MASTERARBEIT | MASTER'S THESIS

Titel | Title

The Moderating Effects of Extraversion on the Impact of Social Isolation

verfasst von | submitted by

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angestrebter akademischer Grad | in partial fulfilment of the requirements for the degree of

Master of Science (MSc)

Wien | Vienna, 2025

Studienkennzahl lt. Studienblatt | Degree programme code as it appears on the student record sheet:	UA 066 840
Studienrichtung lt. Studienblatt | Degree programme as it appears on the student record sheet:	Masterstudium Psychologie
Betreut von | Supervisor:	Univ.-Prof. Giorgia Silani Privatdoz. PhD

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Acknowledgements

This thesis was part of a larger research project conducted under the supervision of Univ. Prof. Dr. Giorgia Silani and Ana Stijovic, PhD and in cooperation with several colleagues. I am sincerely grateful for their guidance, patience, and assistance throughout data collection and for helping me in developing the scaffold of this thesis - its conceptualization, methodological framework, and overall structure. The process was profoundly instructive, and I am thankful to have been a part of this team. Some contents and aspects of this thesis may overlap with the theses of Christina Spitzhofer (2021) and Fiona Eslami Tehrani (2021) due to the common study design and materials.

I also wish to thank my colleagues, Christina and Fiona, for the mutual support we shared during data collection and for the encouragement that sustained us through the development and writing of our theses.

I thank my mum, who championed my education and encouraged me to believe in myself and reach my potential. Her sustained support has been instrumental to my path. Parenting largely on her own, she faced substantial challenges, yet remained a steady source of loving encouragement and support.

Last but not least, I want to thank my fiancé. I am deeply thankful and in awe of your endless patience, trust, and believe in me, as well as your unwavering support in every aspect of life. Without you, I would not be where I am today. Without you, I probably would still not have finished this thesis. Thank you for never pressuring and never doubting me. You mean the world to me.

Artificial Intelligence Use Declaration

In my thesis, I used Grammarly and Microsoft Word as provided by the University of Vienna exclusively for the correction of spelling mistakes, grammar and sentence structure. No generative artificial intelligence was utilized.

Introduction

Social Isolation

An abundance of psychological research in recent decades has converged on the understanding that *social isolation* has profound implications for health and well-being. There is broad scientific consensus that insufficient social connection is detrimental to humans, rivaling established health risk factors in its impact (National Academies of Sciences, Engineering, and Medicine (NASEM), 2020). In fact, a meta-analytic review found that high levels of actual social isolation correspond to a 29% increase in risk of early

mortality (Holt-Lunstad et al., 2015). This heightened mortality risk associated with weak social ties is comparable to the risks posed by well-known factors such as smoking, obesity, or lack of exercise (NASEM, 2020). Consistently, numerous large-scale studies have shown that people who are socially isolated tend to experience poorer health outcomes across the board which include greater incidence of cardiovascular disease, faster cognitive decline and higher rates of dementia, and elevated prevalence of psychological disorders like depression and anxiety (NASEM, 2020). Perhaps most striking is the consistency of these findings across diverse populations and methodologies: whether social isolation is measured by solitary living conditions, small social networks, or low participation in social activities, it reliably predicts worse health and well-being (Taylor et al., 2023).

The scientific community's interest in social isolation has intensified in light of global trends and events. Even before the COVID-19 pandemic, researchers had identified a *loneliness epidemic* in many societies, spurring public health initiatives in countries like the UK, Australia, and the USA to mitigate social isolation (Badcock et al., 2022). The pandemic's enforced social distancing measures then brought unprecedented attention to this topic, as large segments of the population experienced acute social isolation. Initial reports indicated that extended isolation during lockdown was associated with declines in mental health and life satisfaction, though findings on prevalence shifts in loneliness were mixed (Taylor et al., 2023). Nevertheless, the pandemic period reconfirmed what decades of research had already suggested. Namely that social connections are fundamental to human functioning, and prolonged absence of social contact can have serious consequences. This recognition has elevated social isolation to a major public health concern worldwide (Badcock et al., 2022). In summary, according to current research, social isolation is both widespread in modern life and consistently linked to adverse outcomes. This makes it a prominent focus of ongoing psychological research and intervention efforts.

Detrimental Effects of Social Isolation on Non-Human Animals.

The harmful consequences of social isolation are not unique to humans. In fact, hey appear to be deeply rooted in the biology of social species. Research on non-human animals has demonstrated that depriving a social animal of contact with its peers induces a number of behavioral and neurobiological disturbances. In rodents, which are often used as models for human social behavior, even short periods of isolation can cause noticeable signs of distress. Similar early studies showed that isolated mice exhibit increased anxiety-like (Maisonnette at al., 1993) and depression-like (Yates et al., 1991) behaviors compared to mice living together. Hilakivi et al. (1989) found that young mice reared in isolation had

altered exploratory behavior and increased immobility in stress tests, suggesting behavioral despair. These older findings helped establish the principle that social deprivation produces psychological stress in animals. This result has been replicated and extended in later research. Recent studies have built on this foundation using modern behavioral measures and physiological measures. Takatsu-Coleman et al. (2013) demonstrated that short-term isolation (in the range of hours) in male mice induces depressive-like behavior results as well as elevated levels of corticosterone. This indicated that social isolation triggers a stress response at the hormonal level. These neurobiological effects can be lasting (Makinodan et al., 2012; McGrath & Briand, 2021; Lavenda-Grosberg et al., 2022). Chronic isolation in rats and mice leads to dysregulation in brain neurotransmitter systems (e.g. serotonin, dopamine) and even changes in brain structures involved in stress and social behavior (Heidbreder et al., 2000).

Studies in social primates have similarly underscored the detrimental impact of isolation. Non-human primates such as monkeys are highly social creatures. When they are isolated, they develop a suite of behavioral and biological problems reminiscent of those seen in humans. Classic work on rhesus macaques found that infants reared without mothers or peers displayed severe social and emotional deficits (e.g. rocking, self-clasping, and heightened aggression) later in life, which highlights the importance of early social bonds for normal development (Harlow et al., 1965). More recent primate research has quantified how even short-term social separation affects these animals. Isolated primates often show signs of elevated stress (e.g. increased cortisol similar to rodents) and, once given the opportunity, a heightened motivation to seek social contact (Taylor et al., 2015). In other words, a monkey that has been alone will strongly prefer social interaction when it becomes available. This indicates a rebound effect driven by an internal *social hunger* (Taylor et al., 2015). Løseth et al. (2014) reviewed evidence that brief social isolation increases the attractiveness of social stimuli and engagement in social behaviors in monkeys. This suggests that social deprivation triggers an innate social-seeking drive in primates similar to how hunger triggers a seeking of food. Neurobiologically, studies have found that social isolation in infant monkeys can distsurb central emotion-regulation circuits, with documented neurochemical and gene-expression changes in the amygdala and structural alterations of the prefrontal cortex (Martin et al., 1991; Sabatini et al., 2007; Spinelli et al., 2009). Taken together, findings across animal models converge on the notion that social isolation is intrinsically aversive and produces a state of internal stress across species. Such findings highlight that social interaction is a very basic and evolutionary need and its' withdrawal can cause deep and sometimes bodily deprivation symptoms across a multitude of species.

Detrimental Effects of Social Isolation on Humans.

Several previous studies observed severe detrimental effects of social isolation on human psychology and physiology. Socially isolated individuals report more frequent feelings of sadness, hopelessness, and higher rates of clinical depression and generalized anxiety have been observed among humans with chronically low levels of social interaction (NASEM, 2020). Moreover, social isolation has repeatedly been linked directly to lesser cognitive capacities and measurable losses in brain structures (Shen et al., 2022; Lammer et al., 2023; Murayama et al., 2025). Therefore the current consensus ist that regular social engagement provides cognitive stimulation and support that help maintain mental capacities, which is especially true in older adulthood during which an absence of such social engagement is linked to an increased risk of cognitive decline (NASEM, 2020). One longitudinal study on adults found that socially isolated inidivduals showed significantly greater declines in global cognition and memory over a multi-year period, which is still observable after controlling for baseline health and demographic factors (Yu at al., 2021). Therefore, social isolation and loneliness have been shown to be risk factors for dementia onset in later life (Elovainio et al. 2022; Luchetti et al. 2024). Furthermore, subjective well-being and life satisfaction are generally lower in people who are isolated (Clair et al., 2021; Hao et al. 2024). Humans have an innate need to belong, and not meeting this need has a severe impact on overall happiness and fulfillment (Baumeister & Leary, 1995; Clair et al., 2021; Cramer & Pawsey 2023). Experimental evidence reinforces this: even in short-term isolation conditions, people report marked drops in positive affect and satisfaction; one laboratory study that imposed a day of complete social isolation found that participants felt significantly less happy and more discomfort than they did under normal social conditions (Tomova 2020). In sum, mood, stress, cognition, and general well-being all suffer when social contact is withdrawn. These deleterious effects can manifest quickly (within hours or days of isolation) and may compound over time into serious long-term mental and physical health problems (Matthews & Tye, 2019).

Relevance and Rationale for Studying Social Isolation.

Understanding social isolation is of pressing importance for theoretical as well as practical reasons. As previously highlighted, detrimental effects of social isolation can be observed in various social animal species and consequentially, since human beings could be considered an ultrasocial species, such effects can be assumed to be even more present and severe in humans. Our brains have evolved to depend on interpersonal connections to regulate emotions, stress, and even basic physiological processes (Coan et al., 2006; Eisenberger

& Cole, 2012). There are also strong practical and societal motivations for research on social isolation. Our modern life has seen an increase in multiple risk factors for isolation, such as more people living alone, families being smaller, and more people choosing to engage with technology rather than having actual in-person interactions (Taylor et al., 2023). Public health experts are concerned about this. Among other reasons due to the rise of social isolation and loneliness, which have strong associations with poorer health outcomes and higher mortality (Holt-Lunstad et al., 2015). Recognizing this, governments and organizations around the world have launched initiatives to address social isolation. For example, the World Health Organization (WHO) now identifies social isolation as a fundamental social factor of health (WHO, 2025). However, effective intervention requires a deep understanding of why and how isolation causes harm. Psychological research can help in these efforts by exploring the cognitive, affective and behavioral links between isolation and health. For example, if studies find that even short-term isolation reliably increases stress hormones and negative mood, this underscores the need for early interventions to prevent isolated individuals from developing chronic stress or depression. The relevance of the psychological study of social isolation became especially evident during the COVID-19 pandemic. As millions experienced forced isolation, questions about its effects on mental health, cognitive functioning (e.g. among children out of school), and behavior (such as changes in social skills or motivation) became even more relevant. Research during this period, including field studies that measured people's mood and stress during lockdowns, has provided valuable data showing that lack of social contact can quickly have negative effects on emotional well-being and vitality (Stijovic, 2023).

Social Isolation and Loneliness

Definition and Distinction.

Loneliness is commonly defined as a subjective feeling of distress caused by a gap between the social relationships one desires and those one actually has (Hawkley & Cacioppo, 2010). In psychological terms, it is the emotionally aversive state of perceived social disconnection, thus essentially *perceived social isolation* rather than any objective state of being alone. This concept is based on classic discrepancy theories of loneliness, which state that it is the quality of social bonds and not the number of contacts, that determines if a person feels content or lonely (Perlman & Peplau, 1981; Cacioppo & Hawkley, 2009). Consequently, loneliness is not the same as social isolation. The latter refers to an objective lack of social contact or relationships. Still, an individual in social isolation could still not feel lonely if they are content with solitude and if the individual chose the current social

withdrawal, its effects can even be positive (Nguyen et al., 2018). On the other hand, a person can be surrounded by others and still experience strong loneliness (Hawkley & Cacioppo, 2010). Therefore, while social isolation and loneliness are often linked and can increase each other, they are not the same concepts. Rather, loneliness and social isolation are conntected but distinct concepts (Hawkley & Cacioppo, 2010; Schutter et al., 2020). Each can be present without the other, and each can uniquely impact health and wellbeing (Holt-Lunstad et al., 2015). This distinction was recognized in recent reports, such as in NASEM's (2020) framework, which separated objective isolation from perceived loneliness and urged targeted interventions for both. Consequentially, loneliness is best understood as a subjective psychosocial state rooted in one's perception of relationship quality rather than a number of external social contacts (Hawkley & Cacioppo, 2010). Despite this distinction, greater social isolation is tightly linked to higher levels of loneliness (Taylor, 2020).

In an evolutionary and theoretical context, loneliness is thought to serve an adaptive social-signaling function. For example, Cacioppo and colleagues (2014) have argued that feelings of loneliness likely evolved similarly to hunger or thirst as an aversive signal to essential deficits such as a lack of social connection, thereby motivating individuals to reconnect with others for survival. In other words, human beings as an ultrasocial species have inherent mechanisms that register social isolation as a threat, triggering loneliness as a *social pain* that encourages the establishing of social bonds (Cacioppo et al., 2014). This theoretical perspective aligns with evidence that loneliness induces a state of hypervigilance for social threats and stressors. It heightens one's awareness of potential rejection or danger in the social environment (Hawkley & Cacioppo, 2010). Such cognitive-affective mechanisms may have once improved early humans' odds of survival when isolated, by causing them to seek safety in numbers. However, in modern contexts these same responses can become maladaptive when loneliness is chronic.

Psychological Research and Consensus on Loneliness.

Over the past two decades, loneliness has garnered extensive research attention as a significant public health concern. Prevalence surveys indicate that loneliness is relatively common across the lifespan; for instance, roughly 5–10% of adults in Western countries report frequent or intense loneliness, with higher rates (15–30%) when considering those who experience it at least occasionally (Hawkley & Cacioppo, 2010). Critically, the literature has converged on the finding that chronic loneliness is deleterious to mental and physical health. A robust body of longitudinal studies has established that loneliness is not just a transient emotion but a condition that can predispose individuals to a broad range of adverse

outcomes (Holt-Lunstad et al., 2015; Hawkley & Cacioppo, 2010). Indeed, there is now scientific consensus that persistent loneliness functions as a psychosocial stressor, one that activates many of the same biological stress pathways implicated in disease. As such, contemporary psychology and neuroscience view loneliness as an important social determinant of health, not merely a byproduct of other conditions. In recognition of this, numerous high-profile calls to action have been made: for example the world's first Minister for Loneliness appointed by the United Kingdom in 2018 (Prime Minister's Office, 10 Downing Street, 2018), Japan created a Cabinet-level Loneliness and Isolation Task Force in 2021 to coordinate nationwide countermeasures (Cabinet Secretariat, Government of Japan, 2021), and the U.S. Surgeon General (Office of the Surgeon General, 2023) as well as the World Health Organization (2025) have recently highlighted loneliness as a great challenge of society, especially in aging populations.

Detrimental Effects of Loneliness on Humans.

