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everyday life"**

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Teresa O'Rourke, BSc

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Univ.-Prof. Dr. Urs Nater

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## Abstract

**Background:** It is necessary to successfully cope with stressful situations in daily life to prevent stress-related health consequences. Coping styles can be understood as tendencies to use specific coping strategies in daily life situations. However, not all coping styles are equally successful at resolving stress reactions. No research has yet been done on how individual coping styles impact the ability to successfully cope with daily life situations.

**Objective:** The aim of this study was to investigate the impact of individual coping styles on the ability to cope with stressful situations in everyday life and to examine how momentary stress level and gender interact with these effects.

**Method:** An ecological momentary assessment (EMA) study with the mobile health app TrackYourStress (TYS) was conducted with 113 participants. Coping styles were measured at baseline and stress levels as well as situational coping were assessed approximately once per day over four weeks. Multilevel models were conducted to test the effects of the coping styles on situational coping. Momentary stress level was included as level 1 predictor and gender as level 2 predictor and all direct and indirect effects were analyzed. Additionally, gender differences were evaluated.

**Results:** The coping styles *Positive Thinking* and *Active Stress Coping* were associated with higher situational coping in daily life. A higher stress level was associated with lower situational coping and decreased the effect of *Social Support* on situational coping. Additionally, various cross-level interaction effects between gender and stress level on situational coping were observed.

**Conclusion:** Tailored interventions that identify specific coping strategies, personalized to different stress levels or populations, might lead to better coping-outcomes than generalized interventions. YYS could be used to monitor stress and coping in daily life and combined with just-in-time interventions that are applied when changes in stress level or coping are detected.

**Keywords:** coping, ecological momentary assessment, mHealth, mobile application, stress

## **Zusammenfassung**

**Theoretischer Hintergrund:** Die erfolgreiche Bewältigung von Stresssituationen im täglichen Leben ist notwendig, um stressbedingte Gesundheitsfolgen zu verhindern. Coping-Stile können als Tendenzen zur Anwendung bestimmter Coping-Strategien verstanden werden. Es sind allerdings nicht alle Coping-Stile gleich erfolgreich in der Auflösung von Stressreaktionen. Es ist bisher nicht erforscht worden, wie sich Coping-Stile auf die Fähigkeit auswirken, Alltagssituationen erfolgreich zu bewältigen.

**Ziel:** Ziel dieser Studie war es zu untersuchen, wie sich individuelle Coping-Stile auf die Stressbewältigung im Alltag auswirken und wie Stresslevel und Geschlecht mit diesen Effekten interagieren.

**Methode:** Eine Ecological Momentary Assessment (EMA) Studie mit der mobile health (mHealth)-App TrackYourStress (TYS) wurde mit 113 Teilnehmer\*innen durchgeführt. Die Coping-Stile wurden zur Baseline und das Stresslevel sowie das situative Coping ungefähr einmal pro Tag vier Wochen lang erhoben. Es wurden Mehrebenenmodelle durchgeführt, um die Effekte der Coping-Stile auf das situative Coping zu testen. Das momentane Stresslevel wurde als Level-1 Prädiktor und Geschlecht als Level-2 Prädiktor aufgenommen. Alle Haupt- und Interaktionseffekte, sowie Geschlechterunterschiede wurden analysiert.

**Ergebnisse:** Die Coping-Stile *Positives Denken* und *Aktives Stress-Coping* waren mit einem höheren situativen Coping im Alltag assoziiert. Ein höheres Stresslevel war mit einem niedrigeren situativen Coping assoziiert und reduzierte den Effekt der *Sozialen Unterstützung* auf das situative Coping. Zusätzlich wurden verschiedene Interaktionseffekte zwischen Geschlecht und Stresslevel auf das situative Coping beobachtet.

**Schlussfolgerung:** Interventionen, die auf verschiedene Stresslevels oder Populationen zugeschnittene Coping-Strategien identifizieren, könnten zu besseren Coping-Ergebnissen führen als generalisierte Interventionen. YYS könnte zur Überwachung von Stress und Coping im Alltag eingesetzt werden und mit Just-in-time-Interventionen kombiniert werden, die angewendet werden, wenn Veränderungen im Stresslevel oder im Coping festgestellt werden.

**Schlagwörter:** Coping, Stress, Ecological Momentary Assessment, mHealth, mobile Anwendung

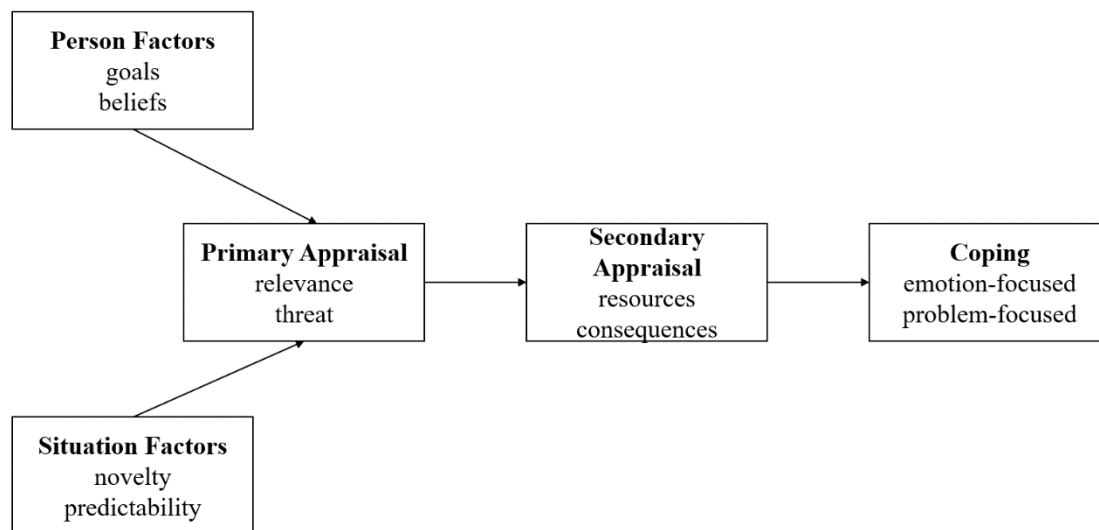
## 1. Introduction

Coping is defined as the effort a person musters to manage a situation that he or she perceives as threatening, stressful or burdensome (Carver, 2011) and regards cognitive processes or behaviors a person uses to deal with the demands of stressful situations (Folkman, 2010). Successful coping is necessary on a daily basis to alleviate stress consequences of daily life stress experiences, and prevent negative health consequences of chronic stress experiences. Being exposed to stressful situations has become an omnipresent part of everyday life in contemporary society. Technological advances have enabled workers to be less place- and timebound, which can make work life easier in some ways, but also leads to constant reachability – and the pressure to be available – at any given time. Such new ways of working have the potential to reduce the work-family conflict (Kossek et al., 2009), but have also been shown to increase the overall workload and -time (Kelliher & Anderson, 2010). Besides such work-related stressors, people are to varying degrees confronted by minor stressors or daily hassles, such as bad traffic or interpersonal discord, and major stressors or traumas such as car accidents or natural disasters in their daily life. Consequently, people are surrounded by work-related and social stressors on a daily basis and successful coping is vital to function in daily life despite such stressors.

### 1.1. Transactional Stress Model (Lazarus and Folkman, 1984)

The transactional stress model by Lazarus and Folkman (1984), which is schematically illustrated in Figure 1, is one of the most established concepts of stress and coping. According to this model, stress responses to a stressful situation are influenced by the cognitive appraisals of the situation as well as personal abilities and resources. These appraisals are influenced by personal and situational variables. Lazarus and Folkman (1984) further differentiate between *primary appraisal* and *secondary appraisal*. In the process of *primary appraisal*, a person assesses the importance of the situation to themselves and whether the situation is a threat to them. In the *secondary appraisal*, a person evaluates whether he or she has enough resources to successfully cope with the situation, how to utilize these resources to deal with the stressor, and what consequences could arise from this strategy. These cognitive appraisals are then followed by individual coping strategies that are either targeted to actively resolve the stressful situation (problem-oriented) or to reduce the emotional consequences of this situation (emotion-oriented; Lazarus & Folkman, 1984). These processes can be influenced by personal

factors such as personal goals or beliefs and situational factors such as the novelty or predictability of a stressful situation.



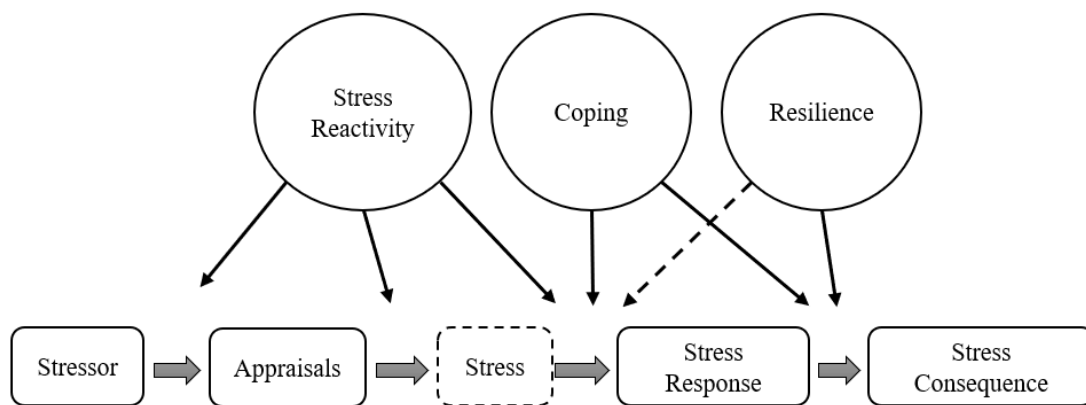
*Figure 1* Components of the Transactional Stress Model. Adapted from “*Stress, appraisal, and coping.*” By R. S. Lazarus & S. Folkman, 1984, Springer, New York.

