

# Social Support as a Stress Buffer or Stress Amplifier: The Moderating Role of Social Motives

**Alisa Haufler**

University of Konstanz

**Beate Ditzen**

Heidelberg University

**Julia Schüler** (✉ [julia.schueler@uni-konstanz.de](mailto:julia.schueler@uni-konstanz.de))

University of Konstanz <https://orcid.org/0000-0002-7790-0491>

---

## Research Article

**Keywords:** Trials guidance: Three to ten keywords representing the main content of the article. Stress, Trier Social Stress Test, Social support, Social motives, Cortisol, Reproductive hormones

**Posted Date:** November 30th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-781012/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

---

# Abstract

*Trials* guidance: The Abstract should not exceed 350 words. Please minimize the use of abbreviations and do not cite references in the abstract. The abstract must include the following separate sections:

- **Background:** the context and purpose of the study
- **Methods:** how the study will be performed
- **Discussion:** a brief summary and potential implications

**Background.** Social Support research shows that providing social support in socio-evaluative stress situations reduces participants' stress responses. This stress-buffer effect of social support, however, does not hold for everybody and some studies even found a stress-amplifying effect of social support. Motive disposition research suggests that social motives (affiliation and power) lead to differential and sometimes even opposing affective, and physiological responses to interpersonal interaction processes. We here integrate both lines of research and hypothesize that participants with strong affiliation motives benefit whereas participants with strong power motives do not benefit from social support in terms of psychobiological responses to a given stressor. Further, participants with strong affiliation and power motives are expected to respond to social support with an arousal of motive-specific affects and reproductive hormone responses (affiliation: progesterone, power: estradiol, testosterone). In addition, we test whether women and men differ in the response to social support and in strengths of social motives.

**Methods.** We aim to collect data of 308 participants (equal number of men and women) recruited at the local university of the authors. Participants' social motives are assessed using a standardized measure in motive research (Picture Story Exercise) administered via a web-survey. In a following laboratory session, the Trier Social Stress designed for groups is used to experimentally induce psychosocial stress. One group of participants receives social support from a confederate of the experimenter whereas the control group does not. Stress responses will be assessed by a modified version of the state anxiety scale of the State – Trait Anxiety Inventory (Spielberger, 1970) and by physiological indicators of stress (cortisol, alpha-amylase gained from saliva samples) at seven points of measurement. Reproductive hormones will be analyzed from four out of these seven saliva samples. Heart rate and heart rate variability will be assessed continuously. We additionally measure participants' performance in the interview (part of TSST) using a self-developed categorization system.

**Discussion.** Our theory-driven integration of social motives in social support research, and the precise analysis of sex differences might disentangle inconsistent findings in TSST- research. The more faceted view on individual differences has direct implications for applied contexts as it provides a framework for tailored conceptualizations of social support programs.

## **Trial registration:**

OSF- Preregistration: Registration DOI 10.17605/OSF.IO/984RW

Citation: Schüler, J., Ditzen, B., & Haufler, A. (2021, July 5). Social support as a stress buffer or stress amplifier: The moderating role of social motives. <https://doi.org/10.17605/OSF.IO/984RW>

## **Administrative Information**

*Trials* guidance: please include this text in your protocol just above the Administrative information table:

Note: the numbers in curly brackets in this protocol refer to SPIRIT checklist item numbers. The order of the items has been modified to group similar items (see <http://www.equator-network.org/reporting-guidelines/spirit-2013-statement-defining-standard-protocol-items-for-clinical-trials/>).

Title (Antonucci & Akiyama)	<p>SPIRIT guidance: Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym.</p> <p>Social support as a stress buffer or stress amplifier:</p> <p>The moderating role of social motives</p>
Trial registration {2a and 2b}.	<p>SPIRIT guidance: Trial identifier and registry name. If not yet registered, name of intended registry.</p> <p>Item 2b is met if the register used for registration collects all items from the World Health Organization Trial Registration Data Set.</p> <p>Since the planned experiment is not a clinical trial, a trial registration is not necessary.</p>
Protocol version {3}	<p>SPIRIT guidance: Date and version identifier.</p>
Funding {4}	<p>SPIRIT guidance: Sources and types of financial, material, and other support.</p> <p>The research is funded by German Research Foundation (Schu 2902/2-1 (22972119))</p>
Author details {5a}	<p>SPIRIT guidance: Affiliations of protocol contributors.</p> <p>Alisa Haufler, University of Konstanz, Constance, Germany</p> <p>Prof. Dr. Beate Ditzen, Institute of Medical Psychology, Heidelberg University Hospital, Heidelberg University, Germany</p> <p>Prof. Dr. Julia Schöler, University of Konstanz, Constance, Germany</p>
Name and contact information for the trial sponsor {5b}	<p>SPIRIT guidance: Name and contact information for the trial sponsor.</p> <p>Prof. Dr. Julia Schöler (Principal Investigator)</p> <p>julia.schöler@uni-konstanz.de</p> <p>Prof. Dr. Beate Ditzen (Co-PI)</p> <p>beate.ditzen@med.uni-heidelberg.de</p>
Role of sponsor {5c}	<p>SPIRIT guidance: Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities.</p> <p>This study is funded by the German Research Foundation. The funders played no role in the design of the study and collection, analysis, interpretation of data, and in writing the manuscript.</p>

## Introduction

### Background and rationale {6a}

SPIRIT guidance: Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention.

## **Stress and Social Support**

There is an extended body of research outlining that stress affects basically every physiological system (McEwen, 2000; Sapolsky et al., 2000) and significantly impairs subjective well-being (Feldman et al., 1999; Pemberton & Tyszkiewicz, 2016). Therefore, it is already mandatory that the WHO anticipates stress-related illness to develop to the second leading cause of disease in the coming decades (World Health Organization, 2001). Hence, it is essential to better understand the complexity of the concept of stress to be able to develop effective interventions. In the last decades a great deal of research has shown that social support, defined as “social interactions or relationships that provide individuals with actual assistance or with a feeling of attachment to a person or group that is perceived as loving or caring” (Hobfoll & Stokes, 1988, p. 499) can improve health (Berkman et al., 2000; Ditzen & Heinrichs, 2014; Pressman & Cohen, 2005; Uchino, 2004). One of the leading explanations for this phenomenon is that social support unfolds a stress-buffering effect (Broadhead et al., 1983; Cohen & Wills, 1985) and can thus counteract the negative consequences of stress. For example, social support leads to lower mortality rates (Brummett et al., 2001; Rutledge et al., 2004), better recovery from surgery (Kulik & Mahler, 1989), and sport injuries (Bianco & Eklund, 2001). Yet, interestingly social support does not work as a stress buffer for everyone (Ditzen & Heinrichs, 2014). We assume that social support is perceived differently by individuals and investigate social motives (affiliation and power motive, Schultheiss, 2008) as moderators. They influence the perception of interpersonal relationships and should therefore also explain responses to social support.

## **Implicit Motives**

Implicit motives are preferences for certain kinds of incentives and disincentives, which modulate reward experiences (Brunstein, 2010; McClelland, 1985; McClelland et al., 1989; Schüler et al., 2015; Schultheiss, 2008). Being relatively stable across time (such as personality traits), they drive, orient, and select behavior for summaries, see Brunstein and Schultheiss (2010). Motive research has focused on the three domains affiliation, power, and achievement motives, of which we consider only the social motives in our study.

Individuals with a strong *affiliation motive (AFF)* derive pleasure from affiliative experiences (Dufner et al., 2015; Schultheiss, 2008). They have the desire for warm and friendly interpersonal relations (French, 1956), aim to feel *socially related*, want to experience reciprocal care and concern for important others (Atkinson et al., 1954; Schultheiss, 2008), and emotionally suffer from discord, rejection, and loneliness (Atkinson et al., 1954; Schultheiss, 2008; Weinberger et al., 2010). Situations in which these needs can be satisfied lead to an affiliation-motive specific affect such as joy, and feeling socially related (for a summary of the affiliation motive see (Hofer & Hagemeyer, 2018).

Individuals with a strong *power motive (POW)* have the desire to have an impact on others and influence others (in socially desirable and undesirable ways) to feel superior to others and gain or maintain reputation and prestige (Schmalt & Heckhausen, 2010; Winter, 1973). Simultaneously they aim to avoid defeat, other's dominance and feelings of inferiority (Fodor, 2010). In brief, they have "the capacity to derive pleasure from having physical, mental, or emotional impact on other individuals or groups of individuals and to experience the impact of others on themselves as aversive" (Schultheiss, 2008, p. 606). The lack of opportunities in which others can be impacted or, even worse, situations signaling one's inferiority function as stressors and lead to power-motive specific affect (e.g. feeling inferior, experiencing limited control) and impaired well-being (Baumann et al., 2005; Hofer & Busch, 2011).