Unaddressed and chronic loneliness has great detrimental effects on human mood, stress levels, cognition, and physical health. On an emotional level, loneliness is strongly linked to negative mood states and psychopathology (Mann et al., 2022; Cho et al., 2025; Patrichi et al., 2025). Chronically lonely individuals report significantly higher levels of depression, anxiety, and hopelessness (Hawkley & Cacioppo, 2010). Also, loneliness has been identified as an independent risk factor for the development of clinical depression over time (Hawkley & Cacioppo, 2010). Parts of these effects are caused by the cognitive biases that come with loneliness. For example, lonely individuals become more vigilant for social threats and may misperceive neutral interactions as hostile or rejecting (Spithoven et al., 2017). This can result in a negative cicle of withdrawal, which can then cause further negative affective consequences (Spithoven et al., 2017). Over longer periods the stress of loneliness engages physiological stress-response systems, which has been observed in research showing that lonely adults exhibit chronically elevated hypothalamic-pituitary-adrenal (HPA) axis activation and higher cortisol output compared to their less lonely peers, especially in the morning (Doane & Adam, 2010).

The most often observed effects of loneliness are on physical health. Lonely individuals tend to experience greater negative physiological consequences due chronic stress activation, which was shown in multiple epidemiological studies repeatedly finding that loneliness independently predicts worse health outcomes and mortality (Steptoe et al., 2013; Holt-Lunstad et al., 2015; Foster et al., 2023). In summary, the evidence is consistently showing that loneliness can seriously damage human health, elevates the risk for psychiatric

disorders, accelerates cognitive aging, and contributes to morbidity and mortality (Hawkley & Cacioppo, 2010).

Social Isolation and Stress

In essence, stress is a psychobiological process. It generally appears when an individual perceives that external demands are greater than their ability to cope with them, which causes emotional distress and activates physiological systems (O'Connor et al., 2021). From a psychological perspective, social isolation as an objective lack of social contact is now recognized as a strong stressor (Stafford et al., 2013; NASEM, 2020; Slavich, 2020). Evidence indicates that the absence of interpersonal contact can trigger stress-related responses because humans generally find prolonged social deprivation intrinsically stressful (Bzdok & Dunbar, 2020). Consistent with this, chronic social isolation is associated with reported elevated perceived stress levels (Grabowski et al., 2021; Su et al., 2023) as well as higher levels of anxiety and distress in several populations (Shankar et al., 2011; Li et al., 2024). Moreover, lacking a supportive social network may reduce one's perceived control over life stressors. Recent research during the COVID-19 pandemic found that low social support contributed to a perceived loss of control, which heightened anxiety and depression among isolated individuals (Shi, 2024). Socially disconnected individuals may also adopt more avoidant coping strategies as in withdrawing or disengaging from stressors, which are maladaptive strategies over time. Studies of lonely or isolated youth, have documented greater use of avoidant coping behaviors (e.g. distraction, denial) that lead to higher stress and anxiety (Seepersad, 2004).

On the biological perspective, evidence from many studies links social isolation with dysregulation of stress physiology. The body's primary stress-response axis (the hypothalamic-pituitary-adrenal (HPA) axis) shows signs of dysregulation in isolated individuals (Stafford et al., 2013; Dickman et al., 2020; Zilioli & Jiang, 2021). Research indicates that people who are socially isolated exhibit heightened HPA activity and cortisol output. Isolated individuals often exhibit elevated physiological stress markers, such as heightened cortisol levels (Grant et al., 2009) and blood pressure (Grant et al., 2009; Shankar et al., 2011). Especially in response to acute stressors (Grant et al., 2009). Over time, this stress-axis overactivation may explain why isolation increases vulnerability to anxiety and depression through neuroendocrine pathways (Kanbay et al., 2023). Social isolation is also linked to elevated sympathetic-adrenal activity while there are no currently availably studies that investigate an effect of social isolation on salivary alpha-amylase, which is another adrenergic stress marker. In summary, there is scientific conensus that a lack of social contact

can dysregulate emotional and biological stress-regulation processes. Social isolation is associated with increased anxiety, diminished feelings of control, and avoidant coping behavior, alongside with hyperactivation of stress physiology.

Social Isolation and Mood

Mood is typically defined in contemporary psychology as a relatively enduring, low-intensity affective state that can last for hours or days and often arises without a clear precipitant (American Psychological Association (APA), n.d.). Unlike short emotions tied to specific events, moods reflect a general "disposition to respond emotionally" in a certain way over time (APA, n.d.). In psychological literature, mood is often described as a diffuse, low-intensity affective state that lasts longer than discrete emotions, is often objectless, and can be located on broad dimensions such as valence (pleasant to unpleasant) and activation (high to low arousal) (Russell, 2003; Beedie et al., 2005). Importantly, mood influences many aspects of mental processes. Even subtle shifts can alter perception (Gasper & Clore, 2002), memory (Faul & LaBar 2023), motivation (Custers & Aarts, 2005), and social behavior (Dunn & Schweitzer, 2005).

Objective social isolation like reduced contact, network size, or participation is linked to a more negative mood, but these effects often take effect through perceived social isolation or *loneliness*, which show stronger and more direct links to depressive and anxiety symptoms (Cornwell & Waite, 2009; Santini et al., 2020). Many neuroscientific papers investigating humans do not clearly separate structural measures of social isolation such as a perceived lack of control from subjective feelings of isolation, including loneliness and perceived disconnection (Finley & Schaefer, 2023). Researchers seem to focus on loneliness. This may be because it is conceptually closer to affective outcomes, tends to yield larger effect sizes for depression, and can be captured with brief scales, while objective isolation can be more difficult to operationalise (Cornwell & Waite, 2009; Santini et al., 2020). Moreover, the empirical focus also lies on diagnosable mood disorders (primarily depression and anxiety) rather than broader mood indicators or affective well-being, as shown by studies where objective isolation predicted major depression or anxiety odds (Domènech-Abella et al., 2019; Li et al., 2024; Wang et al., 2025). The literature also observes mostly cohorts of older adults, for whom isolation is common and easier to quantify, which in turn leaves younger populations underrepresented (Sherman et al., 2024).

Furthermore, a lot of research indicates that perceived social isolation has a strong impact on mood. As previously established, humans are an ultrasocial species and being cut off from others is intrinsically aversive and often triggersnegative affective states that likely

evolved to signal the need to reconnect (Tomova et al., 2019). Consistent with this, individuals chronically experiencing a subjective feeling of isolation show more negative mood and fewer positive feelings than their socially connected counterparts and show elevated depression and anxiety levels (Finley & Schaefer, 2023), which indicates a shift to more negatively valenced mood (e.g. persistent sadness, worry) and heightened agitation. This negative mood has broad detrimental effects on well-being and functioning by impairing cognitive performance (Feng et al., 2021) and emotion regulation (Sheppes & Meiran, 2007), increasing stress physiology (Radin et al., 2016), and raising the risk for clinical disorders like major depression (Kuppens et al., 2012).

Current research has started to identify specific mood markers affected by social isolation. Mood valence is consistently related to isolation through lower happiness and higher sadness or irritability (Finley & Schaefer, 2023). Correspondingly, isolated people experience less calmness and more agitation, as shown by heightened anxiety and stress levels during loneliness (Steptoe et al. 2004; Domènech-Abella et al., 2019). Finally, boredom is a common affective side effect of isolation. Without social stimulation, isolated individuals often report boredom, which can be roughly described as a low-arousal negative state. For example, during COVID-19 lockdowns, boredom was one of the most frequently reported feelings, and higher boredom in isolation correlated with greater depression and anxiety symptoms (Tutzer et al., 2021). In sum, social isolation tends to generate a more negatively valenced, tense, and bored mood profile, which in turn can undermine mental well-being and daily functioning if sustained.

Social Isolation and Fatigue

Contemporary models converge on the idea that coping with social isolation taxes self-regulatory systems and diminishes the energy available to the self, making fatigue a theoretically relevant outcome. The strength model treats effortful regulation as resource-consuming and links it to increased subjective fatigue (Hagger et al., 2010). Self-determination theory similarly defines vitality as felt energy and says that pressured regulation (e.g. coping with isolation when relatedness is impaired) reduces that energy (Ryan & Deci, 2008). Empirically, loneliness and day-to-day energy and fatigue are bidirectionally linked: in a diary study, higher loneliness predicted next-day daytime dysfunction (sleepiness, fatigue, low energy) and vice versa, even after adjusting for sleep duration (Hawkley et al., 2010). Field evidence from Stijovic and colleagues (2023) indicates that acute social isolation during a COVID-19 lockdown corresponded with diminished energetic arousal. Mechanistically, an integrative social-allostasis account proposes that

isolation triggers hypervigilance and other coping responses that come with physiological costs, offering a pathway from isolation to energetic depletion (Quadt et al., 2020). Direct experimental evidence aligns with this view: the broader paper published on this lab study, which also utilised the same data set underlying this study but explored different effects, found that acute social isolation lowered energetic arousal and increased fatigue (Stijovic et al., 2023).

Social Homeostasis

Homeostasis describes the processes by which organisms maintain a stable internal environment within an optimal range despite external fluctuations, a stability that stress threatens by upsetting the organism's normal equilibrium (Lovallo, 2016; Clark, 2018). Originally described in physiological processes like body temperature or fluid balance, the principle of homeostatis has been extended to psychological processes. This includes the regulation of social behavior. Social homeostasis serves to maintain an optimal level of social contact and connectedness (Matthews & Tye, 2019; Lee et al., 2021), since social relationships have been shown to be crucial for survival (Cacioppo et al., 2014). As previously highlighted, social connectedness is increasingly recognized as a basic need similar to hunger or thirst that evolved to promote survival in humans as a ultrasocial species (Baumeister & Leary, 1995; Cacioppo et al., 2014). From this perspective, humans and other social animals possess regulatory mechanisms that monitor the quantity as well as quality of social interactions and trigger adaptive responses to imbalances in social contact (Matthews & Tye 2019). This adaptive social need drive is thought to restore homeostatic balance by causing an individual to engage in social behavior until one's social needs are met (Tomova et al., 2020). In short, social homeostasis maintains a balance of sufficient interpersonal contact, which results in emotional well-being, while prolonged social isolation produces an imbalance that the organism is motivated to correct.

From an evolutionary and neuroscientific perspective, the concept of social homeostasis aligns with the idea of survival circuits regulating fundamental needs. LeDoux (2012) proposed that mammals have neural circuits for vital survival functions in the five domains of defense, energy and nutrient balance, fluid balance, thermoregulation, and reproduction. These circuits work to maintain homeostasis in each domain. However, evidence across species shows that social bonds enhance survival and fitness (Snyder-Mackler et al., 2020). This suggests that the brain may also treat social disconnection as a threat to homeostasis. Indeed, Matthews and Tye (2019) propose a sixth survival circuit in the human brain dedicated to social homeostasis and responsible for regulating social

contact as an additional survival-related need. In their model, a detector monitors changes in social contact (e.g. detecting when social interaction falls below an individual's set-point), a central integrator compares the current state to the desired social baseline, and effector mechanisms generate behavioral and physiological responses to correct any deviation. For example, acute social isolation can trigger an aversive alarm state that engages stress-responsive and motivational circuits, leading to heightened craving for social connection and increased vigilance for social cues. Such a mechanism would explain why prolonged social isoalation can have severe emotional and health consequences: the chronic activation of social homeostatic circuits (in an effort to regain balance) may contribute to stress-related pathology when reconnection is not achieved (Matthews & Tye, 2019).

As established, social deprivation evokes an aversive state that subsequently elicits a sustained motivation to restore homeostasis and thus terminate the aversive state. Motivation is typically described as the set of processes that energize and direct behavior toward desired goals and sustain action over time (Ryan & Deci, 2000). In the framework of motivation, approach and avoidance are complementary forces: organisms are driven to pursue desirable, rewarding stimuli (*approach*) and to avoid harmful or overstimulating situations (*avoidance*; Salamone & Correa 2012). Social homeostasis requires navigating this approach-avoidance dynamic. Under normal conditions, individuals seek an optimal level of social stimulation, approaching others to fulfill belongingness needs but also withdrawing when overwhelmed or facing social threat (Matthews & Tye, 2019; Tomova et al., 2019). Within contemporary reward frameworks, a fundamental distinction is drawn between *wanting* and l*iking*. In affective neuroscience, wanting refers to the individual desire for a reward and liking is defined as the individual's pleasure that is subjectively perceived when it consumes the reward (Berridge 1996; Salamone & Correa 2012). These two components, initially identified in general reward processing (e.g. for food or drugs), can also apply to social rewards (Chevallier et al., 2012), wherein the desire for social contact can be considered analogous to wanting and the enjoyment of such social contact as analogous to liking. In their review Tomova et al. (2019) summarize animal studies showing that even brief isolation increases motivation to seek conspecifics, and isolated animals will work to obtain social contact, indicating heightened social seeking under deprivation. Furthermore, according to Tomova et al. (2019) during social deprivation, the desire for social contact (wanting) is amplified even if the actual enjoyment (liking) of social interaction upon reuniting may vary with context. Neurobiologically, the state of wanting has been linked to dopaminergic activity in mesolimbic reward pathways (Tomova et al., 2019). Notably, experimental findings show

that brief forced isolation induces a strong dopaminergic craving response to social stimuli. For instance, Tomova et al. (2020) found that after 10 hours of total social isolation, human participants reported elevated social craving and showed selective midbrain activation to social cues, a neural signature strikingly similar to hunger-deprived individuals viewing food.

Overall, wanting and liking processes interact within social homeostatis: a person high in social wanting (e.g. due to social isolation) will be strongly approach-motivated to find companionship, but if they also anticipate social threat or rejection, avoidance tendencies might counteract their approach (Tomova et al., 2019). More specifically, such results support the idea that the absence of social contact creates a powerful wanting for social reward, mediated by the same survival-oriented neural systems that govern other primal needs (Tomova et al., 2020).

Extraversion

Extraversion and Personality.

Our personality has a significant influence on our life, including our well-being (Anglim et al., 2020; P. T. Costa & McCrae, 1980), mental health (Bucher et al., 2019; Hakulinen et al., 2015; Watson et al., 2019), sociability (Corr & Matthews, 2009; Pollet et al., 2011; Wilkowski & Ferguson, 2014), emotionality (Corr & Matthews, 2009; Hughes et al., 2020), and cognition (Lazarus, 1991; Simon et al., 2020). For instance, the extent of the negative impacts of the COVID-19 pandemic and whether it was a time of increased psychological distress or a sense of calm for an individual is partially due to one's personality (Staneva et al., 2022).

There are various distinct theories and definitions of personality. However, most concur *personality* is rooted in biologically innate components (Corr & Matthews, 2009) and helps determine behaviour (*APA Dictionary of Psychology*, n.d.). According to the broad definition of the American Psychological Association, personality describes the enduring characteristics and behavioural patterns that define an individual's adaption to life, "including major traits, interests, drives, values, self-concept, abilities, and emotional patterns" (*APA Dictionary of Psychology*, n.d.). Personality is considered a complex integration of many factors, such as genetic predispositions, cultural norms, crucial experiences, and social relations (*APA Dictionary of Psychology*, n.d.; McAdams & Pals, 2006).

