Psychosocial well-being of employees in the technology sector: The interplay of job demands and job resources

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2006, company visit. A note on an electric fuse box read: “Opgelet: kast onder spanning!” (caution: fuse box is under tension!). I would like to thank the anonymous employee who added: “Wij ook!” (so are we!). It summarizes one of the main reasons for my dissertation: employees are often experiencing a lot of tension, but at the same time, they can be creative.

As you can read throughout my dissertation, a major component of my research is about job resources. This preface provides me with the opportunity to thank all those who provided me with these (matching) job resources.

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CHAPTER 1
INTRODUCTION AND LITERATURE REVIEW

This first chapter provides an introduction to the present dissertation by giving a research-based overview of the literature on job demands and job resources in relation to work outcomes such as employee well-being and job strain. An overview of two basic theoretical work stress models is provided in order to introduce the Demand-Induced Strain Compensation (DISC) Model. Empirical evidence of the DISC Model is provided and some remaining gaps in empirical evidence are identified. This leads to the main research objectives of this dissertation. The empirical studies presented in the next chapters are briefly introduced with regard to these main research objectives.
INTRODUCTION

Employees’ psychosocial well-being has already been the subject of many work and organizational studies for several decades now. Historically, most research was focused on negative job related outcomes (e.g. ill-health, unwell-being, job strain, burnout, depression, sickness absence), while research in the last decade also focuses more on health and positive employee well-being (Schaufeli & Bakker, 2001). The current dissertation will study both negative (labeled in the current dissertation as “job strain”) and positive work outcomes (labeled in the current dissertation as “employee well-being”). Two prominent basic work stress models in this line of research are the Demand-Control (DC) Model (Karasek, 1979; Karasek & Theorell, 1990) and the Effort-Reward Imbalance (ERI) Model (Siegrist, 1996; Siegrist, Siegrist, & Weber, 1986).

In short, both models predict that employees experiencing high job demands (i.e. work-related tasks that require effort) and insufficient job resources to handle these job demands (e.g. decision latitude or rewards) simultaneously, have an increased risk for the development of job strain (e.g. burnout). However, when enough job resources are available, these resources can counteract the negative impact of high job demands on these outcomes and can even change a stressful situation into a challenging one. In other words, job resources influence job demands in such a way that job demands can lead to both job strain and employee well-being.

As shown in review articles and meta-analyses the above mentioned models (i.e. DC, ERI) have their merits and rightfully have a central place in this field of research (Hausser, Mojzisch, Niesel, & Schulz-Hardt, 2010; Tsutsumi & Kawakami, 2004; Van der Doef & Maes, 1999; Van Vegchel, De Jonge, Bosma, & Schaufeli, 2005). However, findings indicate more empirical support for additive effects of job demands and job resources and less empirical support for the moderating effect of job resources (cf. Hausser, et al., 2010; Van der Doef & Maes, 1999). Hausser, et al. (2010) suggest that moderating effects of job resources on the relation between job demands and job strain or employee well-being, largely depend on whether or not job demands and job
resources are based on qualitatively identical dimensions. They refer to the so-called “matching principle” which is the key principle in the Demand-Induced Strain Compensation (DISC) Model (De Jonge & Dormann, 2003, 2006). To increase our understanding of the particular moderating role of job resources in the job stress process, Hausser, et al. (2010) encourage empirical research in search of this kind of matching interactions between job demands and job resources.

The present dissertation investigates the issue of match between job demands and job resources in the prediction of job strain and employee well-being as outlined by the Demand-Induced Strain Compensation (DISC) Model. In this model, job demands, job resources and job-related outcomes are considered multidimensional constructs comprising cognitive, emotional and/or physical components. As an illustration, the distinction between cognitive, emotional and physical job demands as it is made by the DISC Model, is also reflected in the most recent European Working Conditions Survey (EWCS), carried out in 2010 (Eurofound, 2011). This survey distinguishes between what is called psychosocial factors (i.e. emotional), cognitive factors and physical factors. Psychosocial or emotional factors are for example assessed by the question “Does your job involve dealing directly with people such as customers, pupils, patients, etc.?” with 50.0 % of Belgian respondents answering “(Almost) all of the time” (44.1 % of the full European sample). An example question of the cognitive factor is “Does your work involve complex tasks”. More than half of the Belgian respondents (55.8 %) and 57.7 % of European respondents answered “yes”. Finally, regarding physical factors, 31.9 % of Belgian respondents and 33.5 % of European respondents answered “yes” on the question “Does your work involve carrying or moving heavy loads at least a quarter of the time” (Eurofound, 2011).

The core principle of the DISC Model, the triple-match principle, proposes that the strongest, interactive relationships between job demands and job resources are observed when job demands, job resources and outcomes are based on qualitatively identical dimensions (i.e. cognitive, emotional, or
physical). Second, the compensation principle states that the negative effects of job demands can be best compensated by matching job resources. Third, the balance principle proposes that a balanced mixture of job demands and matching job resources is associated with employee well-being outcomes.

Thus far, the DISC Model has received considerable empirical support in the literature. However, several shortcomings and some remaining avenues for further research can be identified. For example, previous research has been largely based on samples taken from human service and health care settings. The gaps in the empirical literature on the DISC Model form the basics of the research objectives of the present doctoral dissertation.

More specific, the present dissertation will test generalizability and relevance of the DISC Model in the technology sector (i.e. non-human service), both in a cross-sectional and a longitudinal manner and both in heterogeneous and homogeneous samples of employees. Further, the, previously less studied, balance principle in the DISC Model (cf. Van den Tooren, De Lange, & Dormann, 2011) will be investigated, next to the compensation principle. Finally, the current dissertation will also investigate the role of personal characteristics on the relations between work characteristics and job strain.

**BASIC THEORETICAL FRAMEWORKS: ABOUT JOB DEMANDS AND JOB RESOURCES**

Over the past decades, a large body of research in work and organizational psychology, conducted in a variety of occupational sectors, has focused on two crucial components of the work itself, job demands and job resources, in predicting and understanding job-related outcomes, such as job strain and employee well-being (e.g. Kahn & Byosiere, 1992; Schaufeli & Bakker, 2004). Job demands are work related tasks that require effort. Job resources can be broadly conceptualized as instrumental, psychosocial, assets at work which can be used as strategic options for action (cf. Hobfoll, 1989, 2002). Most authors propose interactive effects of job demands and job resources, in which job resources are assumed to moderate the relation between
job demands and outcomes (Cooper, Dewe, & O'Driscoll, 2001). Both work characteristics, job demands and job resources, can be deduced from prominent job stress models such as the Demand-Control-(Support) Model (DC(S); Johnson & Hall, 1988; Karasek, 1979; Karasek & Theorell, 1990) and the Effort Reward Imbalance Model (ERI; Siegrist, 1996; Siegrist, et al., 1986). These two social epidemiological models are claimed to have the most explanatory power on job strain and employee well-being (Calnan, Wadsworth, May, Smith, & Wainwright, 2004).

In the following, a short overview of theoretical and empirical evidence for the DC(S) and ERI models is provided, followed by critiques on, and shortcomings of these models, which will lead us to the description of the DISC Model that was investigated in the current dissertation.

**DEMAND-CONTROL-(SUPPORT) MODEL**

The DC Model (Karasek, 1979) postulates that two work characteristics (i.e. job demands and job control) determine employee health, well-being and job strain. In the DC Model, job demands are defined as the psychological stressors in the work environment. Job control (i.e. a job resource) or decision latitude refers to employees’ control over their tasks and how those tasks are executed. It consists of both skill discretion and decision authority. Skill discretion describes the degree to which the job involves a variety of tasks, low levels of repetitiveness, occasions for creativity and opportunities to learn new things and develop special abilities. Decision authority describes both the employee’s ability to make decisions about their own job, and their ability to influence their own work team and more general company policies. According to the strain hypothesis of the DC Model, employees working in a high-strain job, reporting high job demands and low job control, experience the highest levels of stress reactions. On the other hand, the combination of high job demands and high job control is associated with the highest level of learning, motivation, and personal growth (i.e. active learning hypothesis). Later, Johnson and Hall expanded the DC Model with a workplace social support dimension and it was then labeled the Demand-Control-Support Model (DCS; Johnson &
Hall, 1988). With the DCS, it is argued that adverse outcomes might be mitigated by social support at work from colleagues and superiors, which interacts with job resources to protect employees from the potential negative effects of high job demands. The DC Model has been very successful in generating empirical studies and several overviews of empirical evidence were published and showed that the model can be used to predict job strain, employee health and well-being, and both motivational and productivity outcomes (e.g. De Lange, Taris, Kompier, Houtman, & Bongers, 2003; Hausser, et al., 2010; Van der Doef & Maes, 1999).

**Effort Reward Imbalance Model**

The ERI Model (Siegrist, 1996; Siegrist, et al., 1986) emphasizes the reward, rather than the control structure of work (Bakker & Demerouti, 2007). In the ERI Model, efforts spent at work, the rewards in return for these efforts, and the personal characteristic overcommitment are the determinative factors of employees’ well-being (Siegrist, 1996). Efforts are defined as job demands and/or obligations that are imposed on the employee. Rewards include salary, esteem, and job security or career opportunities (Siegrist, 1996). Overcommitment is defined as a set of attitudes, behaviors and emotions reflecting excessive striving in combination with a strong desire of being approved and esteemed (Siegrist, 1998). Resting on these central constructs, the ERI Model proposes three hypotheses. First, the imbalance between high effort and low reward is associated with the highest level of stress reactions, over and above the risk associated with high effort and low reward separately (Siegrist, 2005). Second, employees characterized by a high level of overcommitment are at higher risk for stress reactions or stress-related diseases (Siegrist, 2005). Third, the highest risk of stress-related diseases is expected when both high overcommitment and an imbalance between high effort and low reward are present (Siegrist, 2005). In particular, overcommitment is assumed to increase the negative association of an effort-reward imbalance and ill-health. Evidence for these patterns has indeed been reported (for a review, cf. Tsutsumi & Kawakami, 2004; Van Vegchel, et al., 2005).
MAIN SHORTCOMINGS OF THE DC(S) AND ERI MODELS

In sum, both the DC(S) and the ERI Model predict that job strain will occur when an employee is faced with high job demands and insufficient job resources to handle these job demands. In contrast, when enough job resources are available, these resources can mitigate the negative impact of job demands on job strain and can even change a stressful situation into a challenging one, leading to higher employee well-being (Van Vegchel, 2005). This assumption has often been operationalized as an interaction between job demands and job resources in relation to job strain and employee well-being. An interaction means that the total effect of high job demands and low job resources is larger than the sum of the individual effects of high job demands and low job resources. In other words, an interaction effect can be regarded as a situation of “1 + 1 = 3”, due to the extra influence of the interplay between characteristics that reinforce each other, whereas without this interplay there would simple be an additive effect (“1 + 1 = 2”) (Van Vegchel, 2005). As shown in review articles and meta-analyses, the above mentioned models (i.e. DC(S), ERI) have their merits and rightfully have a central place in this field of research (Hausser, et al., 2010; Tsutsumi & Kawakami, 2004; Van der Doef & Maes, 1999; Van Vegchel, et al., 2005). However, findings indicate more empirical support for additive effects of job demands and job resources and less empirical support for the moderating effect of job resources (cf. Hausser, et al., 2010; Van der Doef & Maes, 1999). Notwithstanding the valuable contribution of both models, the DC(S) and ERI Models have been criticized in the literature.

One common critique is the fact that both the DC(S) and the ERI Model only focus on a limited part of the (psychological) working situation (De Jonge, Dormann, & Van Vegchel, 2004; Houtman & Smulders, 2003; Sparks & Cooper, 1999). It is argued that the strength of the DC(S) and ERI Models lies in their simplicity, but that this simplicity does not always do justice to reality (cf. Bakker & Demerouti, 2007). For instance, Houtman and Smulders (2003) argued that the DC Model should take into account a larger variety of job
demands. Similarly, a larger variety of associated job resources should be included to deal with the various job demands.

A second criticism applies mainly on the DC(S) Model and states that the DC(S) Model is a purely environment-directed model: individual differences in personal characteristics between employees are considered less relevant for the effects of work characteristics on employee well-being and job strain (e.g. De Jonge & Kompier, 1997; Schnall, Landsbergis, & Baker, 1994). In contrast, the ERI Model does provide a variable reflecting individual differences: overcommitment, which we discussed earlier in this chapter.

Third, the central constructs of both models are non-specific or general (cf. Van Vegchel, De Jonge, Bakker, & Schaufeli, 2002). In particular, several components are combined into one measure, making it unclear which component exactly is responsible for a certain effect. For instance, the construct ‘rewards’ in the ERI Model covers three specific rewards (i.e., salary, esteem, and job security / career possibilities) but combines these into one global measure. This lack of specificity of the central constructs in both models was put forward as a possible explanation for the inconsistent evidence regarding interaction effects of job demands/efforts and job control/rewards (Van Vegchel, 2005). A similar point was made with regard to the DC Model (De Jonge, van Vegchel, Shimazu, Schaufeli, & Dormann, 2010; Van der Doef & Maes, 1998, 1999). Moreover, by using more specific operationalizations, more specific guidelines can be given for setting up interventions in practice.

A last criticism that adds up to the previous one concerns the issue of match between job demands and job resources. In 1985, Cohen and Wills formulated their ‘stress-matching hypothesis’, suggesting that interaction effects between job demands and social support will only occur when the specific form of social support allows the employee to deal with the specific demands of his/her job (Cohen & Wills, 1985). Assuming that only certain resources will moderate the influence of certain job demands, implies that specific measures of both constructs have to be used. This issue of match has not been included so far in both models, although studies have been carried out on the usefulness of
specific measures in the DC and ERI Model (e.g. De Jonge, et al., 2010; Tuckey & Hayward, 2011). A systematic narrative review of 63 studies published between 1979 and 1997, focusing on psychological well-being outcomes (Van der Doef & Maes, 1999), revealed that the literature provides considerable support for main effects of job demands and job resources. However, support for the moderating influence of job resources is less consistent. In a recent review of 83 studies published between 1998 and 2007, Hausser, et al. (2010) updated the work by Van der Doef and Maes (1999) and found similar results. Findings indicate more empirical support for additive effects of job demands and job resources and less empirical support for the moderating effect of job resources. Furthermore, the authors suggest that buffering effects largely depend on whether or not job demands and job resources are based on qualitatively identical dimensions. They refer to the so-called matching principle which is the key principle in the Demand-Induced Strain Compensation (DISC) Model (De Jonge & Dormann, 2003, 2006). To increase our understanding of the particular moderating role of job resources in the job stress process, Hausser, et al. (2010) encourage further empirical research in search of this kind of matching interactions between job demands and job resources. As this matching principle is not (yet) stipulated explicitly in other often cited work stress models such as the Job Demands-Resources Model (Bakker & Demerouti, 2007; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), the focus of the current doctoral dissertation will be on the DISC Model.

**DISC Model**

To overcome most of the above-mentioned shortcomings, De Jonge and Dormann (2003) introduced the DISC Model. First, in the following section, the theoretical framework, core principles and underpinnings of the DISC Model are presented. Second, an overview of empirical evidence is provided. Third, the gaps in empirical evidence concerning the DISC Model, will lead us to the research questions of the present dissertation.
FRAMEWORK AND THEORETICAL UNDERPINNINGS

The DISC Model (De Jonge & Dormann, 2003, 2006) is premised on several principles. A first and central tenet of the DISC Model is the so-called multidimensionality principle. It states that job demands and job resources, as well as job-related outcomes, are multidimensional constructs. They comprise cognitive, emotional, and physical dimensions (cf. Hockey, 2000). Job demands are defined as those properties of a job that require emotional, cognitive and/or physical effort and can have both positive and negative consequences (Jones & Fletcher, 1996). Job resources can be conceptualized as work-related assets that can be employed to deal with job demands. Job demands can be cognitive (e.g. having to display high levels of concentration and precision), emotional (e.g. having to deal with people who get easily angered towards you), or physical (e.g. having to bend and/or stretch a lot at work). A similar distinction can be made for job resources, which can be cognitive (e.g. control at work), emotional (e.g. colleagues providing sympathy and affection), or physical (e.g. being able to use adequate technical equipment to accomplish physically strenuous tasks). Finally, job-related outcomes can either be positive (i.e. employee well-being) or negative (i.e. job strain), and can also be cognitive (e.g. competence, cognitive failure), emotional (e.g. emotional well-being, emotional exhaustion), or physical (e.g. physical well-being, physical health complaints).

Next to recognizing the multidimensionality of stress concepts, a second key principle of the DISC Model is the triple-match principle (TMP; De Jonge & Dormann, 2003, 2006). The TMP proposes that the strongest interactive relationships between job demands and job resources are observed when job demands, job resources, and outcomes are based on qualitatively identical dimensions. In other words, for a triple-match, there should both be a match between job demands and job resources on the one hand, and a match between job demands/resources and outcomes on the other hand. An example of a triple-match is a situation in which emotional job resources mitigate the negative impact of emotional job demands on employees' emotional exhaustion. The TMP builds further on the work of Cohen and Wills (1985) and Frese (1999),
who elaborated on two kinds of matching principles in social support literature. Although the idea of matching is not new, it forms the most innovative aspect of the DISC Model.

Cohen and Wills (1985) proposed that interaction effects were most likely to be found when specific stressors corresponded to specific forms of social support. This was labeled ‘a double-match of common kind’, reflecting a match between job demands and job resources only, irrespective of the type of outcome (De Jonge & Dormann, 2003). An example of a double-match of common kind is an association between emotional job demands and cognitive outcomes that is moderated by the availability of emotional job resources (cf. De Jonge, Le Blanc, Peeters, & Noordam, 2008).

Frese (1999) proposed that the job strain or employee well-being outcome can be a source of match or non-match too. Therefore, in the DISC Model, the label ‘double-match of extended kind’ means that either job demands or job resources match the outcome (De Jonge & Dormann, 2003). Two examples of a double-match of extended kind are (1) an association between physical job demands and physical outcomes that is moderated by emotional job resources, and (2) an association between cognitive job demands and emotional outcomes that is moderated by emotional job resources.

These two kinds of ‘double-matches’ (i.e. double-match of common kind and double-match of extended kind) are weaker in terms of match (only two out of three constructs match) and thus less likely to occur than triple-matches (Van den Tooren, et al., 2011). Finally, the interactions where neither job demands, job resources, nor outcomes match are labeled ‘non-matches’ (e.g. an association between cognitive job demands and physical outcomes that is moderated by emotional job resources).

The DISC Model and its’ TMP considers the likelihood of finding a triple-match interaction higher than the likelihood of only finding a double-match of common kind (i.e. a match only exists between job demands and job resources), a double-match of extended kind (i.e. a match only exists between job demands or job resources and the job-related outcome) or a non-match (i.e.
no matches exist between job demands, job resources and job-related outcomes). It should be noted, however, that the TMP does not represent a deterministic law; rather, it proposes a probabilistic principle. This means that interactions between job demands and job resources should not occur exclusively when matching work characteristics are analyzed.