Coping strategies can further be divided into active coping strategies, which aim to remove the stressor, and passive coping strategies, which attempt to regulate the emotional reaction to it (Carver, 2011). Similarly, coping strategies can also be divided into approach and avoidance strategies (Taylor & Stanton, 2007). An approach strategy is, for example, the active removal of a stressor, while the withdrawal from a situation that is perceived as stressful is an avoidance strategy. Coping strategies can be both adaptive and maladaptive and not all strategies are equally successful at resolving a stress reaction. Examples for adaptive coping strategies are active stress coping, social support, support in faith, and an example for a maladaptive coping strategy is alcohol and cigarette consumption (Satow, 2012). Some coping strategies, such as avoidance, can be adaptive for some time, but maladaptive in the long-run (Seiffge-Krenke & Klessinger, 2000). Resources that can enable adaptive coping are, for example, optimism or social support (Taylor & Stanton, 2007). A lack of adaptive coping strategies or coping resources has been associated with the experience of chronic stress (Repetti et al., 2002) and may be a symptom, risk or maintaining factor of various mental disorders. Avoiding coping strategies such as social withdrawal can even lead to an increased subjective stress experience (Frazier, 2005), while approach or problem-oriented strategies have been

associated with better coping results, such as better psychological adjustment (Roesch & Weiner, 2001).

## 1.2. Stress Process Model (Schlotz, 2019)

The following stress process model presents various factors in which people can differ from one another in their stress experience. It is based on the psychobiological stress theories of McEwen (1998) and Ursin and Eriksen (2004) and defines operationalizations for measuring stress in everyday life. The model illustrates the main factors, pathways, and moderators of stress and is schematically depicted in Figure 2.



*Figure 2* Stress process model. Adapted from “Investigating associations between momentary stress and cortisol in daily life: What have we learned so far?” by W. Schlotz, 2019, *Psychoneuroendocrinology*, 105, p. 109.

According to this model, the stress process starts with a stressor, a condition or situation that holds the potential to elicit a stress response. Stressors can be environmental factors such as loud noises or extreme weather conditions or intrapersonal factors such as fears or negative expectations (Lazarus, 1993). Stress responses can therefore be triggered externally and internally. Another important aspect in this regard is the distinction between *acute stressors* and *chronic stressors*. Acute stressors are distinct and time-limited situations such as public speaking or exams (Segerstrom & Miller, 2004). A person that is experiencing chronic stressors, on the other hand, does not know if and when the stressors will subside and the



stressful situation will end. Being forced to flee one's country due to war or caring for severely disabled relatives can act as chronic stressors (Segerstrom & Miller, 2004).

While Selye (1936) still distinguished two types of stress, the positive, performance-enhancing eustress and the negative, overstraining distress, only one type of stress is assumed today, which can be perceived differently depending on the individual appraisal. Based on the cognitive stress theory of Lazarus and Folkman (1984), a stressor only leads to a stress reaction if a person assesses the stressor as personally relevant or important to himself or herself, threatening and uncontrollable. Such an assessment is followed by a stress response that evokes physiological, affective, cognitive, and behavioral changes (Schlotz, 2019). On the physiological level the stress response elicits, among other things, an activation of the hypothalamus-pituitary-adrenal (HPA) axis and usually within 15 to 20 minutes an associated increase in the stress hormone cortisol. Affective consequences can be nervousness or excitement; cognitive consequences include a shift of attention to the stressor. At the behavioral level, various types of behavior, such as harmful health behavior, may follow. These behaviors can play a role in the relationship between the experience of stressful situations and the development of diseases (Schlotz, 2019).

A moderating factor that influences the stress process is stress reactivity, which can be understood as the disposition to react to stressors with fast, intensive, and long-lasting stress reactions and is not equally pronounced in all people (Schulz et al., 2005). According to this model, coping is another crucial moderating factor of stress. Coping strategies can not only influence the stress response following a stressful situation, but also potential subsequent health consequences through behavioral and physiological processes.

Resilience is another factor in the model by Schlotz (2019), which has a moderating influence on the stress process and in which people can differ from one another. Resilience can be understood as the ability to recover from stress or trauma or as a positive adaptation after stressful or traumatic events and depends on genetic, cognitive, psychosocial, neurobiological, and developmental factors (Southwick & Charney, 2012). Resilient persons show fewer (psycho-) pathological symptoms after stressful or traumatic events than less resilient persons and exhibit adaptive biological changes (Lindert et al., 2018). The resilience of a person thus has a decisive influence on the effects of a stress reaction on their mental and physical health. Resilience, however, refers to a person's psychological resilience and can vary between persons, while coping refers to the coping styles and strategies actually used to deal with a stressful situation and can vary between as well as within persons. Situational coping can vary within a person depending on the frequency and intensity of stressors (Schneiderman et al.,

2005). Such intraindividual aspects should also be taken into account when researching stress experience and coping. In cross-sectional and laboratory studies, however, such intraindividual processes can only be insufficiently considered. While laboratory studies often apply stress tests in order to elicit acute stress responses (e.g., the Trier Social Stress Test; Kirschbaum et al., 1993), dynamic stress processes and fluctuations cannot be comprehensively studied in such settings. Furthermore, although stress tests in laboratory studies are now so well developed that they represent stressors that can occur in the everyday life of the subjects, they are still tested in an artificial situation, which limits the generalization of the results of such studies to real-world settings.

### **1.3. Stress, Coping, and Health**

The term stress, as it is understood today, was first used in 1936 by Hans Selye, who understood it to mean “the non-specific response of the body to a request for change”. He put forward the then-revolutionary theory that experiencing stressful situations over a prolonged period of time can lead to various diseases. That experiencing chronic stress can induce, aggravate, and maintain somatic symptoms is now considered to be proven (Cohen et al., 2007; Nater et al., 2011). Some of the health consequences that can follow chronic stress reactions are cardiovascular disease, impaired wound healing, and general reduced immune function (Faasse & Petrie, 2015). Furthermore, chronic stress experiences are also associated with mental disorders such as depression (Stansfeld & Candy, 2006). As everyone experiences stressful situations at some point in their lifetime, it is important to understand the relationship between experiencing stressful situations and physical and mental illness in order to take preventive action.

What makes coping an important concept in stress research is the possibility to intervene between stressful experiences and their effects on mental and physical health by means of concrete coping processes. Interventions administered by health professionals to increase coping skills could be helpful in reducing the long-term risks associated with stressful experiences (Taylor & Stanton, 2007). Interventions that focus on improving people’s ability to cope with stressful situations, such as relaxation training or cognitive-behavioral stress management, can improve people’s health outcomes (Faasse & Petrie, 2015). Coping also seems to be related to individual personality traits. Optimism, extraversion, conscientiousness and openness are associated with active coping, while neuroticism seems to be more related to avoidance strategies (Carver & Conner-Smith, 2010).

People react with different subjective and biological stress responses to stressors

(Schulz et al., 2005), i.e., subjective stress experience unfolds differently from person to person. Consequently, it is important to consider interindividual differences in the stress experience when researching the relationship between prolonged stress reactions, coping, and health outcomes. As both stress responses and coping can also vary within a person, it is additionally important to investigate intraindividual changes over time in this regard as well.

#### **1.4. Stress, Coping, & Gender**

One factor that may influence coping is gender. For a long time, it was assumed that women use more emotion-focused coping, whereas men use more problem-focused coping (Lazarus, 1984). Indeed, many studies come to the conclusion that women use emotion-focused coping strategies such as emotional or social support more than men do (e.g. Blanchard-Fields et al., 1991; Kelly et al, 2008). However, the results of a previous meta-analysis on gender-differences in coping strategies suggest that women are generally more likely than men to use most coping strategies, especially strategies such as seeking social support, using religion, or even active coping to deal with stressful situations (Tamres et al., 2002).

Some studies with adolescents and young adults show that women are more likely than men to use maladaptive coping strategies such as self-blame, ignoring the problem, hiding feelings (Al-Bahrani et al., 2013) or venting anger on others and eating sweets (Hänninen & Aro, 1996). In the latter study, young women were more likely to use most dysfunctional coping strategies, apart from drinking alcohol, which is typically reported more often for men (e.g. Woodhead et al., 2014).

According to the above-mentioned meta-analysis, women tend to appraise stressors as more stressful than men (Tamres et al, 2002), which could explain some of the differences in coping between women and men. Furthermore, women across Europe report higher perceived job stress than men (De Smet et al., 2005). Such differences in perceived stress levels in women and men could influence coping in daily life.

It is still unclear how individual coping styles impact situational coping in women and men, and how stress levels interact with these effects.

