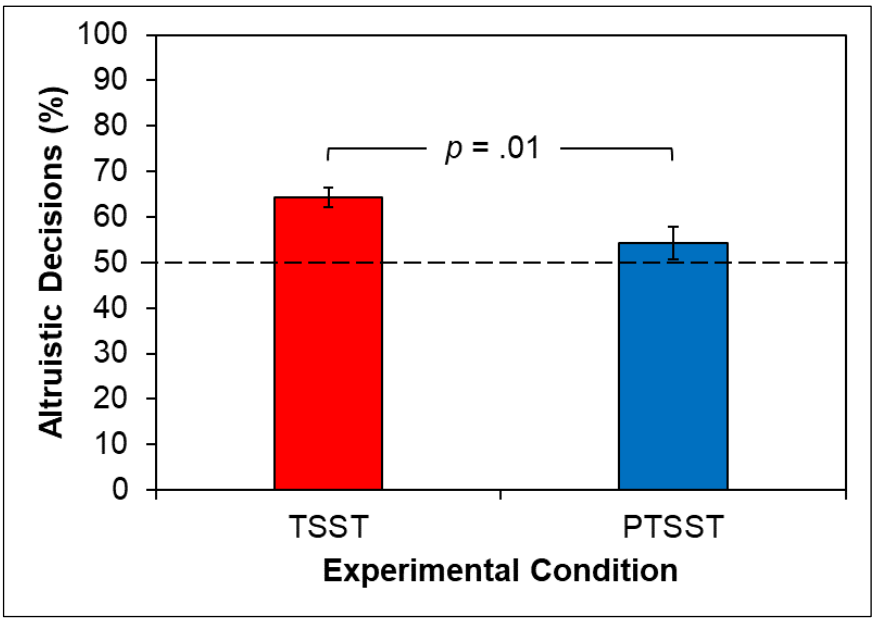
Considering these potential constraints, in my master's thesis, I investigated the effects of exposure to acute psychosocial stress on decision-making, decision certainty, and emotionality in everyday moral dilemmas (Singer et al., 2017). Applying a between-subjects design with a stress (TSST exposure, n = 30) and a control condition (PTSST exposure, n = 20), 50 young healthy men were confronted with 28 everyday moral dilemmas with altruistic versus egoistic response alternatives (developed by Sommer et al., 2010). By this study, we aimed to contribute to the current literature in several respects: First, we assessed endocrine, autonomic, and subjective stress responses according to a multidimensional stress concept (Levine & Ursin, 1991). Second, we investigated only males in order to reduce the effects of variations in gonadal hormone concentrations on HPA axis stress responses (Kirschbaum et al., 1999). Third, we controlled for potentially confounding personality variables, namely the *Big Five* personality factors (Oda et al., 2014; Starcke & Brand, 2012), social desirability (Szekely et al., 2015), and empathy (Rosen et al., 2016). Fourth, we used the more everyday life

resembling moral conflict scenarios of Sommer et al. (2010) in order to increase external and ecological validity. Fifth, the everyday moral decision-making task started at +10 min after TSST/PTSST exposure and was therefore performed at the typical time window of peak cortisol levels after TSST exposure (approximately 10-20 min after cessation of the stress task; Kudielka et al., 2007). An additional saliva sample (+20 min) was taken while completing the paradigm in order to capture cortisol levels during everyday moral decision-making. Sixth, we deliberately oversampled the stress condition in order to ensure an adequate number of participants with robust cortisol increases for the investigation of the impact of cortisol on everyday moral decision-making.

In our data, we observed that the participants in the stress condition made significantly more altruistic decisions than the participants in the control condition (see Figure 4). The effect size of this group difference was medium to large (Cohen's d = 0.74).

Figure 4

Mean percentage of altruistic decisions in the everyday moral decision-making task (± SEM) in the stress (TSST) and control (PTSST) condition of the Singer et al. (2017) study

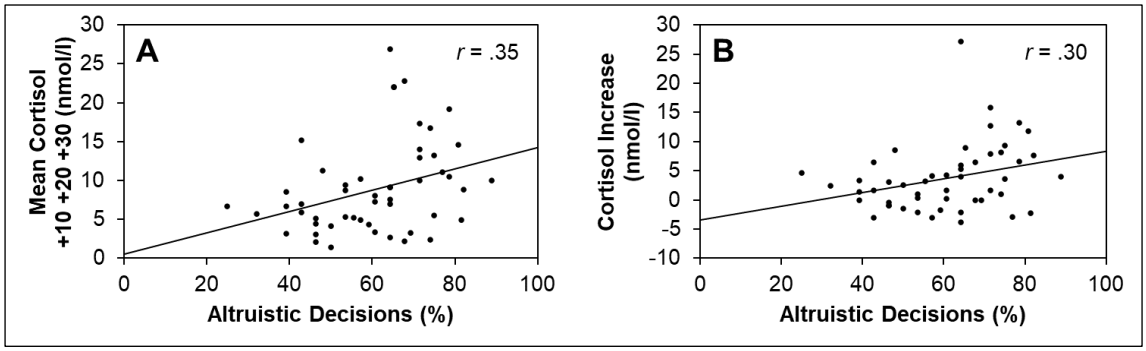


Note. The dashed line indicates the 50% mark of altruistic decisions.
Reprinted from *Hormones and Behavior*, *Vol. 93*, Singer, N., Sommer, M., Döhnel, K., Zänkert, S., Wüst, S., & Kudielka, B. M., Acute psychosocial stress and everyday moral decision-making in young healthy men: The impact of cortisol, pp. 72-81, https://doi.org/10.1016/j.yhbeh.2017.05.002. Copyright 2017, with permission from Elsevier (personal use of material of my own Elsevier article within my dissertation).

An additional ANCOVA revealed that the personality trait *agreeableness* significantly explained part of the variance in altruistic decisions between the stress and the control condition (η^2_p = 0.15), but the effect size of the factor *Condition* was still medium (η^2_p = 0.06). Moreover, our data showed positive associations between cortisol levels and altruistic decision-making (see Figure 5), which remained significant after controlling for the potentially confounding personality variables (*Big Five*, social desirability, and empathy) in regression analyses.

Figure 5

Correlations between cortisol levels and the percentage of altruistic decisions in the Singer et al. (2017) study



Note. A) Correlation of the mean cortisol level while performing the everyday moral decision-making task (*mean cortisol +10+20+30*) with the percentage of altruistic decisions in the total study sample (*N* = 50). B) Correlation of the cortisol increase with the percentage of altruistic decisions in the total study sample (*N* = 50).
Reprinted from *Hormones and Behavior*, *Vol. 93*, Singer, N., Sommer, M., Döhnel, K., Zänkert, S., Wüst, S., & Kudielka, B. M., Acute psychosocial stress and everyday moral decision-making in young healthy men: The impact of cortisol, pp. 72-81, https://doi.org/10.1016/j.yhbeh.2017.05.002. Copyright 2017, with permission from Elsevier (personal use of material of my own Elsevier article within my dissertation).

The two experimental groups did not differ regarding decision certainty and emotion ratings. However, altruistic decisions came along with significantly higher decision certainty and significantly more positive emotion ratings than egoistic decisions.

In sum, the results of my master's thesis suggested that both acute stress exposure and cortisol levels have prosocial effects on everyday moral decision-making in young healthy men. Additionally, these data also provided first indications that specific personality traits like agreeableness might play an important role in everyday moral decision-making after acute stress exposure.

2.3.3 Integration of own previous findings (Singer et al., 2017) into the broader field of research on stress and social decision-making

Our previous empirical findings of increased altruistic everyday moral decision-making after acute stress exposure in males (Singer et al., 2017) can also be integrated into the broader field of research on stress and social decision-making. Notably, our data fit the *Stress Induced Deliberation-to-Intuition (SIDI) Model* (Yu, 2016). Within the *SIDI Model*, it is proposed that decisions under stress result from the combination of reduced cognitive control and increased intuitive and spontaneous response tendencies, which have empirically been shown to be prosocial (Gächter, 2012; Rand, 2016; Rand et al., 2012, 2014; Zaki & Mitchell, 2013). Several research groups in the related domain of social decision-making also support the hypothesis that acute stress exposure increases prosocial and altruistic behavior (e.g., Berger et al., 2016; Margittai et al., 2015; Sollberger et al., 2016; Sparrow et al., 2019; Takahashi, 2007; von Dawans et al., 2012, 2019; Zhen et al., 2020). According to the review of Buchanan and Preston (2014), acute stress evokes prosocial behavior under conditions that promote survival and well-being at the individual and group level in immediate need situations. This also fits the so-called *tend-and-befriend hypothesis*, which postulates that some animals and also humans seek to protect their offspring (tend) and their social group for mutual defense (befriend) in response to threat (Taylor, 2006; Taylor et al., 2000).

However, our results are in contrast to studies reporting enhanced antisocial and egoistic behavior after acute stress exposure (e.g., Bendahan et al., 2017; FeldmanHall et al., 2015; Schweda et al., 2020; Starcke et al., 2011; Steinbeis et al., 2015; Vinkers et al., 2013). Such a behavioral pattern could be explained by the rapid activation of the SAM system under acute stress as already proposed by the *fight-or-flight theory* almost a century ago (Cannon, 1932).

In sum, the current state of research on stress and social decision-making is heterogeneous and there is an urgent need to identify influential variables and contextual factors that lead to prosocial/altruistic versus antisocial/egoistic behavior after acute stress. As already stated above, the timing of behavioral tasks relative to stressor onset might be one important factor influencing the direction of results (Margittai et al., 2015; Vinkers et al., 2013; see also Section 2.1.2.2). Additionally, the relationship status to the target persons has been shown to affect the degree of prosocial behavior (Margittai et al., 2015; Passarelli & Buchanan, 2020). Moreover, there is a growing number of studies reporting gender differences in the domain of stress and social decision-making

(e.g., Nickels et al., 2017; Schweda et al., 2019; Youssef et al., 2018; Zhang et al., 2019). With regard to everyday moral decision-making after acute stress exposure, the impact of these potentially influential factors has not been systematically investigated so far.

Further, data of our own (Singer et al., 2017) and other research groups (Habashi et al., 2016; Oda et al., 2013, 2014; Rosen et al., 2016; Zhang et al., 2019; Zhao & Smillie, 2015) revealed that particular personality traits play an important role in prosocial and altruistic decision-making (both in contexts with and without acute stress exposure). In this respect, the present dissertation focuses on the personality traits agreeableness, empathy, and social desirability and investigates their impact on everyday moral decision-making after exposure to acute psychosocial stress.

CHAPTER 3

3 RESEARCH AIMS AND STUDY OVERVIEW

Building on the presented literature and especially on my master's thesis (Singer et al., 2017; see Section 2.3.2), the overarching aim of my PhD project was to experimentally investigate the effects of acute stress exposure on decision-making in everyday moral conflict situations.

As outlined in the previous chapters, there is increasing empirical evidence that acute stress and stress hormones affect social and moral decision-making. However, with respect to everyday moral decision-making, there are to date neither comprehensively validated laboratory paradigms nor parallelized item sets that can be applied in repeated-measurement approaches. Therefore, the main objective of *Study I* (*Chapter 4*) was the development and validation of a new measure with two parallelized item sets to assess decision-making in everyday moral conflict situations, the *Everyday Moral Conflict Situations (EMCS) Scale*. Moreover, beyond scale development and validation, *Study I* aimed at contributing to the investigation of experimental design parameters in everyday moral dilemmas by varying the social closeness of the protagonists in the conflict scenarios (socially close versus socially distant). As suggested by relevant literature (Zhan et al., 2018), we hypothesized more altruistic decisions for scenarios involving socially close (e.g., mother) compared to socially distant (e.g., stranger) protagonists. Further, *Study I* aimed at examining gender differences in everyday moral decision-making. We therefore recruited an equal number of male and female subjects for participation in the three validation surveys of *Study I* and counterbalanced the everyday moral conflict scenarios with respect to gender of the protagonists. Finally, *Study I* also aimed at exploratively analyzing if the answers to items with socially close protagonists differed depending on the actual existence of the target persons (e.g., brother, sister) in the real lives of the participants. The rationale behind this supplementary analysis was to rule out the actual (non-)existence of the respective target persons in the lives of participants as a potentially confounding factor.

Using the newly developed EMCS Scale, *Studies II and III* then aimed at examining the effects of acute stress exposure on everyday moral decision-making in controlled laboratory settings. In *Study II (Chapter 5)*, similar to our previous study (Singer et al., 2017), we recruited a solely male sample and expected significantly more altruistic decisions after acute psychosocial stress (TSST exposure) compared to a control condition (PTSST exposure). Moreover, we investigated potential effects of social closeness and timing, as related research in the field of social decision-making suggests

that acute stress exposure can promote either prosocial or antisocial behavior depending on social distance and time elapsed between stress and decision-making (see also Sections 2.1.2.2 and 2.3.3). More specifically, in the study of Margittai et al. (2015), acute stress exposure increased generosity at an early time point only toward close but not toward distant others compared to non-stressed men or men tested 90 min after stressor onset. This has not been investigated for everyday moral decision-making so far. Building on these empirical findings, we hypothesized increased altruistic decision-making in the everyday moral conflict scenarios after acute stress exposure toward socially close but not toward socially distant protagonists at an early (+10 until +30 min) but not at a late (+75 until +95 min after (P)TSST exposure) point of measurement. Additionally, we exploratively analyzed associations with endocrine and psychological stress responses as well as personality variables.

In *Study III* (*Chapter 6*), we finally designed two within-subjects studies and exposed two samples of healthy men and women to the TSST and a non-stress control condition (resting period) on two testing days in random order. At +10 until +30 min after stress/resting, subjects responded to each one of the two parallelized item sets of the EMCS Scale. Overall, we expected a higher percentage of altruistic decisions after acute stress exposure compared to control (Singer et al., 2017) as well as in scenarios involving socially close versus distant protagonists (Passarelli & Buchanan, 2020; Zhan et al., 2018). Moreover, we hypothesized positive relationships between altruistic decision-making and neuroendocrine as well as subjective stress responses. Additionally, we were interested in the effects of participants' gender and of the three a priori selected personality traits agreeableness, empathy, and social desirability (see Sections 2.3.2 and 2.3.3). To gain insight into the external validity of the EMCS Scale, we also explored potential associations between the percentage of altruistic decisions in the EMCS Scale (*EMCS Scores*) and real prosocial behavior (operationalized as the donation amount for a local organization supporting homeless people, *Strohhalm Regensburg e.V.*). Last but not least, we investigated whether real donation behavior to charity was influenced by forgoing stress exposure versus rest. Based on the findings of Sollberger et al. (2016), who observed that stress significantly reduced environmental donation behavior in men, we hypothesized that acute stress exposure reduces the donated amount of money to *Strohhalm Regensburg e.V.*

CHAPTER 4

Study I

Singer, N., Kreuzpointner, L., Sommer, M., Wüst, S., & Kudielka, B. M. (2019). Decision-making in everyday moral conflict situations: Development and validation of a new measure. *PLOS ONE*, *14*(4), Article e0214747. https://doi.org/10.1371/journal.pone.0214747[1]

Nina Singer, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka developed the study concept and study design. Nina Singer performed data collection. Nina Singer and Ludwig Kreuzpointner performed data analysis. Nina Singer drafted the manuscript under the supervision of Ludwig Kreuzpointner. Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

4 STUDY I: DECISION-MAKING IN EVERYDAY MORAL CONFLICT SITUATIONS: DEVELOPMENT AND VALIDATION OF A NEW MEASURE

4.1 Abstract

In everyday life, we are often confronted with morally conflicting social interaction situations. Therefore, the main objective of the present set of studies was the development and validation of a new measure to assess decision-making in everyday moral conflict situations. All vignettes required a decision between an altruistic versus an egoistic behavioral response alternative. In three independent surveys (N = 200), we developed a 40-items measure with preferable mean rates of altruistic decisions (Study 1), clear representation of altruistic and egoistic response classes (Study 2), unambiguousness of social closeness classifications (socially close vs. socially distant protagonists; Studies 1 and 2), and high similarity to reality ratings (Studies 1 and 2). Additionally, we developed two parallelized item sets for future use in within-subjects design studies and investigated the measurement properties of our new scale (Studies 1 and 3). Results of Rasch model analyses and classical test theory fit indices showed unidimensionality and confirmed the appropriateness of the fragmentation into two parallelized item sets. Notably, in our data, there were neither effects of social closeness nor gender on the percentage of altruistic decisions. In sum, we propose the *Everyday Moral Conflict Situations (EMCS) Scale* as a promising new measurement tool that may facilitate further research in different research areas due to its broad applicability.

4.2 Introduction

For humans and most animals, the social interaction with conspecifics is a common everyday life activity (Frith & Frith, 2007). Thereby, we humans are often confronted with morally conflicting social interaction situations. According to Christensen and Gomila (2012), moral conflicts are situations in which someone is pulled in contrary directions by rival moral reasons. They can, amongst others, occur when deciding between a personal interest versus an accepted moral value.

In experimental studies, decision-making in moral conflict situations is typically investigated by moral dilemmas presented as short stories about situations involving moral conflicts (see Christensen & Gomila, 2012 for review). To date, most studies in various research areas (e.g., judgment and decision-making, cognitive neuroscience, social psychology, or stress research) have applied abstract moral dilemmas. The trolley problem, for instance, prompts the participant to decide whether or not one person should be actively sacrificed in order to save a greater number of people (e.g., Greene et al., 2001, 2004; Kossowska et al., 2016; Starcke et al., 2012; Youssef et al., 2012). Such abstract moral dilemmas with utilitarian versus deontological response alternatives were once inspired by thought experiments of famous historical moral philosophers like Immanuel Kant (1724-1804) and experimental studies of developmental psychologists like Jean Piaget (1896-1980) or Lawrence Kohlberg (1927-1987). Over the last decades, abstract moral dilemma research has provided us many important and fascinating insights into the processes involved in moral judgment (e.g., regarding the interplay between cognition and emotion; Capraro et al., 2019; Greene et al., 2001, 2004; Haidt, 2007) using very different paradigms and scales (see for example Kahane et al., 2018 for a recently developed abstract moral decision-making scale, which has been successfully applied by Capraro et al., 2019). Nevertheless, methodological concerns about the interpretation of the results of abstract moral dilemma research have been raised in the last years (e.g., Kahane, 2015; Kahane et al., 2015). Additionally, despite of recent attempts to transfer trolley-style moral dilemmas to real life situations (e.g., Bostyn et al., 2018), such sacrificial dilemmas lack external and ecological validity (Bauman et al., 2014; FeldmanHall, Mobbs, et al., 2012) and can only hardly be transferred to situations experienced in everyday life (Sommer et al., 2010).

Thus, current moral dilemma research comprises no longer only abstract reasoning about moral dead-or-life situations (e.g., Greene et al., 2001, 2004) but also research on moral decision-making in a variety of daily life situations (e.g., Hofmann et al., 2014,

2018). Applying ecological momentary assessment in a large study sample (N = 1.252 participants), Hofmann et al. (2014) repeatedly assessed moral or immoral acts and experiences in everyday life. The authors were able to confirm five areas of human morality (care/harm, fairness/unfairness, loyalty/disloyalty, authority/subversion, and sanctity/degradation) as originally proposed by the *Moral Foundations Theory* (MFT; Graham et al., 2011; Haidt & Graham, 2007). Moreover, honesty/dishonesty was the third most frequently mentioned dimension regarding morality in everyday life and, thus, emerged as another important category (Graham et al., 2013; Hofmann et al., 2014).

With regard to research in laboratory settings, several scholars (e.g., Rosen et al., 2015; Sommer et al., 2010; Starcke et al., 2011) recently developed everyday moral dilemmas. Everyday moral dilemmas are short vignettes describing hypothetical everyday life situations. The vignettes require decisions between the fulfilment of a moral standard or social obligation towards another person versus a personal-oriented hedonistic behavior that would explicitly not cause serious bodily harm or legal consequences (Sommer et al., 2010). The given response alternatives are typically altruistic (e.g., helping an old woman who is in distress) versus egoistic (e.g., catching the waiting bus home; see Starcke et al., 2011 or Singer et al., 2017 for further examples).

However, to date, there is a paucity of validated everyday moral decision-making paradigms. To the best of our knowledge, only Starcke et al. (2011) and Rosen et al. (2015) reported validation studies of their everyday moral conflict scenarios as supplementary material to their manuscripts. Both Starcke et al. (2011) and Rosen et al. (2015) subdivided their items into high- versus low-emotional dilemmas, but many of their high-emotional dilemmas do not describe common everyday life situations (e.g., deciding about leaving your partner who is suicidal), which is a potential constraint of these paradigms. By contrast, the scenarios developed by Sommer and colleagues (2010) do rather reflect very typical daily life situations and proved useful in several experimental studies (Singer et al., 2017; Sommer et al., 2010, 2014). However, a more comprehensive validation of such everyday moral conflict situations would be highly desirable. Furthermore, all of the above-mentioned vignettes were only developed for use in between-subject design studies. Thus, to date, no parallelized item sets of everyday moral decision-making paradigms for use in within-subjects design studies are available (e.g., to be applied before and after an experimental manipulation like acute stress induction). Such material would enable researchers to control for potential effects due to interindividual variability in trait variables (e.g., personality traits; see Oda et al., 2014)

and, thus, help to achieve more statistical power (Charness et al., 2012). Moreover, the availability of parallelized item sets would be of high advantage as simple retesting with identical stimulus material is not advisable because memory effects could confound the findings.

Therefore, the main objective of the present studies was the development and validation of a new measure with two parallelized item sets assessing decision-making in everyday moral conflict situations. We operationalized everyday moral decision-making as the readiness to act altruistically, defined as the degree of following accepted moral values instead of fulfilling personal interests (see Sommer et al., 2010). Based on the MFT (Graham et al., 2011, 2013; Haidt & Graham, 2007) and the results of a recent ecological momentary assessment study (Hofmann et al., 2014), we developed the *Everyday Moral Conflict Situations (EMCS) Scale*, a new set of everyday moral dilemmas with the dimensions of care/harm, fairness/unfairness, loyalty/disloyalty, and honesty/dishonesty. We decided against including items referring to authority/subversion in order to avoid potential confounding influences of legal consequences (Sommer et al., 2010). Moreover, the dimension of sanctity/degradation was considered as inappropriate for our new scale because in our view, religious standards cannot be clearly assigned to altruistic versus egoistic behavior.

In addition to scale development and validation, we aimed at investigating if everyday moral decision-making depends on the social closeness of the protagonists. As revealed in a recent review, the relatedness of the participant to the story characters is an important experimental design parameter in moral dilemma research (Christensen & Gomila, 2012). Therefore, social closeness could be one further potential modulating factor of everyday moral decision-making (apart from the emotionality of a situation, which has already been examined in previous studies; see Rosen et al., 2015; Starcke et al., 2011). Consistently, several studies have shown that both abstract and everyday moral decision-making differ depending on the closeness of the relationship with the target person (e.g., Hofmann et al., 2018; Kossowska et al., 2016; Kurzban et al., 2012; Linke, 2012; Tassy et al., 2013; Zhan et al., 2018). With regard to everyday moral decision-making in laboratory settings, so far only Zhan et al. (2018) investigated the impact of the social closeness of the protagonists. They observed that participants made less altruistic decisions, took more time for their decisions, and rated the situations as emotionally more negative if the moral conflicts involved strangers versus friends and acquaintances. Presuming that altruistic decisions are some kind of generous acts, this finding is also in line with studies in social

psychology on social discounting, showing that generosity decreases hyperbolically with increasing social distance between the donor and the recipient (Jones & Rachlin, 2006; Margittai et al., 2015, 2018; Strombach et al., 2014, 2015; Takahashi, 2007). Thus, we experimentally varied the social closeness of the protagonists in our scenarios (socially close vs. socially distant) and hypothesized a lower percentage of altruistic decisions for scenarios involving socially distant protagonists as compared to stories involving socially close target persons.

Furthermore, several studies reported gender differences in abstract moral decision-making (e.g., Armstrong et al., 2018; Capraro & Sippel, 2017; Friesdorf et al., 2015; Fumagalli et al., 2010; Youssef et al., 2012). Historically, this line of research can be traced back to Gilligan (1982), who proposed that males differ from females in their approach to moral reasoning (justice focused vs. care focused; see Giammarco, 2016). Moreover, in related research disciplines, it has been demonstrated that females are more honest (Abeler et al., 2019; Capraro, 2018) and also more altruistic than males regarding generosity in the Dictator Game (see Rand et al., 2016 and Brañas-Garza et al., 2018 for two recent meta-analyses). We therefore hypothesized gender differences in everyday moral decision-making as well. Thus, we equally recruited males and females for participation in our surveys and counterbalanced our new vignettes in terms of the gender of the protagonists.

In sum, we conducted three independent validation surveys in order to (a) develop and evaluate the psychometric properties of our new 40-items EMCS Scale (20 items with socially close and 20 items with socially distant protagonists; Studies 1 and 2), (b) develop two parallelized item sets for future use in within-subjects design studies (Studies 1 and 3), and (c) evaluate the measurement properties of our new scale and its different subsets (Studies 1 and 3). In addition to scale development and validation, we examined two research questions regarding the impact of the social closeness of the protagonists as well as potential gender differences in everyday moral decision-making. As a supplementary analysis, we finally examined if the answers to items with socially close protagonists differed depending on the actual existence of the target persons (e.g., partner, brother, sister) in the real lives of the participants. The rationale behind this supplementary investigation was to rule out the possibility that the actual (non-)existence of the respective target persons in the lives of participants might be a confounding factor that influences everyday moral decision-making. It should be of note that this exploratory question had no direct empirical foundation yet.

