SCM
Studies in Communication and Media

FULL PAPER

Watching down cortisol levels?
Effects of movie entertainment on psychophysiological recovery

Filme zur Stress-Reduktion?
Die Wirkung von unterhaltsamen Filmen auf die physiologische Erholung

Diana Rieger & Gary Bente

Diana Rieger (Jun.-Prof. Dr.), Department of Media and Communication Studies, University of Mannheim, B 6, 30-32, 68159 Mannheim, Germany; Contact: diana.rieger(at)uni-mannheim.de

Gary Bente (Prof. Dr.), Department of Communication, Michigan State University, 404 Wilson road, East Lansing, MI 48824; Contact: gabente(at)msu.edu

FULL PAPER

Watching down cortisol levels?
Effects of movie entertainment on psychophysiological recovery

Filme zur Stress-Reduktion?
Die Wirkung von unterhaltsamen Filmen auf die physiologische Erholung

Diana Rieger & Gary Bente

Abstract: Research on recovery from stress demonstrated that entertaining movies increase psychological detachment and relaxation. In addition, entertainment experiences foster feelings of vitality and thereby contribute to well-being. The current study tested whether movies can be beneficial after stressful situations in order to recover. Saliva cortisol was assessed to relate a physiological measure to experiences of recovery and vitality. In an experiment (N = 60), participants were stressed before they either watched a hedonic, a eudaimonic, or a calm, neutral movie. Results demonstrated that media stimuli amplify recovery experiences when they convey more entertainment experiences (hedonic and/or eudaimonic). Further, cortisol levels influenced vitality by enhancing energetic arousal and affect. These results are discussed regarding the interpretation of physiological indicators to study work strain.

Keywords: Stress, entertainment experiences, cortisol, recovery experiences, vitality

Zusammenfassung: Die Forschung zu Erholung von Stress zeigt, dass unterhaltsame Filme bei den Rezipient*innen psychologische Distanzierung und Entspannung nach stressvollen Zuständen fördern können. Zusätzlich kann das Unterhaltungserleben zum Empfinden von Vitalität führen und damit zum Wohlbefinden beitragen. Die vorliegende Studie untersuchte, ob Filme nach stressvollen Situationen förderlich sein können, um sich wieder zu erholen. Wir haben bei den Versuchspersonen den Kortisolspiegel erfasst, um einen physiologischen Indikator von Stress mit Erholungserfahrungen durch Medieninhalte und dem subjektiven Erleben von Vitalität in Verbindung zu setzen. In einem Experiment (N = 60) wurden die Versuchspersonen gestresst bevor sie entweder einen hedonischen, einen eudaimonischen oder einen ruhigen, neutralen Film sehen konnten. Die Ergebnisse verdeutlichen, dass Medieninhalte insgesamt zu der Erfahrung von Erholung beitragen. Darüber hinaus beeinflusst der Kortisolspiegel die empfundene Vitalität, auf Erregungs- und Affektebene. Diese Ergebnisse werden in Hinblick auf ihre Interpretation von physiologischen Indikatoren im Zusammenhang mit der Erforschung von Stress und Erholung durch Medieninhalte diskutiert.

Stichwörter: Stress, Unterhaltungserleben, Kortisol, Erholungserfahrungen, Vitalität

Acknowledgments: The authors want to thank Svenija Bräutigam, Yvonne Kaiser, and Maike Vianden for their effort in this project, their help during data collection and the interesting discussions about the topic.

1. Introduction

Many studies have focused on the impact of media on health and well-being by their potential to regulate negative mood states, reduce stress and foster relaxation (Nabi & Krcmar, 2004). This self-regulatory function of media use is conceptualized within mood management theory (MMT; Zillmann, 1988b; Zillmann & Bryant, 1985). MMT is based on the assumption that humans have a hedonic motivation to terminate negative states and to strive for more positive and pleasurable moods and levels of arousal (Knobloch-Westerwick, 2006). The theory proposes that users selectively expose themselves to media stimuli that fulfill these hedonic goals in order to regulate arousal and to facilitate desired affective states.

This perspective has been expanded by recent research drawing a broader link between entertainment media and its potential effects in fostering recovery. Recovery can be defined as a process in which functional capacities that have been demanded during a stressful event or experience return to their pre-stress levels (Meijman & Mulder, 1998). In a series of studies, Reinecke and colleagues (2009a, 2009b; Reinecke, Klatt, & Krämer, 2011) demonstrated that the use of entertaining media is associated with the satisfaction of multiple *recovery needs* and leads to subjective experiences of recovery and is related to several beneficial health outcomes, such as increased cognitive performance and vitality (Reinecke et al., 2011; Reinecke & Trepte, 2008).

Moreover, research on recovery via media stimuli provided evidence for beneficial effects of non-hedonic media. Rieger, Reinecke and Bente (2017) found movie stimuli with positive as well as negative affective valence impacted recovery, vitality and cognitive performance. Further, drawing upon recent theories distinguishing hedonic from so called eudaimonic entertainment media, different pathways to recovery were identified (Rieger, Reinecke, Frischlich, & Bente, 2014). While for example lighthearted comedies may trigger a hedonic entertainment experience, an eudaimonic experience may be evoked by media of artistic value, such as meaningful portrayals that focus on human virtues (e.g., justice, courage or honesty), which may encourage the viewer to reflect on his or her own life or life in general (Oliver & Bartsch, 2011; Oliver & Hartmann, 2010). A hedonic experience is qualified by positive affect and fun, whereas a eudaimonic experience co-occurs with so-called meaningful affect, such as feeling inspired or moved (Oliver & Bartsch, 2010) and facilitates reflective thoughts after the reception (Bartsch, Kalch, & Oliver, 2014).

Although existing research on media-induced recovery provides strong indicators of the positive recovery potential of entertaining media content, it has two main limitations:

(1) So far, research on media-induced recovery has mainly focused on measuring effects through self-reports. However, certain processes – in particular in the context of stress and recovering from it – might unfold without conscious aware-

ness (Koole & Rothermund, 2011). Further, endocrinological or psychophysiological aspects of self-regulation are not necessarily associated with the subjective experience of stress or its regulation. In particular, media content that contains highly entertaining elements, such as pleasurable or relaxing content can even induce bodily stress, e.g., football games, thrillers, erotic movies (Zillmann, 1991b). It is thus possible that physiological features of stress contradict subjectively experiences of stress.

Further, indicators of subjective well-being on the connection between entertainment consumption and well-being that have been used in previous research (e.g., vitality) have theoretically and empirically been linked to somatic and psychological factors (Ryan & Frederick, 1997). While previous research has provided evidence for vitality depending on the absence of stress and the presence of positive affect, the somatic aspect of these constructs has seldom been investigated. Consequently, assessing biological aspects of stress, namely through the assessment of cortisol levels, might contribute to our understanding of what recovering from stress and strain through entertainment media means on a physiological as well as a subjective level (Nabi, Prestin, & So, 2016).

(2) Previous studies have mainly compared different media conditions with a non-media control condition in which participants were asked to wait. These media conditions either elicited positive or negative affect, or evoked a hedonic or eudaimonic entertainment experience in participants. The possibility that also calm and neutral media stimuli can have positive effects (e.g., Bryant & Zillmann, 1984) that do not necessarily evoke strong affective reactions or entertainment experiences in the viewers, has not been addressed yet. Moreover, in a recent study by Nabi, and colleagues (2016), the amount of television viewing increased cortisol levels in some conditions, while it decreased cortisol levels in others. Besides a main effect for gender, they also found that cortisol level regulation weakly depended on the type (genre) of television consumption. That is, the type of media content should be considered when investigating media effects on recovery and well-being.

The present study therefore aims at extending existing research in two important ways: 1) We present a study in which a hedonic, a eudaimonic and a third neutral stimulus are compared regarding their impact on bodily and subjective stress, recovery and vitality. It focuses on the impact of entertainment experiences as an audience response originating from three different types of media stimuli. 2) We assess saliva cortisol levels in order to provide evidence for a biomarker of stress in the context of work strain and the impact of media offerings on physiological processes, recovery and post-receptive vitality (energetic arousal and positive affect).