Intuitively the TMP appears to be quite logical in its nature. For example, to prevent physical health problems caused by physical job demands, providing matching physical job resources seems to be a very logical and intuitive remedy; more logical than providing or promoting non-matching emotional or cognitive resources. Moreover, several theoretical frameworks in the field of occupational health psychology and similarities to existing theories in other fields provide a clear theoretical context for the TMP. First, the TMP can be framed within the self-regulation literature. The idea of functional homeostatic regulation, described in contexts of immune functioning (e.g. Lekander, 2002) and nervous systems (e.g. Montague, 1996), can be transferred to organizational settings (Boekaerts, Maes, & Karoly, 2005; Vancouver, 2000). Functional homeostatic regulation at work involves self-regulation processes in order to cope with states of psychological imbalance induced by job demands (cf. Pomaki & Maes, 2002). Ideally, individuals will activate functional, matching job resources to mitigate the effects of specific job demands (De Jonge, Dormann, & Van den Tooren, 2008). Second, the TMP can also be situated within the person-environment fit approach to job strain (e.g. Ostroff & Judge, 2007), which states that employees experience more positive work-related outcomes in case a job supplies something that matches the desires of an employee (Daniels & De Jonge, 2010; Edwards & Harrison, 1993). Third, means efficacy, a relatively new concept in the work stress literature, can be used to provide theoretical support for the TMP. Means efficacy is defined as employees’ belief in the utility of particular tools available for task performance and can boost performance (Eden, Ganzach, Flumin-Granat, & Zigman, 2010). Given the intuitive logic of the TMP, employees’ belief in the efficacy of job resources that match the required job demands could be a fairly plausible explanation of the TMP.
Two more principles emerge from the TMP: the compensation principle and the balance principle.

The *compensation principle* states that negative effects of job demands can be best compensated by matching job resources. This principle describes the self-regulating process (e.g. Vancouver, 2000) through which an employee can use job resources to prevent or diminish the possible negative effects of job demands. For instance, it is proposed that employees who are confronted with high emotional job demands (e.g. anger control) are least likely to experience emotional job strain (e.g. emotional exhaustion) if sufficient emotional job resources (e.g. a listening ear from colleagues or supervisors) are available to deal with their emotionally demanding job. If insufficient emotional job resources are available, emotional job strain is more likely to occur.

The *balance principle* proposes that a balanced mixture of job demands and matching job resources is associated with positive employee well-being outcomes. For instance, employees who are confronted with high cognitive job demands (e.g. solving complex problems) are most likely to experience cognitive well-being (e.g. competence) if sufficient cognitive job resources (e.g. the opportunity to take mental breaks) to deal with their cognitively demanding job are available. If workers have insufficient cognitive job resources at their disposal, cognitive well-being is less likely to occur.

**Empirical Evidence**

Recent overviews of empirical evidence regarding the DISC Model were provided by De Jonge, et al. (2008), Daniels and De Jonge (2010) and Van den Tooren, De Jonge and Dormann (2011). Studies conducted to test the principles of the DISC Model show that results in general have been supportive. It should be noted that in order to identify a triple-match in a regression analysis, the interaction term between similar job demands and resources in the prediction of an identical outcome, should be significant (Daniels & De Jonge, 2010). To identify a cognitive triple-match, for example, the multiplicative interaction term between cognitive job demands and cognitive job resources in the
prediction of cognitive outcomes should be statistically significant. If a significant moderating effect is in line with the compensation principle (i.e. job resources buffer the relation between job demands and job strain) or the balance principle (i.e. job resources strengthen the relation between job demands and employee well-being), it is called a theoretically valid triple-match, double-match, or non-match. However, if a significant moderating effect contradicts the compensation principle (i.e. job resources strengthen job strain) or the balance principle (i.e. job resources diminish employee well-being), it is called a theoretically non-valid triple-match, double-match, or non-match (cf. Chrisopoulos, Dollard, Winefield, & Dormann, 2010; De Jonge & Dormann, 2006; Van den Tooren, et al., 2011).

Eight out of eleven DISC studies reported by De Jonge, et al. (2008) showed evidence for the triple-match principle (i.e. 72.7 %). This overview was updated by Daniels and De Jonge (2010), and they report that fifteen out of nineteen studies showed evidence in support of the TMP (i.e. 78.9 %). A third overview of empirical studies on the DISC Model was provided by Van den Tooren, et al. (2011). They did a review of 29 studies on the DISC Model and concluded that the matching hypothesis and the triple-match principle were partly supported with respect to the stress-buffering effect of matching job resources (i.e. compensation principle), whereas no support was found for the activation-enhancing effect of matching job resources (i.e. balance principle). In these previous reviews, studies comprised papers published (or in press) in international journals, papers published (or in press) in national journals, papers submitted for publication in international journals, master’s theses, honor’s theses, reports and conference contributions.

In the following paragraphs we will give a brief and chronological overview of studies on the DISC Model, in which we only include studies published or in press in peer reviewed journals. Furthermore, only studies investigating the hypothesized interaction effects in the DISC Model were included in this overview. Other studies inspired by the DISC Model (De Jonge, Spoor, Sonnentag, Dormann, & Van den Tooren, in press; Van den Tooren &
De Jonge, in press, 2010) are described later in this dissertation. The study by Van de Ven, Vlerick and De Jonge (2008) was also excluded from this overview, as it will be discussed in Chapter 3. In total nine studies will be summarized (cf. also Table 1.1).

First, De Jonge et al. (2004) performed two cross-sectional studies among 471 and 405 Dutch nursing home workers. They found four out of six possible triple-match interactions (i.e. 66.7 %) and two out of twelve double-match interactions of common kind (i.e. 16.7 %). No double-match interactions of extended kind or non-matching interactions were added in the analyses.

Second, De Jonge and Dormann (2006) did two two-wave panel studies with a two-year time lag among 280 and 267 Dutch health care workers. They found longitudinal support for an interaction between baseline physical job demands and physical job resources in predicting physical health complaints (physical strain) two years later, and for an interaction between baseline emotional job demands and emotional job resources in predicting emotional exhaustion (emotional strain) two years later. The likelihood of finding interaction effects was linearly related to the degree of match, with 33.3 % of all tested interactions becoming significant when there was a triple-match, 16.7 % significant interactions when testing for double.matches (common kind as well as extended kind), and 0.0 % significant interactions when there was no match.

Third, De Jonge, Peeters, and Le Blanc (2006) investigated the moderating influence of emotional and cognitive job resources on the relation between emotional job demands and three cognitive outcome measures (i.e. creativity, active learning and challenge). In their cross-sectional study among 826 health care workers, they concluded that a match between an emotional job demand and an (emotional) job resource leads to a higher probability of positive work outcomes than a non-match between an emotional job demand and a (cognitive) job resource.

Fourth, in a cross-sectional internet-study by De Bruin, Van Boxmeer, Verwijs, and Le Blanc (2007) the compensation principle of the DISC Model was investigated among 390 employees from different occupational sectors.
Their results neither showed evidence for the effects of matching nor non-matching interactions.

Fifth, De Jonge, Le Blanc, Peeters, and Noordam (2008) tested the moderating role of matching and non-matching job resources in the relation between emotional job demands and emotional exhaustion, employee creativity, and work motivation. Results of the analyses on 826 health care workers revealed that emotional job resources were able to moderate the relation between emotional job demands and emotional exhaustion. Further, both emotional job resources and, to a lesser extent, cognitive job resources were able to moderate the relation between emotional job demands and positive well-being outcomes (i.e. employee creativity and work motivation).

Sixth, in a cross-sectional sample of 69 nurses from a Dutch nursing home, Van den Tooren and De Jonge (2008) found that the likelihood of finding theoretically-valid moderating effects was related to the degree of match between job demands, job resources, and outcomes.

Seventh, De Jonge and Peeters (2009) showed that (multi-source measured) counterproductive work behavior is associated with job demands and job resources and that both physical and emotional job resources moderated the relation between physical job demands and counterproductive work behavior. They conclude that the DISC Model has the potential of making a profound contribution to our understanding of counterproductive working behaviors in health care work.

Eighth, Chrisopoulos, Dollard, Winefield and Dormann (2010) found empirical evidence for one out of three tested triple-match interactions in their two-wave panel study with a one-year time lag among 179 Australian police officers. They found longitudinal support for an interaction between baseline cognitive job demands and cognitive job resources in predicting professional efficacy one year later.
Table 1.1. Chronological overview of DISC studies published in peer reviewed journals.

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample (country)</th>
<th>Design</th>
<th>Demands</th>
<th>Resources</th>
<th>Outcomes</th>
<th>TM</th>
<th>DMc</th>
<th>DMe</th>
<th>NM</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Jonge et al. (2004)</td>
<td>471 and 405 nursing home workers (NED)</td>
<td>Cross-sectional (two studies)</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO + EO - PO -</td>
<td>4/6 (67%)</td>
<td>2/12 (17%)</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>De Jonge &amp; Dormann (2006)</td>
<td>280 and 267 nursing home workers (NED)</td>
<td>Longitudinal (two-wave; two studies)</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO + EO - PO -</td>
<td>2/6 (33%)</td>
<td>2/12 (17%)</td>
<td>4/24 (17%)</td>
<td>0/12 (0%)</td>
</tr>
<tr>
<td>De Jonge et al. (2006)</td>
<td>826 health care workers (NED)</td>
<td>Cross-sectional (3x)</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO +</td>
<td>n.a.</td>
<td>1/6 (17%)</td>
<td>0/6 (0%)</td>
<td>n.a.</td>
</tr>
<tr>
<td>De Bruin et al. (2007)</td>
<td>390 workers (NED)</td>
<td>Cross-sectional</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO - EO - PO -</td>
<td>0/3 (0%)</td>
<td>0/6 (0%)</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>De Jonge et al. (2008)</td>
<td>826 health care workers (NED)</td>
<td>Cross-sectional (3x)</td>
<td>ED</td>
<td>CR ER PR</td>
<td>CO + (2x) EO -</td>
<td>1/3 (33%)</td>
<td>2/6 (33%)</td>
<td>1/9 (11%)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Van den Tooren &amp; De Jonge (2008)</td>
<td>69 nursing home workers (NED)</td>
<td>Cross-sectional</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO + EO - PO -</td>
<td>1/3 (33%)</td>
<td>1/6 (17%)</td>
<td>1/12 (8%)</td>
<td>0/6 (0%)</td>
</tr>
<tr>
<td>De Jonge &amp; Peeters (2009)</td>
<td>54 health care workers and co-workers (matched) (NED)</td>
<td>Cross-sectional</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO - (2x) EO -</td>
<td>0/2 (0%)</td>
<td>2/4 (50%)</td>
<td>0/8 (0%)</td>
<td>2/4 (50%)</td>
</tr>
<tr>
<td>Chrisopoulos et al. (2010)</td>
<td>179 police officers (AUS)</td>
<td>Longitudinal (two-wave)</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO - EO - PO -</td>
<td>1/3 (33%)</td>
<td>1/6 (17%)</td>
<td>3/12 (25%)</td>
<td>0/6 (0%)</td>
</tr>
<tr>
<td>Van den Tooren et al. (in press)</td>
<td>317 teachers (BEL)</td>
<td>Longitudinal (two-wave)</td>
<td>CD ED PD</td>
<td>CR ER PR</td>
<td>CO - EO - PO -</td>
<td>0/3 (0%)</td>
<td>1/6 (17%)</td>
<td>1/12 (8%)</td>
<td>0/6 (0%)</td>
</tr>
</tbody>
</table>

Note. Table partly based on Van den Tooren (2010); AUS = Australia; BEL = Belgium; NED = Netherlands; CD, ED, and PD = cognitive, emotional, and physical job demands; CR, ER, and PR = cognitive, emotional, and physical job resources; CO, EO, and PO ( - or +) = (negative or positive) cognitive, emotional, and physical outcome; TM = triple-matches; DMc, DMe = double-matches of common kind, extended kind; n.a. = not applicable (match was not tested); 1/3 = one out of 3 tested matches was valid.
Ninth, Van den Tooren, De Jonge, Vlerick, Daniels and Van de Ven (in press) also investigated the TMP as part of their two-wave panel study among 317 beginning teachers in Belgium. Results revealed that the stress-buffering effects of job resources on the lagged relation between job demands and job strain were equally likely to occur in case of a match between specific types of job demands and job resources, as in case of a non-match between specific types of job demands and job resources.

To conclude, although most DISC studies show that particular combinations of specific job demands and matching job resources are more likely to be related to cognitive, emotional, and physical outcomes, our overview of both cross-sectional and longitudinal studies, published in peer reviewed journals (cf. Table 1.1.), revealed mixed results with regard to the core DISC principles.

GAPS AND SHORTCOMINGS IN EMPIRICAL EVIDENCE

As the overview of empirical evidence on the DISC Model above shows, the DISC Model has received a fair amount of attention in the literature. As a starting point for further research in the current dissertation, we will give an overview of gaps and inconsistencies in the empirical evidence gathered so far.

First, although the majority of empirical studies shows evidence for the TMP (cf. also Van den Tooren, et al., 2011, for an overview), several studies with the same aim do not (De Bruin, et al., 2007). Although, longitudinal studies provide more support for the TMP (cf. Chrisopoulos, et al., 2010; De Jonge & Dormann, 2006), inconsistency in longitudinal findings remains an issue (e.g. Van den Tooren, et al., in press).

Second, several empirical study results and authors (e.g. Bakker, Demerouti, & Euwema, 2005) challenge the DISC-idea that specific job demands and job resources should match in order to show moderating effects in the prediction of job-related outcomes, raising doubt regarding the generalizability of the matching hypothesis.
Third, although the DISC Model acknowledges the existence and secondary importance of non-matches, not all previous studies have included them in their analyses (e.g. De Bruin, et al., 2007; De Jonge, et al., 2004).

Fourth, different dependent variables have been used in the studies mentioned above. However, not all studies included emotional as well as cognitive and physical work characteristics and outcomes (e.g. De Jonge, et al., 2006; De Jonge & Peeters, 2009), implying that often only a part of the DISC Model has been studied.

Fifth, the overview of all DISC studies (including unpublished work) by Van den Tooren, et al. (2011) shows that most research has been focused on the compensation principle (i.e. stress-buffering effect of job resources) and that evidence for the overall DISC Model can be largely explained by findings on the compensation principle. More research on the balance principle is therefore badly needed (Van den Tooren, et al., 2011).

Sixth, the majority of DISC studies were cross-sectional, with all the related downsides such as the impossibility to determine causal directions (Edwards, 2008; Taris & Kompier, 2003).

Seventh, most studies investigating the DISC principles have been conducted in homogeneous samples in health care and human service occupations, where employees often have to deal with mainly emotional job demands (cf. De Jonge, Dormann, et al., 2008). Previous DISC studies also largely depend on samples with predominantly female respondents. Further, most published work on the DISC Model is based on samples of employees from the Netherlands. This sample selection bias calls again for the study of the relevance and generalizability of the DISC Model in other occupational sectors and in more heterogeneous samples.

Finally, some first attempts have been made to include personal characteristics into the DISC Model. For example, Van den Tooren and De Jonge (in press) investigated the moderating role of regulatory focus (i.e. prevention focus versus promotion focus; cf. Higgins, 1997) in a daily diary
study among 64 nurses. However, results showed that the short-term relation between job demands, job resources, and job strain was not affected by the regulatory focus of the employee. Further, Van den Tooren, et al. (in press) investigated the moderating role of matching active coping styles (i.e. cognitive, emotional, and physical active coping styles) on the stress buffering effects of job resources on the longitudinal relation between job demands and job strain. Results revealed no such moderating effect. Further research into these personal characteristics has the potential to refine the DISC Model and should be investigated (cf. Van den Tooren, 2010).

**MAIN RESEARCH OBJECTIVES OF THE PRESENT DISSERTATION**

In the present dissertation four main research questions are addressed and research objectives are formulated.

The *first research objective* is to test generalizability and relevance of the TMP in the technology sector. Two studies within this dissertation will answer this question. First, in Chapter 2 a cross-sectional study will investigate the issue of match in a large sample of employees in the technology sector. Second, in Chapter 4, a two-wave panel study is reported that will investigate the issue of match in the technology sector in a longitudinal manner, with six different outcome variables.

The *second research objective* is to investigate the, previously less studied, balance principle in the DISC Model (cf. Van den Tooren, et al., 2011). The balance principle proposes that a balanced mixture of job demands and matching job resources is associated with positive employee well-being outcomes (De Jonge & Dormann, 2003). In Chapter 3, two cognitive well-being indicators are included to test the balance principle in a homogeneous sample of informatics. In Chapter 4, three positive well-being indicators (i.e. a cognitive, an emotional, and a physical one) are used to address this issue.

The *third research objective* is to investigate the compensation principle in the technology sector. The compensation principle proposes that the potential
The negative effects of job demands can be best compensated by matching job resources. In Chapter 2, three job strain indicators (i.e. a cognitive, an emotional, and a physical indicator) are included in a cross-sectional study. In Chapter 4, three job strain indicators are included to investigate the compensation principle in a longitudinal manner.

The fourth research objective is to investigate the role of personal characteristics on the relations between work characteristics and job strain. To address this issue, in Chapter 5 the influence of emotional support seeking on the stress-buffering effect of emotional job resources on the relation between emotional job demands and emotional exhaustion is examined.

Figure 1.1 provides a general overview of the research model used in the present dissertation. In the following section, the technology sector will be introduced as the background of our empirical studies. This will be followed by an overview in which each empirical chapter will be briefly outlined and presented. Figures and tables will illustrate the different variables and interactions studied in each individual chapter.

**Figure 1.1. General Research design: conceptual model.**

**TECHNOLOGY SECTOR**

The empirical studies presented in this dissertation focus on samples of employees in the Belgian technology sector.
The technology sector consists of many fast-paced firms, a variety of occupational groups and many very specialized workers from which a strong personal engagement in work is required. Their work is often deadline-driven and competitive with long workdays; they are often exposed to a mixture of challenging cognitive, emotional and physical job demands, where it is difficult to separate work from home life. In the last few decades there has been a rise in the technology sector mainly in industrialized countries (Arvidsson, et al., 2006). Information and communication technology is becoming more and more important in a variety of domains.

As organizations with attention for the development of both a well-designed technological (e.g. IT) environment and well-being and development of employees, are more productive than organizations whose sole interest is in IT and less in well-being and human capital (Sandblad, et al., 2003), research dealing with the work environment and the well-being of employees with technology related work is of high importance. Moreover, previous research showed that technology workers can be considered knowledge workers with possible health problems such as musculoskeletal symptoms and reduced self-reported productivity (Hagberg, Vilhemsson, Tornqvist, & Toomingas, 2007).

The job of the IT professional is, for example, often thought of in terms of technology. These employees are responsible for keeping up with the latest technological developments, devising technological solutions to business problems, and supporting users as they employ technology (cf. Rutner, Riemenschneider, O'Leary-Kelly, & Hardgrave, 2011). However, Rutner et al. (2011) show in their study among IT professionals that technical excellence is in itself not enough and that IT professionals must also be good team players and maintain productive working relationships with non-IT colleagues and clients (cf. Bassellier & Benbasat, 2004; Markus & Benjamin, 1996). This demonstrates that even in very cognitively demanding jobs, emotion work and emotional labor plays an important role. Rutner, Hardgrave and McKnight (2008) studied the impact of emotional dissonance on work exhaustion and concluded that emotional dissonance (i.e. the felt conflict between the way one
feels toward interaction partners and the emotion one feels compelled to display towards those individuals) predicted IT professionals’ work exhaustion better than perceived workload, role conflict or role ambiguity. Furthermore, numerous studies on repetitive strain injury (e.g. Helliwell & Taylor, 2004) show that also physical job demands are very relevant beyond those sectors in which one would typically study physical job-related outcomes.