4.3 Materials and methods

4.3.1 Participants

Altogether, N = 200 volunteers (100 males, 100 females, mainly students) aged 18-43 years (mean age ± SD = 22.55 ± 4.22 years), participated in three separate surveys, which took place at the University of Regensburg. The study protocols were approved by the local ethics committee of the University of Regensburg, Germany and performed in line with the Declaration of Helsinki. All participants gave written informed consent to their participation in the surveys and received a monetary compensation of 4 €, chocolate, or course credit, respectively.

4.3.2 Everyday moral conflict situations

Initially, a pool of 60 hypothetical everyday moral conflict situations with two forced-choice response alternatives (altruistic vs. egoistic) was created. For that purpose, we modified the 28 everyday moral dilemmas originally developed by Sommer et al. (2010), and developed 32 additional new scenarios with the contents of care/harm, fairness/unfairness, loyalty/disloyalty, and honesty/dishonesty (Graham et al., 2011, 2013; Hofmann et al., 2014). We aimed at creating only everyday moral conflict situations that could easily occur in daily life in order to achieve high external and ecological validity of our new measure.

All stories were constructed in first-person narrative and followed a three-sentence structure. We systematically varied the social closeness of the protagonists (two categories: socially close vs. socially distant), so that in half of the stories, the protagonist was a socially close person (e.g., father, partner, friend), and in the other half he or she was socially distant (e.g., cashier, barkeeper, stranger). Moreover, the conflict situations were counterbalanced in terms of the gender of the target persons (for examples see Table 1; the complete final item set is provided in the Appendix, Table 8). Using Research Randomizer® (Urbaniak & Plous, 2020), a fixed random presentation order of the 60 (Studies 1 and 2) or 40 (Study 3) scenarios was created before application. This order was then realized for all participants.

Table 1

Item examples of the EMCS Scale

Everyday moral conflict situation	**Response alternatives (altruistic vs. egoistic)**
Examples of scenarios with socially close protagonists	
It is the soccer world cup and the final match is on TV. I am a big soccer fan and very excited about the game. All of a sudden, a friend of mine who is not feeling well gives me a call and wants to meet up with me right now. What do I do?	I meet up with my friend. I watch the soccer game.
I have promised my partner to go to the company party with him/her. He/she has already signed both of us up. Now I realize that I would urgently need the time to prepare for an important exam. What do I do?	I keep my promise. I prepare for the exam.
I am at the airport, ready to leave on a long-planned holiday. While I am standing at the check-in counter, my mother gives me a call. She tells me that my father had a little accident and was admitted to the hospital. What do I do?	I cancel the holiday. I take the flight anyway.
Examples of scenarios with socially distant protagonists	
I want to sell my old car. I know that the car's radiator actually needs to be exchanged urgently. A man who does not notice the problem with the radiator offers to pay a good price in cash right away. What do I do?	I mention the defect. I keep quiet about the defect.
I am at the checkout of a supermarket and I want to pay for my groceries, which cost 8 €. I give a 10 € bill to the cashier. She accidentally gives me back 4 € instead of 2 €. What do I do?	I return the money. I keep the money.
I am running to catch a bus that is about to leave and that only runs once every hour. In front of me, several items drop out of the purse of a woman with two small children. Except for me, there is no one else around to help the woman. What do I do?	I help the woman. I run to the bus.

Note. Examples of the everyday moral conflict situations with corresponding response alternatives (altruistic vs. egoistic) subdivided into scenarios with socially close and socially distant protagonists. The order of the two corresponding response alternatives was counterbalanced in our surveys.

In all our surveys, the items were originally presented in German language. However, for the purpose of presentation in the manuscript, the items were in a first step translated into English language by four independent persons (including NS and BMK). In a second step, a consentaneous version was reached by discussion. In a third step, the obtained English translation was thoroughly reviewed by an English native speaker for colloquial speech and concordance with the German original (AP; see Acknowledgements).

4.3.3 Procedure

4.3.3.1 General procedure

Depending on study assignment, participants had to fill out one of four different paper-pencil questionnaires, which all took about 15-30 minutes to complete. The questionnaires consisted of 60 (Studies 1 and 2) or 40 (Study 3) everyday moral conflict situations. Before responding to the everyday moral conflict situations, all participants provided demographic information (age, gender, occupation). Prior to the tasks, participants were given a standardized written instruction that reminded them to put themselves into the positions of the protagonists described in the conflict stories and to answer all questions spontaneously.

4.3.3.2 Study 1

In Study 1, the complete set of 60 stories was given to $n = 50$ participants (25 males, 25 females; aged 23.38 ± 4.47 years). After every conflict situation, the question "What do I do?" as well as the altruistic and the egoistic response alternatives were presented in a counterbalanced order. For every item, participants first had to indicate their decision. Subsequently, they were asked to rate the social closeness of the protagonist on a 7-point Likert scale ranging from 1 = *very socially distant* to 7 = *very socially close* and the similarity to reality of the presented situation on a 7-point Likert scale ranging from 1 = *very far from reality* to 7 = *very close to reality*. For the purpose of analysis, altruistic decisions were coded as "1" and egoistic decisions as "0"; then the percentage of altruistic decisions was calculated. The ratings of social closeness and similarity to reality were each aggregated to calculate their arithmetic means.

In order to examine if the answers to the items with socially close protagonists differed depending on the actual existence of the target persons in the real lives of the participants, subjects additionally had to indicate at the end of the survey if they currently were in a

partnership, and if they had a father, mother, brother, sister, uncle, aunt, grandfather, or grandmother who they knew or had known in the past.

4.3.3.3 Study 2

In Study 2, n = 50 participants (25 males, 25 females; aged 24.08 ± 4.44 years) were confronted with the same 60 everyday moral conflict situations as in Study 1. However, differing from Study 1, where we assessed the item difficulties of the everyday moral conflict scenarios via binary decisions between given altruistic versus egoistic responses, the main aim of Study 2 was to validate the *a priori* defined altruistic and egoistic response alternatives of the stories. Therefore, in Study 2, we replaced the answer options at the end of the stories in two different ways. First, every story was finished by a statement that indicated altruistic behavior of the acting person (e.g., "My decision: I help the woman") and second, each story was ended by a description of the actor behaving egoistically (e.g., "My decision: I take the bus"). We then created two different versions of the survey, each with 30 given altruistic and 30 given egoistic responses, and randomly assigned n = 25 participants (12 males, 13 females) to one version of the questionnaire (Study 2A) and n = 25 participants (13 males, 12 females) to the other version (Study 2B). In both subversions, we asked the participants to judge the given responses on a 7-point Likert scale ranging from 1 = *egoistic* to 7 = *altruistic*. Altruistic and egoistic response options were presented in a counterbalanced order. Similar to Study 1, participants subsequently had to rate the social closeness of the protagonists on a 7-point Likert scale ranging from 1 = *very socially distant* to 7 = *very socially close* as well as the similarity to reality of the presented situations on a 7-point Likert scale ranging from 1 = *very far from reality* to 7 = *very close to reality*. Furthermore, at the end of the survey, participants also had to indicate if they currently were in a partnership, and if they had a father, mother, brother, sister, uncle, aunt, grandfather, or grandmother who they knew or had known in the past.

For the purpose of analysis, the ratings of the altruistic and egoistic responses, social closeness, and similarity to reality were each aggregated to calculate their arithmetic means. As the ratings for social closeness and similarity to reality were part of the Studies 1 and 2, we merged these data resulting in a total sample of n = 100 participants (50 males, 50 females; aged 23.73 ± 4.45 years) for respective analyses.

4.3.3.4 Study 3

In Study 3, n = 100 participants (50 males, 50 females; aged 21.36 ± 3.64 years) were confronted with 40 everyday moral conflict situations (20 items with socially close and 20 items with socially distant protagonists), which were selected based on the results of Studies 1 and 2. Since one aim of Study 3 was the development of two parallelized item sets (set A and B), which could then be used in repeated-measurement design studies, participants were only confronted with the question "What do I do?" and the two possible response alternatives (altruistic vs. egoistic) in the fixed random order.

For the purpose of analysis, altruistic decisions were coded as "1" and egoistic decisions as "0"; then the percentage of altruistic decisions was calculated. As the type of decision (altruistic vs. egoistic) was assessed in Studies 1 and 3, we also merged the data of these surveys. Thus, we developed the two parallelized item sets for future use in within-subjects design studies and assessed the test and measurement properties of our new scale based on a total sample of n = 150 participants (75 males, 75 females; aged 22.04 ± 4.04 years).

4.3.4 Statistical analyses

Statistical analyses were performed using the IBM® SPSS® (version 25.0) statistical software package and R® (version 3.5.1; R Core Team, 2018) with the packages psych® (Revelle, 2018), eRm® (Mair et al., 2018), foreign® (R Core Team, 2017), and psychometric® (Fletcher, 2010). The significance level was set at $\alpha = 0.05$, all testing was two-tailed. Results in the text are given as mean ± standard deviation ($M \pm SD$). For all between- and within-group comparisons, Cohen's d is reported as a measure of effect size.

The results section is structured into two main parts. In the first main part, we present analyses concerning the development and validation of our new 40-items EMCS Scale as well as the development of two parallelized 20-item sets (each ten scenarios with socially close and socially distant protagonists) for future use in within-subjects design studies. For the two parallelized sets A and B, we used Wilks L_{mvc} tests to demonstrate parallelism (Wilks, 1946). The procedure by Wilks tests the hypothesis that the means are equal, the variances are equal, and the covariances are equal. The test statistic is based on the weighted differences of the subsample means with the grand mean and the ratio of subsample and complete sample (co)variances, which are shown to be chi²-distributed when the data meets hypothesis (see Wilks, 1946, formula 1.4). Moreover, we report the

measurement qualities based on Rasch model analyses and classical test theory fit indices of the complete 40-items EMCS Scale and its two subsets A and B.

The second main part presents first content-related analyses regarding our newly developed EMCS Scale. We used Welch-tests (Rasch et al., 2009) to examine the effects of the social closeness of the protagonists and the gender of our participants on everyday moral decision-making. Furthermore, we explored possible effects of the actual existence of a socially close protagonist in the lives of the participants on response tendencies in everyday moral conflict situations. We also ran Welch-tests to analyze between-group mean differences in the percentage of altruistic decisions, social closeness ratings, and similarity to reality ratings.

4.4 Results

4.4.1 Development and scale characteristics of the EMCS Scale

4.4.1.1 Scale development

The new EMCS Scale was developed in a six-step procedure. Overall, we selected 40 out of initially 60 items (20 items with socially close and 20 items with socially distant protagonists) based on four criteria: (1) preferable mean rate of altruistic decisions, (2) clear representation of altruistic and egoistic response classes, (3) unambiguousness of social closeness classifications, and (4) high similarity to reality ratings.

In a first step, we calculated the item difficulties of all 60 items. This analysis was based on the data of Study 1. In order to avoid ceiling or floor effects as much as possible, we excluded 16 items (ten items with socially close and six items with socially distant target persons) due to a relatively high (≥ 0.8) or low (≤ 0.2) percentage of altruistic decisions.

In a second step, we validated the *a priori* defined behavioral response classifications. We therefore analyzed if altruistic decisions were clearly perceived as altruistic and egoistic decisions as egoistic. This analysis was based on the data of Study 2. All of the 44 remaining items provided acceptable mean altruistic and egoistic response ratings (i.e., for altruistic responses above and for egoistic responses below the average scale value of 4).

In a third step, we checked the *a priori* defined social closeness classifications, that is, if socially close protagonists were clearly perceived as socially close and socially distant target persons as socially distant. This analysis was based on the data of Studies 1 and 2.

All items showed social closeness ratings in the expected direction: The means of items with socially close protagonists were above the average scale value of 4, and the means of items with socially distant protagonists below 4.

In a fourth step, we checked the similarity of the stories to everyday life situations. This analysis was based on the data of Studies 1 and 2. One item with a socially distant protagonist showed a somewhat lowered mean similarity to reality rating of 3.43 and was therefore excluded. The similarity to reality ratings of the remaining items reached at least a mean rating above 3.5 (range: 3.57 to 5.74).

In a fifth step, we excluded three further items with socially distant protagonists that showed the least favorable combination of the four aforementioned criteria in order to reach a final 40-items set with 20 socially close and 20 socially distant protagonists.

In a sixth step, the final 40 items were adjusted in terms of the gender of the protagonists. For that purpose, the gender of eight target persons (five socially close and three socially distant) was changed to achieve an equal gender distribution.

4.4.1.2 Scale characteristics

Regarding our final 40-items EMCS Scale, participants chose the altruistic response alternative in an average of 59.70% (± 14.59, with 0.40% missings) of the everyday moral conflict situations, which was significantly higher than 50% ($t(149) = 8.15$, $p < 0.001$). The item statistics for all final 40 items of the EMCS Scale on single item basis (subdivided into items with socially close and socially distant protagonists) can be found in the Appendix, Tables 8 and 9.

4.4.2 Development of two parallelized item sets for use in within-subjects design studies

In order to develop two parallelized item sets for future use in within-subjects design studies, we took the complete 40-items EMCS Scale and generated item pairs based on social closeness, gender of the protagonists, and story content in a first step. In a second step, the 20 item pairs were split into two different item sets (each ten scenarios with socially close and socially distant protagonists). In a third step, the allocation of the items was pairwise interchanged until we achieved two parallelized item sets regarding item difficulty (percentage of altruistic decisions) and their properties (social closeness ratings and similarity to reality ratings).

In the final version, the items 2, 5, 7, 8, 9, 10, 11, 12, 16, 20 (socially close protagonists) and 24, 26, 27, 30, 31, 35, 37, 38, 39, 40 (socially distant protagonists) were assigned to set A; the items 1, 3, 4, 6, 13, 14, 15, 17, 18, 19 (socially close protagonists) and 21, 22, 23, 25, 28, 29, 32, 33, 34, 36 (socially distant protagonists) became part of set B (see last column in the Appendix, Table 8).

Regarding the percentage of altruistic decisions, the comparison of the means and standard deviations of the sets A and B showed a very close to one value of $L_{mvc} = 0.997$ ($p = 0.78$), indicating that there were no significant differences between set A (59.38% ± 16.47) and set B (60.03% ± 15.95). The Spearman-Brown corrected split-half reliability was 0.77. Moreover, the same results arose for the comparison of the sets A and B including only the items with socially close protagonists (set A 60.30% ± 18.21, set B 60.83% ± 17.79; $L_{mvc} = 0.999$, $p = 0.90$) or the items with socially distant protagonists (set A 58.51% ± 20.66, set B 59.23% ± 20.98; $L_{mvc} = 0.998$, $p = 0.88$), respectively. The mean social closeness ratings for the items with socially close protagonists (set A 5.84 ± 0.49, set B 5.85 ± 0.52; $d = -0.002$) and for the items with socially distant protagonists (set A 1.76 ± 0.80, set B 1.78 ± 0.75; $d = -0.03$) also hardly differed between the two constructed item sets. Moreover, there was no relevant difference between the mean similarity to reality ratings in set A (4.67 ± 0.89) and set B (4.66 ± 0.85; $d = 0.004$).

4.4.3 Test and measurement properties of the EMCS Scale and its two item sets A and B

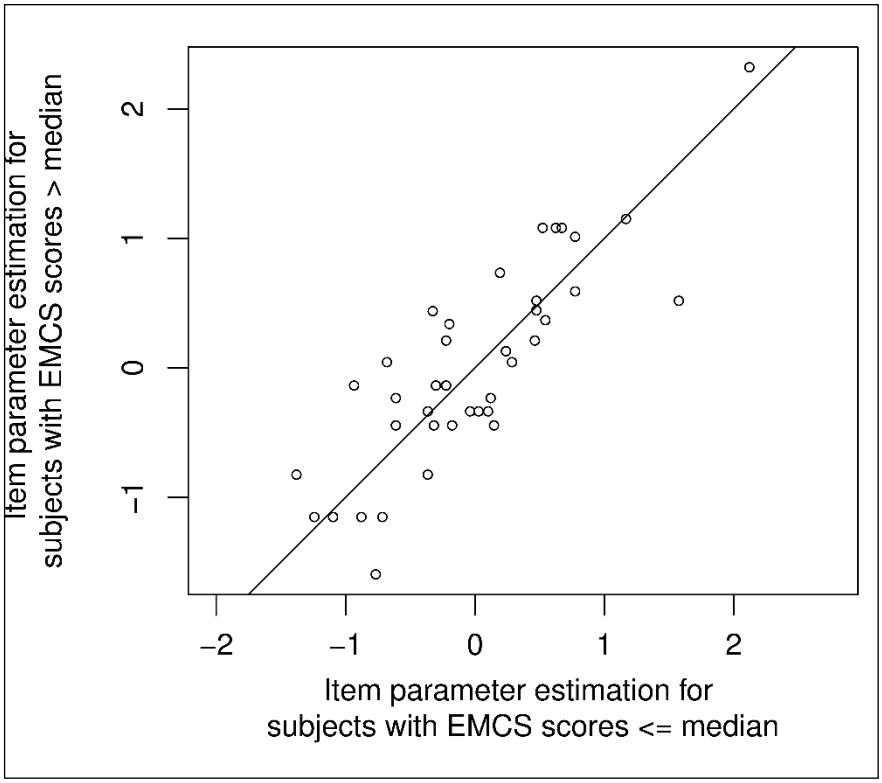
We tested the measurement qualities of our new scale by fitting a one-parameter logistic Rasch model (1 PL IRT; e.g., Embretson & Reise, 2000; von Davier, 2016) for the complete EMCS Scale and its two subsets A and B. The model fit was tested with the Andersen LR-test (Andersen, 1973) based on a median split and a graphical model check. We used the defaults of the eRm packages reducing the R code to: eRm::LRtest(eRm::(data[,items])). For testing the unidimensionality of the EMCS Scale and the appropriateness of the fragmentation into the two item sets A and B, we used the Martin-Loef LR-test (Christensen et al., 2002). With the Martin-Loef LR-test, the likelihood of the unidimensionality assumption is compared with the likelihood of two or more (in this study up to four) dimensions. A unidimensional interpretation of the measure is more appropriate, the lesser the enhancement of a more specific structure (multiple dimensions; R code: eRm::MLoef(eRM::RM(data[,items])). Thereby, the complete 40-items set was in a first step split into two parts based on a median split

regarding the items' raw scores. In a second step, we checked the fit for dividing the items into the sets A and B. Moreover, we split the items into four parts depending on their belonging to set A or B and the social closeness of the protagonists (set A socially close, set A socially distant, set B socially close, set B socially distant).

The Andersen test indicated a proper fit for the complete EMCS Scale ($LR(39) = 45.49$, $p = 0.22$), showing that there was one latent trait variable underlying our measures. Additionally, the graphical model test did not give hints for items, which fell out of line (see Figure 6). The item furthest away from the diagonal was item 24. However, this item still had an adequate mean-square outlier-sensitive fit of 0.82 (Linacre, 2002), and it did also not show other striking item characteristics (see the Appendix, Table 9 for all item statistics and results of Rasch model analyses on single item basis).

Figure 6

Graphical model check



Note. Graphical model check plotting the item values estimated for participants with *EMCS Scores* less or equal than the median against the item values estimated for participants with *EMCS Scores* above the median. The results indicated a proper fit for all 40 items.

There were neither indications against unidimensionality nor the valid fragmentation into the subsets A and B nor the further subdivision into socially close or socially distant protagonists (10 items each) in subsets A versus B (see Table 2). Moreover, the classical test theory fit index Cronbach's alpha indicated a reasonable internal consistency for the total scale score as well as acceptable values for the subsets A and B. However, the additional split of set A and B into the 10-items parts depending on the social closeness of the protagonists showed rather low Cronbach's alpha values, speaking against an uncoupled use of only these 10-items parts.

Table 2

Results of Martin-Loef LR-tests and classical test theory fit indices (Cronbach's alpha) for the complete EMCS Scale, its two item sets A and B, and the additional split of the item sets A and B into each 10-items parts with socially close and socially distant protagonists

	LR-value	**df**	***p***	**Cronbach's alpha**
EMCS Scale (40 items)	166.69	398	1	0.84
Set A, set B (each 20 items)	141.40	399	1	0.60, 0.73
Set A socially close, set A socially distant, set B socially close, set B socially distant (each 10 items)	838.74	14597	1	0.37, 0.65, 0.58, 0.55

The descriptives of the inter-item correlations (n = 780, M = 0.11, SD = 0.15, Min = -0.34, Max = 0.75, skewness = 0.51, kurtosis = 0.99; for all details see the Appendix, Table 10) and the item discriminations based on the complete EMCS Scale (n = 40, M = 0.23, SD = 0.08, Min = 0.09, Max = 0.43, skewness = 0.29, kurtosis = -0.61; for all details see the Appendix, Table 9) indicated that the bivariate linearity of the items was not as strong as normally expected for dichotomous performance tests (Lord, 1980). This might explain the somewhat lower values of Cronbach's alpha, although the assumptions of the Rasch model were fulfilled.

4.4.4 Effects of social closeness and gender on everyday moral decision-making

Concerning the social closeness of the protagonists, there were no significant differences in the percentage of altruistic decisions (Studies 1 and 3) and the ratings of altruistic responses (Study 2) between the items with socially close protagonists and the items with socially distant protagonists (see Table 3). However, there was a significant difference in the ratings of social closeness (Studies 1 and 2) in the expected direction with a very large effect size (d = 7.49), which additionally confirmed our *a priori* defined social closeness classifications.

Table 3

Means, standard deviations, and between-group comparisons regarding the percentage of altruistic decisions, altruistic and egoistic response ratings, social closeness ratings, and similarity to reality ratings separately for the 20 items with socially close and socially distant protagonists

			Socially close protagonists (20 items)		**Socially distant protagonists (20 items)**				
Variable	***n***	**Range**	***M***	***SD***	***M***	***SD***	***t***	***p***	***d***
Percentage of altruistic decisions[1]	150	0-100	60.58	16.94	58.85	12.56	$t(35.04) = 0.37$	0.72	0.12
Altruistic response ratings[2]	50	1-7	5.70	0.30	5.83	0.46	$t(32.93) = -1.11$	0.27	0.36
Egoistic response ratings[2]	50	1-7	2.54	0.36	2.30	0.38	$t(37.89) = 2.11$	0.04	0.69
Social closeness[3]	100	1-7	5.85	0.77	1.77	0.19	$t(21.39) = 23.10$	<0.001	7.49
Similarity to reality[3]	100	1-7	4.39	0.46	4.94	0.51	$t(37.63) = -3.57$	0.001	1.16

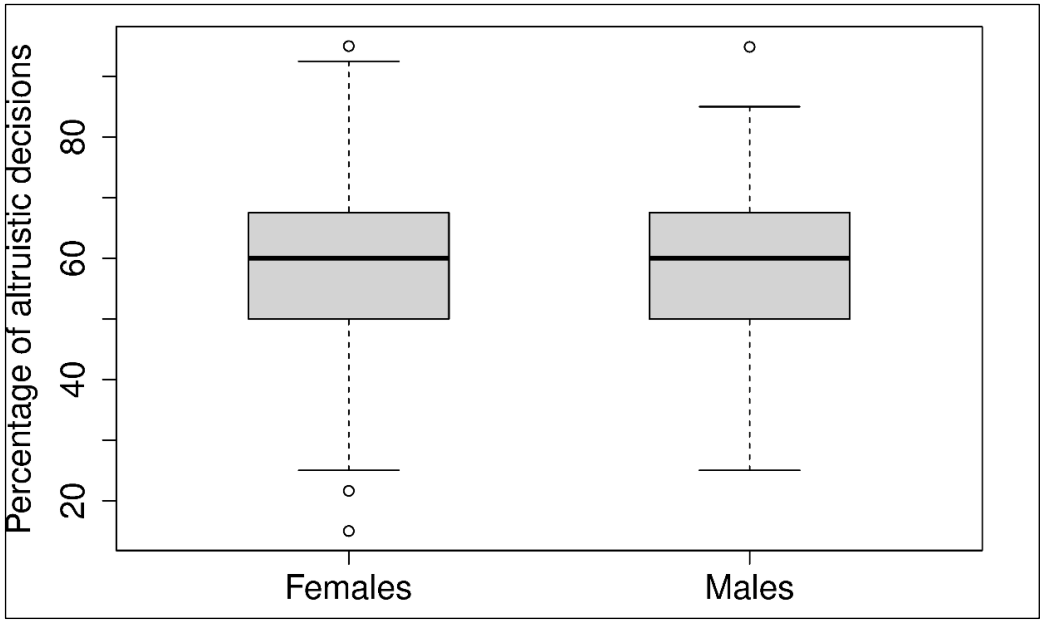
Note. [1] Based on the available data from Studies 1 and 3.
[2] Based on the available data from Study 2.
[3] Based on the available data from Studies 1 and 2.

Additionally, the items with socially close protagonists differed from the items with socially distant protagonists regarding the ratings of egoistic responses (Study 2) and similarity to reality ratings (Studies 1 and 2; see Table 3). Egoistic responses of items with socially distant protagonists were rated as significantly more egoistic than egoistic responses of scenarios with socially close protagonists, indicating that fulfilling a personal desire towards strangers was perceived as slightly more egoistic than towards family and friends. Furthermore, the similarity to reality ratings were significantly higher for the items with socially distant protagonists, suggesting that our participants were more likely to encounter everyday moral conflict situations with strangers than with family or friends.

With regard to potential gender effects, there were no significant differences in the percentage of altruistic decisions between females (59.75% ± 15.53) and males (59.66% ± 13.68; $t(145.67) = 0.04$, $p = 0.97$, $d = 0.01$; see Figure 7), indicating that everyday moral decision-making did not differ depending on the gender of our participants.