#### **1.5. Ecological Momentary Assessment (EMA)**

Contrary to laboratory studies, a method of data acquisition that enables the generalization of results to real-world contexts is Ecological Momentary Assessment (EMA), which is defined as the assessment of data in real-world environments, in real time, over multiple measurement time-points that can be either event-based, time-based or randomly

prompted (Stone & Shiffman, 1994).

The collection of data in real-world environments is beneficial, because individual context variables such as time of day can be taken into account. As some problematic behaviors or psychopathological symptoms tend to occur only under specific conditions, it is important to consider context, such as environment or time of day when assessing such data (Trull & Ebner-Priemer, 2009). This can often not be considered in laboratory studies. Another advantage of this type of investigation is that it enables the measurement of subjective stress experience in real time, so that any distortions caused by retrospective assessments can be avoided. For example, people tend to be more likely to remember situations that are more relevant to them personally, happened more recently or are unusual, which can bias retrospective reports (Trull & Ebner-Priemer, 2009). EMA can furthermore be used to monitor certain behavior, treatment progress or stress levels (Pryss et al., 2019; Trull & Ebner-Priemer, 2009). Thus, EMA studies are suitable for assessing inter- and intraindividual differences in everyday life over a longer period of time, which gives them high ecological validity (Schlotz, 2019).

EMA designs are becoming more widely used in studies with the increasing use of smartphones and other electronic devices in the general population due to technological progress. With the advance of digitalization, smartphone-based mobile health (mHealth) apps have become popular, as they are a low-threshold option of mental health support and have the potential to reach large numbers of people (Kazdin, 2017). Such mHealth apps facilitate the integration of questionnaires into daily life which enables the assessment of dynamic coping processes over time with EMA designs in contrast to retrospective assessments which cannot take such dynamic changes into account. Furthermore, with the use of smartphones, participants' entries in EMA studies can be time-stamped, which allows the examination of whether participants actually comply with the study plan and provide real-time assessments.

## **1.6. Objectives and Research Questions**

The main objective of this master's thesis is to investigate the impact of individual coping styles on situational coping in everyday life and to find out which coping strategies predict situational coping at which stress level. Thus, this thesis addresses the second path/stress-moderating factor of the aforementioned model by Schlotz (2019), stress-related coping. Another aim is to determine whether men and women differ in their coping and whether gender interacts with the effect of the coping styles on situational coping.

Based on this theoretical background, this thesis addresses the following central questions:

- 1) Do people with different coping styles differ in their ability to cope with stress in everyday life?
- 2) Does the impact of coping styles on situational coping change with different stress levels?
- 3) Do women and men differ in their coping?
- 4) Does gender moderate the effects of coping styles and the stress level on situational coping?

## **1.7. Hypotheses**

In the further course of this thesis, I will test the following hypotheses:

H1: The individual coping styles vary in the degree to which they influence the ability to cope with the stress level in everyday life.

H2: Women and men differ significantly in their coping.

- a. Women and men differ significantly in their coping styles.
- b. Women and men differ significantly in their situational coping.

H3: The influence of coping styles on the ability to cope with the momentary stress levels in everyday life changes with different stress levels.

H4: Gender moderates the effect of coping styles and stress level on the ability to cope with the momentary stress levels in everyday life.

- a. Gender moderates the effect of coping styles on the ability to cope with the momentary stress levels in everyday life.
- b. Gender moderates the interaction between coping styles and stress level on the ability to cope with the momentary stress levels in everyday life.

## **2. Method**

### **2.1. Study Design**

In the course of this master's thesis, I will analyze existing data that was collected by three student researchers in an EMA study with the Crowdsensing platform and app

TrackYourStress (TYS) from July 2018 to January 2019. This pilot study was conducted as part of the TrackYourStress project, in collaboration with the Danube University Krems, the Lutheran University of Applied Sciences Nuremberg, the University of Ulm, and the University of Würzburg. After a baseline assessment, participants were instructed to rate their subjective stress experience and coping for four weeks. The participants filled out the app's questionnaires on their own mobile phones at self-chosen times in their regular daily life. To keep the participants' effort at a minimum, the questionnaires were chosen to be as short as possible, while retaining acceptable psychometric qualities, and no in-depth assessments of further participant characteristics were conducted.

## **2.2. Sample and Procedure**

Three students from the FOM universities Munich and Augsburg recruited the participants for this study. The sample was a convenience sample recruited at these universities and in the social networks of the three student recruiters. To partake in this study, participants had to be at least 18 years old, own a smartphone with either Android or iOS system software, and agree to use the TYS app for four weeks (informed consent). A total of 113 participants (test users excluded) filled out the questionnaires of the TYS app over a period of four weeks each.

The mobile application was downloaded via private installation routines on the participants' devices. Each participant then completed the registration with a password-protected user profile. After this procedure, the participants completed the baseline assessment by filling out a registration questionnaire including the coping scale of the stress and coping inventory (SCI; Satow, 2012). The participants were then asked to fill out the questions of the daily questionnaire (see below), at least once per day over a course of four weeks each. The assessments were not event-based and could be made at self-chosen points of time. The participants had the possibility to set personalized reminders in the app that would notify them to fill out the questionnaires at chosen time points. Beyond that, the participants could also fill out the questionnaires at any given time.

## **2.3. Materials**

### **2.3.1. *TrackYourStress***

TYS (<https://www.trackyourstress.org>) was developed by researchers from the Danube University Krems, the University of Ulm, and the Lutheran University of Applied Sciences Nuremberg to measure subjective stress experience and coping in everyday life. The app will

soon be freely available in the app stores for both iOS and Android. On the one hand, the app offers users the opportunity to systematically measure their individual fluctuations in stress levels and find out how these are related to various events in their daily lives. On the other hand, TYS can be used to research subjective stress perception and coping in everyday life. TYS contains several established questionnaires that have been chosen to have good psychometric qualities and to be as short as possible, so that participants remain motivated to complete them repeatedly over a longer period of time. In a registration questionnaire, in addition to basic demographic variables, the individual stress reactivity is assessed with the Perceived Stress Reactivity Scale (PSRS; Schlotz et al., 2011), stress coping with the Stress and Coping Inventory (SCI; Satow, 2012) and the stress level of the last seven days with a short version of the Perceived Stress Scale (PSS-4; Cohen et al., 1983). The app's daily questionnaire consists of various questions on situational stress levels and situational coping. These questions were designed to address the main concepts of the transactional stress model (Lazarus & Folkman, 1984). The app also contains a weekly questionnaire, which assesses the stress level of the last seven days and a monthly questionnaire that again covers coping styles. The latter two questionnaires, however, are not relevant for this master's thesis, which focuses on the SCI coping scales of the registration questionnaire and the daily questionnaires' results. Additionally, users can view the history of their data and receive personalized feedback on their entries on a website. TYS can be used as a self-management strategy to identify individual stress fluctuations. Figure 3 depicts a screenshot of the TrackYourStress iOS and Android user interfaces, which are in German.

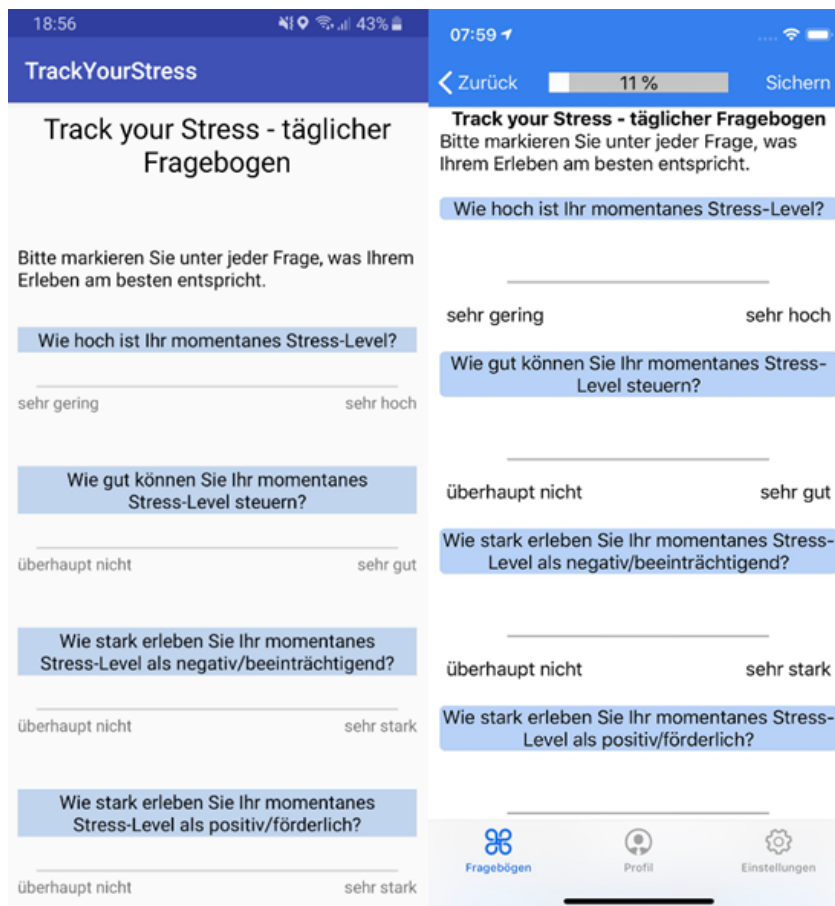


Figure 3 Screenshot of the TrackYourStress iOS and Android user interfaces

### 2.3.2. Stress and Coping Inventory (SCI; Satow, 2012)

The SCI is a questionnaire for the measurement of stress load, stress symptoms, and stress coping styles with a total of 54 items. To measure the participants' individual coping styles in this study, the SCI coping scale with 20 items was used. The coping scale consists of the following five subscales:

- *Positive Thinking (PT)*; e.g. "I tell myself that stress and pressure also have their good sides."),
- *Active Stress Coping (AS)*; e.g. "I try to avoid stress in advance."),
- *Social Support (SS)*; e.g. "When I come under pressure, I have people who help me."),
- *Support in Faith (SF)*; e.g. "Under stress and pressure, I find stability in faith."), and
- *Increased Alcohol and Cigarette Consumption (AC)*; e.g. "Under stress and pressure, I relax with a glass of wine or beer in the evening.).