Since antiquity, we have been exploring human personality; the theories evolved from personality typologies, such as Galen's temperaments, to varying numbers of personality dimensions, such as Eysenck's *neuroticism* and *extraversion* mid-20th century (Satow, 2012). While a personality typology tries to categorise individuals into specific types, a personality

dimension is viewed as a significant personality trait that is stable over time and present in all people but can vary in its manifestation (Satow, 2020). For instance, whereas the psychoanalyst and author C. G. Jung introduced the concepts of Introversion and Extraversion in 1921 as distinct types (Jung, 1990), in the late-twentieth century, the psychologist H. J. Eysenck deemed Introversion-Extraversion as a continuum on which individuals can fall (Eysenck, 1998). In the mid-twentieth century, Allport (1937) established that all primary character traits reflect in natural language (*lexical hypothesis*). On this basis, other exponents of trait theory later identified initially 16 primary factors (Cattell & Mead, 2008), then five global factors of personality through factor analysis (Cattell & Mead, 2008; Norman, 1963). Since the latter has repeatedly been shown to be universal and comprehensive personality dimensions (Corr & Matthews, 2009; Satow, 2020), Goldberg (1981) introduced the term "*Big Five*" for these five factors. In the 1980s, based on these results, Costa and McCrae (2008) developed the first personality questionnaire (NEOFFI) measuring the Big Five. The *Five-Factor Model* (FFM) is one of the most influential and widespread paradigms in personality research (Corr & Matthews, 2009), and there is substantial support for the model's existence and universality (McCrae et al., 2005; Schmitt et al., 2007).

The Five Factor Model offers an integrative description of personality variations and orders them into five broad domains, which are extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (Goldberg, 1993; McCrae & John, 1992; Satow, 2020). Extraversion includes an approach-oriented disposition towards engagement with the social world as well as a reward-sensitive disposition linked to positive activation (Smillie, 2013). It further relates to a high number of social contacts, assertive interpersonal behavior, and high positive activity (Soto & John, 2017).

In Satow's Big-Five-Personality-Test (B5T) framework, extraversion is defined as an outgoing, energetic, and socially engaged personality style and is further characterized by frequent seeking of interpersonal contact, affinity for conversation, talkativeness, and a readiness to act and assert oneself in group contexts. Individuals high on this trait are described as active, sociable, communicative, and self-confident in social situations while lower scorers tend to be more passive and quiet (Satow, 2021).

Strong associations have been found between the Big Five and both self-reported subjective well-being and psychological well-being (Anglim et al., 2020). Across these findings, extraversion is especially linked to positive relations with others and is positively associated with life satisfaction, with more extraverted individuals reporting higher levels of

subjective well-being and life satisfaction (Anglim & Grant, 2016; Grant et al., 2009; Meléndez et al., 2019; Sun et al., 2018). Possible pathways for these links could be the behavioral patterns observed in extraversion. Such as the seeking out of and engaging with positive social connections and rewards (Smillie et al., 2015; Sun et al., 2017). Overall, the evidence highlights the central role of personality in subjective experience of well-being (Anglim et al., 2020). It is also in line with early observations that extraverted dispositions heighten positive enjoyment or life satisfaction (Costa & McCrae, 1980).

Extraversion, Social Isolation and Loneliness.

To my knowledge, no study has explicitly examined the association between trait extraversion and social isolation. However, converging evidence implies that extraverts may be differentially affected when social contact is constrained. Extraversion is negatively linked to affinity for aloneness, which suggests that more extraverted individuals are less likely to seek or enjoy solitary contexts (Teppers et al., 2013). Consistent with this, people who were more socially active before the COVID-19 pandemic experienced greater increases in depressive symptoms when their social contacts were reduced (Sommerlad et al., 2022). Field studies further indicate that on social-isolation days, more sociable individuals showed a stronger decrease in desire for social contact and lower energetic arousal compared to baseline (Stijovic, 2023). Together, these findings support the possibility that extraverts, who typically derive motivation and positive activation from interpersonal engagement (Lucas & Diener, 2001), may experience stronger affective and motivational costs during periods of social isolation.

In line with these finding, loneliness shows a strong negative relation with extraversion (Buecker et al., 2020; Freilich et al., 2023). A meta-analysis found that extraversion remains a significant and unique predictor when controlling for the other Big Five traits which makes it one of the two strongest traits correlated to loneliness. (Buecker et al., 2020). Studies that examined this association, consistently report that more extraverted individuals tend to feel less lonely (Stokes, 1985; Teppers et al., 2013; Schermer & Martin, 2019; Schutter et al., 2020). Proposed explanations emphasize extraverts' tendency to seek social situations and have broader interpersonal networks (Stokes, 1985; Buecker et al., 2020). Indeed, extraverts have been observed to possess larger networks on multiple levels of connectedness (Pollet et al., 2011). Further findings also indicate that Extraversion is negatively related to affinity for aloneness (Teppers et al., 2013). Together, these patterns suggest that the advantages of extraversion regarding social abilities and resources may

buffer against loneliness. However, the exact underlying mechanisms and directions of such effects remain unclear.

Extraversion and Stress.

Further evidence indicates that extraversion is generally linked to lower emotional stressor reactivity (Leger et al., 2016), but physiological responses vary by context (O'Riordan et al., 2023; Marshall et al., 2024). In a large diary study, higher extraversion predicted smaller increases in negative affect on stressor days, which is consistent with reduced emotional reactivity to everyday stress (Leger et al., 2016). Likewise, a meta-analysis found that extraversion was associated with lower perceived stress overall and trait-physiology associations tended to be weak or inconsistent across studies (Luo et al., 2023). Physiologically, more extraverted individuals tend to show reduced or more rapidly habituating cardiovascular responses to acute social stress, consistent with an adaptive stress profile (O'Riordan et al., 2023). Overall, extraverted individuals seem to have certain advantages in emotional stress reactivity and recovery, while physiological effects of extraversion likely depend on task demands and repeated exposure. (Leger et al., 2016; Luo et al., 2023; O'Riordan et al., 2023).

Extraversion and Mood.

Together with its beneficial associations with stress, extraversion is also linked to more favorable mood outcomes. Extraversion shows stronger associations with positive affect than other broad traits (Anglim et al., 2020). Moreover, extraversion can also change how mood changes through interactions between a person and their environment as well as regulation processes (Lischetzke & Eid, 2006; Klaiber et al., 2022). Diary evidence suggests that more extraverted individuals report a higher frequency of positive daily events (especially social ones) which then elevates same-day mood, which in turn suggests an exposure pathway from trait to affective experience (Klaiber et al., 2022). Extraverts also appear to prefer and sustain mood states that fit their motivational style. They are more likely to seek activities that make them happy when they find themselves in effortful contexts and they show stronger mood maintenance abilities, which are mechanisms that help keep their affective state positive across the day (Lischetzke & Eid, 2006; Tamir, 2009). Taken together, these emotion regulation patterns suggest that extraversion's typical engagement with and maintenance of positive affect may have mixed effects on energy and the buffering of fatigue in some contexts while amplifying it in others.

Extraversion and Fatigue.

Ineed, extraversion shows a nuanced relationship with fatigue. At the between-person level, a large meta-analysis found that higher extraversion is associated with a lower likelihood of both concurrent and incident fatigue (Stephan et al., 2022). This was observed over follow-ups of 5 to 20 years and even after accounting for health and activity correlates, suggesting a general protective association of extraversion with fatigue. In contrast, Stijovic et al., 2023 found in their field study that during days of social isolation, energetic arousal decreased and fatigue increased. The decrease in energy was especially pronounced among more sociable individuals and absent among less sociable participants (Stijovic et al., 2023). Taken together, extraversion appears linked to lower long-term fatigue, potentially through healthier activity profiles and lower strain. At the same time, acute unmet social needs can negatively impact energy and cause fatigue. (Stephan et al., 2022; Stijovic et al., 2023).

Extraversion, Social Reward and Wanting.

Extraversion has long been linked to heightened reward sensitivity, meaning that extraverts respond more strongly to rewarding stimuli and contexts than introverts (Depue & Collins, 1999; Smillie, 2013; Smillie et al., 2019). For example, extraversion correlates with increased brain reactivity to positive emotional stimuli in several cortical and subcortical regions such as a greater activation in the frontal cortex and the amygdala (Canli et al., 2001). Likewise, individuals high on extraversion show enhanced activation in dopamine reward circuitry such as the ventral striatum when anticipating or receiving desirable outcomes like monetary rewards (Cohen et al., 2005). These patterns align with influential models proposing that extraversion is based in a more sensitive dopaminergic *approach system* that regulates incentive motivation (Depue & Collins, 1999). Social stimuli appear to hold especially high motivational significance for extraverts. Electrophysiological evidence indicates that people higher on extraversion show greater attention to social cues and this heightened processing suggests that social interactions are more rewarding for them (Fishman et al., 2011). In line with this, extraverts even form implicit associations between social stimuli and reward value, meaning they implicitly associate people with rewards (Wilkowski & Ferguson, 2014), a tendency that may underlie their increased sociability (Fishman et al., 2011; Wilkowski & Ferguson, 2014). However, findings are not entirely consistent. In exampler, one study found that extraverts showed reduced neural reactivity to social feedback, which was observed in smaller error-related negativity (ERN) amplitudes (Fishman & Ng, 2013). A possible explanation for this could be that they perceive social outcomes as more pleasant and less threatening. Furthermore, an influential paper argued that it is not the

sensitivity to social reward, but rather the social attention towards such reward, that is the central feature of extraversion (Ashton et al., 2002). Also, a recent large-sample fMRI study detected no significant association between extraversion and neural reward-response (Hyatt et al., 2020). The link of extraversion and reward should therefore be considered to be complex. Overall, the existing evidence suggests the assumption that extraverts are especially motivated by rewarding experiences (particularly social rewards) and might therefore exhibit increased wanting of social reward, especially under social deprivation.

Aim of this Study

As previously introduced, studying social isolation is profoundly relevant: it addresses fundamental scientific questions about human social needs and simultaneously has direct applications for improving mental health and societal well-being. However, to the date of conceptualization of this study, only one other study has investigated the effects of short-term social isolation on an experimental level (Tomova et al., 2020). The present research aims to advance our understanding of the acute dynamics of social isolation and their implications through experimental means. Such knowledge is crucial for developing evidence-based interventions, preventive measures and policies to safeguard both mental and physical health of the general population in an increasingly isolated world. As a broader research framework, the concept of social homeostasis as a processes analogous to those for other survival needs (Matthews & Tye, 2019) provides a basis for understanding why and how humans regulate their interpersonal connections.

Within this context, extraversion is closely linked to sociability and repugnance for aloneness and people high on extraversion typically derive motivation and well-being from interpersonal engagement, so converging evidence suggests they may experience higher affective and energetic costs when social contact is constrained even though they are generally less lonely. Including extraversion as a core measure can thus explain heterogeneity in isolation responses and test whether it moderates the impact of isolation on outcomes such as loneliness, mood, stress reactivity, fatigue, and approach behavior. Overall, empirical studies examining such a potential influence of extraversion on the effects of social isolation are entirely lacking. Thus, this explorative study will aim to further the understanding of whether extraversion functions as a vulnerability or resilience factor in this dynamic by answering the following research questions.

1. Are there individual differences in the effects of social isolation on the trait of Extraversion?

2. Does Extraversion moderate the change in motivation to seek social contact and reestablish social homeostasis in response to acute social isolation?

Hypotheses

Hypotheses Regarding Research Question 1

As established in the preceding introduction, although social isolation is consistently linked to greater loneliness, and extraversion generally has a negative relationship with loneliness, the association between social isolation and extraversion itself has yet to be established. More extraverted individuals' high sociability affinity may make social isolation especially detrimental thereby increasing loneliness. Conversely, extraversion's favorable associations with positive affect and lower stress may buffer its impact. Coping with this state of deprivation may therefore impose respective differential energetic costs. It is expected that extraversion will moderate the association between social isolation and its various effects, but the direction of this moderating effect is not specified. Because of this and due to the explorative nature of this study, hypotheses are derived non-directionally. Furthermore, as previously established, a change in these effects can be expected dependent on time spent in social isolation. Due to the proposed link of extraversion to the basic effects themselves, a moderating effect of extraversion on this change across time is also expected in the following hypotheses.

Hypothesis 1: The effects of social isolation on **loneliness** differ on the trait of Extraversion.

Hypothesis 1.1: The change in reported loneliness (VAS) under social isolation differs on the trait of Extraversion.

Hypothesis 1.2: The change in reported loneliness (VAS) dependent on time spent in social isolation differs on the trait of Extraversion.

Hypothesis 2: The detrimental effects of social isolation on **stress** differ on the trait of Extraversion.

Hypothesis 2.1: The increase in reported measures of stress (momentary stress (VAS), anxiety (VAS), feelings of control (VAS), avoidance (VAS), salivary cortisol (sCort), salivary alpha-amylase (sAA), heart rate (HR)) under social isolation differs on the trait of Extraversion.

Hypothesis 2.2: The increase in reported measures of stress (momentary stress (VAS), anxiety (VAS), feelings of control (VAS), avoidance (VAS), salivary cortisol (sCort),

salivary alpha-amylase (sAA), heart rate (HR)) dependent on time spent in social isolation differs on the trait of Extraversion.

Hypothesis 3: The detrimental effects of social isolation on **mood** differ on the trait of Extraversion.

Hypothesis 3.1: The decrease in reported measures of mood (mood valence (MDBF), calmness (MDBF), energetic arousal (MDBF), Boredom (VAS)) under social isolation differs on the trait of Extraversion.

Hypothesis 3.2: The decrease in reported measures of mood (mood valence (MDBF), calmness (MDBF), energetic arousal (MDBF), Boredom (VAS)) dependent on time spent in social isolation differs on the trait of Extraversion.

Hypothesis 4: The detrimental effects of social isolation on **fatigue** differ on the trait of Extraversion.

Hypothesis 4.1: The increase in reported measures of fatigue (mental fatigue (MFI), physical fatigue (MFI), reduced activity (MFI)) under social isolation differs on the trait of Extraversion.

Hypothesis 4.2: The increase in reported measures of fatigue (mental fatigue (MFI), physical fatigue (MFI), reduced activity (MFI)) dependent on time spent in social isolation differs on the trait of Extraversion.

Hypotheses Regarding Research Question 2

As established, social isolation is expected to lead to an increase in approach motivation (wanting) towards social rewards in order to reestablish social homeostasis. Furthermore, more extraverted individuals possess heightened reward sensitivity, experience social interactions as intrinsically rewarding, and even tend to associate people with rewards. Consequentially, within the scope of this study, an increase in wanting of social reward under the condition of social deprivation is expected, which in turn is expected to be heightened on the trait of extraversion.

Hypothesis 5: The positive change in **motivation (wanting)** to reestablish social homeostasis by engaging in social contact when subjected to social isolation increases with higher expressions on the trait of Extraversion.

Hypothesis 5.1: A higher expression on the trait of Extraversion results in greater behavioral wanting of social contact (Force exerted) to reestablish social homeostasis when subjected to social isolation.

Hypothesis 5.2: A higher expression on the trait of Extraversion results in greater reported wanting of social contact (DSC) to reestablish social homeostasis when subjected to social isolation.

Hypothesis 5.3.: The positive change in reported wanting of social contact (DSC) to reestablish social homeostasis dependent on time spent in social isolation increases with higher expressions on the trait of Extraversion.

Methods

Ethics

The investigation was reviewed and approved by the Ethics Committee of the University of Vienna and implemented in strict accordance with the principles set out in the Declaration of Helsinki (World Medical Association, 2013). Before any data was collected, prospective participants received a comprehensive written explanation of the study, covering its aims, procedures, and any foreseeable risks or benefits. Participants were informed that participation was entirely voluntary and could be discontinued at any moment without penalty. Informed consent was documented by signature. To ensure confidentiality, each participant was assigned a unique identification code. Personally identifying information was stored separately from the research data under restricted access.