Figure 7

Boxplot for the percentage of altruistic decisions for females (n = 75) versus males (n = 75)



4.4.5 Supplementary analysis: Influence of the actual existence of socially close protagonists in the lives of participants

As a supplementary analysis, we finally investigated the impact of the actual existence of a respective socially close protagonist (i.e., partner, father, mother, brother, sister, uncle, aunt, grandfather, grandmother) in the lives of the participants on the percentage of altruistic decisions, social closeness ratings, and similarity to reality ratings. The performed analyses showed that there were no significant between-group differences in the percentage of altruistic decisions, social closeness ratings, or similarity to reality ratings (see Table 4), indicating that the actual existence of a respective socially close protagonist in the lives of participants had no impact on altruistic versus egoistic decision-making, social closeness ratings, or similarity to reality ratings in everyday moral conflict situations. It should be noticed that for the father and mother item, we were unable to perform between-group comparisons because all participants reported to have a father and mother who they knew or had known in the past. Moreover, for the uncle, aunt, grandfather, and grandmother item, we refrained from computing these analyses due to the partially very small and unequal sample sizes.

Table 4

Sample sizes and between-group comparisons (if applicable) regarding the impact of the actual existence of socially close protagonists in the lives of participants on the percentage of altruistic decisions, social closeness ratings, and similarity to reality ratings

Socially close protag-onist	Study	Actual existence in the lives of participants		Percentage of altruistic decisions[1]	Social closeness[2]	Similarity to reality[2]
		Yes	No			
Partner	1	25	25	$t(47.98) = 1.71$, $p = 0.09$, $d = 0.48$	$t(86.92) = 0.23$, $p = 0.82$, $d = 0.05$	$t(97.76) = -0.14$, $p = 0.89$, $d = -0.03$
	2	29	21			
Father	1	50	0	-	-	-
	2	50	0			
Mother	1	50	0	-	-	-
	2	50	0			
Brother	1	31	19	$t(35.52) = 0.81$, $p = 0.43$, $d = 0.26$	$t(57.17) = 1.05$, $p = 0.30$, $d = 0.24$	$t(86.36) = -0.85$, $p = 0.40$, $d = -0.17$
	2	30	20			
Sister	1	31	19	$t(40.00) = -0.82$, $p = 0.42$, $d = -0.22$	$t(97.16) = -0.43$, $p = 0.67$, $d = -0.09$	$t(90.47) = 0.75$, $p = 0.46$, $d = 0.15$
	2	27	23			
Uncle	1	48	2	-	-	-
	2	43	7			
Aunt	1	48	2	-	-	-
	2	46	4			
Grand-father	1	48	2	-	-	-
	2	46	4			
Grand-mother	1	50	0	-	-	-
	2	49	1			

Note. [1] Based on the available data from Study 1.
[2] Based on the available data from Studies 1 and 2.

4.5 Discussion

Despite the growing field of moral psychology (Greene, 2015), there is still a paucity of validated everyday moral decision-making paradigms for use in laboratory settings. Therefore, we conducted three independent studies to develop and validate a new measure to assess decision-making in everyday moral conflict situations. To sum up, our new EMCS Scale, which can be applied both as paper-pencil questionnaire and as computer task, comprises 40 everyday moral conflict scenarios with high similarity to everyday life situations. Concerning the content of our scenarios, we got inspired by the MFT (Graham et al., 2011, 2013; Haidt & Graham, 2007) as well as the empirical results of a large ecological momentary assessment study (Hofmann et al., 2014). Instead of varying the emotionality of the stories as done in previous research (e.g., high vs. low emotionality; Rosen et al., 2015; Starcke et al., 2011), we varied the social closeness of the protagonists (socially close vs. socially distant) in order to investigate the impact of the relatedness of the participants to the story characters as a further potential modulating factor of everyday moral decision-making (Christensen & Gomila, 2012). Additionally, we counterbalanced our new measure in terms of the gender of the protagonists and equally recruited males and females for participation in our surveys to explore potential gender differences. For the first time in everyday moral dilemma research, we additionally developed and validated two parallelized item sets for future use in within-subjects design studies. This offers the opportunity to control for potential effects of interindividual differences in trait variables (e.g., personality; see Oda et al., 2014).

During the process of scale development, we selected 40 out of 60 items with preferable mean rates of altruistic decisions in order to avoid ceiling or floor effects. This is in contrast to earlier studies (e.g., Rosen et al., 2015), where especially high-emotional dilemmas came along with a very high percentage of altruistic decisions (up to 96%). Moreover, we only selected items with a clear representation of altruistic and egoistic response classes, unambiguous social closeness classifications, and high similarity to reality ratings. Regarding our final 40-items set, all items provided satisfactory psychometric parameters (percentage of altruistic decisions between 17% and 83%, altruistic response ratings above and egoistic response ratings below the mean scale value of 4, social closeness ratings for items with socially close protagonists above and for items with socially distant protagonists below the mean scale value of 4, and relatively high similarity to reality ratings; see Table 3 and the Appendix, Table 8). Additionally, using

Wilks L_{mvc} tests (Wilks, 1946), we successfully developed two parallelized 20-items sets A and B.

With regard to the test and measurement properties, our results showed that both the EMCS Scale and its two subsets A and B fitted the Rasch model, which implied that there was one underlying latent trait variable. Furthermore, the classical test theory fit index Cronbach's alpha indicated reasonable internal consistencies for the total EMCS Scale as well as the two item sets A and B ($0.60 \leq \alpha \geq 0.84$). Even the fragmentation into four parts still resulted in a sufficient estimation by the Rasch model, although Cronbach's alpha results spoke against an uncoupled use of only these 10-items parts. Thus, both the complete EMCS Scale and its two parallelized subsets A and B can be utilized as valid measures for decision-making in everyday moral conflict situations.

In our data, we did not observe that the percentage of altruistic decisions differed depending on the social closeness of the protagonists. This is in contrast to the results of Zhan et al. (2018), the only study so far that investigated the impact of social closeness on everyday moral decision-making. Contrary to Zhan et al. (2018), we only observed a slightly, but not significantly lower percentage of altruistic decisions for the items with socially distant protagonists than for the items with socially close protagonists, and this difference only reached a very small effect size (d = 0.12). Additionally, Rasch model analyses indicated that there was one underlying latent trait variable, which further speaks against a significant impact of social closeness on everyday moral decision-making in our surveys. This divergent finding could possibly be explained by methodological differences. Since Zhan et al. (2018) did not provide concrete examples of their stimulus material in their manuscript, it remains unclear whether their vignettes represented everyday moral conflict situations. Furthermore, our data also appear to be in contrast to several abstract moral decision-making studies, which showed that social closeness is an important experimental design parameter in moral dilemma research (Kossowska et al., 2016; Kurzban et al., 2012; Linke, 2012; Tassy et al., 2013; see also Christensen & Gomila, 2012). One potential explanation could be that abstract moral dilemmas describe dead-or-alive situations, whereas the consequences of the response alternatives in our everyday moral dilemmas are less grave. Therefore, one might be more willing to accept the costs of an egoistic response option not only for socially distant others, but also to some degree for socially close persons.

Somewhat unexpectedly, we found that the egoistic responses of items with socially distant protagonists were rated as significantly more egoistic than the egoistic responses

of items with socially close protagonists. We also observed this group difference for the altruistic response ratings, at least on a descriptive level and with a medium effect size (d = 0.36; i.e., altruistic responses of items with socially distant protagonists were rated as slightly, but not significantly more altruistic than altruistic responses of items with socially close protagonists). These interesting results could be potentially traced back to the fact that the similarity to reality ratings were also significantly higher for the scenarios with socially distant protagonists, indicating that our participants are more likely to encounter everyday moral conflict situations with strangers than with family or friends. This is in line with the results of a recent ecological momentary assessment study about morality in everyday life, where the most frequent type of victim categories were "no concrete person/other entity" or "stranger" (Hofmann et al., 2018). Taken together, these findings combined with our data raise the hypothesis that participants might be better able to evaluate more frequently experienced everyday moral conflict situations, namely conflicts with socially distant than with socially close others, and consequently are more confident to choose the more extreme response categories.

As a supplementary analysis, we further examined if the responses to the items with socially close protagonists differed depending on the actual existence of the respective target persons in the real lives of the participants. The rationale behind this investigation was to rule out the possibility that the actual existence, respectively non-existence, of the socially close protagonists in the lives of participants might be a potential confounding factor that influences decision-making in everyday moral conflict situations. This appeared not to be the case, since we did not observe any between-group differences in the percentage of altruistic decisions, social closeness ratings, and similarity to reality ratings (as far as the analyses were feasible; for details see the results section). Thus, our results provide evidence that the EMCS Scale can be broadly applied independently of the actual existence of the respective persons in participants' lives.

Interestingly, we also did not observe gender differences in our surveys, which, on the one hand, is not uncommon for hypothetical moral dilemmas (Giammarco, 2016), but, on the other hand, is in sharp contrast to early moral reasoning research (Gilligan, 1982) and current abstract moral decision-making studies (Armstrong et al., 2018; Capraro & Sippel, 2017; Friesdorf et al., 2015; Fumagalli et al., 2010; Youssef et al., 2012). This inconsistent result could potentially be explained by the fact that our new EMCS Scale measures altruistic and egoistic response tendencies, which are behavioral measures that rather reflect outcomes of morality, but not moral attitudes itself (Giammarco, 2016).

Altogether, in combination with the social closeness results, our data therefore point to the idea that everyday moral decision-making with altruistic versus egoistic response options seems to be quite a different construct than abstract moral decision-making with utilitarian versus deontological response alternatives.

One obvious limitation of our new measurement tool is that the EMCS Scale, which was developed for use in laboratory settings, cannot reach external and ecological validity as high as ecological momentary assessment (e.g., Hofmann et al., 2014, 2018). However, the similarity to reality ratings achieved in our surveys showed that all selected stories may at least potentially occur in everyday life, thus indicating relatively high ecological validity of our new scale. Moreover, our participants chose the altruistic response alternatives in almost 60% of all cases, which is in accordance with the fact that a remarkable facet of human behavior is that people often decide to help others even when it comes at personal cost, and when there is no expectation of receiving any material returns (Rilling & Sanfey, 2011). It should also be considered that research regarding morality in everyday life is still in its infancies in many application fields (e.g., regarding the impact of stress and stress hormones on everyday moral decision-making; see Singer et al., 2017). Hence, in a first step, controlled laboratory studies with measures like the EMCS Scale are important to achieve higher internal validity.

Furthermore, we did not explicitly control for socially desirable responding in our surveys. Nevertheless, we tried to keep the potential impact of social desirability as low as possible by ensuring strict anonymity to all our participants. Moreover, we excluded all items with extremely high percentages of altruistic decisions. For the remaining items, we observed statistical variance both within participants and across items, which probably speaks against highly socially desirable responding.

Additionally, it has to be acknowledged that we did not achieve an equal distribution of the four moral dimensions (namely care/harm, fairness/unfairness, loyalty/disloyalty, and honesty/dishonesty) as introduced by MFT. However, to date, it is still a question of debate whether morality is a unified construct or can be deconstructed into several factors (Greene, 2015; Sinnott-Armstrong, 2008). Our data seem to provide support for the assumption of unidimensionality (one latent trait variable). For future studies, a much larger data base would be necessary to perform a further in-depth analysis of the potentially underlying factoral structure. In this regard, we would expect a bifactor structure (i.e., loadings on both a global and several specific factors), since in the EMCS Scale, a clear distinction of different moral dimensions (as for example realized by

Clifford et al., 2015) had to stand back from the aim of high criterion validity for the everyday life situations. Indeed, explorative factor analysis of the present data suggested at least six factors, thus underscoring the idea that there might be a somewhat more complicated underlying measurement structure. But, as Reise et al. (2000) summarized, there would be a need of much bigger sample sizes to perform such analyses. Moreover, for future research, it would be interesting to examine gender differences in the response behavior to the EMCS Scale in more detail (e.g., regarding the impact of the gender of the participants depending on the gender of the protagonists; see Ceccato et al., 2018 or Oda et al., 2013 for examples in other research areas). Additionally, it would be conceivable that social closeness as an important experimental design parameter in everyday moral decision-making may only emerge in combination with certain experimental manipulations, like the induction of acute psychosocial stress (e.g., Margittai et al., 2015; for a potential theoretical explanation see Taylor, 2006). Therefore, we highly encourage researchers to use the EMCS Scale to explore the impact of social closeness on everyday moral decision-making in combination with different experimental paradigms and tasks. More generally, future studies should also try to develop measures for the investigation of other types of moral conflicts in everyday life situations (e.g., conflicts between different duties or between sets of apparently incommensurable values; see Christensen & Gomila, 2012), since the EMCS Scale covers only one particular sort of moral conflicts, namely accepted moral values versus self-interests.

In conclusion, our new EMCS Scale appears to be a promising new measurement tool for the investigation of the manifold determinants of decision-making in everyday moral conflict situations. In particular, we developed and validated a measure that is composed of two parallelized item sets A and B. Therefore, it can be utilized both in between- and within-subjects design studies. In between-subjects design studies, the EMCS Scale offers the opportunity to realize more than one point of measurement (e.g., at different time points before and after an experimental/control manipulation). In within-subjects design studies, the parallelized item sets provide the advantage of controlling for interindividual variability in trait variables affecting everyday moral decision-making. Altogether, the EMCS Scale may prove useful in many areas of application, as for instance in individual differences research, social psychology, psychobiological stress research, clinical psychology, or occupational and organizational psychology.

4.6 Acknowledgements

We thank April Points, Katharina Spannruft, and Marina Weber for their assistance with the translation of the everyday moral conflict situations.

CHAPTER 5

Study II

Singer N., Binapfl, J., Sommer, M., Wüst, S., & Kudielka, B. M. (2020). Everyday moral decision-making after acute stress exposure: Do social closeness and timing matter? *Stress: The International Journal on the Biology of Stress*. https://doi.org/10.1080/10253890.2020.1846029[2]

Nina Singer and Brigitte M. Kudielka developed the study concept and study design. Nina Singer and Julia Binapfl performed data collection and analysis. Nina Singer drafted the manuscript, and Julia Binapfl, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

[2] The right to include this article in a dissertation that is not to be published commercially was given by the publisher, provided that prior publication in the journal is acknowledged.

5 STUDY II: EVERYDAY MORAL DECISION-MAKING AFTER ACUTE STRESS EXPOSURE: DO SOCIAL CLOSENESS AND TIMING MATTER?

5.1 Abstract

There is increasing empirical evidence that social distance and timing affect prosocial behavior after acute stress exposure. The present study focused on everyday moral decision-making after acute psychosocial stress and how it is influenced by effects of social closeness and timing. We exposed 40 young healthy men to the Trier Social Stress Test (TSST, $n = 20$) or its non-stressful placebo version (PTSST, $n = 20$). Moral decision-making was assessed early (+10 until +30 min) and late (+75 until +95 min) after (P)TSST exposure by the *Everyday Moral Conflict Situations (EMCS) Scale*. The EMCS Scale requests altruistic versus egoistic responses to everyday moral conflict situations with varying closeness of target persons. Results revealed significantly higher total percentages of altruistic decisions in the stress than in the control condition and for scenarios involving socially close (e.g., mother) versus socially distant (e.g., stranger) protagonists, while the main effect of timing was nonsignificant. Only secondary analyses showed increased altruistic decision-making after acute stress exposure toward socially close but not toward distant protagonists at the early but not at the late point of measurement. Moreover, psychological stress responses and personality traits were significantly associated with *EMCS Scores*. Positive correlations between cortisol levels and altruistic decision-making were descriptively observable, but did not reach statistical significance. In sum, our findings suggest increased altruistic decision-making toward socially close compared to socially distant protagonists and provide further evidence that acute stress influences decision-making in everyday moral conflict scenarios in a prosocial manner.

5.2 Introduction

There is growing evidence that both stress and stress-related cortisol increases affect moral decision-making (e.g., Kossowska et al., 2016; Li et al., 2019; Singer et al., 2017; Starcke et al., 2011; Youssef et al., 2012). Most of these studies have used abstract moral dilemmas that require reasoning about moral dead-or-alive situations, but this traditional approach lacks external and ecological validity (Bauman et al., 2014). To remedy this shortcoming, Starcke et al. (2011) and we (Singer et al., 2017) utilized everyday moral conflict scenarios with altruistic versus egoistic response alternatives. Starcke et al. (2011) did not find differences in judgments between experimentally stressed versus non-stressed participants directly after exposure but they observed an association between cortisol increases and egoistic decision-making. In our own study, we found increased altruistic decision-making at +10 until +30 min after acute stress exposure as well as positive associations between cortisol levels and altruistic decisions in a male sample (Singer et al., 2017). These partially divergent results may be explained by methodological differences (e.g., use of a mixed-sex sample without controlling for menstrual cycle phase by Starcke et al., 2011).

Moreover, with respect to social decision-making, it has been shown that acute stress can promote either prosocial or antisocial behavior depending on time elapsed between stress and decision-making. Margittai et al. (2015) found increased generosity in men tested 20 min after stressor onset compared to men tested 90 min after stressor onset or non-stressed men. By contrast, Vinkers et al. (2013) observed that men acted more consistent with their self-interests at +75 min after stress exposure than directly afterwards. As an explanation for such time-dependent differences, the temporal course of the endocrinological stress response with early catecholaminergic as well as non-genomic corticosteroid and later genomic corticosteroid effects is discussed. On a neural level, acute stress prompts a temporary resource reallocation to a salience network with limbic and subcortical structures at the cost of executive control (Hermans et al., 2014). Several authors (e.g., Taylor, 2006) postulate prosocial behavior as “default response” that might be observable early after acute stress (dominance of salience network < 1 h after stressor onset). By contrast, the later aftermath of stress (> 1 h) is associated with increased executive control, presumably eliminating prosociality. To the best of our knowledge, time-dependent effects of acute stress on everyday moral decision-making have not been investigated so far.

Moreover, Margittai et al. (2015) examined the impact of social closeness of the target persons and observed that acute stress increased generosity at the early time point only toward close but not toward distant others. For moral decision-making, the relatedness of participants to story characters also emerged as important parameter (Christensen & Gomila, 2012). Accordingly, we developed the *Everyday Moral Conflict Situations (EMCS) Scale* that allows for the investigation of social closeness by varying the distance of target persons (Singer et al., 2019).

Building on the aforementioned findings, we were interested in the effects of social closeness and timing on everyday moral decision-making after exposure to acute psychosocial stress. Similar to our previous study (Singer et al., 2017), we expected significantly more altruistic decisions after acute stress exposure compared to a control condition. We further hypothesized that this effect would emerge especially toward socially close (e.g., mother) but not toward distant (e.g., stranger) protagonists at an early but not at a late point of measurement. Additionally, we exploratively examined associations with psychological and endocrine stress responses as well as personality variables.

5.3 Materials and methods

Forty male students of the University of Regensburg, aged 18-37 years (M = 23.98 years, SD = 3.58), participated in the study. All participants were native Germans, naïve to the Trier Social Stress Test (TSST) protocol, non-smokers, medication-free, and in good health. We tested an exclusively male sample to reduce the impact of variations in gonadal hormone concentrations on endocrine stress responses. The study protocol was approved by the ethics committee of the German Psychological Association. All participants gave their written informed consent prior to participation and received either 20 € or course credit.

The study followed a 2 x 2 x 2 mixed design with the between-subjects factor *Condition* (stress versus control) and the within-subjects factors *Social Closeness* of the target persons (socially close versus socially distant) and *Timing* (early versus late). In the stress condition (n = 20), the standard procedure of the TSST was used. In the control condition (n = 20), participants were exposed to its placebo version (PTSST; Het et al., 2009). To minimize confounding effects due to differences in energy availability (Zänkert et al., 2020), all subjects ingested a 75 g glucose drink 45 min before (P)TSST exposure (resting period). All sessions started between 13:00 and 18:00 h. Based on our earlier

findings, where we observed a medium to large effect of acute stress exposure on altruistic decision-making (Singer et al., 2017), our study reached a statistical power of 0.74 (calculated using *G*Power* version 3.1.9.4; one-tailed, $d = 0.74$, $\alpha = 0.05$, $N = 2$ x 20). For the within-subjects comparisons (socially close versus socially distant protagonists/early versus late point of measurement), the statistical power was 0.87 (presuming a medium effect; two-tailed, $d = 0.50$, $\alpha = 0.05$, $N = 40$).

To capture endocrine stress responses, we measured salivary cortisol levels (expressed as nmol/l) at -1, +1, +10, +20, +30, +75, +85, and +95 min relative to (P)TSST. Saliva samples were collected using Salivettes® (Sarstedt, Nümbrecht, Germany), stored at -20 °C until analysis, and assayed in duplicate using a time-resolved immunoassay with fluorometric detection (DELFIA) at the University of Trier. Inter- and intra-assay coefficients of variation were below 10%. To capture psychological stress responses, participants completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) at -1, +1, +30, +75, and +95 min and the Primary Appraisal Secondary Appraisal (PASA) questionnaire (Gaab et al., 2005) directly before and after (P)TSST (PASA stress index).

Everyday moral decision-making was assessed by a computerized version of the EMCS Scale (Singer et al., 2019). The EMCS Scale consists of two parallelized 20-items sets (A and B) comprising each ten scenarios with socially close and ten with socially distant protagonists. Examples of items with socially close and distant protagonists as well as altruistic and egoistic response alternatives are provided in Table 5. The complete 40-items set of the EMCS Scale can be found in the supplementary material of Singer et al. (2019).

Table 5

Item examples of the EMCS Scale (Singer et al., 2019) with socially close and distant protagonists as well as altruistic and egoistic response alternatives

Everyday moral conflict situation	**Response alternatives (altruistic vs. egoistic)**
Examples of items with socially close protagonists	
1. I am just about to leave for work as a neighbor and friend rings my bell. She asks me if I could drive her to the doctor because she is not feeling well. I am already late and have a meeting with my boss today. What do I do?	I drive her to the doctor. I go to work.
2. I have promised my sister to take care of her children tonight. Now, I realize that I am also invited to a farewell party today that is very important for me. I could think up an excuse to go to the party. What do I do?	I keep my promise. I think up an excuse.
Examples of items with socially distant protagonists	
3. I want to go home on a train that runs only once every hour. The train is about to leave and I am just boarding as a man with crutches near me falls on the platform. If I help him up, I will miss the train. What do I do?	I help the man. I take the train.
4. I have ordered a pizza from a delivery service on the internet. After delivery, I pay with a 50 € bill. As the pizza delivery boy gives me the change, I realize that he has given me back 5 € too much. What do I do?	I return the money. I keep the money.

Within the two 20-items sets A and B, a fixed random presentation order of the scenarios was created before application using *Research Randomizer*® (Urbaniak & Plous, 2020), which was then realized for all participants. The order of the two item sets (AB versus BA) was counterbalanced between participants. All subjects completed the first set between +10 until +30 min after (P)TSST exposure (early) and the second set between +75 until +95 min (late). Between the two item sets, there was a resting period of 45 min. Both sets consisted of two parts with ten scenarios each with five socially close and five socially distant protagonists (duration per block: 5 min 30 s).

Two of the saliva samples (+20 and +85 min) were collected during short breaks between the parts. Vignettes were presented via *Presentation*® 18.1 (Neurobehavioral

Systems Inc., Albany, CA, USA). Presentation times of stimuli, response times, and instructions were similar to Singer et al. (2017). For analysis, we calculated the total percentage of altruistic decisions (*EMCS Total Scores*) as well as the percentages of altruistic decisions for scenarios involving only socially close (*EMCS SC Scores*) and socially distant protagonists (*EMCS SD Scores*).

Before debriefing, subjects filled out questionnaires assessing the *Big Five* (NEO Five-Factor Inventory; Borkenau & Ostendorf, 2008), social desirability (Social Desirability Scale-17; Stöber, 2001), and empathy (E-Scale; Leibetseder et al., 2007).