In sum, we conclude that IT professionals, and employees in the technological sector in general, are faced with cognitive, emotional and physical job demands. Previous research has taught us that these job demands are associated with both job strain and employee well-being, and that the availability of (matching) job resources plays a pivotal role in the relationship between job demands and these outcomes. In the present dissertation we will focus on samples in the technology sector to further investigate these relations, in line with our main research objectives formulated earlier in this chapter.

OUTLINE OF THE PRESENT DISSERTATION

In the present dissertation four empirical studies are presented in chapters 2, 3, 4, and 5. Each chapter will be briefly outlined and presented, with reference to the four research objectives mentioned above.

In Chapter 2, the TMP and compensation principles of the DISC Model are tested with regard to three employee well-being outcomes: cognitive failure, emotional exhaustion and physical health complaints. Cross-sectional data were collected in a large sample of employees in the technology sector (n = 1533). This first empirical study refers to the first and third research objectives in the present dissertation and aims to investigate generalizability and relevance of the TMP and compensation principle of the DISC Model in the technology sector. Figure 1.2 is a graphical representation of the research design of Chapter 2. Further, in Table 1.2 an overview of all interactions tested in this chapter (i.e. triple-matches, double-matches of common kind, double-matches of extended kind, and non-matches) is provided.
Figure 1.2. Research design Study 1 (Chapter 2).

Table 1.2. Overview of interactions tested in Study 1 (Chapter 2).

<table>
<thead>
<tr>
<th></th>
<th>Cognitive Failure</th>
<th>Emotional Exhaustion</th>
<th>Physical Health Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x</td>
<td>TM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Cognitive JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x</td>
<td>DMe</td>
<td>TM</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>TM</td>
</tr>
<tr>
<td>Physical JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>NM</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>NM</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>NM</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>NM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>NM</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>NM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JD x</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. JD = job demands; JR = job resources; TM = triple-match interaction; DMe = double-match interaction of common kind; DMe = double-match interaction of extended kind; NM = non-matching interaction.
In Chapter 3, the balance principle of the DISC Model is tested with regard to two cognitive well-being indicators: learning motivation and professional efficacy. Cross-sectional data were collected in a homogeneous sample of IT-professionals ($n = 207$). This second empirical study refers to the second research objective in the present dissertation. Figure 1.3 is a graphical representation of the research design of Chapter 3. Further, in Table 1.3 an overview of the interactions tested in this chapter (i.e. triple-matches, and double-matches of common kind) is provided.

![Figure 1.3. Research design Study 2 (Chapter 3).](image)

**Table 1.3. Overview of interactions tested in Study 2 (Chapter 3).**

<table>
<thead>
<tr>
<th></th>
<th>Learning Motivation</th>
<th>Professional Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x</td>
<td>TM</td>
<td>TM</td>
</tr>
<tr>
<td>Cognitive JR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x</td>
<td>DMc</td>
<td>DMc</td>
</tr>
<tr>
<td>Emotional JR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x</td>
<td>DMc</td>
<td>DMc</td>
</tr>
<tr>
<td>Physical JR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* JD = job demands; JR = job resources; TM = triple-match interaction; DMc = double-match interaction of common kind.
In Chapter 4, the TMP, as well as the compensation and balance principles of the DISC Model, are tested with regard to three employee well-being outcomes and three job strain outcomes (i.e. cognitive, emotional and physical job strain and employee well-being). Longitudinal data were collected in the technology sector ($n = 720$). This study refers to the first, second, and third research objectives in the present dissertation and aims to investigate generalizability and relevance of the DISC Model in the technology sector and more specific its TMP and compensation and balance principles. Figure 1.4 is a graphical representation of the research design of Chapter 4. Further, in Table 1.4 an overview of all interactions tested in this chapter (i.e. triple-matches, double-matches of common kind, double-matches of extended kind, and non-matches) is provided.

![Figure 1.4. Research design Study 3 (Chapter 4).](image)
Table 1.4. *Overview of interactions tested in Study 3 (Chapter 4).*

<table>
<thead>
<tr>
<th>Cognitive JD x Cognitive JR</th>
<th>Cognitive strain</th>
<th>Emotional strain</th>
<th>Physical strain</th>
<th>Cognitive well-being</th>
<th>Emotional well-being</th>
<th>Physical well-being</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x Emotional JR</td>
<td>TM DMe DMe TM DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x Emotional JR</td>
<td>DMe TM DMe DMe TM DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x Physical JR</td>
<td>DMe DMe TM DMe DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x Emotional JR</td>
<td>DMe DMe NM DMe DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x Physical JR</td>
<td>DMe DMe NM DMe DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x Cognitive JR</td>
<td>DMe DMe NM DMe DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x Physical JR</td>
<td>NM DMe DMe NM DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x Cognitive JR</td>
<td>DMe NM DMe NM DMe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* JD = job demands; JR = job resources; TM = triple-match interaction; DMe = double-match interaction of common kind; DMe = double-match interaction of extended kind; NM = non-matching interaction.
Chapter 5 refers to the fourth research objective and will investigate the role of personal characteristics on the relations between work characteristics and job strain. The influence of emotional support seeking on the stress-buffering effect of emotional job resources on the relation between emotional job demands and emotional exhaustion is examined in a two-wave panel study among employees in the technology sector \( (n = 711) \). Figure 1.5 is a graphical representation of the research design of Chapter 5.

In sum, four empirical studies, presented in Chapter 2 through Chapter 5 will attempt to answer four main research questions. Table 1.5 provides an overview of research objectives and the studies that aim to answer the main research questions posed in this introduction (i.e. marked with X).

### Table 1.5. Overview of empirical chapters and research objectives.

<table>
<thead>
<tr>
<th>Research objective</th>
<th>Chapter 2</th>
<th>Chapter 3</th>
<th>Chapter 4</th>
<th>Chapter 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Triple-match principle</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Balance principle</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3. Compensation principle</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4. Personal characteristics</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
REFERENCES


CHAPTER 2

TESTING THE TRIPLE-MATCH PRINCIPLE AMONG TECHNOLOGY EMPLOYEES.

The Triple-Match Principle (TMP) proposes that the strongest, interactive relationships between job demands and job resources are observed when job demands, job resources and job-related outcomes are based on qualitatively identical dimensions. This principle is tested with regard to three outcomes: cognitive failure, emotional exhaustion and physical health complaints. Data were collected in a large sample of employees in the technology sector (n=1533). Results demonstrate that the positive association between emotional job demands and emotional exhaustion is moderated by the availability of emotional job resources. No triple-match interactions are found with regard to cognitive failure or physical health complaints. Furthermore, technology employees' emotional exhaustion is associated with a double-match of common kind between physical job demands and physical job resources. Finally, results show that the likelihood of finding theoretically-valid interactions is related to the degree of match between job demands, job resources and outcomes. However, non-matching interactions are found more often than double-match interactions. These findings offer, for the first time, partial support for the TMP within the technology sector.

This chapter is largely based on:

INTRODUCTION

Over the past decades a large body of research in work and organizational psychology, conducted in a variety of occupational sectors, has focused on two main work characteristics, job demands and job resources, in predicting and understanding job-related outcomes such as job strain. Both work characteristics can be deduced from prominent job stress models such as the Job Demand-Control Model (Karasek, 1979), the Effort Reward Imbalance Model (Siegrist, Siegrist & Weber, 1986), and the Job Demands-Resources Model (Demerouti, Bakker, Nachreiner & Schaufeli, 2001).

Although there is a lot of empirical evidence regarding the main effects of job demands and job resources on job strain and employee well-being, mixed results for the stress-buffering effect of job resources have been found (Bakker & Demerouti, 2007). Hausser, Mojzisch, Niesel and Schulz-Hardt (2010) stated that these mixed results are possibly due to a lack of specificity and match in previous research. This potential explanation is captured by the Demand-Induced Strain Compensation (DISC) Model (De Jonge & Dormann, 2003, 2006). The aim of the present chapter is to study the issue of matching job demands and job resources in the technology sector. Specifically, we investigate how the interaction between specific job demands and specific job resources is associated with three job strain outcomes: emotional exhaustion, cognitive failure and physical health complaints in a large sample of employees in the technology sector.

THE DISC MODEL AND THE TRIPLE-MATCH PRINCIPLE

The DISC Model is premised on several principles. Firstly, it states that job demands and job resources, as well as job-related outcomes, are not one-dimensional concepts. Each of them comprises cognitive, emotional and physical components. Job demands can be cognitive (e.g. display high levels of concentration and precision), emotional (e.g. deal with people who get easily angered towards him/her) or physical (e.g. having to bend and/or stretch a lot at work). A similar distinction can be made for job resources, which can be
cognitive (e.g. control at work), emotional (e.g. colleagues providing sympathy and affection) or physical (e.g. be able to use adequate technical equipment to accomplish physically strenuous tasks). Finally, job-related outcomes can also be cognitive (e.g. cognitive failure), emotional (e.g. emotional exhaustion) or physical (e.g. physical health complaints).

Next to recognizing the multidimensionality of stress concepts, a second key principle of the DISC Model is the triple-match principle (TMP; De Jonge & Dormann, 2003, 2006). It proposes that the strongest interactive relationships between job demands and job resources are observed when job demands and job resources and outcomes are based on qualitatively identical dimensions. In other words, for a triple-match, there should both be a match between job demands and job resources on the one hand, and a match between job demands/resources and outcomes on the other hand. An example of a triple-match is a situation in which emotional job resources mitigate the negative impact of emotional job demands on employees' emotional exhaustion. The DISC Model considers the likelihood of finding such a triple-match interaction higher than the likelihood of only finding a double-match of common kind (i.e. a match only exists between job demands and job resources), a double-match of extended kind (i.e. a match only exists between job demands or job resources and the job-related outcome) or a non-match (i.e. no matches exist between job demands, job resources and job-related outcomes).

The TMP builds further on the work of Cohen and Wills (1985) and Frese (1999), who elaborated on two kinds of matching principles in social support literature. Theoretically, this matching assumption is derived from homeostatic regulation processes. Vancouver (2000) stated that the idea of functional homeostatic regulation can be easily applied to organizational settings. Similar to the activation of matching internal resources in the area of immune and nervous functioning (e.g. Lekander, 2002), the DISC Model assumes that job demands and the matching job resources are most likely to affect work outcomes within the same domain.
A third DISC principle emerges from the TMP. The compensation principle states that the negative effects of job demands can be best compensated by matching job resources. This principle describes the self-regulating process (e.g. Vancouver, 2000) through which an employee can use job resources to prevent or diminish the negative effects of job demands.

Five remarks can be mentioned regarding published DISC related empirical studies. Firstly, although the majority (exactly 15 out of 19 studies) of empirical studies shows evidence for the TMP (cf. Daniels & De Jonge (2010) for an overview), several studies with this aim do not (e.g. De Bruin et al., 2007). Secondly, several empirical study results and authors (e.g. Bakker, Demerouti & Euwema, 2005) challenge the DISC-idea that specific job demands and job resources should match in order to show moderating effects in the prediction of job-related outcomes, raising doubts regarding the generalizability of the matching hypothesis. Thirdly, although the DISC Model acknowledges the existence and secondary importance of non-matches, not all previous studies have included them in their analyses (e.g. De Bruin et al., 2007). Fourthly, different dependent variables have been used in the studies mentioned above. However, not all studies included emotional as well as cognitive and physical work characteristics and outcomes (e.g. De Jonge, Dormann & Van den Tooren, 2008; De Jonge & Peeters, 2009), implying that often only a part of the DISC Model has been studied. Finally, most studies investigating the DISC principles have been conducted in homogeneous health care and school teacher samples, where employees often have to deal with mainly emotional job demands (cf. De Jonge, Dormann & Van den Tooren, 2008). This sample selection bias calls again for study of the relevance and generalizability of the DISC Model in other occupational sectors and in more heterogeneous samples. Therefore this study will test the TMP for the first time in a large heterogeneous sample of employees in the technology sector.

TECHNOLOGY EMPLOYEES

The technology sector consists of many fast-paced firms, a variety of occupational groups and many very specialized workers from which a strong
personal engagement in work is required. Their work is often deadline-driven and competitive with long workdays; they are often exposed to a mixture of challenging cognitive, emotional and physical job demands, where it is difficult to separate work from home life. In the last few decennia there has been a rise in the technology sector mainly in industrialized countries (Arvidsson et al., 2006). Information and communication technology is becoming more and more important in a variety of domains.

As organizations with attention for the development of both a well-designed technological (e.g. IT) environment and well-being and development of employees are more productive than organizations whose sole interest is in IT and less in well-being and human capital (Sandblad et al., 2003), research dealing with the work environment and the well-being of employees with technology related work is of high importance. Moreover, previous research showed that technology workers can be considered as knowledge workers with possible health problems such as musculoskeletal symptoms and reduced self-reported productivity (Hagberg, Vilhemsson, Wigaeus Tornqvist, & Toomingas, 2007).

Summarized, testing the validity of the DISC Model within the technology sector is relevant and important given (a) the above mentioned shortcomings of previous empirical DISC research, (b) the particular occupational health psychological relevant characteristics of the technology sector, and (c) the growing impact, use and continued breakthrough of technology in work contexts which induce changes in human's daily work environment and challenge job designing and theoretical occupational health psychological models (Grant, Fried, Parker & Frese, 2010).

The present study will add to the scientific literature by testing the validity of the TMP in a heterogeneous sample of employees in the technology sector. Further, also non-matching interactions will be included in the research design. And, an emotional outcome (emotional exhaustion), a cognitive outcome (cognitive failure) and a physical outcome (physical health complaints) will be studied as dependent variables. In doing so the present chapter will go
by studying its generalizability and relevance in a rarely studied occupational sector and by testing the full model in one single research paper.

**DEPENDENT VARIABLES**

Selection of the three dependent variables was based on theoretical (cf. multidimensionality of outcomes) and practical considerations. To ensure compatibility with existing research, we employ an emotional dependent variable (emotional exhaustion) that has been used frequently in research on occupational stress, including investigations of the triple-match principle that we focus on (e.g. De Jonge & Dormann, 2006). Emotional exhaustion is a prominent outcome in stress research as one of the core elements of the larger phenomenon of employee burnout, and represents an emotionally laden strain variable (Maslach, Schaufeli & Leiter, 2001; Schaufeli & Taris, 2005).

As a cognitive outcome we selected cognitive failure. More than half of Europe’s employees report that they have to perform complex tasks which require efficient data processing (Merllié & Paoli, 2001). Cognitive failures can be defined as a “cognitively based error that occurs during the performance of a task that a person is normally successful in executing” (Martin, 1983, p. 97).

The physical outcome in this study is physical health complaints. Physical health has often been found to be associated with psychosocial work characteristics, including job demands and job resources (Schat, Kelloway & Desmarais, 2005). In the current study physical health complaints are conceptualized as a broad variable including various health complaints, such as gastrointestinal problems, headaches, sleep disturbances, and respiratory illness.

**HYPOTHESES**

*Hypothesis 1:* Employees’ emotional exhaustion is positively associated with emotional job demands, and this relation is moderated by matching emotional job resources. Specifically, we expect that the positive relation
between emotional job demands and emotional exhaustion will be weakened by
the availability of emotional job resources.

Hypothesis 2: The level of reported cognitive failures by employees is
positively associated with cognitive job demands, and this relation is moderated
by matching cognitive job resources. Specifically we expect that the positive
relation between cognitive job demands and cognitive failure will be weakened
by the availability of cognitive job resources.

Hypothesis 3: Employees’ reported physical health complaints are
positively associated with physical job demands, and this relation is moderated
by matching physical job resources. Specifically we expect that the positive
relation between physical job demands and physical health complaints will be
weakened by the availability of physical job resources.

Hypothesis 4: Triple-match interactions are most likely to be found,
followed by double-match interactions of common kind and double-match
match interactions of extended kind, while non-matching interactions are least
likely to be found.

**METHOD**

**PROCEDURE AND PARTICIPANTS**

Data were collected using a paper-and-pencil questionnaire in a large
Belgian company in the technology sector that specializes in innovative
technical installations and services for the industry, energy, tertiary and
infrastructure markets. A total of 1533 out of 4912 employees filled out the
questionnaire on voluntary basis leading to a response rate of 32 %. A reminder
letter was sent to increase response rates. Although this response rate is rather
low, it falls within the range of one standard deviation below the mean response
rate in this type of research, which can be considered acceptable (Baruch &
Holtom, 2008). Given the available data, a non-response bias test was not
possible. However, management representatives in the organization indicated
that the demographic characteristics of the sample were consistent with those of their organization population at the time of data collection and all occupational groups within the company were represented. The sample includes blue-collar workers (e.g. welders, electricians) as well as white-collar workers (e.g., secretaries, accountants). Most of the respondents were Dutch speaking (63 %) and a vast majority is male (95 %). The age of the participants ranged from 19 to 65 years, with an average of 43.18 years ($SD = 10.14$). Six % had completed only primary education, 62 % had completed secondary education and 32 % had college or university degrees. The average organizational seniority was 16.03 years ($SD = 10.91$).

**MEASURES**

*Emotional exhaustion* was assessed by a subscale of the Maslach Burnout Inventory General Survey (Schaufeli & Van Dierendonck, 2000). The scale contained five items with a seven-point response scale ranging from 0 (never) to 6 (always, daily). Internal consistency for the scale was $\alpha = .87$. An example item is: “I feel emotionally drained from my work”.

*Cognitive failure*. A seven item scale, adapted from the Cognitive Failures Questionnaire by Broadbent, Cooper, FitzGerald, and Parkes (1982) was used to measure cognitive failure at work (Cronbach’s $\alpha = .80$). The seven items asked the participants to indicate on a five-point scale, ranging from 1 (never) to 5 (very often), how often a number of cognitive mistakes were made by them in the past six months. An example item for the cognitive failure scale is: “Do you forget where you put something like your files or your keys?”.

*Physical health complaints* were assessed using the Physical Health Questionnaire (Schat et al., 2005). This self-report scale includes 14 items reporting somatic symptoms such as gastrointestinal problems, headaches, sleep disturbances, and respiratory illness. The response format ranged from 1 (not at all) to 7 (all the time). The recommended overall single index was calculated (Cronbach’s $\alpha = .86$).
Job demands and job resources were measured using the DISQ 2.0 (De Jonge, et al. 2007). Earlier versions of this questionnaire have shown promising psychometrical properties (e.g. Van den Tooren & De Jonge, 2008). Items were scored on a 5-point frequency scale, ranging from 1 (never or very rarely) to 5 (very often or always). Cognitive job demands (e.g. having to make complex decisions at work) were measured with five items (Cronbach’s $\alpha = .78$). Emotional job demands (e.g. having to do a lot of emotionally draining work) were measured with six items (Cronbach’s $\alpha = .82$). Physical job demands (e.g. having to perform a lot of physically strenuous tasks to carry out his/her job) were measured with five items (Cronbach’s $\alpha = .94$). Cognitive job resources (e.g. having the opportunity to take a mental break when tasks require a lot of concentration) were measured with five items (Cronbach’s $\alpha = .65$). Emotional job resources (e.g. being able to stop emotionally-laden interactions with others for a while whenever he/she wants to) were measured with five items (Cronbach’s $\alpha = .81$). Physical job resources (e.g. being able to use adequate technical equipment to accomplish physically strenuous tasks) were measured with five items (Cronbach’s $\alpha = .85$).

