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PHD THESIS

EMOTIONAL INERTIA AT WORK: CORRELATES OF INFLEXIBLE EMOTION DYNAMICS IN THE WORKPLACE

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CHAPTER 1

INTRODUCTION

Relevance of Emotion Dynamics at Work

Emotions refer to affective experiences elicited by significant events that influences individuals' inclination to act (Barsade & Gibson, 2007; Frijda, 2006). Although various conceptualizations of emotions have been offered over the years, the consensus emerged that emotions represent adaptive responses to the demands of the environment (Elfenbein, 2007; Ekman, 1992; Scherer, 1984; Smith & Ellsworth, 1985). Typically, emotions are considered discrete, short-term feeling states, such as fear, anger, joy (Barsade & Gibson, 2007). Whereas the pervasive role of emotions in organizational life has been neglected for a long time, over the past 25 years, research about affect in organizations has grown rapidly as a consequence of what has been called the "affective revolution" (Barsade, Brief, & Spataro, 2003 p. 3).

As argued by Pekrun and Frese (1992) "work can be assumed to be among the important determinants of human emotional life (p. 154)". While working, people experience a variety of different emotions, which may be related to the self, to the task, as well as other people and social relations. In turn, emotions influence behaviors, attitudes, cognition and their outcomes in terms of social climate and productivity (Pekrun & Frese, 1992). However, the impact of work related emotional experiences extend well over individual organizational behavior. As it stands, work is one of the more valued area of adult life. Thus, it is not surprising that empirical studies have attested a significant link between the quality of individuals' emotional life and individuals' health (Lyubomirsky, King, & Diener, 2005), and quality of peoples' private life outside the work (e.g., Heller & Watson, 2005; Judge & Ilies, 2004).

This Thesis aims to contribute to the understanding of emotional dynamics at work, namely of "'…the trajectories, patterns, and regularities with which emotions, or one or more of their subcomponents (such as experiential, physiological, or behavioral components) fluctuate across time, their underlying processes, and downstream consequences" (Kuppens & Verduyn, 2015, p. 71). In doing so, it answers to the call issued by Gooty, Gavin and Ashkanasy (2009) for organizational psychologists to conceiving emotions at work as truly dynamic phenomena. A crucial aspect of emotions, in fact, consists in their dynamic nature (Ashkanasy, 2003) as emotions are, by definition (see Barsade & Gibson, 2007; Frijda, 2006), dynamic and intra-individual phenomena that are highly variable over time (e.g., days, moments).

So far, research about emotion dynamics at work have used experience sampling methods (ESM) in which participants report their emotions throughout their normal daily work activities in order to capture online snapshots of the individuals' emotional dynamics at work. Evidence from this line of research suggests that the experience of positive mood and emotions is associated with higher productivity and quality of customer service (Rothbard & Wilk, 2011) and organizational citizenship behaviors (Miner & Glomb, 2010; Zelenski, Murphy, & Jenkins, 2008). Moreover, experiencing positive emotions at work is associated with increased work engagement (Bledow, Schmitt, Frese & Kühnel, 2011), creativity, openness to information, and cognitive flexibility (Amabile, Barsade, Mueller, & Staw, 2005; Bless, 2000; Fiedler, 2000; Fredrickson, 2001). All in all, previous results suggest that the emotions individuals experience at work exert a deep influence on, and concurs to shape individuals' daily life at work (Ashkanasy, 2003).

The present Thesis focuses on a key component of emotional dynamics, namely emotional inertia (Kuppens, Allen, & Sheeber, 2010). Emotional inertia reflects the tendency of affective experiences to be resistant to change and to be predictable over time, with lower levels indicating higher tendency to change and higher levels indicating higher resistance to change (Kuppens et al.,

2010). So far, psychological research has posited emotional inertia among major determinants of psychological maladjustment in the general population (Houben, Van de Noortgate, & Kuppens, 2015; Koval, Sütterlin, & Kuppens, 2016; Kuppens et al., 2010), but little is known about correlates of emotional inertia in the work setting. To address the gap in the literature, the goal of this Thesis is to investigate emotional inertia and its possible job-related correlates.

Understanding Emotion Dynamics at Work

Workers' emotional dynamics reflects how people respond to changes in the surrounding work-environment, and this is a function of workers' ability to self-regulate (Larsen, 2000). Whereas the study of emotional dynamics partly overlap with that of emotion-related self-regulation (e.g., Derryberry & Rothbart, 1997), it is important to recognize the conceptual distinction between these two fields. Emotion-related self-regulation refers to a person's ability to understand and manage internal feelings and emotions by engaging in appropriate cognitive and behavioral strategies (Eisenberg & Spinrad, 2004; Gross, 2002). The distinctive feature of research on emotion dynamics is "the explicit recognition that a thorough understanding of the nature, causes, and consequences of emotions entails explicitly taking into account the dimension of time" (see Kuppens & Verduyn, 2017, p. 22).

Studies conducted so far have demonstrated how short term workers' emotional dynamics are strictly related to adjustment (Gross & John, 2003; Gross & Muñoz, 1995) and well-being (Houben et al., 2015; Sonnentag, 2015), even across long periods of time (Kuppens et al., 2012; van de Leemput et al., 2014).

Usually, researchers have pointed to high emotional variability as to the landmark of maladaptive psychological functioning (Kuppens et al., 2010). Indeed, literature documents significant correlations between emotional variability and indices of psychological maladjustment

such as depression, low emotional stability and, low self-esteem (e.g., Eid & Diener, 1999; Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007). However, it is often argued that emotional variability as it is usually measured may not completely reflect emotional reactivity, but rather the range and extremity with which emotions are experienced by a specific individual (Larsen & Diener, 1987). Emotions of extreme intensity are disruptive, and indeed they are considered at the heart of many emotional disorders such as depression, anxiety and mania (Barlow, Allen, & Choate, 2004). Yet there is a difference between being incline to experience emotional states of extreme intensity and being emotionally reactive. Many conditions of psychological maladjustment are indeed characterized by reduced emotional reactivity (Koval, Butler, Hollenstein, Lanteigne, & Kuppens, 2015).

From a general stance, emotions represent adaptive responses that aid and motivate an organism to cope with the demands and threats in the environment (Frijda, 2006; Izard, 2009). More generally, it can be argued that much of the value of emotions for the human life resides in their capacity to be mobilized as responses to specific internal or external events (Kuppens et al., 2010). Depending on how attuned emotional changes are to environmental contingencies, experiencing changing emotions is expected to be generally adaptive and functional (Weiss & Beal, 2005). Affective Events theory (AET), for example, proposes that people's emotions at work generally depend upon the specific event experienced (Weiss & Cropanzano, 1996). When workers experience positive work related events, or uplift (such as receiving a positive feedback, or attaining a valued work goal), or, rather, a work related negative event (an attack from a client, not meeting an important deadline) their emotional state is expected to change accordingly.

By contrast, lack of emotional responsiveness, in the form of persisting and apparently unchangeable emotional states, may be the gauge of a state of decoupling of emotional responses from environmental demands or psychological states (Bylsma, Morris, & Rottenberg, 2008). This

reduced emotional responsivity may affect not only the onset, but also the maintenance of specific emotional states (Rottenberg, 2005), and it is associated to impaired emotion regulation skills (Gross, 2007) which is typical of psychological maladjustment (Rottenberg, 2005). Empirical studies have supported the hypothesis of a close link between psychological maladjustment and lack of emotional reactivity (Heimpel, Wood, Marschall, & Brown, 2002; Hemenover, 2003; Peeters, Nicolson, Berkhof, Delespaul & deVries, 2003; Sheeber, Allen, Davis, & Sorensen, 2000; Silk, Steinberg, & Morris, 2003). A condition that has been documented being associated with relented emotional dynamics has been labeled emotional inertia (Suls, Green, & Hillis, 1998).

Emotional Inertia

Emotional inertia refers to the extent to which the intensity of a current emotional state is correlated with the intensity of a previous emotional state (Koval et al., 2016; Wang, Hamaker, & Bergeman, 2012). Differently stated, it indicates the interdependence of measures of the same emotions at adjacent time points. As such, it is synonymous with emotions temporal dependency. This is considered to reflect a lack of emotional flexibility, which impair the individuals' ability to continually adapt emotional responses and regulate emotions to fluctuating changes in the environment (Kashdan & Rottenberg, 2010; Koval et al., 2016). People showing high emotional inertia are "affectively stuck" (Koval, Kuppens, Allen, & Sheeber, 2012): their emotional states are highly predictable over time, testifying their disconnection from internal and/or external contingencies (Kuppens et al., 2010). For those individuals, emotions are likely to have loosen their adaptive value, to the point they become dysfunctional (Kuppens et al., 2010; Hollenstein, Granic, Stoolmiller, & Snyder, 2013).

Emotional inertia is different from germane constructs, like emotional variability and emotional instability. *Emotional variability*, for example, refers to within-individual variation of

emotions (positive and negative) over time (e.g., Eid & Diener, 1999). It is often operationalized as the standard deviation of emotions, and thus it indices the mean range of levels within which emotions varies over a certain period.

Emotional instability, instead, reflects how rapidly emotions fluctuates between successive time- points (Jahng, Wood, & Trull, 2008). Usually, it is operationalized as the average of the squared difference between affective states recorded at consecutive observations (Jahng et al., 2008, Equation 3). Emotional instability may result not related to the average level of emotions. Different individuals characterized by different rates of moment-to-moment fluctuations in emotions during a time period may report an identical mean emotional level over that period.

Emotional inertia refers to the rate of change in emotional experiences and it is generally operationalized as the autocorrelation of an emotion (Kuppens et al., 2010). Empirical findings show that high levels of inertia of negative emotions are associated with indicators of maladjustment, such as neuroticism (Suls et al., 1998), low self-esteem (Kuppens et al., 2010), and rumination (Brose, Schmiedek, & Kuppens, 2015), as well as forms of psychopathology such as depression (Koval & Kuppens, 2012; Koval et al., 2016), bipolar disorder and borderline personality disorder (Houben et al., 2015). Interestingly, recent evidence suggests that inertia of negative emotions is related to both current and future health. Indeed, high levels of emotional inertia may increase the risk of depression (Kuppens et al., 2012; van de Leemput et al., 2014) and health problems (Wang et al., 2012). Studies investigating inertia of positive emotions, have, instead, produced less consistent results (Kuppens et al., 2010; Höhn et al., 2013; Koval, Pe, Meers, & Kuppens, 2013). Taken together, these findings suggest that emotional inertia, in particular of negative emotions, results at least partly from maladaptive emotion regulation mechanisms (Kuppens et al., 2010; Suls & Martin, 2005), and further encourage the investigation of fluctuations in individuals' emotional sates over time (Koval & Kuppens, 2012). All in all, although inertia of both negative and positive emotions is theorized to be

maladaptive, stronger evidence is available on the noxious effects of inertia of negative emotions (henceforth, NE inertia; Houben et al., 2015; Koval et al., 2016).

Inertia of Negative Emotions at Work

The above results fit well with studies in the organizational literature suggesting that negative emotions have a stronger influence on attitudes and behavior than positive emotions (Weiss & Cropanzano, 1996). NE inertia may be particularly relevant for organizational researchers for several reasons. First of all, NE inertia may be an indicator of a state of impaired emotion regulation (Kuppens et al., 2012), following a condition of resource depletion. Following Bakker and Costa (2014) NE inertia may be the gauge of a state of chronic emotional exhaustion and thus contribute to strengthen the workers' loss cycle. In line with Conservation of Resources theory (COR; Hobfoll, 1989), workers who constantly deal with negative emotions may be further depleted by the resources necessary to successfully fulfill the requests of their role, and this process may be particularly detrimental to those workers who directly and constantly interact with other people. In addition to this, the persistence of negative state determined by NE inertia may increase the likelihood that they are shared or transferred to other people at work (Hatfield, Cacioppo, & Rapson, 1994), and thus have an impact on group climate and group performance (see Ashkanasy & Humphrey, 2011 for a review). This way, individual NE inertia may have a more general impact on organizational functioning.

When versing in a state of stable high negative arousal, workers may react more negatively to negative events such as interpersonal conflicts, provocations, or frustrations. The reason is that the experience of momentary increase in negative emotions elicited by these events may take more time to dissipate, and in fact become persistent, for individuals high in NE inertia. Then, following Spector and Fox (2002), one may expect that this experience of stable high negative emotions may lead individuals to respond to these events resorting to counterproductive work behaviors (CWB). These

behaviors have indeed been linked to the experience of negative emotions **(**Neuman & Baron, 2005; Spector & Fox, 2005).

In sum, examining temporal dependency of emotional states may be especially relevant in the work setting, in which emotion dynamics plays a critical role with respect to the prediction of work-related goals and attitudes (Beal, Trougakos, Weiss, & Green, 2006; Fisher & Noble, 2004; Ilies & Judge, 2002; Rodell & Judge, 2009), although this fact is often neglected (Gooty et al., 2009).

Overview of the studies

In this Thesis, I am presenting three studies aimed at investigating inertia of negative emotions at work. Despite the many studies linking emotional inertia to psychological maladjustment and low wellbeing (Houben et al., 2015), little is known about its correlates in the workplace. Nowadays, the importance of emotions for organizations has been widely acknowledged. However, the organizational literature has still to catch up with insights about emotion dynamics gained in other research areas (Nübold, Kuppens, & Verduyn, 2019). For this reason, by using intensive repeated assessment design (experience sampling), I conducted three studies aimed at examining (1) a possible antecedent of inertia of negative emotions at work; (2) behavioral correlates of inertia of negative emotions at work; (3) physiological processes underlying inertia of negative emotions. The general aim of this Thesis is to understand if and how temporal dependency of negative emotions might be relevant for organizational research.

In Study 1, I will test the association between inertia of negative emotions and exhaustion, the core dimension of burnout syndrome. Under the theoretical framework of Conservation of Resources Theory (COR; Hobfoll, 1989), I predict that workers reporting high levels of exhaustion may be depleted by the resources necessary to successfully regulate their negative emotional states at work.

Examining the role of exhaustion in predicting subsequent levels of emotional inertia may be of help for identifying potential focal points for interventions.

In Study 2, I replicate findings from Study 1, and further investigate inertia of negative emotions at work by exploring its association to CWB. In line with the emotion-centered model of voluntary work behavior, which considers CWB as a possible result of negative emotions at work (Spector & Fox, 2002), I posit emotional inertia as a moderator in the relationship between negative emotions and CWB. The idea underlying my hypothesis is that workers who show high inertia (i.e., who are constantly dealing with negative emotions), may be more prone to engage in CWB at work.