Social motives are also associated with specific hormones (for an overview, see Schultheiss (2013); Schultheiss and Köllner (in press)). Being inferior, for example in a contest situation, has been associated with a decrease in testosterone in men with strong power motives (Stanton & Schultheiss, 2009). For high power-motivated women, motive frustration leads to a decrease in estradiol (Stanton & Schultheiss, 2009). Arousal of the affiliation motive is accompanied by an increase in progesterone, for both sexes (Schultheiss, 2013; Schultheiss et al., 2004; Wirth & Schultheiss, 2006). Furthermore, social motives in relationship with stress have been associated with various parameters of health: blood pressure, immune system (McClelland et al., 1989), medication use and somatic symptoms (Schüler et al., 2009), or job burnout and physical symptoms (Brandstätter et al., 2016). Summing up, previous research has confirmed that affiliation and power motives lead to differential emotional, behavioral, and physiological responses to social cues.

### **Social support and social motives**

Based on the evidence that both, social support and social motives, modulate the stress response, we aim to investigate to what extent the interplay of these two factors can contribute to further enlightenment of the stress-buffer effect. Social support situations are highly ambiguous leaving wide room for interpretation about, for example, one's position in the social context, the intentions of the social support provider, and the quality of the social relationships. By this, they are prototypes of social interaction processes, which are full of incentives or disincentives for the social motives. They can, however, be perceived very differently by individuals with strong affiliation in contrast to power motives and therefore elicit different physiological and psychological responses. Thus, social support might signal a positive and warm relationship for individuals with a strong affiliation motive, but trigger feelings of weakness and inferiority in individuals with a strong power motive. In sum, we assume that social motives influence the perception of social support provided by others and functions as a stress -buffer for affiliation motivated individuals, and as a stress amplifier for power motivated people.

### **Social support, sex and gender**

Other moderators that are discussed to influence participants' response to social support are sex and gender (Ditzen & Heinrichs, 2014; Ditzen et al., 2007; Kirschbaum et al., 1995). Women benefit stronger in terms of well-being from being socially-supported than men (Antonucci & Akiyama, 1987; Jackson, 2006),

even though some studies found opposite effects (Knoll & Schwarzer, 2002). Thus, in the social support literature the resulting pattern about concerning sex differences is still inconsistent.

Sex differences have also been found in social motive research. Since the arousal of the affiliation and power motive in a specific situation is accompanied by the release of female reproductive hormones (estradiol, progesterone) and male reproductive hormone (testosterone), it is assumed, that this sex specificity should also be reflected in corresponding motive differences. Women are expected to show higher scores in affiliation motives, and men are assumed to have higher power motives. This was clearly empirically supported for the affiliation motive (Denzinger et al., 2016; Drescher & Schultheiss, 2016), whereas for the power motive the result pattern is less clear (Denzinger et al., 2016; Pang & Schultheiss, 2005). We assume that these motives are assumed to correlate with a concept on a broader level of abstraction, that is gender role self-concepts (GRSC; Athenstaedt, 2003). The individual GRSC is defined as describing oneself with agentic traits like *confident* or *assertive* (masculine GRSC) vs. with communal traits like *empathic* or *cooperative* (feminine GRSC). We assume that the inconsistent findings reported above may be due to shared variance between sex, GRSC and motives. We aim to identify the specific influences of sex, GRSC, and social motives on stress-response to social support by considering them simultaneously and disentangling them in our statistical analyses.

## Planned Research

The main objective of the present study is to test whether social motives and participants' sex moderate the effects of social support in stressful situations. We use the Trier Social Stress Test for groups (Von Dawans et al., 2011) that is based on the TSST (Kirschbaum et al., 1993), which is an established stress-induction paradigm triggering strong psychobiological stress responses (Dickerson & Kemeny, 2004). Schultheiss et al. (2014) found that the TSST elicited differently strong cortisol responses for individuals with weak and strong implicit achievement motives which supports our assumption that the TSST might be a potentially suitable paradigm that reveals motive differences. Wiemers et al. (2015) concluded from their study that the TSST has a specific arousal effect for the implicit power motive.

We vary from the classic TSST approach in the following points. While TSST studies usually focus on the detection of the stress hormone cortisol (Goodman et al., 2017; Liu et al., 2017), we add the analysis of reproductive hormones (progesterone, estradiol, testosterone), which allow us to examine the arousal of motives in the social support situations. We will further extend the TSST paradigm by analyzing participant's responses in the interview (part of TSST) to gain an indicator for speech performance. Whereas in the classical TSST paradigm it is only announced that the speech will be recorded (as an additional stressor), we here will actually record the speeches and apply a simple evaluation system to assess speech performance as a variable that we assume to depend on stress.

Except for these variations, we adhere to the procedure of the TSST- G (Von Dawans et al., 2011). As in previous studies analyzing social support (Ditzen et al., 2007; Kirschbaum et al., 1995; Robles, 2007), the experimental group will receive social support during the TSST preparation phase. The control group will

be also exposed to stress but receives no social support. To test the hypotheses (see below), self-reports (well-being, perceived stress, and motive-specific affect), and biological parameters (heart rate, heart rate variability, cortisol, reproductive hormones) will be collected as displayed in Figure 1.

## Objectives

SPIRIT guidance: Specific objectives or hypotheses.

We test the following hypotheses to investigate the role of social motives in the social support and stress relationship:

**Hypothesis 1: Effect of Stress Induction:** Participants in both groups (social support vs. no social support) showed an increase in stress responses, comparable to previous studies. We expect a rise of the physiological parameter cortisol by at least 1.5 nmol/ml (Miller criterion, Miller et al., 2013).

**Hypothesis 2: Social Support x Social Motive:** The affiliation motive moderates the effects of social support on stress responses. The higher participants' affiliation motive, the more they benefit from social support, i.e. they will express lower psychobiological stress responses (better self-reported well-being, less perceived stress, lower heart rate, higher HRV, lower levels of cortisol, and alpha-amylase). Whereas the affiliation motive is expected to function as a stress-buffer, the power motive is assumed to function as a stress-amplifier. The higher participants' power motive, the more they are negatively impacted by social support, i.e. g. they will report lower well-being, more perceived stress, higher heart rate, lower HRV, higher levels of cortisol and alpha amylase).

**Hypothesis 3: Motive-Specific Arousal Hypotheses:** Participants with strong affiliation and power motives, respectively, respond to social support with arousal of *self-reported motive-specific affect* (i.e., affiliation: joy, feeling socially related; power: feeling weak and inferior) and with an increase of motive-specific reproductive hormone responses (affiliation: progesterone, power: estradiol, testosterone).

**Hypothesis 4: Sex Difference Hypotheses:** Women and men are hypothesized to differ in their social motives, with higher affiliation and lower power motives in women than in men. Women and men will specifically respond to social support with relative increases in estradiol and progesterone in women and testosterone in men.

**Hypothesis 5: Speech Performance Hypotheses:**

Participants who receive social support show better presentation performance in TSST interviews than participants in the no-social support group. This relationship is moderated by social motives. Participants in the social support group perform better when affiliation motive is high and perform worse when power motive is high.

**Exploratory Hypothesis: Gender Role Self-Concepts**

On an exploratory level, we plan to investigate the association of self-reported gender role self-concepts with social motives and their moderating role on whether individuals with either sex benefit from social support or not.

### **Trial design {8}**

SPIRIT guidance: Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory).

The study is based on a mixed within- and between subject design. The within subject factors are participants stress responses (self-reports, biological markers) across the steps of the TSST procedure (see Figure 1). The between subject factors are experimental groups (social support vs. no social support), social motives, and participants' sex. Gender role self-concepts, as well as other control variables will be assessed as controls and entered as covariates into the analysis models. Allocation will be based on a 1:1 ratio. There will be no cross-over into the experimental group.

## **Methods: Participants, Interventions And Outcomes**

### **Study setting {9}**

SPIRIT guidance: Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained.

The study will be conducted in the laboratory of sports psychology of the Department of Sports Science at the University of Konstanz, Germany. The analyses of hormones, and alpha amylase will be performed in the biochemical laboratory of the Institute for Medical Psychology in Heidelberg, Germany.

### **Eligibility criteria {10}**

SPIRIT guidance: Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists).

#### **Primary inclusion criteria**

The following criteria must be fulfilled to participate in the study:

- The participants have given informed consent to all aspects of the study (agreement with video recording, hormone collection).
- The participants must be at least 18 years old and speak German as their native language.

#### **Primary exclusion criteria**

If the participant meets the following criteria, they will be excluded from study participation:

Previous participation in stress experiments as well as psychology and sports students from the 5th semester.

Physical or mental illness, nicotine consumption, drug use, a body mass index (BMI) of 30 or more, and any regular use of medication (including hormonal contraception) lead to exclusion from the experiment, as they are factors that could influence the physiological stress response (Foley & Kirschbaum, 2010).