Control variables. Age, sex and educational level included as control variables as they are in various ways related to emotional exhaustion, cognitive failure and physical health complaints (cf. Zapf, Dormann & Frese, 1996).
<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. cognitive job demands</td>
<td>3.67</td>
<td>0.64</td>
<td>.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. emotional job demands</td>
<td>2.89</td>
<td>0.72</td>
<td>.52**</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. physical job demands</td>
<td>2.87</td>
<td>1.16</td>
<td>-.19**</td>
<td>.05</td>
<td>.94</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. cognitive job resources</td>
<td>3.24</td>
<td>0.61</td>
<td>.19**</td>
<td>-.04</td>
<td>-.29**</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. emotional job resources</td>
<td>2.95</td>
<td>0.76</td>
<td>.01</td>
<td>-.16**</td>
<td>-.14**</td>
<td>.54**</td>
<td>.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. physical job resources</td>
<td>3.45</td>
<td>0.84</td>
<td>-.02</td>
<td>-.16**</td>
<td>-.19**</td>
<td>.45**</td>
<td>.49**</td>
<td>.85</td>
<td></td>
</tr>
<tr>
<td>7. emotional exhaustion</td>
<td>2.94</td>
<td>1.19</td>
<td>.10**</td>
<td>.32**</td>
<td>.22**</td>
<td>-.21**</td>
<td>-.28**</td>
<td>-.20**</td>
<td>.87</td>
</tr>
<tr>
<td>8. cognitive failure</td>
<td>2.27</td>
<td>0.56</td>
<td>.03</td>
<td>.09**</td>
<td>-.01</td>
<td>.02**</td>
<td>-.06*</td>
<td>.00</td>
<td>.29**</td>
</tr>
<tr>
<td>9. physical health complaints</td>
<td>2.58</td>
<td>0.90</td>
<td>.06*</td>
<td>.23**</td>
<td>.10**</td>
<td>-.14**</td>
<td>-.14**</td>
<td>-.16**</td>
<td>.52**</td>
</tr>
</tbody>
</table>

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

Means, standard deviations, and Pearson correlations for the independent and outcome variables are presented in Table 2.1. Cronbach’s alpha values for the different scales are found on the diagonal (boldface) in Table 2.1. Prior to the hierarchical regression analyses, normality of the variables was assessed. Skewness and kurtosis were within the acceptable range (± 1.00; Muthén & Kaplan 1985).

Subsequently, six hierarchical regression analyses were performed, with emotional exhaustion, cognitive failure and physical health complaints as dependent variables. In line with De Jonge and Dormann (2006), we performed two different analyses per dependent variable, one with the triple-matches and double-matches of common kind and one with the double-matches of extended kind and non-matches. Consistent with many other occupational stress studies (e.g. Dollard & Winefield, 1998), age (in years), sex and educational level were included as covariates in the first step. In the second step, the three types of job demands and three types of job resources were entered as standardized main effects. In the first hierarchical regression analysis, the third step included the three matching interactions between the studied job demands and job resources (each statistically modeled by means of a multiplicative term), allowing to test six double-match interactions of common kind and three triple-match interactions (cf. Table 2.2). In the second hierarchical analysis, the third step included the six non-matching interactions between the studied job demands and job resources, allowing to test twelve double-match interactions of extended kind and six non-matching interactions (cf. Table 2.3). In line with recommendations of Jaccard and Turrisi (2003) for analyzing interactions, unstandardized regression coefficients are displayed in Tables 2.2 and 2.3. The description of the results is structured per dependent variable and focused on the hypothesized interactions.
Table 2.2. Testing double-match interactions of common kind and triple-match interactions: regression results per dependent variable.

<table>
<thead>
<tr>
<th></th>
<th>Emotional exhaustion</th>
<th>Cognitive Failure</th>
<th>Physical Health Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B at step</td>
<td>Final B</td>
<td>B at step</td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex a</td>
<td>-.303*</td>
<td>.143</td>
<td>-.056</td>
</tr>
<tr>
<td>Age</td>
<td>.003</td>
<td>.003</td>
<td>.002</td>
</tr>
<tr>
<td>Education Level b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Secondary school level</td>
<td>-.373**</td>
<td>-.336**</td>
<td>.083</td>
</tr>
<tr>
<td>- High educated non university</td>
<td>-.421**</td>
<td>-.249</td>
<td>.045</td>
</tr>
<tr>
<td>- High educated university</td>
<td>-.038</td>
<td>.174</td>
<td>.075</td>
</tr>
<tr>
<td>R²</td>
<td>.015</td>
<td>.003</td>
<td>.015</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.015**</td>
<td>.003</td>
<td>.015**</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive job demands</td>
<td>-.000</td>
<td>.010</td>
<td>-.020</td>
</tr>
<tr>
<td>Emotional job demands</td>
<td>.319**</td>
<td>.300**</td>
<td>.059**</td>
</tr>
<tr>
<td>Physical job demands</td>
<td>.240**</td>
<td>.226**</td>
<td>-.024</td>
</tr>
<tr>
<td>Cognitive job resources</td>
<td>-.059</td>
<td>-.039</td>
<td>.038*</td>
</tr>
<tr>
<td>Emotional job resources</td>
<td>-.200**</td>
<td>-.185**</td>
<td>.059**</td>
</tr>
<tr>
<td>Physical job resources</td>
<td>-.036</td>
<td>-.076</td>
<td>.015</td>
</tr>
<tr>
<td>R²</td>
<td>.202</td>
<td>.021</td>
<td>.103</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.188**</td>
<td>.018**</td>
<td>.088**</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x Cognitive JR</td>
<td>.033</td>
<td>-</td>
<td>-.013</td>
</tr>
<tr>
<td>Emotional JD x Emotional JR</td>
<td>-.076**</td>
<td>-</td>
<td>-.007</td>
</tr>
<tr>
<td>Physical JD x Physical JR</td>
<td>-.066**</td>
<td>-</td>
<td>.011</td>
</tr>
<tr>
<td>R²</td>
<td>.213</td>
<td>.023</td>
<td>.105</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.010**</td>
<td>.002</td>
<td>.002</td>
</tr>
</tbody>
</table>

Note. The values in the table are unstandardized weights (B).

B at step = coefficient of the particular step at which the variable initially entered the equation.

Final B = coefficient in the final (3rd) step.

JD = Job demands, JR = Job resources

* p < .05; ** p < .01

a 0 = male, 1 = female

b Dummy coded variables, reference category = Lower educated
Table 2.3. Testing double-match interactions of extended kind and non-matching interactions: regression results per dependent variable.

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Emotional exhaustion</th>
<th>Cognitive Failure</th>
<th>Physical Health Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B at step</td>
<td>Final B</td>
<td>B at step</td>
</tr>
<tr>
<td>Sex a</td>
<td>-.303*</td>
<td>.157</td>
<td>-.056</td>
</tr>
<tr>
<td>Age</td>
<td>.003</td>
<td>.002</td>
<td>.002</td>
</tr>
<tr>
<td>Educational Level b</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Secondary school level</td>
<td>-.373**</td>
<td>-.317**</td>
<td>.083</td>
</tr>
<tr>
<td>- High educated non university</td>
<td>-.421**</td>
<td>-.242</td>
<td>.045</td>
</tr>
<tr>
<td>- High educated university</td>
<td>-.038</td>
<td>.195</td>
<td>.075</td>
</tr>
</tbody>
</table>

R² | .015 | .003 | .015 |

ΔR² | .015** | .003 | .015** |

Step 2

<table>
<thead>
<tr>
<th>Cognitive job demands</th>
<th>B at step</th>
<th>Final B</th>
<th>-.000</th>
<th>-.004</th>
<th>-.020</th>
<th>-.023</th>
<th>-.022</th>
<th>-.029</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional job demands</td>
<td>.319**</td>
<td>.307**</td>
<td>.059**</td>
<td>.060**</td>
<td>.211**</td>
<td>.215**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical job demands</td>
<td>.240**</td>
<td>.237**</td>
<td>-.024</td>
<td>-.021</td>
<td>.064*</td>
<td>.068*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive job resources</td>
<td>-.059</td>
<td>-.050</td>
<td>.038*</td>
<td>.035</td>
<td>-.051</td>
<td>-.052</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional job resources</td>
<td>-.200**</td>
<td>-.193**</td>
<td>-.059**</td>
<td>-.056**</td>
<td>-.032</td>
<td>-.033</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical job resources</td>
<td>-.036</td>
<td>-.047</td>
<td>.015</td>
<td>.010</td>
<td>-.066*</td>
<td>-.069</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² | .202 | .021 | .103 |

ΔR² | .188** | .018** | .088** |

Step 3

<table>
<thead>
<tr>
<th>Cognitive JD x Emotional JR</th>
<th>B at step</th>
<th>Final B</th>
<th>-.063*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x Physical JR</td>
<td>.097**</td>
<td>.025</td>
<td>.035</td>
</tr>
<tr>
<td>Emotional JD x Cognitive JR</td>
<td>-.035</td>
<td>.008</td>
<td>-.011</td>
</tr>
<tr>
<td>Emotional JD x Physical JR</td>
<td>-.035</td>
<td>.030</td>
<td>.012</td>
</tr>
<tr>
<td>Physical JD x Cognitive JR</td>
<td>-.080*</td>
<td>-.009</td>
<td>-.045</td>
</tr>
<tr>
<td>Physical JD x Emotional JR</td>
<td>.032</td>
<td>-.011</td>
<td>.058*</td>
</tr>
</tbody>
</table>

R² | .214 | .028 | .111 |

ΔR² | .011** | .007 | .007 |

Note. The values in the table are unstandardized weights (B).

B at step = coefficient of the particular step at which the variable initially entered the equation.

Final B = coefficient in the final (3rd) step.

JD = Job demands, JR = Job resources

* p < .05; ** p < .01

a 0 = male, 1 = female

b Dummy coded variables, reference category = Lower educated
EMOTIONAL EXHAUSTION

In the first hierarchical regression analysis with emotional exhaustion as a dependent variable (Table 2.2), the third step (including the double-matches of common kind and the triple-match interaction) added significantly to the explained variance ($\Delta R^2 = .01, p < .01$), over and above the influence of control variables (cf. step 1) and the main terms (cf. step 2). Two moderating terms reached statistical significance ($p < .05$).

First, the interaction of emotional job demands and emotional job resources on emotional exhaustion was significant, $B = -0.08$, $p < .01$. To better understand the moderating influence, this significant interaction is graphically represented in Figure 2.1. Following the recommendations of Aiken and West (1991) we plotted levels of emotional job resources at $1 SD$ below the mean and at $1 SD$ above the mean. As graphically depicted in Figure 2.1, the combination of high emotional job demands ($+ 1 SD$) and low emotional job resources ($- 1 SD$) was associated with high reported emotional exhaustion. In addition, Figure 2.1 also shows that at high levels of emotional job resources, the positive association between emotional job demands and emotional exhaustion became substantially weakened, which is in line with our first hypothesis. An examination of the regression weights (simple slopes) at $1 SD$ above and below the mean of emotional job resources revealed that emotional job demands were more strongly related to emotional exhaustion when emotional job resources were low, $B = .41$, $t = 11.43$, $p < .01$, as compared with when emotional job resources were high, $B = .26$, $t = 6.98$, $p < .01$. 
Second, also the double-match of common kind interaction between physical job demands and physical job resources on emotional exhaustion was significant, $B = -0.07$, $p < .01$. At high levels of physical job resources, the positive association between physical job demands and emotional exhaustion became substantially weakened.

In the second hierarchical regression analysis with emotional exhaustion as a dependent variable (Table 2.3), the third step (including the double-matches of extended kind and the non-matching interactions) also added significantly to the explained variance ($\Delta R^2 = .01$, $p < .01$). Three interactions reached statistical significance. First, the (double-match of extended kind) interaction of cognitive job demands and emotional job resources on emotional exhaustion was significant, $B = -0.06$, $p < .05$. At high levels of emotional job resources, the positive association between cognitive job demands and emotional exhaustion

![Figure 2.1. Interaction of emotional job demands and emotional job resources on emotional exhaustion.](image-url)
became weakened. Second, the (non-match) interaction of cognitive job demands and physical job resources on emotional exhaustion was significant, $B = 0.10, p < .01$. Surprisingly, at low levels of physical job resources, the positive association between cognitive job demands and emotional exhaustion became weakened, thus representing a reversed interaction (cf. De Jonge & Dormann, 2006; Chrisopoulos et al., 2010). Third, the (non-match) interaction of physical job demands and cognitive job resources on emotional exhaustion was significant, $B = -0.08, p < .05$. At high levels of cognitive job resources, the positive association between physical job demands and emotional exhaustion became weakened.

**COGNITIVE FAILURE**

In the first hierarchical regression analysis with cognitive failure as a dependent variable (Table 2.2), the third step (including the double-matches of common kind and the triple-match interaction) did not add significantly to the explained variance ($\Delta R^2 = .002, p = ns$). None of the moderating terms reached statistical significance, so hypothesis 2 could not be confirmed. In the second hierarchical regression analysis with cognitive failure as a dependent variable (Table 2.3), the third step (including the double-matches of extended kind and the non-matching interactions) also did not add significantly to the explained variance ($\Delta R^2 = .007, p = ns$).

**PHYSICAL HEALTH COMPLAINTS**

In the first hierarchical regression analysis with physical health complaints as a dependent variable (Table 2.2), the third step (including the double-matches of common kind and the triple-match interaction) did not add significantly to the explained variance ($\Delta R^2 = .002, p = ns$). None of the moderating terms reached statistical significance, so hypothesis 3 could not be confirmed. In the second hierarchical regression analysis with physical health complaints as a dependent variable (Table 2.3), the third step (including the double-matches of extended kind and the non-matching interactions) also did not add significantly to the explained variance ($\Delta R^2 = .007, p = ns$).
TRIPLE-MATCH HYPOTHESIS

Regarding our fourth hypothesis we investigated whether the likelihood of finding valid moderating effects is related to the degree of match between job demands, job resources, and job-related outcomes. Results showed (cf. Table 2.4) that one of the tested triple-match interactions was significant (33.3 %), while only two out of eighteen tested double-matches (of common and extended kind) (11.1 %) and only one out of the six tested non-matching interactions were significant (16.7 %). These results partially support our fourth hypothesis.

Table 2.4. Number of theoretically valid interactions compared to the number of tested moderating terms.

<table>
<thead>
<tr>
<th>Moderating terms</th>
<th>Tested interactions</th>
<th>Valid interactions</th>
<th>Ratio of valid interactions / Interactions tested (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple-match</td>
<td>3</td>
<td>1</td>
<td>33.3</td>
</tr>
<tr>
<td>Double-match (common kind)</td>
<td>6</td>
<td>1</td>
<td>16.7</td>
</tr>
<tr>
<td>Double-match (extended kind)</td>
<td>12</td>
<td>1</td>
<td>8.3</td>
</tr>
<tr>
<td>Double-match (both kinds)</td>
<td>18</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Non-match</td>
<td>6</td>
<td>1</td>
<td>16.7</td>
</tr>
</tbody>
</table>

DISCUSSION

The purpose of the present chapter was to study the TMP in the technology sector in order to study the validity and generalizability of the DISC Model. We investigated how the interaction between job demands and job resources is associated with three job strain outcomes: emotional exhaustion, cognitive failure and physical health complaints in a large heterogeneous sample of technological workers.

Our first hypothesis was confirmed. Technology employees’ emotional exhaustion was positively related with emotional job demands and this relation is weakened by the availability of matching emotional job resources. This result is in line with the compensation principle of the DISC Model which describes the self-regulating process where job resources are used to diminish the
negative effects of job demands and is also congruent with previous empirical studies in which the buffering role of specific emotional job resources (e.g. camaraderie) has been shown in fire-fighters exposed to emotional job demands (Tuckey & Hayward, 2011).

Also the interaction between physical job demands and physical job resources on emotional exhaustion was found to be significant. This is referred to as a double-match of common kind (De Jonge & Dormann, 2003, 2006). This finding suggests that next to an emotional triple-match interaction also a double-match interaction of common kind arising from another domain (e.g. physical) can be functional for maintaining employees' emotional well-being.

Furthermore, three interactions were statistically significant in our second analysis with emotional exhaustion as a dependent variable. First, the double-match of extended kind interaction between cognitive job demands and emotional job resources on emotional exhaustion was significant. The second (non-matching) interaction of cognitive job demands and physical job resources on emotional exhaustion represented a reversed interaction (cf. De Jonge & Dormann, 2006; Chrisopoulos et al., 2010). Third, the non-match interaction of physical job demands and cognitive job resources on emotional exhaustion was significant. The moderating influence of emotional job resources, regardless of the type of job demands, is in line with previous research and with the Demand-Control-Support Model (Karasek & Theorell, 1990), in which social support at work is considered as a major work characteristic that can have main and moderating effects on employee well-being and health (cf. also Frese, 1999; Peeters & Le Blanc, 2001). These non-hypothesized interactions are also in line with Daniels and De Jonge (2010) who, building on the work of Hobfoll (1989), clearly explain that if matching job resources are not available in the work environment employees will seek and use other type of available job resources in combating their job demands.

As adding double-match or non-match interactions in the third step of the hierarchical regression analyses did not explain any additional variance with regard to both cognitive failure and physical health complaints, our second and
third hypotheses were not confirmed. Moreover, we were only able to explain a very small percentage of variance in both outcomes. Because both outcomes are relevant and can have very harmful effects (e.g. safety) in a technological work context, these results are surprising and not in line with the DISC Model. They may be due to social desirable answers by technological employees elicited by the measures we used, resulting in low average scores (respectively $M = 2.27$ and $M = 2.58$). Alternatively, it may also be the case that other antecedents are more important for understanding both outcomes than the work related variables we studied. Indeed employees' cognitive failure and physical health complaints may be influenced also by personal factors (e.g. personality trait consciousness, physical activity, etc.) and/or organizational variables (e.g. safety culture).

We also investigated if the likelihood of finding triple-matches is greater than the likelihood of finding double-matches (of common and of extended kind) and non-matches. Our findings partly confirm our fourth hypothesis that the likelihood of finding theoretically-valid moderating effects is related to the degree of match between job demands, job resources and job-related outcomes. Indeed, the percentage of valid triple-match interactions was higher than the percentages for double-matches and non-matches. The explanatory theoretical mechanism here is that a match or congruence, complementary or supplementary, between two or more phenomena promotes development, performance and well-being at work because it facilitates and increases the likelihood of functional coping when dealing with job demands (Daniels & De Jonge, 2010). On the other hand, our analyses revealed that double-matches occur less often than non-matches. This implies that our study results do not fully confirm the TMP in the technology sector.