In Study 3, under the theoretical frameworks of the allostatic load theory (McEwen, 1998) and COR theory (Hobfoll, 1989), I examine the physiological processes underlying emotional inertia at work. The focus is on heart rate variability, as an important indicator of emotional regulation abilities (Thayer & Lane, 2007) and work stress (e.g., Togo & Takahashi, 2009). Extending findings from Study 1 and Study 2, that show how inertia of negative emotions is consistently linked to exhaustion, I test if inflexible emotion dynamics are mirrored by low heart rate variability.

Finally, I present general conclusions from these studies, discussing their theoretical and practical contributions.

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CHAPTER 2

INERTIA OF NEGATIVE EMOTIONS AT WORK: THE ROLE OF EXHAUSTION

Abstract

Fluctuations in people's emotional states over time may reveal crucial information about their psychological functioning and well-being (Koval & Kuppens, 2012). Several studies have focused on temporal dependency of emotions, namely emotional inertia, which refers to the rate of change in emotional experiences and it is generally operationalized as the autocorrelation of an emotion (Kuppens et al., 2010). Evidence indicates that high emotional inertia is related to a number of markers of psychological maladjustment such as neuroticism (Suls, Green, & Hillis, 1998), depression (Koval & Kuppens, 2012; Koval, Sütterlin, & Kuppens, 2015), low self-esteem (Kuppens et al., 2010) and rumination (Brose et al., 2015). However, little is known about emotional inertia at work. The present study aims at expanding existing literature on emotional inertia by investigating its association with exhaustion in a sample of 128 Italian workers, which were assessed during working hours. Participants were prompted six times per day for 5 working days, making a total of 30 times. Specifically, I hypothesized a positive association between emotional inertia of negative emotions and exhaustion. In accordance with the principles of COR Theory (Hobfoll, 1989), results showed that exhaustion predicts high emotional inertia of negative emotions, suggesting that individuals reporting high levels of exhaustion may become unable to flexibly adapt their emotional states to the environmental circumstances.

Keywords: emotional inertia, negative emotions, emotion dynamics, exhaustion, work-related stress

Exhaustion is an Antecedent of Emotional Inertia

Exhaustion refers to the feeling that one's emotional and physical resources are depleted and it reflects a core component of job burnout, a psychological syndrome that results from chronic stressors on the job (Maslach & Jackson, 1981; Maslach, Scaufeli, & Leiter, 2001). A large body of research indicates that exhaustion is associated with a number of negative individual and organizational outcomes such as anxiety, depression, and life dissatisfaction (Ahola, 2007; Hakanen & Schaufeli, 2012), mood disturbances (Hillhouse, Adler, & Walters, 2000), impaired job performance (Bakker & Heuven, 2006; Witt, Andrews, & Carlson, 2004; Wright & Bonett, 1997), turnover (Schaufeli & Enzmann, 1998), and absenteeism (Schaufeli, Bakker, & Van Rhenen, 2009). According to Bakker and Costa (2014), employees experiencing consistently highly demanding working environments may, over time, see their experience of fatigue transforming into chronic exhaustion. As a consequence, they may show self-undermining behaviors, impaired job performance, and a reduced ability to manage emotions (Bakker & Costa, 2014). At present, however, the mechanisms linking the experience of chronic exhaustion to daily experiences and behaviors at work are poorly understood (Bakker & Costa, 2014).

According to the Conservation of Resources Theory (COR, Hobfoll, 1989), exhaustion occurs when individuals experience a net loss of physical, cognitive or emotional resources, ingenerated by a prolonged exposure to work stress (Hobfoll & Shirom, 2001). As a consequence, individuals confronted with such a loss, may adopt a defensive posture in order to protect their resource reserve, minimize the loss and to keep remaining resources readily available in case of a future loss (Hobfoll, 2001). This process can lead to a successful adaptation and generation of new resources, or, in contrast, to maladjustment, which is related to negative functional and emotional outcomes (Hobfoll, 2001).

Following this reasoning, I propose that exhaustion may have consequences in terms of emotion regulation, by reducing the emotional responsiveness and reactivity to the environment. Stated differently, individuals who report high levels of exhaustion may be depleted by the resources necessary to adapt their emotional states to external changes, thus "getting affectively stuck" (Koval, Kuppens, Allen, & Sheeber, 2012, p. 1413). As a result, exhaustion may affect emotion dynamics, by contributing to an emotional slowing down or higher persistence of negative emotional states across time, reflected in high levels of inertia of negative emotions. A study by Van Gelderen, Konijn, and Bakker (2017) showed that workers reporting higher levels of strain at work were more likely to use suboptimal emotional regulation strategies (see also Bakker & Costa, 2014). Accordingly, because emotions are not actively regulated, exhaustion as a typical strain symptom may result in high levels of emotional inertia. In this way, negative emotions experienced by individuals with high levels of exhaustion may be less responsive to external or internal changes and slow to change (Kuppens et al., 2010). This hypothesis is also motivated by the evidences of an association between emotional inertia and neuroticism (Suls, Green, & Hillis, 1998) and depression (Koval & Kuppens, 2012; Koval, Sütterlin, & Kuppens, 2016); of interest, both neuroticism and depression have been shown to be consistently correlated to exhaustion as well (Alarcon, Eschleman, & Bowling, 2009). Thus, the hypothesis is that exhaustion positively predicts high levels of NE inertia.

H1. Exhaustion predicts high NE inertia.

Controlling for Potential Confounders

Previous studies have reported an association of NE inertia with several person-level and processual factors. For instance, self-esteem and neuroticism have been repeatedly and consistently associated with NE inertia in previous studies (e.g., Heimpel, Wood, Marschall, & Brown, 2002; Hemenover, 2003). In addition, the effect of gender has been also usually controlled in these studies. Moreover, Koval et al. (2016) suggested that to reliably conclude that emotional inertia is attributable

to endogenous (e.g., chronic exhaustion) versus exogenous (e.g., differential exposure to events) factors, it is important to control for the individual exposure to negative events. Thus, in the present study I controlled for gender, self-esteem, and neuroticism at the person level, and negative work events at the within-person level. Although multilevel models are able to control for different spacing among successive assessments (Snijders & Bosker, 1999) I further controlled for the differences in the time-lag between successive assessments determined by the fact that participants worked a different number of hours per day.

Method

Sample

Participants were 128 workers who work directly with the public (i.e., who interact with the recipients of their service). Most of participants (61.7%) were female, with an average age of 35.8 years (*SD* = 12.9), and an average job tenure of 10.5 years (*SD* = 11.2). Participants worked in a broad range of different professions and occupational fields: 19% worked in the sales sector, 13.2% worked in the health sector, 12.2% worked in the education sector, 11.6% were technical professional, 2.6% were police officers, and the remaining 41.4 % were employees in various fields.

Procedure

Participants were recruited mostly via advertisement posted online, but also via word of mouth. Only people working for at least five consecutive hours per day were considered eligible for this study. A week before the beginning of the daily study (T0), socio-demographic characteristics, as well as (1) exhaustion, (2) neuroticism, and (3) self-esteem were assessed. All participants were also asked to provide their work schedule for the week of the study, specifying, for each working day, their start and end times as well as breaks at work. Starting from the following Monday, participants were prompted (via a tone signal on their mobile phone) six times per day during working hours for

five working days, making a total of 30 prompts. Prompts occurred at random times and the time interval between two prompts varied depending on the number of hours per work-day (e.g. for a six-hour workday, prompts occurred about 60 minutes apart). After participants were prompted, they had 10 or 20 minutes to respond to the initial question, depending on the length of the workday (e.g. for a six-hour workday, participants had 10 minutes to fill a questionnaire, for an eight hours' workday, participants had 20 minutes to fill a questionnaire). Participants provided informed consent.

Measures

Exhaustion (α = .84)**.** At T0, exhaustion was assessed using the five items (e.g. ''I feel emotionally drained from my work'') of the Maslach Burnout Inventory - General Survey (Schaufeli, Leiter, Maslach, & Jackson, 1996). Response scale: 1 = "Never"; 5 = "Daily".

Neuroticism (α = .81)**.** Neuroticism was assessed at T0 using 12 items (e.g. ''I'm subject to frequent mood changes") drawn by the Big Five Questionnaire-2 (BFQ-2; Caprara, Barbaranelli, Borgogni, & Perugini, 1993). Participants indicated agreement with the extent to which each item described them on a 5-point scale ranging from 1 = "Very false for me" to 5 = "Very true for me".

Self-esteem (α = .77)**.** At T0, self-esteem was assessed by means of the Rosenberg Self-Esteem scale (Rosenberg, 1965), which is composed of 10 items (e.g., "I feel that I have a number of good qualities") scored on a 4-point scale (1 = "Strongly disagree"; 4 = "Strongly agree").

NE inertia. Six times per day, participants were asked to report their current levels of negative emotions. Participants were asked to indicate the extent to which they were currently feeling each of nine negative emotions (sad, anxious, angry, frustrated, ashamed, disgusted, guilty, irritable, restless) by moving a slider on the screen of their mobile phones along a continuum anchored with the numbers 0 and 100. Answers were coded as a number from 0 to 100. The above affect words were drawn from various sources, including the Positive Affect Negative Affect Scale (Watson, Clark, & Tellegen, 1988) and Ekman's basic emotions (e.g., Ekman, Friesen, & Ellsworth, 1972). I calculated the

between- and within-person reliability using MIXED methods with SPSS 25.0 (Bonito, Ruppel & Keyotn, 2012). The between-person reliability was .83 and the within-person reliability was .78. The within-person value can be considered substantial (Shrout, 1998). Following the procedure discussed in previous studies (e.g., Kuppens, Allen, & Sheebr, 2010; Koval et al., 2016), NE inertia was calculated by running two-level autoregressive models (these models are described in the statistical analyses section).

Negative work events. At each prompt, participants completed a 4-item negative events checklist (e.g., "Had a heavy workload"; "Had a conflict with a coworker") adapted from Gable, Reis, and Elliot (2000). The checklist included events that may occur frequently at work (see also Basch & Fisher, 2000) and measures of job demands, such as workload, drawn from the Job Content Questionnaire (JCQ, Karasek, 1985). Participants were instructed to check any negative event that occurred since the previous survey and rate how significant the event was on a 6-point scale (0 = "It did not happen", 5 = "It happened and it was extremely important"). A composite (formative) index was created by averaging the four events. Given the potential independence among the different events, an alpha coefficient is not an appropriate measure of reliability for this scale (i.e., it refers to a formative construct).

Time-lag. The time-lag was calculated as the interval (in minutes) between two prompts (i.e., time at which the current survey was filled minus time at which the previous one was filled).

Statistical Analyses

Because of the nested data structure (prompts nested within individuals), I tested the hypotheses using multilevel modeling, in order to simultaneously estimate within- and between-person effects while handling varying time intervals between prompts and missing data (see Snijders & Bosker, 1999). Statistical significance of parameters estimates was investigated using the bias-corrected bootstrap method with 10,000 resamples. Critical values for the upper and lower 95% bias-

corrected confidence limits for all parameter estimates were computed. All coefficients with an associated confidence interval that did not include zero were considered statistically significant ($p < .05$). Given that some variables slightly deviated from normality (i.e., skewness or kurtosis > 1.00), I decided to square root transform all variables.

To test the hypotheses, I compared several nested models: (1) a null model including only the intercept, and (2) in line with previous research on emotional inertia (e.g., Kuppens et al., 2010; Koval et al., 2016), a two-level autoregressive (AR1) model including both a random intercept and a random (autoregressive) slope. In this latter model (i.e., Model 2), the Level 1 first order autoregressive slope of negative emotions (representing NE inertia) was specified in this way:

(1) $\text{NegativeEmotions}_{ti} = \beta_{01} + \beta_{1i}\,(\textit{NegativeEmotions}_{t\text{-}1i}) + \beta_{2i}\,(\textit{NegativeWorkEvents}_{t\text{-}1i}) + \beta_{3i}\,(\textit{Time Lag}_i) + \varepsilon_{ti}$.

In the above equation, Level-1 ($\textit{NegativeEmotions}_{t\text{-}1}$) is the person *i*'s level of an emotion at time *t-1*. β_{1i} is a random slope capturing the strength of the longitudinal association between negative emotions level at *t-1*, and his/her emotional level at the successive *t*, or the degree of "emotional inertia" (see Suls et al., 1998), and usually ranges from -1 to 1 (as an autocorrelation coefficient). Negative work events at *t-1* and length of the time lag are Level-1 control variables.

As recommended (Enders & Tofighi, 2007), all lagged predictors (i.e., $\text{Negative Emotions}_{t\text{-}1}$ and Negative Work Events $_{t\text{-}1}$) were person-mean centered to remove between person differences from Level-1 parameter estimates (see Judge, Ilies, & Scott, 2006). Under this parametrization, the β_{01} parameter, representing the Level-1 intercept, is equivalent to each person *i*'s level of negative emotions across all occasions. β_{01} (i.e., the intercept), and β_{1i} (i.e., the slope) were allowed to vary randomly across persons. At Level-2, exhaustion, neuroticism, and self-esteem were included as grand-mean centered covariates:

(2) $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{Exhaustion}_i) + \gamma_{02}\,(\text{Neuroticism}_i) + \gamma_{03}\,(\text{Self-esteem}_i) + \gamma_{04}\,(\text{Sex}_i) + r_{0i}$,

(3) $\beta_{1i} = \gamma_{10} + r_{1i.}$; (4) $\beta_{2i} = \gamma_{20} + r_{2i}$; (5) $\beta_{3i} = \gamma_{30} + r_{3i}$.

To be parsimonious and maintain the model simple, the variances of random terms r_{1i} to r_{31} were tested for statistical significance and eventually removed from the model. Likewise, the covariance between all random terms were tested and fixed to zero if not statistically significant. In Model 3, I then used individual exhaustion (grandmean centered), as a Level-2 variable as a predictor of the autoregressive slope. This model is shown in the equations below:

(6) $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{Exhaustion}_i) + \gamma_{02}(\text{Neuroticism}_i) + \gamma_{03}(\text{Self-esteem}_i) + \gamma_{04}(\text{Sex}) + r_{0i}$,

(7) $\beta_{1i} = \gamma_{10} + \gamma_{11}(\text{Exhaustion}_i) + r_{1i}$.