5.4 Results

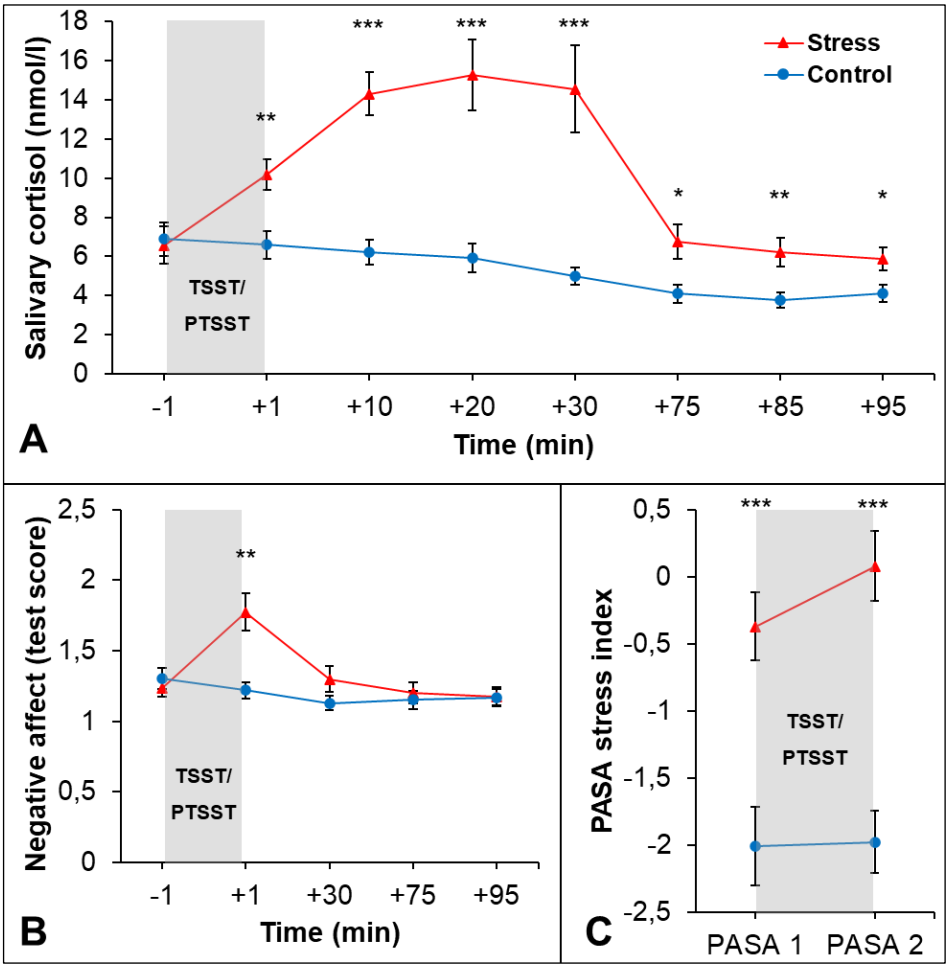
Participants in the two experimental conditions (stress versus control) did not differ significantly regarding age, pre-exposure cortisol levels, the *Big Five*, social desirability, and empathy (all $ps \geq 0.067$). As manipulation check, a 2 (*Condition*) x 8 (*Time*) ANOVA on salivary cortisol (natural log transformed values) revealed significant main effects of *Condition* ($F(1, 38) = 17.98$, $p < 0.001$, $\eta^2_p = 0.32$) and *Time* ($F(3.15, 119.85) = 47.27$, $p < 0.001$, $\eta^2_p = 0.55$) as well as a significant *Condition* x *Time* interaction ($F(3.15, 119.85) = 18.43$, $p < 0.001$, $\eta^2_p = 0.33$), with higher cortisol levels in the stress than control condition after (P)TSST exposure ($ps \leq 0.013$, $ds \geq 0.83$; see Figure 8A). For negative affect, a 2 (*Condition*) x 5 (*Time*) ANOVA yielded a significant main effect of *Time* ($F(2.04, 77.55) = 15.08$, $p < 0.001$, $\eta^2_p = 0.28$) and a significant *Condition* x *Time* interaction ($F(2.04, 77.55) = 12.56$, $p < 0.001$, $\eta^2_p = 0.25$; see Figure 8B). Positive affect scores did not differ between conditions ($ps \geq 0.274$, $ds \leq 0.36$). For the PASA stress index, a 2 (*Condition*) x 2 (*Time*) ANOVA revealed a significant main effect of *Condition* ($F(1, 38) = 32.72$, $p < 0.001$, $\eta^2_p = 0.46$), with higher stress appraisals in the stress than control condition ($ps < 0.001$, $ds \geq 1.38$; see Figure 8C).

Figure 8

A) Mean salivary cortisol responses (nmol/l ± SEM) to the (P)TSST in the stress and control condition

B) Mean negative affect scores (± SEM) in the stress and control condition

C) Mean anticipatory (PASA 1) and retrospective (PASA 2) stress appraisals (± SEM) in the stress and control condition



Note. The shaded area indicates the exposure period. Figure 8A shows untransformed data for illustration reasons.
* $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$ in post hoc independent samples *t*-tests.

To investigate our main question, a 2 (*Condition*) x 2 (*Social Closeness*) x 2 (*Timing*) ANOVA on *EMCS Total Scores* resulted in significant main effects of *Condition* ($F(1, 38) = 4.31$, $p = 0.045$, $\eta^2_p = 0.10$) and *Social Closeness* ($F(1, 38) = 4.93$, $p = 0.032$, $\eta^2_p = 0.12$). The main effect of *Timing* and all two-/three-way interactions were nonsignificant ($Fs \leq 2.42$, $ps \geq 0.128$, $\eta^2_p s \leq 0.06$). *EMCS Total Scores* were significantly higher in the stress (66.07 ± 13.45%) than in the control condition (56.85 ± 14.91%; $t(38) = 2.05$, $p = 0.047$, $d = 0.65$). Moreover, participants decided significantly more

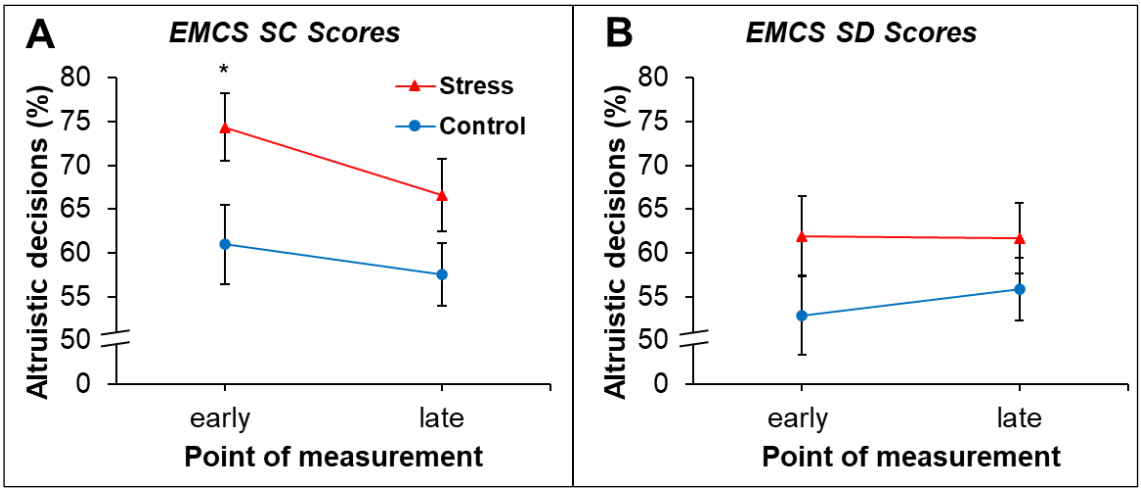
altruistically in scenarios involving socially close (64.77 ± 14.89%) versus distant protagonists (58.19 ± 20.01%; $t(39) = 2.15$, $p = 0.038$, $d = 0.37$).

We then exploratively analyzed *EMCS SC* and *SD Scores* separately. For *EMCS SC Scores*, a 2 (*Condition*) x 2 (*Timing*) ANOVA also resulted in a significant main effect of *Condition* with larger effect size ($F(1, 38) = 6.52$, $p = 0.015$, $\eta^2_p = 0.15$). Although the main effect of *Timing* and the *Condition* x *Timing* interaction did not reach significance (Fs ≤ 2.23, ps ≥ 0.140, η^2_ps ≤ 0.06), secondary analyses showed significantly higher *EMCS SC Scores* in the stress than control condition at the early ($t(38) = 2.23$, $p = 0.032$, $d = 0.72$) but not at the late point of measurement ($t(38) = 1.65$, $p = 0.106$, $d = 0.54$; see Figure 9A). For *EMCS SD Scores*, both main effects and the interaction were nonsignificant (Fs ≤ 1.39, ps ≥ 0.246, η^2_ps ≤ 0.04; see Figure 9B).

Figure 9

A) Percentage of altruistic decisions for scenarios involving only socially close protagonists (EMCS SC Scores; M ± SEM) in the stress and control condition at the early (+10 until +30 min) and at the late (+75 until +95 min after (P)TSST exposure) point of measurement

B) Percentage of altruistic decisions for scenarios involving only socially distant protagonists (EMCS SD Scores; M ± SEM) in the stress and control condition at the early (+10 until +30 min) and at the late (+75 until +95 min after (P)TSST exposure) point of measurement



Note. * $p < 0.050$ in explorative post hoc independent samples *t*-tests.

Finally, Pearson correlations revealed significant positive relationships between psychological stress responses and *EMCS Scores*. Higher changes in negative affect in response to (P)TSST were associated with higher *EMCS Total*, *SC*, and *SD Scores* (rs ≥ 0.32, ps ≤ 0.043). Additionally, higher anticipatory stress appraisals co-varied with higher *EMCS SC Scores* ($r = 0.34$, $p = 0.035$). For endocrine stress responses (cortisol increase, AUC, mean cortisol levels during EMCS), no significant correlations with *EMCS Scores* were observed (rs ≤ 0.23, ps ≥ 0.149). The personality variables agreeableness, social desirability, and empathy were positively associated with *EMCS Total* (rs ≥ 0.28, ps ≤ 0.086) and *SC Scores* (rs ≥ 0.31, ps ≤ 0.049), indicating that higher scores of agreeableness, social desirability, and empathy co-varied with more altruistic decisions in the everyday moral conflict situations.

5.5 Discussion

Given the increasing evidence that stress influences moral decision-making, we investigated the interplay of acute psychosocial stress, social closeness, and timing on decision-making in everyday moral conflict scenarios in males.

First, we observed a significantly higher total percentage of altruistic decisions in the stress than in the control condition, thus successfully replicating the central finding of our previous study (Singer et al., 2017). Moreover, we found that the percentage of altruistic decisions was significantly higher for scenarios involving socially close versus distant protagonists. Although we did not observe that the percentage of altruistic decisions differed depending on social closeness in the paper-pencil validation of the EMCS Scale (Singer et al., 2019), this result is in accordance with Christensen and Gomila (2012) and Zhan et al. (2018) who reported less altruistic decisions for strangers versus friends and acquaintances.

Second, our primary analyses showed neither a significant main effect of timing nor any significant two- or three-way interactions. These results were unexpected and are in contrast to Margittai et al. (2015) who observed a significant main effect of timing and a significant *Condition* x *Timing* interaction on generosity toward close others. Moreover, the nonsignificant main effect of timing is also inconsistent with other stress and decision-making literature (e.g., Pabst et al., 2013). In our data, the sample size ($N = 40$) might have been too small to detect potential two- or three-way interactions. Only secondary analyses revealed increased altruistic decision-making after acute stress exposure toward socially close but not toward distant protagonists at the early and not at the late point of

measurement. This seems to fit the tend-and-befriend hypothesis (Taylor, 2006) by pointing to the idea that increased altruistic decision-making might be restricted to socially close protagonists at the early time point. On a neuroendocrinological level, our data could be explained by the observation that directly after stress (< 1 h), monoamines and non-genomic corticosteroids (acting primarily via mineralocorticoid receptors) promote the choice of simple yet effective strategies to face environmental challenges, with an increased focus on the self and close ones (de Kloet et al., 2018). According to Joëls et al. (2018), this does not necessarily mean more selfish behavior, but a sharper distinction between whom to offer costly help (i.e., socially close ones) and whom not (i.e., socially distant ones). At the late time point (> 1 h after stressor onset), genomic corticosteroid hormones (acting via glucocorticoid receptors) are postulated to lead to heightened executive control (de Kloet et al., 2019; de Kloet & Joëls, 2020; Hermans et al., 2014; Joëls et al., 2018), which might have reduced effects of forgoing stress.

Third, in line with the observed effects of acute stress exposure on everyday moral decision-making, psychological stress responses were positively associated with *EMCS Scores*. Positive correlations between cortisol levels and altruistic decisions were descriptively observable, but did not reach statistical significance. Moreover, there were significant associations between altruistic decision-making and agreeableness, empathy, and social desirability. These results firstly support the claim of our previous study that personality traits might play an important role in everyday moral decision-making (Singer et al., 2017). Secondly, our results fit current literature that identified agreeableness (Habashi et al., 2016; Zhao & Smillie, 2015) and empathy (Rosen et al., 2016; Zhang et al., 2019) as being closely associated with altruistic and prosocial decision-making. Thirdly, the present data point to the importance of taking social desirability into account in psychological self-report research (see Perinelli & Gremigni, 2016 for review).

One limitation of the current study is its relatively small sample size. Given equivocal findings in the stress and prosocial decision-making literature (see for example von Dawans et al., 2012 versus Vinkers et al., 2013), it remains to be investigated whether the present findings can be replicated in larger samples. However, our main finding of increased altruistic decision-making after acute stress exposure is in line with our earlier study (Singer et al., 2017), where we used a similar set of everyday moral conflict scenarios.

A further limitation is the investigation of an exclusively male sample. Since there is empirical evidence for increased prosocial behavior of stressed women (von Dawans et

al., 2019), which was found to be higher than in males (Smeets et al., 2009; Tomova et al., 2014), one might expect even more altruistic decision-making after acute stress exposure in females. However, it has to be acknowledged that Starcke et al. (2011) observed no main effect of acute stress exposure on everyday moral decision-making in a mixed-sex sample. Though, they did not control for menstrual cycle phase in females, which might have confounded their results. Thus, future studies should examine the impact of gender in larger, well-controlled mixed-sex samples.

Additionally, pharmacological manipulation studies would be helpful to test the specific role of the stress hormone cortisol. From the present data alone, it cannot be concluded if the experience of social-evaluative threat evoked by the TSST, the stress-induced cortisol increase, a combination of both, or something completely different was causally responsible for the observed effect of increased altruistic decision-making in stressed men. Building on the findings of Margittai et al. (2018), who reported that experimental hydrocortisone administration promoted prosocial tendencies toward close others in males, it remains to be investigated whether this effect can be generalized to altruistic decision-making as well.

Moreover, although the EMCS Scale was designed to comprise moral conflict situations with high similarity to everyday life (Singer et al., 2019), it presents choices that are hypothetical rather than ones that portray real outcomes. Since decontextualized hypothetical scenarios might not accurately reflect moral decisions in everyday life (FeldmanHall, Mobbs, et al., 2012), future studies should experimentally examine the external validity of the EMCS Scale. At least, we observed in our own data (unpublished observations) that *EMCS Scores* correlated with real donation behavior for a local organization supporting homeless people.

In sum, our findings revealed significantly higher percentages of altruistic decisions after acute stress exposure and for scenarios involving socially close compared to socially distant protagonists. The main effect of timing was nonsignificant. However, secondary analyses showed increased altruistic decision-making after stress exposure toward socially close protagonists at the early time point. Moreover, our data revealed positive associations between altruistic decision-making and psychological stress responses as well as personality traits. Overall, our study provides further evidence that acute psychosocial stress influences everyday moral decision-making in males in a prosocial manner.

CHAPTER 6

Study III

Singer, N., Sommer, M., Wüst, S., & Kudielka, B. M. (2021). Effects of gender and personality on everyday moral decision-making after acute stress exposure. *Psychoneuroendocrinology, 124*, Article 105084. https://doi.org/10.1016/j.psyneuen.2020.105084[3]

Nina Singer, Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka developed the study concept and study design. Nina Singer performed data collection and analysis. Nina Singer drafted the manuscript, and Monika Sommer, Stefan Wüst, and Brigitte M. Kudielka provided critical revisions.

[3] The inclusion of this article in my dissertation was permitted by the publisher (use of one's own article in a dissertation for non-commercial purposes).

6 STUDY III: EFFECTS OF GENDER AND PERSONALITY ON EVERYDAY MORAL DECISION-MAKING AFTER ACUTE STRESS EXPOSURE

6.1 Abstract

Exposure to acute psychosocial stress has been shown to affect moral decision-making, though little is known about potential gender differences or effects of personality. In two within-subjects design studies, 179 healthy men and women (N = 99 in Study 1, N = 80 in Study 2) were exposed to the Trier Social Stress Test (TSST) and a non-stress control condition (resting period) on two testing days in random order. After stress/resting, moral decision-making was assessed by the *Everyday Moral Conflict Situations (EMCS) Scale* (Singer et al., 2019), which requests altruistic versus egoistic responses to everyday moral conflict scenarios with varying closeness of target persons. We investigated effects of acute stress, social closeness, participants' gender, and the a priori selected personality traits agreeableness, empathy, and social desirability on everyday moral decision-making. Despite high statistical power, we could neither confirm the hypothesized effects of acute stress nor social closeness on *EMCS Scores* in both samples. However, our data revealed a prosocial impact of acute stress on everyday moral decisions rather in females than males as well as effects of agreeableness and social desirability. Salivary alpha-amylase (sAA) levels in Study 1 and cortisol levels in females in Study 2 were significantly correlated with higher *EMCS Scores* after acute stress exposure. Additionally, lower anticipatory subjective stress responses were associated with more altruistic decisions. Moreover, we found positive relationships between hypothetical moral decision-making and real prosocial behavior (opportunity for a charitable donation). In sum, due to methodological differences compared to previous between-subjects design studies, it might not be justified to rule out effects of acute stress on everyday moral decision-making based on the current within-subjects results. Nevertheless, the present data suggest that specific personality traits like agreeableness might have a stronger impact on everyday moral decision-making than short term-exposure to acute stress.

6.2 Introduction

Moral decisions are ubiquitous to everyday life and are influenced by various factors (Hofmann et al., 2014, 2018). Among others, psychobiological research suggests that acute stress and stress hormones affect moral decision-making (e.g., Kossowska et al., 2016; Li et al., 2019; Singer et al., 2017, 2020; Starcke et al., 2011, 2012; Youssef et al., 2012).

In laboratory studies, moral decision-making is typically investigated by moral dilemmas, which are short stories about situations involving moral conflicts (Christensen & Gomila, 2012). In most previous studies, abstract moral dilemmas requiring sacrificial decisions about moral dead-or-alive situations were used. However, abstract moral dilemmas lack external and ecological validity and thus cannot be transferred to everyday life (Bauman et al., 2014; FeldmanHall, Mobbs, et al., 2012). So far, investigating the impact of stress on moral decision-making, only Starcke et al. (2011) and Singer et al. (2017, 2020) utilized everyday moral conflict scenarios with altruistic (e.g., helping an old woman who is in distress) versus egoistic (e.g., catching the waiting bus home) response alternatives. In a mixed-gender sample (N = 40), Starcke et al. (2011) did not observe effects of experimentally-induced stress on everyday moral decision-making, but a correlation between stress-related cortisol increases and egoistic decision-making. By contrast, we investigated solely male samples and found increased altruistic decision-making after acute stress exposure compared to control (Singer et al., 2017, 2020). Moreover, our data showed positive associations between altruistic decisions and cortisol levels (Singer et al., 2017) as well as subjective stress responses (Singer et al., 2020). Thus, the impact of gender on everyday moral decision-making after acute stress exposure has not been sufficiently investigated, and female subsamples controlled for menstrual cycle phase are currently lacking.

Furthermore, all three previous studies followed between-subjects designs not accounting for interindividual variability in altruistic decision-making. Within-subjects designs would entail higher statistical power and enable a better control of confounding variables, since both of our earlier experiments revealed that personality traits might play an important role in everyday moral decision-making after acute stress (Singer et al., 2017, 2020). First, in both studies, the personality trait agreeableness was positively associated with altruistic decision-making. In our primary study, we also observed that agreeableness explained 15% of the variance in the percentage of altruistic decisions between the stress and the control group (Singer et al., 2017). Accordingly, other research

groups identified agreeableness as the *Big Five* dimension of personality most closely associated with prosocial and altruistic behavior (Habashi et al., 2016; Zhao & Smillie, 2015). Second, apart from agreeableness, the personality trait empathy has been shown to predict altruistic (Rosen et al., 2016) and prosocial (Zhang et al., 2019) decision-making. Consistently, we observed positive relationships between empathy and altruistic decision-making (Singer et al., 2017, 2020). Third, social desirability was positively correlated with altruistic decisions in both of our previous experiments and should thus also be controlled for. In this regard, Oda et al. (2013) examined the validity of their altruism scale by correlating scale scores with real frequency of blood donation in order to minimize confounding effects due to socially desirable responding.

Moreover, the relatedness of participants to story characters emerged as important parameter in moral decision-making research (Christensen & Gomila, 2012; Zhan et al., 2018). Accordingly, Passarelli and Buchanan (2020) observed increased prosocial behavior (donated amount of money) toward kin and friends compared to strangers. In our own data, we found that males decided more altruistically in scenarios involving socially close (e.g., mother) versus socially distant (e.g., stranger) protagonists (Singer et al., 2020). Regarding potential stress effects, an explorative analysis pointed to increased altruistic decision-making after acute stress toward socially close but not toward distant protagonists (at an early point of measurement). However, this finding was only preliminary and requires further investigation in larger samples.

Building on these results, we designed two within-subjects studies to examine the effects of acute psychosocial stress and social closeness on everyday moral decision-making. Moreover, we investigated potential associations between the percentage of altruistic decisions and neuroendocrine as well as subjective stress responses. We used our recently developed *Everyday Moral Conflict Situations (EMCS) Scale*, an everyday moral decision-making paradigm with two parallelized item sets that can be applied in repeated-measurement approaches (Singer et al., 2019). Additionally, the EMCS Scale allows for the investigation of the impact of social closeness by manipulating the distance of the protagonists in the conflicts. Overall, we expected a higher percentage of altruistic decisions after acute stress exposure compared to control as well as in scenarios involving socially close versus distant protagonists. Moreover, we hypothesized positive relationships between altruistic decision-making and stress responses. Further, we were interested in the effects of participants' gender and of the personality traits agreeableness, empathy, and social desirability. On two testing days, participants performed the two

parallelized item sets of the EMCS Scale between +10 and +30 min after exposure to the Trier Social Stress Test (TSST) respectively a resting period, which is the typical time window of peak cortisol levels after TSST exposure (Kudielka et al., 2007). To examine the external validity of our results, subjects were additionally given the opportunity to make a charitable donation for a local organization supporting homeless people at the end of the experiment. We first analyzed if real donation behavior was influenced by forgoing stress exposure versus rest. Secondly, we investigated whether hypothetical decisions in the moral vignettes coincided with real donation behavior.

6.3 Study 1

6.3.1 Materials and methods

6.3.1.1 Participants

Ninety-nine volunteers (50 males, 49 females; 18-35 years; *M* = 22.97 years, *SD* = 3.36) participated in Study 1. All participants passed an anamnestic interview including an in-house questionnaire, in which they confirmed to be healthy, medication-free, non-obese (BMI: *M* = 22.92 kg/m², *SD* = 2.84), non-smokers, and naïve to the TSST protocol. For females, further exclusion criteria were pregnancy, breast-feeding, and intake of oral contraceptives (Zänkert et al., 2019). All females were tested in the luteal phase of their menstrual cycle (defined as 6-9 days after luteinizing hormone surge; Wolfram et al., 2011), as determined by a chromatographic ovulation predictor test kit (gabControl by gabmed GmbH, Cologne, Germany). The study protocol was approved by the ethics committee of the University of Regensburg. All participants gave written informed consent prior to participation and received either 28€ (*n* = 87) or course credit (*n* = 12).

6.3.1.2 Study design

Following an experimental within-subjects design, testing took place on two different days separated by *M* = 4.28 days (*SD* = 0.89, range 2-6). Males and females were equally assigned to either start with the stress or non-stress control condition in counterbalanced order. The standard procedure of the TSST (Kirschbaum et al., 1993) was used to induce acute psychosocial stress. In the control condition, participants were instructed to rest for 17 min (same duration as TSST) until the experiment was continued. We decided against applying the placebo version of the TSST (Het et al., 2009) in order to rule out potential carry-over effects (e.g., memory effects) and possible stress responses to the placebo

TSST (Het et al., 2009, experiment 2). Presuming a small to medium effect of acute stress exposure on everyday moral decision-making (based on our earlier findings; Singer et al., 2017), Study 1 reached a statistical power of 99.84% (calculated using *G*Power* version 3.1.9.4; two-tailed, $d = 0.50$, $\alpha = 0.05$, $N = 99$).

6.3.1.3 Assessment of stress responses

On both testing days, we collected six saliva samples each to determine free cortisol levels (expressed as nmol/l) and salivary alpha-amylase (sAA) activity (expressed as U/ml) at -1, +1, +10, +20, +30, and +40 min relative to the TSST/resting period. Saliva samples were collected using Salivettes® (Sarstedt, Nümbrecht, Germany), stored at -20 °C until analysis, and assayed in duplicate at the University of Trier. A time-resolved immunoassay with fluorometric detection (DELFIA; Dressendörfer et al., 1992) was used for analysis. The intra-assay coefficient of variation (CV) was between 4.0-6.7%, and the inter-assay CVs were between 7.1-9.0%. sAA was assessed by a quantitative enzyme kinetic method using the chromogenic molecule 2-chloro-4-nitrophenyl-α-D-maltotrioside as substrate (Lorentz et al., 1999). The intra-assay CV was between 2.8-6.3%, and the inter-assay CVs were between 5.5-7.6%.

To capture subjective stress responses, participants completed the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) at -1, +1, +10, and +30 min. Additionally, in the stress condition, we assessed anticipatory and retrospective cognitive stress appraisals by the Primary Appraisal Secondary Appraisal (PASA) questionnaire (Gaab et al., 2005) directly before and after the TSST. We computed the "PASA stress index" according to guidelines. Higher scores represented higher subjectively perceived stress.

6.3.1.4 Everyday moral decision-making task

Everyday moral decision-making was assessed by a computerized version of the EMCS Scale (Singer et al., 2019). The EMCS Scale consists of two parallelized 20-items sets (A, B) comprising each ten scenarios with socially close and distant protagonists. On both testing days, subjects completed one item set (order counterbalanced) between +10 and +30 min after TSST exposure/resting. Both sets consisted of two 10-items parts with each five scenarios with socially close and distant protagonists (duration per block: 5 min 30 s).

The experimental procedure was run using Presentation® 18.1 (Neurobehavioral Systems Inc., Albany, CA, USA) on a 22.4-inch CRT display. Presentation times of stimuli and response times were similar to Singer et al. (2017). Before TSST exposure/resting, participants were given a standardized verbal instruction, prompting to put themselves in the shoes of the protagonists and to answer spontaneously. For analysis, the total percentage of altruistic decisions (*EMCS Total Scores*) in the stress and control condition and the percentages of altruistic decisions for scenarios involving only socially close (*EMCS SC Scores*) and distant protagonists (*EMCS SD Scores*) were calculated.