**STUDY LIMITATIONS AND FUTURE RESEARCH**

One limitation of the current study may be the reliance on self-report data. Common method variance may lead us to overestimate the size of the relationships (Semmer, Grebner, & Elfering, 2004). However, Spector (2006) stated that the influence of common method variance is not as high as could be expected. Second, all scales used in this study showed good psychometrical
properties, both in this study as well as in previous studies. Only the internal consistency of the cognitive job resources scale was rather low ($\alpha = .65$), showing the necessity for further empirical research into the psychometrical properties of the DISQ-questionnaire (De Jonge, et al. 2007). Thirdly, the cross-sectional nature of the data does not allow any clear inference of a cause-effect relationship. Further longitudinal studies are therefore needed. On the other hand, a cross-sectional study design is common and plays a pivotal role in replication in psychological research (Thompson, 1994). Indeed the present study is the first one studying the TMP among technology employees and partly replicates previous studies demonstrating the validity of the DISC Model. Fourth, although already more specific than the general concepts of ‘job demands’ and ‘job resources’ the measures used in this study still are quite general in nature. Further research using even more sector specific or occupational specific measures to assess job demands and job resources can shed more light on the interplay between particular job demands and job resources (cf. Tuckey & Hayward, 2011; Van Vegchel, De Jonge, Bakker & Schaufeli, 2002). Finally, our interactions explain only limited variance. However, according to Frazier, Tix, and Barron (2004), effect sizes for interactions are generally small ($R^2 = .02$ or smaller). We therefore believe that the interactions found in this study are important from a theoretical as well as practical perspective.

**CONCLUSION**

In conclusion, the theoretical implications of this study are that this chapter adds to the existing empirical evidence in favor of the DISC Model and more specifically for its triple-match and compensation principles. However, the results only partly support generalizability and relevance of this model in the technology sector, as our results also suggest the important role of double-matches and non-matches for understanding emotional strain at work. We speculate that matching job resources may be particularly functional for mitigating work related stress only in particular work settings. More specifically, to prevent emotional exhaustion in technology employees,
employers could provide or stimulate matching emotional job resources (e.g. supervisors' emotional support, emotional support among colleagues) to counter the negative impact of the emotional job demands to which technology employees are exposed. From a practical perspective, our results show that matching can be considered as a guiding principle for job designing. As a consequence, employers, in particular in the technology sector, should be sensitive for the need of matching the resources they offer to their employees in correspondence with the demands they require from them.
REFERENCES


investment of the DISC Model: Results of an internet study among various occupational groups]. *Gedrag & Organisatie*, 20, 238–259.


CHAPTER 3
THE INTERPLAY OF JOB DEMANDS, JOB RESOURCES AND COGNITIVE OUTCOMES IN INFORMATICS.

The present study investigates the issue of match between job demands and job resources in the prediction of employees’ cognitive well-being. In this study we specifically hypothesize that cognitive job resources are most likely to moderate the relationship between cognitive job demands and cognitive outcomes. Two measures of cognitive well-being are included: learning motivation and professional efficacy. Using a web based questionnaire, data were collected in a sample of 207 informatics. Results partially confirm our hypotheses both in terms of main as in terms of interaction effects. Informatics with high cognitive job demands have a higher feeling of competence than informatics with low cognitive job demands. This effect is stronger when matching high cognitive job resources are available.

This chapter is largely based on:

INTRODUCTION

Cognitive functioning and cognitive well-being at work is relevant for most jobs nowadays: more than half of the employees in Europe report that they have to perform complex tasks in their jobs in which efficient information processing is important (cf. Van Horn, Taris, Schaufeli & Schreurs, 2004). In this study we define cognitive well-being as a broad concept and we will look specifically at learning motivation and professional efficacy as indicators of cognitive well-being. Both indicators are generally assumed to enhance employees’ performance and well-functioning on the job (Taris, 2006).

Learning motivation is defined as the motivation for learning new behavior patterns and reflects a cognitively laden outcome (Taris & Kompier, 2005). Our concept of learning motivation corresponds closely to Karasek and Theorell's (1990) definition of active learning. Professional efficacy is a major dimension in the clinical burnout syndrome. It is described as not or hardly doubting your efficacy as an employee to do your job (Schaufeli & Van Dierendonck, 2000) and encompasses both social and non-social aspects of occupational accomplishments. (Demerouti, Bakker, De Jonge, Janssen & Schaufeli, 2001).

Previous research stresses the importance of work characteristics such as job demands and job resources in relation to work-related outcomes (e.g. Kahn & Byosiere, 1992). Most research proposes interactive effects of job demands and job resources (Cooper, Dewe, & O’Driscoll, 2001), in which job resources are assumed to moderate the relation between job demands and outcomes. However, not only the interaction effects but also the nature of the variables used and their operationalizations have been discussed in the literature (Van Der Doef & Maes, 1999). For instance, many studies failed to find moderating effects. Early research tended to treat job demands and job resources as global and unidimensional constructs, which obscured the interaction effects (e.g. Viswesvaran, Sanchez & Fisher, 1999). Job demands are defined as those properties of a job that require emotional, cognitive and/ or physical effort and can have both positive and negative consequences (Jones & Fletcher, 1996). Job
resources can be conceptualized as some sort of cognitive-energetic reservoirs which are tapped when the individual has to cope with job demands (cf. Hobfoll, 2002). Job demands and job resources as well as job-related outcomes (such as job strain and concepts concerned with positive well-being) are not one-dimensional concepts. At a very basic level they may comprise of cognitive, emotional and physical components. This is described as the multidimensionality principle by De Jonge and Dormann (2003, 2006). Job demands can be primarily cognitive (e.g. display high levels of concentration and precision), emotional (e.g. deal with people who get easily angered towards him/her) or physical (e.g. having to bend and/or stretch a lot at work). A similar distinction is possible with job resources which can be primarily cognitive (e.g. have the opportunity to vary complex tasks with simple tasks), emotional (e.g. get emotional support from others) or physical (e.g. be able to use adequate technical equipment to accomplish physically strenuous tasks). Finally, also employee outcomes can be primarily cognitive (e.g. professional efficacy), emotional (e.g. emotional exhaustion) or physical (e.g. low back pain).

De Jonge and Dormann (2003, 2006) introduced the triple-match principle (TMP). The TMP proposes that the strongest, interactive relationships between job demands and job resources are observed when job demands and job resources and outcomes are based on qualitatively identical dimensions. In other words, there should both be a match between job demands and job resources on the one hand and a match between job demands/resources and outcomes on the other hand. Theoretically, this matching assumption is derived from homeostatic regulation processes. Vancouver (2000) stated that the idea of functional homeostatic regulation can be easily applied to organizational settings. Similar to the activation of matching internal resources in the area of immune and nervous functioning (e.g. Lekander, 2002), cognitive job demands and the matching cognitive job resources are most likely to affect cognitive work outcomes. It is exactly this hypothesis which will be examined in this study with two outcome measures: professional efficacy and learning motivation.
Although the assertion of triple-match sounds appealing, empirical evidence with regard to TMP is mixed and mainly derived from samples in health and service sectors, where employees often have to deal with mainly emotional job demands (for an overview of studies cf. De Jonge, Dormann & Van den Tooren, 2008). In order to study the generalizability of the TMP principle, research in other occupational sectors and groups is badly needed (De Jonge & Dormann, 2006).

Also, occupational research on psychosocial well-being and health outcomes mainly stems from the health care and school sectors (Hetland, Sandal & Johnsen, 2007). However, if a strong personal engagement in work is required and there is an imbalance between demands and possible renewal of resources, these same outcomes may occur and should be studied beyond the human services and educational settings (Maslach & Schaufeli, 1993). These aspects are evident in many careers within fast paced firms, where work is often deadline driven and competitive, with long workdays, and where it is difficult to separate work from home life. The current chapter is based on data from employees within an Information Technology (IT) firm, which encompasses all of these characteristics. In the last few decennia there has been an up march in the IT sector (Arvidsson et al., 2006; Sparks, Faragher & Cooper, 2001), mainly in industrialized countries (Christensen & Lundberg, 2001). Information- and communication technology is becoming more and more important in a variety of domains. Since organizations with attention for the development of both a well-designed IT-environment and well-being and development of employees are more productive than organizations whose sole interest is in IT and less in well-being and human capital (Sandblad et al., 2003), research dealing with the work environment and the well-being of employees with computerized work is of high importance. Moreover, previous research showed that informatics can be considered as knowledge computer workers with possible health problems such as musculoskeletal symptoms and reduced self-reported productivity (Hagberg, et al., 2007).
THE PRESENT STUDY

The aim of the present chapter is to investigate how the interaction between cognitive job demands and cognitive job resources is associated with two cognitive well-being outcomes, learning motivation and professional efficacy, in a sample of informatics. This general research question can be transformed into the following two hypotheses.

Hypothesis 1: Informatics’ learning motivation is positively associated with cognitive job demands and this relation is moderated by matching cognitive job resources. Specifically, we expect that the positive relation between cognitive job demands and learning motivation will be stronger in case of the availability of cognitive job resources.

Hypothesis 2: Informatics’ professional efficacy is positively associated with cognitive job demands and this relationship is moderated by matching cognitive job resources. Specifically, we expect that the positive relation between cognitive job demands and professional efficacy will be stronger in case of the availability of cognitive job resources.

METHOD

PROCEDURE AND PARTICIPANTS

Cross-sectional data were collected using a web based questionnaire. A total of 660 employees of a consulting, technology and outsourcing specialized company received an email with a link to the researchers’ website. The response rate was 31.88 %, which is in line with De Bruin, Van Boxmeer, Verwijs and Le Blanc (2007) that used a similar web based procedure and questionnaire. Non-response analysis, based on company data, showed no significant differences with regard to demographics. The questionnaire was available both in Dutch and in French since the company is located in bilingual Belgium. Two weeks later a reminder email was sent. The respondents \( N = 207 \), Mean age \( (M) = 37.8 \) years, Standard deviation \( (SD) = 9.4 \) are all higher educated full-
time employed informatics. In total 157 men ($M = 37.9$ years, $SD = 9.6$ years, range = 22 - 61 years) and 44 women ($M = 37.3$ years, $SD = 9.0$ years, range = 23 - 54 years) participated.

**MEASURES**

*Cognitive well-being* was measured using the two indicators: learning motivation and professional efficacy. Learning motivation was measured with a subscale (seven items, Cronbach’s $\alpha = .76$) of the Motivation to Learn Scale (MOLE; Kompier & Taris, 2004). The MOLE items were inspired on a motivation to learn scale used in a study by Van Mierlo, Rutte, Seinen, and Kompier (2001). Items were scored on a four-point scale, ranging from 1 “*almost never*” to 4 “*almost always*”. An exemplary item is: “In my job I am stimulated to pick up new things”. A high score refers to a high level of motivation to learn. Professional efficacy was assessed by a subscale of the Dutch version (Schaufeli and Van Dierendonck, 2000) of the MBI-General Survey. The scale contained six items with a seven-point response scale ranging from 0 “never” to 6 “*always, daily*”. Cronbach’s $\alpha$ is .79. An example item is: “In my opinion, I am good at my work.” A high score refers to a high level of professional efficacy.

*Job demands and job resources* were measured using the DISQ 1.1 (De Jonge, et al. 2004). This questionnaire has shown promising psychometrical properties and was used in previous research (Van den Tooren & De Jonge, 2008). Translation/back translation procedures were used to obtain the French version that was semantically equivalent to the basic questionnaire in Dutch. Cognitive (5 items, Cronbach’s $\alpha = .66$), emotional (6 items, Cronbach’s $\alpha = .78$) and physical (5 items, Cronbach’s $\alpha = .77$) job demands were scored on a five-point scale, ranging from 1 “*(almost) never*” to 5 “*(almost) always*”. Cognitive (5 items, Cronbach’s $\alpha = .65$), emotional (5 items, Cronbach’s $\alpha = .80$) and physical (5 items, Cronbach’s $\alpha = .89$) job resources were also scored on a five-point scale, ranging from 1 “*(almost) never*” to 5 “*(almost) always*”.
STATISTICAL ANALYSES

To test our hypotheses, we first calculated Pearson intercorrelations. Subsequently, two hierarchical regression analyses were performed with learning motivation and professional efficacy as dependent variables. Consistent with many other occupational stress studies (e.g., Dollard & Winefield, 1998; Zapf, Dormann & Frese, 1996), age (in years), and gender were included as covariates in the first step, as their relation with health and well-being outcomes is well-established. Since all respondents worked for the same company and were all higher educated, there was no need to control for other confounding variables. A double check on their effects showed no significant effects indeed.

In the second step the three types of job demands and three types of job resources were entered as standardized main effects. A match between job demands and job resources can be statistically modeled by means of a multiplicative interaction term (i.e. job demand x job resource), in which the main terms are standardized to avoid multicollinearity. In the third and last step we included the three matching interaction-effects between job demands and job resources, i.e. cognitive x cognitive, emotional x emotional and physical x physical. In line with recommendations of Jaccard and Turrusi (2003) for analyzing interactions, unstandardized regression coefficients are displayed in the tables. To better understand the moderating influence of cognitive job resources, the interactions were graphically represented following the recommendations of Aiken and West (1991).
Table 3.1. Means, Standard Deviations, Pearson Intercorrelations and Reliabilities (N = 207).

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>(SD)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cognitive job demands</td>
<td>3.87</td>
<td>(.45)</td>
<td>.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Emotional job demands</td>
<td>3.02</td>
<td>(.59)</td>
<td>.45**</td>
<td>.78</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Physical job demands</td>
<td>1.36</td>
<td>(.47)</td>
<td>.03</td>
<td>.16*</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Cognitive job resources</td>
<td>3.75</td>
<td>(.54)</td>
<td>.05</td>
<td>-.22*</td>
<td>-.34**</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Emotional job resources</td>
<td>3.10</td>
<td>(.68)</td>
<td>-.08</td>
<td>-.31**</td>
<td>-.20**</td>
<td>.54**</td>
<td>.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Physical job resources</td>
<td>3.66</td>
<td>(1.07)</td>
<td>-.07</td>
<td>-.18**</td>
<td>-.19**</td>
<td>.40**</td>
<td>.34**</td>
<td>.89</td>
<td></td>
</tr>
<tr>
<td>7. Learning motivation</td>
<td>19.34</td>
<td>(3.20)</td>
<td>.39**</td>
<td>.12</td>
<td>-.01</td>
<td>.22**</td>
<td>.07</td>
<td>.09</td>
<td>.76</td>
</tr>
<tr>
<td>8. Professional efficacy</td>
<td>28.82</td>
<td>(5.06)</td>
<td>.41**</td>
<td>.05</td>
<td>-.11</td>
<td>.27**</td>
<td>.20**</td>
<td>.14</td>
<td>.59**</td>
</tr>
</tbody>
</table>

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

Mean scores, standard deviations, and Pearson correlations for the independent variables and the two outcome variables are presented in Table 3.1. Cronbach’s alpha values for the different scales are found on the diagonal (boldface) in Table 3.1. Overall, the informatics in our sample reported moderate levels of job demands and job resources with an exception for physical job demands that are really low ($M = 1.36; SD = .47$) and cognitive job demands that are highest ($M = 3.87; SD = .45$). In line with our hypotheses we find the highest significantly positive correlations between cognitive job demands and the two cognitive outcome variables, learning motivation ($r = .39; p < .01$) and professional efficacy ($r = .41; p < .01$). Cognitive job resources also significantly correlate positive with learning motivation ($r = .22; p < .01$) and professional efficacy ($r = .27; p < .01$). Cronbach’s alpha’s are acceptable for cognitive job demands ($\alpha = .66$) and cognitive job resources ($\alpha = .65$) and good to very good for the other scales (from $\alpha = .76$ to $\alpha = .89$).

**Table 3.2. Hierarchical regression of job demands and job resources on learning motivation and professional efficacy.**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Learning Motivation</th>
<th>Professional efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1</td>
<td>Step 2</td>
</tr>
<tr>
<td>Control variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-.069</td>
<td>-.310</td>
</tr>
<tr>
<td>Age</td>
<td>-.008</td>
<td>-.015</td>
</tr>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Job Demands</td>
<td>1.274**</td>
<td>1.361**</td>
</tr>
<tr>
<td>Emotional Job Demands</td>
<td>-.068</td>
<td>-.003</td>
</tr>
<tr>
<td>Physical Job Demands</td>
<td>.205</td>
<td>.166</td>
</tr>
<tr>
<td>Cognitive Job Resources</td>
<td>.681*</td>
<td>.747**</td>
</tr>
<tr>
<td>Emotional Job Resources</td>
<td>-.044</td>
<td>.003</td>
</tr>
<tr>
<td>Physical Job Resources</td>
<td>.161</td>
<td>.135</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive x Cognitive</td>
<td>.194</td>
<td></td>
</tr>
<tr>
<td>Emotional x Emotional</td>
<td>.255</td>
<td></td>
</tr>
<tr>
<td>Physical x Physical</td>
<td>-.173</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>.001</td>
<td>.206</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>-.009</td>
<td>.173</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td>.001</td>
<td>.206**</td>
</tr>
</tbody>
</table>

*Note. The values in the table are unstandardized weights ($B$); *: 0 = male, 1 = female; #: $p < .10$. * $p < .05$. ** $p < .01$. 
The results of the two hierarchical regression analyses are depicted in Table 3.2. For learning motivation (hypothesis 1), hierarchical regression analysis showed only significant positive main effects for cognitive job demands ($B = 1.27, p < .01$) and cognitive job resources ($B = .68, p < .05$). Their interaction however was not significant.

With regard to professional efficacy (hypothesis 2), hierarchical regression analysis showed positive significant main effects of cognitive job demands ($B = 2.38, p < .01$) and cognitive job resources ($B = .86, p < .05$) as well as for emotional job resources ($B = .84, p < .05$). Notably the interaction between cognitive job demands and cognitive job resources on professional efficacy was significant ($B = .58, p < .01$). As graphically depicted in Figure 3.1, the combination of high cognitive job demands and high cognitive job resources (+ 1 SD) was associated with higher professional efficacy. In addition, Figure 3.1 also shows that at high levels of cognitive job resources (+ 1 SD), the association between cognitive job demands and cognitive job resources became substantially strengthened which is in line with our second hypothesis. An examination of the regression weights (simple slopes) at one standard deviation above and below the mean of cognitive job resources revealed that cognitive demands were more strongly related to professional efficacy when cognitive resources were high ($B = 6.33, p <.01$), as compared with when cognitive job demands were low ($B = 3.53, p < .01$). Overall we were able to explain 23 % of the variance in learning motivation and 29 % in professional efficacy.
DISCUSSION

Based on the triple-match principle (TMP), we tested the interplay of job demands, job resources and cognitive well-being in informatics, as this occupational group is becoming more and more important in modern society. Looking at the mean values for the two outcome variables we see rather high levels of learning motivation \( (M = 19.3 \text{ with a maximum of } 28) \) and professional efficacy \( (M = 28.8 \text{ with a maximum of } 42) \). Due to the fact that our sample consists only of informatics working in office settings the low mean score \( (M = 1.4 \text{ with a maximum of } 5) \) on physical job demands was to be expected. All other mean scale scores were also in line with expectations, considering the type of job (mainly cognitive work, less contact with clients) the participants in our study have \( (M = 3.0 \text{ for emotional job demands, } M = 3.9 \text{ for cognitive job demands}) \). As expected we found the highest significant correlations between our two outcome variables on the one hand, and cognitive job demands and cognitive job resources on the other. Looking at the results of the two hierarchical regression analyses we find partial support for our first hypothesis concerning learning motivation. In the second step only the two

![Interaction of Cognitive Job demands and Cognitive Job resources on Professional Efficacy.](image)
main effects for cognitive job demands and cognitive job resources were significant, no other main effects were found. The interaction term was not significant as opposed to our first hypothesis. These findings are consistent with Davis (2003, cited in De Jonge et al., 2008) who also found two positive main effects of cognitive work characteristics, but no significant interaction effect of cognitive job demands and cognitive job resources.