The Level-2 equations for β_{2i}, β_{3i}, and β_{4i} remained unaltered. In this final model, β_{0i} is the intercept representing the mean level of NE and β_{1i} represents the slope, or the average relationship between previous and subsequent negative emotions (or average inertia) across the sample. γ_{10} represents the average level of NE inertia across the sample, and γ_{11} can be interpreted as the standardized regression weight between exhaustion and NE inertia. Thus, considering the case of a worker reporting a score on exhaustion higher than one standard deviation over the sample mean, and assuming an estimated γ_{11} value of .30, it is predicted to have a NE inertia level higher of .30 units above the score reported by the average worker in the sample. I used the difference between the respective likelihoods and degrees of freedom associated with the above models to test the improvement of each model over the previous one.

Results

Descriptive Statistics and Correlations of Level 2 Variables

On average, prompts occurred at an interval of 59.90 minutes (*SD* = 21.43). All correlations were significant and in the expected direction (see Table 1), except for those of negative events with (1) neuroticism, and (2) and self-esteem, and (3) negative emotions with self-esteem.

Preliminary Analyses

Before testing the hypotheses, I examined whether negative emotions and negative work events differed within persons. Partitioning of the total variance into within-person and between-person variance showed that 65% of the total variance of negative emotions was within persons. This amount of within-person variance reflects the one found in previous studies (Shockley, Ispas, Rossi, & Levine, 2012). As for negative work events, 29% of the total variance was within persons. Overall, these analyses show that a substantial portion of the variance in negative emotions and negative work events can be attributed to within-person variation.

Table 1

Means, standard deviations, and correlations among Study 1 variables at Level-1 and Level-2.

	Mean	SD	1	2	3	4	5	6
1. Neuroticism	3.01	.78		-	-	-	-	-
2. Self-esteem	1.93	.38	-.37**		-	-	-	-
3. Exhaustion	2.20	.92	.38**	-.19*		-	-	-
4. Negative work-events	1.68	.49	.08	-.06	.29**		.23**	-
5. Negative emotions	10.09	10.35	.43**	.13	.39**	.29**		.77**
6. Negative emotions$_{t-1}$	10.09	10.37	-	-	-	-	-	-

Note. ** $p < .01$; ** $p < .05$.

Level-1 (or "prompt level") correlations are presented above the diagonal; Level-2 (or "individual level") correlations are presented below the diagonal. Correlations for negative emotions$_{t-1}$ are not reported as they are the same as those presented for the non-lagged variable (negative emotions).

Multilevel Models

First of all, I estimated the absolute levels of emotional inertia for Negative Emotions by entering in the above model (1) at Level-1 only the uncentered lagged *Negative Emotions*$_{t-1}$ (see Hamaker & Grasman, 2015), and (2) no Level-2 predictors. In this model, the autoregressive parameter (γ_{10}) representing the inertia of negative emotions was positive and significant and moderately high in size (i.e., .40, *SE* = .03, $p < .001$, 95% BCB [.35, .45]).

Table 2 shows the results from testing my substantive hypotheses. Model 1, including negative work events and time lag as Level 1 control variables, as well as exhaustion, gender, neuroticism, and self-esteem as Level 2 control variables showed a better model fit than the null model. Estimates of NE inertia were almost similar to those reported above. All covariates (except negative work events) significantly predicted average levels of negative emotions. Model 2, in which the prediction of current levels of negative emotions by previous negative emotions was specified as random, showed a better model fit than Model 1. In Model 3, I explored if the strength of this prediction, representing NE inertia was moderated by individuals' average levels of exhaustion. Indeed, exhaustion predicted the association between previous and concurrent level of negative emotions, supporting *H1* that exhaustion is associated with NE inertia. Furthermore, Model 3 fitted better than Model 2 (Table 2). I also run all analyses removing control variables and all results remained unchanged.

Table 2

Multilevel models examining the relation between exhaustion and NE inertia (Study 1).

	Null Model			*Model 1*			*Model 2*			*Model 3*		
	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI
Variables												
Level 2												
Intercept (γ_{00})	2.54 (.019)	.000	2.57, 2.50	2.37 (.023)	.000	2.41, 2.32	2.37 (.023)	.000	2.41, 2.33	2.37 (.023)	.000	2.41, 2.329
Exhaustion (γ_{01})	-	-	-	.448 (.023)	.000	.489, .407	.448 (.023)	.000	.488, .407	.448 (.023)	.000	.489, .406
Neuroticism (γ_{02})	-	-	-	.880 (.028)	.000	.932, .829	.880 (.028)	.000	.927, .829	.880 (.028)	.000	.927, .829
Self-esteem (γ_{03})	-	-	-	.340 (.057)	.000	.442, .237	.338 (.057)	.000	.441, .236	.339 (.057)	.000	.441, .236
Gender (γ_{04})	-	-	-	.172 (.045)	.000	.255, .091	.171 (.044)	.000	.253, .091	.171 (.044)	.000	.253, .091
Level 1												
Negative emotions (γ_{10})	-	-	-	.400 (.027)	.000	.450, .351	.391 (.022)	.000	.419, .355	.396 (.022)	.000	.422, .362
Negative work events (γ_{20})	-	-	-	.014 (.097)	.889	.189, -159	-.003 (.096)	.976	.127, -.159	-.003 (.096)	.974	.127, -.159
Time Lag (γ_{30})	-	-	-	.000 (.000)	.035	.000, .000	.000 (.000)	.032	.000, .000	.000 (.000)	.030	.000, .000
Cross level interaction												
Exhaustion*NE_{t-1} (γ_{11})	-	-	-	-	-	-	-	-	-	.038 (.021)	.016	.067, .002
L-1 Residual(ε_{ti})	1.26 (.045)	.000	1.22, 1.20	.867 (.041)	.000	.841, .825	.843 (.041)	.000	.833, .726	.843 (.041)	.000	.833, .726
Intercept variance (τ_{00})	2.36 (.050)	.000	2.62, 2.24	1.57 (.044)	.000	1.75, 1.47	1.58 (.043)	.000	1.75, 1.48	1.58 (.043)	.000	1.75, 1.474
Slope variance (τ_{11})	-	-	-				.019 (.010)	0.01	.039, .009	.019 (.010)	.006	.038, 009
-2 Log (lh)	11888.40			6781.46			6759.65			6754.94		
df	3			10			11			12		
Difference of -2 Log	-			5106.94			21.81			4.71		
Difference in *df*	-			7			1			1		

Note. All variables were square root transformed. The random effects associated with "Negative work events" and "Time Lag" were tested and found to be statistically not significant. Therefore, they were removed from the model. Likewise, the covariance between the intercept and the random slope was tested and (being not statistically significant) was removed from the model

Discussion of Study 1 Findings

Although in previous studies NE inertia was found to be related with several indicators of maladjustment and psychological wellbeing (e.g., Koval et al., 2016; van de Leemput et al., 2014), its correlates in the work setting remained unexplored. Accordingly, this first study aimed to expand previous research by investigating the association of NE inertia with exhaustion at work.

Moving from the assumption that individuals experiencing exhaustion may be depleted by the resources necessary for emotional regulation (Hobfoll, 2001), I found support for the hypothesis that initial levels of exhaustion – as a possible consequence of prolonged work-related stress – may be associated to emotional dysfunctions mostly represented by affective dysregulation and inflexibility (Koval et al., 2012). Differently stated, workers reporting higher levels of exhaustion, being in a condition of resources impairment, may adopt a defensive posture and progressively become unable to flexibly adapt their emotional states to the environmental circumstances. In this way, exhaustion may affect emotional functioning, by decoupling emotions from their adaptive function and creating a condition of psychological vulnerability (Kuppens et al., 2010). All in all, these findings attest the relevance of NE inertia at work, suggesting that exhaustion is associated with a reduced ability to adapt negative emotional states at work. At the individual level, this reduced ability results in emotional states that persist over time during the work day.

From a theoretical point of view, the link between exhaustion and NE inertia sheds light on the impact of initial levels of work-related stress on subsequent emotion dynamics at work. Indeed, the capacity to fine-tune emotional states in accordance to external contingencies is a key aspect of the coping process (Eisenberg, Fabes, & Guthrie, 1997). Individuals who lack the ability to self-regulate their negative emotions at work are at higher risk to respond inappropriately to stressful conditions. In addition, by lacking the flexibility to emotionally adapt to ongoing events, they may be particularly vulnerable to stressors and thus show a reduced ability to recover from stress.

As conceptualized by Kuppens and colleagues (2010), emotional inertia represents a relatively stable individual characteristic arising from a dynamic process. Indeed, emotional inertia perfectly

instantiates an example of a pathological process (i.e., the chronical slowing down of individual emotional dynamics) that, once crystallized, emerges as a person-level style of emotional regulation. At the within-individual level, the lack of emotional responsiveness, in the form of persisting and apparently unchangeable emotional states, is likely to signal a state of resource depletion, often related to chronical stress states. At the between-person level, the reduced emotional responsivity and the deriving persistence of specific emotional states are related to differences in observed individuals' organizational behavior. Loosely speaking, workers' emotional inertia may emerge as a result of their interaction with the organizational environment, and then, once structured, it is likely that it may affect workers' behavior and attitudes.

This first study contributes to the knowledge on job-stress correlates by demonstrating how exhaustion is associated with a specific within-individual emotional dynamic. Indeed, these findings provide a picture of everyday emotional experiences of workers experiencing exhaustions, by examining for the first time the temporal dynamics of their negative emotions. This study also contributes to gain a better understanding of the mechanisms underlying emotional inflexibility at work, as it suggests a pattern of loss cycle at work in which the repeated exposure to stressful conditions may lead to a flattened emotional life characterized by negative emotions that are more pervasive and slow to change. Thus, it provides insights for interventions aimed at managing and reducing work-related stress.

Limitations

This study is not without limitations. One first limitation is the exclusive reliance on self-reports and related concerns of common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Person-mean centering mitigates this problem, as person-mean centered scores are deprived by response tendencies stemming from individual differences. However, future studies may consider integrating self-report measures with physiological emotional measures, such as cardiovascular,

endocrine, or electrodermal measures, which represent good indicators of emotional response following stressors (Ganster et al., 2018).

A second limitation refers to the temporal frame considered. Although five days may seem reasonable, and similar to the timeframe used in previous similar studies (Sonnentag, Binnewies, & Mojza, 2008), it is not unlikely that emotional inertia may require more time to develop and fix. Moreover, it is likely that emotional inertia may behave as a persisting state, and thus that some workers may appear relented and emotionally slow during certain time periods but not in others. Future studies may use different timeframes for testing the generalizability of these results.

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CHAPTER 3

BEHAVIORAL CORRELATES OF INERTIA OF NEGATIVE EMOTIONS AT WORK: COUNTERPRODUCTIVE WORK BEHAVIOR

Abstract

Emotional inertia is a key component of emotional dynamics and it describes the tendency of emotional experiences to be self-predictable over time and to be resistant to change (Kuppens, Allen, & Sheeber, 2010). Investigating emotion inertia in the workplace may be particularly relevant, as affective experiences are intimately connected to organizational behavior and effectiveness. In this study, I examined the moderating role of inertia of negative emotions in the relationship between negative emotions at work and counterproductive work behavior (CWB), which refers to employees' intentional acts that harm or are intended to harm organizations or their stakeholders (Spector & Fox, 2005). Participants were 116 Italian workers, who were prompted six times per day for 5 working days, making a total of 30 prompts. The hypotheses were tested by using multilevel modeling. Findings suggest that inertia of negative emotions aggravates the relation between negative emotions and workers' counterproductive behavior. Furthermore, in line with results from Study 1, findings showed that inertia of negative emotions is consistently associated with exhaustion. All in all, these results attest the relevance of temporal dependency of negative emotions in the workplace, as it may affect employees' behavior.

Keywords: emotional inertia, negative emotions, counterproductive work behavior, emotion dynamics, experience sampling method

The Role of Emotional Inertia in Affecting Counterproductive Work Behavior

The aims of this second study were twofold. The first aim was to further investigate the correlates of workers' NE inertia in terms of organizational behavior. The second aim was to replicate results from Study 1 in a different sample of workers.

In the light of Study 1 findings, I focused on a specific class of organizational behaviors, namely counterproductive work behaviors (CWB). CWB represent performance-related behaviors which consist of employees' intentional acts that harm organizations or their stakeholders (Spector & Fox, 2005). These include avoiding work, doing tasks incorrectly, physical aggression, verbal hostility, sabotage, and theft. I decided to focus on CWB because according to Spector and Fox (2002) model, negative emotions play a central role in eliciting this form of voluntary behavior at work. Moreover, CWB represent a frequent and costly phenomenon for organizations, as they lead to reduced productivity, increased turnover and absenteeism, as well as reduced wellbeing (e.g., Einarsen, Hoel, Zapf, & Cooper, 2003; LeBlanc & Kellowey, 2002). While previous research provides evidence on the association between CWB, stress and negative emotions (e.g., Penney & Spector, 2005; Rodell & Judge, 2009), this study extends current literature by taking into account the role of time, in terms of duration of negative emotional experiences at work.

The emotion-centered model of voluntary work behavior views workers' behavior as the result of their interaction with work environment (Spector & Fox, 2005). Being the source of several needs' fulfillment, the workplace represents an environment that can elicit strong emotional reactions (Spector & Fox, 2002). Workers tend to monitor the environment and to emotionally react to those situations that are considered relevant for their wellbeing. Their emotional experiences in turn, may affect workers' behavior and action tendencies either immediately, or at a later time (Spector & Fox, 2002). Specifically, CWB are associated with workers' action tendencies deriving from general states of physiological arousal induced by specific affective states (Spector & Fox, 2002). As argued above, workers are expected to change their affective state as a consequence of events happening over time.

Notably, perceiving stressors or frustrating conditions lead workers to experience negative emotional feelings at work, which are then expected to contribute to the formulation of behavioral intentions and thus to specific behavioral reactions. Hence, emotional experiences play a crucial role in this process, as they represent an immediate reaction to stress. More precisely, Spector and Fox (2002) maintained that the behavioral response prompted by the experience of negative emotions may lead employees to enact openly destructive action (corresponding to CWB). Accordingly, I posited the following hypothesis.

H1. The experience of negative emotions predicts CWB.