2. Recovery and the use of non-interactive media content

In everyday life, work as well as non-work related activities can demand mental and physical resources and thereby lead to physiological and psychological fatigue, negative affect, and the need for recovery (Fuller et al., 2003; Sluiter, Van Der Beek, & Frings-Dresen, 1999). In order to satisfy this need for recovery,

phases of rest (e.g., when stressors are absent) are required for depleted resources to return to baseline levels without any specific environmental demands (Craig & Cooper, 1992; Meijman & Mulder, 1998). Sonnentag and Zijlstra (2006) thus have defined recovery as "the process of replenishing depleted resources or rebalancing suboptimal systems" (p. 331).

Several dimensions of experiencing recovery were proposed: psychological detachment, relaxation, mastery experiences and control experiences (Sonnentag & Fritz, 2007). For the current paper, especially the first two dimensions are of importance. *Psychological detachment* means to have mental distance from work or stress-related cognitions (Sonnentag & Fritz, 2007). Detachment is necessary to stop work-related preoccupations and their detrimental effects on well-being (Sonnentag & Bayer, 2005), and the process of replenishment (Fritz, Sonnentag, Spector, & McInroe, 2010). The arousal aspects of recovery relate to *relaxation*. Heightened levels of physiological and psychological arousal can be the result of work-related stress. According to the theory, they should return to baseline levels during leisure time to ensure cognitive functioning (Meijman & Mulder, 1998). Further, a lack of relaxation thwarts the recovery process and leads to negative affect. In contrast, one important aspect of fostering relaxation is positive affect (Sonnentag & Fritz, 2007)

Bridging this research with media effects research, there is considerable evidence for the recovery potential of interactive and non-interactive entertaining media. Reinecke (2009a, 2009b) found that all four recovery dimensions are an integral part of the video gaming experience. This impact of media to foster recovery has been linked to further outcomes beyond the mere subjective experience: For instance, video games can improve performance in a concentration test (Reinecke & Trepte, 2008). In contrast, Reinecke and colleagues (2011) found that non-interactive media are less able to foster mastery and control experiences than interactive stimuli. In particular, the use of non-interactive media was effective in terms of psychological detachment and relaxation but only marginally affected mastery experiences and control.

As far as non-interactive media are concerned, Rieger, Reinecke, and Bente (2017) tested the effects of different types of movies on recovery and well-being. Results demonstrate that movie stimuli with a positive compared to those with a negative affective valence contribute to recovery via different mechanisms: While negative (eudaimonic) movie scenes enhanced (subjective) arousal levels and thereby led to a higher recovery experience, positive movie scenes enhanced people's mood and thereby fostered relaxation. Compared to a non-media control group, both media conditions led to higher levels of psychological detachment. In line with the results obtained by Reinecke and colleagues (2011), mastery experience and control did not play a relevant role for the recovery potential of non-interactive media in those studies. Due to these results, the present study solely focusses on the two recovery dimensions previously associated with non-interactive media, psychological detachment and relaxation.

Based on the distinction between hedonic and eudaimonic entertainment (Vorderer, 2011), we selected movie stimuli that fostered either a hedonic entertainment experience or a eudaimonic experience because both were found to contrib-

ute differentially to recovery (Janicke, Rieger, Reinecke, & Connor III, 2017; Janicke-Bowles, Rieger & Connor III, 2018; Rieger, Reinecke, et al., 2014). A suitable comparison that had been overlooked in previous studies is that of a media stimulus eliciting low levels of both entertainment experiences. Therefore, in the present study we compared a predominantly hedonic stimulus, a predominantly eudaimonic one and a third neutral stimulus with neither hedonic nor eudaimonic content.

Research referring to MMT has repeatedly demonstrated the strong intervention potential of media use and its ability to interrupt ruminations about negative events and stressors (Knobloch-Westerwick, 2006; Zillmann, 1988b, 1991a). Intervention potential is defined as a medium's ability to capture an individual's attentional resources (Bryant & Davies, 2006).

Generally, it is argued that messages with higher intervention potential are more likely to distract an individual from the root cause of their noxious mood state. Prior research has demonstrated that intervention potential is influenced in part by attributes found in message content, such as the hedonic valence (Knobloch et al., 2003; Zillmann et al., 2001) or the amount of cognitive demand (Bowman & Tamborini, 2012). Connecting these results to eudaimonic and hedonic entertainment, hedonic experiences as well as challenging, demanding (eudaimonic) experiences can be associated with a higher likelihood of interrupting ruminations or cognitive distraction from own preoccupations. In contrast, media content that is less prone to elicit strong hedonic and/or eudaimonic experiences should be less effective in interfering with unpleasant mood or stress levels.

Relating these findings to the idea of media stimuli providing psychological detachment, through media's high potential to direct people's attention away from themselves, movie stimuli were found to help in forgetting and distancing from work-related preoccupations (Janicke et al., 2017; Reinecke, 2009a, 2009b; Reinecke et al., 2011; Rieger, Reinecke, et al., 2014, 2017). Specifically, hedonically pleasant as well as challenging movies amplified psychological detachment in comparison to a control condition (Rieger, Reinecke, et al., 2014, 2017). Based on this logic, we expected that participants in the hedonic media condition as well as participants in the eudaimonic media condition will report higher levels of psychological detachment than those in the neutral, soothing media condition (H1).

Relaxation, as the second sub-dimension of recovery, was expected to significantly differ among the three movie stimuli. Building upon prior research, the reception of especially hedonic media entertainment was expected to foster relaxation. Many studies in the context of MMT provide evidence for the mood alleviating effect especially of hedonic media (Zillmann, 1988a, 1988b) which has been described as one factor contributing to relaxation (Sonnentag & Fritz, 2007) and has already been identified as a predictor for recovery. Further, recovering through a hedonically pleasant media stimulus was driven by an increase in positive affect (Rieger, Bowman, Frischlich, & Bente, 2014) which is a specific component of hedonic media (see pretest in the method section). Hedonically pleasant media were also found to lead to higher levels of relaxation compared to a more negatively-valenced (eudaimonic) stimulus and a non-media control condition (Rieger, Reinecke, et al., 2017).

Notably – through the processes already described – eudaimonic as well as soothing media content can also contribute to relaxation (through positive affect and lowering of arousal). However, previous research also demonstrated that even for stressed individuals soothing media content might not be the choice in order to regulate stress levels (Bryant & Zillmann, 1984; Zillmann, 1988b). Concluding that relaxation can best be achieved through media content that fosters arousal regulation in combination with increasing positive affect, we stated the following second hypothesis: Participants in the hedonic media condition will report higher levels of relaxation than those in the eudaimonic media condition and the neutral, soothing condition (H2).

3. The components of vitality

Stress and strain can significantly affect individual arousal levels, and returning to a baseline level of arousal is a crucial part of the recovery process (Meijman & Mulder, 1998). In the context of mood repair and recovery, arousal regulation can take the form of either unwinding from noxious states of arousal (Bryant & Zillmann, 1984; Sonnentag & Fritz, 2007) or of restoring vitality (Ryan & Frederick, 1997).

Previous studies on media-induced recovery have linked it to further recovery outcomes that indicated re-established energy (Reinecke et al., 2011; Rieger, Reinecke, et al., 2014). Energetic arousal refers to "subjective sensations of energy, vigor, or peppiness" (Thayer, 1989, p. 6) and hence reflects the energy subjectively available to the individual. It is contrasted with tense arousal that reflects negative aspects of activation associated with being tense, strained and stressed.

Prolonged work and the consumption of resources during demanding situations result in feelings of tiredness and fatigue (Craig & Cooper, 1992) increasing the need for a restoration of energetic arousal. Prior research grounded in MMT identified the excitatory potential of a medium to crucially affect individual levels of energetic arousal. For instance, Knobloch and Zillmann (2002) revealed a significant positive association between selective exposure to energetic music and levels of energetic arousal after music consumption. In a related vein, Reinecke and Trepte (2008) found that participants who had played a video game showed higher levels of energetic arousal than participants who were not exposed to a video game. These results underline the potential of media messages with high excitatory potential to energize media users and to ameliorate fatigue.

Previous studies have often used energetic arousal as measurement of vitality. However, Ryan and Frederick (1997) argued vitality to be associated with being positive and enthusiastic. Thus, a positive mood can also be regarded as part of vitality which is not covered within the energetic arousal aspect. In the current study, we therefore used self-reported energetic arousal to represent the arousal dimension of vitality and positive affect to represent the affective dimension of vitality.