Sample

Participants were recruited through the Faculty of Psychology's online participant pool (https://labs-univie.sona-systems.com) and supported by additional advertisements on social-media platforms, university notice boards, and cafés in Vienna. The final sample consisted of 30 healthy women between 18 and 35 years old ($M = 22.57$, $SD = 3.10$) who were fluent German speakers. All displayed body mass indices within the normal range ($M = 21.81$, $SD = 1.57$). To minimize endocrine variability, only users of hormonal contraceptives were enrolled, and testing was scheduled outside the menstrual phase. Exclusion criteria were current medication use, smoking, pregnancy or lactation, a history of neurological or psychiatric disorders, current or past alcohol or drug abuse. Restricting participation to hormonally regulated female participants ensured that sex-related differences in salivary cortisol and α-amylase would not confound the findings.

Monetary compensation was tied to the extent of study involvement. Participants who appeared for the initial appointment yet failed to finish even one complete laboratory session received €10 for their time. If a participant withdrew after successfully completing at least one full session, the compensation rose to €40. Full completion of all three laboratory

sessions was rewarded with €180. Beyond this base amount, an extra €5 was compensated for each follow-up saliva sample and questionnaire set returned from home on the morning after a session, allowing participants to earn up to an additional €15.

Procedure

The experimental procedures were part of a larger research project (Stijovic, 2023) and largely identical to those described by Spitzhofer (2021) and Eslami Tehrani (2021). The general study proceeded in two sequential stages. During the first phase, after reviewing the informed-consent information, participants completed an online questionnaire. This was followed by an experimental phase during which three separate experimental sessions took place at the laboratories of the Facutly of Psychology of the University of Vienna.

Questionnaire Phase.

Participants first completed a German-language online questionnaire to assess core sociodemographic attributes such as age, educational level and relationship status, and relevant health information, including present medication use, alcohol or drug consumption, body-mass index and menstrual-cycle characteristics. To screen for the possible presence of eating disorders, the Eating Disorder Examination Questionnaire (EDE-Q; Hilbert et al., 2007) was administered. Individuals with scores indicating an elevated risk of a present eating disorder were excluded. Perceived loneliness was quantified with the UCLA Loneliness Scale (Lamm & Stephan, 1986) because elevated loneliness has been linked to altered circadian cortisol profiles (Steptoe et al., 2004). Given that habitual social contact frequency can influence responses to acute isolation, social engagement was further assessed via the Social Isolation Index (Grant et al., 2009). To assess personality-based variability in affective and motivational reactions to social isolation, participants also completed the extraversion subscale of the German Big Five Test (Satow, 2012). Applicants who satisfied all inclusion criteria were subsequently contacted to reconfirm eligibility, receive a detailed explanation of the study protocol and arranged dates for the three laboratory sessions.

Experimental Phase.

The experimental phase consisted of three experimental sessions following a repeated-measures within-subject design. On each laboratory day, each consisting of an 8-hour time block, participants were subjected to experimental manipulations meant to induce one of three states: social isolation, hunger and no deprivation (neutral). In the neutral condition both meals and scheduled conversations with close contacts were permitted. In the social isolation condition meals were available but all social exchanges were withheld. In the hunger condition participants could interact with friends or relatives yet were subjected to

reduced food intake. Sessions were separated by intervals of minimum one to maximum three weeks to minimize carry-over and possible time-based confounding effects.

When social interaction was part of the protocol, participants submitted in advance a timetable containing four thirty-minute slots and the telephone numbers or Skype details of the people they intended to contact. Participants were asked to schedule the appointed time slots with their chosen social contacts to ensure their availability during precisely these times. Three days before each visit, participants forwarded a list of three to five personal pastime items so that compliance of their content could be confirmed. Only objects free of social content were permitted, such as knitting materials or non-fiction books. Novels, magazines displaying faces, electronic devices, and sports equipment were prohibited. The study team also prepared a selection of neutral activities such as crossword puzzles, coloring books and a Rubik's Cube that could be used in any condition.

Participants were instructed to fast overnight to reduce confounding saturation before each experimental session and were then first served a standardized breakfast upon arrival at the experimental site. An experimenter then provided roughly ninety minutes of instruction covering laboratory rules, room layout and the correct handling of all recording devices. These included nine labelled SaliCaps (IBL International, Hamburg, Germany) for hourly collection of salivary cortisol and α-amylase, an iPod running an ecological momentary assessment application that prompted both the saliva sampling and the administration of brief self-report questionnaires every second hour, and a chest belt for heart-rate-variability monitoring. Participants received a written schedule and an illustrated manual and were informed that a ceiling-mounted camera allowed staff to monitor safety without storing any footage. After a short acclimatization period, personal belongings, especially mobile phones, were secured in a separate room. Remaining questions were addressed, and the eight-hour experimental period began at approximately 10:50a.m. on each day of experimentation.

Throughout the day the iPod signaled each hourly saliva collection, and every other hour the device delivered mood and state questionnaires with a varied duration across assessments. Meals were conducted at two-hour intervals during the neutral and social-aversive days, whereas equivalent thirty-minute social-interaction periods were scheduled during the neutral and hunger conditions. At the end of the eight hours participants relocated to an adjacent room to complete a battery of computerized tests assessing approach behavior, motor coordination, response inhibition and working memory (e.g., finger-tapping). An experimenter then outlined the overnight follow-up procedure, which involved collecting additional saliva samples and completing questionnaires the next morning before returning

them to the laboratory. For a visual overview of the experimental procedure in the neutral condition, view figure 1.

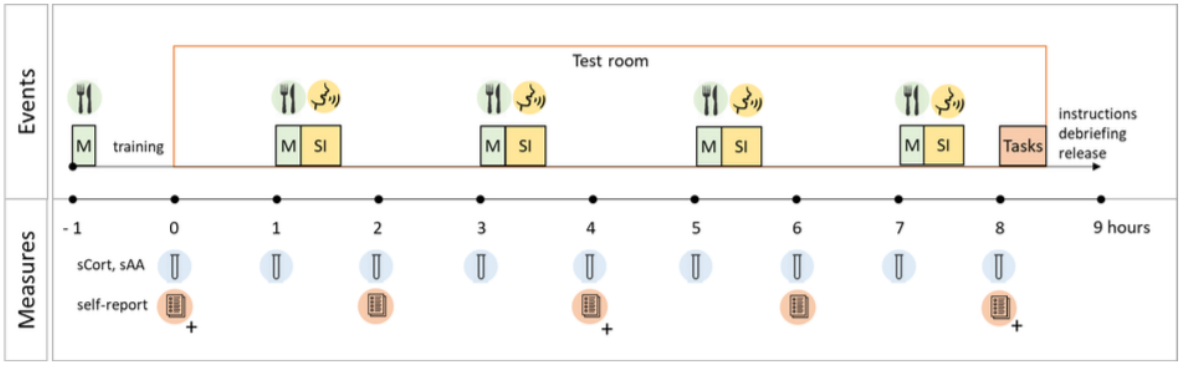

Figure 1. Visualization of the timeline of the neutral condition. M = meal. SI = social interaction.

Measures

Questionnaire Phase Measures.

The risk of clinically significant disordered eating was evaluated with the 22-item **Eating Disorder Examination Questionnaire** (EDE-Q; Hilbert et al., 2007), which yields separate scores for restraint, eating concern, weight concern and shape concern. Each item asks participants to indicate on a seven-point frequency scale from "no days" (0) to "every day" (6) how often the specified behaviors or attitudes occurred during the previous twenty-eight days.

Perceived loneliness was assessed with the 20-item **UCLA Loneliness Scale** (Lamm & Stephan, 1986; Russell et al., 1980). Items are rated on a four-point continuum ranging from "I never feel this way" (1) to "I often feel this way" (4), and the summed score indicates overall loneliness.

Routine social interaction was quantified using the **Social Isolation Index** (Grant et al., 2009), which consists of a brief set of three yes/no questions concerning contact with relatives, friends and participation in group activities. Scores of three or four indicated pronounced isolation.

Finally, individual differences in sociability were captured with the extraversion subscale of the **German Big-Five-Personality Test** (B5T; Satow, 2012), in which ten statements are rated on a four-point agreement scale from "does not apply to me at all" (1) to "applies to me completely" (4).

Furthermore, general sociodemographic variables such as age, gender, education, and relationship status were assessed within the questionnaire.

Experimental Phase Measures.

Even though more experimental measures were collected throughout the larger experimental study, only measurements relevant to this thesis will be listed herein. Furthermore, only measures taken during the social isolation and neutral conditions were taken into account for the conduct of this thesis.

Physiological stress was monitored through endocrine and autonomic, and cardiac indices, the latter not being further considered in this thesis. Salivary cortisol provided a widely accepted indicator of psychological stress (Qi et al., 2016). Complementing this measure, salivary α-amylase, an enzyme whose concentration mirrors sympathetic nervous system activation, captured autonomic adjustments to stress (Linnemann et al., 2015; Nater & Rohleder, 2009). To sample these measures, during each laboratory day participants collected nine saliva samples using SaliCap tubes (IBL International, Hamburg, Germany). Once every hour they refrained from swallowing for two minutes, transferred the accumulated fluid into the appropriate pre-labelled vial through use of a straw, and entered the vial's identification number into the study iPod to verify timing. Samples were stored in a portable cool box during the session and subsequently frozen at −20 °C in the Department of Psychology's laboratory freezers before biochemical analysis.

Self-Report Measures. During the eight-hour laboratory session the ecological-momentary-assessment device prompted participants at three nested intervals to provide subjective ratings. Most frequently, namely once every hour, they used a 1-to-100 visual analogue scale to indicate how strongly they currently felt stressed, anxious, inclined to avoid the situation and able to exert control over their current situation.

A broader mood profile was assessed five times, namely at the start of the session and then every two hours by alternating the two parallel short forms of the **Multidimensional Mood Questionnaire** (MDBF; Steyer et al., 2004). Each form contains twelve adjectives covering valence, alertness and calmness, which participants endorsed on a five-point scale ranging from "not at all" to "very much."

In the same two-hour rhythm they completed an abbreviated version of the **Multidimensional Fatigue Inventory** (MFI; Lin et al., 2009) that retained one representative statement from each of the original five subscales (general, physical and mental fatigue, reduced motivation and reduced activity). These measures were again rated on a five-point agreement continuum.

The two-hour set also included single visual-analogue ratings of hunger, loneliness and boredom, together with a brief four-item **Desire for Social Contact** (DSC) questionnaire.

This questionnaire was designed for this study specifically and adapted from a cigarette-urge measure (Cox et al., 2001) and responses ranged from “not at all” to “extremely.”.

Every four hours, namely at 0, 4 and 8 hours the **Profile of Mood States** (POMS; Dalbert, 1992) provided a more detailed affective snapshot by asking participants to rate 19 mood-descriptive words on a seven-point intensity scale, resulting in indices of sadness, hopelessness, tiredness, anger and positive mood.

Collectively, this multi-layered schedule generated a fine-grained time series of mood, stress, fatigue and motivational states that could be aligned with the physiological data to evaluate the impact of social deprivation.

Experimental Approach Behavior Task.

Wanting measurements. Approach motivation toward (behavioral wanting) socially relevant and nonsocial visual cues of differing reward value was evaluated with a modified version of the paradigm introduced by Ziauddeen and colleagues (2014). Participants viewed images depicting either food items or human faces that had been pre-classified as high-valence/positive or neutral/low-valence. Facial photographs originated from the FACES database and food pictures from the Food Research Image database (Ebner et al., 2010; Foroni et al., 2013). Stimuli within each valence tier were matched on potentially confounding attributes, specifically caloric content for food and perceived attractiveness for faces. Smiling expressions, for example, were treated as high-valence whereas angry expressions were treated as neutral or low-valence reward cues.

The experiment proceeded through eight short blocks, each containing five stimuli from a single category, resulting in 45 trials overall and resulting in an overall duration of the task for approximately 20 minutes. Prior to the main task, individuals pressed a hand-held dynamometer three times to establish their maximum grip strength, which served as the 100 % maximum force reference. Every picture remained on screen for six seconds. During the initial four seconds participants could magnify the presented image by exerting force on the dynamometer, after which the final image size was passively observed for the remaining two seconds. Real-time enlargement was linearly scaled to the momentary percentage of maximal force, which thereby served as the primary measure for behavioral wanting. A 20-second rest period followed each separate block to reduce potentially confounding effects of hand muscle fatigue. See figure 2 for further illustration of the behavioral task.

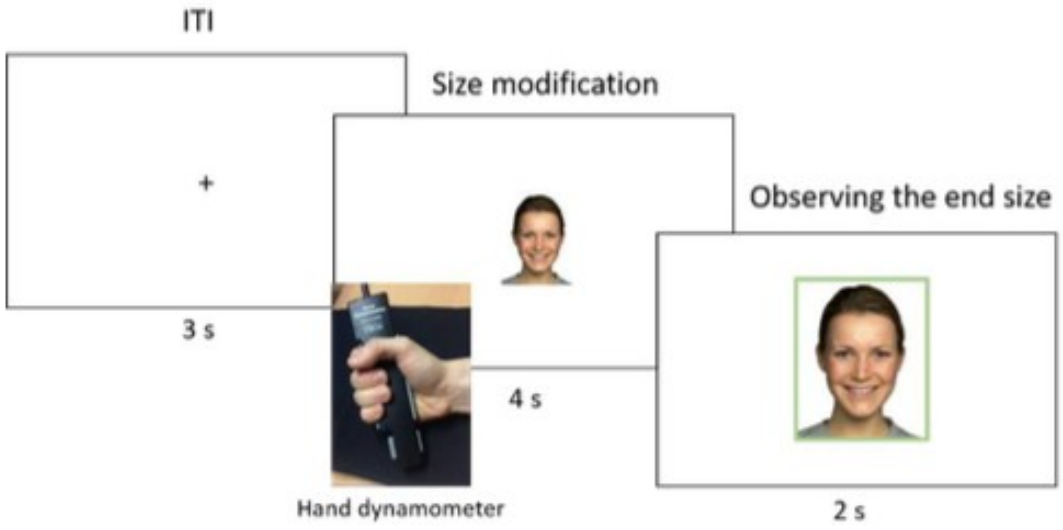

Figure 2. Illustration of sequencing and size modification in the behavioral task.

Measuring liking. After each stimulus presentation in the behavioral task, participants were asked to rate the pleasantness (liking) of each stimulus on a visual analogue scale before the next stimulus was presented. More precisely, they were asked to rate the previous stimulus from “very unpleasant” (negative value) to “very pleasant” (positive value), which resulted in a central neutral point (0). In this study, this measure was later used to verify the actual reward component of the presented stimuli within the sample and ensure a comparable trajectory of perceived reward of both stimuli types between the low and high reward categories.