### **Who will take informed consent? {26a}**

SPIRIT guidance: Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32).

The participants will receive the study information sheet and give their informed consent in the screening online survey (for more details see Appendix B.1) before the lab session. If they fulfill the inclusion criteria, they will be invited to the lab session. Here the participants will again read the study information sheet and sign the informed consent (for more details see Appendix C.1 and C.2).

### **Additional consent provisions for collection and use of participant data and biological specimens {26b}**

SPIRIT guidance: Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable.

Participants data and biological specimens will only be interpreted in ancillary studies, following the participants' informed consent.

## **Interventions**

### **Explanation for the choice of comparators {6b}**

SPIRIT guidance: Explanation for choice of comparators.

Since stress research has already clearly shown that the TSST reliably induces stress (Kirschbaum et al., 1993), we refrain from comparing a stressed vs. non-stressed group. Instead, we focus on the role of social support by comparing a socially supported group of subjects with a non-socially supported group. At the same time, we analyse the moderating role of social motives, which we capture as continuous variables.

### **Intervention description {11a}**

SPIRIT guidance: Interventions for each group with sufficient detail to allow replication, including how and when they will be administered.

### **Web-survey prior to the lab session**

The participants complete an online questionnaire (Limesurvey) at home. Here, the eligibility criteria are checked, the implicit motives are assessed by using a Picture Story Exercise (Schultheiss & Pang,

2007) and gender role self-concepts (Zimmermann et al., 2011), as well as other control variables will be measured. The exercise and sports activity questionnaire (Fuchs et al., 2015) will be administered to test a related but different research question (for more details see appendix B.3). Participants, who are eligible for the study will be invited to the laboratory session via e-mail. Participants confirmed their agreement that they will be contacted by e-mail and learn that e-mail addresses will be deleted after having made the appointment.

## **Lab session**

Figure 1 shows the schematic procedure of data collection. It starts with a *general preparation phase*, where the baseline measurement of the physiological parameters (hormones), the control variables, and psychological variables (self-reports about well-being, stress-experience and motive-specific affect) takes place. In the *preparation phase for the TSST-G*, the participants prepare for the task. The participants in the experimental group receive social support during this phase, while the participants in the control group do not receive any social support. Finally, there will be a 45-minute period of rest during which repeated physiological as well as the psychological questionnaires will be taken. A detailed procedure can be found in the study protocol (see Appendix A).

## **General preparation phase**

In each lab session, three participants will arrive between 5:00 and 5:15 pm outside the laboratory and will be led individually to their own preparation room (so that they cannot contact each other). First, they will be asked to read the study information sheet again and then will provide their written consent (for details see Appendix C.1 and C.2). Afterwards, the participants will generate their participant code via paper and pencil format, which ensures that the saliva samples, as well as other collected data, can be stored anonymously. Then they complete a short day-screening questionnaire, (see Appendix D) on the computer which will assess control variables (a. o., sports, medication intake, smoking, caffeine- and alcohol consumption). Afterward they will be asked to wear the pulse belt which contains a Polar H10 sensor (Polar Electro UK Ltd., Warwick, UK). To put on the belt, the experimenter leaves the room. After that, the participants will provide an initial saliva sample at measurement time T0(-11min) and will complete the first test battery including different questionnaires on the computer (hereafter: psychological questionnaire).

## **Preparation phase TSST-G without social support.**

For the preparation phase, each participant sits in a separate room. Here they receive the written instructions for the upcoming interview (see Appendix E). After they have had 10 minutes of preparation time for this task, they give a saliva sample (T1, 0min) and complete the psychological questionnaire again. Subsequently the participants are individually led to their places in front of the panel.

## **Preparation phase TSST-G with social support.**

The preparation phase is identical with the described scenario for the participants without social support, with the exception that the experimenter introduces a female confederate as a student assistant that can assist the participant if he or she needed. The female confederate provides passive social support for the first five minutes, ostensibly working on the computer. In the second five minutes of the preparation phase, the confederate gives active social support and also notes the reactions of the participants (for a detailed procedure, see Appendix F). At the end of the 10-minute preparation period, the confederate asks the participant for a saliva sample (T1, 0min) and to complete the psychological questionnaire again. Then rooms are changed. All other instructions are the same as in the group without social support.

## **TSST -G**

Our procedure is based on the TSST-G developed by Von Dawans et al. (2011). Each participant is required to present his or her interview individually in front of the panel for three minutes at a time. During this time, they are interrupted in a standardized manner by the panel (for more details see Appendix G). After that, they give a saliva sample (T2, +12min) and complete the psychological questionnaire. In the following, each participant has to perform the arithmetic task three times for 30 seconds. When this task is finished, they give another saliva sample (T3, +20min). During this whole procedure, the participants are recorded with a microphone and a camera. The experimenter then leads the participants individually from the TSST-G test room to the respective preparation rooms. There they again fill in the psychological questionnaire.

## **Rest-phase**

During the rest period, three additional saliva samples are collected (T4,+30min; T5, +45min; T6, +65min). Participants who have received social support will complete a social support scale at T6(+65min) (see Appendix H).

## **Debriefing.**

Finally, the experimenter leads all subjects to the TSST-G testing room and provides a debriefing about the aim of the study (see Appendix I). Questions are answered as needed. The participants receive their payment and are dismissed.

## **Criteria for discontinuing or modifying allocated interventions {11b}**

SPIRIT guidance: Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease).

Participants can discontinue the study at any time without giving any reason. They will still receive their payment.

## **Strategies to improve adherence to interventions {11c}**

SPIRIT guidance: Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests).

The entire study takes place under controlled laboratory conditions and adherence with the study protocol is closely monitored.

### **Relevant concomitant care permitted or prohibited during the trial {11d}**

SPIRIT guidance: Relevant concomitant care and interventions that are permitted or prohibited during the trial.

Study participants will be screened for medication, caffeine intake, smoking, sports and heavy meals prior to the experiment. Chronic illness and medication intake are defined as exclusion criteria for the study.

### **Provisions for post-trial care {30}**

SPIRIT guidance: Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation.

The TSST has not been linked to any adverse consequences, so no harm from trial participation is expected. At the end of the study, a detailed debriefing takes place, the experimenter inquires about the subjects' condition and is available for questions.

### **Outcomes {12}**

SPIRIT guidance: Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended.

### **Manipulation check social support**

To check whether social support was received as such by the participants, a modified version of the received support subscale of the Berlin Social Support Scale (BSSS; Schulz & Schwarzer, 2003) will be used (see Appendix H, T6(+65min)). Item wording was adapted to the study context. Two items from the original scale were deleted because they refer to instrumental support, and the social support in this study rather refers to emotional and informal social support. The item "This student assistant was there for me when I needed her" is also counted as instrumental support according to Schulz and Schwarzer (2003), but it can also be understood as emotional support and therefore remains included. Items are rated on a 4-point Likert scale ranging from 1 (not true) to 4 (exactly true). The original version of the received support scale has good internal consistency ( $\alpha = .83$ ). In addition, participants will be asked directly whether they received support from the student assistant and whether they found this support helpful.

## Test battery of psychological questionnaires

Participants are asked to complete the psychological questionnaire a total of 7 times (see Figure 1).

*Well-being* will be captured via 6 items (short version A) from the Multidimensional Well-being questionnaire (MDBF; Steyer et al., 1997). The items start with "Right now I feel..." and will be continued with one of the following adjectives: good, bad, alertness, fatigue, relaxed, and restlessness. The participants will be able to rate them on a 5-level scale which will be labelled from *not at all* to *very*. A slightly modified version of the trait anxiety scale of the State - Trait Anxiety Inventory (Spielberger, 1970) will be used to assess the *momentary anxiety* of the participants. A total of 6 adapted items are included, which can be answered on a 5-point scale, "How big do you think your fear is at the moment?", "How much do you feel physically uncomfortable right now?", "How strong is your need to leave the situation?", "How tense is your feeling right now?", "How much are you in control of the situation?", "How stressed do you feel? ". Per our knowledge, no standardized *motive-specific affect* questionnaire exists so far. We therefore created an adjective list which is theoretically derived from McClelland's (1985) early work and added adjectives that have been used in more recent research (Job et al., 2012) (see self-determination theory, Ryan & Deci, 2000). Participants indicated for 7 items how they feel right now by using a 7-point response scale (1: *not at all* to 7: *very much*). The items are "socially-related", "calm" (affiliation motive specific affect) (the item "relaxed" from the MDBF questionnaire will also be used in the analysis for the affiliation motive), "strong", "excited", "enthusiastic" (power motive), and "competent" and "self-determined" as additional items representing achievement and autonomy motive-specific affect, respectively (see appendix J). Construct validity of this motive-specific affect scale will be checked.