More relevant for the scope of the current paper, Ryan and Frederick (1997) posited that vitality also depends on somatic, physiological functions. They see vitality to be an "organismic state" (p. 536) that is influenced by physiological as

well as psychological factors. While the psychological factors were at least in part covered by previous research linking the dimensions of recovery to vitality (Rieger, Reinecke, et al., 2014), physiological aspects were not included and cannot reliably be assessed by self-reports. An appropriate means for detecting alterations in relation to chronic or acute stress and to provide evidence for a biomarker of stress is to collect saliva cortisol levels (Kirschbaum & Hellhammer, 1994).

Cortisol is released in response to activation in HPA (hypothalamic pituitary adrenal cortex axis) and is defined as an important mediator of the relationship between stressful life experiences and health outcomes. The HPA response and therewith its endproduct cortisol is one component of the organism's adaptive system for maintaining function under changing environmental circumstances (Nicholson, 2008). Cortisol levels can be reliably measured by saliva samples because it is passively diffused from blood to saliva (Kirschbaum & Hellhammer, 1994; Pollard & Ice, 2007). Specifically, when cortisol is injected, salivary levels were found to increase within one minute (Walker, 1984), and peak concentrations in blood are seen two to three minutes later in saliva (Kirschbaum & Hellhammer, 2000).

Arousal as reported in questionnaires is an indicator of stress and has been found to not necessarily be identical with bodily stress, in particular with cortisol levels (Dettenborn, Tietze, Bruckner, & Kirschbaum, 2010; Hébert, Béland, Dionne-Fournelle, Crête, & Lupien, 2005). Thus, bodily sensations of stress do not automatically lead to the subjective experience of stress, nor does feeling stressed automatically alter physiological responses. It was concluded that the physiological part of stress and the subjective experience are two distinct concepts (van Holland, Frings-Dresen, & Sluiter, 2012).

In media psychological research, few studies directly assessed the impact of media stimuli on cortisol levels. Those studies that exist, found contradictory results regarding the relationship between cortisol and subjective measures of stress and the impact of media offering on altering cortisol levels. For instance, Rohrmann, Hopp, Schienle and Hodapp (2009) measured cortisol levels in participants who viewed a disgust-inducing film and had to either suppress or exert mimic reactions. This study did not reveal any differences in cortisol segregation. Maass, Lohaus, and Wolf (2010) compared cortisol levels for participants playing/watching a violent or a non-violent video game/film and found that violent content (irrespective of whether it was displayed in the video game or in the film) had greater effects on physiological stress than nonviolent content. At the same time, content featuring violence was evaluated as more entertaining. Higher cortisol levels could thus be associated with a higher entertainment experience.

Closer related to the current study, Hubert and de Jong-Meyer (1990, 1991) compared exposure to positive or negative film scenes and subsequent cortisol levels but did not find any changes in cortisol. They acknowledge that "although a large body of research has been accumulated regarding cortisol function in depressive illness and negative emotional states, positive emotions as happiness, security, warmth or other, have received little attention in psychoendocrinological studies. Preliminary results are inconsistent." (p. 265).

In one exemplary study on media offerings eliciting positive emotions, Hubert, Möller and de Jong-Meyer (1993) found increased cortisol levels as a response to amusing film scenes. They reported a positive correlation between perceived fun and interest during film reception and cortisol levels. Taken these results together, cortisol secretion may thus be linked to emotional activation, regardless of the emotional valence. Relatedly, Kalman and Grahn (2004) compared two different movie genres (comedy vs. scary) with a control group that engaged in a stressful activity (school work). They found similar decreases in cortisol for those who watched the movies compared to those who engaged in the stressful activity.

In a more recent study by Nabi et al. (2016), the authors found that the impact of television viewing on cortisol levels was a function of gender: Cortisol levels decreased in women (except for when they watched romance), whereas in men it did not. These findings point toward the importance of integrating physiological indicators of stress into studies on the beneficial health effects of entertainment media in order to grasp subjective as opposed to objective markers of stress.

For the current study, these results point toward two possible outcomes: First, hedonic and eudaimonic films could influence cortisol levels differently (see research by Hubert & de Jong-Meyer, 1990, 1991; Kalman & Grahn, 2004). We therefore pose the following research question: How do hedonic and eudaimonic media stimuli influence cortisol levels (RQ1)? Second, media content could increase cortisol levels and still positively contribute to vitality (see Hubert et al., 1993). Previous research demonstrated the link between eudaimonic and hedonic entertainment experiences and vitality (Rieger, Reinecke et al., 2014). How do cortisol levels contribute to feelings of vitality, operationalized through energetic arousal and positive affect (RQ2)?

4. Method

4.1 Participants

A total of 60 college students (42 women) participated. They were on average 23.50 years (SD = 2.61) old (range 18–31). Participants were randomly assigned to one of the three experimental conditions: eudaimonic movie (n = 20), hedonic movie (n = 20), and control movie (n = 20). The groups did not differ with regard to gender, $\chi^2(2) = 1.43$, ns, or age, $F < 1$.

Due to the special requirements for cortisol measurements, we further checked whether participants within the experimental conditions differed on several points known to influence cortisol levels (Pollard & Ice, 2007): Food intake, pregnancy, exercise, intake of contraceptives, menstrual cycle, smoking, caffeine intake and shift-working.

4.2 Procedure

The experiment took place at a laboratory at a large German university. Participants took part for course credits in a study about movie perception. Data collection was conducted in the early afternoon only (from 1:30 pm to 6:30 pm). This

time slot was chosen since cortisol underlies natural circadian variations. While cortisol levels are highest in the early morning hours and then decrease during the day (Kiess et al., 1995), the decline is the least pronounced during afternoon hours. Upon invitation to the experiment, participants were informed that the experimenters would collect saliva samples throughout the study. To enhance comparability of the bio-physiological states, after arrival, all participants were asked to rest and wait for ten minutes until the experiment started. During this waiting time, they signed an informed consent and completed questions as baseline measurement (affect, arousal, questions about their day, sleeping behavior and further descriptives in order to test their compatibility with the sensitive cortisol measurement). At the end of this waiting period, participants were equipped with notebooks and headphones and started the experiment via mouse click. They were asked to collect their first saliva sample following the instructions provided on screen. The whole experiment was programmed using Questback software.

4.2.1 Stress induction.

The procedure to induce stress in participants was adapted from the Trier Social Stress Task (TSST; Kirschbaum, Pirke, & Hellhammer, 1993) in order to enhance both anticipatory, cognitive and social-evaluative stress levels in participants: Participants were told that their performance when answering questions would be videotaped since research showed that new situations that are unpredictable and potentially uncomfortable lead to stress reactions (Dickerson & Kemeny, 2004; Mason, 1968).

The experimenter informed the participants that they had to perform a task that tested their common knowledge and their math skills. First, math skills were assessed via the paced auditory serial addition task (PASAT; Gronwall, 1977) which took about 8 minutes. Afterwards, participants had to answer to 40 questions that tested their common knowledge (politics, nature, history, art and culture, religion, geography). During task completion, participants were filmed with a video camera. The whole stress induction took about 20 minutes and cortisol levels were collected afterwards. At the same time, participants were again asked for their affect and arousal state (T2).

Subsequently, one out of three movie stimuli (eudaimonic, hedonic, and neutral) was shown for about 30 minutes, before saliva samples, affect and arousal states were assessed for the third time (T3). Afterwards, recovery experience dimensions, energetic arousal and affect were measured. After the last question, participants were thanked and fully debriefed.

4.2.2 Media stimuli

The media stimuli were selected via pretest. Based on the notion that eudaimonic media are characterized by stimulating mixed affective responses (Oliver, Hartmann, & Woolley, 2012; Wirth, Hofer, & Schramm, 2012), a total of 19 movie clips were tested for the affect they elicit by N = 43 subjects (n = 26 female, M_{age} = 27.09, SD_{age} = 11.41) in an online survey. After each video, participants

responded to the positive, negative and meaningful affect subscales developed by Oliver et al. (2012) on a 7-point Likert scale (1 = "not at all", 7 = "very much"). Further, a mixed affect score was calculated following the original procedure (Ersner-Hershfield, Mikels, Sullivan, & Carstensen, 2008; Oliver et al., 2012).