6.3.1.5 Donation behavior

Real donation behavior was measured with a procedure comparable to Sollberger et al. (2016). At the end of test session 2, participants received their financial compensation of 28€ in one 10€ bill, two 5€ bills, three 2€ coins, and two 1€ coins. After subjects filled out the compensation receipt, the investigator drew their attention to a small donation box and a flyer and explained that the department was collecting money for a local charitable organization supporting homeless people (*Strohhalm Regensburg e.V.*; http://www.strohhalm-regensburg.de/). The investigator emphasized that the donation was absolutely voluntary. In case the participant wanted to donate, he/she could put money into the box. The donation box was non-transparent and always contained a fixed amount of money to create the impression that it could not be traced back whether and how much money was given. Subsequently, the investigator pretended to have forgotten something important, leaving the participant with the donation box shortly unobserved in the room. After the investigator returned, subjects were fully debriefed. They finally answered a short in-house questionnaire on whether they had previously known *Strohhalm Regensburg e.V.* and how much money they had for free disposal per month. After departure of the participant, the investigator counted and noted the donation amount. The donated money (208.30€ in Study 1) was forwarded to *Strohhalm Regensburg e.V.* at the end of the project.

6.3.1.6 Procedure

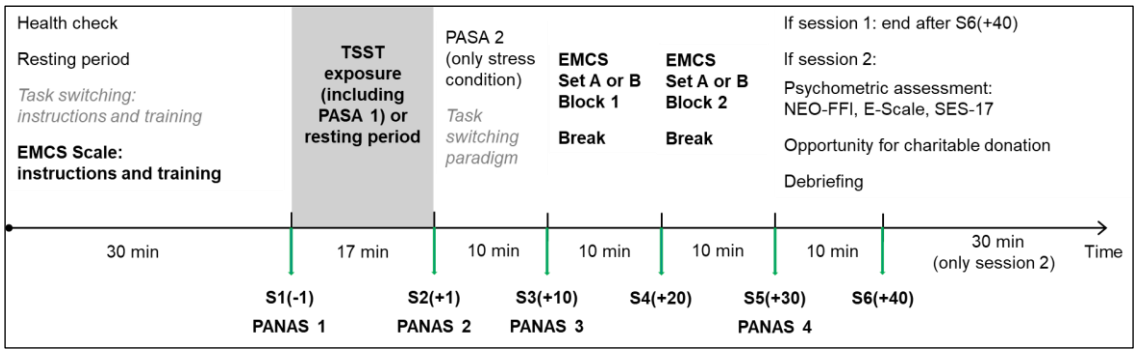
The overall study procedure consisted of a screening (including the anamnestic interview) and two laboratory test sessions. In case of eligibility, females were instructed to the ovulation predictor test kit and laboratory appointments were scheduled accordingly. Test

sessions were run in the afternoon (start between 12:30 and 6:00 pm). Participants were instructed to refrain from physical exercise, a heavy lunch, caffeine, and alcoholic beverages on testing days.

At the beginning of both test sessions, the acute health status was checked by a brief questionnaire (see Figure 10). After a 15 min resting period, participants received instructions for a task switching paradigm (results not reported here) and were introduced to the EMCS Scale. Approximately 30 min after arrival, participants were either confronted with the TSST (stress condition) or instructed to rest for the same time (control condition). Immediately before and after the TSST/resting period, saliva samples S1(-1) and S2(+1) were collected and PANAS 1 and 2 were completed. In the stress condition, participants additionally filled out PASA 1 at the beginning of the TSST and PASA 2 directly afterwards. Subsequently, subjects performed the task switching paradigm, provided saliva sample S3(+10), and completed PANAS 3. Then, participants answered either set A or B of the EMCS Scale, whereby saliva sample S4(+20) was collected during a short break between its two parts. Session 1 ended after completing PANAS 4 at +30 min and providing saliva samples S5(+30) and S6(+40). At session 2, participants additionally filled out questionnaires assessing agreeableness (NEO Five-Factor Inventory, NEO-FFI; Borkenau & Ostendorf, 2008), empathy (E-Scale; Leibetseder et al., 2007), and social desirability (Social Desirability Scale-17, SDS-17; Stöber, 2001). Finally, subjects received their financial compensation, were given the opportunity for charitable donation, and were fully debriefed.

Figure 10

Flow chart of the experimental procedure of the two main test sessions in Study 1



Note. Following an experimental within-subjects design, participants were exposed to the stress as well as control condition and the two sets of the *Everyday Moral Conflict Situations (EMCS) Scale* in a counterbalanced order. Session 1 ended after providing saliva sample S6(+40) whereas session 2 lasted approximately 30 min longer (psychometric assessment, opportunity for charitable donation, debriefing). The *italicized* components indicate a task switching paradigm, which was part of the full study procedure (not reported in this manuscript).

6.3.1.7 Statistical analyses

As manipulation check, mixed ANOVAs with the within-subjects factors *Condition* (stress, control) and *Time* (respective points of measurement) as well as the between-subjects factors *Gender* (male, female) and *Treatment Order* (stress-control, control-stress) were computed on salivary cortisol, sAA, and subjective stress responses (see Section 6.3.2.1). Cortisol and sAA values were logarithmized (natural log transformed) before analysis. Greenhouse-Geisser corrections and post hoc *t*-tests were applied when appropriate. One female was excluded from all sAA analyses due to values > 1000 U/ml (extreme outlier with raw values ≥ 4 *SD*s from respective means). Moreover, 17 of the 1188 cortisol samples (1.43%) and 14 of the 1188 sAA samples (1.17%) were missing data. Thereof, six (cortisol) respectively nine (sAA) values were replaced by linear regression estimates of respective neighboring values. In cases of missing peak values or more than two missings at one test session, no interpolation was performed. Thus, reported analyses were based on partly different sample sizes.

To investigate the effects of acute psychosocial stress, gender, and personality on everyday moral decision-making, we conducted a 2 (*Condition*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA on *EMCS Total Scores* and added *Agreeableness*, *Empathy*, and *Social Desirability* as continuous factors (see Section 6.3.2.2). For explorative reasons, we additionally analyzed the data of the two test sessions separately.

Moreover, we conducted linear regression analyses to further examine the associations between *EMCS Total Scores* in the stress and control condition (dependent variables) and *Gender*, *Treatment Order*, *Agreeableness*, *Empathy*, and *Social Desirability* (independent variables). In a subsequent 2 (*Condition*) x 2 (*Social Closeness*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA, we also analyzed the impact of the protagonists' social closeness.

Then, we investigated potential associations between *EMCS Scores* and neuroendocrine as well as subjective stress responses using Pearson correlations (see Section 6.3.2.3). For cortisol and sAA, we calculated the areas under the curve with respect to ground (AUC_G) and increase (AUC_I) on unlogarithmized data (Pruessner et al., 2003).

Finally, real donation behavior was analyzed (see Section 6.3.2.4). To test whether donation behavior was influenced by forgoing stress exposure (at the same test session), an independent samples *t*-test with the between-subjects factor *Treatment Order* was run on the donation amount. Additionally, we calculated Pearson correlations to investigate associations between *EMCS Scores* and real donation behavior.

6.3.2 Results and discussion

6.3.2.1 Manipulation check: Stress responses

6.3.2.1.1 Neuroendocrine stress responses

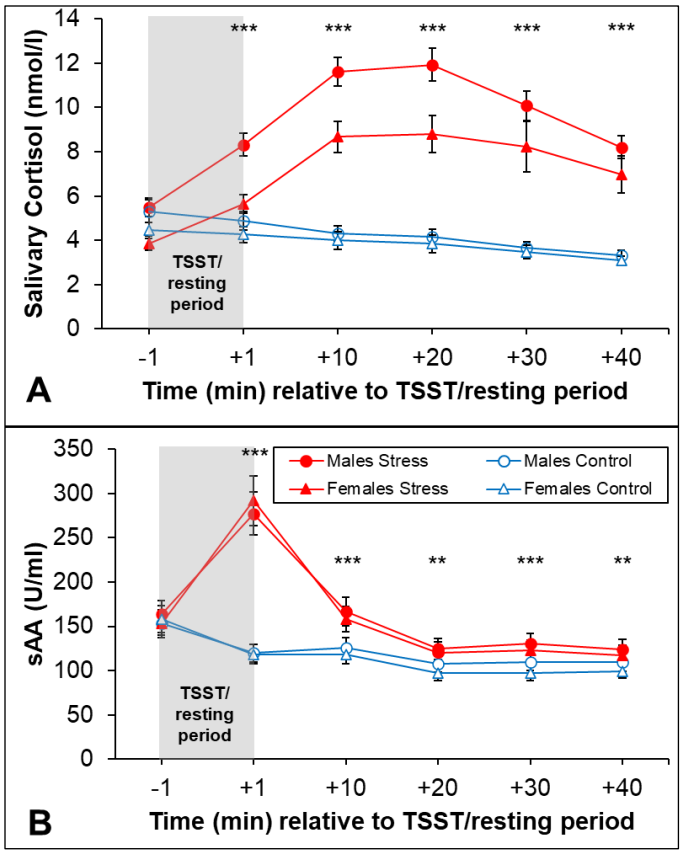
For salivary cortisol, a 2 (*Condition*) x 6 (*Time*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA revealed significant main effects of *Condition* ($F(1, 92) = 114.97$, $p < 0.001$, $\eta^2_p = 0.56$), *Time* ($F(2.03, 186.43) = 47.23$, $p < 0.001$, $\eta^2_p = 0.34$), and *Gender* ($F(1, 92) = 7.24$, $p = 0.008$, $\eta^2_p = 0.07$) as well as *Condition* x *Time* ($F(1.93, 177.68) = 105.34$, $p < 0.001$, $\eta^2_p = 0.53$) and *Condition* x *Gender* ($F(1, 92) = 3.86$, $p = 0.052$, $\eta^2_p = 0.04$) interactions. In the total sample of Study 1, cortisol levels were significantly higher in the stress than control condition at +1, +10, +20, +30, and +40 min (see Figure 11A). Moreover, males displayed significantly higher cortisol levels than females in the stress condition at -1, +1, +10, and +20 min (ps ≤ 0.006, ds ≥ 0.57), while no gender differences emerged at +30 and +40 min (ps ≥ 0.157) nor during the resting condition (ps ≥ 0.177). The main effect of *Treatment Order* ($F(1, 92) = 2.12$, $p = 0.140$) and all other two-/three-/four-way interactions were nonsignificant (Fs ≤ 2.99, ps ≥ 0.087).

For sAA, an analogous mixed ANOVA resulted in significant main effects of *Condition* ($F(1, 92) = 68.45$, $p < 0.001$, $\eta^2_p = 0.43$), *Time* ($F(3.80, 349.54) = 87.14$, $p < 0.001$, $\eta^2_p = 0.49$), and *Condition* x *Time* interaction ($F(3.82, 351.42) = 59.22$, $p < 0.001$, $\eta^2_p = 0.39$). sAA levels were significantly higher in the stress than control condition at +1, +10, +20, +30, and +40 min (see Figure 11B). The main effects of *Gender* and *Treatment Order* were nonsignificant ($Fs \leq 1.11$, $ps \geq 0.295$), but the *Condition* x *Time* x *Treatment Order* interaction became significant ($F(3.82, 351.42) = 6.09$, $p < 0.001$, $\eta^2_p = 0.06$). All other two-/three-/four-way interactions were nonsignificant ($Fs \leq 1.98$, $ps \geq 0.101$).

Figure 11

A) Mean salivary cortisol responses (nmol/l ± SEM) in males and females to the stress and control condition in Study 1

B) Mean salivary alpha-amylase (sAA) responses (U/ml ± SEM) in males and females to the stress and control condition in Study 1



Note. The shaded area indicates the TSST exposure/resting period. Asterisks display significant within-subjects comparisons (stress versus control) in the total study sample. ** $p < 0.010$, *** $p < 0.001$ in post hoc paired *t*-tests. Figures 11A and B show untransformed data for illustration reasons.

6.3.2.1.2 Subjective stress responses

For positive affect, a 2 (*Condition*) x 4 (*Time*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA demonstrated a significant main effect of *Time* ($F(3, 285) = 37.54$, $p < 0.001$, $\eta^2_p = 0.28$) and a *Condition* x *Time* interaction ($F(2.72, 258.72) = 10.92$, $p < 0.001$, $\eta^2_p = 0.10$), while the main effects of *Condition*, *Gender*, and *Treatment Order* were nonsignificant (Fs ≤ 2.87, ps ≥ 0.093). Post hoc paired *t*-tests only revealed significantly higher positive affect ratings at +1 min after TSST (2.87 ± 0.66) compared to resting (2.57 ± 0.74; $t(98) = 4.11$, $p < 0.001$, $d = 0.43$). Moreover, there were significant *Condition* x *Treatment Order* ($F(1, 95) = 25.79$, $p < 0.001$, $\eta^2_p = 0.21$), *Time* x *Treatment Order* ($F(3, 285) = 3.98$, $p = 0.008$, $\eta^2_p = 0.04$), and *Condition* x *Time* x *Treatment Order* ($F(2.72, 258.72) = 3.04$, $p = 0.034$, $\eta^2_p = 0.03$) interactions. The other two-/three-/four-way interactions were nonsignificant (Fs ≤ 2.58, ps ≥ 0.054).

For negative affect, there were significant main effects of *Condition* ($F(1, 95) = 58.05$, $p < 0.001$, $\eta^2_p = 0.38$), *Time* ($F(2.55, 242.59) = 45.97$, $p < 0.001$, $\eta^2_p = 0.33$), and a *Condition* x *Time* interaction ($F(2.18, 206.68) = 78.34$, $p < 0.001$, $\eta^2_p = 0.45$). The main effects of *Gender* and *Treatment Order* were nonsignificant (Fs ≤ 0.03, ps ≥ 0.858). Negative affect ratings were significantly higher in the stress than control condition at +1 (stress: 1.86 ± 0.65; control: 1.16 ± 0.25; $t(98) = 11.35$, $p < 0.001$, $d = 1.29$) and +10 min (stress: 1.38 ± 0.40; control: 1.24 ± 0.36; $t(98) = 3.56$, $p = 0.001$, $d = 0.39$). Further, the *Condition* x *Treatment Order* interaction ($F(1, 95) = 10.02$, $p = 0.002$, $\eta^2_p = 0.10$) was significant. No other two-/three-/four-way interaction reached significance (Fs ≤ 1.89, ps ≥ 0.151).

Regarding the PASA (only stress condition), subjects reported a significantly higher PASA stress index after the TSST (0.54 ± 1.44) compared to pre-stress (-0.10 ± 1.26; $t(98) = 6.26$, $p < 0.001$, $d = 0.46$). There were neither effects of *Gender* nor *Treatment Order* (Fs ≤ 2.23, ps ≥ 0.138).

6.3.2.2 Effects of acute psychosocial stress, social closeness, gender, and personality on everyday moral decision-making

The 2 (*Condition*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA on *EMCS Total Scores* with *Agreeableness*, *Empathy*, and *Social Desirability* as continuous factors revealed significant *Condition* x *Agreeableness* ($F(1, 92) = 8.46$, $p = 0.005$, $\eta^2_p = 0.08$) and *Condition* x *Empathy* ($F(1, 92) = 6.89$, $p = 0.010$, $\eta^2_p = 0.07$) interactions as well as

a main effect of *Social Desirability* ($F(1, 92) = 16.61$, $p < 0.001$, $\eta^2_p = 0.15$). No other main/interaction effects became significant (Fs ≤ 2.56, ps ≥ 0.113). Analyzing the data of the two test sessions separately did also not result in significant main effects of *Condition* (Fs ≤ 0.37, ps ≥ 0.545). Similarly, a post hoc 2 (*Condition*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA on *EMCS Total Scores* without the personality variables as continuous factors did reveal neither significant main nor interaction effects (Fs ≤ 3.26, ps ≥ 0.074).

Linear regression analyses with *EMCS Total Scores* in the stress and control condition as dependent variables showed that *Gender* (female) and *Agreeableness* had a significant impact on *EMCS Total Scores* only in the stress condition (see Table 6). Female gender and higher levels of agreeableness were associated with higher *EMCS Total Scores* after acute stress exposure. Moreover, higher social desirability scores co-varied with higher *EMCS Total Scores* in both the stress and control condition.

Table 6

Linear regression analyses with EMCS Total Scores in the stress and control condition in Study 1

Dependent variable	Independent variables	*B*	*SE*	*CI* [95%]	*β*	*t*(98)	*p*
EMCS Total Scores stress condition	Gender (female)	6.83	3.38	[0.13, 13.54]	0.20	2.02	0.046*
	Treatment order (stress-control)	-2.00	3.10	[-8.16, 4.15]	-0.06	-0.65	0.520
	Agreeableness (NEO-FFI)	0.55	0.26	[0.04, 1.06]	0.20	2.12	0.036*
	Empathy (E-Scale)	-0.17	0.12	[-0.40, 0.06]	-0.15	-1.48	0.143
	Social desirability (SDS-17)	1.91	0.54	[0.84, 2.98]	0.33	3.54	0.001**
EMCS Total Scores control condition	Gender (female)	2.20	3.53	[-4.80, 9.20]	0.07	0.62	0.534
	Treatment order (stress-control)	-1.74	3.24	[-8.16, 4.69]	-0.05	-0.54	0.593
	Agreeableness (NEO-FFI)	-0.11	0.27	[-0.64, 0.43]	-0.04	-0.39	0.699
	Empathy (E-Scale)	0.09	0.12	[-0.15, 0.33]	0.08	0.74	0.464
	Social desirability (SDS-17)	2.13	0.56	[1.01, 3.25]	0.37	3.78	<0.001***

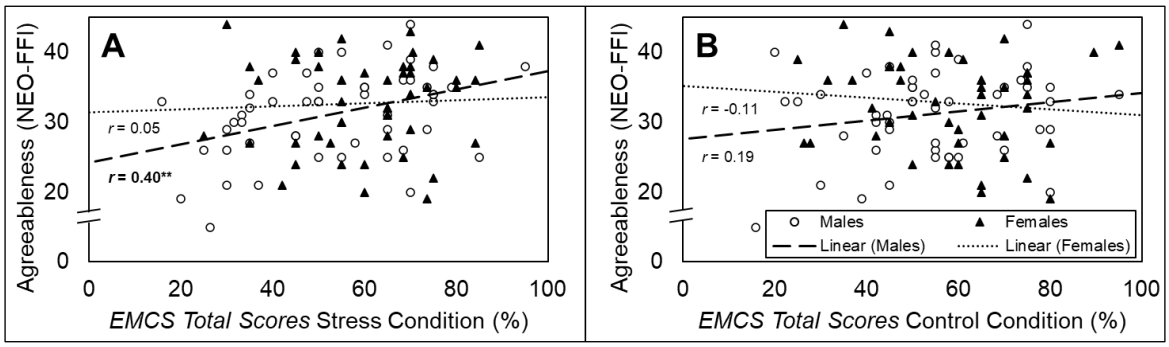
Note. B = unstandardized regression coefficient; *SE* = standard error; *CI* [95%] = lower and upper bound of the 95% confidence interval for *B*; *β* = standardized *β*-coefficient; EMCS = Everyday Moral Conflict Situations; NEO-FFI = NEO Five-Factor Inventory; SDS-17 = Social Desirability Scale-17.
* $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$.

Furthermore, Pearson correlations demonstrated that agreeableness was only significantly associated with higher *EMCS Total Scores* in the stress ($r = 0.26$, $p = 0.009$), but not in the control condition ($r = 0.06$, $p = 0.564$). In gender-specific analyses, higher scores of agreeableness co-varied with higher *EMCS Total Scores* in the stress condition in males ($r = 0.40$, $p = 0.004$), but not females ($r = 0.05$, $p = 0.736$; see Figure 12A). In the control condition, agreeableness did not correlate with *EMCS Total Scores* neither in males ($r = 0.19$, $p = 0.193$) nor females ($r = -0.11$, $p = 0.467$; see Figure 12B).

Figure 12

A) Correlation of the personality trait agreeableness (NEO-FFI) and the percentage of altruistic decisions (EMCS Total Scores) in the stress condition in males (n = 50) and females (n = 49) in Study 1

B) Correlation of the personality trait agreeableness (NEO-FFI) and the percentage of altruistic decisions (EMCS Total Scores) in the control condition in males (n = 50) and females (n = 49) in Study 1



Note. ** $p < 0.010$.

Adding *Social Closeness* as within-subjects factor did reveal neither further significant main effects nor interactions (Fs ≤ 2.66, ps ≥ 0.106).

6.3.2.3 Associations between stress responses and EMCS Scores

For neuroendocrine stress responses, we observed a significant positive relationship between *EMCS Total Scores* and *sAA* AUC_I in the stress condition (r = 0.21, p = 0.036). All other correlations between *EMCS Total Scores* and neuroendocrine measures (*sAA* AUC_G, *cortisol* AUC_G, *cortisol* AUC_I) were nonsignificant in the stress and control condition (rs between -0.16 and 0.09, ps ≥ 0.130). Since we observed gender differences in cortisol stress responses (see Section 6.3.2.1.1), we additionally performed the correlational analyses between *EMCS Total Scores* and cortisol measures in the stress condition for both genders separately. However, no significant gender-specific correlations emerged (rs between -0.10 and 0.07, ps ≥ 0.484).

For subjective stress responses, PANAS 1 and 4 negative affect scores correlated negatively with *EMCS Total Scores* in the stress condition (rs = -0.35 and -0.24, ps ≤ 0.018). In the control condition, only PANAS 4 negative affect scores were negatively associated with *EMCS Total Scores* (r = -0.28, p = 0.004). Hence, lower negative affect ratings shortly before TSST exposure and after completion of the EMCS

Scale (in both conditions) co-varied with more altruistic decisions. Changes in positive and negative affect in response to TSST/resting and to the EMCS Scale did not correlate with *EMCS Total Scores*, neither in the stress nor control condition (*r*s between -0.14 and 0.05, *p*s ≥ 0.178). Moreover, the PASA 1 stress index (before TSST) was negatively associated with *EMCS Total Scores* (r = -0.20, p = 0.050) whereas the PASA 2 stress index (after TSST) did not correlate with *EMCS Total Scores* (r = 0.03, p = 0.760).

6.3.2.4 Real donation behavior and associations with EMCS Scores

Overall, 69 (79.31%) of the 87 participants who took the financial compensation of 28€ made a donation to *Strohhalm Regensburg e.V.* Fifty-six subjects (56.60%) indicated to have previously known the organization. The mean donation amount was 2.39€ (*SD* = 2.61, range 0.10-15.00). The donation amount did not differ depending on *Treatment Order* ($t(85) = 0.63$, p = 0.528), hence it was not influenced by forgoing stress exposure versus rest. Adding the monthly amount of money for free disposal as continuous factor did not influence the results ($F(1, 84) = 0.48$, p = 0.488).

Concerning associations with *EMCS Scores*, we observed significant relationships between the donation amount and *EMCS Total* (r = 0.45, p < 0.001), *SC* (r = 0.36, p = 0.001), and *SD Scores* (r = 0.44, p < 0.001). A higher percentage of altruistic decisions in the hypothetical everyday moral conflicts was associated with a higher real donation amount. Controlling for *Agreeableness*, *Empathy*, and *Social Desirability* did not change the significance of results (*r*s between 0.36 and 0.47, *p*s ≤ 0.001).

6.3.2.5 Study 1: Discussion

In a within-subjects design based on 99 participants, we investigated the effects of acute psychosocial stress, social closeness, gender, and personality on everyday moral decision-making. Contrary to our earlier studies that followed between-subjects designs in males (Singer et al., 2017, 2020), we observed neither effects of acute stress exposure nor social closeness on the percentage of altruistic decisions. Analyzing the data of the two test sessions separately did also not reveal significant differences between the stress and the control condition. However, our data showed positive relationships between *EMCS Total Scores* and female gender as well as agreeableness only in the stress condition. Gender-specific analyses revealed that agreeableness co-varied significantly with *EMCS Total Scores* after acute stress exposure in males, but not females. Concerning stress responses,

sAA levels were positively associated with *EMCS Total Scores* in the stress condition, whereas anticipatory subjective stress responses correlated negatively with altruistic decision-making.

Besides the repeated-measurement approach confronting each subject with the stress and control condition, one main difference to our earlier studies (Singer et al., 2017) was the implementation of a task switching paradigm between TSST exposure and the EMCS Scale. Since we could not exclude the possibility that this cognitive paradigm led to an interruption of any social-evaluative stress experience (Dickerson & Kemeny, 2004), which might be essential to elicit stress effects on everyday moral decision-making, we decided to replicate this study procedure without task switching in Study 2.

6.4 Study 2

6.4.1 Materials and methods

Eighty healthy subjects (40 males, 40 females; 18-35 years; M = 22.91 years, SD = 3.20) participated in Study 2. The two test sessions were separated by M = 3.78 days (SD = 0.97, range 2-6). Exclusion criteria, study design, assessment of stress responses, the everyday moral decision-making task, measurement of real donation behavior, and statistical analyses were identical to Study 1. The main difference was the implementation of a waiting period between +1 and +10 min after TSST exposure/resting instead of the task switching paradigm (similar to Singer et al., 2017). Study 2 reached a statistical power of 99.30% (two-tailed, d = 0.50, α = 0.05, N = 80). In this study, we only measured salivary cortisol levels due to financial restrictions. Two participants (one male, one female) had to be excluded from cortisol analyses due to insufficient saliva. Additionally, one missing cortisol value was replaced by the linear regression estimate of its neighboring values. In Study 2, n = 75 participants took the financial compensation (28€), n = 5 took course credit.