## Social Motives

Implicit social motives are measured using the Picture Story Exercise (Schultheiss & Pang, 2007) which is the most frequently used measure to assess implicit motives. Key validity criteria are met, interrater reliability is good, and retest reliability is satisfactory (Schultheiss & Köllner, in press; Schultheiss & Pang, 2007); for further discussion see (Schüler et al., 2015). The PSE will be part of the online questionnaire prior to the lab session (for validity of computer version of PSE, Bernecker & Job, 2011). Participants will be instructed that they will see six different pictures and for each of them, they should write a fictional story with a beginning, middle, and end. The pictures will be presented for 15 sec and then a text box will appear, where they can type their story. Questions that help participants to organize their stories will be presented above the pictures (e.g, "What is happening right now? Who are the characters?). For each story, the participants will have four minutes. After 3 min 30 sec, a small reminder will appear asking them to finish the story. After the four minutes have elapsed, the next picture will appear. The six pictures couple by the river, nightclub scene, sorrow, beachcombers, NewPic32, NewPic9 will be presented, for more details see appendix B.3. As recommended (Schultheiss & Pang, 2007), two experienced coders will score the stories for the power and affiliation motive according to Winter's scoring manual (Winter, 1994) (Interrater reliability is expected to be between ICC = .80-.90). Disagreements between coders will

be resolved by discussion (Schultheiss & Pang, 2007). Motive scores will be corrected by word count. For further details about test administration and scoring procedure see Schultheiss & Pang (2007).

All participants will complete a short German version of the Bem Sex Role Inventory, to screen for GRSC (Zimmermann et al., 2011).

## **Physiological measures**

### **Endocrine measurements**

Saliva samples will be collected for the recording of cortisol, alpha amylase and reproductive hormones. Approximately 10ml of saliva will be dispensed through a straw into Salicaps (IBL International, Hamburg, Germany) (see Appendix K for instructions). After the study, all saliva samples will be frozen and stored at -20°C. Hormone and enzyme levels will be analysed at the stress biomarkers lab at the Institute of Medical Psychology, Heidelberg University Hospital.

#### **Salivary cortisol**

The concentration of cortisol in saliva will be recorded in ng/ml. Seven saliva samples will be collected using Salicaps (IBL International, Hamburg, Germany) at measurement time points T0(-11min before TSST-G), T1(TSST-G onset), T2(after job interview), T3(after arithmetic task), at T4, T5, and T6 during resting phase (+30min, +45min, +65min after TSST-G onset). Cortisol will be determined with the Cortisol free in Saliva Elisa assay from Demeditec.

#### **Alpha-amylase**

Alpha-amylase is recorded in U/mL. The concentration is derived from the same seven saliva samples as used for the cortisol analysis and will be determined by a kinetic colorimetric test. The reagents for this will be obtained from DiaSys Diagnostic Systems (Holzheim, Germany).

#### **Reproductive hormones**

Reproductive hormones (testosterone, estradiol, and progesterone) will be recorded in pg/ml. Four saliva samples will be collected using Salicaps (IBL International, Hamburg, Germany) at the measurement time points T0(-11min before TSST-G), T1(TSST-G onset), T3(after the arithmetic task), and T6 during rest (+65min after TSST-G onset). Hormone concentrations will be determined by biochemical analysis in the laboratory. The following kits from IBL will be used for analysis: Testosterone Luminescence Immunoassay, 17 beta - Estradiol Saliva Luminescence Immunoassay, Progesterone Luminescence Immunoassay.

#### **ANS measurements**

Heart rate and heart rate variability will be measured with a Polar H10 sensor (Polar Electro UK Ltd., Warwick, UK). The sensor is placed in a pulse belt that the participants will wear around their chest. With

the help of a Polar station and an iPad, the participants' data is transmitted wirelessly and in real time.

## **Speech performance**

The participants will be videotaped while they complete the tasks (interview and arithmetic task) in front of the panel. The video sequences showing the recording of the interview will be coded for speech performance using a self-developed coding system. This system includes three quality criteria: the information content, the presentation style, and the perceived competence of the participants. The assessment of the information content is based on a checklist for the evaluation of a presentation according to Ascheron (2019). The content is scored on the following 5 items, "structure/ organization", "comprehensibility of content", "flow", "information content" and "message". These items will be rated on a scale that ranges from 1 (*very good*) to 6 (*unsatisfactory*). A modified questionnaire of Ascheron (2019) will be used to evaluate the presentation style. Two items (intonation, English quality) were left out because intonation overlaps with another item (emphasis), and English quality is irrelevant because the study will be conducted in German. The presentation style is rated on the basis of the following 5 items: "speed", "intelligibility", " emphasis ", "body language" and "eye contact", whereby we added the latter item to complement the construct in more detail. The items will be scored using a six-point scale (1: *very good* to 6: *unsatisfactory*). Since there is no suitable measurement tool for the assessment of perceived competence in the literature, we determined 5 items that should enable a differentiated evaluation of this construct. The following items will be also scored on a six-point scale: "technical language/vocabulary", "use of filler words", "use of everyday language", "interest" and "persuasiveness". Construct validity of this competence scale will be checked.

## **Participant timeline {13}**

SPIRIT guidance: Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see figure at <http://www.spirit-statement.org/publications-downloads/>).

The timeline for participants is displayed in Figure 1.

## **Sample size {14}**

SPIRIT guidance: Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations.

It is intended to recruit 154 participants (77 women). This sample size was calculated using a power analysis *G\*Power 3.1* (Faul et al., 2009), with an additional 20% added to compensate for possible drop-outs.

## **Recruitment {15}**

SPIRIT guidance: Strategies for achieving adequate participant enrolment to reach target sample size.

The recruitment will be done by flyer distribution in the University of Konstanz, as well as an entry in an online platform where experiments are offered by the departments of psychology and linguistics.

### **Assignment of interventions: allocation**

#### **Sequence generation {16a}**

SPIRIT guidance: Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions.

Participants will be randomly assigned into the social-support or no-social support group, based on their arrival time in front of the laboratory.

#### **Concealment mechanism {16b}**

SPIRIT guidance: Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned.

The participants do not have any information in which group they will be assigned to, nor do they know that the other participants may be undergoing a different form of the experiment.

#### **Implementation {16c}**

SPIRIT guidance: Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions.

Depending on the order in which the participants arrive before the laboratory, they may or may not receive social support.

### **Assignment of interventions: Blinding**

#### **Who will be blinded {17a}**

SPIRIT guidance: Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, **data** analysts), and how.

The participants will be blind to the condition, until the end of the experiment. The advertisement for the study states that we are investigating the relationship between verbal creativity and physiological reactions (for the exact wording of the cover story see appendix B.1). The experimenter, as well as the confederate, know who will be in which condition. The TSST- panel will not know who is in which condition. The coders of the motive measure are also condition blind.

## **Procedure for unblinding if needed {17b}**

SPIRIT guidance: If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial.

The participants will be debriefed about the aims, as well as the group assignments in the study (for more details, see appendix I).

## **Data collection and management**

### **Plans for assessment and collection of outcomes {18a}**

SPIRIT guidance: Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol.

In the section "Outcomes 12b" the measures for psychological and physiological parameters are explained in detail.

### **Plans to promote participant retention and complete follow-up {18b}**

SPIRIT guidance: Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols.

Participants will receive 30 Euro payment at the end of the lab session independently of whether or when participants decide to discontinue the study. To promote participant adherence with the appointment and study protocol, they will receive a reminder e-mail after having filled in the web-survey and one day before their lab appointment.

### **Data management {19}**

SPIRIT guidance: Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol.

The questionnaire data will be downloaded from Limesurvey and stored on the university server. The psychological questionnaire from T2, which were collected by paper and pencil format, as well as heart rate, and heart rate variability will be stored in an excel table by the study experimenter directly after the study. The video file will also be saved directly after the experiment, on a laptop of the sport psychology lab and a back-up server. The saliva samples will be sent to the biochemical laboratory of the Institute for Medical Psychology in Heidelberg, Germany. To guarantee the accuracy of the analyses, 10% of the

cortisol samples, as well as 20% of the samples for the reproductive hormones will be double-determined. The signed consent forms of the participants will be collected in a folder laboratory of the sports psychology department in Konstanz. Only the experimenter will have access to the data, which will be stored for 10 years on a server of the University.

### **Confidentiality {27}**

SPIRIT guidance: How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial.

The participants will generate their own code that allows to merge the data of the web surveys with the data gained in the laboratory.

### **Plans for collection, laboratory evaluation and storage of biological specimens for genetic or molecular analysis in this trial/future use {33}**

SPIRIT guidance: Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable.

Saliva samples will be stored at the biochemical lab at Heidelberg University Hospital for at least two years after completion of the study and will then be discarded.

### **Statistical methods**

#### **Statistical methods for primary and secondary outcomes {20a}**

SPIRIT guidance: Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol.