The selection of media stimuli for the main study was based on three points: 1) film stimuli should be equal in length, 2) they should differ with regard to the elicitation of positive and mixed affect, and 3) to keep differences in liking or identification processes at the minimum possible, we aimed at selecting two film stimuli with the same actor as protagonist (Will Smith). Given these criteria, a scene from *Hitch* (scene length: 00:29:13; Tennant, 2005) was chosen as pleasurable stimulus. To represent the eudaimonic movie, a scene from *The Pursuit of Happiness* (scene length: 00:30:22; Muccino, 2006) was chosen.

The addition of a third condition in which a media stimulus was present should provide information on the effects of a stimulus not eliciting neither high amounts of positive, nor mixed affective responses. In light of the research question, it has already been demonstrated that in noxious mood states, such as an increased arousal (= stress), people tend to select calming, soothing media content to balance their suboptimal arousal levels (Bryant & Zillmann, 1984). The third stimulus therefore represents a kind of soothing stimulus people could benefit from as a reaction to stress and strain. A scene from a documentary on nature which was cut together from two films, *Chronos* and *Home*, (scene length: 00:29:13; Arthus-Bertrand, 2009; Fricke, 1985). The pretest confirmed that *Hitch* elicited significantly more positive affect than both other film stimuli; *the Pursuit of Happiness* elicited significantly more mixed and meaningful affect than both other stimuli and the neutral film stimulus elicited the lowest levels of affects altogether.

4.3 Measures

4.3.1 Hedonic valence/Eudaimonic entertainment experience.

Entertainment experience were assessed via the Eudaimonic/Hedonic Entertainment Experience scale (Wirth et al., 2012). Items were answered on a 5-point scale (1 = "I strongly disagree," 5 = "I strongly agree").

In order to test whether the selected movie stimuli differed with regard to hedonic and eudaimonic entertainment experience, we divided the scale into two subscales, the first one representing eudaimonic entertainment experiences (subscales: Purpose in life, Autonomy, Competence, Relatedness and Activation of Central Values) and the second one assessing hedonic valence (subscale: Hedonic Entertainment, see also Rieger, Reinecke et al., 2014). Both subscales had high internal validity (Eudaimonic: $\alpha = .90$; Hedonic: $\alpha = .96$).

4.3.2 ffect and arousal

Affect and arousal were measured using an adapted version of the Affect Grid (Russell et al., 1989). The scale asks participants to visually map their current state in the semantic space between positive and negative affect (the x-axis) and

high or low arousal (the y-axis) using a 9x9 grid, with the square center of the grid representing a 'neutral, average, everyday feeling' (Russell et al., 1989, p. 501). Higher numbers represent more positive affect and more arousal. The differences in affect and arousal before and after the experimental manipulation (T1 and T2) were used as manipulation check in order to test the impact of the stress induction on affect and arousal. Based on the description on the y-axis, arousal values can be regarded to represent tense arousal and are considered as a subjective indicator of stress. Further, the third measure of affect (T3) was used to test RQ2. Table 2 depicts all means and standard deviations for the scales.

4.3.3 Saliva cortisol

The saliva samples for the determination of cortisol were collected with Sarstedt Salivettes (cotton swabs from Sarstedt, Nümbrecht, Germany). Based on previous research, the timing of cortisol collection was calculated to account for a time span of 15 minutes to make cortisol assessable in saliva (see Riad-Fahmy, Read, Walker, & Griffiths, 1982). Baseline collection of cortisol (T1) was done during completion of the baseline questionnaire. T2 was assessed after stress induction and finally, T3 was assessed after the movie reception phase.

After collection, the saliva was frozen at a refrigerator at -20°C. The concentration of cortisol was determined by a radio immunoassay (Kirschbaum, Strasburger, Jammers, & Hellhammer, 1989) in mg/dl and analysed by Dr. Eberhard & Partner (www.labmed.de). Due to the fact that saliva cortisol levels were positively skewed (Maass et al., 2010; Nicholson, 2008), they were log-transformed prior to further analyses.

4.3.4 Recovery experience

The recovery experience facets of *psychological detachment* (e.g., "When I watched the movie, I forgot about work*")* and *relaxation* (e.g., "When I watched the movie, I used the time to relax") were assessed via the respective 4-item subscales of the Recovery Experience Questionnaire (Sonnentag & Fritz, 2007). The items were rated on a 5-point scale (1 = "strongly disagree," 5 = "strongly agree"). Reliabilities for both subscales were high (Psychological detachment $\alpha = .79$, relaxation $\alpha = .90$).

4.3.5 Energetic arousal

Ten items of the energetic arousal subscales (energy and tiredness) of the *Activation-Deactivation-Checklist* (Thayer, 1989) were applied to measure the arousal dimension of vitality. Both subscales consist of five items each (e.g., such as "energetic," "sleepy") and were answered on a 4-point scale from 1 "definitely do not feel [adjective] at the moment" to 4 "definitely feel [adjective] at the moment." The items of the tiredness subscale were then reversely coded and all ten items were averaged to form a mean score of energetic arousal ($\alpha = .92$).

5. Results

5.1 Manipulation check

We conducted MANOVAs with Condition (Eudaimonic vs. Hedonic vs. Control movie) as between-subject factor and hedonic or eudaimonic entertainment experience as dependent variables to check our manipulations. There was a multivariate effect, Wilk's $\lambda = .29$, $F(4, 112) = 24.26$, $p < .001$, $\eta_p^2 = .46$. Univariate ANOVAs showed that for hedonic entertainment experience, there was a significant main effect for Condition, $F(2, 57) = 40.96$, $p < .001$, $\eta_p^2 = .59$. Pairwise simple comparisons (LSD) confirmed that all three media conditions were different from each other regarding the elicited hedonic entertainment experience with hedonic media ($M = 4.30$, $SD = 0.55$) being rated as more hedonically entertaining than the eudaimonic ($M = 3.73$, $SD = 0.92$, $p = .03$) and the neutral condition. ($M = 2.12$, $SD = 0.86$, $p < .001$) and further eudaimonic media being rated as more hedonically entertaining than the neutral condition ($p < .001$).

For the eudaimonic entertainment experience, there was a significant main effect for Condition, $F(2, 57) = 23.43$, $p < .001$, $\eta_p^2 = .45$. Again, pairwise simple comparisons confirmed that all three media conditions differed significantly from each other in the predicted direction; the eudaimonic condition ($M = 3.29$, $SD = 0.35$) was experienced as more eudaimonic than the hedonic condition ($M = 2.78$, $SD = 0.61$, $p = .006$), and more than the neutral condition ($M = 2.08$, $SD = 0.67$, $p < .001$). Also, the hedonic condition elicited higher levels of eudaimonic experiences than the neutral condition ($p < .001$).

Further, we tested whether the stress induction was successful. Three paired *t*-tests with affect, arousal and log-transformed cortisol levels as dependent variables at T1 and T2 indicated that our stress induction was successful as it significantly decreased affect at T2 ($M = 4.43$, $SD = 2.00$) compared to T1 ($M = 5.93$, $SD = 1.56$), $t(59) = 5.73$, $p < .001$, $d_z = 0.74$. Further, arousal also was significantly higher at T2 ($M = 6.15$, $SD = 1.55$) compared to T1 ($M = 4.27$, $SD = 1.41$), $t(59) = -9.02$, $p < .001$, $d_z = -1.17$. It has to be noted, that cortisol levels failed to differ between T1 ($M = 0.22$, $SD = 0.09$) and T2 ($M = 0.21$, $SD = 0.83$), $t(58) = 1.76$, *ns* ($p = .08$).[1]

5.2 Hypotheses testing

Correlations among all variables are depicted in Table 1. H1 and H2 predicted differences in reported psychological detachment and relaxation between the different media conditions. A MANOVA revealed a significant multivariate effect, Wilk's $\lambda = .83$, $F(4, 112) = 2.80$, $p = .03$, $\eta_p^2 = .09$. To explore this effect in greater detail, follow-up ANOVAs and contrast analyses were conducted.

1 This nonsignificant difference between cortisol levels at T1 vs. T2 could point to important considerations for future research using saliva cortisol levels. They are discussed in the discussion and limitation section of this manuscript.