Where does NE inertia enter in this relation? Emotional inertia reflects an increased likelihood of a negative emotion experienced at one moment being carried over to the next moment (Kuppens, Allen, & Sheeber, 2010). Thus, the impact of experiencing negative emotions is expected to be stronger for those workers displaying higher levels of emotional inertia. The reason is that these workers are indeed unable of managing, controlling and reducing their general negative emotional state, even when the event that caused it has passed. Thus, their negative feelings persist over time, because they are unable to let them dissipate. If so, NE inertia is expected to act as a moderator of the postulated association of negative emotions with CWB. High and stable levels of negative emotions should make individuals more susceptible to any environmental cues (i.e., interpersonal conflicts, provocations, frustrations, etc.) that may potentially trigger CWB. On the contrary, workers experiencing low levels of negative emotions, but reporting high NE inertia, are expected to be less susceptible to CWB because they are less reactive to any environmental cue that could trigger CWB. Accordingly, Spector and Fox (2002) maintain that emotions do not necessarily lead to CWB, but they increase the likelihood of engaging in CWB, which can occur under certain condition. Occasional negative emotional experiences, in fact, should not have much impact on behavioral tendencies, while repeated and cumulative negative experiences will be summative and thus enhance the likelihood of CWB (Spector & Fox, 2002). As a result, I hypothesized the following:

H2. NE inertia moderates the relationship between negative emotions and CWB.

Of importance, in testing these hypotheses I controlled for all covariates considered in the previous study, including exhaustion. Indeed, because exhaustion was a significant predictor of NE inertia, controlling for it will further refine the understanding of the specific impact of NE inertia on the relationship between level of negative emotions and CWB.

Method

Sample and procedure

Participants were 116 workers who worked directly with the public. Most participants (62.6%) were female. Average age was 43.3 years (*SD* = 12.8). Participants worked in a broad range of different professions and occupational fields, with 21.1% of working in the health sector, 18.8% working in the sales sector, 15.6% working as technical professionals, 6.6% working in the education sector, 2.5% of working as police officers, and the remaining 35.4% working in o fields. Mean job tenure was 15.6 years (*SD* = 11.9). The procedure followed was the same as in Study 1: after providing their work schedule for the study week, participants were prompted six times per day, for five working days (making a total of 30 prompts) during working hours.

Measures

Exhaustion (α = .84)**.** At T0, exhaustion was assessed using the five items (e.g. ‘‘I feel emotionally drained from my work’’) of the Maslach Burnout Inventory - General Survey (Schaufeli, Leiter, Maslach, & Jackson, 1996). Response scale: 1 = “Never”; 5 = “Daily”.

Neuroticism (α = .91)**.** Neuroticism was assessed at T0 using 12 items (e.g. ‘‘I'm subject to frequent mood changes”) drawn by the Big Five Questionnaire-2 (BFQ-2; Caprara, Barbaranelli, Borgogni, & Perugini, 1993). Participants indicated agreement with the extent to which each item described them on a 5-point scale ranging from 1 = “Very false for me” to 5 = “Very true for me”.

Self-esteem (α = .76)**.** At T0, self-esteem was assessed by means of the Rosenberg Self-Esteem scale (Rosenberg, 1965), which is composed of 10 items (e.g., “I feel that I have a number of good qualities”) scored on a 4-point scale (1 = “Strongly disagree”; 4 = “Strongly agree”).

NE inertia. Six times per day, participants were asked to report their current levels of negative emotions. Participants were asked to indicate the extent to which they were currently feeling each of nine negative emotions (sad, anxious, angry, frustrated, ashamed, disgusted, guilty, irritable, restless) by moving a slider on the screen of their mobile phones along a continuum anchored with the numbers 0 and 100. Answers were coded as a number from 0 to 100. The above affect words were drawn from various sources, including the Positive Affect Negative Affect Scale (Watson, Clark, & Tellegen, 1988) and Ekman's basic emotions (e.g., Ekman, Friesen, & Ellsworth, 1972). I calculated the between- and within-person reliability using MIXED methods with SPSS 25.0 (Bonito, Ruppel & Keyotn, 2012). The between-person reliability was .86 and the within-person reliability was .76. The within-person value can be considered substantial (Shrout, 1998). Following the procedure discussed in previous studies (e.g., Kuppens et al., 2010; Koval, Sütterlin, & Kuppens, 2016), NE inertia was calculated by running two-level autoregressive models (these models are described in the statistical analyses section).

Negative work events. At each prompt, participants completed a 4-item negative events checklist (e.g., "Had a heavy workload"; "Had a conflict with a coworker") adapted from Gable, Reis, and Elliot (2000). The checklist included events that may occur frequently at work (see also Basch & Fisher, 2000) and measures of job demands, such as workload, drawn from the Job Content Questionnaire (JCQ, Karasek, 1985). Participants were instructed to check any negative event that occurred since the previous survey and rate how significant the event was on a 6-point scale (0 = "It did not happen", 5 = "It happened and it was extremely important"). A composite (formative) index was created by averaging the four events. Given the potential independence among the different events, an alpha coefficient is not an appropriate measure of reliability for this scale (i.e., it refers to a formative construct).

Time-lag. The time-lag was calculated as the interval (in minutes) between two prompts (i.e., time at which the current survey was filled minus time at which the previous one was filled).

CWB. CWB were measured with three items (i.e., "I behaved in an unfriendly manner", "I gossiped about other people at work", and "I spent time on tasks unrelated to work") from the scale created by Dalal, Lam, Weiss, Welch, and Hulin (2009). At each prompt, participants were asked whether they had or had not engaged in each behavior since the previous survey. This resulted in a sum score that ranged from 0 (participant had not engaged in any behavior) to 3 (participant had engaged in all behaviors).

Statistical analyses

First, I aimed at a replication of the results from Study 1 by performing the same analyses and using the same methodology. Then NE inertia was computed as the within-individual estimate of negative emotions autocorrelation obtained by using hierarchical linear modelling parameterized as previous Model 2 and implementing the analytical procedures described by Raudenbush and Bryk (2002). Essentially, I calculated and extracted the autoregressive parameter estimated for each single individual within the overall multilevel model described above. These estimates were then used as indicators of Level 2 NE inertia in all subsequent analyses.

As in Study 1, I began with a null model and then moved to testing *H2* by using a series of nested multilevel models. First of all, I specified a model in which CWB_t was predicted by previous CWB_{t-1}, Negative $Emotions_{t-1}$, and by the same set of covariates included in Study 1 (Model 1 to Model 3). Note that the prediction of CWB_{ti} by Negative $Emotions_{t-1}$ represents the main effect of negative emotions on CWB over time. The resulting equations for this model were:

(8) Level 1 $CWB_{ti} = \beta_{01} + \beta_{1i}(CWB_{t-1i}) + \beta_{2i}(NegativeEmotions_{t-1i}) + \beta_{3i}(NegativeWorkEvents_{t-1i}) + \beta_{4i}(Time\ Lag_i) + \varepsilon_{ti}$.

(9) $\beta_{0i} = \gamma_{00} + \gamma_{01}(NE\_Inertia_i) + \gamma_{02}(Exhaustion_i) + \gamma_{03}(Neuroticism_i) + \gamma_{04}(Self\text{-}esteem_i) + \gamma_{05}(Sex_i) + r_{0i}$,

(10) $\beta_{1i} = \gamma_{10} + r_{1i}$; (11) $\beta_{2i} = \gamma_{20} + r_{2i}$; (12) $\beta_{3i} = \gamma_{30} + r_{3i}$; (13) $\beta_{4i} = \gamma_{40} + r_{4i}$;

Again, the variances of random terms r_{1i} to r_{41} and the covariance between all random terms

were tested and fixed to zero, unless they were statistically significant. In Model 2, I tested if the strength of the association between CWB_{ti} and Negative $Emotions_{t-1}$ varied randomly across individuals. Finally, in Model 3 I tested H2. The Level-1 part of this model was identical to Model 2. I expanded the Level-2 equations by including the cross-level interaction between NE inertia and the absolute levels of negative emotions in predicting CWB over time, as follows:

(11) $\beta_{0i} = \gamma_{00} + \gamma_{01}(NE\_Inertia_i) + \gamma_{02}(Neuroticism_i) + \gamma_{03}(Self\text{-}esteem_i) + \gamma_{04}(Sex_i) + \gamma_{05}(NegativeEmotions_i) + r_{0i}$,

(12) $B_{2i} = \gamma_{10} + \gamma_{11}(NE\_Inertia_i) + r_{1i}$

As in Study 1, all Level-1 variables were person-mean centered, and all Level-2 variables were grand-mean centered. The Level-2 equations for β_{1i}, β_{3i}, and β_{4i} remained unaltered. The hypothesis *H2* is linked to the significance of the coefficient γ_{11} that reflects how differences in NE inertia change the relationship between the experienced level of negative emotions and CWB.

Results

Descriptive Statistics and Correlations of Level 2 Variables

On average, participants were prompted every 60.99 minutes (*SD* = 22.22). Correlations were significant and in the expected direction (Table 3), except for those of negative work-events with (1) neuroticism and (2) self-esteem. CWB was significantly and positively related only with negative emotions. NE inertia was significantly and negatively related with neuroticism, but positively with exhaustion and negative emotions.

Table 3

Means, standard deviations, and correlations among Study 2 variables at Level-1 and Level-2

	Mean	SD	1	2	3	4	5	6
1. Neuroticism	2.87	.78		-	-	-	-	-
2. Self-esteem	1.82	.31	-.36**		-	-	-	-
3. Exhaustion	2.20	.89	.30**	-.34**		-	-	-
4. Negative emotions	9.83	11.04	.42**	-.35**	.50**		.27**	.12**
5. Negative work-events	3.12	1.74	.12	.01	.18*	.32**		-
6. CWB	.35	.33	.13	-.05	.10	.22*	.12	
7. Emotional inertia	.00	.09	.23*	.02	.18*	.21*	.07	.01

Note. ** $p < .01$; ** $p < .05$.

Level-1 (or "prompt level") correlations are presented above the diagonal; Level-2 (or "individual level") correlations are presented below the diagonal.

Note that emotional inertia is computed as a normal standardized variable and thus its mean is equal to 0.

Preliminary Analyses

As in Study 1, before testing the hypotheses, I examined whether negative emotions, CWB, and negative work events fluctuated within persons. Partitioning of the total variance into within- and between-person variance showed that 70% of the total variance of negative emotions was within persons. For CWB within-person variance was 28%. For negative work events within-person variance was 29%. Overall, these analyses show that a substantial portion of the variance in negative emotions, negative work events, and CWB can be attributed to within-person variation.

Testing H1: The Experience of Negative Emotions is Positively Associated with CWB

I investigated if the experience of negative emotions at *t-1* predicted CWB. As displayed in Table 4, findings from Model 1 did not support this hypothesis, as the Level-1 slope linking negative emotional states to concurrent CWB was not statistically significant. Workers reporting high levels of negative emotions did not report an increase in CWB at the next moment.

Testing H2: NE Inertia Increases the Relationship Between Negative Emotions and CWB

According with H2, workers characterized by higher levels of overall NE inertia were more likely to enact CWB when experiencing negative emotions. Adding the interaction between negative emotions and NE inertia to the previous model improved model fit (Table 4). In line with H2, the relationship between negative emotions and CWB was stronger when NE inertia was high (+ 1 SD: B = .04; SE = .01; $p < .0001$, 95% CI [.06, .02]) than when it was low (- 1 SD: B = .02; SE = .01; p = .08, 95% CI [.06, -.01]). Figure 1 displays the observed relationship between negative emotions and CWB as a function of NE inertia. As it can be seen, workers reporting high levels of negative emotions and high NE inertia engaged more in CWB than workers high in negative emotions, but low in NE inertia. Workers reporting low levels of negative emotions and high level of NE inertia reported lower levels of CWB than workers reporting low level of negative emotions and low NE inertia.

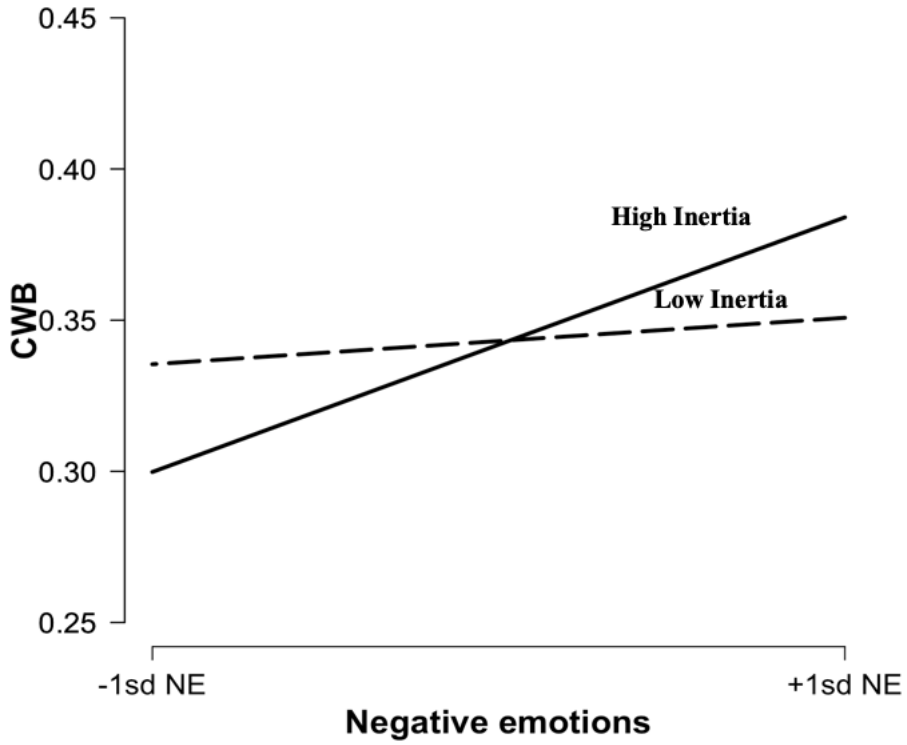
Table 4

Multilevel estimates for models testing the association between NE inertia, negative emotions and CWB.