The subscales each consist of four questions on a Likert scale from 1 (do not agree at all) to 4 (strongly agree). For most items, higher values represent a better fit with the respective coping style. Only in the second item of the subscale *Increased Alcohol and Cigarette Consumption* does a higher score indicate a worse fit with this particular coping style (“No matter how much stress I get, I would never turn to alcohol or cigarettes because of stress.”). This item has hence to be recoded. Similarly, higher scores on a scale level represent higher coping, although higher scores in the AC subscale represent a more maladaptive coping. In our sample, the subscales of the SCI showed the following internal consistencies (Cronbach’s  $\alpha$ ): *PT* ( $\alpha=.70$ ), *AS* ( $\alpha=.77$ ), *SS* ( $\alpha=.90$ ), *SS* ( $\alpha=.77$ ) and *AC* ( $\alpha=.70$ ). These values indicate acceptable to excellent reliabilities and are similar to the Cronbach alphas in the original sample (Satow, 2012): *PT* ( $\alpha=.74$ ), *AS* ( $\alpha=.74$ ), *SS* ( $\alpha=.88$ ), *SF* ( $\alpha=.78$ ), *AC* ( $\alpha=.75$ ).

### **2.3.3. Daily Questionnaire**

The daily questionnaire (Table 1) contains nine questions about the situational stress experience that were designed by the developers of the app. Of these nine, the following two questions are relevant to this master’s thesis:

- 1) How high is your momentary stress level?
- 2) How well can you cope with your momentary stress level?

The first of these questions focuses on the currently experienced stress intensity and can be answered on a Visual Analogue Scale (VAS) from *very low* to *very high*. The VAS is interpreted with values from 0 to 100. The second question concerns the situational coping. To enhance readability, I will refer to the ability to control the current stress level in daily life as situational coping in the further course of this master’s thesis. Like the first question, it can be answered on a VAS from *not at all* to *very well*.

Table 1

*Daily Questionnaire*

1. How high is your momentary stress level?
2. How well can you cope with your momentary stress level?
3. How strongly are you experiencing your momentary stress level as negative/impairing?
4. How strongly are you experiencing your momentary stress level as positive/beneficial?
5. What stresses you at the moment?
6. How is your mood right now?
7. How is your arousal right now?
8. How important is the current situation for you personally?
9. How would you assess your resources to manage the currently experienced situation?

**2.4. Statistical Analysis**

The statistics program SPSS v26 was used for all statistical analyses. All of the statistical tests were 2-tailed and the significance level was set to  $p < .05$ . Addressing the nested data structure, linear multilevel models were conducted to test hypotheses 1, 3, and 4. The participants' respective measurement time points in all of these models were time varying factors at level 1 and the participants' characteristics were time-invariant at level 2. The dependent variable was situational coping in level 1 in all models. All main effects were tested for all multilevel models and interaction effects were tested if interactions were included in the model. All multilevel models were calculated with the full maximum likelihood estimation. The intercept varied freely in these models, while the slope parameter was a fixed coefficient. When analyzing longitudinal data, multilevel models have more advantages over repeated-measures designs with ANOVA or MANOVA designs (O'Connell & McCoach, 2004). For instance, they allow a more flexible handling with missing data, which is likely to occur in longitudinal data.

H1: The coping scales of the SCI were added as level 2 predictors. All 5 scales were added to one model in order to control for the effect of the other scales.

H2a: To test whether women and men differ in their individual coping styles (H2), t-tests for unpaired samples were calculated. Hedge's  $g$  was used to calculate the effect sizes of

the t-tests. Hedge's  $g$  is interpreted as follows: 0.2 = small effect, 0.5 = medium effect, 0.8 = big effect (Durlak, 2009).

H2b: In this model, gender was added as a dichotomous factor at level 2 and coded as 0=women and 1=men.

H3: To test H3, the stress level was set as level-1 predictor and level-2 predictor were the individual coping styles. All main and interaction effects were evaluated.

H4: The influence of gender was included as a dichotomous factor and coded as 0=women and 1= men.

H4a: Gender and coping styles were added as a level 2 predictors. All main and interaction effects were tested.

H4b: Gender and coping styles were added as level 2, momentary stress level as level 1 predictors. All main and interaction effects were tested.

### 3. Results

During the study interval, the 113 participants filled out the daily questionnaire a total of 2228 times and a mean 1.03 times per day. Of these, 65 were female and 47 were male. The participants' ages ranged from 18 to 62 years with a mean age of  $M = 33.46$  ( $SD = 11.36$ ). One participant did not state their age and one participant's age could not be calculated based on the provided information. As these missing values in the demographical data did not have an impact on the results of the inferential statistics, these participants' assessments were included in the further analyses of the hypotheses. The participants reported averaged situational coping scored from 17.22 to 100 ( $M=66.12$ ,  $SD=19.56$ ) and averaged stress levels from 0.00 to 75.70 ( $M=33.56$ ,  $SD=16.44$ ). Women reported significantly higher stress levels than men in this sample ( $p=.014$ ). This effect was small in size (Hedge's  $g=.47$ ).

#### 3.1. Results for Hypothesis 1 (The individual coping styles vary in the degree to which they influence the ability to cope with the momentary stress levels in everyday life.):

Table 2 shows the results of the linear multilevel model testing the effect of coping styles on situational coping. The effect of the SCI subscale *Positive Thinking* on situational coping was significant ( $p=.031$ ). The estimate was positive ( $\beta=1.76$ ). This means that higher scores in the coping style *Positive Thinking* were associated with higher situational coping in daily life. The effect of *Active Stress Coping* on situational coping was also significant

( $p=.038$ ). The estimate was also positive ( $\beta=1.85$ ), which means that higher scores in the subscale *Active Stress Coping* were associated with higher situational coping in daily life.

*Table 2*

*Fixed effects of the linear multilevel model testing the effect of coping styles on situational coping*

Parameter	Estimate	SE	df	<i>T</i>	<i>p</i>	95% CI
Intercept	26.93	14.80	117.07	1.820	.071	[-2.37, 56.24]
PT	1.76	.80	112.50	2.182	.031*	[.16, 3.36]
AS	1.85	.88	116.74	2.102	.038*	[.11, 3.59]
SS	.42	.71	114.36	.594	.554	[-.99, 1.84]
SF	-.79	.82	111.77	-.963	.337	[-2.41, .83]
AC	-.37	.68	113.10	-.544	.588	[-1.72, .98]

*Note.* CI = confidence interval, \*  $p < .05$ ., \*\*  $p < .001$ , women were coded as 0 and men were coded as 1 in this multilevel model, PT = Positive Thinking, AS = Active Stress Coping, SS = Social Support, SF = Support in Faith, AC = Increased Alcohol and Cigarette Consumption

### **3.2. Results for Hypothesis 2** (Women and men differ significantly in their coping.)

***Results for Hypothesis 2a*** (Women and men differ significantly in their coping styles.)

The results of the t-tests are depicted in table 3. Women scored significantly higher in the SCI subscale *Social Support* than men ( $p=.007$ ). The effect was positive ( $T=2.77$ ) and medium of size (Hedge's  $g=.056$ ). This result was still significant after Bonferroni correction. No gender differences between women and men were found for any of the other four coping styles.

Table 3

*Differences in coping styles between women and men*

	Women		Men		<i>T</i> ( <i>df</i> )	<i>p</i>	95% CI	<i>Hedge's g</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
PT	11.45	2.33	12.06	2.34	-1.39 (110)	.169	[-1.50, .27]	-0.26
AS	11.65	2.23	11.45	2.14	.48 (110)	.636	[-.63, 1.03]	0.09
SS	14.14	2.07	12.68	3.16	2.77 (73.77)	.007*	[.41, 2.51]	0.56
SF	7.27	2.31	6.45	2.23	1.87 (110)	.065	[-.10, 1.68]	0.35
AC	6.52	2.51	6.85	2.73	-.66 (110)	.513	[-1.32, .66]	-0.12

*Note.* CI = confidence interval, \*  $p < .05$ ., \*\*  $p < .001$ , PT = Positive Thinking, AS = Active Stress Coping, SS = Social Support, SF = Support in Faith, AC = Increased Alcohol and Cigarette Consumption

**Results for Hypothesis 2b** (Women and men differ significantly in their situational coping.)

Table 4 shows the results of the linear multilevel model testing the effect of gender on situational coping. The effect of gender on situational coping was significant ( $p=.003$ ). The estimate was positive ( $\beta=10.98$ ). As men were coded as 1 in this model, this means that men reported higher situational coping than women.