Table 1. Zero-order correlations among cortisol, entertainment experiences, recovery experiences, and vitality (Energetic Arousal and Affect)

	1.	2.	3.	4.	5.	6.	7.
1. Cortisol T3	-	.19	.21	.07	.05	.35**	.27*
2. Hedonic Entertainment Experiences		-	.62***	.49***	.55***	.54***	.58***
3. Eudaimonic Entertainment Experiences			-	.30*	.34**	.52***	.35**
4. Psychological Detachment				-	.72***	.28*	.46***
5. Relaxation					-	.35**	.55***
6. Energetic Arousal						-	.65***
7. Affect							-

* $p < .05$, ** $p < .01$, *** $p < .001$

For psychological detachment, there was a significant main effect for Condition, $F(2, 57) = 4.36$, $p = .02$, $\eta_p^2 = .13$. A priori contrast analysis tested our hypotheses. It was expected that both media conditions (the hedonic ($M = 3.61$, $SD = 0.86$) as well as the eudaimonic media condition ($M = 3.18$, $SD = 0.88$), contrast weights: 1) would lead to higher psychological detachment than the neutral media condition ($M = 2.76$, $SD = 0.99$, contrast weight: -2). This analysis revealed a significant contrast, $t(57) = 2.53$, $p = .01$. H1 can thus be supported.

For relaxation, there again was a significant main effect for Condition, $F(2, 57) = 3.36$, $p = .04$, $\eta_p^2 = .11$. In order to test H2, contrasts were specified so that the hedonic media condition ($M = 4.08$, $SD = 0.82$, contrast weight: 2) would lead to higher relaxation than the other two conditions (eudaimonic: $M = 3.43$, $SD = 0.91$; neutral: $M = 3.40$, $SD = 1.06$; contrast weights: -1). There was a significant effect, $t(57) = 2.59$, $p = .01$. H2 can thus also be supported (see Table 2).

In order to test differences in cortisol levels (RQ1), a 3 (Media Stimulus: Eudaimonic vs. Hedonic vs. Control) × 2 (Time: T2 (prior to media exposure) vs. T3 (after media exposure)) mixed ANCOVA was conducted with gender serving as covariate and Time serving as repeated-measurements factor. There was no main effect for Time, $F(1, 56) = .0.26$, ns., and no main effect for Condition, $F(2, 56) = 0.52$, ns. However, there was a significant interaction between Time and Condition, $F(2, 56) = 3.79$, $p = .03$, $\eta_p^2 = .12$. With regard to the covariate, the main effect for gender was significant, $F(1, 56) = 5.30$, $p = .03$, $\eta_p^2 = .09$. Women showed lower cortisol level than men ($M_{women} = -0.73$, $SE = .02$; $M_{men} = -0.64$, $SE = .04$). Simple pairwise comparisons revealed that from T2 to T3 no significant changes in cortisol were observed as reaction to the hedonic and the eudaimonic movie stimuli (both $p > .16$). In the neutral film condition, however, cortisol levels significantly decreased over time ($M_{T2} = -0.68$, $SE = .04$; $M_{T3} = -0.78$, $SE = .04$, $p = .02$).

Table 2. Means and standard deviations for all dependent variables split by condition and time of measurement

Dependent Variable	Condition	Time of Measurement					
		T1		T2		T3	
		M	*SD*	*M*	*SD*	*M*	*SD*
Psychological Detachment							
	Eudaimonic					3.18[a, b]	0.88
	Hedonic					3.61[a]	0.86
	Control					2.76[b]	0.99
Relaxation							
	Eudaimonic					3.43[a]	0.91
	Hedonic					4.08[b]	0.82
	Control					3.40[a]	1.06
Energetic Arousal							
	Eudaimonic					2.55[a]	0.70
	Hedonic					2.75[a]	0.67
	Control					1.95[b]	0.61
Affect							
	Eudaimonic	5.85[a]	1.73	4.30[a]	2.41	5.25[a]	2.00
	Hedonic	5.75[a]	1.55	4.65[a]	1.79	6.80[b]	1.06
	Control	6.20[a]	1.43	4.35[a]	1.84	4.60[a]	1.79
Cortisol (lg10)							
	Eudaimonic	-0.66[a]	0.15	-0.69[a]	0.13	-0.69[a]	0.17
	Hedonic	-0.75[a]	0.15	-0.75[a]	0.20	-0.69[a]	0.22
	Control	-0.67[a]	0.19	-0.68[a]	0.18	-0.78[b]	0.15

Notes. Numbers with different superscripts in a row differ from each other ($p < .05$).

In order to test RQ2, two separate linear regressions were calculated, one with energetic arousal as criterion, the other one with affect. As predictors, psychological detachment, relaxation and cortisol levels at T3 were entered. For both analyses, psychological detachment, relaxation and cortisol could positively predict both aspects of vitality, affect ($R_{adj}^2 = .34$, $p < .001$), as well as energetic arousal ($R_{adj}^2 = .18$, $p < .01$). While psychological detachment did not serve as significant predictor in itself, relaxation and cortisol significantly contributed to an overall feeling of vitality (see Table 3). Thus, for RQ2, the data can be interpreted as suggesting that vitality, as defined by energetic arousal and affect, is associated with increased relaxation and cortisol levels.

Table 3. Regression analyses for affect and energetic arousal

Vitality					
		β	*SE*	*t*	
Affect	Psychological Detachment	.11	0.30	0.73	
	Relaxation	**.46****	**0.30**	**3.01**	
	Cortisol	**.24***	**1.07**	**2.26**	
	$Radj^2$				**.34*****
Energetic Arousal	Psychological Detachment	.02	0.13	0.14	
	Relaxation	**.32**$^{+}$**	**0.13**	**1.89**	
	Cortisol	**.32****	**0.46**	**2.70**	
	$Radj^2$				**.18****

Notes. *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p = .06$.

6. Discussion

6.1 General discussion

The present study aimed at expanding previous work by comparing media stimuli that offer distinct entertainment experiences with regard to their impact on the experience of recovery. More relevant, it was one of the first study to examine how cortisol – as biomarker of stress – is affected by media offerings and how it is related to vitality after media reception.

Our results provide evidence that entertainment media serve recovery experiences by fostering psychological detachment and relaxation. Movies, which are associated with a higher intervention potential as described within MMT, such as an increased hedonic or an increased eudaimonic experience, were able to help people to psychologically detach from stress and strain (H1). Further, in particular a hedonic movie led to higher relaxation than both the eudaimonic movie as well as the neutral movie (H2). Relevant for the external validity of prior findings, these results were obtained with movie stimuli that more closely resembled real reception situations since they were 30 instead of only 5 minutes long.

Additionally, our study aimed at extending studies on media-induced recovery using self-reports by including a physiological measure. Media can be used for recovery purposes and indicators of vitality, namely energetic arousal and positive affect; however, relationships between recovery and vitality were only based on subjective experiences reported by participants. In our study, we used saliva cortisol levels to have a physiological indicator of stress (Kirschbaum & Hellhammer, 1994). Further, building upon Nabi et al.'s (2016) results, we aimed at investigating the impact of distinct entertainment experiences in altering bodily traces of stress.

Our results demonstrate movies to be able to alter cortisol levels in participants: While after a hedonic or eudaimonic movie we did not find differences in cortisol, a more neutral, calm and soothing movie led to decreases in cortisol. There are several ideas how to explain this finding: It could be explained by gen-

eral research on physiology, demonstrating that relaxation (Handlon et al., 1962), meditation (Jevning, Wilson, & Davidson, 1978), hypnosis (Sachar, Cobb, & Shor, 1966) and a high degree of control and predictability (Frankenhäuser & Lundberg, 1982) are associated with a decrease in cortisol levels. As our neutral stimulus featured many of these characteristics (scenes with calm music depicting nature, slow camera, an atmosphere inspiring to contemplate), the results can be interpreted in a way that cortisol is lowered by media stimuli that are calm and predictable in their narration (RQ1). This could further be supported by studies in the tradition of MMT, demonstrating that in conditions of noxious mood states (defined as high, unpleasant levels of arousal), people turn to calming, soothing media content in order to alleviate their arousal levels (Bryant & Zillmann, 1984). In addition, many studies on the effects of music found that relaxing music reduced cortisol levels compared to silence (e.g., Khalfa, Bella, Roy, Peretz, & Lupien, 2003; Kölsch et al., 2011). Since our neutral stimulus also featured music, this might have contributed to the soothing effect.