With regard to our second hypothesis we find evidence both in terms of main effects as in terms of a significant interaction effect. This confirms our second hypothesis. In the overview of empirical studies given by De Jonge et al. (2008) four TMP studies found similar results. The important role of matching of job demands and job resources for understanding employees’ well-being can theoretically be explained by self-regulation mechanisms. For instance, in the area of immune functioning, homeostatic regulation processes are known to cause an activation of internal resources (e.g., T- and B-cells) when particular demands occur (Lekander, 2002). According to De Jonge et al. (2008), functional homeostatic regulation at work involves identical self-regulation processes in order to cope with states of psychological imbalance at work induced by job demands. Individuals activate functional, matching (cognitive) job resources to strengthen the positive effect of cognitive job demands on cognitive well-being indicators. The new behavioral learning response, if effective and usable, will be incorporated in the employee’s repertoire of activities. In accordance with Demand-Control Model, we further argue that the potential activity level will increase in the future due to an increasing number of solutions to deal with challenging job demands (cf., Karasek, 1998).

Apart from the cognitive main effects and the cognitive interaction effect, we also found a significant main effect of emotional job resources on professional efficacy. This effect could be explained by the fact that informatics, although primarily having a cognitive job, are also susceptible to emotional job resources, such as social support from colleagues and superiors. This finding is in line with the Demand-Control-Support Model (Karasek & Theorell, 1990) in which social support at work is considered as a major work
characteristic which can have main and moderating effects on cognitive well-being and strain at work. As expressed by the DISC Model, further qualification of particular kinds of job resources seems to be highly important. In addition, it seems to be that the TMP is not an exclusive principle, but a major one instead.

**LIMITATIONS**

The current study shares some limitations with other studies. First, our cross-sectional design precludes causal interpretations. Longitudinal studies are needed in this respect. Second, common method bias (due to self-report measures) might have played a role, although Spector (2006) recently stated that this influence is not as high as could be expected. Third, the low response rate might have consequences for the study’s generalizability, although non-response analysis did show no differences with regard to the demographics studied. Fourth, we used non-specific operationalizations of job demands and job resource in a specific job sector. It would be interesting to see if the use of job-specific operationalizations of job demands and job resources provide additional support for the TMP. Finally, another challenging research avenue is to explore whether only the availability of job resources (as measured in this study) matters.

In conclusion, this chapter provides additional empirical evidence that cognitive work characteristics are positively associated with cognitive well-being outcomes and that cognitive job resources moderate the relationship between particular job demands and cognitive well-being. Nonetheless, the influence of emotional job resources should not be underestimated. From a practical point of view, these findings suggest that informatics can benefit from a matching interplay between their work characteristics. Practitioners should focus on enhancing particular job resources which enable employees to deal with their job demands.
REFERENCES


CHAPTER 4
THE TRIPLE-MATCH PRINCIPLE IN THE TECHNOLOGY SECTOR: A TWO-WAVE LONGITUDINAL PANEL STUDY.

The present study investigates the issue of match between job demands and job resources in the prediction of employee strain and well-being as outlined by the Demand-Induced Strain Compensation (DISC) Model. Demands, resources and job-related outcomes are considered multidimensional constructs comprising physical, cognitive, and/or emotional components. The DISC Model comprises three core principles: the triple-match principle, the compensation principle, and the balance principle. These three principles were tested using a two-wave longitudinal panel study (n = 720). Analyses were conducted with structural equation modeling, and results largely confirm our core hypothesis. The likelihood of finding valid interaction effects was nearly linearly related to the degree of match between demands, resources and outcomes. Generalizability of the DISC Model in the technology sector was shown. Practically, findings indicate that enhancing specific, matching, resources enables employees to deal with their high job demands.

This chapter is largely based on:

The current chapter will study both negative (labeled as “job strain”) and positive work outcomes (labeled as “employee well-being”). Since Robert Karasek introduced the Demand-Control Model (Karasek, 1979), a vast body of research has focused on two crucial components of the work itself, job demands and job resources, in predicting and understanding job-related outcomes such as employee health, well-being and performance as well as job strain (e.g., Schaufeli & Bakker, 2004). Job demands are defined as those properties of a job that require emotional, cognitive and/or physical effort. As such, job demands can have both positive and negative consequences in terms of employee health and well-being (Jones & Fletcher, 1996). Job resources, such as job control or workplace social support, can be conceptualized as work-related assets that can be employed to deal with job demands. Job resources can moderate the relation between job demands and job-related outcomes in such a way that they can strengthen the positive association in case of positive outcomes such as well-being and performance, and that they can weaken the negative association in case of negative outcomes such as adverse health or job strain (cf. Schaufeli & Bakker, 2004). In addition, job demands and job resources can also have main effects on job-related outcomes. A systematic narrative review of 63 studies published between 1979 and 1997, focusing on psychological well-being and job strain outcomes (Van der Doef & Maes, 1999), revealed that the literature provides considerable support for main effects of job demands and job resources. However, support for the moderating influence of job resources is less consistent. In a recent review of 83 studies published between 1998 and 2007, Hausser, Mojzisch, Niesel, and Schulz-Hardt (2010) updated the work by Van der Doef and Maes (1999) and found similar results. Findings indicate more empirical support for additive effects of job demands and job resources and less empirical support for the moderating effect of job resources. Furthermore, the authors suggest that buffering effects largely depend on whether or not job demands and job resources are based on qualitatively identical dimensions. They refer to the so-called matching principle which is the key principle in the Demand-Induced Strain Compensation (DISC) Model (De
To increase our understanding of the particular moderating role of job resources in the job stress process, Hausser, et al. (2010) encourage empirical research in search of this kind of matching interactions between demands and resources. Therefore, the present longitudinal study investigates the matching interactions of job demands and job resources in the prediction of job strain and employee well-being. In addition, because a large amount of research regarding the matching principle has been done in human services (De Jonge, Dormann, & Van den Tooren, 2008), this study will use a rather different sample of employees from the technology sector.

**TRIPLE-MATCH PRINCIPLE**

The DISC Model is a job stress model that elaborates upon the principles of the Demand-Control Model by adding two innovative principles, namely multidimensionality of constructs and the matching principle (De Jonge & Dormann, 2003; De Jonge, et al., 2008). A central tenet of the DISC Model is that job demands, job resources as well as job strain and employee well-being outcomes, are multidimensional constructs. They comprise of at least cognitive, emotional and physical dimensions (cf. Hockey, 2000). Job demands can be primarily cognitive (e.g., having to display high levels of concentration and precision), emotional (e.g., having to deal with people who get easily angered towards him/her) or physical (e.g., having to bend and/or stretch a lot at work). A similar distinction is possible regarding job resources, which can be primarily cognitive (e.g., having the opportunity to take a mental break when tasks require a lot of concentration), emotional (e.g., getting emotional support from others) or physical (e.g., being able to use adequate technical equipment to accomplish physically strenuous tasks). Finally, the DISC Model distinguishes cognitive, emotional, and physical outcomes, which can be either negative (e.g., concentration problems, emotional exhaustion, and physical health complaints) or positive (e.g., competence, emotional strength, and physical strength).

The Triple-Match Principle (TMP) proposes that the strongest, interactive, relations between job demands and job resources can be observed when both job demands and job resources as well as job-related outcomes are
based on qualitatively identical dimensions. (De Jonge & Dormann, 2003). In other words, there should be a match between job demands and job resources, as well as a match between job demands/resources and outcomes. This triple-match hypothesis builds further on the work of Cohen and Wills (1985) and Frese (1999), who elaborated on two kinds of matching principles in social support literature. First, correspondence (a match) between a job demand and a job resource is called a double-match of common kind. Second, a match between a job demand/resource and a job-related outcome is called a double-match of extended kind (cf. Frese, 1999). All kinds of match have received empirical support in previous research (De Jonge, et al., 2008).

In line with Karasek (1979) as well as other authors (e.g., Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Ganster, 1989), job resources can buffer negative effects of job demands on job strain as well as enhance positive effects of job demands on employee well-being. Two further corollaries of the DISC Model therefore arise: the compensation principle and the balance principle. The compensation principle describes the self-regulating process (e.g., Vancouver, 2000) where job resources are used to prevent or diminish the negative effects of job demands. It is also predicted that job resources from within the same domain as the job demands (i.e., cognitive, emotional, or physical) will produce a greater likelihood of counteracting the negative job demands. The balance principle proposes that a balanced mixture of job demands and matching job resources is associated with positive employee well-being outcomes (e.g., employee competence).

Intuitively the TMP appears to be quite logical in its nature. For example, to prevent physical health problems caused by physical demands, providing matching physical resources seems to be a very logical and intuitive remedy; more logical than providing or promoting non-matching emotional or cognitive resources. Moreover, several theoretical frameworks in the field of occupational health psychology and similarities to existing theories in other fields provide a clear theoretical context for the TMP. First, the TMP can be framed within the self-regulation literature. The idea of functional homeostatic regulation,
described in contexts of immune functioning (e.g., Lekander, 2002) and nervous systems (e.g., Montague, 1996) can be transferred to organizational settings (Boekaerts, Maes, & Karoly, 2005; Vancouver, 2000). Ideally, individuals will activate functional, matching job resources to mitigate the effects of specific job demands (De Jonge, et al., 2008). Second, the TMP can also be situated within the person-environment fit approach to job strain (e.g., Ostroff & Judge, 2007), which states that employees experience more positive work-related outcomes in case a job supplies something that matches the desires of an employee (Daniels & De Jonge, 2010; Edwards & Harrison, 1993). Third, means efficacy, a relatively new concept in the work stress literature, can be used to provide theoretical support for the TMP. Means efficacy is defined as employees’ belief in the utility of the tools available for task performance and can boost performance (Eden, Ganzach, Flumin-Granat, & Zigman, 2010). Although this is not the primary goal of the present study, we believe that, given the intuitive logic of the TMP, employees’ belief in the efficacy of matching resources to the required demands is a fairly plausible explanation of the TMP.

Previous research has shown a fair amount of empirical support for the TMP (Daniels & De Jonge, 2010). Fifteen out of nineteen studies reported by Daniels and De Jonge (2010) showed evidence in support of the TMP. The majority of these studies however were cross-sectional, with all the related downsides such as the impossibility to determine causal directions (Edwards, 2008; Taris & Kompier, 2003). Two studies thus far have investigated the TMP longitudinally, and found empirical support for it. First, De Jonge and Dormann (2006) performed two two-wave panel studies with a two-year time lag among Dutch health care workers. They found longitudinal support for an interaction between baseline physical job demands and physical job resources in predicting physical health complaints (physical strain) two years later, and for an interaction between baseline emotional job demands and emotional job resources in predicting emotional exhaustion (emotional strain) two years later. Second, Chrisopoulos, Dollard, Winefield and Dormann (2010) found empirical evidence for one out of three tested triple-match interactions in their two-wave panel study with a one-year time lag among 179 Australian police officers.
They found longitudinal support for an interaction between baseline cognitive job demands and cognitive job resources in predicting professional efficacy (cognitive strain) one year later. Remarkably, the likelihood of finding interaction effects in both studies was nearly linearly related to the degree of match, with 33.3 % of all tested interactions becoming significant when there was a triple-match, 18.5 % significant interactions when testing for double-matches (common kind as well as extended kind), and 0.0 % significant interactions when there was no match. In their limitations section, Chrisopoulos et al. (2010) acknowledged the possibility that their findings could be related to their specific sample and consequently call for future research to validate their findings in other types of samples. In spite of similar research designs and methodological approaches, these two longitudinal tests of the TMP provide slightly different results, which could be due to the different kinds of samples (cf. healthcare and police officers) as well as the different time lags. However, both studies had rather homogeneous samples from human services and did not fully address the DISC Model to test both the compensation and balance principle. The present longitudinal study will try to overcome these shortcomings by means of (1) using a more heterogeneous sample of Belgian employees in the technology sector (non-human services), and (2) focusing on three negative and three positive outcomes (cognitive, emotional and physical) to test both the compensation and balance principle.

It should be noted that in the present study job strain is operationalized as cognitive job strain (cognitive failure), emotional job strain (emotional exhaustion) and physical job strain (physical health complaints), for successively the cognitive, emotional and physical dimensions in our theoretical framework. Similarly, in line with the DISC Model, employee well-being is operationalized as cognitive well-being (employee competence), emotional well-being, and physical well-being. The following three hypotheses will be tested:

Hypothesis 1: Triple-Match Principle. The likelihood of interaction effects between job demands and job resources in the prediction of job-related
outcomes increases as the degree of match increases. Put differently, job strain buffering effects or well-being enhancing effects of job resources on the longitudinal relation between job demands and employee strain/well-being will occur more often if there is a match between specific types of job demands, job resources and outcomes than if there is a non-match between specific types of job demands, job resources and outcomes.

*Hypothesis 2: Compensation Principle.* Job strain has a lagged relation with job demands, and this relation is particularly moderated by matching job resources. Specifically, we expect that the positive association between job demands and job strain will be weakened by the availability of matching job resources.

*Hypothesis 3: Balance Principle.* Employee well-being has a lagged relation with job demands, and this relation is particularly moderated by matching job resources. Specifically, we expect that the positive association between job demands and employee well-being will be strengthened by the availability of matching job resources.

**METHOD**

**PROCEDURE AND PARTICIPANTS**

Data were gathered in a large Belgian organization in the technology sector using a two-wave panel survey with a one-year time lag. Key reasons for choosing this time lag were controlling for possible seasonal fluctuations and giving natural changes a fair chance to occur (cf. De Jonge, et al., 2001). At Time 1 (4912 employees) and at Time 2 (4622 employees) exactly one year later, all participants received a paper-and-pencil questionnaire with an accompanying letter that explained the purpose of the study. Voluntary participation was emphasized and confidentiality was guaranteed. Three weeks later, a reminder letter was sent to increase response rates. Management representatives in the organization indicated that the demographic characteristics of the sample were consistent with those of their organization
population at the time of data collection. Furthermore, all occupational groups and hierarchical levels within the organization were represented. The sample includes blue-collar workers (e.g., welders, electricians) as well as white-collar workers (e.g., secretaries, accountants). At Time 1, 1533 employees returned a completed questionnaire (response rate of 31.2 %) and at Time 2, 1254 employees responded (27.1 %). Note that Time 2 questionnaires were sent to all employees, regardless of whether they had completed and returned a Time 1 questionnaire. The final panel sample (respondents to both panels) consisted of 720 respondents (46.9 % of the initial Time 1 sample).

Potential effects of attrition in the longitudinal data were assessed by a multiple logistic regression analysis to determine whether participation at Time 2 was related to any of the Time 1 variables under study (Goodman & Blum, 1996; De Jonge & Dormann, 2006). Minor attrition effects were found for cognitive job demands and emotional job strain. Continuous participants (Time 1 and Time 2) reported slightly higher cognitive demands ($M = 3.71$, $SD = 0.61$) than Time 2 drop-outs ($M = 3.64$, $SD = 0.66$). Furthermore, continuous participants reported somewhat lower emotional job strain ($M = 2.85$, $SD = 1.15$) than Time 2 drop-outs ($M = 3.01$, $SD = 1.22$), putting a small cautionary note to the interpretation of our results. Although statistically significant in terms of independent samples t-tests, the differences in means represent only 1.4 and 2.3 % of the range of the respective scales.

In the final panel sample 243 employees (33.8 %) were French speaking versus 477 Dutch speakers (66.2 %). A vast majority was male (94.4 %) and the mean age at Time 1 was 44.48 years ($SD = 9.41$). Most respondents were married or lived together with a partner (84.1 %), and most of those partners were also employed (69.3 %). The majority of employees in the sample (74.5 %) had one or more children ($M = 1.81$, $SD = 0.86$). Lower educated and higher educated employees comprised 66.6 and 33.4 % of the sample, respectively. Mean seniority at Time 1 in the organization and in the present job was 16.72 years ($SD = 10.84$) and 14.17 years ($SD = 10.89$), respectively. The sample consisted of 36.4 % of employees with leading responsibilities at Time 1.
MEASURES

Job demands and job resources were measured using the DISC Questionnaire (DISQ) 2.0 (De Jonge, et al., 2007). Earlier versions of this questionnaire have shown promising psychometrical properties in previous studies (e.g., De Jonge & Peeters, 2009; Van den Tooren & De Jonge, 2008). Items were scored on a 5-point frequency scale, ranging from 1 (never or very rarely) to 5 (very often or always). The six subscales assessed cognitive demands (5 items, Cronbach’s α Time 1 = .76), emotional demands (6 items, Cronbach’s α Time 1 = .83) and physical demands (5 items, Cronbach’s α Time 1 = .95), and cognitive resources (5 items, Cronbach’s α Time 1 = .67), emotional resources (5 items, Cronbach’s α Time 1 = .81) and physical resources (5 items, Cronbach’s α Time 1 = .86). Items included aspects such as “making complex decisions” (cognitive job demand); “doing a lot of emotionally draining work” (emotional job demand); “performing a lot of physically strenuous tasks” (physical job demand); “having access to useful information” (cognitive job resource); “emotional support from peers and supervisors” (emotional job resource); and “using adequate technical equipment” (physical job resource).

Employee Well-being. To assess cognitive well-being we used the competence subscale of the Maslach Burnout Inventory General Survey (Schaufeli & Van Dierendonck, 2000). The scale contained five items with a 7-point response scale ranging from 0 (never) to 6 (always, daily). Internal consistencies for the scale were Cronbach’s α = .78 both at Time 1 and Time 2. An example item is: “In my opinion, I am good at my work”. A 3-item scale was used to measure emotional well-being with a 5-point response scale ranging from 1 (almost never) to 5 (almost always) (Cronbach’s α Time 1 = .72, Cronbach’s α Time 2 = .73). An example item is “I feel emotionally stable”. Physical well-being was measured by three items (Cronbach’s α Time 1 = .88, Cronbach’s α Time 2 = .89) with a 5-point response scale ranging from 1 (almost never) to 5 (almost always). An example item is “I feel physically energetic”.