Table 4

*Fixed effect of the linear multilevel model testing the effect of gender on situational coping.*

Parameter	Estimate	SE	df	<i>T</i>	<i>p</i>	95% CI
Intercept	62,45	2.33	108.48	26.777	<.001**	[57.83, 67.07]
gender	10,98	3.65	112.07	3.009	.003*	[3.75, 18.21]

*Note.* CI = confidence interval, \*  $p < .05$ , \*\*  $p < .001$ , women were coded as 0 and men were coded as 1 in this multilevel model

### 3.3. Results for Hypothesis 3 (The influence of the coping styles on the ability to cope with the momentary stress levels in everyday life changes with different stress levels.)

Table 5 shows the results of the linear multilevel model testing the interaction effects of coping styles and stress level on situational coping. The effect of stress level on situational coping was significant ( $p<.001$ ). The estimate was negative ( $\beta=-.54$ ). This means that higher

stress levels were associated with lower situational coping in daily life. Furthermore, the cross-level interaction between the SCI subscale *Social Support* and momentary stress level was significant ( $p=.041$ ). The estimate was negative ( $\beta=-.01$ ). This means that *Social Support* had a less positive effect on situational coping at higher stress levels.

Table 5

*Fixed effects of the linear multilevel model testing the interaction effect of coping styles and stress level on situational coping*

Parameter	Estimate	SE	df	<i>T</i>	<i>p</i>	95% CI
Intercept	60.45	12.33	161.697	4.904	<.001**	[36.11, 84.80]
PT	.95	.66	147.708	1.434	.154	[-.359, 2.26]
AS	1.09	.73	163.841	1.486	.139	[-.359, 2.54]
SS	.39	.59	151.460	.665	.507	[-.77, 1.56]
SF	-.37	.68	149.210	-.554	.581	[-1.71, .96]
AC	.03	.57	157.826	.058	.954	[-1.09, 1.16]
Stress level	-.54	.14	2224.936	-3.728	<.001**	[-.82, -.26]
PT * stress level	.01	.007	2218.668	1.421	.156	[-.004, .02]
AS * stress level	.0005	.008	2227.232	.058	.954	[-.02, .02]
SS * stress level	-.01	.007	2224.265	-2.045	.041*	[-.03, -.001]
SF * stress level	-.005	.008	2226.28	-.668	.504	[-.021, .01]
AC * stress level	.005	.006	2221.95	.743	.457	[-.007, .02]

*Note.* CI = confidence interval, \*  $p < .05$ , \*\*  $p < .001$ , women were coded as 0 and men were coded as 1 in this multilevel model, PT = Positive Thinking, AS = Active Stress Coping, SS = Social Support, SF = Support in Faith, AC = Increased Alcohol and Cigarette Consumption

### 3.4. Results for Hypothesis 4 (Gender moderates the effect of the coping styles and stress level on the ability to cope with the momentary stress levels in everyday life.):

**Results for Hypothesis 4a** (Gender moderates the effect of coping styles on the ability to cope with the momentary stress levels in everyday life.):

Table 6 shows the results of the linear multilevel model evaluating the interaction effects of coping styles and gender on situational coping. The effect of *Social Support* was significant ( $p=.028$ ). The estimate was positive ( $\beta=2.35$ ). As women were coded as 0 in this model, this means that higher scores in the SCI subscale *Social Support* were associated with

higher situational coping for women. The two-way interaction effect between *Active Stress Coping* and gender was significant ( $p=.041$ ). The estimate was positive ( $\beta=3.62$ ). As men were coded as 1 in this model, this means that higher scores in the SCI subscale *Active Stress Coping* were associated with higher situational coping for men in comparison to women.

Table 6

*Fixed effects of the linear multilevel model testing the interaction effect of coping styles and gender on situational coping*

Parameter	Estimate	SE	df	<i>T</i>	<i>p</i>	95% CI
Intercept	8.51	19.53	105.42	.436	.664	[-30.22, 47.23]
PT	1.77	.97	108.13	1.814	.072	[-.16, 3.70]
AS	.44	1.02	109.43	.434	.665	[-1.58, 2.46]
SS	2.35	1.05	105.93	2.232	.028*	[.263, 4.44]
SF	-.46	.96	106.11	-.478	.633	[-2.37, 1.45]
AC	-.21	.86	105.34	-.240	.811	[-1.92, 1.50]
gender	15.57	29.00	118.71	.537	.592	[-41.86, 73.00]
PT * gender	-1.34	1.64	111.69	-.818	.415	[-4.58, 1.90]
AS * gender	3.62	1.75	123.24	2.069	.041*	[.16, 7.09]
SS * gender	-2.06	1.43	110.00	-1.434	.154	[-4.90, .79]
SF * gender	-.04	1.66	113.94	-.027	.979	[-3.34, 3.25]
AC * gender	-.26	1.31	113.32	-.198	.843	[-2.85, 2.34]

*Note.* CI = confidence interval, \*  $p < .05$ , \*\*  $p < .001$ , women were coded as 0 and men were coded as 1 in this multilevel model, PT = Positive Thinking, AS = Active Stress Coping, SS = Social Support, SF = Support in Faith, AC = Increased Alcohol and Cigarette Consumption

**Results for Hypothesis 4b** (Gender moderates the interaction between coping styles and stress level on the ability to cope with the momentary stress levels in everyday life.):

Table 7 shows the results for the multilevel model evaluating the effect of coping styles and stress levels on situational coping when gender was added as a predictor. When controlling for stress level, the effect of *Social Support* on situational coping was significant ( $p=.044$ ) and the estimate was positive ( $\beta=1.89$ ). As women were coded as 0 in this model this means that higher scores in the SCI subscale *Social Support* were associated with higher situational coping for women. The effect of stress level on situational coping was significant ( $p=.015$ ). The estimate was negative ( $\beta=-.46$ ), which means that higher stress levels were associated with

lower situational coping for women. The two-way interaction effect between social support and stress level was significant ( $p=.038$ ) and negative ( $\beta=-.02$ ). This means that social support had a less positive effect on situational coping at higher stress levels for women. Additionally, the three-way interaction effect between gender, *Social Support*, and stress level was significant ( $p=.031$ ) and positive ( $\beta=.03$ ). As men were coded as 1 in this model, this means that higher scores in the SCI subscale *Social Support* were associated with higher situational coping at higher stress levels for men in comparison to women. Furthermore, the three-way interaction effect between gender, *Increased Alcohol and Cigarette Consumption*, and stress level was significant ( $p=.019$ ) and positive ( $\beta=.03$ ). This means that higher scores on the SCI subscale *Increased Alcohol and Cigarette Consumption* were associated with higher situational coping at higher stress levels for men in comparison to women.



Table 7

*Fixed effects of the linear multilevel model testing the interaction effect of coping styles, gender, and stress level on situational coping*

Parameter	Estim					
	ate	SE	df	<i>T</i>	<i>p</i>	95% CI
Intercept	41.09	17.15	154.63	2.396	.018*	[7.21, 74.97]
PT	1.05	.84	149.72	1.249	.214	[-.61, 2.72]
AS	.20	.90	165.02	.217	.828	[-1.59, 1.98]
SS	1.89	.93	158.28	2.028	.044*	[.05, 3.72]
SF	-.14	.85	161.79	-.168	.866	[-1.83, 1.54]
AC	.79	.76	159.14	1.036	.302	[-.72, 2.30]
gender	26.29	25.50	171.80	1.031	.304	[-24.03, 76.62]
stress level	-.46	.19	2192.55	-2.427	.015*	[-.84, .09]
gender * PT	-.17	1.40	146.11	-.120	.905	[-2.93, 2.60]
gender * AS	2.09	1.54	178.99	1.355	.177	[-.95, 5.13]
gender * SS	-2.30	1.25	152.68	-1.842	.067	[-4.75, .17]
gender * SF	-.66	1.43	150.31	-.459	.647	[-3.48, 2.17]
gender * AC	-1.54	1.14	157.86	-1.351	.179	[-3.78, .71]
PT * stress level	.005	.008	2201.84	.631	.528	[-.01, .02]
AS * stress level	.006	.01	2221.20	.660	.509	[-.01, .03]
SS * stress level	-.02	.01	2205.74	-2.079	.038*	[-.04, -.001]
SF * stress level	.002	.01	2187.69	.214	.830	[-.02, .02]
AC * stress level	-.009	.008	2220.07	-1.112	.266	[-.02, .007]
gender * stress level	-.22	.32	2217.05	-.689	.491	[-.84, .40]
gender * PT * stress level	-.02	.02	2220.99	-.924	.355	[-.05, .02]
gender * AS * stress level	-.006	.02	2221.98	-.292	.771	[-.04, .03]
gender * SS * stress level	.03	.01	2221.99	2.163	.031*	[.003, .06]
gender * SF * stress level	-.01	.02	2201.61	-.536	.592	[-.06, .03]
gender * AC * stress level	.03	.01	2217.61	2.354	.019*	[.005, .06]

*Note.* CI = confidence interval, \*  $p < .05$ , \*\*  $p < .001$ , women were coded as 0 and men were coded as 1 in this multilevel model, PT = Positive Thinking, AS = Active Stress Coping, SS = Social Support, SF = Support in Faith, AC = Increased Alcohol and Cigarette Consumption

## 4. Discussion

### 4.1. Findings

This EMA study investigated the effects of five different coping styles (positive thinking, active stress coping, social support, support in faith, and alcohol and cigarette consumption) on situational coping in everyday life. It furthermore examined these effects at different stress levels. The results are summarized and interpreted gender-specifically, based on the conducted analyses. All hypotheses could partially be confirmed for at least one of the five coping styles.