Cortisol levels after media consumption led to higher levels of vitality, operationalized through increased energetic arousal and increased affect (RQ2). This is in line with research showing that activation can have beneficial effects, such as increased mood repair (Rieger, Frischlich, Wulf, Bente, & Kneer, 2015). The result is further compatible with Thayer's (1989) notion of two different dimensions of arousal: *Energetic arousal* as being the positive aspect of feeling alive and dynamic (after exposure to a stressful situation), versus *tense arousal* as being stressed, tense and strained. In this case, our measurement of vitality is in part composed of the first, functional part of arousal. Thereby, this result adds to the mixed results obtained in previous studies on cortisol in response to media stimuli, demonstrating that bodily stress seems to be related to emotional activation – regardless of emotional valence (Hubert & de Jong-Meyer, 1990, 1991; Hubert et al., 1993; Nabi et al., 2016).

Along with this last statement, the results point toward the necessity to more precisely look at differences in the perception of stress as it alters arousal levels: Research on physiological and psychological stress make a distinction between positive aspects of stress, namely eustress, and the negative aspects of stress, which are called distress (Nelson & Simmons, 2004; Selye, 1980). While distress is associated with feelings of strain, tension, sorrow and anxiety, eustress encompasses positive factors, such as fun, relaxation, good mood and the absence of boredom. These findings add to the notion that physiological processes and subjective evaluations can occur independently from each other and should therefore be investigated separately

It has to be noted that only relaxation and cortisol were significant predictors for vitality, psychological detachment was not. Considering what psychological detachment stands for, it is defined as mental disengagement from work, and related to cognitive processes such as stopping to ruminate about work issues and workload (Sonnentag & Bayer, 2005). In contrast, relaxation is associated with the arousal dimension of recovery, aiming to achieve a balanced arousal level that ensures cognitive functioning and resembles a leisure time, pre-stress state (Sonnentag & Fritz, 2007). One explanation for this nonsignificant finding could

theoretically lie in the original conceptualizations of those two recovery subdimensions. While psychological detachment is only weakly related to arousal-aspects of recovery, relaxation together with cortisol are able to predict vitality. Our results for vitality also suggest that recovery experiences and cortisol levels work in concert to foster energetic arousal and positive affect. Future research should take a more differential look on the contexts in which cortisol levels increase or decrease and whether this is rather associated with a eustress or a distress situation.

Relatedly, previous work found eudaimonic entertainment experiences to be associated with the mastery experience dimension of recovery (Rieger, Reinecke et al., 2014). Since this subdimension (as well as control experiences; see Reinecke et al., 2011; Rieger, Hefner, & Vorderer, 2017) was not assessed in the present paper, future studies should aim at a deeper elaboration of the interplay between (non-interactive) audiovisual stimuli and the elicitation of mastery and control experiences for recovery. Comparing the results of this study with the ones obtained by Rieger, Reinecke et al. (2014), cortisol – as biomarker of stress – could be added to the model as a moderator: In light of the current results, physiological stress could intensify media's impact on well-being. This might be explained by research on Excitation-Transfer Theory (Zillmann, 1971), demonstrating that residual activation can intensify subsequent experiences: Participants with heightened cortisol levels could have attributed their activation to feeling vital and positive due to their entertainment experiences.

The current study therefore contributes to the growing body of entertainment research that aims at relating entertainment experiences to health and well-being outcomes, e.g., by assessing subjective and objective recovery-related outcomes (Janicke et al., 2017; Nabi et al., 2016; Reinecke et al., 2011; Rieger, Reinecke, et al., 2014, 2017). It thereby also informs research on methods how to study media reception processes and effects. Moreover, it triggers first ideas for future research in the context of how entertainment experiences can be used in a beneficial way for the individual by suggesting that physiological activation can amplify entertainment experiences as well as indicators of well-being.

6.2 Limitations

The first limitation refers to the failed manipulation check for cortisol levels. Our results did not reveal significant changes in cortisol from T1 (baseline) and T2 (after the stress induction). However, self-reports as well as discussions with the participants after completion of the study support a successful stress induction. While we were not able to proof alterations in cortisol after our stress task, we suppose that the reason for this might be found in the time span that is needed to make changes in cortisol levels become apparent in saliva. As previous research reports, changes in cortisol are measurable in saliva with a time delay between 15 and 30 minutes (Aardal-Eriksson, Karlberg, & Holm, 1998; Kirschbaum & Hellhammer, 1994). With our chosen time of measurement (20 minutes after T1), the saliva samples we collected fall within this range but it is possible that measurable physiological stress reactions toward the TSST (Kirschbaum et al., 1993) did

not unfold in this time period. Future studies should therefore consider enlarging the time period to 30 minutes to tackle changes in saliva cortisol.

Second, people not only differ with regard to the perception of stress, they also differ concerning the physiological release of stress-related hormones (Buchanan, Tranel, & Adolphs, 2006). Therefore, recent research has made the distinction between so-called 'responders' versus 'non-responders' in terms of changes in cortisol levels (Buchanan et al., 2006). Relatedly, viewing a brief film about the loss of a parent triggered an increase in cortisol, but only for adults who reported poor relationships with family (Luecken, 1998). In our study, we found different results for men and women concerning cortisol changes (see also Nabi et al., 2016) although it has to admitted that men and women were not equally represented in our sample. However, this finding relates to research demonstrating that women's excretion of cortisol varies over the menstrual cycle (Nepomnaschy et al., 2011). Also, women were found to differ with regard to their experience of entertainment depending on the menstrual cycle (Meadowcroft & Zillmann, 1987). Although phases within the menstrual cycle of female participants were equally distributed among experimental conditions in this study, the findings discussed here in this section suggest that future research should directly investigate individual differences with regard to physiological reactions to media products in greater depth.

The results further suggest that the interpretation of cortisol levels might be dependent on the context: When watching entertaining movies, cortisol levels might not be solely negative: After a stress induction, cortisol levels did not decrease as a reaction to movies with a high entertainment experience. Additionally, cortisol positively predicted an enhanced vitality after media reception.

To conclude, the present study can be considered as an extension to previous studies focusing on media-induced recovery, but it also tackles important questions to consider for researchers aiming at investigating the effects of media, in particular with the attempt to increase well-being in people and find psychological as well as physiological relief from stress and strain in our daily lives.

References

Aardal-Eriksson, E., Karlberg, B. E., & Holm, A. C. (1998). Salivary cortisol – an alternative to serum cortisol determinations in dynamic function tests. *Clinical Chemistry and Laboratory Medicine*, *36*(4), 215–222.

Arthus-Bertrand, Y. (2009). *Home*. France: France 2.

Bartsch, A., Kalch, A., & Oliver, M. B. (2014). Moved to think. The role of emotional media experiences in stimulating reflective thoughts. *Journal of Media Psychology: Theories, Methods, and Applications*, *26*(3), 125–140. https://doi.org/10.1027/1864-1105/a000118

Bowman, N. D., & Tamborini, R. (2012). Task demand and mood repair: The intervention potential of computer games. *New Media & Society*, *14*(8), 1339–1357. https://doi.org/10.1177/1461444812450426

Bryant, J., & Davies, J. (2006). Selective exposure processes. In J. Bryant & P. Vorderer (Eds.), *Psychology of Entertainment* (pp. 19–33). Lawrence Erlbaum Associates Publishers.

Bryant, J., & Zillmann, D. (1984). Using television to alleviate boredom and stress: Selective exposure as a function of induced excitational states. *Journal of Broadcasting*, *28*(1), 1–20. https://doi.org/10.1080/08838158409386511

Buchanan, T. W., Tranel, D., & Adolphs, R. (2006). Impaired memory retrieval correlates with individual differences in cortisol response but not autonomic response. *Learning & Memory*, *13*(3), 382–387.

Craig, A., & Cooper, R. E. (1992). Symptoms of acute and chronic fatigue. In A. P. Smith & D. M. Jones (Eds.), *Handbook of human performance* (Vol.3, pp. 289–339). London: Academic Press.