6.4.2 Results and discussion

6.4.2.1 Manipulation check: Stress responses

6.4.2.1.1 Neuroendocrine stress responses

Similar to Study 1, the mixed ANOVA for salivary cortisol showed significant main effects of *Condition* (F(1, 74) = 148.19, p < 0.001, η^2_p = 0.67), *Time* (F(2.20, 162.76)

= 33.18, $p < 0.001$, $\eta^2_p = 0.31$), and *Gender* ($F(1, 74) = 4.09$, $p = 0.047$, $\eta^2_p = 0.05$) as well as significant *Condition* x *Time* ($F(2.53, 187.07) = 132.16$, $p < 0.001$, $\eta^2_p = 0.64$) and *Condition* x *Gender* ($F(1, 74) = 10.41$, $p = 0.002$, $\eta^2_p = 0.12$) interactions. Cortisol levels were significantly higher in the stress than control condition at all sampling points after TSST exposure (ps < 0.001, ds ≥ 0.82). Moreover, males displayed significantly higher cortisol responses than females at +1, +10, +20, and +30 min after stress (ps ≤ 0.036, ds ≥ 0.48), while no gender differences emerged at -1 and +40 min (ps ≥ 0.057) nor during the resting condition (ps ≥ 0.583). Moreover, while there was no main effect of *Treatment Order* ($F < 1$, $p = 0.925$), the *Condition* x *Time* x *Treatment Order* interaction was significant ($F(2.53, 187.07) = 7.49$, $p < 0.001$, $\eta^2_p = 0.09$). No other two-/three-/four-way interactions became significant (Fs ≤ 3.04, ps ≥ 0.085).

6.4.2.1.2 Subjective stress responses

For positive affect, the main effects of *Condition* ($F(1, 75) = 5.78$, $p = 0.019$, $\eta^2_p = 0.07$), *Time* ($F(3, 225) = 19.01$, $p < 0.001$, $\eta^2_p = 0.20$), and *Gender* ($F(1, 75) = 19.77$, $p < 0.001$, $\eta^2_p = 0.21$; higher positive affect ratings in males than females) were significant, while the main effect of *Treatment Order* was nonsignificant ($F(1, 75) = 0.10$, $p = 0.759$). There was a significant *Condition* x *Time* interaction ($F(2.61, 195.68) = 15.50$, $p < 0.001$, $\eta^2_p = 0.17$), with higher positive affect at +1 min after TSST exposure (2.98 ± 0.74) compared to resting (2.60 ± 0.61; $t(79) = 4.76$, $p < 0.001$, $d = 0.56$). Moreover, the *Condition* x *Treatment Order* ($F(1, 75) = 43.24$, $p < 0.001$, $\eta^2_p = 0.37$) and *Condition* x *Time* x *Treatment Order* ($F(2.61, 195.68) = 8.55$, $p < 0.001$, $\eta^2_p = 0.10$) interactions were significant. No other two-/three-/four-way interactions reached significance (Fs ≤ 2.43, ps ≥ 0.123).

For negative affect, there were significant main effects of *Condition* ($F(1, 75) = 42.43$, $p < 0.001$, $\eta^2_p = 0.36$) and *Time* ($F(2.57, 192.61) = 60.58$, $p < 0.001$, $\eta^2_p = 0.45$), but neither effects of *Gender* nor *Treatment Order* (Fs ≤ 0.56, ps ≥ 0.458). Moreover, there was a significant *Condition* x *Time* interaction ($F(2.37, 178.06) = 67.71$, $p < 0.001$, $\eta^2_p = 0.47$), with higher negative affect ratings in the stress than control condition at +1 (stress: 1.68 ± 0.55; control: 1.13 ± 0.18; $t(79) = 9.80$, $p < 0.001$, $d = 1.22$), +10 (stress: 1.26 ± 0.35; control: 1.12 ± 0.17; $t(78) = 3.89$, $p < 0.001$, $d = 0.49$), and +30 min (stress: 1.21 ± 0.32; control: 1.11 ± 0.20; $t(79) = 2.52$, $p = 0.014$, $d = 0.35$). Additionally, the *Time* x *Gender* x *Treatment Order* ($F(2.57, 192.61) = 6.13$, $p = 0.001$, $\eta^2_p = 0.08$) and *Condition* x *Time* x *Gender* x *Treatment Order* ($F(2.37, 178.06) = 8.21$, $p < 0.001$,

$\eta^2_p = 0.10$) interactions became significant. All other two-/three-way interactions were nonsignificant (Fs ≤ 3.62, ps ≥ 0.061).

For the PASA (only stress condition), subjects reported a significantly higher PASA stress index after the TSST (0.53 ± 1.44) compared to pre-stress (-0.02 ± 1.26; $t(79) = 4.65$, $p < 0.001$, $d = 0.40$). There were neither effects of *Gender* nor *Treatment Order* (Fs ≤ 1.75, ps ≥ 0.190).

6.4.2.2 Effects of acute psychosocial stress, social closeness, gender, and personality on everyday moral decision-making

The 2 (*Condition*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA on *EMCS Total Scores* with *Agreeableness*, *Empathy*, and *Social Desirability* as continuous factors revealed significant main effects of *Agreeableness* ($F(1, 73) = 5.01$, $p = 0.028$, $\eta^2_p = 0.06$) and *Social Desirability* ($F(1, 73) = 10.66$, $p = 0.002$, $\eta^2_p = 0.13$). No other main/interaction effects became significant (Fs ≤ 3.65, ps ≥ 0.060). Analyzing the data of the two test sessions separately did also result in nonsignificant effects of *Condition* (Fs ≤ 0.75, ps ≥ 0.390). Analogously, in a post hoc 2 (*Condition*) x 2 (*Gender*) x 2 (*Treatment Order*) mixed ANOVA on *EMCS Total Scores* without the personality variables as continuous factors, all main and interaction effects were nonsignificant (Fs ≤ 0.37, ps ≥ 0.546).

Similar to Study 1, linear regression analyses with *EMCS Total Scores* in the stress and control condition as dependent variables indicated that *Agreeableness* had a significant positive impact on *EMCS Total Scores* only in the stress condition, whereas *Social Desirability* co-varied with higher *EMCS Total Scores* in the stress and control condition. Contrary to Study 1, *Gender* had no significant impact on *EMCS Total Scores* in the stress condition (see Table 7).

Table 7

Linear regression analyses with EMCS Total Scores in the stress and control condition in Study 2

Dependent variable	Independent variables	*B*	*SE*	*CI* [95%]	*β*	*t*(79)	*p*
EMCS Total Scores stress condition	Gender (female)	-1.14	3.38	[-7.88, 5.60]	0.04	0.34	0.737
	Treatment order (stress-control)	3.25	3.13	[-2.99, 9.49]	0.10	1.04	0.302
	Agreeableness (NEO-FFI)	0.71	0.30	[0.12, 1.30]	0.26	2.41	0.019*
	Empathy (E-Scale)	0.13	0.11	[-0.10, 0.36]	0.12	1.12	0.244
	Social desirability (SDS-17)	2.17	0.57	[1.03, 3.32]	0.38	3.79	<0.001***
EMCS Total Scores control condition	Gender (female)	-2.77	3.30	[-9.34, 3.80]	-0.09	-0.84	0.404
	Treatment order (stress-control)	2.00	3.05	[-4.09, 8.08]	0.07	0.65	0.515
	Agreeableness (NEO-FFI)	0.51	0.29	[-0.06, 1.09]	0.20	1.78	0.080
	Empathy (E-Scale)	0.18	0.11	[-0.04, 0.40]	0.19	1.66	0.102
	Social desirability (SDS-17)	1.26	0.56	[0.14, 2.38]	0.25	2.25	0.028*

Note. B = unstandardized regression coefficient; *SE* = standard error; *CI* [95%] = lower and upper bound of the 95% confidence interval for *B*; *β* = standardized *β*-coefficient; EMCS = Everyday Moral Conflict Situations; NEO-FFI = NEO Five-Factor Inventory; SDS-17 = Social Desirability Scale-17.
* $p < 0.050$, *** $p < 0.001$.

Adding *Social Closeness* as further within-subjects factor revealed significant *Social Closeness* x *Empathy* ($F(1, 73) = 4.29$, $p = 0.042$, $\eta^2_p = 0.06$) and *Condition* x *Social Closeness* x *Empathy* ($F(1, 73) = 4.19$, $p = 0.044$, $\eta^2_p = 0.05$) interactions. Separate linear regression analyses with *EMCS SC* and *SD Scores* as dependent variables showed that regardless of condition, *Empathy* was significantly associated with *EMCS SD* (*B* = 0.30, *SE* = 0.13, *CI 95%* = [0.05, 0.56], *β* = 0.27, *t*(79) = 2.34, *p* = 0.022), but not *SC Scores* (*B* = 0.01, *SE* = 0.11, *CI 95%* = [-0.21, 0.24], *β* = 0.01, *t*(79) = 0.11, *p* = 0.916). This

effect was more pronounced in the stress (B = 0.37, SE = 0.15, CI 95% = [0.06, 0.67], β = 0.27, $t(79)$ = 2.39, p = 0.020) than control condition (B = 0.24, SE = 0.14, CI 95% = [-0.04, 0.51], β = 0.20, $t(79)$ = 1.71, p = 0.091).Thus, higher levels of empathy were associated with more altruistic decisions toward socially distant protagonists, especially after acute stress exposure. No other main/interaction effects became significant (Fs ≤ 1.77, ps ≥ 0.187).

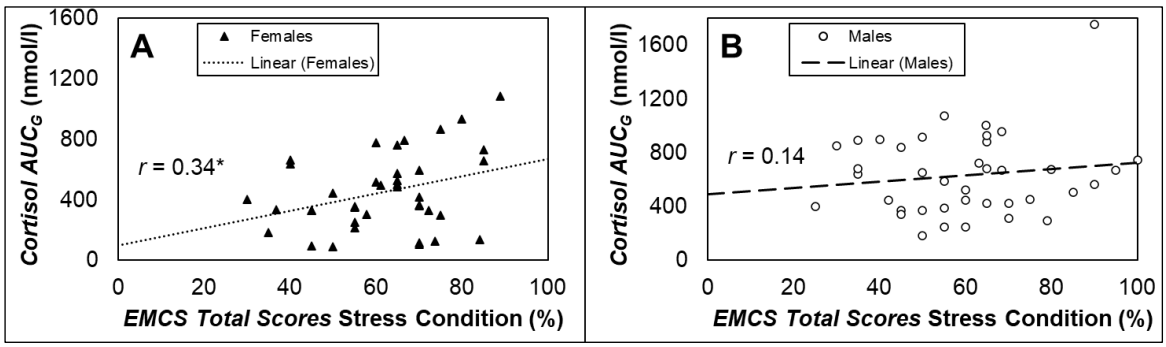
6.4.2.3 Associations between stress responses and EMCS Scores

In the total sample of Study 2, there were no significant correlations between *EMCS Total Scores* and cortisol levels (AUC_G, AUC_I), neither in the stress (rs = 0.08 and 0.19, ps ≥ 0.094) nor control condition (rs = -0.05 and 0.11, ps ≥ 0.353). However, gender-specific analyses revealed a significant relationship between *EMCS Total Scores* and *cortisol* AUC_G in the stress condition in females (r = 0.34, p = 0.036; see Figure 13A). Higher cortisol levels were associated with more altruistic decisions after stress exposure in females. For males, no significant correlations between *EMCS Total Scores* and cortisol emerged (rs between -0.07 and 0.14, ps ≥ 0.392; see Figure 13B for the respective correlation between *EMCS Total Scores* and *cortisol* AUC_G in the stress condition in males).

Figure 13

A) Correlation of cortisol AUC_G and the percentage of altruistic decisions (EMCS Total Scores) in the stress condition in females in Study 2 (n = 39)

B) Correlation of cortisol AUC_G and the percentage of altruistic decisions (EMCS Total Scores) in the stress condition in males in Study 2 (n = 39)



Note. * p < 0.050.

Regarding subjective stress, there were in the total sample no significant associations between positive or negative affect ratings and *EMCS Total Scores*, neither in the stress nor control condition (*r*s between -0.16 and 0.19, *p*s ≥ 0.088). Gender-specific analyses revealed in males a significant relationship between PANAS 1 positive affect ratings and *EMCS Total Scores* in the stress condition ($r = 0.38$, $p = 0.017$), indicating that higher positive affect before TSST exposure co-varied with altruistic decision-making in males. Regarding PANAS change scores, in the total sample only changes in positive affect in response to the EMCS Scale were significantly associated with *EMCS Total Scores* in the stress condition ($r = 0.24$, $p = 0.033$). Moreover, similar to Study 1, the PASA 1 stress index was negatively associated with *EMCS Total Scores* ($r = -0.28$, $p = 0.011$), whereas the respective correlation with the PASA 2 stress index was nonsignificant ($r = -0.18$, $p = 0.120$).

6.4.2.4 Donation behavior and associations with EMCS Scores

In Study 2, 65 (86.67%) of the 75 subjects who took the financial compensation (28€) donated money to *Strohhalm Regensburg e.V.* Forty-three participants (57.33%) indicated to have previously known the organization. The mean donation amount was 2.82€ (*SD* = 2.87, range 0.32-13.00; total donation amount: 211.62€). Regarding potential stress effects, there was again no significant impact of *Treatment Order* on the donation amount ($t(61.25) = 1.95$, $p = 0.056$), although it was descriptively lower in the stress (2.18 ± 1.95€) than control condition (3.42 ± 3.43€). Adding the monthly amount of money for free disposal as continuous factor did not influence the results ($F(1, 72) = 3.60$, $p = 0.062$).

Regarding associations with *EMCS Scores*, we found positive correlations between the donation amount and *EMCS Total* ($r = 0.39$, $p = 0.001$), *SC* ($r = 0.22$, $p = 0.055$), and *SD Scores* ($r = 0.45$, $p < 0.001$). Controlling for *Agreeableness*, *Empathy*, and *Social Desirability* resulted in significant associations between the donation amount and *EMCS Total* ($r = 0.35$, $p = 0.003$) as well as *SD* ($r = 0.41$, $p < 0.001$), but not *SC Scores* ($r = 0.18$, $p = 0.142$).

6.4.2.5 Study 2: Discussion

This replication study set out to investigate the effects of acute psychosocial stress, social closeness, gender, and personality on everyday moral decision-making without

presenting an intermediary task switching paradigm. Similarly, without application of this cognitive paradigm, there were neither effects of acute stress exposure nor social closeness on *EMCS Scores*. Though, the data of Study 2 replicated the central finding of Study 1 that higher scores of agreeableness were associated with higher percentages of altruistic decisions only in the stress condition. With this, our data emphasize the impact of the personality trait agreeableness on altruistic decision-making after acute stress exposure. Moreover, we observed significant associations between cortisol levels (AUC_G) and higher percentages of altruistic decisions in the stress condition in females. Regarding subjective stress responses, higher positive affect ratings before TSST exposure co-varied with more altruistic decisions in the EMCS Scale in males.

6.5 General discussion

Building on growing empirical evidence that both acute stress and stress hormones influence moral decision-making, we conducted two within-subjects design studies to further examine effects of acute psychosocial stress, social closeness, gender, and the personality variables agreeableness, empathy, and social desirability on everyday moral decision-making.

In both studies, we did not observe significantly higher percentages of altruistic decisions after acute stress exposure compared to control despite high statistical power (99.84% in Study 1, 99.30% in Study 2). This result is in accordance with several between-subjects design studies that also failed to detect significant effects of stress on social and moral decision-making (e.g., Berger et al., 2016; Schweda et al., 2019; Starcke et al., 2011; Zhang et al., 2019). However, it is in contrast to two of our earlier studies, where we found increased altruistic decision-making after acute stress exposure in males (Singer et al., 2017, 2020). Further, contrary to Singer et al. (2020), the percentages of altruistic decisions did not differ depending on protagonists' social closeness in both present samples. This also contradicts the findings of Passarelli and Buchanan (2020), who reported more prosocial behavior toward kin and friends than toward strangers. One main difference to these earlier studies was the use of within-subjects designs, where carry-over and demand effects are more likely than in between-subjects designs (Charness et al., 2012). Moreover, within-subjects designs entail greater risks of framing, order, and memory effects. We tried to minimize such confounding factors by the use of two parallelized item sets of the EMCS Scale (Singer et al., 2019) and by the implementation of a resting period instead of the placebo TSST (Het et al., 2009). In order

to avoid potential framing effects, we kept the study information as neutral as possible. With respect to order effects, it should be noticed that in the present data, there was no main effect of treatment order, neither for stress responses nor for moral decision-making. While for stress responses, there were at least partly significant two-/three-/four-way interactions with treatment order, no such interactions emerged for moral decision-making. Thus, order effects seem rather unlikely as explanation for the absence of group differences in moral decision-making. Moreover, analyzing the data of the two test sessions separately (analogous to between-subjects designs) did also not reveal significant differences in judgments between the stress and the control condition. With regard to this, it should be considered that the use of two sets of parallelized but not identical items (as it was the case in Singer et al., 2017) might have led to more interindividual variance, and potentially to the disappearance of significant between-group differences. Hence, although we tried to avoid confounding factors as far as possible, it is conceivable that the within-subjects setup of the present two studies still entailed methodological issues that might have contributed to the current absence of effects.

Concerning gender differences, both present studies showed significantly higher cortisol stress responses in males than females, which is in accordance with a recent meta-analysis (Liu et al., 2017) and the review of Zänkert et al. (2019). With regard to everyday moral decision-making, we did not observe main effects of gender in both studies. This result is in contrast to Youssef et al. (2012) and Friesdorf et al. (2015), who reported gender differences in moral decision-making. However, it is in line with a meta-analytic review suggesting that men and women do not differ in their overall amounts of cooperation (Balliet et al., 2011). Finally, it should be of note that, at least in Study 1, linear regression analyses revealed female gender as significant positive predictor of *EMCS Total Scores* in the stress condition (see Section 6.3.2.2).

With regard to neuroendocrine stress responses, we observed a significant correlation between *EMCS Total Scores* and *sAA* AUC_I in the stress condition in Study 1: The higher the sAA increases, the higher were the *EMCS Total Scores* after acute stress exposure (see Section 6.3.2.3). Contrary to our earlier findings (Singer et al., 2017), salivary cortisol levels were not significantly associated with altruistic decision-making in both present total samples. This result is also in contrast to Margittai et al. (2018), who reported that hydrocortisone administration promoted prosocial tendencies toward close others. However, since Schweda et al. (2019) only found an association between cortisol and prosocial behavior after controlling for testosterone levels, it similarly seems possible that

altruistic decisions after acute stress are not related to changes in cortisol alone. Thus, the potentially crucial interplay with sex hormones like testosterone (Carré & Mehta, 2011) or neuropeptides like oxytocin (Riem et al., 2013; Striepens et al., 2011) remains to be investigated in future studies. Nevertheless, gender-specific analyses revealed at least a significant relationship between *EMCS Total Scores* and cortisol levels (AUC_G) in the stress condition in females in Study 2. In combination with the positive association between female gender and *EMCS Total Scores* in the stress condition of Study 1, our results appear to support the tend-and-befriend hypothesis, which was originally proposed as females' biobehavioral response to stress. According to this hypothesis, individuals try to protect themselves and their offspring by affiliating with others after stress (Taylor et al., 2000).

For subjective stress responses, we only observed that lower negative (Study 1) and higher positive (Study 2, males) affect ratings before TSST exposure were significantly correlated with altruistic decision-making. Besides this, we found in both studies that lower anticipatory cognitive stress appraisals were associated with higher *EMCS Total Scores*. These results suggest an inverse relationship (lower anticipatory subjective stress responses associated with more altruistic decisions) and are in contrast to our earlier findings of positive correlations between psychological stress responses and *EMCS Scores* in males (Singer et al., 2020). However, different from this earlier study, the present experiments included male and female participants and cognitive stress appraisals were only measured in the stress conditions. Thus, available data seem to speak for a partly lack of covariance between physiological and subjective stress responses, a well-known phenomenon in biopsychological stress research (Campbell & Ehlert, 2012; Zänkert et al., 2019). Finally, lower negative affect ratings after completion of the EMCS Scale (Study 1) and changes in positive affect in response to the EMCS Scale (Study 2) were significantly associated with altruistic decisions, indicating that altruistic decision-making in the EMCS Scale increases positive and decreases negative affect.

Examining the impact of personality, the present data revealed an important role of the personality trait agreeableness, which is in line with our earlier studies (Singer et al., 2017, 2020). In Study 2 (without intermediary task switching paradigm), we observed a significant main effect of agreeableness on *EMCS Total Scores*. Additionally, in both studies, the relationship between the percentage of altruistic decisions and agreeableness was significant in the stress but not in the control condition. Gender-specific analyses showed that this relationship was more pronounced in males than females. With this, our

data support the claim that agreeableness is associated with prosocial and altruistic behavior (Habashi et al., 2016; Zhao & Smillie, 2015), and suggest that agreeableness might play a larger role in everyday moral decision-making after acute stress compared to non-stressful circumstances (especially in males). One explanation might be that acute stress exposure prompts a temporary resource allocation to a salience network with limbic and subcortical structures at the cost of executive control (Hermans et al., 2014). After acute stress, higher levels of agreeableness seem to substantially contribute to the process of deciding altruistically whereas under non-stress conditions, higher executive control might reduce the positive effects of agreeableness on altruistic decision-making.

Regarding empathy, we found no significant associations with *EMCS Total Scores* in both present studies. However, in Study 2, there was a positive relationship between empathy and *EMCS SD Scores*: Toward socially distant protagonists like strangers, higher levels of empathy co-varied with more altruistic decisions (especially after acute stress exposure). These linear regression results partly differ from our earlier studies (Singer et al., 2017, 2020) as well as from Rosen et al. (2016) and Zhang et al. (2019), who reported that empathy predicted prosocial and altruistic decision-making. However, these authors used partly other questionnaires to measure empathy. Thus, the specific role of empathy in everyday moral decision-making after acute stress exposure needs to be more thoroughly investigated in future research.

With respect to social desirability, there were significant main effects on *EMCS Total Scores* in both studies. To additionally gain insight into the external validity of our findings, participants were exposed to the opportunity for a real charitable donation at the end of the experiment. Firstly, results showed that the real donation amount was not influenced by forgoing stress exposure. This is in contrast to Sollberger et al. (2016), who reported that stress significantly reduced the donated amount of money. However, at least in Study 2, a comparable effect was descriptively observable. Secondly, we found significant correlations between *EMCS Scores* and real donation amounts. A higher percentage of altruistic decisions in hypothetical everyday moral conflicts was associated with a higher amount of money donated to charity, providing further evidence for the external and ecological validity of the EMCS Scale. For future studies, it would additionally be interesting to examine real life stressors and their impact on everyday moral decision-making by ambulatory assessment methods (Hofmann et al., 2014, 2018).

As a limitation, it should be of note that the within-subjects design of the present two studies implies strengths as well as weaknesses. While this approach entails higher

statistical power than between-subjects designs and allows to hold constant interindividual variability in dependent variables, such a design, at the same time, might cause other methodological issues like demand, framing, order, or memory effects. Further, in both studies, we observed the well-known gender differences in cortisol stress responses (Zänkert et al., 2019). Thus, if one assumes a biological modulation of everyday moral decision-making (Singer et al., 2017), the existence of gender differences might obscure such relationships. Finally, although we deliberately decided to use a resting period instead of the placebo TSST (see Section 6.3.1.2), this could have caused differential effects on moral decision-making compared to our earlier studies (Singer et al., 2017, 2020). Consequently, due to methodological differences compared to previous between-subjects studies, it might not be justified to rule out effects of acute stress exposure on everyday moral decision-making solely based on the current within-subjects results.

In sum, we observed neither effects of acute stress exposure nor social closeness on *EMCS Scores*. However, our data revealed a prosocial impact of acute stress on everyday moral decision-making rather in females than males, and point, in particular, to important roles of the personality traits agreeableness and social desirability. Salivary alpha-amylase levels in Study 1 and cortisol levels in females in Study 2 were significantly correlated with altruistic decision-making after acute stress. In both studies, lower anticipatory subjective stress responses were associated with higher *EMCS Scores*. Moreover, we found positive relationships between hypothetical moral decision-making and real prosocial behavior (opportunity for a charitable donation). To conclude, the present data raise the idea that specific personality traits like agreeableness might have a stronger impact on everyday moral decision-making than short-term exposure to moderate acute psychosocial stress.

6.6 Acknowledgements

This work was supported by the German Research Foundation (DFG) grant numbers DFG-KU1401/10-1 and 10-2 assigned to Brigitte M. Kudielka, Monika Sommer, and Stefan Wüst. Additionally, we thank Thomas Buchmin, Raphaela Rückerl, Philipp Vogel, and Florian Zimmer for their help in running the experimental sessions and data entry.

CHAPTER 7

7 GENERAL DISCUSSION

This chapter presents a general discussion of the results of *Studies I, II,* and *III* (see *Chapters 4* to *6*) in the context of the current literature (see *Chapter 2*) and the research aims of the present dissertation (see *Chapter 3*). First, a summary of the main findings of *Studies I, II,* and *III* will be provided in Section 7.1. Afterwards, overarching implications (see Section 7.2), limitations (see Section 7.3), and open questions for future research (see Section 7.4) will be discussed.

7.1 Summary of main findings

The main objective of this dissertation was to experimentally investigate the thesis that exposure to acute psychosocial stress influences decision-making in everyday moral conflict situations. In *Study I* (see *Chapter 4*), we therefore developed and validated a new measure to assess everyday moral decision-making in laboratory settings, the EMCS Scale. In *Studies II* and *III* (see *Chapters 5* and *6*), we then used a computerized version of the newly developed EMCS Scale to experimentally investigate the effects of acute stress exposure on everyday moral decision-making. In *Study II*, we additionally explored potential effects of social closeness of the target persons as well as effects of timing of the moral decision-making task. In *Study III*, we finally examined potential gender differences and effects of personality on everyday moral decision-making after acute stress exposure.