	Null Model			*Model 1*			*Model 2*			*Model 3*		
	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI
Variables												
Level 2												
Intercept (γ_{00})	.182 (.004)	0.000	.191, .173	.188 (.007)	0.000	.201, .174	.188 (.007)	0.000	.201, .175	.188 (.007)	0.000	.200, .176
NE Inertia (γ_{01})	-	-	-	-.117 (.062)	0.048	.006, -.237	-.116 (.062)	0.050	.015, -.240	-.116 (.062)	0.051	.020, -.243
Exhaustion (γ_{02})	-	-	-	.013 (.006)	0.028	.025, .001	.012 (.006)	0.031	.023, .001	.012 (.006)	0.031	.024, .001
Neuroticism (γ_{03})	-	-	-	.024 (.007)	0.001	.038, .009	.024 (.007)	0.001	.039, .009	.024 (.007)	0.000	.039, .009
Self-esteem (γ_{04})	-	-	-	-.010 (.017)	0.546	.024, -.044	-.011 (.017)	0.505	.024, -.044	-.010 (.017)	0.544	.026, -.043
Gender (γ_{05})	-	-	-	.001 (.010)	0.945	.020, -.019	.001 (.010)	0.939	.021, -.019	.000 (.001)	0.961	.023, -.020
Level 1												
CWB (γ_{10})	-	-	-	.043 (.014)	0.002	.072, .015	.041 (.014)	0.005	.055, .018	.042 (.014)	0.006	.054, .019
Negative emotions (γ_{20})	-	-	-	.007 (.005)	0.150	.017, -.003	.005 (.005)	0.170	.011, -.003	.004 (.005)	0.229	.013, -.004
Negative work events (γ_{30})	-	-	-	.022 (.025)	0.360	.070, -.026	.021 (.025)	0.402	.061, -.025	.022 (.025)	.365	.059, .019
Time Lag (γ_{40})	-	-	-	-.000 (.000)	0.704	.000, -.000	-.000 (.000)	0.714	.000, -.000	-.000 (.000)	0.712	.000, -.000
Cross level interaction												
Neg. emotions* NE Inertia (γ_{11})	-	-	-	-	-	-	-	-	-	.102 (.044)	0.000	.192, .014
L-1 Residual(ε_{ti})	.061 (.002)	0.000	.061, .057	.061 (.002)	0	.061, .056	.061 (.002)	0.000	.062, .050	.061 (.002)	0.000	.065, .058
Intercept variance (τ_{00})	.022 (.001)	0.000	.029, .017	.022 (.002)	0	.030, .017	.022 (.002)	0.000	.030, .017	.022 (.003)	0.000	.030, .017
Slope variance (τ_{11})	-	-	-				.000 (.001)	0.977	.002, .000	.000 (.001)	0.570	.006, .000
-2 Log (lh)		415.93		373.00			369.77			364.30		
df		3		12			13			14		
Difference of -2 Log				42.93			3.23			5.46		
Difference in *df*				8			1			1		

Note. A model in which CWB, negative work events, and Time-lag were allowed to vary randomly across participants was also tested, but these estimates resulted not statistically significant and overall results were confirmed. Therefore, those were removed from the model. Likewise, the covariance between the intercept and the random slope was tested and (being not statistically significant) was removed from the model.

Figure 1.



Prediction of CWB by contemporaneous negative emotions as a function of NE inertia.

Note. NE = Negative emotions; CWB = Counterproductive Work behavior.

Replicating Results of Study 1

The degree of NE inertia was tested as in Study 1. Results of multilevel models testing the relationship between NE inertia and exhaustion are presented in Table 5. Negative emotions were autocorrelated over time, with a moderately high autoregressive parameter of .44 (Model 1). As in Study 1, exhaustion was related to the average level of negative emotions. Most importantly, and in line with Study 1 findings, exhaustion significantly predicted NE inertia. With respect to covariates, I noticed the same pattern as observed in Study 1: except negative work events, all covariates significantly predicted average levels of negative emotions. As in Study 1, I re-run all analyses removing control variables and all results remained unchanged.

Table 5

Multilevel models examining the relation between exhaustion and NE inertia (Study 2).

	Null Model			*Model 1*			*Model 2*			*Model 3*		
	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI
Variables												
Level 2												
Intercept (γ_{00})	2.40 (.019)	.000	2.44, 2.37	2.58 (.022)	.000	2.62 2.54	2.58 (.022)	.000	2.62, 2.54	2.58 (.022)	.000	2.62, 2.54
Exhaustion (γ_{01})	-	-	-	.800 (.022)	.000	.840, .761	.800 (.021)	.000	.836, .762	.800 (.022)	.000	.835, .762
Neuroticism (γ_{02})	-	-	-	.580 (.024)	.000	.625, .534	.580 (.024)	.000	.620, .537	.580 (.024)	.000	.621, .537
Self-Esteem (γ_{03})	-	-	-	.677 (.064)	.000	.794, .562	.679 (.062)	.000	.784, .567	.680 (.062)	.000	.790, .569
Gender (γ_{04})	-	-	-	-.409 (.035)	.000	-.346, -.472	-.412 (.034)	.000	-.347, -.473	-.412 (.033)	.000	-.347, -.472
Level 1												
Negative emotions (γ_{10})	-	-	-	.440 (.023)	.000	.483, .398	.406 (.019)	.000	.407, .382	.404 (.019)	.000	.404, .381
Negative work events (γ_{20})	-	-	-	-.069 (.089)	.442	.090, -.230	-.083 (.088)	.340	.064, -.239	-.090 (.089)	.311	.059, -.245
Time lag (γ_{30})	-	-	-	-.000 (.000)	.828	.000, -.000	-.000 (.000)	.725	-.000, 0000	-.000 (.000)	.311	.059, -.245
Cross level interaction												
Exhaustion*NE_{t-1} (γ_{11})	-	-	-	-	-	-	-	-	-	.065 (.019)	.000	.072, .040
L-1 Residual(ε_{ti})	1.21 (.040)	.000	1.18, 1.16	.899 (.034)	.000	.873, .858	.873 (.035)	.000	.873, .743	.874 (.035)	.000	.874, .744
Intercept variance (τ_{00})	2.80 (.059)	.000	3.03, 2.67	1.79 (.032)	.000	1.97, 1.69	1.79 (.042)	.000	1.97, 1.68	1.79 (.042)	.000	1.99, 1.68
Slope variance (τ_{11})	-	-	-				.019 (.008)	.066	.035, .011	.015 (.008)	.434	.030, .007
-2 Log (lh)	11098.61			9241.71			9203.76			9196.38		
df	3			10			11			12		
Difference of -2 Log	-			1856.89			37.96			7.38		
Difference in *df*	-			7			1			1		

Note. All variables were square root transformed. The random effects associated with "Negative work events" and "Time lag" were tested and found to be statistically not significant. Therefore, they were removed from the model. Likewise, the covariance between the intercept and the random slope was tested and (being not statistically significant) was removed from the model.

Ancillary Analysis

To further rule out the interpretation that the higher impact of previous negative emotions on CWB was simply attributable to a state of irritability stimulated by a higher level of exhaustion, I also tested, in a different model, the role of exhaustion as a cross-level moderator of the relationship between previous negative emotions and subsequent CWB. This parameter was not significant.

Discussion

Using a relatively large and diverse sample of workers, but using the same methodology of Study 1, results from this second study further demonstrated the significant association between exhaustion and NE inertia at work. Whereas these findings need to be replicated in other independent studies, the idea that high levels of exhaustion are related to high levels of NE inertia at work is sufficiently supported. A second important finding of this study refers to the impact of NE inertia on the relationship between the experience of negative emotional states and CWB. In contrast with my prediction, the experience of negative emotions itself was not related to the enactment of CWB. Instead, it was the persistence of negative emotions over time that increased the likelihood that CWB would occur.

However, this result is consistent with previous findings by Dalal et al. (2009) that found a significant concurrent association between affect and CWB, but not a lagged one. These results suggest that the experience of high negative emotions may be related to a higher tendency to enact CWB only for those workers who are unable to let their negative feelings dissipate (i.e., high NE inertia). It is likely that at the within-person level, short-lived emotional episodes do not necessarily predict CWB over time. This result help to clarify a key mechanism through which negative emotions may promote CWB, namely NE inertia. In this study, those workers reporting high feelings of exhaustion showed high NE inertia over time. These same workers appeared prone to enact CWB over time.

Overall, findings from the present study further attest the relevance of temporal dependency of negative emotional states at work. From one hand, they support the idea that NE inertia may derive from a state of resources depletion (i.e., exhaustion); from the other hand, they offer insights on the mechanisms by which NE inertia may affect organizational behavior.

Thus, this second study (1) contributes to knowledge on job-stress correlates by testing the association between exhaustion and a specific within-individual emotional dynamic; (2) shows how alterations at this level may be related to workers' organizational behavior.

From a theoretical perspective, these results demonstrate the need for future research to investigate both (1) within-person processes as they unravel as processes of action and reaction within a particular individual's universe of experiences at work, and (2) the differences between workers (at the between-person level), such that one's standing relative to others might modulate within-person processes, such as CWB. By considering one of these levels only, no theory of organizational behavior can aspire to be complete or even comprehensive. Instead, it is by the conjoint consideration of the between-person and the within-person level that the relevance of emotional inertia in the work setting can be fully appreciated.

Finally, these results are in line with previous research as they suggest that when emotions are highly inert, they may become dysfunctional. However, this study is just a first step toward a better understanding of the association between NE inertia a workers' behavior, and these results need to be replicated in future studies.

Limitations and Future Research

This study has some limitations. As in Study 1, one first limitation is the exclusive reliance on self-reports and related concerns of common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Future studies may consider gathering reports by co-workers or the supervisor. This advice, of course, is of outmost importance for CWB, while it may be more difficult to find reliable other sources for negative emotions and even exhaustion. Self-report measure of stress and

emotional responding may be ideally integrated with physiological indicators (Ganster, Crain, & Brossot, 2018).

Again, as in Study 1, a second limitation refers to the temporal frame considered. Future studies may use different timeframes for testing the generalizability of these results.

Furthermore, the occurrence of CWB in this sample was relatively low. Therefore, researchers should examine whether the results also hold in work settings characterized by a higher occurrence of CWB. One may expect a stronger moderating effect of emotional inertia in this case, given that engaging in CWB may be perceived as more common. In the absence of empirical data, more research is necessary on this point.

Finally, it is of outmost importance to determine the optimal timeframe to assess emotional inertia. Following previous studies (e.g. Koval, Pe, Meers, & Kuppens, 2013; Koval et al., 2016), in these first two studies five days were considered to be sufficient. However, it is likely that emotional inertia may accumulate and then dissipate also all over a single working day. It is also possible that correlates of emotional inertia may change when observed over such a short time span. To reliably assess such a phenomenon, it would be necessary to prompt workers more than six times per day, as was done over multiple days. Given the cost of conducting similar studies, it is important to determine their optimal characteristics

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CHAPTER 4

INERTIA OF EMOTIONS AND INERTIA OF THE HEART: A LOOK AT THE PHYSIOLOGICAL PROCESSES UNDERLYING INERTIA OF NEGATIVE EMOTIONS AT WORK

Abstract

Emotional inertia is a key feature of emotional dynamics and it refers to the degree of which a current emotional state can be predicted by a previous emotional state (Kuppens, Allen, & Sheeber, 2010). In this study, using the experience sampling method, I examined the relationship between inertia of negative emotions at work and parasympathetic activity, measured by vagally-mediated heart rate variability (HRV). In line with current literature on HRV I propose that temporal dependency of negative emotions at work may be associated to lower HRV, an important marker of the ability to flexibly adjust to a changing environment. Participants (n = 120) were prompted six times during a regular workday, while wearing a heart rate monitor. In accordance with the Conservation of Resources theory and the Allostatic Load theory, findings supported the hypothesis and indicated that workers with lower HRV tend to show high time persistence of negative emotions at work. Practical implications and directions for future research are discussed.

Keywords: emotional inertia, heart rate variability, negative emotions, emotion regulation, exhaustion

Mechanisms underlying emotional inertia

While the link between emotion dynamics at work and psychological adjustment has been widely investigated (e.g., Clark, Robertson, & Carter, 2016; Dalal, Lam, Weiss, Welch, & Hulin, 2009; Judge, Ilies, & Scott, 2006; Rodell & Judge, 2009), the mechanisms underlying emotional experiences and their change over time have not been fully clarified. Many different processes have been suggested to underlie emotional inertia, such as specific emotion regulation strategies, reduced exposure and reactivity to events, and recovery from events (e.g., Brose, Schmiedek, & Kuppens, 2015; Koval, Kuppens, Allen, & Sheeber, 2012; Koval, Butler, Hollenstein, Lanteigne, & Kuppens, 201). Recent studies on the general population have focused on neural mechanism (Provenzano et al., 2018; Waugh et al., 2017), and genetic and environmental contributions (van Roekel, Verhagen, Engels, & Kuppens, 2018; Zheng, Plomin, & von Stumm, 2016; Zheng & Asbury, 2019) shaping individual differences in emotion dynamics. Less evidence is available about the relationships between specific dynamic features of emotions, and more volatile physiological processes, such as autonomic nervous system responses (e.g., Koval, Pe, Meers & Kuppens, 2013; Koval et al., 2015). To fill this gap, using a large sample of workers, in this study I explored the association between a key characteristic of emotional dynamics, namely, inertia of negative emotions, and parasympathetic nervous system responses, measured by heart rate variability (HRV), both assessed during an entire working day. In doing so, I follow the recommendation of Ganster and colleagues (2018) to apply physiological measures to current dynamic emotion perspectives and to investigate dynamic changes in autonomic nervous system responses. HRV provide information about the activity of the parasympathetic nervous system and it represents a particularly promising method for organizational researchers due to the fact that it can be assessed in naturalistic settings in a simple and noninvasive way (Peterson, Reina, Waldman, & Becker, 2015). Yet, most studies in the emerging field of organizational neuroscience have used brain and brain-imaging techniques and there is an overall lack of research exploring insights derived from cost-effective peripheral physiology measures (Massaro & Pecchia, 2019). In the following paragraphs, I first present the construct of HRV and its

association with emotion dynamics, then I present the theoretical rationale underlying this study, and develop the hypotheses motivating this research.

Heart rate variability and emotion dynamics

Resting HRV refers to the beat-to beat variation in heart rate. HRV may serve as a robust and noninvasive indicator of the autonomic nervous system activity, which is responsible for individuals' physiological adaptations to changing environmental demands (McEwen, 1998). More specifically, HRV reflects the interplay between the sympathetic (SNS) and parasympathetic (PNS) nervous systems. PNS and SNS regulate the lengths of intervals between consecutive heartbeats, with faster heart rates corresponding to shorter interbeat intervals and vice versa.