Dettenborn, L., Tietze, A., Bruckner, F., & Kirschbaum, C. (2010). Higher cortisol content in hair among long-term unemployed individuals compared to controls. *Psychoneuroendocrinology*, *35*(9), 1404–1409. https://doi.org/10.1016/j.psyneuen.2010.04.006

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

Ersner-Hershfield, H., Mikels, J. a, Sullivan, S. J., & Carstensen, L. L. (2008). Poignancy: mixed emotional experience in the face of meaningful endings. *Journal of Personality and Social Psychology*, *94*(1), 158–67. https://doi.org/10.1037/0022-3514.94.1.158

Frankenhäuser, M., & Lundberg, U. (1982). Psychoneuroendocrine aspects of effort and distress as modified by personal control. In W. Bachmann & I. Udris (Eds.), *Mental Load and Stress in Activity-European Approaches* (pp. 97–103). Berlin: VEB Deutscher Verlag der Wissenschaften.

Fricke, R. (1985). *Chronos*. USA: Canticle Films.

Fritz, C., Sonnentag, S., Spector, P. E., & McInroe, J. A. (2010). The weekend matters: Relationships between stress recovery and affective experiences. *Journal of Organizational Behavior*, *1162*, 1137–1162. https://doi.org/10.1002/job.672

Fuller, J. A., Stanton, J. M., Fisher, G. G., Spitzmuller, C., Russell, S. S., & Smith, P. C. (2003). A lengthy look at the daily grind: time series analysis of events, mood, stress, and satisfaction. *Journal of Applied Psychology*, *88*(6), 1019–1033.

Gronwall, D. (1977). Paced auditory serial-addition task: A measure of recovery from concussion. *Perceptual and Motor Skills*, *44*, 367–373.

Handlon, J. H., Wadeson, R. W., Fishman, J. R., Sachar, E. J., Hamburg, D. A., & Mason, J. W. (1962). Psychological factors lowering plasma 17-hydroxycorticosteroid concentration. doi:10.1002/jts.20260. *Psychsomatic Medicine*, *24*(6), 535–542.

Hébert, S., Béland, R., Dionne-Fournelle, O., Crête, M., & Lupien, S. J. (2005). Physiological stress response to video-game playing: The contribution of built-in music. *Life Science*, *76*, 2371–2380. https://doi.org/10.1016/j.lfs.2004.11.011

Hubert, W., & de Jong-Meyer, R. (1990). Psychophysiological response patterns to positive and negative film stimuli. *Biological Psychology*, *31*, 73–93.

Hubert, W., & de Jong-Meyer, R. (1991). Autonomic, neuroendocrine, and subjective responses to emotion-inducing film stimuli. *International Journal of Psychophysiology*, *11*, 131–140.

Hubert, W., Möller, M., & Jong-Meyer, R. de. (1993). Film-induced amusement changes in saliva cortisol levels. *Psychoneuroendocrinology*, *18*(4), 265–272.

Janicke-Bowles, S. H., Rieger, D., & Connor, W. (2018). Finding maning at work: The role of inspiring and funny YouTube videos on work-related well-being. *Journal of Happiness Studies*, *0*(0). https://doi.org/10.1007/s10902-018-9959-1

Janicke, S. H., Rieger, D., Reinecke, L., & Connor, W. (2018). Watching Online Videos at Work: The Role of Positive and Meaningful Affect for Recovery Experiences and Well-Being at the Workplace. *Mass Communication and Society*, *21*(3), 345–367. https://doi.org/10.1080/15205436.2017.1381264

Jevning, R., Wilson, A. F., & Davidson, J. M. (1978). Adrenocortical activity during meditation. *Hormones and Behavior*, *10*(1), 54–60.

Kalman, B. A., & Gahn, R. E. (2004). Measuring salivary cortisol in the behavioral neuroscience laboratory. *The Journal of Undergraduate Neuroscience Education*, *2*, A41–A49.

Khalfa, S., Bella, S. D., Roy, M., Peretz, I., & Lupien, S. L. (2003). Effects of relaxing music on salivary cortisol level after psychological stress. *American New York Academy of Science*, *37*, 374–376. https://doi.org/10.1196/ annals.1284.045

Kiess, W., Meidert, A., Dressendörfer, R. A., Schriever, K., Kessler, U., König, A., & Al., E. (1995). Salivary cortisol levels throughout childhood and adolescence: Relation with age, pubertal stage, and weight. *Pediatric Research*, *37*, 502–506. https://doi.org/10.1203/00006450-199504000-00020

Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine re-search: Recent developments and applications. *Psychoneuroendocrinology*, *19*(4), 313–333. https://doi.org/10.1016/0306-4530(94)90013-2

Kirschbaum, C., & Hellhammer, D. H. (2000). Salivary cortisol. In G. Fink (Ed.), *Encyclopedia of stress* (Vol. 3, pp. 379–383). New York: Academic Press.

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.

Kirschbaum, C., Strasburger, C. J., Jammers, W., & Hellhammer, D. H. (1989). Cortisol and behavior: 1. Adaptation of a radioimmunoassay kit for reliable and inexpensive salivary cortisol determination. *Pharmacology, Biochemistry, & Behavior*, *34*, 747–751.

Knobloch-Westerwick, S. (2006). Mood management: Theory, evidence, and advancements. In J. Bryant & P. Vorderer (Eds.), *Psychology of entertainment* (pp. 239–254). Mahwah, NJ: Erlbaum.

Knobloch, S., Hastall, M., Zillmann, D., & Callison, C. (2003). Imagery effects on the selective reading of Internet newsmagazines. *Communication Research*, *30*(1), 3-29.

Knobloch, S., & Zillmann, D. (2002). Mood management via the digital jukebox. *Journal of Communication*, *52*(2), 351–366. https://doi.org/10.1111/j.1460-2466.2002.tb02549.x

Kölsch, S., Fürmetz, J., Sack, U., Bauer, K., Hohenadel, M., Wiegel, M., … Heinke. (2011). Effects of music listening on cortisol levels and propofol consumption during spinal anesthesia. *Frontiers in Psychology*, *2*, 58. https://doi.org/10.3389/fpsyg.2011.00058

Koole, S. L., & Rothermund, K. (2011). "I feel better but I don't know why": The psychology of implicit emotion regulation. *Cognition and Emotion*, *25*(3), 389–399. https://doi.org/10.1080/02699931.2010.550505

Luecken, L. J. (1998). Childhood attachment and loss experiences affect adult cardiovascular and cortisol function. *Psychosomatic Medicine*, *60*(6), 765-772.

Maass, A., Lohaus, A., & Wolf, O. T. (2010). Media and stress in adolescent boys in Germany. *Journal of Children and Media*, *4*(1), 18–38. https://doi.org/10.1080/17482790903407259

Mason, J. W. (1968). A review of psychoendocrine research on the pituitary-adrenal cortical system. *Psychosomatic Medicine*, *30*(5), 576–607. https://doi.org/1968/09000

Meadowcroft, J. M., & Zillmann, D. (1987). Women's comedy preferences during the menstrual cycle. *Communication Research*, *14*(2), 204–218. https://doi.org/10.1177/009365087014002004

Meijman, T. F., & Mulder, G. (1998). Psychological aspects of workload. In P. J. D. Drenth, H. Thierry, & C. J. de Wolff (Eds.), *Handbook of work and organizational psychology* (Vol. 2, pp. 5–33). Hove: Psychology Press.

Muccino, G. (2006). *The pursuit of happiness*. USA: Sony Pictures.

Nabi, R. L., & Krcmar, M. (2004). Conceptualizing media enjoyment as attitude: Implications for mass media effects research. *Communication Theory*, *14*, 288–310. https://doi.org/10.1111/j.1468-2885.2004.tb00316.x

Nabi, R. L., Prestin, A., & So, J. (2016). Could watching TV be good for you? Examining how media consumption patterns relate to salivary cortisol. *Health Communication*, 1–11. https://doi.org/10.1080/10410236.2015.1061309

Nelson, D. L., & Simmons, B. L. (2004). Eustress: An elusive construct, an engaging pursuit. *Research in Occupational Stress and Well-Being*, *3*, 265–322. https://doi.org/10.1016/S1479-3555(03)03007-5

Nepomnaschy, P. A., Altman, R. M., Watterson, R., Co, C., McConnell, D. S., & England, B. G. (2011). Is cortisol excretion independent of menstrual cycle day? A longitudinal evaluation of first morning urinary specimens. *PLoS ONE*, *6*(3), e18242. https://doi.org/10.1371/journal.pone.0018242

Nicholson, N. A. (2008). Measurement of cortisol. In L. J. Luecken & L. C. Gallo (Eds.), *Handbook of physiological research methods in health psychology* (pp. 37–74). Thousand Oaks, CA: SAGE Publications.