**Hypothesis 1:** The SCI subscales *Positive Thinking* and *Active Stress Coping* had significant positive effects on situational coping in daily life. This result was in line with the hypothesis assuming differences between the coping styles in their effects on situational coping. Furthermore, this result corresponds with principal findings about the SCI coping scales, which showed that both *Positive Thinking* and *Active Stress Coping*, as well as *Social Support* were negatively correlated with stress symptoms (Satow, 2012). The effect of *Social Support*, on situational coping, however, did not reach statistical significance in this study.

**Hypothesis 2:** Women in our sample had higher scores on the SCI subscale *Social Support* than men with a medium effect size, indicating that women are more likely than men to use social support as a coping strategy in daily life, which confirms the hypothesis regarding gender-differences in coping styles and is in line with existing literature (Brougham et al., 2009; Steinert & Haesner, 2019; Tamres et al., 2002).

Additionally, men reported significantly higher situational coping than women in this sample. This might be explained by the fact that women in this sample reported higher stress levels than men, which is in line with previously mentioned research (Tamres et al., 2002; De Smet et al., 2005).

**Hypothesis 3:** Stress level had a significant negative effect on situational coping, which implies that a higher stress level negatively affects the ability to cope with situations in daily life. The negative interaction effect between *Social Support* and stress level furthermore suggests that seeking social support as a coping strategy is more effective in daily life situations with lower stress-intensities.

**Hypothesis 4a:** When investigating gender-specific effects of the coping styles on situational coping, social support was associated with higher situational coping in daily life. In comparison, the interaction effect between gender and *Active Stress Coping* suggests that active stress coping had a more positive effect on situational coping in daily life for men in comparison to women. This finding is interesting, as some studies show that women are more

likely to use active stress coping strategies than men (Brougham et al., 2009; Tamres et al., 2002). These studies, however, assessed the specific coping strategies used in stressful situations while the present study assessed the individual coping styles of the participants, which could account for some of the differences between the results and the literature.

**Hypothesis 4b:** In this sample, higher scores in the SCI subscale *Social Support* were associated with higher situational coping for women when controlling for stress level. Additionally, higher stress levels were associated with lower situational coping for women and social support had a less positive effect on situational coping at higher stress levels for women. Moreover, it seems that social support as a coping strategy is more effective at high stress levels for men in comparison to women. As discussed above, women are more likely to use social support as a coping strategy and seem to appraise stressors as more stressful than men (Tamres et al., 2002), which could also play a role in the results of the current study. In that study, women used active coping more than men when they appraised the stressor as more severe. In the current sample however, the interaction between *Active Stress Coping* and stress level did not reach statistical significance. As mentioned above, the specific coping strategies used in daily life by the participants were not assessed, but rather the tendency to use specific coping strategies, which could account for some of the differences between these results and the existing literature. Furthermore, the participants reported rather low stress levels in general which could have influenced the results as well. To investigate this circumstance and reach higher statistical power, the conducted analyses should be repeated in a sample with higher reported stress levels.

The three-way effect between *Increased Alcohol and Cigarette Consumption*, gender, and stress level indicates that the increased consumption of alcohol and cigarettes as a coping strategy has a positive effect on the ability to cope with especially stressful situations for men, in comparison to women. Although this study focused on coping, these findings match the results of other studies, which investigated the effects of alcohol and cigarette consumption on stress. On the one hand, higher stress levels seem to lead to a higher alcohol and cigarette consumption. A multitude of studies show that alcohol consumption can be predicted by high stress levels (e. g. Corbin et al., 2013; White et al., 2017). Regarding cigarette consumption, findings from Azagba and Sharaf (2011) indicate that high job stress is associated with higher smoking intensity and that this effect can be reduced by social support. On the other hand, the consumption of alcohol seems to have at least some short-term stress-response reducing features. In a study by Moberg et al. (2011), participants with higher blood alcohol levels showed a greater reduction of their stress response, whereas this effect was higher in situations

with high-intensity stressors, indicating that alcohol consumption can have an attenuating effect on the stress response, depending on dosage and stress intensity. The positive effects of alcohol consumption also seem to depend on personality traits. For example, Fairbairn et al. (2015) showed that more extraverted persons benefitted from greater mood improvement after alcohol consumption than less extraverted persons. Although the consumption of alcohol as a coping strategy might have some positive effects, at least in the short term, chronic alcohol use or abuse has negative effects on several neurological and physiological functions, including the HPA-Axis, which can lead to stress dysregulation in the long-term (Herman, 2012). Additionally, chronic alcohol consumption can lead to severe negative health consequences including liver diseases, cancer or stroke (McPherson, 2004). Smoking is also associated with a wide variety of negative health outcomes, increases overall mortality, and can cause cancer (Warren et al., 2014). Therefore, alcohol and cigarette consumption should not be promoted as adaptive coping strategies.

## **4.2. Limitations**

There are various restrictions and limitations that may have influenced the results of this study. One limitation of this study is the rather low internal validity due to the non-experimental design and the assessments being made in everyday life settings, which made it impossible to control for potential confounding variables. Additionally, the stressful situations were not assessed any further than the distinction between *work-related matters*, *private matters* or *other*, so that individual context variables during the assessments could not be controlled. Nevertheless, the ecological validity of this study is high as the assessment method of EMA allows the generalization of the results to everyday life contexts. Another limiting factor is that the sample was not recruited randomly, but rather at universities and in the social networks of the three student recruiters. The sample is therefore not representative of the general population. To maintain maximum anonymity, possible relationships between participants and recruiters were not assessed. Concerning future studies with the TYS app, it will be possible to recruit more representative samples when the TYS is made available in app stores. Furthermore, the sample did not report high stress levels, which also limits the generalizability.

Another limitation is that the participants did not fill out the questionnaires at the same time of day, which could account for different stress levels at the assessment points of time. Considering physiological stress-measures, such as the stress-related biomarker cortisol, which tends to spike in the morning and to gradually decrease over the course of the day (Doerr et al., 2015), it is possible that participants who filled out the questionnaires in the morning reported

higher stress levels than participants who filled out the questionnaires in the evening (Fischer et al., 2016). While some research suggests that the frequency of reporting stress can influence participants' subjective stress experience (Zawadski et al., 2019), results of a pilot study with the TYS app showed that stress levels did not change for participants using the app over the course of four weeks (Pryss et al., 2019). As the usage of time-stamps in TYS can account for time of day, it would be interesting to analyze the effects of daytime in future research. Moreover, it is important to note that the coping styles, conceptualized as the tendency to use certain coping strategies in daily life, were only once assessed at baseline. The participants did not report which specific coping strategies they actually used to deal with the stressful situations that were assessed during the study interval. Assessing coping multiple times a day at random time points would increase the obtained information. Nevertheless, the questionnaire used to assess the individual coping styles provides a reliable and valid instrument. Furthermore, possible pre-existing stress-related illnesses such as burnout or any other psychological and physiological illnesses that could have an impact on individual stress levels were not assessed and not taken into consideration during the analysis of the current data.

#### **4.3. Implications and Prospect**

The results of this study show that the effect of some coping styles on situational coping in daily life is moderated in part by momentary stress level and gender. These findings could be relevant for coping interventions aimed at increasing adaptive coping and reducing the consequences of chronic stress. Future studies should examine if coping interventions specifically tailored to women and men or varying stress levels could lead to better stress-outcomes than generalized interventions. The present findings suggest that active stress coping could be associated with better coping for men than for women. Gender differences for the other coping styles should, however, be interpreted with caution, as these effects did not reach significance. Nevertheless, the meaningfulness of gender-specific health promotion is also supported by findings from other studies. For instance, in a German study on health behaviors in university students, male students showed drug-taking behaviors more often, whereas female students showed preventive health behaviors such as healthy nutrition more often (Stock, Wille, & Krämer, 2001). Female students in that study furthermore showed stronger interest in most health promotion programs than male students and this interest could be predicted by alcohol consumption in male students and psychosocial stress in female students.