Analysis

A manipulation check was conducted on the dependent variable of desire for social contact along the independent variables of condition (neutral vs isolation) and time spent in the experimental setting (metric) to assess whether the experimental manipulation to induce social isolation had indeed worked and caused a linear increase throughout its duration. A second manipulation check was conducted on the dependent variable of liking along the independent variables of stimulus type (faces vs food) and valence (low vs high) to ensure participants perceived the intended dimension of reward valence and that its trajectory did not differ depending on stimulus type. For both manipulation checks, a respective repeated measures analysis of variance (rmANOVA) was conducted in JASP (Version 0.19.3; JASP Team, 2025).

The main analysis aimed to explore the effects and interactions of the independent variables of condition (dichotomous), time spent in the experimental setting (metric) and total extraversion score (metric), on the dependent measures of loneliness, stress (momentary

stress, anxiety, feeling of control, avoidance, salivary cortisol), mood (mood valence, calmness, energetic arousal, boredom), fatigue (mental fatigue, physical fatigue, reduced activity) and wanting of social contact (desire for social contact, behavioral wanting). Therefore, a linear mixed-effects model (LMM) was conducted for each dependent variable in JASP (Version 0.19.3; JASP Team, 2025). In this model, condition was used as a categorical predictor with the neutral condition as a reference category, meaning that each model tested contrasts between the neutral condition and social isolation. Time was a continuous predictor, indicating the number of hours since the start of the session. Extraversion was also included as a continuous predictor based on the respective participants' extraversion score. Time and extraversion were centered for better interpretability. All continuous variables were z-standardized. All possible terms based on the predictor variables were included in the model. No random effects other than intercept were included in the model, since for a study of such complexity and relatively small sample size, more random slopes would likely deplete the power of the analysis too much (Matuschek et al., 2017). The model used restricted maximum likelihood estimation and Satterthwaite's method of significance testing.

Due to the variable structure in the behavioral task, namely the absence of the variable time and the presence of the variable stimulus type (dichotomous), a separate LMM was conducted for the dependent variable of behavioral wanting. The analytic procedure was identical to that in the first model.

Descriptives were assessed in JASP (Version 0.19.3; JASP Team, 2025) and reference *mean value (M)* and *standard deviation (SD).* Due to the exploratory nature of this study, an overarching significance level of $\alpha = 0.05$ was chosen. Standardized beta-coefficients were used to assess respective effect sizes. β-values around 0.10 are regarded as small, those near 0.30 are taken as medium, and coefficients of 0.50 or larger are interpreted as large effects (Cohen, 1992).

Results

Manipulation Checks

Manipulation Check - Desire for Social Contact.

On the manipulation check on desire for social contact, Maulchy's test of sphericity revealed a significant violation of the assumption of sphericity for time ($\varepsilon = 0.72$, $p = .010$) and the interaction of time and condition ($\varepsilon = 0.74$, $p < .001$). Consequentially, Greenhouse-Geisser sphericity corrections were applied.

The overall desire for social contact was higher in the social isolation condition (M = 38.50, SD 26.18) than in the neutral condition (M = 24.23, SD 23.09). The main effect of condition was significant ($F(1, 28) = 12.12$, $p = .002$, $\eta p^2 = 0.30$). Contrasts confirmed a significantly higher desire for social contact in the social isolation condition compared to the neutral condition ($\Delta M = 13.58$, $SE = 3.90$, $p = .002$, $d = 0.47$).

The main effect of time was also significant ($F(2.90, 81.12) = 17.04$, $p = <.001$, $\eta p^2 = .38$), indicating a significant difference across time-points independently of condition. In the case of time, contrasts also confirmed a significantly higher desire for social contact at the end of the experimental sessions compared to the start ($\Delta M = 17.46$, $SE = 2.93$, $p < .001$, $d = 0.61$).

The interaction of condition and time was also significant ($F(2.96, 82.77) = 3.08$, $p = .033$, $\eta p^2 = 0.10$), indicating a significantly steeper increase across timepoints dependent on condition (see figure 3). Post-hoc comparison of simple main effects revealed a significant increase in desire for social contact across time within both, the social isolation condition ($F(4, 112) = 18.64$, $p < .001$, $\eta p^2 = .40$) and the neutral condition ($F(4, 112) = 5.00$, $p < .001$, $\eta p^2 = .15$).

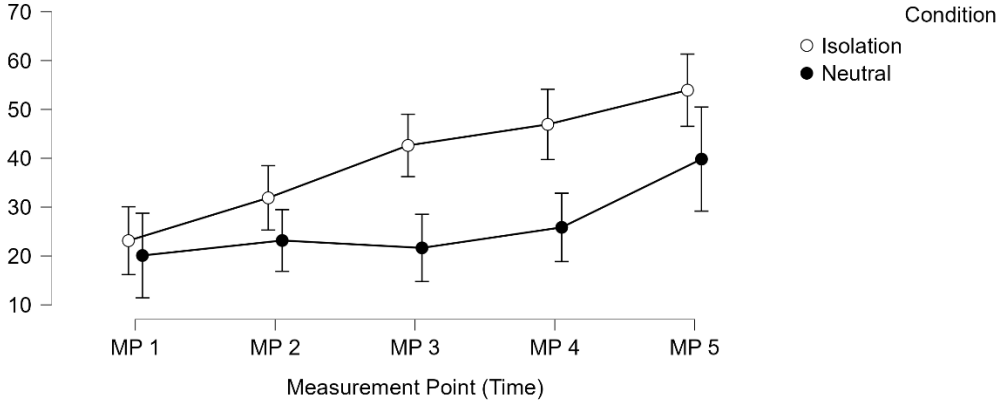

Figure 3. Significant interaction of condition and time on desire for social contact. 95% confidence intervals represented by error bars.

Manipulation Check - Liking.

Due to the factor structure of the manipulation check on liking Maulchy's test of sphericity, namely two categorical variables with two factor levels, no sphericity check or correction had to be applied.

The overall liking rating was highest for food pictures in the high valence category (M = 4.54, SD 2.86), second highest for face pictures in the high valence category (M = 1.82, SD 3.41), third highest for food pictures in the low valence category (M = 0.25, SD 2.35) and lowest for face pictures in the low valence category (M = -1.85, SD 3.19) (see figure 4).

The main effect of valence was significant ($F(1, 30) = 98.06$, $p < .001$, $\eta p^2 = 0.77$). Contrasts confirmed a significantly higher rating of liking for the high valence category compared to the low valence category of reward stimuli ($\Delta M = 3.98$, $SE = .40$, $p < .001$, d = 1.34).

The main effect of reward type was also significant (($F(1, 30) = 16.35$, $p < .001$, $\eta p^2 = 0.35$). However, in this case contrasts confirmed a significantly lesser liking of social face stimuli compared to non-social food stimuli across conditions and participants ($\Delta M = -2.42$, $SE = 0.60$, $p < .001$, $d = 0.81$).

The interaction of valence and reward type was not significant ($F(1, 30) = 1.04$, $p = .323$, $\eta p^2 = 0.03$).

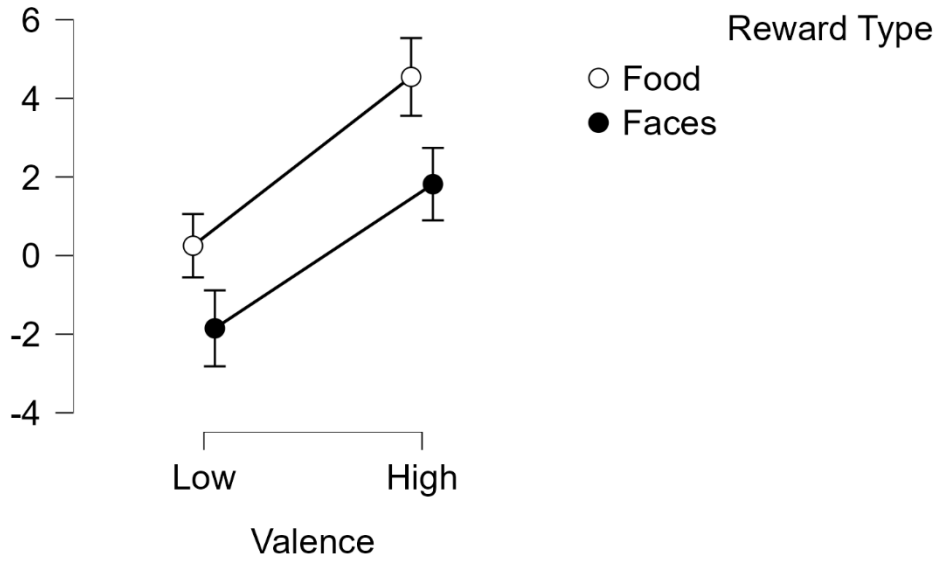

Figure 4. Significant interaction of valence and reward type on liking rating of presented stimuli. 95% confidence intervals represented by error bars.

Results on Loneliness and Extraversion

Regarding the dependent variable of loneliness, neither the interaction of condition and extraversion proposed in hypothesis 1.1 nor the interaction of condition, time and extraversion proposed in hypothesis 1.2 reached significance.

However, outside of the main hypotheses, a large significant main effect of condition revealed an overall increase of loneliness in the social isolation condition ($\beta = 0.48$, $SE = .07$, $df = 270$, $t = 7.00$, $p < .001$). The small significant main effect of time on loneliness ($\beta = 0.12$, $SE = .05$, $df = 270$, $t = 2.67$, $p = .008$) suggests a general linear increase of loneliness with time spent in the experimental conditions, while the small significant interaction of condition

and time simultaneously suggests this trajectory to be steeper in the social isolation condition ($\beta = 0.17$, $SE = .06$, $df = 270$, $t = 2.61$, $p = .010$).

Results on Stress and Extraversion

The interaction effect of condition and extraversion failed to reach significance for all dependent variables indicating stress as proposed by hypothesis 2.1, namely momentary stress, anxiety, feeling of control, avoidance, salivary cortisol and salivary alpha-amylase. The same is true for all of these dependent variables proposed in hypothesis 2.2 with the exception of the feeling of control, wherein a small significant interaction of condition, time and extraversion could be observed ($\beta = 0.09$, $SE = .045$,$df = 510$, $t = 1.98$, $p = .049$) and suggests a significantly more positive development of the feeling of control across time spent in social isolation dependent on extraversion.

Several significant observations could be made outside the hypotheses. Regarding momentary stress, the significant large main effect of extraversion ($\beta = 0.85$, $SE = .07$,$df = 32.66$, $t = 11.87$, $p < .001$) and the significant small interaction of extraversion and time ($\beta = -0.09$, $SE = .021$,$df = 510$, $t = -4.55$, $p < .001$) simultaneously suggest a higher level of reported momentary stress dependent on extraversion along with a decrease in reported momentary stress across time dependent on extraversion. The small main effect of condition on the dependent variable of feelings of control was also significant ($\beta = -0.12$, $SE = .05$, $df = 510$, $t = -2.59$, $p = .010$), indicating an overall decrease in perceived control in the social isolation condition. Significant medium effects of both condition ($\beta = 0.32$, $SE = .06$,$df = 510$, $t = 5.89$, $p < .001$) and time ($\beta = 0.34$, $SE = .04$,$df = 510$, $t = 8.74$, $p < .001$) on the dependent variable of avoidance suggest an increase in the dependent variable in social isolation compared to the neutral condition and generally across time. The significant medium main effect of extraversion on salivary cortisol ($\beta = 0.26$, $SE = .09$, $df = 36.88$, $t = 2.84$, $p = .007$) indicate a generally higher concentration of salivary cortisol dependent on extraversion. Regarding salivary cortisol, the significant large main effect of time ($\beta = -0.54$, $SE = .04$, $df = 510$, $t = -13.02$, $p < .001$) indicated a general decrease therein as time progresses, while the significant small interaction of time and extraversion ($\beta = -0.20$, $SE = .04$, $df = 510$, $t = -4.90$, $p < .001$) suggest a steeper reduction across time depending on extraversion. A similar interaction effect of time and extraversion could be observed regarding salivary alpha-amylase ($\beta = -0.10$, $SE = .04$, $df = 505.97$, $t = 2.65$, $p = .008$), suggesting a steeper decrease therein across time dependent on extraversion.

Results on Mood and Extraversion

The interaction effect of condition and extraversion as well as the three-way-interaction of condition, time and extraversion failed to reach significance for all dependent variables suggested in hypotheses 3.1 and 3.2, namely mood valence, calmness, energetic arousal and boredom.

Further findings regarding mood include a significant small main effect of condition (β = -0.21, *SE* = .085, *df* = 270, *t* = -2.44, *p* = .015) on mood valence, suggesting a generally more negative mood in social isolation. The significant medium main effect of condition (β = -0.48, *SE* = .11, *df* = 28.49, *t* = -4.27, *p* < .001) on energetic arousal suggests a reduction therein under social isolation, while the significant medium main effect of extraversion (β = 0.38, *SE* = .10, *df* = 14.34 , *t* = 3.62 , *p* = .003) on energetic arousal suggests an increase in energetic arousal dependent on extraversion. The significant medium main effects of both condition (β = 0.45, *SE* = .08, *df* = 270, *t* = 5.44, *p* < .001) and time (β = 0.23, *SE* = .05, *df* = 270, *t* = 4.34, *p* < .001) on boredom indicate an increase therein under social isolation and generally across time.

Results on Fatigue and Extraversion

Regarding the measures of fatigue proposed in hypothesis 4.1, namely mental fatigue, physical fatigue and reduced activity, results revealed a significant small interaction of condition and extraversion (β = 0.19 *SE* = .08, *df* = 270, *t* = 2.27, *p* = .024) on reduced activity, which indicates a generally lesser reduction of activity under social isolation dependent on extraversion. As for the three-way-interactions proposed for the same measures in hypothesis 4.2, there was a significant small interaction of condition, time and extraversion (β = -0.19, *SE* = .08, *df* = 270, *t* = -2.36, *p* = .019) on mental fatigue, indicating a more negative development of mental fatigue across time spent in social isolation depending on extraversion. Other interactions proposed in hypothesis 4.1 and 4.2 remained insignificant.

Outside the hypotheses, a significant small main effect of time on mental fatigue could be observed (β = 0.24, *SE* = .06, *df* = 270, *t* = 4.10, *p* < .001), indicating a general increase therein across time. Condition (β = 0.22, *SE* = .08, *df* = 270, *t* = 2.89, *p* = .004) and time (β = 0.13, *SE* = .05, *df* = 270, *t* = 2.73, *p* = .007) both showed significant small main effects on physical fatigue, indicating an increase therein dependent on both, social isolation and across time. The significant medium main effect of condition on reduced activity (β = 0.34, *SE* = .08, *df* = 270, *t* = 4.15, *p* < .001) further indicated an increase of activity generally depending on social isolation.

Results on Wanting and Extraversion

The three-way interaction of condition, reward type and extraversion on behavioral wanting proposed in hypothesis 5.1 indeed revealed a small significant interaction ($\beta = 0.122$, $SE = .06$, $df = 2364$, $t = 2.03$, $p = 0.04$), indicating that there was greater motivation to consume social reward stimuli when subjected to social isolation depending on extraversion.

The interaction of condition and time on desire for social contact as proposed in hypothesis 5.2 also revealed a small significant effect ($\beta = 0.18$, $SE = .07$, $df = 270$, $t = 2.52$, $p = .013$), suggesting a general increase in desire for social contact when subjected to social isolation depending on extraversion. The interaction of condition, time and extraversion on desire for social contact as per hypothesis 5.3 remained insignificant.