Job Strain. A 7-item scale, adapted from the Cognitive Failures Questionnaire (Broadbent, Cooper, Fitzgerald, & Parkes, 1982) was used to measure cognitive job strain. Items were selected based on a brief pilot study in which three subject matter experts selected independently from each other the items relevant for use in an occupational context (Cronbach’s $\alpha$ Time 1 = .80, Cronbach’s $\alpha$ Time 2 = .82). The seven items asked the participants to indicate on a 5-point scale, ranging from 1 (never) to 5 (very often), how often a number of cognitive mistakes were made by them in the past six months. An example item for the cognitive failure scale is: “How often do you read something and find you haven’t been thinking about it and must read it again?”. Emotional job strain was assessed by the emotional exhaustion subscale of the of the Maslach Burnout Inventory General Survey (Schaufeli & Van Dierendonck, 2000). The scale contained five items with a 7-point response scale ranging from 0 (never) to 6 (always, daily). Internal consistencies for the scale were Cronbach’s $\alpha$ = .87 at Time 1 and Cronbach’s $\alpha$ = .88 at Time 2. An example item is: “I feel emotionally drained from my work”. Physical Job strain was assessed using the Physical Health Questionnaire (Schat, Kelloway, & Desmarais, 2005). This self-report scale includes 14 items reporting somatic symptoms such as gastrointestinal problems, headaches, sleep disturbances, and respiratory illness. The response format ranged from 1 (not at all) to 7 (all the time). The recommended overall single index was calculated (Cronbach’s $\alpha$ Time 1 = .87; Cronbach’s $\alpha$ Time 2 = .86).

Control variables. Previous work has shown that age and gender are in various ways related to the variables under study. Therefore we controlled for the effects of these variables. Age was measured continuously and gender was dummy coded with 0 = male and 1 = female.

Measures were adopted or translated to the native language of the participants (Dutch or French), using the multistage translation/back-translation procedure (Brislin, 1980).
STATISTICAL ANALYSES

In line with previous longitudinal studies into the DISC Model, identical statistical strategies were used in the present study (Chrisopoulos, et al., 2010; De Jonge & Dormann, 2006). Analyses were conducted with structural equation modeling (LISREL 8; Jöreskog & Sörbom, 1993) to simultaneously cross the three dimensions of job demands, job resources and outcomes. Each analysis consisted of 14 variables (gender, age, 3 types of job demands, 3 types of job resources, and 6 outcomes). Furthermore, proposed interaction effects between job demands and job resources were included as multiplicative terms after standardizing the single predictor variables (cf. Aiken & West, 1991; Van Vegchel, De Jonge, & Landsbergis, 2005). However, because of the large number of possible interactions in one analysis, we followed the same approach as Chrisopoulos et al. (2010) and De Jonge and Dormann (2006) and split the analysis into two separate steps according to our theoretical assumptions and hypotheses. Our first analytical step included all triple-match interactions and all double-match interactions of common kind, thereby looking at 18 of the possible 54 interactions. In the second analytical step, the double-match interactions of extended kind and the non-match interactions were included, thereby testing the remaining 36 possible interactions. The structural models were fully saturated because residuals among the outcome variables were allowed to correlate (cf. De Jonge & Dormann, 2006). Therefore, we could not report practical fit indices as saturated models always have a perfect fit. Furthermore, prior to our analyses, we normalized the distributions of the dependent variables to be within the boundaries of skewness and kurtosis using square root and log-transformations (Aiken & West, 1991).
Table 4.1. *Descriptive statistics and Pearson intercorrelations among study variables (N = 720).*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
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<tbody>
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<td>1. Cognitive Demands T1</td>
<td>3.71</td>
<td>0.61</td>
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<td>2. Emotional Demands T1</td>
<td>2.87</td>
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<td>0.52**</td>
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<td>3. Physical Demands T1</td>
<td>2.76</td>
<td>1.17</td>
<td>-0.21**</td>
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<td>4. Cognitive Resources T1</td>
<td>3.27</td>
<td>0.62</td>
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<td>5. Emotional Resources T1</td>
<td>2.96</td>
<td>0.73</td>
<td>0.06 -0.14** -0.13** 0.54** (.81)</td>
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<td>6. Physical Resources T1</td>
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<td>7. Cognitive well-being T1</td>
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<td>0.05 -0.06 0.17** 0.19** 0.13** (.78)</td>
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<td>8. Cognitive well-being T2</td>
<td>5.00</td>
<td>0.88</td>
<td>0.17**</td>
<td>0.04 -0.04 0.15** 0.11** 0.10** 0.68** (.78)</td>
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<td>9. Emotional well-being T1</td>
<td>3.85</td>
<td>0.66</td>
<td>0.05 -0.09* -0.09* 0.14** 0.14** 0.12** 0.39** 0.35** (.72)</td>
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<td>0.72</td>
<td>-0.01 -0.04 0.01 0.07 0.07* 0.11** 0.25** 0.34** 0.47** (.73)</td>
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<td>11. Physical well-being T1</td>
<td>3.87</td>
<td>0.69</td>
<td>0.00 -0.11** -0.04 0.10** 0.10** 0.12** 0.38** 0.35** 0.44** 0.32** (.88)</td>
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<td>12. Physical well-being T2</td>
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<td>0.71</td>
<td>-0.02 -0.13** -0.01 0.05 0.09* 0.07 0.32** 0.40** 0.33** 0.39** 0.65** (.89)</td>
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<td>13. Cognitive job strain T1</td>
<td>2.28</td>
<td>0.55</td>
<td>0.04 0.16** 0.03 0.04 -0.07 0.03 -0.25** -0.20** -0.21** -0.16** -0.30** -0.33** (.80)</td>
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<td>14. Cognitive job strain T2</td>
<td>2.30</td>
<td>0.58</td>
<td>0.06 0.17** 0.04 0.02 -0.03 0.03 -0.23** -0.26** -0.22** -0.19** -0.29** -0.36** 0.76** (.82)</td>
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<td>15. Emotional job strain T1</td>
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<td>1.15</td>
<td>0.16** 0.34** 0.20** -0.17** -0.25** -0.16** -0.19** -0.19** -0.34** -0.27** -0.46** -0.41** 0.31** 0.34** (.87)</td>
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<td>16. Emotional job strain T2</td>
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<td>1.17</td>
<td>0.15** 0.29** 0.17** -0.11** -0.15** -0.10** -0.16** -0.20** -0.28** -0.28** -0.39** -0.46** 0.29** 0.37** 0.70** (.88)</td>
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<tr>
<td>17. Physical job strain T1</td>
<td>2.57</td>
<td>0.91</td>
<td>0.11** 0.28** 0.12** -0.10** -0.12** -0.13** -0.24** -0.22** -0.31** -0.25** -0.51** -0.40** 0.37** 0.37** 0.54** 0.43** (.87)</td>
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<td>18. Physical job strain T2</td>
<td>2.55</td>
<td>0.88</td>
<td>0.10** 0.24** 0.11** -0.07** -0.09* -0.11** -0.22** -0.24** -0.29** -0.28** -0.43** -0.49** 0.37** 0.42** 0.45** 0.51** 0.77** (.86)</td>
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</tr>
</tbody>
</table>

*Note.* Reliability coefficients (Cronbach’s alpha) are displayed in parentheses along the diagonal. T1 = Time 1; T2 = Time 2; *p < .05; **p < .01 (two-tailed)
RESULTS

Descriptive statistics for the measures as well as the correlations between all variables are presented in Table 4.1. At first glance, it appeared that the associations between the key variables are in the predicted direction.

Next, Table 4.2 shows the results obtained from simultaneously testing six possible triple-match effects and 12 possible double-matches of common kind, which represents our first analytical step. The six outcomes analyzed were cognitive, emotional and physical strain (Table 4.2, part 1) and cognitive, emotional and physical well-being (Table 4.2, part 2). Unstandardized coefficients ($B$), standard errors ($SE$), $T$ values, and standardized coefficients ($\beta$) are presented in the table accordingly.

In the first analytical step, 5 out of 18 possible interactions were significant (i.e., two triple-match interactions and three double-match interactions of common kind).

The significant interactions between cognitive job demands, cognitive job resources and cognitive job strain and between emotional job demands, emotional job resources and emotional well-being are triple-match interactions. Regression lines of both triple-match interactions were plotted in Figure 4.1 following the recommendations of Aiken and West (1991) at 1 $SD$ below the mean and at 1 $SD$ above the mean. Post hoc analyses were conducted to explore whether the slope of the regression lines were significantly different from zero (cf. Dawson & Richter, 2006).
## Table 4.2 (part 1). Lagged Structural Equation Models of Cognitive, Emotional and Physical job strain with Triple-Match and Double-Match (Common Kind) Interactions.

<table>
<thead>
<tr>
<th>Source</th>
<th>Control variables</th>
<th>Job Demands and Resources</th>
<th>Time 1 outcome variables</th>
<th>Interaction effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>T</td>
<td>β</td>
</tr>
<tr>
<td>Control variables</td>
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<td>Gender</td>
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<td>0.08</td>
<td>-0.47</td>
<td>-0.01</td>
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<tr>
<td>Age</td>
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<td>0.00</td>
<td>-0.81</td>
<td>-0.02</td>
</tr>
<tr>
<td>Job Demands and Resources</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive demands</td>
<td>-1.41</td>
<td>0.09</td>
<td>-14.86**</td>
<td>-0.50</td>
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<tr>
<td>Emotional demands</td>
<td>0.19</td>
<td>0.03</td>
<td>5.88**</td>
<td>0.18</td>
</tr>
<tr>
<td>Physical demands</td>
<td>0.13</td>
<td>0.09</td>
<td>1.53</td>
<td>0.05</td>
</tr>
<tr>
<td>Cognitive resources</td>
<td>-0.06</td>
<td>0.05</td>
<td>-1.27</td>
<td>-0.05</td>
</tr>
<tr>
<td>Emotional resources</td>
<td>0.50</td>
<td>0.36</td>
<td>1.40</td>
<td>0.05</td>
</tr>
<tr>
<td>Physical resources</td>
<td>-0.23</td>
<td>0.03</td>
<td>-7.06**</td>
<td>-0.30</td>
</tr>
<tr>
<td>Time 1 outcome variables</td>
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<td></td>
</tr>
<tr>
<td>Cognitive well-being (Time 1)</td>
<td>0.03</td>
<td>0.02</td>
<td>1.30</td>
<td>0.04</td>
</tr>
<tr>
<td>Emotional well-being (Time 1)</td>
<td>0.01</td>
<td>0.02</td>
<td>0.48</td>
<td>0.01</td>
</tr>
<tr>
<td>Physical well-being (Time 1)</td>
<td>0.01</td>
<td>0.02</td>
<td>0.35</td>
<td>0.01</td>
</tr>
<tr>
<td>Cognitive job strain (Time 1)</td>
<td>0.04</td>
<td>0.02</td>
<td>1.65</td>
<td>0.05</td>
</tr>
<tr>
<td>Emotional job strain (Time 1)</td>
<td>-0.02</td>
<td>0.02</td>
<td>-1.50</td>
<td>-0.04</td>
</tr>
<tr>
<td>Physical job strain (Time 1)</td>
<td>0.00</td>
<td>0.02</td>
<td>-0.22</td>
<td>-0.01</td>
</tr>
<tr>
<td>Interaction effects</td>
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<tr>
<td>Cog. Dem. x Cog. Res.</td>
<td>0.83</td>
<td>0.29</td>
<td>2.86**</td>
<td>0.13  T</td>
</tr>
<tr>
<td>Emo. Dem. x Emo. Res.</td>
<td>-0.09</td>
<td>0.02</td>
<td>-3.70**</td>
<td>-0.15  Dec</td>
</tr>
<tr>
<td>Phy. Dem. X Phy. Res.</td>
<td>0.12</td>
<td>0.21</td>
<td>0.56</td>
<td>0.02  Dec</td>
</tr>
</tbody>
</table>

**Note.** * p < .05; ** p < .01; Cog. = cognitive, Emo. = emotional, Phy = Physical, Dem. = job demands, Res. = job resources, T = Triple-Match interaction, Dec = Double-Match interaction of common kind.
Table 4.2 (part 2). *Lagged Structural Equation Models of Cognitive, Emotional and Physical well-being with Triple-Match and Double-Match (Common Kind) Interactions.*

<table>
<thead>
<tr>
<th>Source</th>
<th>Control variables</th>
<th>Job Demands and Resources</th>
<th>Time 1 outcome variables</th>
<th>Interaction effects</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Cognitive well-being (T2)</td>
<td>Emotional well-being (T2)</td>
<td>Physical well-being (T2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE</td>
<td>T</td>
</tr>
<tr>
<td>Gender</td>
<td>0.34</td>
<td>0.17</td>
<td>1.94</td>
<td>0.08</td>
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<td>Age</td>
<td>-0.01</td>
<td>0.00</td>
<td>-2.42*</td>
<td>-0.09</td>
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<tr>
<td>Cognitive demands</td>
<td>0.05</td>
<td>0.20</td>
<td>0.27</td>
<td>0.01</td>
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<tr>
<td>Emotional demands</td>
<td>0.05</td>
<td>0.07</td>
<td>0.79</td>
<td>0.03</td>
</tr>
<tr>
<td>Physical demands</td>
<td>0.01</td>
<td>0.18</td>
<td>0.06</td>
<td>0.00</td>
</tr>
<tr>
<td>Cognitive resources</td>
<td>-0.13</td>
<td>0.10</td>
<td>-1.36</td>
<td>-0.07</td>
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<tr>
<td>Emotional resources</td>
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<td>0.74</td>
<td>2.33*</td>
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<td>0.07</td>
<td>0.48</td>
<td>0.03</td>
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<td>Cognitive well-being (Time 1)</td>
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<td>-3.31**</td>
<td>-0.15</td>
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<td>0.04</td>
<td>-0.99</td>
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<td>0.05</td>
<td>2.91**</td>
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<td>Emotional strain (Time 1)</td>
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<td>0.03</td>
<td>-1.24</td>
<td>-0.05</td>
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<tr>
<td>Physical strain (Time 1)</td>
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<td>-0.26</td>
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<td>Cog. Dem. x Cog. Res.</td>
<td>-0.17</td>
<td>0.60</td>
<td>-0.28</td>
<td>-0.02 T</td>
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<tr>
<td>Emo. Dem. x Emo. Res.</td>
<td>-0.21</td>
<td>0.05</td>
<td>-4.39**</td>
<td>-0.25 Dc</td>
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<tr>
<td>Phy. Dem. X Phy. Res.</td>
<td>0.43</td>
<td>0.43</td>
<td>1.00</td>
<td>0.06 Dc</td>
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</table>

Note. * p < .05.; ** p < .01; Cog. = cognitive, Emo. = emotional, Phy = Physical, Dem. = job demands, Res. = job resources, T = Triple-Match interaction, Dc = Double Match interaction of common kind.
Table 4.3 (part 1). Lagged Structural Equation Models of Cognitive, Emotional and Physical job strain with Non-match or Double-Match (Extended Kind) Interactions.

<table>
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<tr>
<th>Source</th>
<th>Cognitive job strain (T2)</th>
<th>Emotional job strain (T2)</th>
<th>Physical job strain (T2)</th>
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<td>$T$</td>
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<td>0.16</td>
<td>-4.54**</td>
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<tr>
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<td>0.00</td>
<td>-0.79</td>
</tr>
<tr>
<td>Job Demands and Resources</td>
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<tr>
<td>Cognitive demands</td>
<td>-0.08</td>
<td>0.05</td>
<td>-1.46</td>
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<tr>
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<td>0.05</td>
<td>1.49</td>
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<tr>
<td>Physical demands</td>
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<td>0.07</td>
<td>-0.96</td>
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<td>0.15</td>
<td>0.07</td>
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<tr>
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<td>0.06</td>
<td>0.28</td>
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<tr>
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<td>0.05</td>
<td>-0.37</td>
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<td>0.04</td>
<td>-4.03**</td>
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<tr>
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<td>0.04</td>
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<td>0.03</td>
<td>0.74</td>
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<tr>
<td>Physical job strain (Time 1)</td>
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<td>0.03</td>
<td>-4.24**</td>
</tr>
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<tr>
<td>Cog. Dem. x Emo. Res.</td>
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<td>0.09</td>
<td>-3.27**</td>
</tr>
<tr>
<td>Cog. Dem. x Phy. Res.</td>
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<td>0.09</td>
<td>3.00**</td>
</tr>
<tr>
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<td>Emo. Dem. x Phy. Res.</td>
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<tr>
<td>Phy. Dem. x Emo. Res.</td>
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<td>0.04</td>
<td>0.58</td>
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</table>

Note: * $p < .05$; ** $p < .01$; Cog. = cognitive, Emo. = emotional, Phy = Physical, Dem. = job demands, Res. = job resources, De = Double-match interaction of extended kind, N = Non-match interaction.
Table 4.3 (part 2). Lagged Structural Equation Models of Cognitive, Emotional and Physical well-being with Non-match or Double-Match (Extended Kind) Interactions.

<table>
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<tr>
<th>Source</th>
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<th>Emotional well-being (T2)</th>
<th>Physical well-being (T2)</th>
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<td>T</td>
</tr>
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<td>Control variables</td>
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<td>0.17</td>
<td>2.29*</td>
</tr>
<tr>
<td>Age</td>
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<td>0.00</td>
<td>-2.39*</td>
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<td>0.79</td>
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<tr>
<td>Physical resources</td>
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<td>-0.24</td>
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<td>Time 1 outcome variables</td>
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<td>Cognitive well-being (Time 1)</td>
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<td>-3.33**</td>
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<tr>
<td>Emotional well-being (Time 1)</td>
<td>-0.05</td>
<td>0.04</td>
<td>-1.22</td>
</tr>
<tr>
<td>Physical well-being (Time 1)</td>
<td>0.10</td>
<td>0.04</td>
<td>2.23*</td>
</tr>
<tr>
<td>Cognitive job strain (Time 1)</td>
<td>0.15</td>
<td>0.03</td>
<td>4.36**</td>
</tr>
<tr>
<td>Emotional job strain (Time 1)</td>
<td>-0.05</td>
<td>0.03</td>
<td>-1.47</td>
</tr>
<tr>
<td>Physical job strain (Time 1)</td>
<td>0.00</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Interaction effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cog. Dem. x Emo. Res.</td>
<td>-0.13</td>
<td>0.10</td>
<td>-1.25</td>
</tr>
<tr>
<td>Cog. Dem. x Phy. Res.</td>
<td>0.23</td>
<td>0.10</td>
<td>2.34*</td>
</tr>
<tr>
<td>Emo. Dem. x Cog. Res.</td>
<td>0.02</td>
<td>0.07</td>
<td>0.36</td>
</tr>
<tr>
<td>Emo. Dem. x Phy. Res.</td>
<td>-0.01</td>
<td>0.07</td>
<td>-0.12</td>
</tr>
<tr>
<td>Phy. Dem. x Cog. Res.</td>
<td>-0.19</td>
<td>0.05</td>
<td>-3.98**</td>
</tr>
<tr>
<td>Phy. Dem. x Emo. Res.</td>
<td>0.04</td>
<td>0.05</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Note. * p < .05.; ** p < .01; Cog. = cognitive, Emo. = emotional, Phy = Physical, Dem. = job demands, Res. = job resources, De = Double-match interaction of extended kind, N = Non-match interaction.
Figure 4.1a shows the triple-match interaction between cognitive job demands, cognitive job resources and cognitive job strain. The figure shows that cognitive strain was not associated with cognitive job demands at high levels of cognitive job resources (+1 SD; simple slope test $t = 0.15, p = \text{ns}$). In contrast, at low levels of cognitive job resources (-1 SD) cognitive strain increases with increasing levels of cognitive job demands (simple slope test $t = 1.91, p < .10$).