HRV can be used as a proxy for emotion regulation ability (Thayer & Lane, 2007), as well as psychological flexibility (Friedman & Thayer, 1998), due to the fact that the autonomic influences on heart rate are regulated remotely by the areas composing the central autonomic network, which support emotion regulation by flexibly adjusting physiological arousal in accordance with environmental demands (Benarroch, 1993; Thayer et al., 2012). Melzig, Weike, Hamm and Thayer (2009), for example, found that high HRV was related with appropriate emotional responses, as indexed by emotion-modulated startle responses, fear-potentiated startle responses, phasic heart rate responses, and behavioral emotional responses. In the study conducted by Geisler, Vennewald, Kubiak and Weber (2010), HRV was found to be related to positive hedonic tone and positive tense arousal, and these effects were completely mediated by the use of executive emotion regulation strategies (e.g., reappraisal, refocusing). In the same study, HRV was also found to be associated with life satisfaction, mediated by the habitual use of executive emotion regulation. Similarly, Williams and colleagues (2015) reported a negative association between resting HRV and self-reported difficulties in emotion regulation. All in all, a substantial amount of evidence support the link between HRV and emotion regulation. Thus, high HRV has been linked to effective self-regulation and adaptive responsivity to the environment, while low HRV appear to be related to reduced flexibility

and reactivity to stimuli, and an impaired ability to regulate emotions (Porges, 1991, 1992). As noted above, and of central interest for the present study, individuals with high levels of HRV tend to produce context appropriated emotional responses (Melzig et al., 2009; Ruiz-Padial, Sollers, Vila, & Thayer, 2003; Thayer & Brosschot, 2005).

In sum, evidences indicate that individuals with high HRV tend to be better at regulating their emotions (Appelhans & Luecken, 2006), show lower levels of worry and rumination (Ottaviani, Shapiro, & Couyoumdjian, 2013; Ottaviani et al., 2016), as well as lower anxiety (Chalmers, Quintana, Abbott, & Kemp, 2014). On the contrary, low HRV has been linked to depression (e.g., Koschke et al., 2009; Ottaviani et al. 2015; Udupa et al., 2007; Wang et al., 2013), negative affect (Sloan et al., 2017), stress (e.g.; Brosschot et al., 2006; Brosschot et al., 2007), work-related rumination (Cropley et al., 2017) and burnout (Lennartsson et al., 2016; Kanthak et al., 2017). Finally, with regard to workplace characteristics, low HRV has been shown to be related to job stressors (Chandola et al, 2010; Collins & Karasek, 2010; Jarczok et al., 2013; Togo & Takahashi, 2009). Specifically, Collins and Karasek (2010) found that high strain (i.e., low decision latitude and high demands) workers displayed reduced short-term variance in vagal cardiac control. The systematic review conducted by Togo and Takahashi (2009) indicated that low HF power (i.e., the integrated spectral power of high frequency) was related with the exposure to occupational toxicants and hazardous environments, shift work and psychosocial workload in terms of organizational injustice, employment grade, fatigue and strain.

Some evidence is available for the association between negative emotions at work and HRV. In the study conducted by Pieper and colleagues (2007), worries about work were found to be related to lower HRV (see also Cropley et al., 2017). In the study conducted by Uusitalo and colleagues (2011), stress feelings at work were correlated with low HRV, and work time irritation was associated to night time cardiac autonomic activity. However, despite the increasing interest in the study of emotions within organization and the acknowledgment that emotion regulation is vital to employee's well-being and job performance (Cŏté & Morgan, 2002; Goldberg & Grandey, 2007), little is known

about emotion dynamics at work and their physiological correlates in terms of HRV, as an emergent tool for the assessment of emotion regulation and flexible adaptation (Appelhans & Luecken, 2006).

Emotional Inertia and Autonomic Inflexibility

Findings from Study 1 and Study 2, by showing the association between inertia of negative emotions and organizational behavior and adjustment, rise a question about the psychophysiological mechanisms that underlie and sustain emotional inertia states. Therefore, Study 3 is devoted at addressing this question by examining whether HRV is linked to NE inertia at work. Previous research suggests that HRV represents a major correlate of work-related stress, documenting a negative association between work stress and HRV (e.g., Togo & Takahashi, 2009; Chandola, Heraclides, & Kumari, 2010). Emotional exhaustion, for example, has been found to be associated with a reduced vagal function (e.g., Kanthak et al., 2017; Lennartsson, Jonsdottir, & Sjörs, 2016).

Given the consistent association of exhaustion and NE inertia in Study 1 and Study 2, it seems reasonable to expect that emotional inertia may be mirrored by autonomic inflexibility. Indeed, following COR theory, emotional inertia can be conceptualized as a state of resource depletion that make self-regulation, and emotional regulation in particular, hard for the individual (COR; Hobfoll, 1989). Resource depleted individuals are thus expected to be characterized by two hampered process. An inability to change one's own emotional state, and the incapacity to fine tune ones' own autonomic activation according to the changing environmental situations.

The allostatic theory (McEwen, 1998, p. 171) provides an additional perspective suggesting an association between low HRV and emotional inertia. Allostasis refers to "the ability to achieve stability through change" (McEwen, 1998, p. 171) and it plays a crucial role in the process of coping with stressful conditions. Allostatic load theory, in fact, describes how the bodily systems adjust to changing environmental factors, as well as the wear and tear associated with this adaptation process (McEwen, 1998). The basic assumption is that such adjustments are adaptive in the short term, but, if prolonged, they may bring long-term consequences on individuals' health, such as dysfunctional physiological reactions (e.g., high blood pressure) and impaired health (e.g., cardiovascular diseases)

(Ganster, Crain, & Brossoit, 2018; Ganster & Rosen, 2013; McEwen, 1998). Given that the autonomic nervous system is responsible for physiological adaptations to the environmental stimuli, it likely plays a role in allostasis. Indeed, HRV changes drive the body into a temporary state that prepares the organism to meet environmental demands (Schulkin, 2003). Thus, HRV represents a key source of information about the organism's adjustment to environmental (work) demands (McEwen, 1998).

Finally, several empirical studies attested that HRV and NE inertia share several correlates, including rumination (e.g., Koval et al., 2015; Ottaviani et al., 2013), depression (e.g., Houben, Van de Noortgate, & Kuppens, 2015; Koschke et al., 2009; Ottaviani et al., 2015; Udupa et al., 2007; Wang et al., 2013); stress (e.g.; Brosschot et al., 2006; Brosschot et al., 2007) and burnout (Lennartsson et al., 2016; Kanthak et al., 2017).

Following the COR theory (Hobfoll, 1989), the allostatic theory (McEwen, 1998), and the bulk of empirical results reviewed above, in this study I hypothesize that low HRV at work signals a state of resource depletion in which failures of emotion regulation may occur, consequently leading to emotional inertia. Stated more formally, I hypothesized the following:

H1. *Low HRV is associated with high NE inertia.*

The present study

I tested the above hypothesis in a sample of workers who directly interact with the public as part of their role. This is because workers who constantly deal with the public may be at high risk of allostatic overload due to the repeated exposure to (interpersonal) stress and demands (e.g., Schaufeli & Buunk, 2003). Among the several indicators of HRV (Task Force, 1996), in this study I choose to focus on root mean square of successive differences between normal heartbeats (RMSSD), as this parameter is less affected by breathing and is therefore recommended for field studies (Laborde, Mosley, & Thayer, 2017; Penttilä et al., 2001). From now on, I will use the term HRV to refer to RMSSD.

This study contributes to the literature in several ways. First, HRV was assessed continuously during an entire work day allowing for ecological validity. A second contribution is the use of a dynamic approach to examine the association between an objective indicator of strain reaction and emotion regulation (HRV), with emotional inflexibility. To my knowledge, this is the first study to combine experience sampling method with simultaneous HRV in the work setting that directly examines how vagally mediated HRV is related to emotion dynamics at work.

Moreover, in order to increase accuracy in estimating parameters implied by my hypotheses, I controlled for the same covariates of Study 1 and Study 2. Following previous studies on HRV (e.g., Ottaviani et al., 2015), I also controlled for BMI, age, medications, caffeine and nicotine consumption. Thus, in the present study I controlled for sex, age, BMI, medications, self-esteem, neuroticism and exhaustion at the person level, and work events (positive and negative), caffeine, and nicotine at the within-person level. Finally, following previous literature on emotional inertia, I further controlled for the time interval between successive assessments.

Method

Sample

Participants were 120 workers who work directly with the public (i.e., who interact with the recipients of their service). Most of participants (54.2%) were males. Average age was 41.4 years (*SD* = 14); average BMI was 24.02 (*SD* = 3.63). 27.7% of participants smoked cigarettes. 77.5% of participants did not use any medication that could affect HRV. A diagnosis of heart disease was an exclusionary criterion. Participants worked in a broad range of different professions and occupational fields. In terms of employment sectors, 25.8% of participants worked in the sales sector, 10.8 of participants worked in the health sector, 7.5% of participants worked in the education sector, 10.8 were entrepreneurs, 9.3% of participants were managers, and the remaining 35.8 % were employees in various fields. Mean job tenure of the sample was 15.27 years (*SD* = 12.53).

Procedure

Participants were recruited mostly via advertisement posted online, but also via word of mouth. Only people working for at least five consecutive hours per day were considered eligible for this study. A week before the beginning of the daily study (T0), socio-demographic characteristics, as well as measure of (1) exhaustion, (2) neuroticism, (3) self-esteem and (4) depression were assessed. All participants were also asked to provide their work schedule for the day of the study, specifying their start/end times and breaks at work. Then, in the selected day of the following week, participants were prompted (via a tone signal on their mobile phone) six times during working hours. Prompts occurred at random times and the time interval between two prompts varied depending on the number of hours worked that day (e.g. for a six hours' workday, prompts occurred randomly about 60 minutes apart). After participants were prompted, they had 10 or 20 minutes to respond to the initial question, depending on the length of the work-day (e.g. for a six hours' work-day, participants had 10 minutes to fill a questionnaire, for an eight hours' work-day, participants had 20 minutes to fill a questionnaire). Participants provided informed consent.

Measures

Exhaustion. At T0, exhaustion was assessed using five items (e.g. ''I feel emotionally drained from my work'') drawn by the Maslach Burnout Inventory - General Survey (MBI-GS - Schaufeli, Leiter, Maslach, & Jackson, 1996). For each item, the rating scale ranged from 1 = "Never" to 5 = "Daily". The alpha coefficient was .84.

Neuroticism. Neuroticism levels were assessed at T0 using 12 items (e.g. ''I'm subject to frequent mood changes") drawn by the Big Five Questionnaire (BFQ; Caprara, Barbaranelli, Borgogni, & Perugini, 1993). Participants indicated agreement with the extent to which each item described them on a 5-point scale ranging from 1 = "Very false for me" to 5 = "Very true for me". The alpha coefficient was .81.

Self-esteem. At T0, self-esteem was assessed by means of the Rosenberg Self-Esteem scale (RSE, Rosenberg, 1965), which is composed of 10 items (e.g., "I feel that I have a number of good

qualities"). Each item was scored on a 4-point scale ranging from 1 = "Strongly disagree" to 4 = "Strongly agree". The alpha coefficient was .77.

NE inertia. Participants were asked to report their current levels of negative emotions for six times during the same day. Participants were asked to indicate the extent to which they were currently feeling each of nine negative emotions (sad, anxious, angry, frustrated, ashamed, disgusted, guilty, irritable, restless) by moving a slider along a continuum anchored with the numbers 0 and 100. Answers were coded as a number from 0 to 100. The above affect words were drawn from various sources, including the Positive Affect Negative Affect Scale (Watson, Clark, & Tellegen, 1988) and Ekman's basic emotions (e.g., Ekman, Friesen, & Ellsworth, 1972). I calculated the between- and within-person reliability using MIXED methods (Bonito, Ruppel & Keyotn, 2012). The between person reliability was .40 and the within person reliability was .86. The within person value can be considered substantial (Shrout, 1998). Following the procedure discussed in previous studies (e.g., Kuppens, Allen, & Sheeber, 2010; Koval, Sütterlin, & Kuppens, 2016), inertia of negative emotions was calculated by running two-level autoregressive models (these models are described in the statistical analyses section).

Heart Rate. HR was recorded as beat-to-beat intervals in ms with the Bodyguard 2 (Firstbeat) HR monitors, that have been extensively used for HR recording and analysis (e.g., Porto & Junqueira, 2009). Participants wore the Firstbeat Bodyguard for 24 consecutive hours (including one work shift and one night of sleep). As a first step, each of the six diary entries were labeled in the cardiac data. Then, the 24-h raw beat-to-beat intervals was arranged in several blocks, one for each interval between two prompts. Any break from work (e.g., lunch break) was removed from analysis. HRV was assessed by computing the root mean square of successive beat-to-beat interval differences (RMSSD), which reflects vagal regulation of HR (Task Force, 1996). Outlier and artifact detection as well as HRV analyses were performed using Kubios HRV software (Tarvainen, Niskanen, Lipponen, Ranta-Aho, & Karjalainen, 2014).

Work events. At each prompt, participants completed an 8-item negative events checklist containing four positive events and four negative events (e.g., "Had positive interactions with my coworkers"; "Had a heavy workload") adapted from Gable, Reis, and Elliot (2000). The checklist included events that may occur frequently at work (see also Basch & Fisher, 2000) and measures of job demands, such as workload, drawn from the Job Content Questionnaire (JCQ, Karasek, 1985). Participants were instructed to check any negative event that occurred since the previous survey and rate how significant the event was on a 6-point scale (0 = It did not happen, 5 = It happened and it was extremely important). A composite (formative) index was created by averaging the four events. Given the potential independence among the different events, an alpha coefficient is not an appropriate measure of reliability for this scale (i.e., it refers to a formative construct).

Time-lag. The time-lag was calculated as the interval (in minutes) between two prompts, or the time passed between observations (i.e., time at which the current survey was filled minus time at which the previous survey was filled).

Statistical analyses

Because of the nested data structure (prompts nested within individuals), I tested the hypothesis using multilevel modeling, in order to simultaneously estimate within- and between-person effects while handling varying time intervals between prompts and missing data (see Snijders & Bosker, 1999). Critical values for the upper and lower 95% bias-corrected confidence limits for all parameter estimates were computed. All coefficients with an associated confidence interval that did not include zero were considered statistically significant ($p < .05$). Given that HRV measures in absolute units (ms2) were positively skewed, RMSSD was log (ln) transformed to normalize its distribution.

To test my hypotheses, I compared several nested models by using the difference between their respective likelihoods and degrees of freedom to ascertain the improvement of each model over the previous one. In particular, I started by fitting a null model including only the intercept. Then, in line with previous research on emotional inertia (e.g., Kuppens et al., 2010; Koval et al., 2016), I

fitted a two-level autoregressive (AR1) model including both a random intercept and a random (autoregressive) slope. In this latter model (i.e., Model 2), the Level 1 first order autoregressive slope of negative emotions (representing NE inertia) was specified in this way:

(1) $\text{NegativeEmotions}_{ti} = \beta_{01} + \beta_{1i}\,(NegativeEmotions_{t-1i}) + \beta_{2i}\,(NegativeWorkEvents_{t-1i}) + \beta_{3i}\,(PositiveWorkEvents_{t-1i}) + \beta_{4i}\,(Caffeine_{t-1i}) + \beta_{5i}\,(Nicotine_{t-1i}) + \beta_{6i}\,(Time\ Lag_{i}) + \varepsilon_{ti}$.