Monitoring stress levels and situational coping over a long period of time can raise stress awareness and make it easier to identify which strategies are effective to cope with stress

in daily life on a personalized level. In this regard, it would be relevant to assess which specific coping strategies individuals use in specific daily life situations. This could not only help monitor users' coping-behavior over longer periods of time, but also identify adaptive coping strategies that effectively reduce perceived stress levels in stressful situations. It would even be possible to combine TYS with an Ecological Momentary Intervention (EMI) to help individuals cope with stressful situations for example by mindful walking (Smyth & Heron, 2016; Pryss et al., 2018). A promising approach is to use so-called just-in-time interventions, which might support individuals when significant changes in stress levels or situational coping are detected (Clarke et al., 2017). In regard to this, event-based assessments in especially stressful situations could be incorporated as an alternative to mechanisms detecting elevated stress levels in individuals (Smyth et al., 2018). A recent study showed that participants' previous stress ratings were most successful at predicting future stress ratings on a larger scale and that environmental factors were most successful at predicting future stress ratings on a more individual level (Rozet et al., 2019). When using machine learning to predict changes in stress levels in order to apply just-in-time interventions, it would therefore be advisable to start with large-scale data pooling and switch to individual assessments and predictors when enough data is collected to apply individual interventions. Such a procedure might be useful in burnout prevention programs that aim to reduce stress-inducing factors at the workplace. Monitoring stress levels over a longer period of time and assessing what specific context variables are associated with high stress levels at work could help design personalized coping-interventions that fit users' everyday work-life and reduce specific stress-related health risks. TYS could additionally be used in the treatment of mental disorders. Some psychopathological symptoms, e.g. dissociation in borderline personality disorder, increase with high stress levels (Stiglmayr et al., 2007). TYS could be used to monitor stress levels of patients with such symptoms and identify context variables that are associated with increased stress levels.

Moreover, most findings about stress responses and coping come from studies conducted in laboratory settings. The use of mHealth apps such as TYS allows researchers to study the experience of stress and coping in real-world contexts and to investigate whether findings from studies with laboratory settings can be transferred to everyday life contexts.

Future studies with TYS should focus on controlling possible confounding variables to increase internal validity, by more specifically assessing the stressful situations assessed, the context variables or adding a control group. It would also be advisable to test the hypotheses of the current study with samples that experience more higher stress intensities on a regular basis, such as emergency room nurses. Participants could also be asked to fill out the

questionnaires in especially stressful situations. Prospective studies could also aim to gain a more comprehensive insight into the stress experience in everyday life by combining the subjective stress-measures of TYS with physiological measures such as stress-related biomarkers or immunologic parameters. Assessing any pre-existing conditions that could impact the experienced stress levels of the participants, such as burnout or chronic illnesses, should also be considered in the future.

Several studies using the mHealth app TYS to measure the subjective stress experience are planned for the future. In the course of my dissertation, I plan to combine these subjective measures with samples of the stress-related salivary biomarkers cortisol and alpha-amylase to obtain a more comprehensive view of the experience of stress and physiological stress responses in daily life. The first of these studies will concern the stress reactivity of individuals in everyday life. The second study will concern interpersonal dyadic stress in romantic relationships. It is planned to include a measure of interpersonal stress into the TYS app for this specific study. The aim of this study will be to investigate the bleed-over of daily-life stress into intimate relationships as well as the bleed-over of dyadic stress into daily life. Finally, the third study will be a randomized controlled trial (RCT) that will combine subjective and physiological stress assessments with an intervention aimed at reducing stress levels in daily life. The aim of this RCT will be to investigate whether such an intervention can reduce perceived stress levels and whether it also has an impact on stress-related biomarker-levels. For any of these studies it would be interesting to implement a semi-random or stratified random sampling protocol with multiple assessments per day, gathered during periods of situational coping in high-stress situations, to investigate daily fluctuations in situational coping. Defining specific strata or time intervals during a day, during which assessments are scheduled at random, ensures that assessments are evenly sampled throughout the day (Shiffman, Stone, & Hufford, 2008).

#### **4.4. Conclusion**

Habitual positive thinking and active stress coping were associated with better situational coping in daily life settings. While social support seemed to be a better coping style for women, active stress coping was associated with better situational coping for men. These results suggest that different coping styles could be more effective in daily life for women than for men, which could be considered in the development of interventions aimed at reducing stress consequences through coping. Furthermore, the effects of some coping styles varied at different stress levels,

which could also be considered when designing such interventions. Some coping strategies might lead to different results depending on the stress level of the situation they are applied in.



## References

- Al-Bahrani, M., Aldhafri, S., Alkharusi, H., Kazem, A., & Alzubiadi, A. (2013). Age and gender differences in coping style across various problems: Omani adolescents' perspective. *Journal of Adolescence*, 36, 303-309. doi: 10.1016/j.adolescence.2012.11.007
- Azagba, S., & Sharaf, M. (2011). The effect of job stress on smoking and alcohol consumption. *Health Economics Review*, 1, 1–14. doi: 10.1186/2191-1991-1-15
- Blanchard-Fields, F., Sulsky, L., & Robinson-Whelen, S. (1991). Moderating effects of age and context on the relationship between gender, sex role differences, and coping. *Sex Roles*, 25(11-12), 645-660. doi: 10.1007/BF00289569
- Brougham, R., Zail, C., Mendoza, C., & Miller, J. (2009). Stress, Gender Differences, and Coping Strategies Among College Students. *Current Psychology*, 28, 85-97. doi: 10.1007/s12144-009-9047-0
- Carver, C. S., & Conner-Smith, J. (2010). Personality and coping. *Annual Review of Psychology*, 61, 679-704.
- Carver, C. S. (2011). Coping. In: Contrada, R. J. & Baum, A. (Eds.), *The Handbook of Stress Science: Biology, Psychology, and Health*. Springer, New York, 221–229.
- Clarke, S., Jaimes, L., & Labrador, M. (2017). MStress: A mobile recommender system for just-in-time interventions for stress. *2017 14th IEEE Annual Consumer Communications & Networking Conference (CCNC)*, 2017, 1-5. doi: 10.1109/CCNC.2017.8015367
- Cohen, S., Kamarck, T., & Mermelstein, R. A. (1983). Global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 385-396. doi: 10.2307/2136404
- Cohen, S., Janicki-Deverts, D., Miller, G. E. (2007). Psychological Stress and Disease. *Journal of the American Medical Association*, 298, 1685–1687. doi:10.1001/jama.298.14.1685
- Corbin, W., Farmer, N., & Nolen-Hoekesma, S. (2013). Relations among Stress, Coping Strategies, Coping Motives, Alcohol Consumption and Related Problems: A Mediated Moderation Model. *Addictive Behaviors*, 38, 1912-919. doi: 10.1016/j.addbeh.2012.12.005

- De Smet, Sans, Dramaix, Boulenguez, De Backer, Ferrario, . . . Kornitzer. (2005). Gender and regional differences in perceived job stress across Europe. *The European Journal of Public Health, 15*, 536-545. doi: 10.1093/eurpub/cki028
- Doerr, J., Ditzen, B., Strahler, J., Linnemann, A., Ziemek, J., Skoluda, N., . . . Nater, U. (2015). Reciprocal relationship between acute stress and acute fatigue in everyday life in a sample of university students. *Biological Psychology, 110*, 42-49. doi: 10.1016/j.biopsycho.2015.06.009
- Durlak, J. (2009). How to select, calculate, and interpret effect sizes. *Journal of Pediatric Psychology, 34*, 917-928. doi: 10.1093/jpepsy/jsp004
- Faasse, K. & Petrie, K. (2015). Stress, Coping and Health. In J. D. Wright, ed. *International Encyclopedia of the Social & Behavioral Sciences*. New York: Elsevier, 551-555.
- Fairbairn, C., Sayette, M., Wright, A., Levine, J., Cohn, J., & Creswell, K. (2015). Extraversion and the Rewarding Effects of Alcohol in a Social Context. *Journal of Abnormal Psychology, 124*, 660-673.
- Fischer, S., Doerr, J., Strahler, J., Mewes, R., Thieme, K., & Nater, U. (2016). Stress exacerbates pain in the everyday lives of women with fibromyalgia syndrome--The role of cortisol and alpha-amylase. *Psychoneuroendocrinology, 63*, 68-77. doi: 10.1016/j.psyneuen.2015.09.018
- Folkman, S. (2010). Stress, coping, and hope. *Psycho-Oncology, 19*, 901-908. doi: 10.1002/pon.1836
- Frazier, P. A., Mortensen, H., & Steward, J. (2005). Coping strategies as mediators of the relations among perceived control and distress in genderual assault survivors. *Journal of Counselling Psychology, 52*, 267-278. doi: 10.1037/0022-0167.52.3.267
- Hänninen, V., & Aro, H. (1996). Sex differences in coping and depression among young adults. *Social Science & Medicine, 43*, 1453-1460. doi: 10.1016/0277-9536(96)00045-7
- Herman, J. (2012). Neural pathways of stress integration: Relevance to alcohol abuse. *Alcohol Research : Current Reviews, 34*, 441-447.
- Kazdin, A. E. (2017). Addressing the treatment gap: a key challenge for extending evidence-based psychosocial interventions. *Behaviour Research and Therapy, 88*, 7-18. doi: 10.1016/j.brat.2016.06.004