Statistical analysis will be performed using the freely available software R-Studio (current version: R version 4.0.2; (Team, 2017)) for statistical analysis and graphs. We will use a nested random effect regression as a multi-level regression approach that allows the intercept to vary with participants to account for the fact that the dependent variables are assessed multiple times. The regression model will be built by sequentially adding predictors after an intercept-only model and its random intercept (random = 1 | ID) has been specified. Every newly added predictor (social support condition, social motive, sex), or interaction-term (condition x social motive, condition x sex, social motive x sex and condition x social motive x sex) is stored as a separate regression model in R-studio to allow for a final comparison of all stages of model-specification. All predictors are kept in a regression model when a further predictor or interaction-term was added to that model. Main and interaction effect models were compared using ANOVAS.

#### **Interim analyses {21b}**

SPIRIT guidance: Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial.

No interim analyses or stopping guidelines are planned.

### **Methods for additional analyses (e.g. subgroup analyses) {20b}**

SPIRIT guidance: Methods for any additional analyses (eg, subgroup and adjusted analyses).

There are exploratory analyses planned on the association of self-reported gender role self-concepts with social motives and their moderating role on psychobiological responses to social support.

### **Methods in analysis to handle protocol non-adherence and any statistical methods to handle missing data {20c}**

SPIRIT guidance: Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation).

Only data from individuals who have fully completed the TSST protocol will be included in the final analyses. Missing data are completed by multiple imputation.

### **Plans to give access to the full protocol, participant level-data and statistical code {31c}**

SPIRIT guidance: Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code.

Study protocol, data and statistical codes will be published on Open Science Framework (OSF).

We will guarantee that the data are still accessible after they will be published by choosing publishing houses that support an open data policy. Furthermore, we will inform researchers about the openness of our data (e.g., state repositories in publications, aim to publish in journals that use badges for open data), and explicitly invite members of our specific scientific disciplines to reuse the data (i.e., in collaborations, at conferences, in talks, and poster presentations).

### **Oversight and monitoring**

#### **Composition of the coordinating centre and trial steering committee {5d}**

Trials guidance: Provide information on the composition, roles and responsibilities of the coordinating centre and trial steering committee and all groups providing day to day support for the trial. There will always be a group running the trial day-to-day and providing organisational support and knowing how often they will meet, plus information on other committees providing oversight such as a Trial Steering Committee, and how often they will meet over the course of the trial, is what we need for item 5d. We do not need names of staff.

SPIRIT guidance: Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee).

This study is a collaboration project between principal investigator of the University of Konstanz, Constance, and the co-PI at the Institute for Medical Psychology in Heidelberg, Germany. Day to day support for the study will be provided by two principle investigators, who hold responsibility for the study execution, a study coordinator and 4 assistants who participate in data collection (e.g., social supporter, experimenter, plenary members in TSST). The whole team will meet once a week. There is no stakeholder or public involvement group.

### **Composition of the data monitoring committee, its role and reporting structure {21a}**

SPIRIT guidance: Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed.

There will be no data monitoring committee (DMC), as our participants will not undergo any unproven intervention. Therefore, there will be no safety concerns for our participants and thus no committee is needed for this study.

### **Adverse event reporting and harms {22}**

SPIRIT guidance: Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct.

No adverse side effects have been reported with the TSST protocol.

### **Frequency and plans for auditing trial conduct {23}**

SPIRIT guidance: Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor.

Not applicable.

### **Plans for communicating important protocol amendments to relevant parties (e.g. trial participants, ethical committees) {25}**

SPIRIT guidance: Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators).

Protocol amendments will be routinely reported to the ethics committee.

## **Dissemination plans {31a}**

SPIRIT guidance: Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions.

The results of the study will be submitted for publication in peer-reviewed scientific journals.

## **Discussion**

*Trials* guidance: This should include a discussion of any practical or operational issues involved in performing the study and any issues not covered in other sections.

### **COVID-10 regulations (if necessary)**

- The research team will be tested with Corona rapid tests before each data collection.
- Participants will only be included upon negative Corona testing within 24hrs before the lab-session, or if there is complete vaccination protection.
- The rooms in which the experiment takes place will be sufficiently vented before the arrival of the participants.
- The participants, the experimenter, the social support provider and the panel will wear medical masks.
- The materials that the participants will touch during the experiment will be cleaned with sanitizer beforehand.
- After the test, all surfaces will be disinfected, and the rooms will be aired again. The minimum distance of 1.5 will be maintained at all times.
- The participants will be advised in the reminder e-mail for their lab session to appear only if they do not show cold symptoms and have not had contact with an infected Covid person.

Since data collection could last several months, we might have to adjust these regulations as necessary.

### **Trial status**

*Trials* guidance: Authors should report the protocol version number and date, the date recruitment began, and the approximate date when recruitment will be completed.

Data collection is scheduled to begin in July 2021. The protocol is the version of the July, 5, 2021. The data collection should take place until spring 2022.

## **Abbreviations**

*Trials* guidance: If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

AFF	Affiliation motive
ANS	Autonomic Nervous System
BMI	Body Mass Index
BSSS	Berlin Social Support Scale
GRSC	Gender Role Self-Concepts
HRV	Heart Rate Variability
ICC	Intraclass Correlation Coefficient
MDBF	Multidimensional Well-Being Questionnaire
POW	Power motive
PSE	Picture Story Exercise
TSST	Trier Social Stress Test
TSST – G	Trier Social Stress Test for Groups
WHO	World Health Organization

## Declarations

*Trials* guidance: All manuscripts must contain the following subheadings:

- Acknowledgements
- Authors' contributions
- Funding
- Availability of data and material
- Ethics approval and consent to participate
- Consent for publication
- Competing interests
- Authors' information (optional)

## Acknowledgements

*Trials* guidance: Please acknowledge anyone who contributed towards the article who does not meet the criteria for authorship including anyone who provided professional writing services or materials. Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements section. See our [editorial policies](#) for a full explanation of acknowledgements and authorship criteria. If you do not have anyone to acknowledge, please write "Not applicable" in this section.

Group authorship (for manuscripts involving a collaboration group): if you would like the names of the individual members of a collaboration Group to be searchable through their individual PubMed records, please ensure that the title of the collaboration Group is included on the title page and in the submission system and also include collaborating author names as the last paragraph of the "Acknowledgements" section. Please add authors in the format First Name, Middle initial(s) (optional), Last Name. You can add institution or country information for each author if you wish, but this should be consistent across all authors. Please note that individual names may not be present in the PubMed record at the time a published article is initially included in PubMed as it takes PubMed additional time to code this information.

## Acknowledgements

We thank Tatjana Stauss and Milena Müller for their assistance in reflecting the anticipated process of data collection critically.

## Authors' contributions {31b}

SPIRIT guidance: [31b] - Authorship eligibility guidelines and any intended use of professional writers.

*Trials* guidance: The individual contributions of authors to the manuscript should be specified in this section. Guidance and criteria for authorship can be found in our [editorial policies](#). Please use initials to refer to each author's contribution in this section, for example: "AB is the Chief Investigator; she conceived the study, led the proposal and protocol development. CD contributed to study design and to development of the proposal. EF was the lead trial methodologist. All authors read and approved the final manuscript."

JS and BD are the principal investigators; they designed the study, supervised the proposal and protocol development. AH contributed to study design and wrote the first draft of the proposal. All authors read and approved the final manuscript.

## Funding {4}

SPIRIT guidance: Sources and types of financial, material, and other support.

*Trials* guidance: All sources of funding for the research reported should be declared. You will be required to include a copy of the original funding document and an English translation of this document as an additional file on submission, which will be checked against this declaration. The role of the funding body

in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript should be declared.

This project is funded by the German Research Foundation (SCHU-2902/2-1).

### **Availability of data and materials {29}**

SPIRIT guidance: Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators.

*Trials* guidance: Please do not include any baseline or pilot data in your study protocol. The Editorial Office will ask you to remove this if it is included. Please declare here who will have access to the final trial dataset and disclose contractual agreements that limit such access for investigators.

The principle investigators will have access to the final trial dataset. Furthermore, it will be made accessible as described above.

### **Ethics approval and consent to participate {24}**

SPIRIT guidance: Plans for seeking research ethics committee/institutional review board (REC/IRB) approval.

*Trials* guidance: Trials do not consider study protocols for studies without ethical approval. You will be required to provide a copy of the original ethical approval document and an English translation of this document as an additional file on submission, which will be checked against this declaration. The name of the ethics committee that approved the study and the committee's reference number (if applicable) should be declared. Details of authors' intentions to obtain consent to participate in the study from participants (or their parent or legal guardian in the case of children under 16) should be declared. "eg. ABC Ethical Review Board ABC123456. Written, informed consent to participate will be obtained from all participants"

The authors received approval from the ethics committee of the University of Konstanz (35/2018).

### **Consent for publication {32}**

SPIRIT guidance: Model consent form and other related documentation given to participants and authorised surrogates.