7.1.1 Study I

The rationale behind *Study I* (Singer et al., 2019) was a paucity of validated everyday moral decision-making paradigms and especially a lack of parallelized item sets that can be used in repeated-measurement approaches (e.g., at different time points after an experimental manipulation like acute stress induction or in a stress versus control condition in within-subjects designs). Based on the stimulus material of Sommer et al. (2010), which has already proven useful in several previous studies (e.g., Singer et al., 2017; Sommer et al., 2010, 2014), we created 60 hypothetical everyday moral conflict scenarios with two forced-choice alternatives (altruistic versus egoistic). In three independent paper-pencil surveys (N = 200), we then developed and validated a new 40-items measure to assess everyday moral decision-making in laboratory settings, the EMCS Scale. Additionally, we created two parallelized 20-items sets for future use in

repeated-measurement approaches and investigated the test and measurement properties of our new scale. The results of *Study I* indicated that the EMCS Scale is characterized by preferable mean rates of altruistic decisions, clear representations of altruistic and egoistic response classes, unambiguousness of social closeness classifications (socially close versus socially distant protagonists), and high similarity to reality ratings. Moreover, results of Rasch model analyses (Andersen and Martin-Loef LR-tests as well as graphical model tests) and classical test theory fit indices (Cronbach's alpha) confirmed unidimensionality and the appropriateness of fragmentation into two parallelized item sets.

Beyond scale development and validation, we investigated the impact of the protagonists' social closeness, a potential experimental design parameter in everyday moral dilemmas (see Christensen & Gomila, 2012). However, different from Zhan et al. (2018), the percentage of altruistic decisions in the EMCS Scale did not differ depending on social closeness. This divergence could most likely be explained by methodological differences, because it is debatable if the items of Zhan et al. (2018) adequately represented everyday moral dilemmas (see Section 2.2.2.2). Moreover, the fact that Rasch model analyses of our data revealed one latent trait variable underlying the EMCS Scale further speaks against a strong impact of social closeness. However, as proposed by the tend-and-befriend hypothesis (Taylor, 2006; Taylor et al., 2000), the impact of social closeness as experimental design parameter might potentially only emerge in combination with the induction of acute psychosocial stress (see for example Margittai et al., 2015; Vinkers et al., 2013; this was further investigated in *Studies II* and *III* of the present dissertation). Moreover, our data did not reveal gender differences in the EMCS Scale, which is in contrast to abstract moral dilemma research (Armstrong et al., 2018; Friesdorf et al., 2015; Fumagalli et al., 2010; Youssef et al., 2012). This divergent finding again points to the importance of methodologically differentiating between abstract and everyday moral dilemmas. And, last but not least, a supplementary analysis of our data showed that the responses to the EMCS Scale did not differ depending on the actual existence of the respective target persons in the real lives of the participants.

Hence, in *Study I*, we developed and validated the EMCS Scale, which is a promising measurement tool to investigate everyday moral decision-making in laboratory settings. Additionally, our data revealed that the EMCS Scale can be broadly applied independently of the participants' gender and the actual existence of the protagonists in the real lives of the participants.

Beyond *Study I*, we conducted a further methodological study with $N = 100$ participants to develop and validate a computer version of the EMCS Scale. Our data mainly indicated equivalence between the paper-pencil and the computer version of the EMCS Scale (details are outlined in the bachelor's thesis of Niklas, 2019). Hence, the EMCS Scale can be applied both as paper-pencil questionnaire and as computer paradigm. Moreover, similar to *Study III*, we gave the participants in this methodological study the opportunity to make a charitable donation for a local organization supporting homeless people (*Strohhalm Regensburg e.V.*). We observed a positive correlation between *EMCS Scores* and the real donation amount ($r = 0.38$, $p < 0.001$). A higher percentage of hypothetical altruistic decisions was associated with more money donated to *Strohhalm Regensburg e.V.*, which can be interpreted as further proof of external and ecological validity of the EMCS Scale. This computer version of the EMCS Scale was then used in *Studies II* and *III*, where we investigated the effects of acute stress exposure on everyday moral decision-making in laboratory settings.

7.1.2 Study II

In *Study II* (Singer et al., 2020), 40 young healthy men were exposed to moderate psychosocial stress by the use of the TSST or its non-stressful placebo version (PTSST) and then responded to the two parallelized item sets of the EMCS Scale at an early (+10 until +30 min) and at a late (+75 until +95 min after (P)TSST exposure) point of measurement. The main focus of *Study II* was on examining how everyday moral decision-making after acute stress exposure was influenced by social closeness and timing. The rationale behind this investigation was, on the one hand, increasing empirical evidence that stress and stress hormones influence moral decision-making (Kossowska et al., 2016; Li et al., 2019; Singer et al., 2017; Starcke et al., 2011, 2012; Youssef et al., 2012). On the other, related research on social decision-making suggests that acute stress can promote either prosocial or antisocial behavior depending on time elapsed between stress and decision-making (Margittai et al., 2015; Vinkers et al., 2013; see also Hermans et al., 2014 for a theoretical framework) and depending on social closeness of the target persons (Margittai et al., 2015). We investigated if this was also the case for everyday moral decision-making after acute stress exposure. Because of the well-known impact of gender, menstrual cycle phase, and oral contraceptives on the HPA axis reactivity (Kirschbaum et al., 1999; Zänkert et al., 2019), we recruited in *Study II* a solely male sample (similar to Singer et al., 2017).

As hypothesized, *EMCS Total Scores* were significantly higher in the stress than in the control condition. With this, we could replicate our previous finding of increased altruistic everyday moral decision-making after acute stress exposure compared to a control condition in males (Singer et al., 2017; see Section 2.3.2). Moreover, we observed a significant main effect of *Social Closeness* with more altruistic decisions in scenarios involving socially close versus distant protagonists. This result was in contrast to the paper-pencil validation of the EMCS Scale (*Study I*; Singer et al., 2019), but in accordance with Christensen and Gomila (2012), Zhan et al. (2018), and Niklas (2019). Somewhat unexpectedly, there were neither a significant main effect of *Timing* nor any two- or three-way interactions between the factors *Condition*, *Social Closeness*, and *Timing*. This was in contrast to Margittai et al. (2015) and other stress and decision-making literature (e.g., Pabst et al., 2013), and can be most likely traced back to the relatively small sample size of *Study II*. Only in secondary analyses, we observed increased altruistic decision-making after acute stress toward socially close but not toward distant protagonists at the early and not at the late point of measurement. Although this finding was only preliminary (due to the nonsignificant two-/three-way interactions in the main analysis), it supported the tend-and-befriend hypothesis (Taylor, 2006; Taylor et al., 2000) by suggesting that increased altruistic decision-making after acute stress might be restricted to socially close persons at an early time point. Regarding timing, our data agree with the assumption that in the first hour after stressor onset, monoamines and non-genomic corticosteroids might increase the focus on the self and close ones (de Kloet et al., 2018; Joëls et al., 2018). At the late time point, the actions of genomic corticosteroids could heighten executive control (de Kloet et al., 2019; de Kloet & Joëls, 2020; Hermans et al., 2014; Joëls et al., 2018), which might have reduced effects of forgoing stress. With this, our data fit the *Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress* (Hermans et al., 2014; see Section 2.1.2.2). However, only future investigations with larger study samples will actually show how far the results of Margittai et al. (2015) in the related research area on social decision-making can be transferred to everyday moral decision-making as well. At least, we observed in *Study II* positive associations between psychological stress responses (changes in negative affect in response to the (P)TSST and anticipatory stress appraisals) and *EMCS Scores*, which was in line with our finding of a higher percentage of altruistic decisions after acute stress exposure. Moreover, we observed positive associations between the personality variables agreeableness, social desirability, empathy and *EMCS Scores*, thus supporting our earlier claim that personality

traits might play an important role in everyday moral decision-making after acute stress exposure (Singer et al., 2017). However, there were no significant correlations between cortisol levels and *EMCS Scores*. This was in contrast to our earlier study (Singer et al., 2017) and also to the recent pharmacological manipulation study of Margittai et al. (2018), who observed that hydrocortisone administration increased prosocial behavior toward close others. Retrospectively, this missing association between cortisol levels and altruistic decisions might have been a first hint for the rather complex picture between stress, stress hormones, and everyday moral decision-making that finally emerged in *Study III*.

7.1.3 Study III

Study III (Singer et al., 2021) mainly focused on investigating potential gender differences and effects of the a priori selected personality traits agreeableness, empathy, and social desirability on everyday moral decision-making after acute stress exposure. In two within-subjects design studies, we exposed 179 healthy men and women to the TSST and a non-stress control condition (resting period) on two testing days in random order. At both test sessions, subjects responded to each one of the two parallelized item sets of the EMCS Scale at +10 until +30 min after stress/resting (i.e., at the typical time window of peak cortisol levels after stress exposure; Kudielka et al., 2007; see also Section 2.1.2.2). We applied within-subjects designs to hold constant interindividual variability in the dependent variables. Moreover, we considered the within-subjects designs as advantageous due to the higher statistical power compared to between-subjects designs (Charness et al., 2012) and due to a better control of confounding variables, since both of our earlier studies have shown that personality traits play an important role in everyday moral decision-making after acute stress exposure (see Singer et al., 2017, 2020). This was also in accordance with Habashi et al. (2016), Oda et al. (2013, 2014), Rosen et al. (2016), Zhang et al. (2019), and Zhao and Smillie (2015). Substudy 2 (N = 80) was primarily a replication of substudy 1 (N = 99) without a task switching paradigm between stress and moral decision-making. Through the application of a waiting period instead, we wanted to rule out the possibility that such a cognitive task potentially confounded our results. With regard to the female participants, we took particular care to control for menstrual cycle phase and tested all 89 females in their luteal phase (as determined by a chromatographic ovulation predictor test kit; Wolfram et al., 2011). Moreover, pregnant

or breast-feeding females as well as oral contraceptive users were excluded from participation (Entringer et al., 2010; Heinrichs et al., 2001; Zänkert et al., 2019).

However, despite high statistical power, we could neither confirm the hypothesized prosocial effects of acute stress nor social closeness on *EMCS Scores*, which was in contrast to our two earlier studies (Singer et al., 2017, 2020). Rather, our data revealed effects of female gender, agreeableness, and social desirability on everyday moral decision-making after acute stress. In substudy 1, female gender and higher levels of agreeableness were associated with higher *EMCS Scores* in the stress condition. Moreover, gender-specific analyses showed that agreeableness co-varied with higher *EMCS Scores* after stress only in males but not in females. By contrast, higher scores of social desirability correlated with more altruistic decisions irrespectively of condition (stress/control). In substudy 2, there were significant main effects of agreeableness and social desirability on *EMCS Scores* in both conditions, but no gender differences. Additionally, in substudy 2, we could replicate the finding that higher scores of agreeableness were associated with higher percentages of altruistic decisions only in the stress condition. Moreover, there was a significant interaction between *Condition*, *Social Closeness*, and *Empathy* (higher levels of empathy associated with more altruistic decisions toward socially distant protagonists, especially after stress; see Section 6.4.2.2).

With regard to stress responses, in substudy 1 we observed a positive relationship between sAA levels (AUC_I) and *EMCS Scores* in the stress condition, but no significant correlations with cortisol levels. This was in contrast to Singer et al. (2017), but in accordance with *Study II* (Singer et al., 2020), where we did similarly not detect significant correlations between the percentage of altruistic decisions and cortisol. Only in the female subsample of substudy 2, higher cortisol levels (AUC_G) were significantly associated with higher *EMCS Scores* after stress exposure. Due to financial restrictions, we did not measure sAA levels in substudy 2, which is why we cannot draw final conclusions about potential associations with sAA (see also Section 7.3). Concerning subjective stress, in both substudies, lower anticipatory subjective stress responses were associated with more altruistic decisions. This result was again in contrast to *Study II* (Singer et al., 2020), where we observed positive relationships between psychological stress responses and *EMCS Scores*. However, in *Study III*, we included male and female participants and measured cognitive stress appraisals only in the stress conditions, which could explain these divergent findings.

Last but not least, similar to the validation study of the computer version of the EMCS Scale (Niklas, 2019; see Section 7.1.1), positive correlations emerged between the percentage of hypothetical moral decisions and real prosocial behavior (donation amount to *Strohhalm Regensburg e.V.*). This finding provided further evidence for the external and ecological validity of the EMCS Scale in two independent samples. However, again contrary to our hypotheses and to earlier research (Sollberger et al., 2016), real donation behavior was not influenced by forgoing stress exposure versus rest. Though, in substudy 2, a comparable effect was descriptively observable.

In sum, as already stated above, the data of *Study III* revealed a rather complex interplay between stress, stress hormones, and altruistic decision-making. At least, the results of *Study III* pointed to effects of gender as well as personality on everyday moral decision-making after acute stress exposure. The divergent findings compared to the three previous between-subjects design studies on this research topic (Singer et al., 2017, 2020; Starcke et al., 2011) can be most likely traced back to methodological differences. Although we deliberately designed the two within-subjects studies due to the already mentioned methodological advantages compared to between-subjects designs (i.e., higher statistical power and better control of confounding variables), within-subjects designs might cause other problematic issues like carry-over, demand, framing, order, or memory effects (Charness et al., 2012). At least, additional analyses of our data revealed order effects as a rather unlikely explanation for the current absence of stress effects. Further methodological differences compared to our two earlier studies were the application of a resting condition instead of the PTSST (Het et al., 2009) and the use of two sets of parallelized but not identical items. This could have potentially led to more interindividual variance and consequently to the disappearance of significant between-group differences. Hence, it might not be justified to rule out effects of acute stress exposure on everyday moral decision-making solely based on the current within-subjects results. Nevertheless, our data suggest that specific personality traits like agreeableness might have a stronger impact on everyday moral decision-making than short-term exposure to acute stress.

7.2 Overarching implications

After having summarized all the individual findings from *Studies I*, *II*, and *III* in Section 7.1, this section now focuses on overarching implications that can be derived from the presented experiments.

First, with the help of all the studies included in this dissertation, we could develop and validate the EMCS Scale as a promising new measurement tool to assess everyday moral decision-making in laboratory settings. Beyond a paper-pencil version (*Study I*), we could also successfully implement the EMCS Scale as a computer task (see *Studies II, III*, and Niklas, 2019). With its two parallelized item sets, the EMCS Scale can be applied both in between- and within-subjects design studies. At the date of publication, the EMCS Scale was available in German and English language, but in the meantime, two other research groups have contacted us to get the permission to translate the EMCS Scale into Brazilian and Chinese language (in preparation). Moreover, another group of researchers from Turkey recently asked for permission to use the EMCS Scale in order to investigate the foreign language effect (i.e., altered moral decision-making by thinking in a foreign language; see for example Geipel et al., 2015) with regard to everyday moral dilemmas. Hence, the EMCS Scale can be broadly administered in different languages and research contexts. Moreover, beyond application in psychobiological stress research (as it was the case in the current dissertation), the EMCS Scale might also prove useful in other research disciplines, as for instance in individual differences research, social psychology, clinical psychology, developmental psychology, and occupational and organizational psychology.

Second, the main findings of *Studies II* and *III* expand our current knowledge on the *SIP-MDM Framework* (Garrigan et al., 2018). As already mentioned in Section 2.2.1, Garrigan et al. (2018) incorporated situational factors into five of six steps of the *SIP-MDM Framework* (see Figure 3) and emphasized the need for further investigations regarding these situational factors. Our empirical studies (Singer et al., 2017, 2020, 2021) contribute to their request by revealing acute stress exposure as an important situational factor that influences everyday moral decision-making, at least in laboratory settings. Moreover, the data of *Study II* also support the *Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress* (Hermans et al., 2014; see Section 2.1.2.2). Taken together, this points to the fact that one strength of the presented experimental studies is their profound theoretical foundation.

Third, if one combines the findings of the presented experiments, a rather complex picture emerges regarding the effects of acute stress exposure on everyday moral decision-making. On the one hand, we could replicate our previous observation of increased altruistic decision-making after acute stress exposure (Singer et al., 2017) in *Study II*. In both of these experiments, we applied between-subjects designs with a stress

(TSST) and a non-stress (PTSST) condition and investigated solely male samples. On the other, in *Study III*, we applied within-subjects designs with a stress (TSST) and a resting (waiting period) condition and tested both male and female participants. Although, during conceptualization of *Study III*, we felt confident that a within-subjects setup would be the design of best choice for investigating the effects of acute stress exposure on everyday moral decision-making (due to its aforementioned methodological advantages), we finally had to acknowledge that the within-subjects design might entail other problematic issues like demand, framing, order, or memory effects (see also Sections 6.5 and 7.1.3). This could have contributed to the absence of stress effects in *Study III*. For me personally, I additionally learned the lesson that there is no "best design" in psychological science (i.e., *there is no black or white*, which also holds true for life in general). Rather, every methodological study setup entails its own strengths and weaknesses. Therefore, a critical combination of the already existing and still outstanding future studies will be necessary and might bring us closer to the truth (see also *Chapter 8*).

7.3 Limitations

As already stated above, an overarching integration of the presented findings is not easily feasible. This can be most likely traced back to several limitations of *Studies I*, *II*, and *III*, which will be discussed in this section.

Generally, it has to be acknowledged that the EMCS Scale is a laboratory paradigm with artificial everyday moral conflict scenarios and response alternatives. Hence, although we endeavored to considerably improve the similarity to reality of the presented scenarios compared to other abstract and everyday dilemmas, studies applying the EMCS Scale still cannot reach external and ecological validity as high as ecological momentary assessment studies (see for example Hofmann et al., 2014, 2018). Moreover, the EMCS Scale was developed based on a sample of only N = 200 participants. Retrospectively, this sample size might have been too small, as in-depth analyses of the data of *Studies II* and *III* have still shown problems with the parallelism of the two item sets of the EMCS Scale (computer version). This issue emerged for the first time in the methodological development and validation study of the computer version of the EMCS Scale (Niklas, 2019). These data revealed a higher percentage of altruistic decisions in set B than in set A. At least, no significant differences emerged between the sets A and B regarding only the items with socially close protagonists. Nevertheless, this methodological issue could have clouded potential stress effects in *Study III*. However, it should be noticed that the

data of *Study I* provided empirical support for the assumption of unidimensionality (i.e., one underlying latent trait variable in Rasch analyses).

One further limitation of the presented experiments are potential social desirability effects. Although we included a measure of social desirability in *Studies II* and *III* by administering the SDS-17 (Stöber, 2001), this was not the case in the development and validation surveys of the EMCS Scale (*Study I*). However, we ensured strict anonymity to all of our participants and excluded all items with extremely high percentages of altruistic decisions. Moreover, for the final 40 items of the EMCS Scale, we observed statistical variance both within participants and across items (see the Appendix, Tables 8 and 9), which rather speaks against highly socially desirable responding. Additionally, the results of *Study III* and Niklas (2019) showed that higher percentages of altruistic decisions in the hypothetical conflicts of the EMCS Scale were associated with higher real donation amounts to *Strohhalm Regensburg e.V.* This finding provides further evidence for the external and ecological validity of the EMCS Scale and again runs counter to merely socially desirable responding.

Last but not least, it should be of note that no clear conclusions regarding the impact of the autonomic and endocrine biomarkers sAA and cortisol on everyday moral decision-making after acute stress can be drawn from the present studies alone. With regard to sAA, this biomarker was only measured in substudy 1 of *Study III*. In this substudy, we observed a positive association between *sAA* AUC_I and the percentage of altruistic decisions after acute stress exposure. Unfortunately, due to financial restrictions, we did neither assess sAA levels in *Study II* nor substudy 2 of *Study III*. Hence, regarding sAA, it is unclear whether the same pattern of results would have also emerged in our other studies. Concerning cortisol, the levels of this steroid hormone were neither significantly associated with altruistic decision-making in *Study II* nor *Study III*, which was in contrast to our earlier research (Singer et al., 2017), but in agreement with the low-emotional dilemmas of Starcke et al. (2011). Only in the female subsample of substudy 2 (*Study III*), we found a significant positive relationship between *EMCS Scores* and cortisol levels (AUC_G) after stress exposure. Thus, the specific role of cortisol in everyday moral decision-making after acute stress exposure remains unclear, and future studies should additionally investigate potential interactions with other hormones like testosterone (Schweda et al., 2019) or neuropeptides like oxytocin (e.g., Riem et al., 2013; Striepens et al., 2011). Further, pharmacological manipulation studies, as it has been done by

Margittai et al. (2018) in the field of social decision-making, might prove helpful to better elucidate the impact of the stress hormone cortisol on everyday moral decision-making.

7.4 Open questions for future research

Although the presented studies provided several exciting insights into the effects of acute stress exposure on decision-making in everyday moral conflict situations, they also raise some open questions for future research, which will finally be outlined in this section.

First, future studies should investigate the test and measurement properties of the EMCS Scale (both of the paper-pencil and the computer version) as well as the parallelism of its two item sets in much larger study samples. Maybe, such analyses might reveal a better subdivision of the 40 items into two parallelized item sets compared to its current version (based on N = 200 participants; Singer et al., 2019), which could be a reason to revise the EMCS Scale and its two subsets. Moreover, it would also be interesting to analyze the factor structure of the EMCS Scale in a much larger data base.

Second, future research is needed in order to replicate the procedure of *Study II* in a larger and mixed-sex sample. Such an investigation will be necessary to finally evaluate the preliminary finding of *Study II* that increased altruistic decision-making might be restricted to socially close protagonists at an early time point after acute stress exposure. Since we recruited only males in both of our between-subjects design studies (Singer et al., 2017, 2020), further between-subjects investigations should include both females and mixed-sex samples. To date, only Starcke et al. (2011) examined the effects of acute stress exposure on everyday moral decision-making in a mixed-sex sample and in a between-subjects design, but they did not control for menstrual cycle phase, which might have confounded their results. In well-controlled, larger, and mixed-sex samples, one might expect even more altruistic decisions after acute stress in females compared to males (Smeets et al., 2009; Tomova et al., 2014; von Dawans et al., 2019). It has to be acknowledged that in *Study III*, we aimed to conduct such an investigation, but the within-subjects setup might have caused other methodological issues that could have obscured potential stress effects. Similarly, there is a need for future pharmacological manipulation studies in order to make profound statements about the specific role of the stress hormone cortisol in everyday moral decision-making (see also Section 7.3). Moreover, fMRI studies are warranted to investigate neural activity during everyday moral decision-making after acute stress exposure. fMRI studies might also be helpful to further

empirically examine the proposed *Biphasic-Reciprocal Model of Reallocation of Neural Resources in Response to Stress* (Hermans et al., 2014).

Third, for future studies it would be interesting to systematically investigate the hypothesis that stress might increase altruistic decision-making through a mechanism of emotion regulation with prosocial behavior as an opportunity to enhance negative mood induced by the TSST (Singer et al., 2017; Sollberger et al., 2016). Potentially, different emotion regulation strategies might play a role at different time points after acute stress exposure, since Langer et al. (2020) reported that acute stress improved the effectivity of the cognitive emotion regulation strategy reappraisal in men at +15 min after TSST offset. By contrast, at +90 min after TSST offset, rather the emotion regulation strategy distraction seems to be increasingly used (Langer et al., 2021).

Fourth, apart from our studies in young, healthy males and females, additionally older participants and clinical samples should be examined. Though, particular care should be warranted, because both age (Kudielka, Buske-Kirschbaum, et al., 2004b) and several somatic and psychiatric diseases (Chrousos, 2009; Zorn et al., 2017) come along with alterations in HPA axis reactivity. Moreover, psychiatric conditions like alexithymia (i.e., difficulties in recognizing and experiencing others' emotional distress) have been shown to decrease altruism in social choices (FeldmanHall et al., 2013).

Fifth, ambulatory assessment studies will be helpful to examine real life stressors and their impact on everyday moral decision-making. This would be worth of investigation since FeldmanHall, Mobbs, et al. (2012) observed that real moral decisions can significantly differ from hypothetical moral decisions. Moreover, it has been shown that real moral decisions also recruit distinct neural circuitry than hypothetical moral decisions (FeldmanHall, Dalgleish, et al., 2012). However, at least Hofmann et al. (2014, 2018) confirmed in their ecological momentary assessment study several areas of human morality similar to those that we used for item construction of the EMCS Scale based on the MFT (Graham et al., 2011, 2013; Haidt & Graham, 2007).

Sixth, the EMCS Scale covers only one particular sort of moral conflicts, namely accepted moral values versus self-interests (Singer et al., 2019). Hence, for future studies it would be interesting to develop and validate further new measures to investigate other types of moral conflicts, like for example conflicts between different duties or sets of apparently incommensurable values (Christensen & Gomila, 2012). It would be a very exciting research question if there were differential effects of acute stress exposure on everyday moral decision-making depending on the type of moral conflict.

CHAPTER 8

8 FINAL CONCLUSIONS

In sum, the *Studies I*, *II*, and *III* included in this dissertation contribute to the investigation of the effects of acute stress exposure on decision-making in everyday moral conflict situations. First, the presented data describe the development and validation of a promising new measure of everyday moral decision-making, the EMCS Scale (*Study I*; Singer et al., 2019). Second, our experiments serve as a window to better understand the effects of acute stress exposure on everyday moral decision-making with particular focus on the effects of social closeness and timing (*Study II*; Singer et al., 2020) as well as gender and personality (*Study III*; Singer et al., 2021).

Taken together, the data of our two between-subjects design studies indicated a prosocial impact of acute stress exposure on everyday moral decision-making (Singer et al., 2017, 2020), whereas our within-subjects investigations revealed a rather complex interplay between stress, stress hormones, and altruistic decision-making (Singer et al., 2021). Under the assumption that these divergent findings can be most likely traced back to methodological differences between the respective study setups, our data suggest that between-subjects designs might be better suitable for the experimental investigation of acute stress effects on everyday moral decision-making than within-subjects designs. However, it would be wrong to assume stress effects on decision-making in everyday moral conflict situations in any case based on our between-subjects results. Likewise, it does not seem justified to completely rule out such effects solely based on the current within-subjects results. Rather, there is a need for further and more large-scale studies. Only a critical combination of the present and still outstanding future research, for example by conducting meta-analyses, will bring us closer to the truth.

More generally, the data included in this dissertation show that human behavior is complex and support the assumption that decision-making after acute stress is influenced by various factors (Starcke & Brand, 2012; van den Bos et al., 2013). However, since my main motivation for studying psychology and also for working as a researcher and psychotherapist is my interest in how people behave and why they do things in a certain way, for me, especially this complexity makes human behavior so exciting for further investigation.