In the above equation, Level-1 ($NegativeEmotions_{t-1}$) is the person *i*'s level of an emotion at time *t-1*. β_{1i} is a random slope capturing the strength of the longitudinal association between negative emotions level at *t-1*, and his/her emotional level at the successive *t*, or the degree of "emotional inertia" (see Suls, Green, & Hillis, 1998), and usually ranges from -1 to 1 (as an autocorrelation coefficient). Negative work events, positive work events, caffeine, and nicotine at *t-1* and length of the time lag are Level-1 control variables.

As recommended (Enders & Tofighi, 2007), all lagged predictors (i.e., Negative $\text{Emotions}_{t-1,}$ HRV_{t-1} and Negative Work Events_{t-1}) except dichotomic variables (i.e., dummy variables on nicotine and caffeine consumption), were person-mean centered to remove between person differences from Level-1 parameter estimates (see Judge, Ilies, & Scott, 2006). Under this parametrization, the β_{01} parameter, representing the Level-1 intercept, is equivalent to each person *i*'s level of negative emotions across all occasions. β_{01} (i.e., the intercept), and β_{1i} (i.e., the slope) were allowed to vary randomly across persons. At Level-2, HRV at work, exhaustion, neuroticism, self-esteem, sex, age and BMI were included as grand-mean centered covariates:

(4) $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{WorkHRV}_i) + \gamma_{02}(\text{Exhaustion}_i) + \gamma_{03}\,(\text{Neuroticism}_i) + \gamma_{04}\,(\text{Self-esteem}_i) + \gamma_{05}\,(\text{Sex}_i) + \gamma_{06}\,(\text{Age}_i) + \gamma_{07}(\text{BMI}_i) + \gamma_{08}(\text{Medications}_i) + r_{0i}$,

To be parsimonious and maintain the model simple, the variances of random terms associated to all L2 variables were tested for statistical significance and eventually removed from the model. Likewise, the covariance between all random terms were tested and fixed to zero if not statistically significant. At this point, I fitted a third model (i.e., Model 3) which included both HRV and Exhaustion (Level 2, person centered) as predictors of the autoregressive slope.

This model is shown in the equations below:

(5) $\text{NegativeEmotions}_{ti} = \beta_{01} + \beta_{1i}\,(\textit{NegativeEmotions}_{t-1i}) + \beta_{2i}\,(\textit{NegativeWorkEvents}_{t-1i}) + \beta_{3i}\,(\textit{PositiveWorkEvents}_{t-1i}) + \beta_{4i}\,(\textit{Caffeine}) + \beta_{5i}\,(\textit{Nicotine}) + \beta_{6i}\,\textit{Time Lag}_i) + \beta_{7i}\,(\textit{NegativeEmotions}_{t-1i}\textit{X HRV}_i) + \varepsilon_{ti}$.

(6) $\beta_{0i} = \gamma_{00} + \gamma_{01}(\text{WorkHRV}_i) + \gamma_{02}(\text{Exhaustion}_i) + \gamma_{03}\,(\text{Neuroticism}_i) + \gamma_{04}\,(\text{Self-esteem}_i) + \gamma_{05}\,(\text{Sex}_i) + \gamma_{06}\,(\text{Age}_i) + \gamma_{07}\,(\text{BMI}_i) + \gamma_{08}(\text{Medications}_i) + r_{0i}$,

(7) $\beta_{1i} = \gamma_{10} + \gamma_{11}(\text{Exhaustion}) + \gamma_{22}(\text{WorkHRV}_i) + r_{1i}$.

In this final model, β_{0i} is the intercept representing the mean level of NE and β_{1i} represents the slope, or the average relationship between previous and subsequent negative emotions (or average inertia) across the sample. γ_{10} represents the average level of NE inertia across the sample, while γ_{11} and γ_{22} can be interpreted as the standardized regression weight between, respectively HRV, exhaustion and NE inertia. Thus, considering the case of a worker reporting a score on HRV (or exhaustion) higher than one standard deviation over the sample mean, and assuming an estimated γ_{11} or γ_{22} value of -.30, it is predicted to have a NE inertia level lover of .30 units below the score reported by the average worker in the sample.

Results

Preliminary Analyses

On average, participants were prompted every 60.99 minutes (*SD* = 22.22). Before testing my hypothesis, I examined whether negative emotions, positive and negative work events and HRV differed within persons. Partitioning of the total variance into within-person and between-person variance showed that 76% of the total variance of negative emotions was within persons. As for work events, 51% of the total variance of negative events was within persons and 65% of the total variance of positive work events was within persons. Overall, these analyses show that a substantial portion of the variance in negative emotions and negative work events can be attributed to within-person variation.

Multilevel Models

After testing the null model, I estimated the absolute levels of emotional inertia for Negative Emotions by entering in the above model (1) at Level-1 only the uncentered lagged *Negative Emotions*$_{t\text{-}I}$ (see Hamaker & Grasman, 2015), and (2) no Level-2 predictors. In this model, the autoregressive parameter (γ_{10}) representing the inertia of negative emotions was positive and significant, although moderately low in size (i.e., .18, *SE* = .05, $p < .001$, 95% CI [.08, .28]).

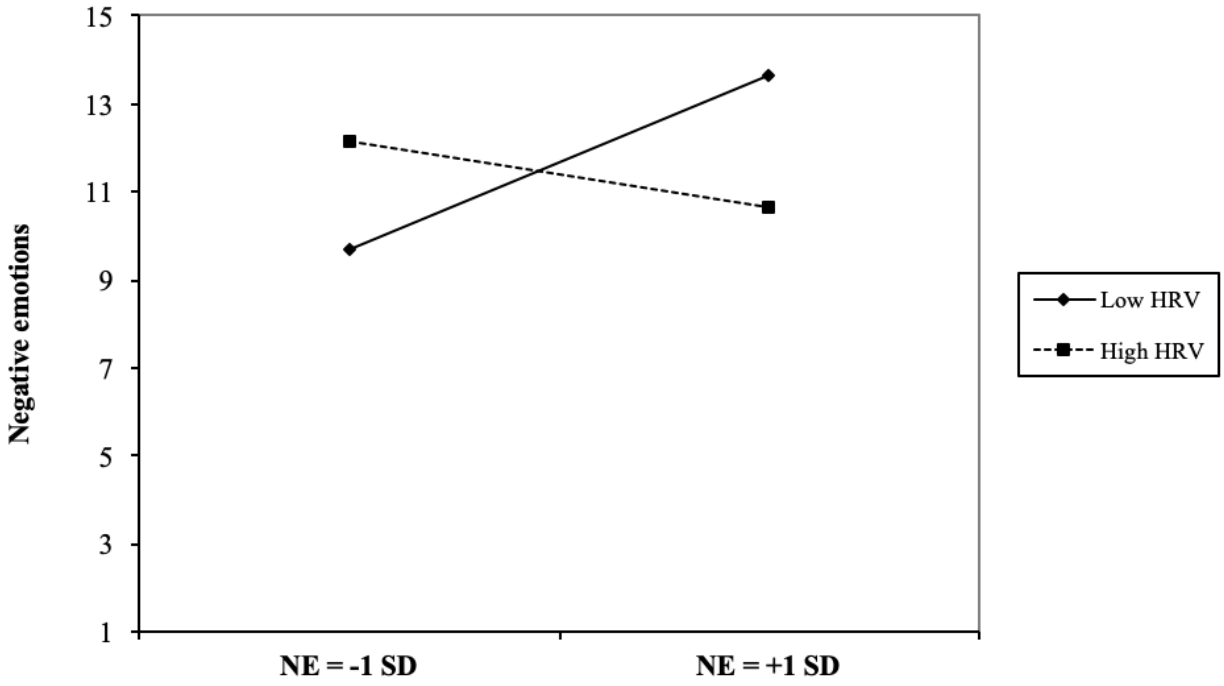
Table 1 shows the results from testing my substantive hypotheses. Model 1, showed a better model fit than the null model. Estimates of NE inertia were almost similar to those reported above. Among the covariates only self-esteem significantly predicted average levels of negative emotions. Model 2, in which the prediction of current levels of negative emotions by previous negative emotions was specified as random, showed a better model fit than Model 1. In Model 3, I explored if the strength of this prediction, representing NE inertia was moderated by individuals' (1) average level of exhaustion; (2) average HRV at work. Both exhaustion and HRV predicted the association between previous and concurrent level of negative emotions, supporting *H1* that HRV is associated with NE inertia. Furthermore, Model 3 fitted better than Model 2 (Table 1).

Figure 2 displays the observed relationship between negative emotions and negative emotions$_{t\text{-}1}$ as a function of HRV at work. As it can be seen, workers reporting high levels of HRV reported a lower association between previous and concurrent intensity of negative emotional states (i.e., low NE inertia). On the other hand, workers reporting high levels of negative emotions and low HRV reported higher levels of negative emotions (i.e., high NE inertia), than workers reporting high level of negative emotions, but and high HRV. When the analyses were performed without control variables, all results remained unchanged.

Table 1. Multilevel Models examining the role of HRV in predicting NE Inertia.

	Null Model			*Model 1*			*Model 2*			*Model 3*		
	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI	Estimate (SE)	*p*	CI
Variables												
Level 2												
Intercept (γ_{00})	8.184 (.952)	.000	10.051, 6.318	13.575 (6.637)	.043	26.584, .566	12.472 (6.420)	.055	25.055, -.110	12.416 (6.419)	.056	24.996, -.164
HRV (work) (γ_{01})	-	-	-	-.797 (1.333)	.550	1.816, -3.410	-.104 (1.244)	.934	2.335, -2.542	-.137 (1.239)	.912	2.291, -2.565
Exhaustion (γ_{02})	-	-	-	.807 (1.150)	.484	3.060, -1.447	.689 (1.116)	.538	2.876, -1.498	.640 (1.116)	.568	2.827, -1.547
Neuroticism (γ_{03})	-	-	-	1.587 (1.381)	.253	4.293,-1.120	1.734 (1.335)	.195	4.340, -.893	1.920 (1.333)	.153	4.533, -.693
Self-Esteem (γ_{04})	-	-	-	6.320 (2.382)	.009	10.989, 1.652	6.764 (2.308)	.004	11.288, 2.240	6.728 (2.302)	.004	11.239, 2.217
Sex (γ_{05})	-	-	-	-2.660 (1.883)	.161	1.032, -6.351	-2.579 (1.825)	.161	.998, -6.156	-2.699 (1.82)	.141	.870, -6.268
Age (γ_{06})	-	-	-	.052 (.075)	.492	.199, -.096	.041 (.073)	.571	.184, -.101	.046 (.073)	.531	.188, -.097
BMI (γ_{07})	-	-	-	-.249 (.272)	.284	.272, -.781	-.201 (.263)	.445	.313,-.716	-.205 (.262)	.436	.309, -.719
Medications (γ_{08})	-	-	-	.780 (2.320)	.738	5.343, -3.784	.237 (2.261)	.996	4.668, -4.195	.175 (2.260)	.938	4.604, -4.254
Level 1												
Negative emotions (γ_{10})	-	-	-	.179 (.049)	.000	.276, .082	.105 (.076)	.174	.254, -.045	.100 (.073)	.176	.242, -.043
Negative work events(γ_{20})	-	-	-	.471 (.606)	.437	1.659, -.717	.246 (.584)	.674	1.390, -.899	.038 (.581)	.948	1.177, -1.101
Positive work events (γ_{30})	-	-	-	-.050 (.459)	.913	.849, -.950	.269 (.440)	.541	1.132, -.593	.259 (.437)	.554	1.116, -.598
Caffeine (γ_{40})	-	-	-	-.241 (.680)	.723	1.090, -1.574	.016 (.638)	.980	1.266, -1.235	.114 (.636)	.858	1.360, -1.133
Nicotine (γ_{50})	-	-	-	-.379 (1.114)	.730	1.804, -2.562	.006 (1.034)	.996	2.033, -2.021	-.040 (1.030)	.963	1.979, -2.058
Time lag (γ_{60})	-	-	-	-.000 (.000)	.271	.000, -.000	.001 (.001)	.210	.002, -.000	.001 (.001)	.167	.002, -.000
Cross level interaction												
Exhaustion*NE_{t-1} (γ_{11})	-	-	-	-	-	-	-	-	-	.147 (.069)	.040	.283, .011
HRV*NE_{t-1} (γ_{22})	-	-	-	-	-	-	-	-	-	-.544 (.205)	.010	-.143, -.946
L-1 Residual(ε_{ti})	36.687 (6.057)	.000	1.18, 1.16	37.979 (6.163)	.000	43.143, 33.439	31.272 (5.592)	.000	35.711, 27.385	31.085 (5.575)	.000	35.519, 27.225
Intercept variance (τ_{00})	101.106 (10.055)	.000	3.03, 2.67	82.999 (9.110)	.000	111.17, 61.795	77.018 (8.776)	.000	103.44, 56.599	77.144 (8.783)	.000	103.78, 56.937
Slope variance (τ_{11})	-	-	-	-	-	-	.158 (.398)	.002	.297, .086	.121 (.348)	.010	.253, .055
-2 Log (lh)	4561.474			4077.541			4021.365			4011.053		
df	3			17			18			20		
Difference of -2 Log	-			483.933			56.175			10.312		
Difference in *df*	-			14			1			2		

Figure 2.



Prediction of current levels of negative emotions by previous levels of negative emotions as a function of HRV.

Discussion

In this study, I examined the physiological correlates of NE inertia at work. Although inertia of negative emotions has been found to be related with several indicators of psychological maladjustment (e.g., Koval et al., 2016; van de Leemput et al., 2014), such as ineffective emotion regulation strategies (e.g., Koval et al., 2015), its physiological correlates had not been explored yet. At the same time, little is known about the association between HRV, as a proxy for emotion regulation capacities (Thayer & Lane, 2000), and moment-to-moment temporal dynamics of negative emotions in real-life situations (i.e., at work). For the above-mentioned reasons, moving from the assumption that NE inertia is mostly driven by impaired emotion regulation abilities (Koval et al., 2012; Koval et al., 2013; Koval et al., 2015), I hypothesized an association between autonomic (i.e. reduced HRV) and emotional inflexibility.