*Trials* guidance: Please do not include any baseline or pilot data in your study protocol. The Editorial Office will ask you to remove this if it is included. If you have included any details, images or videos relating to an individual person, written informed consent for the publication of these details must be obtained from that person (or their parent or legal guardian in the case of children under 18) and declared in this section. Please also state whether you will be willing to provide a model consent form on request. If this section does not apply, please state "Not applicable".

Not applicable

## Competing interests {28}

SPIRIT guidance: Financial and other competing interests for principal investigators for the overall trial and each study site.

*Trials* guidance: All financial and non-financial competing interests must be declared in this section. See our [editorial policies](#) for a full explanation of competing interests. If you are unsure whether you or any of your co-authors have a competing interest please contact the editorial office. Please use the authors initials to refer to each authors' competing interests in this section. If you do not have any competing interests, please state: "The authors declare that they have no competing interests" in this section.

The authors declare that they have no competing interests.

## Authors' information (optional)

*Trials* guidance: This section is optional.

You may choose to use this section to include any relevant information about the author(s) that may aid the reader's interpretation of the article, and understand the standpoint of the author(s). This may include details about the authors' qualifications, current positions they hold at institutions or societies, or any other relevant background information. Please refer to authors using their initials. Note this section should not be used to describe any competing interests.

## References

*Trials* guidance: Examples of the Vancouver reference style are shown below.

See our editorial policies for author guidance on good citation practice

**Web links and URLs:** All web links and URLs, including links to the authors' own websites, should be given a reference number and included in the reference list rather than within the text of the manuscript. They should be provided in full, including both the title of the site and the URL, as well as the date the site was accessed, in the following format: The Mouse Tumor Biology Database. <http://tumor.informatics.jax.org/mtbwi/index.do>. Accessed 20 May 2013. If an author or group of authors can clearly be associated with a web link, such as for weblogs, then they should be included in the reference.

### Example reference style:

*Article within a journal*

Smith JJ. The world of science. *Am J Sci*. 1999;36:234-5.

*Article within a journal (no page numbers)*

Rohrmann S, Overvad K, Bueno-de-Mesquita HB, Jakobsen MU, Egeberg R, Tjønneland A, et al. Meat consumption and mortality - results from the European Prospective Investigation into Cancer and Nutrition. *BMC Medicine*. 2013;11:63.

*Article within a journal by DOI*

Slifka MK, Whitton JL. Clinical implications of dysregulated cytokine production. *Dig J Mol Med*. 2000; doi:10.1007/s801090000086.

*Article within a journal supplement*

Frumin AM, Nussbaum J, Esposito M. Functional asplenia: demonstration of splenic activity by bone marrow scan. *Blood* 1979;59 Suppl 1:26-32.

*Book chapter, or an article within a book*

Wyllie AH, Kerr JFR, Currie AR. Cell death: the significance of apoptosis. In: Bourne GH, Danielli JF, Jeon KW, editors. *International review of cytology*. London: Academic; 1980. p. 251-306.

*OnlineFirst chapter in a series (without a volume designation but with a DOI)*

Saito Y, Hyuga H. Rate equation approaches to amplification of enantiomeric excess and chiral symmetry breaking. *Top Curr Chem*. 2007. doi:10.1007/128\_2006\_108.

*Complete book, authored*

Blenkinsopp A, Paxton P. *Symptoms in the pharmacy: a guide to the management of common illness*. 3rd ed. Oxford: Blackwell Science; 1998.

*Online document*

Doe J. Title of subordinate document. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. 1999. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Accessed 15 Jan 1999.

*Online database*

Healthwise Knowledgebase. *US Pharmacopeia*, Rockville. 1998. <http://www.healthwise.org>. Accessed 21 Sept 1998.

*Supplementary material/private homepage*

Doe J. Title of supplementary material. 2000. <http://www.privatehomepage.com>. Accessed 22 Feb 2000.

*University site*

Doe, J: Title of preprint. <http://www.uni-heidelberg.de/mydata.html> (1999). Accessed 25 Dec 1999.

### FTP site

Doe, J: Trivial HTTP, RFC2169. <ftp://ftp.isi.edu/in-notes/rfc2169.txt> (1999). Accessed 12 Nov 1999.

### Organization site

ISSN International Centre: The ISSN register. <http://www.issn.org> (2006). Accessed 20 Feb 2007.

### Dataset with persistent identifier

Zheng L-Y, Guo X-S, He B, Sun L-J, Peng Y, Dong S-S, et al. Genome data from sweet and grain sorghum (*Sorghum bicolor*). GigaScience Database. 2011. <http://dx.doi.org/10.5524/100012>.

1. Antonucci, T. C., & Akiyama, H. (1987). An examination of sex differences in social support among older men and women. *Sex roles, 17*(11), 737-749. <https://doi.org/10.1007/bf00287685>
2. Ascheron, C. (2019). *Wissenschaftliches Publizieren und Präsentieren: Ein Praxisleitfaden mit Hinweisen zur Promotion und Karriereplanung* [Scientific Publishing and Presentation: A practical guide with advice on doctoral studies and career planning.]. Springer. <https://doi.org/10.1007/978-3-662-58053-0>
3. Athenstaedt, U. (2003). On the content and structure of the gender role self-concept: Including gender-stereotypical behaviors in addition to traits. *Psychology of Women Quarterly, 27*(4), 309-318.
4. Atkinson, J. W., Heyns, R. W., & Veroff, J. (1954). The effect of experimental arousal of the affiliation motive on thematic apperception. *The Journal of Abnormal and Social Psychology, 49*(3), 405. <https://doi.org/10.1037/h0053499>
5. Baumann, N., Kaschel, R., & Kuhl, J. (2005). Striving for unwanted goals: stress-dependent discrepancies between explicit and implicit achievement motives reduce subjective well-being and increase psychosomatic symptoms. *Journal of Personality and Social Psychology, 89*(5), 781. <https://doi.org/10.1037/0022-3514.89.5.781>
6. Berkman, L. F., Glass, T., Brissette, I., & Seeman, T. E. (2000). From social integration to health: Durkheim in the new millennium. *Social science & medicine, 51*(6), 843-857. [https://doi.org/10.1016/s0277-9536\(00\)00065-4](https://doi.org/10.1016/s0277-9536(00)00065-4)
7. Bernecker, K., & Job, V. (2011). Assessing implicit motives with an online version of the picture story exercise. *Motivation and Emotion, 35*(3), 251-266. <https://doi.org/10.1007/s11031-010-9175-8>
8. Bianco, T., & Eklund, R. C. (2001). Conceptual considerations for social support research in sport and exercise settings: The case of sport injury. *Journal of sport and exercise psychology, 23*(2), 85-107. <https://doi.org/10.1123/jsep.23.2.85>
9. Brandstätter, V., Job, V., & Schulze, B. (2016). Motivational incongruence and well-being at the workplace: Person-job fit, job burnout, and physical symptoms. *Frontiers in psychology, 7*, 1153. <https://doi.org/10.3389/fpsyg.2016.01153>

10. Broadhead, W. E., Kaplan, B. H., James, S. A., Wagner, E. H., Schoenbach, V. J., Grimson, R., Heyden, S., TIBBLIN, G., & Gehlbach, S. H. (1983). The epidemiologic evidence for a relationship between social support and health. *American Journal of epidemiology*, *117*(5), 521-537.  
<https://doi.org/10.1093/oxfordjournals.aje.a113575>
11. Brummett, B. H., Barefoot, J. C., Siegler, I. C., Clapp-Channing, N. E., Lytle, B. L., Bosworth, H. B., Williams Jr, R. B., & Mark, D. B. (2001). Characteristics of socially isolated patients with coronary artery disease who are at elevated risk for mortality. *Psychosomatic medicine*, *63*(2), 267-272.  
<https://doi.org/10.1097/00006842-200103000-00010>
12. Brunstein, J. C. (2010). Implicit motives and explicit goals: The role of motivational congruence in emotional well-being. *Implicit motives*, 347-374.  
<https://doi.org/10.1093/acprof:oso/9780195335156.003.0012>
13. Brunstein, J. C., & Schultheiss, O. C. (2010). *Implicit motives*. Oxford University Press.  
<https://doi.org/10.1093/acprof:oso/9780195335156.001.0001>
14. Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological bulletin*, *98*(2), 310. <https://doi.org/10.1037/0033-2909.98.2.310>
15. Denzinger, F., Backes, S., Job, V., & Brandstätter, V. (2016). Age and gender differences in implicit motives. *Journal of Research in Personality*, *65*, 52-61. <https://doi.org/10.1016/j.jrp.2016.09.003>
16. Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: a theoretical integration and synthesis of laboratory research. *Psychological bulletin*, *130*(3), 355.  
<https://doi.org/10.1037/0033-2909.130.3.355>
17. Ditzen, B., & Heinrichs, M. (2014). Psychobiology of social support: the social dimension of stress buffering. *Restorative neurology and neuroscience*, *32*(1), 149-162. <https://doi.org/10.3233/rnn-139008>
18. Ditzen, B., Neumann, I. D., Bodenmann, G., von Dawans, B., Turner, R. A., Ehlert, U., & Heinrichs, M. (2007). Effects of different kinds of couple interaction on cortisol and heart rate responses to stress in women. *Psychoneuroendocrinology*, *32*(5), 565-574.  
<https://doi.org/10.1016/j.psyneuen.2007.03.011>
19. Drescher, A., & Schultheiss, O. C. (2016). Meta-analytic evidence for higher implicit affiliation and intimacy motivation scores in women, compared to men. *Journal of Research in Personality*, *64*, 1-10. <https://doi.org/10.1016/j.jrp.2016.06.019>
20. Dufner, M., Arslan, R. C., Hagemeyer, B., Schönbrodt, F. D., & Denissen, J. J. (2015). Affective contingencies in the affiliative domain: Physiological assessment, associations with the affiliation motive, and prediction of behavior. *Journal of Personality and Social Psychology*, *109*(4), 662.  
<https://doi.org/10.1037/pspp0000025>
21. Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G\* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, *41*(4), 1149-1160.  
<https://doi.org/10.3758/brm.41.4.1149>