A further observation in the context of wanting was a significant medium main effect of condition on desire for social contact ($\beta = 0.47$, $SE = .07$, $df = 270$, $t = 6.80$, $p < .001$) indicating a general increase therein when subjected to social isolation. A significant small main effect of time on desire for social contact ($\beta = 0.124$, $SE = .045$, $df = 264$, $t = 2.74$, $p = .007$) once more revealed an increase therein depending on time alone. A significant medium interaction of condition and time on desire for social contact ($\beta = 0.20$, $SE = .05$, $df = 270$, $t = 3.10$, $p = .002$) reaffirmed a steeper positive trend in this dependent variable across time within social isolation. For the dependent variable of behavioral wanting, a significant large main effect of stimulus type could be observed ($\beta = -0.51$, $SE = .04$, $df = 2364$, $t = -12.04$, $p < .001$), suggesting participants generally exhibited less behavioral wanting for social cues than for non-social cues independent of condition.

Discussion

Summary

This thesis investigates how the personality dimension of extraversion moderates the impact of experimentally induced social deprivation on psychological and physiological indices of loneliness, stress, mood, fatigue, and approach-related motivation (“wanting”). In the underlying study, a cohort of 30 healthy female volunteers completed three laboratory sessions that alternated between two aversive motivational conditions (deprivation) and a neutral condition. Extraversion was quantified with the B5T inventory (Satow, 2012). Complementary self-report and physiological measures assessed loneliness, stress, mood, and fatigue. Approach motivation (“wanting”) was operationalised as the mean grip force applied to a hand dynamometer to obtain social and non-social reward stimuli of differing valence.

Manipulation Checks

Participants in the social isolation condition, who were deprived of in-person contact, reported a greater desire for social interaction than those in the neutral condition, confirming the effectiveness of the experimental manipulation in inducing social deprivation.

The findings of the second manipulation check confirm that as intended, participants perceived a significant reward component within the presented stimuli as indicated by the significant differences between low and high valence categories. The significant difference between social and non-social reward further confirms a distinctiveness of either reward type. Moreover, the lack of a significant interaction confirms that the increase in perceived reward from low to high valence in each reward type is relatively comparable.

Loneliness and Extraversion

The present study found no significant differences in loneliness based on levels of extraversion. Consequently, Hypotheses 1.1 and 1.2 were not supported. This indicates that extraversion neither moderated the effect of experimentally induced social isolation nor did it have a general significant impact on loneliness. This finding contrasts with evidence from a large-scale survey by Miura et al. (2024). In their research, they observed that individuals higher on extraversion were more likely to experience social isolation without loneliness. Particularly when combined with lower neuroticism and fewer depressive symptoms, which suggests that they may remain unaffected by loneliness despite objective isolation. This discrepancy could be explained by differences in context and agency in both studies. While participants in the present study were placed in a controlled and unchangeable state of isolation, the survey respondents could take actions to reduce isolation or loneliness in their daily lives. Prior research consistently links higher extraversion to lower loneliness (Buecker et al., 2020; Stokes, 1985). This is relationship is often attributed to extraverts' greater likelihood to seek out social situations, maintain larger social networks (Buecker et al., 2020; Pollet et al., 2011), and access higher levels of social support (Amirkhan et al., 1995). It is therefore plausible that the absence of agency in the present experimental design reduced the protective influence of extraversion during loneliness typically observed in more naturalistic settings.

Simultaneously, in line with previous evidence (Killgore et al., 2020; Taylor, 2020) and with this study's expectations, there was an overall increase in loneliness dependent on social isolation itself and dependent on time spent in social isolation. However, it was not moderated by extraversion. Therefore, in summary, these findings could imply a previously undocumented observation. Namely that in certain conditions, extraverted individuals could

perceive social isolation similarly to less extraverted individuals and could develop feelings of loneliness equally, if they lack agency to reduce their social deprivation.

Stress and Extraversion

In line with expectations, social isolation indeed induced certain types of stress responses. While there was a general decrease in perceived control across all individuals in the social isolation condition compared to the neutral condition, an increase in the need to avoid the current situation was also present in social isolation. These effects can be considered a logical consequence of the induced deprivation, given that there was a perceived disturbance of social homeostasis without any agency to reestablish it, which in turn lead to an increased need to escape the situation and decreased feeling of control over it. These effects appear independent of the trait of extraversion. This is in line with previous findings that extraversion does not seem to buffer against the immediate negative subjective perception itself when someone is subjected to an aversive situation (Costa & McCrae, 1980). Regarding extraversion and its potential moderating effects, Hypothesis 2.1 was not supported and Hypothesis 2.2 received partial support. During social isolation, higher extraversion predicted a significantly lesser reduction in perceived control over time. This confirms a moderating effect of extraversion on changes in perceived control under social deprivation. A possible explanation for this is that resilience and typical social engagement linked to extraversion provide buffering resources. As established, extraverts generally seek out social contexts and maintain broader networks, affording greater access to support (Amirkhan et al., 1995; Pollet et al., 2011; Stokes, 1985). This is associated with stronger feelings of mastery and resilience under stress, which could enhance a sense of control when faced with stressful situations (Shi et al., 2024). Across different types of stressors, coping self-efficacy (the belief in one's capacity to manage demands) is a central mechanism that restores a sense of control (Benight & Bandura, 2004). Consistent with this, extraversion shows positive associations with generalized self-efficacy (Barańczuk, 2021). Recent evidence further indicates that extraversion positively predicts self-efficacy and suggests a pathway through which more extraverted individuals maintain control when faced with social isolation (Jebram & Harendza, 2024).

In the present study, individuals higher on extraversion reported greater initial stress but also exhibited faster recovery across the session. This is a pattern consistent with evidence that extraverted individuals show heightened early cardiovascular reactivity to cognitive or social stressors while at the same time showing stronger habituation across repeated exposures, which is an adaptive response linked to positive health correlates

(O'Riordan et al., 2023). Some of the elevated early stress in our experimental sessions may reflect task demands at the start. These included learning saliva-sampling procedures and adhering to multiple procedural rules among other factors. These stress effects could have lessened, the more participants became familiar with the experimental setting. More efficient recovery among extraverts aligns with stress-buffering models of social resources. In these models, broader or more readily mobilized social support reduces the stress responses and enhances a return to baseline, while lacking such networks impairs buffering and slows recovery (Grant et al., 2009). Consistent with this, by the end of the sessions extraverted participants reported feeling more in control and less stressed than less extraverted individuals, potentially because trait-congruent social approach and anticipated or planned interactions outside the lab may mitigate the impact of limited in-person contact during the experiment. More broadly, these observations cohere with work demonstrating that social relationships serve a critical stress-buffering function and that having less of such a buffering resource (as should be the case in less extraverted people), amplifies stress responses with downstream consequences for mental and physical health (Cacioppo et al., 2015; Hawkley & Cacioppo, 2010).

More extraverted individuals generally showed higher concentrations of salivary cortisol across both conditions and all time-points. They also exhibited a steeper recovery observed in a reduction of salivary cortisol concentration across time. Within allostatic and psychobiological dynamics, faster recovery is typically viewed as an efficient HPA negative feedback and adaptive regulation (Herman et al., 2016; McEwen, 2000). Resilience-related traits like optimism and hope have also been linked to this high-engagement and quickly recovering cortisol profile (Puig-Perez et al., 2015; Terry et al., 2024) and impaired recovery to maladaptive processing (Maeda et al., 2017). Furthermore, extraversion has been tied to better physiological adaptation to repeated social stress (Lu & Wang, 2017). Overall, these sources support the interpretation that more extraverted individuals showed more efficient stress regulation.

A similarly faster reduction in salivary alpha-amylase concentrations depending on extraversion could be observed. This ties into previous evidence that a steeper post-stressor decline in salivary alpha-amylase (sAA) reflects more efficient down-regulation and thus a more adaptable response. For example, brief self-compassion training produced a more adaptive stress profile including reduced sAA response and better autonomic/subjective recovery (Arch et al., 2014). Furthermore, steeper declines in sAA after being exposed to a stressor have been proposed as more efficient ANS recovery (Thoma et al., 2013) and greater

resilience (Jenkins et al., 2018). Conceptually, sAA is a well-validated marker of sympathetic activity, so efficient recovery in sAA maps onto adaptive sympathetic-adreno-medullar (SAM) axis regulation (Nater & Rohleder, 2009; Cozma et al., 2017). Direct evidence that extraversion specifically yields faster sAA recovery is scarce, but lower extraversion has been linked to higher sAA (Inukai et al., 2010). Thus, the interpretation that the steeper sAA decline dependent on extraversion implies greater adaptability and resilience is consistent with broader SAM-recovery evidence while introducing extraversion as a relevant trait in this dynamic.

Mood and Extraversion

Extraversion did not moderate mood responses to social isolation. Hence, hypotheses 3.1 and 3.2 were rejected. Consistent with the patterns observed for perceived control and avoidance, social deprivation elicited higher negative mood and greater boredom, indicating the aversive character of isolation and a disruption of social homeostasis. Energetic arousal was lower under social deprivation, whereas higher trait extraversion was associated with greater energetic arousal overall, independent of condition. This suggests a broader propensity for heightened activation and responsivity among more extraverted individuals, in line with the study's findings on physiological stress markers. Moreover, it has been shown that greater sleepiness predicted a decrease in social activity (i.e., lower desire to initiate social interactions) suggesting that low energy feeds back into social withdrawal (Holding et al., 2020) and therefor less extraverted behavior, which can be considered in line with the generally hightened activity among more extraverted individuals observed herein.

Fatigue and Extraversion

Results show social deprivation elicited a general reduction of activity across participants. However, the hypothesis 4.1 was partially confirmed since more extraverted individuals showed a lesser decline in activity during social isolation, reporting they felt comparably more active than less extraverted individuals. This pattern accords with the previously discussed findings of higher arousal (mood) and activation (stress) in more extraverted individuals and with evidence that extraversion is associated with greater positive activation (high-arousal positive affect such as feeling energetic/enthusiastic), such as feeling more activated (Smillie at al., 2015).

Hypothesis 4.2 was likewise partially supported. Under social deprivation, individuals high on extraversion, felt significantly more mentally fatigued over time. A plausible explanation could be the discussed higher general activation and arousal in more extraverted individuals, which, coupled with the regulation of elevated stress responses, places additional

demands on limited cognitive resources. Consistent with this view, extraversion was associated with higher concurrent stress indicators (momentary stress, cortisol, and sAA) alongside steeper subsequent declines, suggesting more intensive coping followed by faster recovery, processes that carry subjective and neurocomputational costs and can induce fatigue (Shenhav et al., 2013). More broadly, stress regulation incurs physiological allostatic costs, as the mediators recruited to maintain stability exact cumulative costs (McEwen, 1998). In summary, this could imply a possible mental cost of the previously introduced coping strategies and activity-based resilience of more extraverted individuals when faced with social isolation.

Consistent with the patterns observed for perceived control, avoidance, and negative mood, social deprivation led to greater physical fatigue, further indicating an aversive state and a disturbance of homeostatic balance. Converging evidence indicates that coping with homeostatic imbalance like social isolation requires effortful regulation that consumes self-regulatory resources and elicits hypervigilant, physiologically costly stress responses, culminating in energetic depletion and heightened subjective fatigue (Ryan & Deci, 2008; Hagger et al., 2010; Quadt et al., 2020). Consistent with this account, the present study provides experimental evidence that the aversive state of social deprivation led to the expected outcome of an increase in fatigue.

Wanting and Extraversion

As a primary indicator of social isolation and motivation to obtain social reward, the desire for social contact increased across all participants within the experimental social isolation condition. Furthermore, the increase in desire for social contact in social isolation was greater across time. Overall, these findings confirm the possibility to experimentally induce momentary and prolonged social isolation through the paradigm introduced in this study.

Hypothesis 5.1 was confirmed. Following social isolation, more extraverted individuals showed greater behavioral motivation (approach behavior) toward social rewards than less extraverted individuals. Hypothesis 5.2 was confirmed as well. More extraverted individuals had a greater reported motivation (desire for social contact) under social isolation for social contact. However, the effect did not strengthen with increasing time in social isolation and thus Hypothesis 5.3 was rejected.

Generally, the experimental paradigm used was effective in inducing social isolation. The results also confirm the expectations that extraversion moderates the motivation (wanting) to engage in social contact to re-establish social homeostasis in response to acute

social isolation. These experimental findings align with previous evidence indicating that individuals higher on extraversion exhibit heightened reward sensitivity, especially to social rewards (Canli et al., 2002; Fishman et al., 2011; Smillie, 2013), show greater sociability (Fishman et al., 2011; Soto & John, 2017; Satow, 2021), and a possess a tendency to associate people with reward (Wilkowski & Ferguson, 2014). Moreover, the manipulation of acute social isolation in the underlying study and the associated increase in social motivation, aligns conceptually with Tomova et al. (2020), who demonstrated that brief enforced isolation heightens self-reported social craving.

However, the change of the effect over time spent in social isolation could not be confirmed. This seems to contradict expectations based on the stronger regulation skills of more extraverted individuals (Connor-Smith & Flachsbart, 2007; Barańczuk, 2019; O'Riordan et al., 2023) and the potential buffering function of extraversion previously discussed in this thesis, which would imply a change in desire for social contact across time based on extraversion. A possible explanation for this discrepancy could lie within the specific experimental setup of this study. Whereas more extraverted individuals seem to possess a confirmedly higher baseline motivation towards and desire for social contact when faced with social isolation, a lack of agency and options for translating this motivation into regulation of social homeostasis, which was previously discussed as an inherent aspect of this experimental setup, could cause more extraverted individuals to develop and perceive some of the both negative and positive developments in social isolation similar to that of less extraverted individuals. This in turn could imply, that the herein proposed buffering effects of extraversion lie within specific pathways that could be largely action- and skill-based.

Limitations

In parallel to previously discussed findings, for loneliness, avoidance, mental and physical fatigue, and most importantly desire for social contact, a significant effect singularly based on time was observed. This suggests a possible and unintended mildly socially isolating quality of the neutral condition. Which implies that while the experimental manipulation of social isolation was indeed effective, contrasting the social isolation condition against a supposedly neutral condition seems to be nuanced and difficult to differentiate. In this study, the scheduled and mediated social contact in the neutral condition seems to not have been enough to mitigate a certain degree of social isolation. More precisely, while participants in the neutral condition could use Skype or phone for social contact but remained physically alone, this mediated contact was not enough to fully compensate for the absence of in-person interaction. This was likely due to its limited

capacity to fulfil social needs. This aligns with consistent evidence across populations and contexts showing that face-to-face contact more effectively satisfies social needs (Teo et al., 2015; Stieger et al., 2023; Newson et al., 2024), reduces loneliness (Zhou et al., 2024), and supports mental health (Stieger et al., 2023) than mediated communication. Phone calls can have some benefits of direct personal contact (Seltzer et al., 2012). However, face-to-face interaction shows the strongest and most consistent associations with improved mood (Stieger et al., 2023), greater well-being (Newson et al., 2024), and lower depression risk (Teo et al., 2015). Overall, this could have confounded the effects discussed in this study or rather, such effects could have been more evident in contrast to a more clearly differentiated neutral condition.