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10 APPENDIX

Table 8

Appendix 1. Overview of the finally selected 40 items (everyday moral conflict situations) of the EMCS Scale with corresponding response alternatives (altruistic vs. egoistic), mean item difficulties (Studies 1 and 3), altruistic and egoistic response ratings (Study 2), social closeness and similarity to reality ratings (Studies 1 and 2), and respective assignment to the two parallelized item sets A and B (Singer et al., 2019)

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
Items with socially close protagonists							
1. I buy concert tickets on the internet for my brother and myself. I can get two seats side by side. However, the tickets fall into two different price categories, so that one ticket is 10 € more expensive than the other. What do I do?	I take the more expensive ticket. I take the cheaper ticket.	0.61 (± 0.49)	5.72 (± 1.02)	2.56 (± 1.08)	6.73 (± 0.62)	4.03 (± 1.43)	B
2. I am just about to leave for work as a neighbor and friend rings my bell. She asks me if I could drive her to the doctor because she is not feeling well. I am already late and have a meeting with my boss today. What do I do?	I drive her to the doctor. I go to work.	0.50 (± 0.50)	6.12 (± 0.97)	2.60 (± 0.91)	4.75 (± 0.78)	4.10 (± 1.24)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
3. Today, it is games night and I play poker for money with friends. As one of my opponents shortly gets distracted, I catch a glance of his/her cards. The other players do not notice anything. What do I do?	I let the cards be reshuffled. I keep playing.	0.17 (± 0.37)	5.80 (± 0.91)	2.84 (± 1.07)	5.61 (± 0.84)	4.77 (± 1.57)	B
4. I have been single for quite a long time. Tonight, I finally have a promising date again. As I am about to leave, a good friend of mine who is not feeling well gives me a call and wants to meet up with me now. What do I do?	I meet up with my friend. I go on the date.	0.66 (± 0.48)	5.40 (± 1.08)	2.48 (± 0.82)	6.04 (± 0.94)	4.88 (± 1.54)	B
5. A friend of mine definitely wants to buy an old computer game from me that he loves playing. I promise to sell it to him for 20 € tomorrow. Later on, as I check on the internet, I see that I could sell the game immediately for 60 € there. What do I do?	I keep my promise. I sell the game for more money.	0.79 (± 0.41)	5.64 (± 1.00)	2.40 (± 0.82)	5.63 (± 0.75)	4.14 (± 1.54)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
6. I am talking to my aunt at a family celebration. All of a sudden, it comes to my mind that she lent me a CD last Christmas. She does not seem to remember anymore and I like the CD very much. What do I do?	I return the CD. I keep the CD.	0.74 (± 0.44)	5.44 (± 1.00)	2.12 (± 1.01)	5.70 (± 0.96)	4.78 (± 1.47)	B
7. I have promised my sister to take care of her children tonight. Now, I realize that I am also invited to a farewell party today that is very important for me. I could think up an excuse to go to the party. What do I do?	I keep my promise. I think up an excuse.	0.70 (± 0.46)	5.28 (± 0.98)	2.16 (± 1.03)	6.71 (± 0.57)	4.80 (± 1.52)	A
8. A friend of mine has inherited a coin collection that interests me very much. He offers to sell the coins to me for a low price. The coins are already collector's items and would therefore actually be worth considerably more money. What do I do?	I inform the friend about the value. I buy the coins for the low price.	0.62 (± 0.49)	5.76 (± 0.72)	3.28 (± 1.14)	5.65 (± 0.86)	3.67 (± 1.51)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
9. A friend of mine and I are big fans of a band. This band is going to give a concert in our hometown, and we both want to go. At the ticket agency, I am only able to get one ticket. What do I do?	I give the ticket to my friend. I go to the concert myself.	0.62 (± 0.49)	6.32 (± 0.95)	2.64 (± 1.08)	5.82 (± 0.74)	3.68 (± 1.49)	A
10. While locking up my bike, it falls against a car. In the darkness, I do not detect any scratches on the car. The next day, I hear my well-known neighbor complaining about a fresh scratch on his new car. What do I do?	I inform the neighbor. I keep quiet about the incident.	0.56 (± 0.50)	5.68 (± 0.99)	2.08 (± 0.76)	4.27 (± 1.18)	4.48 (± 1.31)	A
11. It is the soccer world cup and the final match is on TV. I am a big soccer fan and very excited about the game. All of a sudden, a friend of mine who is not feeling well gives me a call and wants to meet up with me right now. What do I do?	I meet up with my friend. I watch the soccer game.	0.81 (± 0.39)	5.60 (± 0.71)	2.44 (± 1.61)	5.76 (± 1.00)	4.40 ± 1.80)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
12. I have promised my partner to go to the company party with him/her. He/she has already signed both of us up. Now I realize that I would urgently need the time to prepare for an important exam. What do I do?	I keep my promise. I prepare for the exam.	0.51 (± 0.50)	5.68 (± 0.95)	3.12 (± 1.05)	6.65 (± 0.82)	4.89 (± 1.53)	A
13. My mother gives me 20 € to buy pet food. At the pet store, I see that the pet food is on special offer and only costs 10 €. Since I have many expenses this month, I could use the remaining 10 € very well for myself. What do I do?	I return the money to my mother. I keep the money.	0.77 (± 0.42)	5.48 (± 1.01)	2.36 (± 1.08)	6.75 (± 0.77)	5.11 (± 1.45)	B
14. A good band is going to give a concert in town. At the ticket agency, I get the very last ticket. When a classmate and friend standing behind me in line realizes this, he is appalled and bursts into tears. What do I do?	I give the ticket to him. I keep the ticket for myself.	0.61 (± 0.49)	5.96 (± 1.06)	2.88 (± 1.27)	4.85 (± 0.97)	3.57 (± 1.55)	B

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
15. I have promised my grandfather to help him complete urgent forms this evening. All of a sudden, I get a phone call from the newspaper. I have won tickets for my favorite band's sold out concert tonight. What do I do?	I help my grandfather. I go to the concert.	0.45 (± 0.50)	6.12 (± 0.73)	2.72 (± 1.06)	6.72 (± 0.81)	3.80 (± 1.58)	B
16. I am at the airport, ready to leave on a long-planned holiday. While I am standing at the check-in counter, my mother gives me a call. She tells me that my father had a little accident and was admitted to the hospital. What do I do?	I cancel the holiday. I take the flight anyway.	0.41 (± 0.49)	5.88 (± 1.05)	2.24 (± 1.17)	6.72 (± 0.89)	4.47 (± 1.45)	A
17. I have promised a neighbor and friend to receive an urgent parcel for her today. Now, it is 5 pm and the parcel service has not been here yet. My gym course will start soon and I would really like to participate. What do I do?	I wait for the parcel service. I go to the gym course.	0.43 (± 0.50)	6.00 (± 0.91)	3.16 (± 0.99)	4.74 (± 0.94)	4.86 (± 1.38)	B

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
18. I have promised to go to a friend's birthday party. Now, I realize that it is the same day as my favorite band's concert, which I do not want to miss. I could think up an excuse to go to the concert. What do I do?	I go to the birthday party. I think up an excuse.	0.83 (± 0.38)	5.24 (± 0.97)	2.20 (± 0.87)	5.56 (± 1.00)	4.52 ± 1.34)	B
19. I want to sell my old laptop. As my uncle hears about it, he offers to pay 200 € and I agree. Soon after, I see on an internet portal that I could sell the laptop immediately for 300 € there. What do I do?	I keep my promise. I sell the laptop for more money.	0.83 (± 0.38)	5.32 (± 1.07)	2.28 (± 0.68)	5.75 (± 0.83)	4.56 ± 1.37)	B
20. I have promised my grandmother to take her to the doctor this afternoon. One hour before the appointment, my boss gives me a call and summons me on short notice for an important meeting. This meeting is supposed to be about my promotion. What do I do?	I take my grandmother to the doctor. I go to the meeting with my boss.	0.52 (± 0.50)	5.48 (± 1.09)	2.32 (± 0.69)	6.48 (± 0.82)	4.32 (± 1.38)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
Items with socially distant protagonists							
21. While pulling out of a supermarket parking space, I accidentally bump the car parking next to mine. At first glance, I cannot detect any damages on my car. It is already dark and nobody else has seen anything. What do I do?	I leave a message for the owner of the car. I drive away quickly.	0.79 (± 0.41)	5.24 (± 1.36)	1.56 (± 0.77)	1.42 (± 0.93)	5.73 (± 1.16)	B
22. After some hours in a café, I request to pay. I have already calculated the total amount to be paid in my head. When the waitress tells me the amount to be paid, I realize that she has miscalculated by 3 € in my favor. What do I do?	I return the money. I keep the money.	0.61 (± 0.49)	6.25 (± 0.99)	1.84 (± 0.69)	2.23 (± 1.05)	5.55 (± 1.20)	B
23. I want to go home on a train that runs only once every hour. The train is about to leave and I am just boarding as a man with crutches near me falls on the platform. If I help him up, I will miss the train. What do I do?	I help the man. I take the train.	0.71 (± 0.46)	6.32 (± 0.85)	1.84 (± 0.90)	1.80 (± 1.03)	4.76 (± 1.30)	B

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
24. After a visit to a cocktail bar during my holiday, I request to pay. A waiter brings me the bill. While looking over it, I notice that he forgot to bill my last cocktail. What do I do?	I point out the mistake. I pay without the last cocktail.	0.37 (± 0.48)	5.80 (± 0.76)	2.52 (± 0.87)	1.92 (± 0.88)	5.37 (± 1.03)	A
25. I advertise my old computer for sale on the internet. A potential buyer and I agree on a price of 320 €. However, the buyer accidentally transfers 40 € too much to my bank account. What do I do?	I transfer the money back. I keep the money.	0.68 (± 0.47)	5.92 (± 0.76)	2.08 (± 0.86)	1.81 (± 1.03)	4.38 (± 1.38)	B
26. I want to sell my old car. I know that the car's radiator actually needs to be exchanged urgently. A man who does not notice the problem with the radiator offers to pay a good price in cash right away. What do I do?	I mention the defect. I keep quiet about the defect.	0.72 (± 0.45)	5.88 (± 0.83)	1.68 (± 0.69)	1.87 (± 0.92)	4.69 (± 1.41)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
27. I am about to get into my car at a supermarket parking lot. Next to me, a woman's full bag of groceries bursts and all her purchases fall to the ground. If I help the woman, I will be too late for an important appointment. What do I do?	I help the woman. I get into my car.	0.68 (± 0.47)	6.32 (± 0.69)	2.08 (± 0.86)	1.83 (± 0.95)	5.09 (± 1.28)	A
28. I have placed an advertisement to sell a wardrobe. A woman who wants to pick up the wardrobe next week offers to pay 140 € and I agree. Soon after, someone else calls who offers to pay 200 €. What do I do?	I keep my promise. I sell the wardrobe for more money.	0.49 (± 0.50)	5.64 (± 0.81)	2.80 (± 1.08)	1.75 (± 0.99)	4.86 (± 1.36)	B
29. I want to get on a bus that is about to leave and that only runs once every 30 minutes. On the bus platform, there is an old woman with a bag of groceries. As I am getting on the bus, the woman's bag falls to the ground. What do I do?	I help the woman. I take the bus.	0.60 (± 0.49)	6.40 (± 0.65)	2.44 (± 0.82)	1.81 (± 0.99)	5.00 (± 1.35)	B

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
30. I am at the checkout of a supermarket and I want to pay for my groceries, which cost 8 €. I give a 10 € bill to the cashier. She accidentally gives me back 4 € instead of 2 €. What do I do?	I return the money. I keep the money.	0.62 (± 0.49)	5.80 (± 0.91)	2.52 (± 1.23)	1.91 (± 1.07)	5.67 (± 1.13)	A
31. I am running to catch a bus that is about to leave and that only runs once every hour. In front of me, several items drop out of the purse of a woman with two small children. Except for me, there is no one else around to help the woman. What do I do?	I help the woman. I run to the bus.	0.61 (± 0.49)	5.96 (± 0.79)	2.16 (± 1.03)	1.80 (± 1.03)	4.97 (± 1.34)	A
32. After a visit to the shopping center, I am on my way back to my car. By chance, I find a 20 € bill on the ground. As I look around, I notice a homeless man going through the dustbins of the shopping center. What do I do?	I give the money to the homeless man. I keep the money.	0.41 (± 0.49)	6.52 (± 0.87)	2.72 (± 1.17)	1.47 (± 0.88)	3.83 (± 1.54)	B

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
33. I got the confirmation for a terrific apartment. However, the landlord does not permit pets, and I own a hamster. The landlord lives 100 km away from the apartment and would probably never find out about the pet. What do I do?	I do not take the apartment. I keep quiet about the pet.	0.42 (± 0.50)	4.88 (± 1.20)	2.84 (± 0.99)	1.96 (± 1.02)	4.76 (± 1.39)	B
34. I have ordered a pizza from a delivery service on the internet. After delivery, I pay with a 50 € bill. As the pizza delivery boy gives me the change, I realize that he has given me back 5 € too much. What do I do?	I return the money. I keep the money.	0.65 (± 0.48)	5.36 (± 0.91)	2.24 (± 0.93)	1.83 (± 1.06)	5.26 (± 1.13)	B
35. I want to sell a painting at a flea market. A woman offers to pay 100 € and I agree. While the woman is on her way to a bank to withdraw money, someone else offers to pay 150 € for the painting. What do I do?	I keep my promise. I sell the painting for the higher price.	0.71 (± 0.46)	5.60 (± 1.00)	2.52 (± 1.09)	1.76 (± 0.93)	4.33 (± 1.39)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
36. On the street, I see an old woman stumble and her purchases roll on the ground. Next to me, I see my bus that is about to leave and that runs only once every two hours. Besides the woman, I am the only person around. What do I do?	I help the woman. I take the bus.	0.56 (± 0.50)	6.00 (± 0.96)	2.56 (± 1.12)	1.75 (± 1.05)	4.29 (± 1.42)	B
37. I find a wallet on the street one evening with 50 € in it but without any personal documents. There is no possibility for me to find out the owner. However, I could turn in the wallet at the city's lost and found office. What do I do?	I turn in the wallet. I keep the wallet.	0.66 (± 0.48)	6.12 (± 0.88)	2.04 (± 0.84)	1.47 (± 1.28)	4.80 (± 1.54)	A
38. I am driving by car to an important business meeting and I am running a bit late today. Right in front of me, a slight rear-end collision happens. If I stop my car, I will probably be too late for my meeting. What do I do?	I stop my car. I keep driving.	0.50 (± 0.50)	5.48 (± 1.05)	2.52 (± 1.01)	1.48 (± 0.86)	4.94 (± 1.44)	A

Everyday moral conflict situation	Response alternatives (altruistic vs. egoistic)	Item difficulty (0-1)[1]	Altruistic response rating (1-7)[2]	Egoistic response rating (1-7)[2]	Social closeness (1-7)[3]	Similarity to reality (1-7)[3]	Set (A/B)
39. I definitely want to catch the bus in order to be home in time for an important appointment. Shortly before the bus leaves, the pedestrian light turns red. A little boy is standing on the other side of the intersection. What do I do?	I wait. I cross the street on red light.	0.35 (± 0.48)	5.04 (± 1.02)	2.72 (± 1.10)	1.78 (± 1.17)	5.74 (± 1.11)	A
40. I want to go home by train. As I am getting on the train, I see a man with crutches unsuccessfully trying to carry his suitcase upstairs to the platform. If I help the man, I will miss the train. What do I do?	I help the man. I get on the train.	0.63 (± 0.48)	6.12 (± 0.93)	2.28 (± 0.98)	1.77 (± 1.11)	4.83 (± 1.45)	A

Note. Items 1-20 are scenarios with socially close protagonists, items 21-40 are scenarios with socially distant protagonists. The 40 items were presented in a fixed random order in all three studies; the order of the two corresponding response alternatives was counterbalanced in our surveys.
[1] Based on the available data from 150 participants (Studies 1 and 3).
[2] Based on the available data from 50 participants (Study 2).
[3] Based on the available data from 100 participants (Studies 1 and 2).

Table 9

Appendix 2. Item statistics and results of Rasch model analyses on single item basis for the final 40 items of the EMCS Scale (Singer et al., 2019)

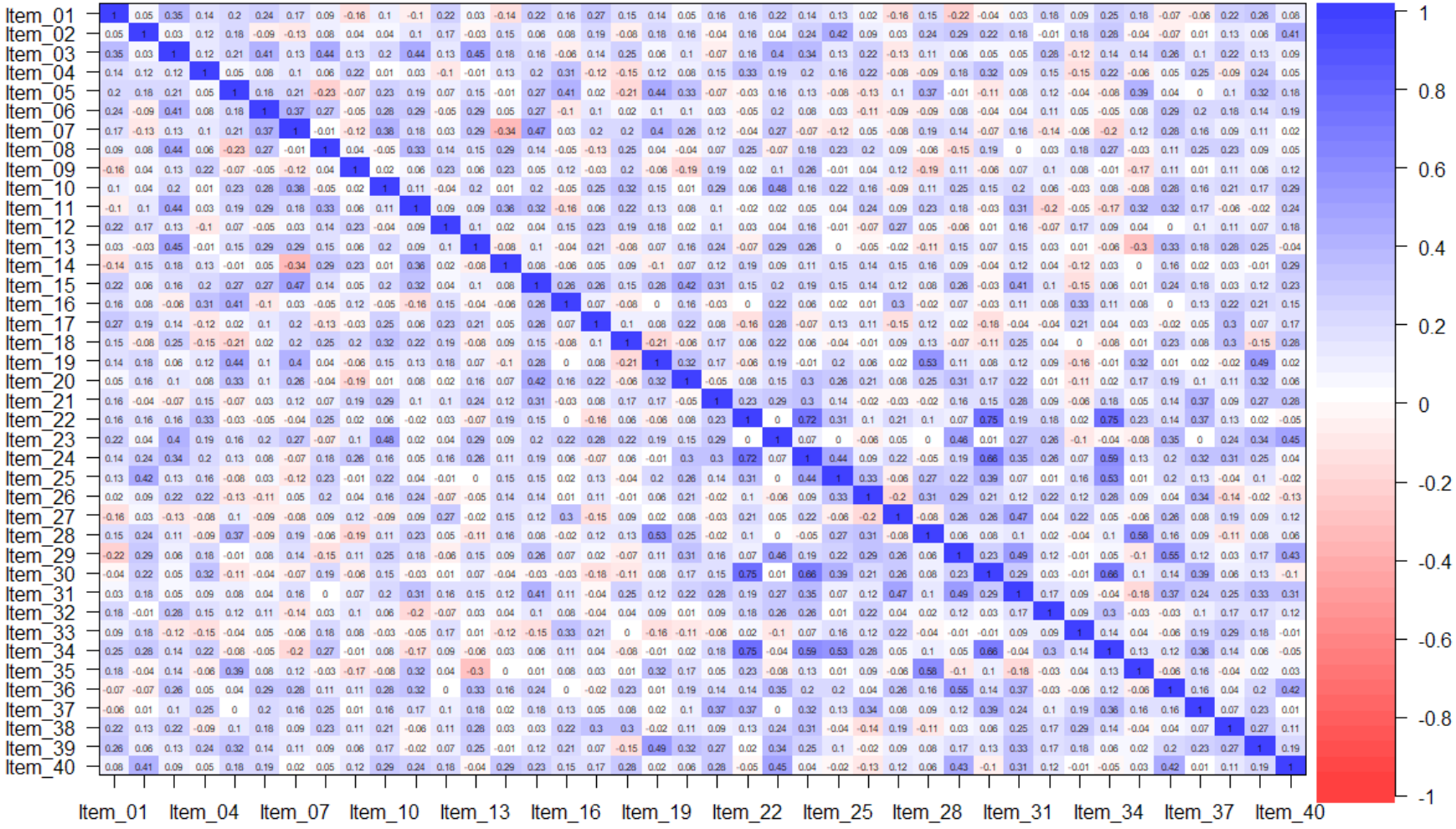
	Item statistics				Rasch model analyses					
	Item difficulty	Sample *SD*	Discrimination: Item with total score	Discrimination: Item with total score without CIS	Beta	*SE*	Outfit *MSQ*	Infit *MSQ*	Outfit *t*	Infit *t*
Item 1	0.58	0.50	0.28	0.20	-0.09	0.17	1.03	1.03	0.44	0.60
Item 2	0.49	0.50	0.31	0.23	-0.47	0.17	1.03	1.01	0.37	0.31
Item 3	0.17	0.37	0.34	0.28	-2.20	0.22	0.90	0.89	-0.47	-0.75
Item 4	0.65	0.48	0.27	0.20	0.24	0.18	1.02	1.02	0.19	0.33
Item 5	0.79	0.41	0.27	0.20	0.96	0.20	0.96	1.00	-0.16	0.00
Item 6	0.74	0.44	0.26	0.19	0.69	0.19	1.06	1.00	0.48	0.00
Item 7	0.69	0.46	0.26	0.18	0.44	0.18	1.03	1.02	0.29	0.28
Item 8	0.62	0.49	0.28	0.20	0.09	0.17	1.01	1.03	0.08	0.48
Item 9	0.59	0.49	0.17	0.09	-0.03	0.17	1.14	1.10	1.58	1.85
Item 10	0.56	0.50	0.36	0.28	-0.18	0.17	0.94	0.97	-0.82	-0.59
Item 11	0.80	0.40	0.27	0.20	1.05	0.21	0.99	0.98	-0.02	-0.15
Item 12	0.51	0.50	0.25	0.16	-0.39	0.17	1.05	1.06	0.70	1.28
Item 13	0.77	0.42	0.24	0.17	0.84	0.20	0.95	1.04	-0.25	0.39
Item 14	0.61	0.49	0.22	0.14	0.06	0.17	1.11	1.06	1.19	1.10
Item 15	0.45	0.50	0.43	0.35	-0.68	0.17	0.89	0.92	-1.53	-1.52
Item 16	0.41	0.49	0.26	0.17	-0.86	0.17	1.05	1.07	0.69	1.11
Item 17	0.43	0.50	0.25	0.16	-0.74	0.17	1.14	1.05	1.77	0.95
Item 18	0.83	0.38	0.20	0.14	1.23	0.22	0.98	1.02	-0.03	0.22
Item 19	0.83	0.38	0.28	0.22	1.23	0.22	0.92	0.95	-0.36	-0.32
Item 20	0.51	0.50	0.35	0.27	-0.39	0.17	1.01	0.97	0.11	-0.54

Item 21	0.78	0.42	0.31	0.25	0.92	0.20	0.95	0.96	-0.24	-0.32
Item 22	0.61	0.49	0.40	0.33	0.06	0.17	0.88	0.94	-1.33	-1.11
Item 23	0.71	0.46	0.39	0.32	0.51	0.18	0.86	0.94	-1.17	-0.79
Item 24	0.37	0.48	0.50	0.43	-1.04	0.18	0.82	0.85	-2.14	-2.31
Item 25	0.68	0.47	0.35	0.28	0.37	0.18	0.93	0.96	-0.65	-0.54
Item 26	0.72	0.45	0.26	0.18	0.58	0.19	1.00	1.02	0.04	0.24
Item 27	0.68	0.47	0.23	0.15	0.37	0.18	1.18	1.05	1.57	0.65
Item 28	0.49	0.50	0.28	0.20	-0.47	0.17	1.03	1.03	0.49	0.63
Item 29	0.60	0.49	0.38	0.31	0.00	0.17	0.99	0.95	-0.11	-0.92
Item 30	0.62	0.49	0.36	0.28	0.09	0.17	0.93	0.97	-0.82	-0.56
Item 31	0.61	0.49	0.44	0.37	0.06	0.17	0.85	0.91	-1.78	-1.61
Item 32	0.41	0.49	0.25	0.16	-0.83	0.17	1.06	1.07	0.76	1.16
Item 33	0.41	0.49	0.18	0.10	-0.83	0.17	1.18	1.12	2.21	2.07
Item 34	0.65	0.48	0.38	0.31	0.21	0.18	0.91	0.95	-0.95	-0.84
Item 35	0.71	0.46	0.19	0.11	0.51	0.18	1.11	1.06	0.87	0.81
Item 36	0.56	0.50	0.40	0.33	-0.18	0.17	0.94	0.94	-0.73	-1.20
Item 37	0.66	0.48	0.38	0.30	0.28	0.18	0.93	0.95	-0.70	-0.76
Item 38	0.50	0.50	0.33	0.25	-0.44	0.17	0.96	1.00	-0.49	-0.09
Item 39	0.35	0.48	0.38	0.30	-1.14	0.18	0.95	0.95	-0.52	-0.67
Item 40	0.63	0.48	0.36	0.28	0.15	0.17	0.95	0.97	-0.49	-0.53

Note. Items 1-20 are scenarios with socially close protagonists, items 21-40 are scenarios with socially distant protagonists. *SD* = standard deviation; without *CIS* = without correlated item score; beta = item easiness, i.e., the more likely a person gave an altruistic response, the higher became the score; *SE* = standard error; outfit *MSQ* = mean-square outlier-sensitive fit; infit *MSQ* = mean-square information-weighted fit; outfit and infit *MSQ* are ideally equal to one, values between 0.5 and 1.5 are called "productive for measurement", and their corresponding *t*-value should be between -1.9 and 1.9 (Linacre, 2002), while other sources suggest to extend these borders and to focus on the *MSQ* to reduce type I errors (Smith et al., 2008).

Table 10

Appendix 3. Inter-item correlations (tetrachoric correlations) of the final 40 items of the EMCS Scale (Singer et al., 2019)



Note. Items 1-20 are scenarios with socially close protagonists, items 21-40 are scenarios with socially distant protagonists.