22. Feldman, P. J., Cohen, S., Lepore, S. J., Matthews, K. A., Kamarck, T. W., & Marsland, A. L. (1999). Negative emotions and acute physiological responses to stress. *Annals of Behavioral Medicine, 21*(3), 216-222. <https://doi.org/10.1007/bf02884836>
23. Fodor, E. M. (2010). Power motivation. In O. C. Schultheiss; & J. C. Brunstein (Eds.), *Implicit motives* (pp. 3-29). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195335156.003.0001>
24. Foley, P., & Kirschbaum, C. (2010). Human hypothalamus–pituitary–adrenal axis responses to acute psychosocial stress in laboratory settings. *Neuroscience & Biobehavioral Reviews, 35*(1), 91-96. <https://doi.org/10.1016/j.neubiorev.2010.01.010>
25. French, E. G. (1956). Motivation as a variable in work-partner selection. *The Journal of Abnormal and Social Psychology, 53*(1), 96. <https://doi.org/10.1037/h0043167>
26. Fuchs, R., Klaperski, S., Gerber, M., & Seelig, H. (2015). Messung der Bewegungs-und Sportaktivität mit dem BSA-Fragebogen [Measurement of physical activity and sports activity with the BSA questionnaire]. *Zeitschrift für Gesundheitspsychologie*. <https://doi.org/10.1026/0943-8149/a000137>
27. Goodman, W. K., Janson, J., & Wolf, J. M. (2017). Meta-analytical assessment of the effects of protocol variations on cortisol responses to the Trier Social Stress Test. *Psychoneuroendocrinology, 80*, 26-35. <https://doi.org/10.1016/j.psyneuen.2017.02.030>
28. Hobfoll, S. E., & Stokes, J. P. (1988). The process and mechanics of social support.
29. Hofer, J., & Busch, H. (2011). When the needs for affiliation and intimacy are frustrated: Envy and indirect aggression among German and Cameroonian adults. *Journal of Research in Personality, 45*(2), 219-228. <https://doi.org/10.1016/j.jrp.2011.02.003>
30. Hofer, J., & Hagemeyer, B. (2018). Soziale Anschlussmotivation: Affiliation und Intimität [social affiliation motive: affiliation and intimacy]. In J. Heckhausen & H. Heckhausen (Eds.), *Motivation und Handeln* (pp. 223-243). Springer. [https://doi.org/10.1007/978-3-662-53927-9\\_7](https://doi.org/10.1007/978-3-662-53927-9_7)
31. Jackson, T. (2006). Relationships between perceived close social support and health practices within community samples of American women and men. *The Journal of Psychology, 140*(3), 229-246. <https://doi.org/10.3200/jrlp.140.3.229-246>
32. Job, V., Bernecker, K., & Dweck, C. S. (2012). Are implicit motives the need to feel certain affect? Motive–affect congruence predicts relationship satisfaction. *Personality and Social Psychology Bulletin, 38*(12), 1552-1565. <https://doi.org/10.1037/e642622013-033>
33. Kirschbaum, C., Klauer, T., Filipp, S.-H., & Hellhammer, D. H. (1995). Sex-specific effects of social support on cortisol and subjective responses to acute psychological stress. *Psychosomatic medicine, 57*(1), 23-31. <https://doi.org/10.1097/00006842-199501000-00004>
34. Kirschbaum, C., Pirke, K.-M., & Hellhammer, D. H. (1993). The 'Trier Social Stress Test'–a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28*(1-2), 76-81. <https://doi.org/10.1159/000119004>
35. Knoll, N., & Schwarzer, R. (2002). Gender and age differences in social support: A study of East German migrants. *Heart disease: Environment, stress and gender, 327*, 198-210.

36. Kulik, J. A., & Mahler, H. I. (1989). Social support and recovery from surgery. *Health psychology, 8*(2), 221. <https://doi.org/10.1037/0278-6133.8.2.221>
37. Liu, J. J., Ein, N., Peck, K., Huang, V., Pruessner, J. C., & Vickers, K. (2017). Sex differences in salivary cortisol reactivity to the Trier Social Stress Test (TSST): a meta-analysis. *Psychoneuroendocrinology, 82*, 26-37. <https://doi.org/10.1016/j.psyneuen.2017.04.007>
38. McClelland, D. (1985). Human motivation. Glenview, IL: Scott, Foresman. DOI: 10.1007.
39. McClelland, D. C., Koestner, R., & Weinberger, J. (1989). How do self-attributed and implicit motives differ? *Psychological review, 96*(4), 690. <https://doi.org/10.1037/0033-295x.96.4.690>
40. McEwen, B. S. (2000). The neurobiology of stress: from serendipity to clinical relevance. *Brain research, 886*(1-2), 172-189. [https://doi.org/10.1016/s0006-8993\(00\)02950-4](https://doi.org/10.1016/s0006-8993(00)02950-4)
41. Miller, R., Plessow, F., Kirschbaum, C., & Stalder, T. (2013). Classification criteria for distinguishing cortisol responders from nonresponders to psychosocial stress: evaluation of salivary cortisol pulse detection in panel designs. *Psychosomatic medicine, 75*(9), 832-840. <https://doi.org/10.1097/psy.0000000000000002>
42. Pang, J. S., & Schultheiss, O. C. (2005). Assessing implicit motives in US college students: Effects of picture type and position, gender and ethnicity, and cross-cultural comparisons. *Journal of Personality Assessment, 85*(3), 280-294. [https://doi.org/10.1207/s15327752jpa8503\\_04](https://doi.org/10.1207/s15327752jpa8503_04)
43. Pemberton, R., & Tyszkiewicz, M. D. F. (2016). Factors contributing to depressive mood states in everyday life: a systematic review. *Journal of affective disorders, 200*, 103-110. <https://doi.org/10.1016/j.jad.2016.04.023>
44. Pressman, S. D., & Cohen, S. (2005). Does positive affect influence health? *Psychological bulletin, 131*(6), 925. <https://doi.org/10.1037/0033-2909.131.6.925>
45. Robles, T. F. (2007). Stress, social support, and delayed skin barrier recovery. *Psychosomatic medicine, 69*(8), 807-815. <https://doi.org/10.1097/psy.0b013e318157b12e>
46. Rutledge, T., Reis, S. E., Olson, M., Owens, J., Kelsey, S. F., Pepine, C. J., Mankad, S., Rogers, W. J., Merz, C. N. B., & Sopko, G. (2004). Social networks are associated with lower mortality rates among women with suspected coronary disease: the National Heart, Lung, and Blood Institute-Sponsored Women's Ischemia Syndrome Evaluation study. *Psychosomatic medicine, 66*(6), 882-888. <https://doi.org/10.1097/01.psy.0000145819.94041.52>
47. Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist, 55*(1), 68. <https://doi.org/10.1037/0003-066x.55.1.68>
48. Sapolsky, R. M., Romero, L. M., & Munck, A. U. (2000). How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine reviews, 21*(1), 55-89. <https://doi.org/10.1210/er.21.1.55>
49. Schmalt, H.-D., & Heckhausen, H. (2010). Machtmotivation [Power motivation]. In *Motivation und Handeln* (pp. 211-236). Springer. [https://doi.org/10.1007/978-3-642-12693-2\\_8](https://doi.org/10.1007/978-3-642-12693-2_8)