It is noteworthy that all social isolation observed in this study are entirely short-term. The effects of social isolation are suggested to accumulate in the long term through repeated short-term exposure (Matthews & Tye, 2019). However, it cannot be ruled out, that long term effects and interaction with extraversion could change across prolonged exposure. Therefore, conclusions drawn from these findings on long-term effects are limited.

Across all participants and conditions, high valence non-social food images were rated as more pleasant than high valence facial stimuli. One plausible explanation for this effect lies in the context of the experimental procedure: participants were provided with relatively sparse and low-palatability meals (e.g., untoasted toast, plain pasta with a small portion of pesto), which may have left them insufficiently satiated and thus heightened the hedonic appeal of food cues, independent of social-deprivation condition (Blechert et al., 2014; Spence, 2016). Moreover, food images have been shown to induce more persistent affective effects than facial stimuli, further supporting the general observed preference for rewarding food over rewarding social stimuli in this context (Blechert et al., 2014; Blechert et al., 2019). However, since the goal of this study was to simply observe a potential change in reactivity on the trait of extraversion in response to the social component of the reward stimuli, not to establish a general preference for either reward type, conclusions on changes within such trends and slopes can still be drawn. Simultaneously it cannot be ruled out, that effects could have been even more evident, had reward types been more equally matched.

Furthermore, the singular effect of time on boredom along with the medium to large effect sizes of this effect and the effect of condition on boredom suggest a high prevalence of boredom in the experimental settings. It cannot be ruled out that this prevalence of boredom could have confounded some of the findings. For example, it has been shown that a lack of

agency or low perceived control is positively linked to boredom (Tze et al., 2014; Struk at al., 2021), which aligns with the present findings on decreased perceived control.

Conclusion

Summarizing all previously discussed findings, three central conclusions can be drawn. Firstly, the experimental paradigm has been shown to be effective in inducing social isolation and thereby eliciting several of its presumed effects such as an increase of loneliness, a decrease of perceived control, an increase in avoidance of social isolation, an increase in negative mood, a reduction in energetic arousal, an increase in both mental and physical fatigue, a reduction in activity, and an increase in the desire for social contact. Other anticipated measures, such physiological stress markers or behavioural approach motivation towards social stimuli, could not be linked to effects of social isolation alone.

Secondly, extraversion has indeed been shown to be a moderator of the effects of social isolation, in some cases generally and in other cases on the effects of time spent in social isolation. This was observed in several measures such as a greater feeling of control, a lesser reduction of activity, a greater increase in mental fatigue, and a greater behavioural and reported motivation towards social stimuli. Thereby, the first research question of whether there are individual differences in the effects of social isolation on the trait of extraversion and the second research question of whether extraversion moderates the change in motivation to seek social contact and reestablish social homeostasis in response to acute social isolation, can both be positively reaffirmed.

Thirdly, the results suggest several possible pathways through which extraversion could moderate the effects of social isolation. The greater initial expressions in and simultaneously more efficient recovery of physiological and subjective stress markers as well as the higher feeling of control observed in more extraverted individuals, suggest a higher regulation and adaptability capacity on the trait of extraversion. The greater initial stress markers together with greater energetic arousal and lesser reduction of activity, suggest a propensity to respond with higher activation to demanding situations in extraverted individuals. Furthermore, the contrast between previous findings and the lack thereof in the present study could suggest, that some of the buffering effects of extraversion are dependent on certain skills and strategies deployed in the reestablishing of social homeostasis. When coping strategies such as social seeking are inhibited, extraverted individuals seem to perceive and experience social isolation similarly to less extraverted individuals.

Future Research Recommendations

While the experimental paradigm is applicable, future research should seek to further improve and refine the deployed manipulations, such as an inclusion of face-to-face social contact in the neutral condition or a more equal matching of reward stimuli, as previously discussed in the limitation segment to possibly be able to observe stronger and more differentiated effects.

The herein suggested possible pathways through which extraversion could moderate the detrimental effects of social isolation should be further explored through experimental means. Especially in respect to possible resilience factors among extraverted individuals and the way in which the observed dynamics unfold in long-term social isolation. This could further inform a scientific basis for deriving interventions against the detriments of social isolation and loneliness, which could in turn assist health-care professionals in tackling the globally rising occurrence of disturbances in social homeostasis such as the loneliness epidemic.

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List of Figures

Appendix

English Abstract

Humans suffer from various detrimental effects when subjected to social isolation, causing some to consider social contact a basic survival need. While the personality trait of extraversion has been repeatedly linked to social contact behavior in humans, few empirical studies investigate the possible moderating role extraversion could have in the effects of social isolation. To test for impacts of short-term social isolation and moderating effects of extraversion, the present study observed 30 female participants across two 8-hour sessions, one with and one without experimentally induced social isolation. Throughout the duration, participants completed several surveys regarding loneliness, stress, mood, fatigue and social motivation. They also provided salivary samples and completed a behavioral social motivation task. The experimental paradigm was effective in inducing several expected general social isolation effects, namely increased loneliness, decreased perceived control, increased desire to avoid the situation, increased negative mood, reduced energetic arousal, increased mental and physical fatigue, reduced activity, and increased desire for social contact. Moderating effects of extraversion could be observed regarding a higher feeling of control, a lesser reduction of activity, a greater increase in mental fatigue, and a greater behavioural and subjective motivation towards social stimuli in more extraverted individuals in social isolation. Several pathways through which extraversion could moderate these effects could be argued, namely higher regulation and adaptation capabilities, greater energetic arousal, and self-employed social strategies. Future research should seek to refine the employed experimental paradigm and investigate the proposed pathways to derive possible interventions against the detrimental impacts of social isolation.

Keywords: Social Isolation, Extraversion, Loneliness, Stress, Fatigue, Mood, Motivation

German Abstract

Menschen erleiden verschiedene negative Auswirkungen, wenn sie sozialer Isolation ausgesetzt sind, weshalb einige soziale Kontakte als grundlegendes Überlebensbedürfnis betrachten. Obwohl das Persönlichkeitsmerkmal Extraversion wiederholt mit dem Sozialkontaktverhalten von Menschen in Verbindung gebracht wurde, gibt es nur wenige empirische Studien, die die mögliche moderierende Rolle von Extraversion in den Auswirkungen sozialer Isolation untersuchen. Um die Auswirkungen kurzfristiger sozialer Isolation und moderierende Effekte von Extraversion zu prüfen, beobachtete die vorliegende Studie 30 weibliche Teilnehmende in zwei achtstündigen Sitzungen, eine mit und eine ohne experimentell induzierter sozialer Isolation. Während der gesamten Dauer füllten die Teilnehmenden mehrere Fragebögen zu Einsamkeit, Stress, Stimmung, Erschöpfung und sozialer Motivation aus. Sie gaben außerdem Speichelproben ab und absolvierten eine verhaltensbasierte Aufgabe zu sozialer Motivation. Das experimentelle Paradigma erwies sich als wirksam, um mehrere erwartete allgemeine Effekte sozialer Isolation auszulösen, nämlich gesteigerte Einsamkeit, verringertes wahrgenommenes Kontrollgefühl, erhöhter Vermeidungswunsch der Situation, verstärkte negative Stimmung, reduzierte energetische Aktivierung, gesteigerte geistige und körperliche Erschöpfung, verminderte Aktivität und gesteigertes Verlangen nach sozialem Kontakt. Ein moderierender Effekt von Extraversion konnte hinsichtlich eines stärkeren Kontrollgefühls, einer geringeren Reduktion der Aktivität, einer stärkeren Zunahme geistiger Ermüdung sowie einer größeren verhaltensbezogenen und subjektiven Motivation gegenüber sozialen Stimuli bei extravertierteren Personen in sozialer Isolation beobachtet werden. Es lassen sich mehrere Wirkweisen argumentieren, über welche Extraversion diese Effekte moderieren könnte, nämlich höhere Regulations- und Anpassungsfähigkeiten, größere energetische Aktivierung und selbstinitiierte soziale Strategien. Künftige Forschung sollte das verwendete experimentelle Paradigma weiter verfeinern und die vorgeschlagenen Wirkweisen untersuchen, um mögliche Interventionen gegen die negativen Auswirkungen sozialer Isolation abzuleiten.

Schlüsselwörter: Soziale Isolation, Extraversion, Einsamkeit, Stress, Erschöpfung, Stimmung, Motivation

Informed Consent Form

TeilnehmerInneninformation und Einwilligungserklärung zur Teilnahme an der Studie:

Der Einfluss von sozialen und nicht sozialen Bedürfnissen auf den körperlichen Zustand

Sehr geehrte(r) Teilnehmer(in),

Wir laden Sie ein, an der oben genannten Studie teilzunehmen.

Ihre Teilnahme an dieser Studie erfolgt freiwillig. Sie können jederzeit ohne Angabe von Gründen aus der Studie ausscheiden. Die Ablehnung der Teilnahme oder ein vorzeitiges Ausscheiden aus dieser Studie hat keine nachteiligen Folgen für Sie.

Diese Art von Studien ist notwendig, um verlässliche neue wissenschaftliche Forschungsergebnisse zu gewinnen. Unverzichtbare Voraussetzung für die Durchführung von Studien ist jedoch, dass Sie Ihr Einverständnis zur Teilnahme an dieser Studie schriftlich erklären.

Bitte lesen Sie den folgenden Text als Ergänzung zum Informationsgespräch mit dem/der StudienleiterIn sorgfältig durch und zögern Sie nicht, Fragen zu stellen.

Bitte unterschreiben Sie die Einwilligungserklärung nur
- wenn Sie Art und Ablauf der Studie vollständig verstanden haben,
- wenn Sie bereit sind, der Teilnahme zuzustimmen,
- wenn Sie sich über Ihre Rechte als TeilnehmerIn an dieser Studie im Klaren sind.

1. Was ist der Zweck der Studie?

Das Ziel der Studie ist die Untersuchung der Schwankungen der Stresshormone Cortisol und Alpha Amylase im Tagesverlauf. Diese werden während drei motivationalen Zuständen gemessen: (1) im Laufe eines normalen Tages, (2) im Laufe eines Tages mit verringerter Kalorienaufnahme und (3) im Laufe eines Tages mit verringertem sozialem Kontakt. Wir sind interessiert daran, wie die hormonellen Veränderungen mit Ihren persönlichen Erfahrungen in Beziehung stehen.

Bitte lesen Sie dieses Dokument aufmerksam durch und fragen Sie bei Unklarheiten nach, bevor Sie Ihr Einverständnis zur Studienteilnahme erteilen.

2. Wie läuft die Studie ab?

Die Studie findet in der Fakultät für Psychologie, Universität Wien, Liebiggasse 5, 1010 Wien, statt. Es werden insgesamt 30 Personen (Alter 18 bis 35 Jahre) daran teilnehmen.

Vor der Teilnahme an der Studie werden potentielle TeilnehmerInnen gebeten einen Online-Fragebogen auszufüllen. Dabei werden diese auf das Zutreffen aller Einschlusskriterien und das Fehlen aller Ausschlusskriterien hin überprüft. Der Online-Fragebogen wird weiter einige vorbereitende psychologische Fragebögen beinhalten. Anschließend bekommen alle

Teilnehmenden die Möglichkeit, allgemeine Fragen zur Studie und zum Design zu stellen. Wenn Sie als TeilnehmerIn für die Studie zulässig sind, werden drei Termine mit Ihnen im Labor der Fakultät für Psychologie vereinbart.

Die Studie besteht aus drei Sitzungen. Jede Sitzung dauert 10 Stunden (insgesamt 30 Stunden). In einer von drei Sitzungen werden Sie nur in der Vorbereitungsphase Essen erhalten, nicht aber während der Testphase (Bedingung der verringerten Kalorienaufnahme). In einer anderen Sitzung werden Sie während der Testphase keinen sozialen Kontakt haben (Bedingung des verringerten sozialen Kontakts). In der dritten Sitzung werden Sie in der Vorbereitungsphase und in der Testphase sowohl Essen als auch sozialen Kontakt haben (Neutrale Bedingung). Die Reihenfolge der Bedingungen wird per Zufall zugeteilt. Am Folgetag jeder Sitzung werden sie gebeten zwei weitere kurze Messungen zu Hause durchzuführen und diese bei der nächsten Sitzung oder an einem anderen vereinbarten Termin abzugeben.

Ablauf einer Sitzung

Die erste Sitzung startet mit einer Vorbereitungsphase von ca. 1 ½ Stunden. In der zweiten und dritten Sitzung wird die Vorbereitungsphase etwas kürzer sein. Am Anfang werden Sie ein Frühstück erhalten und einen psychologischen Fragebogen ausfüllen. Anschließend werden Sie vom/von der VersuchsleiterIn geschult die Messinstrumente selbstständig zu benutzen. Die Messinstrumente beinhalten: Die Salicaps zum Sammeln der Speichelproben, das Ecological Momentary Assessment Device (EMA), über welches die Fragebögen beantwortet werden, und den Gürtel, welcher Ihre Herzfrequenz misst. Am Ende der 1 ½-stündigen Vorbereitungsphase werden wir Sie um die erste selbstständige Messung (bestehend aus Speichelprobe und Fragebögen) bitten.

Auf die Vorbereitungsphase folgt die Testphase. Diese wird 8 Stunden dauern. Sie werden gebeten, Ihre persönlichen Gegenstände im Vorbereitungsraum zu lassen. Das ist notwendig, um die Bedingungen für alle Teilnehmenden so ähnlich und vergleichbar wie möglich zu halten. Außerdem können Sie drei bis fünf Gegenstände von zu Hause als Beschäftigungsmöglichkeit mitbringen. Dabei darf es sich nicht um elektronische Geräte (z.B. Handy, Laptop, I-Pod) oder soziale Inhalte handeln (z.B. Bilder von Gesichtern, Romane). Nähere Informationen zu den Gegenständen werden Sie von uns vor der Sitzung erhalten. Während der Testphase können Sie die Zeit so verbringen, wie Sie es möchten. Zusätzlich zu Ihren eigenen mitgebrachten Gegenständen stehen im Raum verschiedene Beschäftigungsmöglichkeiten (z.B. Bücher, Puzzles, Zeichenmaterial) zu Ihrer freien Verfügung. Ungefähr einmal in der Stunde wird das EMA Gerät Ihnen ein Signal geben (in Form eines Piepens) und Sie auffordern einen kurzen Fragebogen auszufüllen und eine Speichelprobe abzugeben. In den Sitzungen, bei denen Sie während der Testphase Mahlzeiten erhalten, wird Ihnen das Essen zu vorgegebenen Zeiten bereitgestellt. Für die Messung des Hormonspiegels ist es wichtig nur dann zu essen, wenn Sie dazu instruiert werden. In den Sitzungen, bei welchen Sie während der Testphase sozialen Kontakt haben, werden Sie den von Ihnen ausgewählten Gesprächspartnern via Skype und/oder Handy kommunizieren. Sie werden zu bestimmten Zeiten dafür mit einem Laptop und einem Handy ausgestattet (Wichtig: Es handelt sich dabei um Geräte der Universität, nicht Ihre eigenen). Sie werden vor der Sitzung noch nähere Informationen zur Absprache mit Ihren gewählten Kontakten erhalten. Während der Testphase ist die Kommunikation mit dem/der TestleiterIn nicht möglich, außer bei Notfällen oder der Entscheidung, die Studie abzubrechen. Aus diesem Grund wird der Raum mit einer Überwachungskamera ausgestattet, damit der/die TestleiterIn Ihr Wohlbefinden sicherstellen kann. Diese Kamera nimmt nicht auf und überträgt keinen Ton. Ihr Verhalten im Raum wird nicht analysiert.
Am Ende der Testphase werden Sie am Computer noch ein paar Tests durchführen, die aus zwei Teilen bestehen. Im ersten Teil wird Ihnen eine Reihe von Bildern präsentiert. Ihre Aufgabe ist es zu entscheiden, wie groß die Bilder auf dem Bildschirm sein sollen. Danach sollen Sie bewerten, wie sehr Ihnen die Bilder gefallen haben. Im zweiten Teil werden Sie eine Aufgabe zur

Bewegungskoordination, eine Aufgabe zum Arbeitsgedächtnis und eine Aufgabe zur Aufmerksamkeitskontrolle durchführen.