In line with principles of the COR theory (Hobfoll, 1989) and of the allostatic model (McEwen, 1998), these results show that lower HRV increases the persistence of negative emotions at work. According to these results, it seems that for those individuals who show high autonomic inflexibility (i.e., low HRV) emotions tend to lose their flexibility and therefore their adaptive function, turning into a risk factor for psychological wellbeing and health (Houben et al., 2015). On the other hand, high HRV resulted to be associated with better emotion regulation abilities in terms of temporal dynamics of negative emotional states.

This study contributed to the literature by showing how inertia of negative emotions at work reflects a condition of resource impairment both at psychological and physiological level. In addition, as emotional inertia represents a potential early warning signal for clinical depression (van de Leemput et al., 2014), understanding its underlying processes may help to prevent the negative impact of noxious work experience, thus warding of the onset of affective dysfunction leading to different forms of psychopathology. Finally, it is important to note that, although emotion regulation is commonly assumed to influence the temporal dynamics of emotions (e.g., Gross & Thompson, 2007),

few studies have tested this assumption (e.g., Koval et al., 2015) and even less studies have tested it by using a physiological marker for emotion regulation capacity (Koval et al., 2013).

In light of this latter consideration, this result gain relevance especially in light of the role of both vagal functioning and emotional inertia as a hallmark of psychological and somatic health (Houben et al., 2015; Thayer & Lane, 2009; van de Leemput et al., 2014). Prolonged autonomic dysregulation, in fact, has been proposed as one potential mechanism linking depression, stress, and cardiovascular disorder (Larsen & Christenfeld, 2009; Gerin et al., 2012). The association between NE inertia and autonomic inflexibility may therefore contribute to shed light on the possible mechanisms underlying the association between emotional inertia and low well-being (i.e., depression, rumination).

This study adds to the knowledge of emotion dynamics at work and their physiological correlates in terms of HRV. These findings offer insights on the emotional life of workers' experiencing exhaustion, by showing that they may be depleted by the resources necessary to regulate their emotions and thus get stuck in their negative emotional state. Importantly, I found support for the association between temporal dependency of negative emotions and low HRV. Reduced HRV was associated to relented emotion dynamics, with negative emotional states that persist over the working day; high HRV, on the other hand, resulted to be associated with better emotion regulation abilities, in line with previous research suggesting that HRV is highly informative about people emotion regulation abilities (Appelhans & Lueckens, 2006; Thayer & Lane, 2000; Porges, 2001).

Limitations and Future Research

This study is not without limitations. A first limitation refers to the temporal frame considered. Previous studies were conducted assessing HRV over one day (e.g., Loerbroks et al., 2010), however, field research using repeated assessment of heart rate over multiple days would be recommended, as it is still limited in organizational literature. A second limitation pertains the number of time points for the assessment of emotional states. Although six measurements over the course of the same

working day can be considered quite intensive, increasing the number of time points available may improve statistical power (Wang, Hamaker, & Bergeman, 2012). However, I acknowledge that, in my experience, asking workers more than six times per work shift may cast a heavy and probably unbearable burden on them (in light of work rules and constraints). Furthermore (and more realistically), future studies should ideally include multiple physiological indicators other than HRV, such as cortisol which is particularly susceptible to the effects of psychosocial stress. Finally, to further validate this study, these effects should be replicated in different samples and different populations of workers.

Despite these limitations, the strengths of this study are the use of the experience sampling method combined with a physiological measure of emotion regulation abilities (i.e., HRV) at work; the relatively large sample composed of different employees' groups; the repeated measures of heart rate over the same working day; the use of a within person approach to investigate HRV and its link to emotion dynamics at work.

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CHAPTER 5

GENERAL CONCLUSION

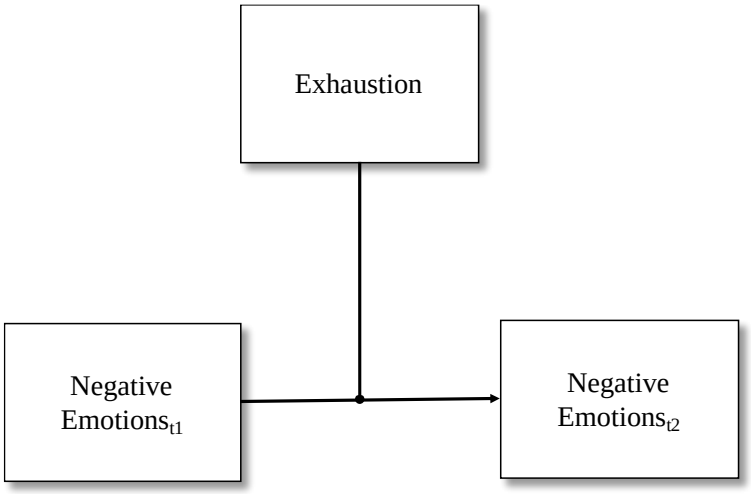
Conclusion and suggestion for future studies

The past decades have seen a dramatic increase of interest in emotions at work, leading to an extensive amount of research (Ashkanasy & Humphrey, 2011; Barsade & Gibson, 2007; Elfenbein, 2007). Despite this, as noted by many scholars (Ashkanasy & Humphrey, 2011; Barsade, Brief, & Spataro, 2003; Brief & Weiss, 2002; Gooty, Gavin and Ashkanasy, 2009), organizational literature has paid very little attention to the temporal nature and dynamics of emotional experiences.

In this Thesis, I adopted a temporal perspective on emotions and, moving from the recent insights in emotion research, I examined inertia of negative emotions in the workplace, which reflects the extent to with negative emotions at work carry over across time (Kuppens, Allen, & Sheeber, 2010). Taken together, the studies included in this Thesis provide evidence for the importance of taking into account the duration of emotional phenomena at work.

Under the theoretical framework of Conservation of Resources Theory (Hobfoll, 1989), I assumed that inertia of negative emotions can derive from a state of prolonged work-related stress and extended previous literature on emotion dynamics. Specifically, I assumed that the condition of resources impairment associated to exhaustion may lead workers to protect their remaining resources and to not invest in emotion regulation. These workers, in fact, may not be able to successfully adapt their negative emotional states to environmental changes, thus showing high persistence of negative emotions over time (see Figure 3). As predicted, Study 1 and Study 2 supported the idea that initial levels of exhaustion, the core dimension of burnout syndrome, are associated to inertia of negative emotions. Indeed, initial levels of exhaustion predicted temporal dependency of negative emotions. This finding, further supported in Study 3, provides valuable information on the emotional life of workers experiencing exhaustion, which may be used for intervention programs aimed at managing stress and fostering wellbeing at work.

Figure 3.



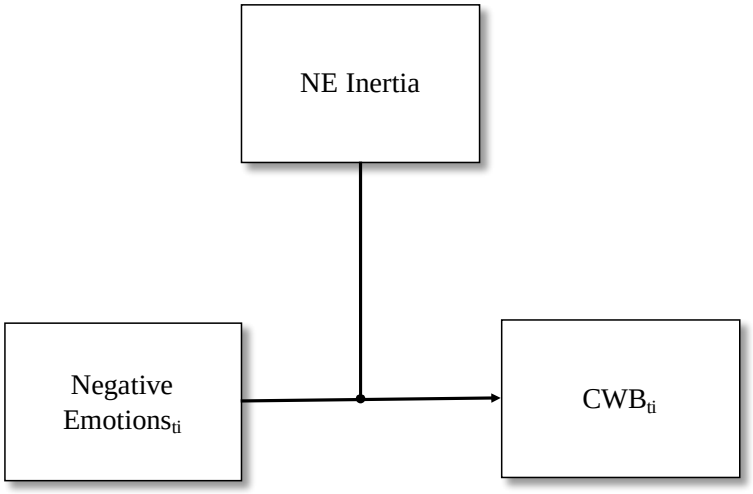
Conceptual representation of the hypothesized moderation effect of exhaustion on the relationship between repeated measures of negative emotions.

After examining the association of exhaustion with NE inertia, I investigated how this latter may be related to workers' organizational behavior (see Figure 4). Due to their association with negative emotions, I focused on counterproductive work behaviors (CWB; Spector & Fox, 2002). Specifically, findings from Study 2 suggest that negative emotions are more likely to induce CWB when they persist longer over time. Short term negative emotional experiences, on the other hand, were not related to CWB, highlighting the relevance of including the temporal dimension when studying emotions.

Finally, in Study 3, under the theoretical frameworks of Allostatic Load theory (McEwen, 1998) and Conservation of Resources Theory (Hobfoll, 1989), I investigated physiological mechanisms underlying NE inertia at work (see Figure 5). Findings from this study suggest that inertia of negative emotions reflect a condition of resource impairment not only at a psychological level, but also at a physiological level. High persistence of negative emotions during the workday, in fact, resulted to be related to autonomic inflexibility (i.e., low heart rate variability). Notably, heart rate variability represents a marker for flexible dynamic regulation of autonomic activity (Thayer & Lane, 2009; Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012).

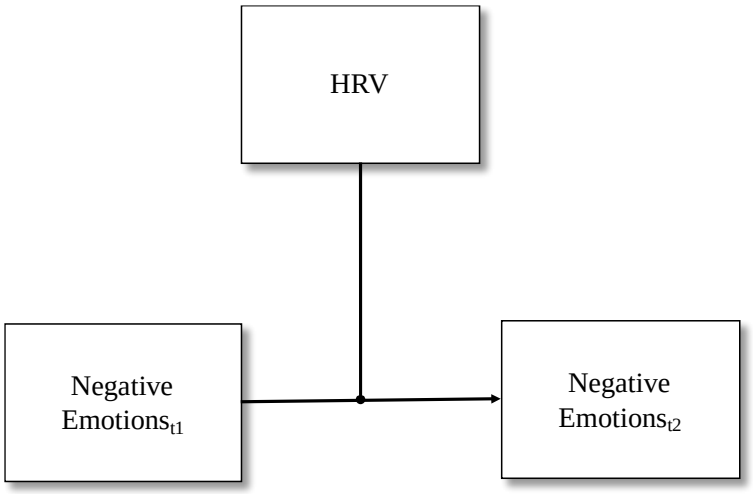
Under the COR theory perspective, findings from these studies suggest that inert negative emotions, ingenerated by chronic exhaustion, may contribute to strengthen the workers' loss cycle. Indeed, dealing with negative emotions is a resource depleting process that can shape employees' behavior in a maladaptive way, thus undermining their wellbeing and ability to work effectively.

Figure 4



Conceptual representation of the hypothesized moderation effect of inertia of negative emotions on the relationship between negative emotions and CWB (Study 2).

Figure 5



Conceptual representation of the hypothesized moderation effect of HRV on the relationship between repeated measures of negative emotions (Study 3).

Limitations and Future Research

A particular important question for future researchers concerns whether and how the effects of workers' emotional inertia unfold after work, during leisure time for example. Indeed, it would be interesting to know *if* and *in which way* workers' emotional inertia, as assessed at work, "survive" after work, or if and when it fades out. It would be also intriguing to investigate whether emotional inertia is a stable and situationally invariant construct, such that emotional inertia assessed at work is different from emotional inertia assessed at home, or if they refer to two correlated but distinct constructs.

As for the relationship between exhaustion and NE inertia, although this study design ruled out many of the pitfalls of cross-sectional research, it cannot be excluded that, for instance, this relationship is dynamical, so that these states reinforce each other over time. NE inertia may in fact contribute both to the onset of exhaustion symptoms and their maintenance over time. One opportunity for shading light on this point would be the use of experimental designs to test causality between exhaustion and emotions, long-term intervention studies, or interrupted time series analysis.

Given the importance of controlling for the time-lag, future studies should investigate the optimal time lag between successive prompts, in order to obtain more reliable estimates of individuals' levels of emotional inertia.

To conclude, in three independent samples I found moderate effect sizes associated with (1) the prediction of NE inertia by initial levels of exhaustion; (2) the moderation of the association between negative emotions and CWB by NE inertia and (3) the association between NE inertia and parasympathetic nervous system responses, measured by heart rate variability. Given that the size of those effects is moderate at best, it is recommended that future studies rely on samples of appropriate size, at least of equal size of those used in the present studies (i.e., at least 100 individuals at Level 2, and at least six prompts at Level 1). In all cases in which it is not possible to increase the Level-2 sample size (e.g., with underrepresented populations), researchers should consider to sample more of observations at Level 1 by increasing (1) the number of assessments per day, (2) the number of study

days, or (3) both. In any case, the present studies' estimates of these effects can be used as a starting point to conduct adequate power analyses and calculate the necessary sample size.

Practical implications

The studies presented in this Thesis offer some practical implications for organizations and managers.

Assuming that exhaustion at least partially predicts inertia of negative emotions, organizations could offer stress management interventions as well as interventions aimed at increasing specific resources (e.g., negative emotions management, social support) to improve well-being at work and outside work (Hobfoll, Halbesleben, Neveu, & Westman, 2018). Job design initiatives may also be of help to promote personal and organizational resources. Recent contributions have included emotions within models of work design, suggesting the importance of combining tasks, activities, and relationships in order to promote pleasant emotions and meaningful work (Parker, 2014). Further options for interventions include training programs aiming at enhancing employees' emotion regulation skills, as well as programs aiming at increasing the quality of the LMX relationship (see Ashkanasy, Troth, Lawrence, & Jordan, 2017). Finally, in order to prevent exhaustion, it seems important to help workers to detach and switch off from work when being at home in order to increase recovery (Sonnentag, Venz, & Casper, 2017). The promotion of healthy lifestyles and sleep quality might also help. Finally, these results indicate that NE inertia is related to workers' organizational behaviors that can impact organizations. Helping workers to manage their work-related stress may therefore have also relevant benefits on the prevention of CWB.

Of interest, some of the activities that reduce stress symptoms are also effective in increasing HRV (Lennartsson, Jonsdottir, & Sjörs, 2016). These include engaging in physical activity and meditation (e.g., Kemp & Quintana, 2013; Lindegård, Jonsdottir, Börjesson, Lindwall, & Gerber, 2015; Olex, Newberg, Figueredo, 2013). Furthermore, specific HRV training protocols can be used to improve physiological functioning and get psychological benefits, an example is the approach

proposed by Sutarto, Wahab, and Zin (2010) which propose a combination of biofeedback and slowing of breathing rate. Of interest, recent studies suggest that daily biofeedback sessions may increase the amplitude of heart rate oscillations, modulating brain oscillatory activity and enhancing functional connectivity in brain networks associated with emotion regulation (Mather & Thayer, 2018). These methods aim at increasing HRV amplitude in order to promote autonomic nervous system balance and are relatively easy and quick to learn.

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