50. Schüler, J., Brandstätter, V., Wegner, M., & Baumann, N. (2015). Testing the convergent and discriminant validity of three implicit motive measures: PSE, OMT, and MMG. *Motivation and Emotion, 39*(6), 839-857. <https://doi.org/10.1007/s11031-015-9502-1>
51. Schüler, J., Job, V., Fröhlich, S. M., & Brandstätter, V. (2009). Dealing with a 'hidden stressor': emotional disclosure as a coping strategy to overcome the negative effects of motive incongruence on health. *Stress and Health: Journal of the International Society for the Investigation of Stress, 25*(3), 221-233. <https://doi.org/10.1002/smi.1241>
52. Schultheiss, O. C. (2008). Implicit motives. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3 ed., pp. 603-633). The Guilford Press.
53. Schultheiss, O. C. (2013). The hormonal correlates of implicit motives. *Social and Personality Psychology Compass, 7*(1), 52-65. <https://doi.org/10.1111/spc3.12008>
54. Schultheiss, O. C., & Köllner, M. G. (in press). Implicit Motives. In O. P. John & R. W. Robins (Eds.), *Handbook of Personality: Theory and Research* (4 ed.). Guilford.
55. Schultheiss, O. C., & Pang, J. S. (2007). Measuring implicit motives. *Handbook of research methods in personality psychology, 322-344*.
56. Schultheiss, O. C., Wiemers, U. S., & Wolf, O. T. (2014). Implicit need for achievement predicts attenuated cortisol responses to difficult tasks. *Journal of Research in Personality, 48*, 84-92. <https://doi.org/10.1016/j.jrp.2013.10.004>
57. Schultheiss, O. C., Wirth, M. M., & Stanton, S. J. (2004). Effects of affiliation and power motivation arousal on salivary progesterone and testosterone. *Hormones and behavior, 46*(5), 592-599. <https://doi.org/10.1016/j.yhbeh.2004.07.005>
58. Schulz, U., & Schwarzer, R. (2003). Social support in coping with illness: the Berlin Social Support Scales (BSSS). *Diagnostica, 49*(2), 73-82. <https://doi.org/10.1026//0012-1924.49.2.73>
59. Spielberger, C. D. (1970). Manual for the State-trait Anxiety, Inventory. *Consulting Psychologist*.
60. Stanton, S. J., & Schultheiss, O. C. (2009). The hormonal correlates of implicit power motivation. *Journal of Research in Personality, 43*(5), 942-949. <https://doi.org/10.1016/j.jrp.2009.04.001>
61. Steyer, R., Schwenkmezger, P., Notz, P., & Eid, M. (1997). Der Mehrdimensionale Befindlichkeitsfragebogen MDBF [Multidimensional mood questionnaire]. *Göttingen, Germany: Hogrefe*.
62. Team, R. C. (2017). R Foundation for Statistical Computing; Vienna, Austria: 2016. R: A language and environment for statistical computing. In.
63. Uchino, B. N. (2004). *Social support and physical health: Understanding the health consequences of relationships*. Yale university press. <https://doi.org/10.12987/yale/9780300102185.001.0001>
64. Von Dawans, B., Kirschbaum, C., & Heinrichs, M. (2011). The Trier Social Stress Test for Groups (TSST-G): A new research tool for controlled simultaneous social stress exposure in a group format. *Psychoneuroendocrinology, 36*(4), 514-522. <https://doi.org/10.1016/j.psyneuen.2010.08.004>

65. Weinberger, J., Cotler, T., & Fishman, D. (2010). The duality of affiliative motivation. *Implicit motives, 1*, 71-89. [https://doi.org/ 10.1093/acprof:oso/9780195335156.003.0003](https://doi.org/10.1093/acprof:oso/9780195335156.003.0003)
66. Wiemers, U. S., Schultheiss, O. C., & Wolf, O. T. (2015). Public speaking in front of an unreceptive audience increases implicit power motivation and its endocrine arousal signature. *Hormones and behavior, 71*, 69-74. <https://doi.org/10.1016/j.yhbeh.2015.04.007>
67. Winter, D. G. (1973). The power motive.
68. Winter, D. G. (1994). *Manual for Scoring Motive Imagery in Running Text:(Version 4.2)*. Winter.
69. Wirth, M. M., & Schultheiss, O. C. (2006). Effects of affiliation arousal (hope of closeness) and affiliation stress (fear of rejection) on progesterone and cortisol. *Hormones and behavior, 50*(5), 786-795. <https://doi.org/10.1016/j.yhbeh.2006.08.003>
70. World Health Organization, M. R. T. (2001). Geneva, Switzerland: World Health Organization.
71. Zimmermann, F., Sieverding, M., & Müller, S. M. (2011). Gender-related traits as predictors of alcohol use in male German and Spanish university students. *Sex roles, 64*(5-6), 394-404. <https://doi.org/10.1007/s11199-010-9897-9>

## Figures

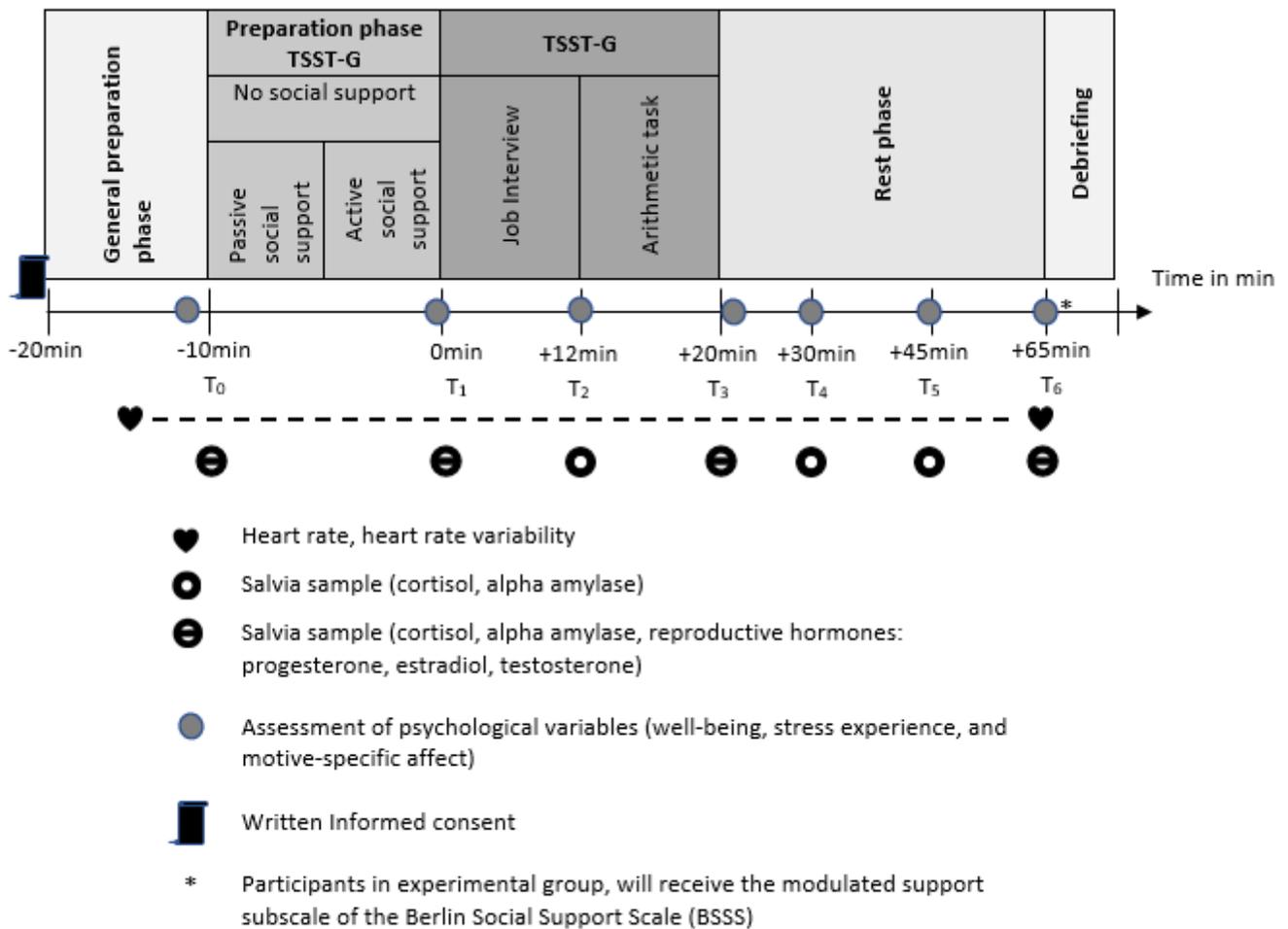


Figure 1

TSST- phases in the lab-session

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [AppendixA.docx](#)
- [AppendixB.docx](#)
- [AppendixC.docx](#)
- [AppendixD.docx](#)
- [AppendixE.docx](#)
- [AppendixF.docx](#)
- [AppendixG.docx](#)

- [AppendixH.docx](#)
- [AppendixI.docx](#)
- [AppendixJ.docx](#)
- [AppendixK.docx](#)