- Kelliher, C., & Anderson, D. (2010). Doing more with less? Flexible working practices and the intensification of work. *Human Relations*, 63, 83-106. doi:10.1177/0018726709349199
- Kelly, M., Tyrka, A., Price, L., & Carpenter, L. (2008). Sex differences in the use of coping strategies: Predictors of anxiety and depressive symptoms. *Depression and Anxiety*, 25, 839-846. doi: 10.1002/da.20341
- Kirschbaum, C., Pirke, K., & Hellhammer, D. (1993). The 'Trier Social Stress Test' – A Tool for Investigating Psychobiological Stress Responses in a Laboratory Setting. *Neuropsychobiology*, 28(1-2), 76-81. <http://dx.doi.org/10.1159/000119004>
- Kossek, E. E., Lautsch, B. A., & Eaton, S. C. (2009). "Good teleworking": Under what conditions does teleworking enhance employee's well-being? In Y. Amichai Hamburger (Ed.), *Technology and Psychological Well-Being*. Cambridge: Cambridge University Press.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer, New York.
- Lazarus, R. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology*, 44, 1-22. doi: 10.1146/annurev.ps.44.020193.000245
- Lindert, J., Schick, A., Reif, A., Kalisch, R., & Tüscher, O. (2018). Verläufe von Resilienz – Beispiele aus Längsschnittstudien. *Der Nervenarzt*, 89, 759-765. doi: 10.1007/s00115-018-0536-y
- McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine*, 338, 171-179.
- McPherson, K. (2004). Disaggregating the health consequences of alcohol by age and gender. *Addiction*, 99, 661-662. doi: 10.1111/j.1360-0443.2004.00751.x
- Moberg, C., Weber, A., & Curtin, S. (2011). Alcohol dose effects on stress response to cued threat vary by threat intensity. *Psychopharmacology*, 218, 217-227. doi: 10.1007/s00213-011-2304-6
- Nater, U. M., Ditzen, B., & Ehlert, U. (2011). Stressabhängige körperliche Beschwerden. In H. U. Wittchen & J. Hoyer (Hrsg.), *Klinische Psychologie & Psychotherapie*. (S.1040-1051). Berlin Heidelberg: Springer Verlag. doi: 10.1007/978-3-642-13018-2\_48

- O'Connell, A., & McCoach, D. (2004). Applications of Hierarchical Linear Models for Evaluations of Health Interventions: Demystifying the Methods and Interpretations of Multilevel Models. *Evaluation & the Health Professions*, 27, 119-151. doi: 10.1177/0163278704264049
- Pryss, R., Reichert, M., John, D., Frank, J., Schlee, W., Probst, T. (2018). A personalized sensor support tool for the training of mindful walking. In: Proceedings of the 15th International Conference on Wearable and Implantable Body Sensor Networks. Presented at: BSN'18; March 4-7, 2018; Las Vegas, NV, USA p. 114-117.
- Pryss, R., John, D., Schlee, W., Schlotz, W., Schobel, J., Kraft, R., . . . Probst, T. (2019). Exploring the Time Trend of Stress Levels While Using the Crowdsensing Mobile Health Platform, TrackYourStress, and the Influence of Perceived Stress Reactivity: Ecological Momentary Assessment Pilot Study. *JMIR MHealth and UHealth*, 7, E13978. doi: 10.2196/13978
- Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin*, 128, 330–366. Doi: 10.1037/0033-2909.128.2.330
- Roesch, S., & Weiner, B. (2001). A meta-analytic review of coping with illness: Do causal attributions matter? *Journal of Psychosomatic Research*, 41, 813-819. doi: 10.1016/S0022-3999(01)00188-X
- Rozet, A., Kronisch, J. M., Schwartz, J. E., & Davidson, K. W. (2019). Using machine learning to derive just-in-time and personalized predictors of stress: Observational study bridging the gap between nomothetic and idiographic approaches. *Journal of Medical Internet Research*, 21:e12910. doi: 10.2196/12910
- Schlotz, W., Yim, I. S., Zoccola, P. M., Jansen, L., & Schulz. P. (2011). The perceived stress reactivity scale: Measurement invariance, stability, and validity in three countries. *Psychological Assessment*, 23, 80-94. doi: 10.1037/a0021148
- Schlotz, W. (2019). Investigating associations between momentary stress and cortisol in daily life: What have we learned so far? *Psychoneuroendocrinology*, 105, 105-116. Doi: 10.1016/j.psyneuen.2018.11.038

- Schneiderman, N., Ironson, G., & Siegel, S. D. (2005). Stress and health: Psychological, behavioral, and biological determinants. *Annual Review of Clinical Psychology*, 1, 607-628. doi: 10.1146/annurev.clinpsy.1.102803.144141
- Schulz, P. J., Jansen, L., & Schlotz, W. (2005). Stressreaktivität: Theoretisches Konzept und Messung. *Diagnostica*, 51, 124-133. doi: 10.1026/0012-1924.51.3.124
- Satow, L. (2012). Stress-und Coping-Inventar (SCI): Test-und Skalendokumentation. Retrieved from: <http://www.drsatow.de> (accessed 25. 1. 2020)
- Seegerstrom, S., & Miller, G. (2004). Psychological Stress and the Human Immune System: A Meta-Analytic Study of 30 Years of Inquiry. *Psychological Bulletin*, 130, 601-630. doi: 10.1037/0033-2909.130.4.601
- Selye, H. (1936). A Syndrome produced by diverse nocuous agents. *Nature*, 138, 32-32. doi: 10.1038/138032a0
- Seiffge-Krenke, I., & Klessinger, N. (2000). Long-term effects of avoidant coping on adolescents' depressive symptoms. *Journal of Youth and Adolescence*, 29, 617-630. doi: 10.1023/A:1026440304695
- Shiffman, S., Stone, A., & Hufford, M. R. (2008). Ecological momentary assessment. *Annual Review of Clinical Psychology*, 4(1), 1-32. doi: 10.1146/annurev.clinpsy.3.022806.091415
- Smyth, J., & Heron, K. (2016). Is providing mobile interventions "just-in-time" helpful? an experimental proof of concept study of just-in-time intervention for stress management. *2016 IEEE Wireless Health (WH)*, 1-7. doi: 10.1109/WH.2016.7764561
- Smyth, J., Sliwinski, M., Zawadzki, M., Scott, S., Conroy, D., Lanza, S., . . . Almeida, D. (2018). Everyday stress response targets in the science of behavior change. *Behaviour Research and Therapy*, 101, 20-29. doi: 10.1016/j.brat.2017.09.009
- Southwick, S., & Charney, D. (2012). The science of resilience: Implications for the prevention and treatment of depression. *Science (New York, N.Y.)*, 338, 79-82. doi: 10.1126/science.1222942
- Stansfeld, S. B., & Candy, B. (2006). Psychosocial work environment and mental health – a meta-analytic review. *Scandinavian Journal of Work Environment and Health*, 32, 443-462.

- Steinert, A., & Haesner, M. (2019). Stress in Retired Adults – Stressors, Symptoms and Coping Strategies. *Ageing International*, 44, 129-140. doi: 10.1007/s12126-018-9327-9
- Stiglmayr, C., Ebner-Priemer, U. W., Bretz, J., Behm, R., Mohse, M., Lammers, C. H., . . . & Bohus, M. (2007). Dissociative symptoms are positively related to stress in borderline personality disorder. *Acta Psychiatrica Scandinavica*, 117, 139 –147. doi: 10.1111/j.1600-0447.2007.01126.x
- Stock, C., Wille, L., & Krämer, A. (2001). Gender-specific health behaviors of German university students predict the interest in campus health promotion. *Health Promotion International*, 16(2), 145-154. Doi: 10.1093/heapro/16.2.145
- Stone, A. A., & Shiffman, S. (1994). Ecological momentary assessment in behavioral medicine. *Annals of Behavioral Medicine*, 16, 199 –202.
- Tamres, L., Janicki, D., & Helgeson, V. (2002). Gender Differences in Coping Behavior: A Meta-Analytic Review and an Examination of Relative Coping. *Personality and Social Psychology Review*, 6, 2-30. Doi: 10.1207/S15327957PSPR0601\_1
- Taylor, S., & Stanton, A. (2007). Coping resources, coping processes, and mental health. *Annual Review of Clinical Psychology*, 3, 377-401. doi: 10.1146/annurev.clinpsy.3.022806.091520
- Trull, T., & Ebner-Priemer, U. (2009). Using Experience Sampling Methods/Ecological Momentary Assessment (ESM/EMA) in Clinical Assessment and Clinical Research: Introduction to the Special Section. *Psychological Assessment*, 21, 457-462. doi: 10.1037/a0017653
- Ursin, H., & Eriksen, H. R. (2004). The cognitive activation theory of stress. *Psychoneuroendocrinology*, 29, 567-529. doi: 10.1016/S0306-4530(03)00091-X
- Warren, G., Alberg, A., Kraft, A., & Cummings, K. (2014). The 2014 Surgeon General's report: The Health Consequences of Smoking—50 Years of Progress: A paradigm shift in cancer care. *Cancer*, 120, 1914-1916. doi: 10.1002/cncr.28695
- White, H., Anderson, K., & Beardslee, J. (2017). Stress, coping, and alcohol use in young adulthood. *Alcohol*, 60, 242. doi: 10.1016/j.alcohol.2017.02.349

- Woodhead, E., Cronkite, R., Moos, R., & Timko, C. (2014). Coping strategies predictive of adverse outcomes among community adults. *Journal of Clinical Psychology*, 70, 1183-1195. doi: 10.1002/jclp.21924
- Zawadzki, M. J., Scott, S. B., Almeida, D. M. et al. Understanding stress reports in daily life: A coordinated analysis of factors associated with the frequency of reporting stress. *Journal of Behavioral Medicine*, 42, 545-560. <https://doi.org/10.1007/s10865-018-00008-x>

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