Nach Vollendung der Testphase erhalten sie Instruktionen für die Nachfolgephase (den Morgen nach der Testung)**.** Diese Phase besteht aus zwei weiteren Messungen, die Sie selbstständig zu Hause durchführen. Sie werden gebeten, jeweils direkt nach dem Aufwachen und 30 Minuten nach dem Aufwachen einen kurzen Fragebogen auszufüllen und eine Speichelprobe abzugeben. Letztlich werden Sie gebeten, diese zu Ihrer nächsten Sitzung oder zu einem anderen vereinbarten Zeitpunkt in die Fakultät für Psychologie, Universität Wien, Liebiggasse 5, 1010 Wien, zu bringen.

3. Worin liegt der Nutzen einer Teilnahme an der Studie?

Die Teilnahme an dieser Studie hat für Sie persönlich keinen unmittelbaren Nutzen. Wir hoffen jedoch, dass die Ergebnisse dieser Studie uns weitere Einblicke in körperliche und emotionale Reaktionen auf Veränderungen in der Menge von Kalorienaufnahme und sozialem Kontakt auf täglicher Ebene liefern.

4. Gibt es Risiken, Beschwerden und Begleiterscheinungen?

Nein, die Teilnahme an der Studie ist nach menschlichem Ermessen mit keinen oder vernachlässigbaren Risiken assoziiert. Die Untersuchungen werden ohne Ausnahme von trainierten VersuchsleiterInnen durchgeführt. Es werden keine medikamentöse oder therapeutische Methoden zu Zwecken der Studie verwendet. Die oben beschriebenen Untersuchungen sind nicht-invasiv und wurden bereits ohne negative Konsequenzen durchgeführt.

5. Hat die Teilnahme an der Studie sonstige Auswirkungen auf die Lebensführung und welche Verpflichtungen ergeben sich daraus?

Wir bitten Sie:

- am Tag der Sitzung bevor Sie ins Labor kommen keinerlei Nahrung zu sich zu nehmen
- 24 Stunden vor Beginn der Sitzungen keinen Kaugummi zu kauen,
- eine Stunde vor Beginn der Sitzungen Ihre Zähne nicht zu putzen,
- in den 18 Stunden vor den Sitzungen nicht zu rauchen oder koffeinhaltige Getränke (Kaffee, Cola, Tee), Säfte oder Alkohol zu konsumieren,
- und 24 Stunden vor Beginn den Sitzungen keinen Sport mehr zu betreiben,

da all diese Aktivitäten Einfluss auf die physiologischen Messungen haben könnten.

Dieselben Einschränkungen gelten auch für den Abend nach der Sitzung, bis zum Zeitpunkt der Nachfolgephase am nächsten Morgen.

6. Was ist zu tun beim Auftreten von Beschwerdesymptomen, unerwünschten Begleiterscheinungen und/oder Verletzungen?

Sollten im Verlauf der Studie unerwünschte Symptome, Begleiterscheinungen, Krankheiten oder Verletzungen auftreten, müssen Sie diese der Studienleitung und/oder den Mitarbeitenden umgehend mitteilen.

7. Wann wird die Studie vorzeitig beendet?

Sie können jederzeit, auch ohne Angabe von Gründen, Ihre Teilnahmebereitschaft widerrufen und aus der Studie ausscheiden, ohne dass Ihnen dadurch irgendwelche Nachteile entstehen.

Ihr/e StudienleiterIn wird Sie über alle neuen Erkenntnisse, die in Bezug auf diese Studie bekannt werden und für Sie wesentlich sein könnten, umgehend informieren. Auf dieser Basis können Sie dann Ihre Entscheidung zur weiteren Teilnahme an dieser Studie neu überdenken.

Es ist aber auch möglich, dass Ihr/e StudienleiterIn Ihre Teilnahme an der Studie vorzeitig beendet, ohne vorher Ihr Einverständnis einzuholen.

Die Gründe hierfür können sein:

a) Sie können den Erfordernissen der Studie nicht entsprechen;
b) Der/die StudienleiterIn hat den Eindruck, dass eine weitere Teilnahme an der Studie nicht in Ihrem Interesse ist.

Sollte Ihre Teilnahme an der Studie vorzeitig beendet werden (von Ihnen oder von der Studienleitung), werden Sie 10€ als Kompensation erhalten, falls keine der Sitzungen vollendet wurde. Sie erhalten 40€, falls bis zu diesem Zeitpunkt zumindest eine Sitzung vollendet wurde.

8. In welcher Weise werden die im Rahmen dieser Studie gesammelten Daten verwendet?

Ihre Daten werden pseudonymisiert (d.h. ohne Verweis auf Ihren Namen gespeichert), indem Ihnen eine ID Nummer zugeordnet wird. Für Personen ohne Zugang zu diesen persönlichen Informationen, wird es daher nicht möglich sein, Rückschlüsse auf Ihre Person zu ziehen. Vorbehaltlich anderslautender gesetzlicher Bestimmungen werden nur Mitglieder der Forschungsgruppe Zugang zu vertraulichen Daten mit persönlichen Informationen erhalten (Name, Vorname, Alter, Email). Diese werden in einem, von den anderen erhobenen Daten separaten Dokument auf einem sicheren, passwort-geschützten Computer gespeichert. Die Forschungsgruppenmitglieder unterliegen der Schweigepflicht.

Die komplette statistische Auswertung wird auf Basis der pseudonymisierten Daten erfolgen. In wissenschaftlichen Publikationen und Präsentationen werden nur die Gruppenergebnisse präsentiert und Sie werden niemals namentlich genannt. Das Dokument in welchem Ihre persönlichen Daten gesammelt werden, wird sobald alle Auswertungen abschlossen sind, zerstört. Alle anderen Daten werden in Übereinkunft mit den gesetzlichen Vorschriften gespeichert.

9. Entstehen für die TeilnehmerInnen Kosten? Gibt es einen Kostenersatz oder eine Vergütung?

Durch Ihre Teilnahme an dieser Studie entstehen für Sie keine Kosten. Als Vergütung für Ihren Zeitaufwand erhalten Sie nach erfolgter Teilnahme **180€**.

Falls Sie für die Studie geeignet sind und für die erste Sitzung erscheinen, diese aber nicht beenden, erhalten Sie ein „Erscheinungsentgelt" von **10€**. Falls Sie mindestens eine, aber weniger als drei Sitzungen vollenden, erhalten Sie ein „Teilentgelt" von **40€**. Wenn Sie alle drei Sitzungen vollenden erhalten Sie das gesamte Entgelt von **180€.**

Für jede vollendete *Nachfolgephase am nächsten Morgen* erhalten Sie zusätzliches Entgelt von jeweils **5€**. Dieses zusätzliche Geld kommt zu Ihrem Hauptentgelt am Ende Ihrer Teilnahme hinzu.

10. Möglichkeit zur Diskussion weiterer Fragen

Für weitere Fragen im Zusammenhang mit dieser Studie stehen Ihnen Ihre Studienleiterin und ihre MitarbeiterInnen gerne zur Verfügung. Auch Fragen, die Ihre Rechte als ProbandIn in dieser Studie betreffen, werden Ihnen gerne beantwortet.

Name	Rolle	Telefon	Email
Dr. Giorgia Silani	Studienleiterin	+43 01 4277 47223	giorgia.silani@univie.ac.at
Ana Stijovic, MSc	Verantwortlicher Datenaufnahme	+43 01 4277 47235	ana.stijovic@univie.ac.at

Einwilligungserklärung

Name der teilnehmenden Person in Druckbuchstaben: .....
Geb. Datum: .....

Ich erkläre mich bereit, an der Studie „Der Einfluss von sozialen und nicht sozialen Bedürfnissen auf den körperlichen Zustand" teilzunehmen.

Ich bin von „....." (Name der aufklärenden Person) ausführlich und verständlich über Zielsetzung, Bedeutung und Tragweite der Studie und die sich für mich daraus ergebenden Anforderungen aufgeklärt worden. Ich habe darüber hinaus den Text dieser TeilnehmerInneninformation und Einwilligungserklärung gelesen, insbesondere den 4. Abschnitt (Gibt es Risiken, Beschwerden und Begleiterscheinungen?). Aufgetretene Fragen wurden mir von der Studienleitung verständlich und ausreichend beantwortet. Ich hatte genügend Zeit, mich zu entscheiden, ob ich an der Studie teilnehmen möchte. Ich habe zurzeit keine weiteren Fragen mehr.

Ich werde die Hinweise, die für die Durchführung der Studie erforderlich sind, befolgen, behalte mir jedoch das Recht vor, meine freiwillige Mitwirkung jederzeit zu beenden, ohne dass mir daraus Nachteile entstehen. Sollte ich aus der Studie ausscheiden wollen, so kann ich dies jederzeit schriftlich oder mündlich bei Dr. Giorgia Silani oder Ana Stijović veranlassen.

Ich bin zugleich damit einverstanden, dass meine im Rahmen dieser Studie erhobenen Daten aufgezeichnet und ausgewertet werden.

Ich stimme zu, dass meine Daten dauerhaft in pseudonymisierter Form elektronisch gespeichert werden. Die Daten werden in einer nur der Projektleitung zugänglichen Form gespeichert, die gemäß aktueller Standards gesichert ist.

Sollte ich zu einem späteren Zeitpunkt, die Löschung meiner Daten wünschen, so kann ich dies innerhalb der nächsten sechs Monate schriftlich oder telefonisch ohne Angabe von Gründen bei Dr. Giorgia Silani (E-Mail: giorgia.silani@univie.ac.at, Tel.: +43-1-4277-47223) oder Ana Stijović (E-Mail: ana.stijovic@univie.ac.at, Tel.: +43-1-4277-47235) veranlassen.

Den Aufklärungsteil habe ich gelesen und verstanden. Ich konnte im Aufklärungsgespräch alle mich interessierenden Fragen stellen. Sie wurden vollständig und verständlich beantwortet.

Eine Kopie dieser TeilnehmerInneninformation und Einwilligungserklärung habe ich erhalten. Das Original verbleibt bei der Studienleitung.

(Datum und Unterschrift der TeilnehmerIn)

.....

(Datum, Name und Unterschrift der Studienleitung)

.....

Compensation Fee Form

Timepoint (TO/T1): , Sosci: , ID:

Fakultät für Psychologie

Institut für Klinische und
Gesundheitspsychologie

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Aufwandsentschädigung

Hiermit bestätige ich, im Rahmen der Studie „Der Einfluss von sozialen und nicht sozialen Bedürfnissen auf den körperlichen Zustand" (Studienleiterin Prof. Giorgia Silani) des Instituts für Klinische und Gesundheitspsychologie als freiwillige Versuchsperson an der Labortestung teilgenommen zu haben und ersuche um Überweisung von € _____ als Dankeschön für die Teilnahme.

Für die etwaige Versteuerung dieser Aufwandsentschädigung erkläre ich mich selbst verantwortlich.

IBAN: _____

BIC: _____
(nur bei ausländischen Konten)

Name: _____

Adresse: _____

_____ _____

Datum: _____ _____
Unterschrift der Versuchsperson

Conversation Time Information

Während Ihrer Sitzung werden Sie 4 Gesprächszeiten haben, die jeweils 30 Minuten dauern. Sie werden Handy und Laptop der Universität für die Gespräche verwenden. Sie werden Zugang zu den Kontakten haben, die Sie in die untenstehende Tabelle eintragen. Alle Nummern die Sie unten eintragen, werden für kurze Zeit an dem Handy der Universität gespeichert und nach Ende Ihrer Sitzung sofort wieder gelöscht.
Falls Sie möchten, werden Sie ebenfalls Ihren eigenen Skype-Account verwenden können und zu all Ihren Skype-Kontakten Zugang haben. Bitte vergewissern Sie sich vor der Sitzung, dass Sie ihren Skype-Username und Ihr Passwort für Skype parat haben.
Notieren Sie die Namen Ihrer Gesprächspartner in der Tabelle so, dass Sie sie später wiedererkennen (Spitznamen), daneben die Telefonnummer und den Skype-Namen (falls erforderlich). Notieren Sie zusätzlich einige Ersatzkontakte, die Sie anrufen können falls ein Gespräch frühzeitig beendet wird oder das geplante Gespräch nicht zustande kommt.
Bitte erinnern Sie Ihre Gesprächspartner noch vor der Sitzung an den Termin.
Informieren Sie Ihre Gesprächspartner, dass diese nicht mit Ihrem eigenen Handy angerufen werden. Das Handy der Universität hat eine anonyme Nummer. Daher wird bei einem eingehenden Anruf “Private number” auf dem Display Ihrer Gesprächspartner aufscheinen.
Die Struktur der Studie erlaubt keine Abweichungen der Gesprächstermine. Die von Ihnen gewählten Gesprächspartner müssen innerhalb der folgenden Gesprächszeiten verfügbar sein:
12:17-12:47
14:22-14:52
16:17-16:47
18:17-18:47
Sie können auch mit der gleichen Person zu verschiedenen Gesprächszeiten kommunizieren oder mit ein paar Personen innerhalb einer Gesprächszeit.
Bitte senden Sie uns den Gesprächszeitenplan spätestens 3 Tage vor der Sitzung zu. **Falls es zu Veränderungen bezüglich der Termine kommen sollte, informieren Sie uns bitte so schnell wie möglich!**
Dieser Plan dient Ihnen auch als Erinnerung während der Sitzung.

List of Activities

Zeitvertreib im Testraum

Bitte NICHT mitbringen:

- Handy, Tablet, Laptop, andere elektronische Geräte
- Lesestoff mit vorwiegend sozialen Inhalten
- Magazine und Zeitungen mit Fotos von Gesichtern und Romane
- Laute Instrumente z.B. Trompete, Saxophon
- Material zur sportlichen Betätigung z.B. Gewichte, Yogamatte, ...

Mitbringen ERLAUBT:

- Lesestoff ohne soziale Inhalte (ohne Bilder von Gesichtern): Lernbücher, Magazine über Natur, Sachbücher,...
- Puzzles, Rätsel, ...
- Leise Instrumente z.B. akkustische Gitarre, Ukulele
- Handarbeitmaterial z.B. Strickzeug
- Material zum Basteln/Zeichnen