Oliver, M. B., & Bartsch, A. (2010). Appreciation as audience response: Exploring entertainment gratifications beyond hedonism. *Human Communication Research*, *36*(1), 53–81. https://doi.org/10.1111/j.1468-2958.2009.01368.x

Oliver, M. B., & Bartsch, A. (2011). Appreciation of entertainment. *Journal of Media Psychology: Theories, Methods, and Applications*, *23*(1), 29–33. https://doi.org/10.1027/1864-1105/a000029

Oliver, M. B., & Hartmann, T. (2010). Exploring the role of meaningful experiences in users' appreciation of "good movies." *Projections: The Journal of Movies and Mind*, *4*(2), 128–150. https://doi.org/10.3167/proj.2010.040208

Oliver, M. B., Hartmann, T., & Woolley, J. K. (2012). Elevation in response to entertainment portrayals of moral virtue. *Human Communication Research*, *38*, 360–378. https://doi.org/10.1111/j.1468-2958.2012.01427.x

Pollard, T. M., & Ice, G. H. (2007). Measuring hormonal variation in the hypothalamic pituitary adrenal axis: Cortisol. In G. H. Ice & G. D. James (Eds.), *Measuring stress in humans* (pp. 122–157). Cambridge, UK: Cambridge University Press.

Reinecke, L. (2009a). Games and recovery. The use of video and computer games to recuperate from stress and strain. *Journal of Media Psychology*, *21*(3), 126–142. https://doi.org/10.1027/1864-1105.21.3.126

Reinecke, L. (2009b). Games at work : The recreational use of computer games during working hours. *Cyberpsychology & Behavior*, *12*(4), 461–465. https://doi.org/10.1089/cpb.2009.0010

Reinecke, L., Klatt, J., & Krämer, N. C. (2011). Entertaining media use and the satisfaction of recovery needs: Recovery outcomes associated with the use of interactive and noninteractive entertaining media. *Media Psychology*, *14*(2), 192–215. https://doi.org/10.1080/15213269.2011.573466

Reinecke, L., & Trepte, S. (2008). In a working mood ? The effects of mood management processes on subsequent cognitive performance. *Journal of Media Psychology*, *20*(1), 3–14. https://doi.org/10.1027/1864-1105.20.1.3

Riad-Fahmy, D., Read, G. F., Walker, F. F., & Griffiths, K. (1982). Steroids in salvia for assessing endocrine function. *Endocrine Reviews*, *3*(4), 367–395. https://doi.org/10.1210/edrv-3-4-367

Rieger, D., Bowman, N. D., Frischlich, L., & Bente, G. (2014). *"I'm pumped, but I don't feel like it!": The differential effects of affect and arousal regulation on mood repair and recovery.* Paper Presented at the 64th Conference of the International Communication Association (ICA), 22.05. –26.05.2014.

Rieger, D., Frischlich, L., Wulf, T., Bente, G., & Kneer, J. (2015). Eating ghosts: The underlying mechanisms of mood repair via interactive and non-interactive media. *Psychology of Popular Media Culture*, *4*(2), 138–154. https://doi.org/10.1037/ppm0000018

Rieger, D., Hefner, D., & Vorderer, P. (2017). Mobile recovery? The impact of smartphone use on recovery experiences in waiting situations. *Mobile Media & Communication*, *5*(2), 161–177. https://doi.org/10.1177/2050157917691556

Rieger, D., Reinecke, L., & Bente, G. (2017). Media-induced recovery: The effects of positive versus negative media stimuli on recovery experience, cognitive performance, and energetic arousal. *Psychology of Popular Media Culture*, *6*(2), 174–191. https://doi.org/10.1037/ppm0000075

Rieger, D., Reinecke, L., Frischlich, L., & Bente, G. (2014). Media entertainment and well-being-linking hedonic and eudaimonic entertainment experience to media-induced recovery and vitality. *Journal of Communication*, *64*(3), 456–478. https://doi.org/10.1111/jcom.12097

Rohrmann, S., Hopp, H., Schienle, A., & Hodapp, V. (2009). Emotion regulation, disgust sensitivity, and psychophysiological responses to a disgust-inducing film. *Anxiety, Stress, and Coping*, *22*(2), 215–36. https://doi.org/10.1080/10615800802016591

Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: A single-item scale of pleasure and arousal. *Journal of Personality & Social Psychology*, *57*(3), 493–502.

Ryan, R. M., & Frederick, C. (1997). On energy, personality, and health: subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, *65*(3), 529–65. https://doi.org/10.1111/j.1467-6494.1997.tb00326.x

Sachar, E. J., Cobb, J. C., & Shor, R. E. (1966). Plasma cortisol changes during hypnotic trance. *Archives of General Psychiatry*, *14*(5), 482–490. https://doi.org/10.1001/archpsyc.1966.01730110034005

Selye, H. (1980). Changing distress into eustress: Hans Selye voices theories on stress. *Texas Medicine*, *76*, 78–80.

Sluiter, J. K., Van Der Beek, A. J., & Frings-Dresen, M. H. (1999). The influence of work characteristics on the need for recovery and experienced health: a study on coach drivers. *Ergonomics*, *42*(4), 573–583. https://doi.org/10.1080/001401399185487

Sonnentag, S., & Bayer, U.-V. (2005). Switching off mentally: Predictors and consequences of psychological detachment from work during off-job time. *Journal of Occupational Health Psychology*, *10*(4), 393–414. https://doi.org/10.1037/1076-8998.10.4.393

Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: development and validation of a measure for assessing recuperation and unwinding from work. *Journal of Occupational Health Psychology*, *65*(3), 204–221. https://doi.org/10.1037/1076-8998.12.3.204

Tennant, A. (2005). *Hitch*. USA: Sony Pictures.

Thayer, R. E. (1989). *The biopsychology of mood and arousal*. New York, NY: Oxford University Press.

van Holland, B. J., Frings-Dresen, M. H. W., & Sluiter, J. K. (2012). Measuring short-term and long-term physiological stress effects by cortisol reactivity in salvia and hair. *International Archives of Occupational and Environmental Health*, *85*(8), 849–852. https://doi.org/10.1007/s00420-011-0727-3

Vorderer, P. (2011). What's next? Remarks on the current vitalization of entertainment theory. *Journal of Media Psychology*, *23*, 60–63. https://doi.org/10.1027/1864-1105/a000034

Wirth, W., Hofer, M., & Schramm, H. (2012). Beyond pleasure: Exploring the eudaimonic entertainment experience. *Human Communication Research*, *38*(4), 406–428. https://doi.org/10.1111/j.1468-2958.2012.01434.x

Zillmann, D. (1971). Excitation transfer in communication-mediated aggressive behavior. *Journal of Experimental Social Psychology*, *7*, 419–434.

Zillmann, D. (1988a). Mood management: Using entertainment to full advantage. In L. Donohew, H. E. Sypher, & E. T. Higgins (Eds.), *Communication, Social cognition, and Affect* (Vol. 31, pp. 147–171). Hillsdale, NJ: Erlbaum.

Zillmann, D. (1988b). Mood management through communication choices. *American Behavioral Scientist*, *31*(3), 327–340. https://doi.org/10.1177/000276488031003005

Zillmann, D. (1991a). Empathy: Affect from bearing witness to the emotions of others. In J. Bryant & D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (pp. 135–168). Hillesdale, NJ: Lawrence Erlbaum.

Zillmann, D. (1991b). Television viewing and physiological arousal. In J. Bryant & D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (pp. 103–134). Hillsdale, N.J.: Erlbaum Associates.

Zillmann, D., & Bryant, J. (1985). Affect, mood, and emotion as determinants of selective exposure. In D. Zillmann & J. Bryant (Eds.), *Selective Exposure to Communication* (pp. 157–189). Hillsdale, NJ: Lawrence Erlbaum Associates.

Zillmann, D., Knobloch, S., & Yu, H. (2001). Effects of photographs on the selective reading of news reports. *Media Psychology*, *3*(4), 301–324. https://doi.org/10.1207/S1532785XMEP0304_01