In Figure 4.1b, the triple-match interaction between emotional job demands, emotional job resources and emotional well-being is plotted. The figure shows a negative relation between emotional job demands and emotional well-being at low levels of emotional job resources as well as at high levels of emotional job resources. However, both slopes did not reach significance in the post hoc tests (simple slope test at +1 SD, $t = -0.15, p = \text{ns}$; simple slope test at -1 SD, $t = -0.99, p = \text{ns}$).

Next to the two triple-match interactions, three double-match interactions of common kind were found in the first analytical step. These interactions are plotted in Figure 4.2. The double-match of common kind interaction between emotional job demands, emotional job resources and cognitive strain is depicted in Figure 4.2a. The figure shows a positive relation between emotional job demands and cognitive strain both at low levels of emotional job resources (-1 SD, $t = 0.65, p = .52$) and at high levels of emotional job resources (+1 SD, $t = 1.99, p < .10$).
SD; simple slope test \( t = 3.78, p < .01 \) as well as at high levels of emotional job resources \((+1 \, SD; \, simple \, slope \, test \, t = 3.26, \, p < .01)\). The double-match interaction of common kind between emotional job demands, emotional job resources and cognitive well-being is plotted in Figure 4.2b. This figure shows that cognitive well-being is not significantly associated with emotional job demands at low levels of emotional job resources \((-1 \, SD; \, simple \, slope \, test \, t = 0.62, \, p = ns\)). A positive relation between emotional job demands and cognitive well-being was found at high levels of emotional job resources \((+1 \, SD; \, simple \, slope \, test \, t = 1.88, \, p < .10)\). The double-match interaction of common kind between emotional job demands, emotional job resources and physical well-being is plotted in Figure 4.2c. The figure shows that physical well-being was not significantly associated with emotional job demands at high levels of emotional job resources \((+1 \, SD; \, simple \, slope \, test \, t = -1.55, \, p = ns\)). A negative relation between emotional job demands and physical well-being was found at low levels of emotional job resources \((-1 \, SD; \, simple \, slope \, test \, t = -3.29, \, p < .01)\).

Figure 4.2. Double-matches of common kind (ED = emotional job demands, ER = emotional job resources).

Table 4.3 shows the results obtained from testing the remaining 24 possible double-matches of extended kind and the 12 possible non-matches, which corresponds with our second analytical step. In general, 6 significant interaction effects were found. All of these interaction effects represent double-matches of extended kind and are graphically represented in Figure 4.3. Firstly, the interaction between cognitive job demands and emotional job resources
(Figure 4.3a), the interaction between cognitive job demands and physical job resources (Figure 4.3b), and the interaction between emotional job demands and cognitive job resources (Figure 4.3c) predicted cognitive job strain. Secondly, the interaction between cognitive job demands and emotional job resources predicted emotional job strain (Figure 4.3d). Finally, the interaction between cognitive job demands and physical job resources (Figure 4.3e) as well as the interaction between physical job demands and cognitive job resources (Figure 4.3f) predicted cognitive well-being.

From a content point of view, 3 out of the 6 interactions depicted in Figure 4.3 represent reversed interactions, which are those interactions counter to general stress theory (cf. Chrisopoulos, et al., 2010; De Jonge & Dormann, 2006). Furthermore, Figures 4.3a, 4.3d and 4.3e represent valid interaction effects between job demands and job resources. Figure 4.3b shows a reversed buffering interaction: cognitive strain is not significantly associated with cognitive job demands at low levels of physical job resources (-1 SD; simple slope test $t = 0.008$, $p = ns$). A positive relation between cognitive job demands and cognitive strain was found at high levels of physical job resources (+1 SD; simple slope test $t = 2.43$, $p < .05$). Figure 4.3c shows a positive relation between emotional job demands and cognitive strain both at low levels of cognitive job resources (-1 SD; simple slope test $t = 4.02$, $p < .01$) as well as at high levels of cognitive job resources (+1 SD; simple slope test $t = 3.14$, $p < .01$). However, cognitive strain was higher at high levels of cognitive job resources than at low levels of cognitive job resources, suggesting a reversed buffering effect. Figure 4.3f also shows a reversed effect of job demands and job resources: a negative relation between emotional job demands and cognitive well-being at high levels of cognitive job resources (+1 SD) and a positive relation between emotional job demands and cognitive well-being at low levels of cognitive job resources (-1 SD). Both slopes however, did not reach significance in the post hoc tests (simple slope test at +1 SD, $t = 1.10$, $p = ns$; simple slope test at -1 SD, $t = 1.45$, $p = ns$).
In summary, we detected 11 significant interactions of the 54 possible interactions, which is 20.3 %. Of these, 8 interactions represented valid interaction effects (i.e., in line with general stress theory), and 3 interactions resembled reversed interaction effects (i.e., contrary to general stress theory). Specifically, looking at the valid interaction effects, we detected 2 out of 6 tested triple-match interactions (33.3 %), 3 out of 12 double-match interactions of common kind (25.0 %), 3 out of 24 double-match interactions of extended kind (12.5 %), and 0 out of 12 tested non-match interactions (0.0 %). The overall pattern of interactions is depicted in Table 4.4.
Table 4.4. Summary of Analyses of Interaction Effects With Different Patterns of Match.

<table>
<thead>
<tr>
<th>Interaction pattern</th>
<th>Valid interactions</th>
<th>Reversed interactions</th>
<th>Tested interactions</th>
<th>Ratio of valid interactions / interactions tested (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple-Match</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>33.3 %</td>
</tr>
<tr>
<td>Double-Match (both kinds)</td>
<td>6</td>
<td>3</td>
<td>36</td>
<td>16.7 %</td>
</tr>
<tr>
<td>Double-Match (common kind)</td>
<td>3</td>
<td>0</td>
<td>12</td>
<td>25.0 %</td>
</tr>
<tr>
<td>Double-Match (extended kind)</td>
<td>3</td>
<td>3</td>
<td>24</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Non-match</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0.0 %</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The present study investigates the core principles of the Demand-Induced Strain Compensation (DISC) Model; that is, the triple-match principle as well as the compensation and balance principles. By analyzing six assumed outcomes (i.e., three negative and three positive outcomes of successively cognitive, emotional, and physical kind), this study is the first longitudinal DISC study that fully tested the DISC Model using structural equation modeling. Moreover, the use of a more heterogeneous sample of Belgian employees from the technology sector (non-human services) also distinguishes the present study from previous longitudinal DISC studies by Chrisopoulos et al. (2010) and De Jonge and Dormann (2006).

The first and core hypothesis of this study was related to a thorough test of the triple-match principle. This hypothesis stated that the strongest, interactive relationships between job demands and job resources are observed when job demands and job resources and outcomes are based on qualitatively identical dimensions. The current study found 2 out of 6 tested triple-match interactions, which is considerably more than expected by chance. Furthermore, 6 out of 36 double-match interactions were found. Three out of 12 double-
matches of common kind (i.e., between a job demand and a job resource) were found and 3 out of 24 double-matches of extended kind (i.e., between a job resource or a job demand, on the one hand, and a job-related outcome, on the other). None of the 12 tested non-match interactions were significant. The triple-match principle is therefore confirmed in this study. Our findings are similar to the longitudinal findings of both Chrisopoulos et al. (2010) and De Jonge and Dormann (2006), and the cross-sectional findings of Van den Tooren and De Jonge (2008) with regard to the pattern of significant interactions found. Similarly to these three studies, our results showed that the likelihood of finding interaction effects was nearly linearly related to the degree of match.

Confirming the triple-match principle in yet another sector (technology sector) and in non-human service workers brings this core principle of the DISC Model a step closer to generalization. However, it needs to be noted that the triple-match principle is a probabilistic principle (cf. De Jonge et al., 2008). Triple-match interactions are considered to appear most likely, but not solely in this type of research. Findings other than triple-match interactions are therefore no counterevidence to the model under study.

Apart from the as most likely hypothesized triple-match interactions, six more theoretically valid interactions between job demands and job resources were found. The pattern of double-matches of common kind and double-matches of extended kind is described above. However, looking closely at the six significant interaction effects found, it is remarkable that, in five of the six cases it is the availability of emotional job resources that moderates the relation between job demands (emotional or cognitive) and job-related outcomes. Earlier studies investigating the DISC core principles have found similar results. Emotional job resources largely comprise aspects of social support. These findings are in line with the Demand-Control-Support Model (Johnson & Hall, 1988; Johnson, Hall, & Theorell, 1989) in which social support was added to the original Job Demand-Control Model (Karasek, 1979). Social support is assumed to be a key variable moderating the impact of job characteristics such as psychological demands and job control on employee health and well-being.
The dominant role of emotional job resources in the prediction of employee health and well-being, reflected in the relatively large amount of significant interactions including emotional job resources, can further be explained by the fact that emotional job resources might be perceived by employees as a panacea against various types of job demands (cf. Cohen & Wills, 1985). This has been argued before in a human service context (e.g., Van den Tooren & De Jonge, 2010), but seems to apply to a non-human service context, too. Indeed, workers in the technology sector faced with either cognitive or physical job demands will often benefit from emotional support from colleagues or supervisors, despite the fact that the probabilistic triple-match principle would argue that successively cognitive and physical resources are more likely to have such an effect on employee health and well-being.

The second hypothesis refers to the compensation principle. Specifically, we expected positive associations between job demands and (matching) strain outcomes, which are weakened by the availability of matching job resources. Results partly confirm this hypothesis. A significant interaction effect was found between cognitive job demands, cognitive job resources and cognitive job strain (cf. Figure 4.1a). The positive relation between cognitive job demands and cognitive strain only remained if cognitive resources were low. This reflects the important role of cognitive job resources when dealing with stressful cognitive job demands. However, regarding physical and emotional strain, we found no empirical support for stress buffering effects of matching job resources when employees are confronted with physical and emotional job demands, respectively.

Our third hypothesis relates to the balance principle. Specifically, we expected positive associations between job demands and (matching) well-being outcomes, which are strengthened by the availability of matching job resources. Findings do not support hypothesis 3. Although we find a significant interaction effect of emotional job demands and emotional job resources on emotional well-being, the direction of the effect is contrary to our hypothesis. Instead of finding a positive relation between emotional job demands and emotional well-
being, strengthened by the availability of emotional job resources, a negative relation was found (cf. Figure 4.1b). However, this negative relation was weakened by the availability of emotional job resources. This remarkable finding could reflect the fact that employees in the technology sector, on average, are less exposed to emotional job demands or that they perceive high emotional job demands as more threatening or differently than employees in other sectors (cf. Lazarus & Folkman, 1984). Other explanations of this finding could be that most technological work requires less emotional effort or emotional labor. Or, more in general, it could be that technological workers’ emotional well-being is also determined by other, non-work related antecedents not included in this study. Results regarding the expected well-being enhancing effects of cognitive and physical job resources were also not in line with our third hypothesis.

LIMITATIONS AND FURTHER RESEARCH

Although the present study has a number of strengths (e.g., its longitudinal design, unique study sample, and multivariate analyses investigating all core DISC principles in one single study), some limitations and suggestions for further research have to be mentioned as well. First, the present study relies on self-report data, which might increase common method bias leading us to overestimate the size of the relationships (Semmer, Grebner, & Elfèring, 2004). Second, the present study investigated the availability of job resources only. Although the availability may well be enough to have a moderating effect on the relation between job demands and health and well-being outcomes, recent research shows the importance of employees’ beliefs about the relevance and use of specific types of job resources (Van den Tooren & De Jonge, 2010). Third, using a specific occupational sector (i.e., technology sector) and a single company for the collection of our data entails both strengths and weaknesses. An advantage is that possible confounders at macro-level (cf. socio-economic factors) and meso-level (cf. organizational climate) are eliminated. A limitation, however, is that the variation in job characteristics might be restricted, in comparison with multi-industry studies. In order to
further generalize the TMP and other findings of this study, more research in other sectors and even more multi-occupational groups is needed. Finally, though the results partially confirm our hypotheses, it needs to be noted that a relatively small amount of significant interactions was found in this study. Only eight (and three reversed) out of 54 possible interactions were significant. Despite our best efforts to comply with best-practice recommendations for estimating interaction effects (Aguinis & Gottfredson, 2010), to avoid type II error, the odds in finding significant interactions are against us (Frese, 1999; McClelland & Judd, 1993).

**CONCLUSION**

In conclusion, this chapter adds to the existing empirical evidence for the DISC Model and its triple-match and compensation principles. Generalizability and relevance of this model in the Belgian technology sector was shown in a longitudinal manner. From a practical perspective, the present study indicates that enhancing specific job resources enables employees to deal with their high job demands. Our results also suggest that employers in the technology sector should be sensitive for offering matching job resources to their employees in order to combat the particular job demands to which they are exposed.
REFERENCES


& H. R. Winefield (Eds.), *Occupational Stress in the Service Professions* (pp. 43 - 74). London: Taylor & Francis.


In the present study, the relation between emotional job demands and emotional exhaustion was investigated as well as the moderating role of emotional job resources and emotional support seeking on this relation. We hypothesized a positive lagged effect of emotional job demands on emotional exhaustion, and proposed that this relation is weakened by the availability of emotional job resources. Further, it was hypothesized that this stress-buffer effect of emotional job resources will be stronger for employees high on emotional support seeking. A two-wave study with a one-year time lag was conducted among employees in the technology sector (n = 711). Results showed that emotional job demands are least likely to result in emotional exhaustion when employees are provided with high emotional job resources and score high on emotional support seeking.

This chapter is largely based on:

Van de Ven, B., Van den Tooren, M., & Vlerick, P. Emotional job resources and emotional support seeking as moderators of the relation between emotional job demands and emotional exhaustion: a two-wave panel study. Manuscript submitted for publication.
INTRODUCTION

Emotional exhaustion, characterized by a lack of energy, negative affect, and a perception that one’s emotional resources have been depleted (Maslach & Jackson, 1986) is a core element of burnout in employees (Leiter & Maslach, 2004). Previous research has connected emotional exhaustion to a large number of individual and organizational outcomes such as cardiovascular diseases and job performance (Wright & Cropanzano, 1998). Two main characteristics of the work environment that have shown to be related to emotional exhaustion are emotional job demands and emotional job resources (De Jonge, Le Blanc, Peeters, & Noordam, 2008). Emotional job demands are work-related tasks that require emotional effort (e.g. anger control). Emotional job resources are sources of emotional support that can be employed to deal with job demands (e.g. a listening ear from colleagues or supervisors). There is a positive relation between emotional job demands and emotional exhaustion that becomes weaker when the availability of emotional job resources increases (De Jonge & Dormann, 2006). Several studies have investigated this relation between emotional job demands, emotional job resources, and emotional exhaustion. Though some studies found empirical support, inconsistency in findings remains an issue (for an overview, cf. Van den Tooren, de Jonge, & Dormann, 2011). One possible explanation for these mixed results is that personal characteristics, such as ones tendency to seek emotional job resources, have been studied less in this literature. It is likely, though, that employees who actively seek emotional job resources will benefit from these resources when they are available, and suffer when these resources are not provided in the work environment. In other words, emotional support seeking may moderate the relation between emotional job demands, emotional job resources, and emotional exhaustion.

Therefore, the aim of the current study is to test the main and interaction effects of emotional job demands and emotional job resources on emotional exhaustion, and to investigate the moderating role of emotional support seeking. While previous research is often characterized by cross-sectional designs and
homogeneous samples from human service sectors (Van den Tooren, et al., 2011), the present study has a two-wave longitudinal design with a one-year time lag and focuses on a large and heterogeneous sample in the technology sector.

EMOTION WORK IN THE TECHNOLOGY SECTOR

The technology sector consists of many fast-paced firms, a variety of occupational groups and many very specialized workers from which a strong personal engagement in work is required. In the last few decennia there has been a rise in the technology sector, mainly in industrialized countries (Arvidsson, et al., 2006). Employees in the technology sector no longer work on technological developments only. They are also involved in customer-related services (Rutner, Riemenschneider, O'Leary-Kelly, & Hardgrave, 2011). As a result, employees in the technology sector are dealing more and more often with clients who may, for instance, have unrealistic expectations or get easily angered towards them. Attempts to stay friendly and to suppress one’s negative emotions during interactions with clients require a lot of emotional effort. Eventually, these emotional job demands can lead to emotional exhaustion, which is one of the core elements of employee burnout (Leiter & Maslach, 2004).

EMOTIONAL EXHAUSTION

Emotional exhaustion is characterized by a lack of energy, negative affect, and a perception that one’s emotional resources have been depleted (Maslach & Jackson, 1986). It is distinct from physical exhaustion or mental fatigue (Enzmann, 1994 as cited in Bakker, Demerouti, & Schaufeli, 2002).

Emotional exhaustion has important implications for both the quality of work life and for optimal organizational functioning (Wright & Cropanzano, 1998). From an employee perspective, prior research has found relationships between emotional exhaustion and depression (Hart & Cooper, 2001), somatic difficulties such as colds, gastro-intestinal problems, headaches and sleep
disturbances (Belcastro & Hays, 1984), cardiovascular diseases (Toppinen-Tanner, Ojajarvi, Vaananen, Kalimo, & Jappinen, 2005), and musculoskeletal diseases (Honkonen, et al., 2006). Emotional exhaustion can even transfer from employees to their intimate partners at home and indirectly influence the partner’s health (Bakker, 2009). From the employers’ perspective, research has shown that emotional exhaustion can lead to an increase in absenteeism (Borritz, Rugulies, Christensen, Villadsen, & Kristensen, 2006), turnover intentions (Cropanzano, Rupp, & Byrne, 2003), actual turnover (Wright & Cropanzano, 1998), a decrease in organizational citizenship behavior (Cropanzano, et al., 2003), and a decrease in job performance (Janssen, Lam, & Huang, 2010).

In a wide range of occupations emotional job demands have been found to have a positive relation with emotional exhaustion (cf. Zapf, 2002, for a review). However, some studies did not find any association between emotional job demands and stress-reactions such as emotional exhaustion (e.g. Cordes, Dougherty, & Blum, 1997; Peeters & Le Blanc, 2001). Therefore, the first aim of the present study was to test the proposed main effect of emotional job demands on emotional exhaustion one year later.

Hypothesis 1: There is a lagged positive relation between emotional job demands and emotional exhaustion.

In addition to the positive association between job demands and job strain, previous research has demonstrated that job resources play an important role as moderators of the relation between job demands and job strain (Kahn & Byosiere, 1992; Karasek & Theorell, 1990; Siegrist, 1996). More specifically, it has been shown that job resources can moderate the relation between job demands and employee outcomes, such that high job demands result in high job strain, unless employees have sufficient job resources to cope with their demanding job (cf. Demerouti, Bakker, de Jonge, Janssen, & Schaufeli, 2001; Karasek, 1979). De Jonge and Dormann (2003, 2006) suggested a theoretical refinement of the moderating role of job resources on the relation between job demands and health and well-being outcomes by introducing the so-called
triple-match principle. This principle proposes that the strongest, interactive relationships between job demands and job resources are observed when job demands, job resources, and outcome variables are based on qualitatively identical dimensions (i.e. a cognitive, an emotional or a physical dimension; cf. Hockey, 2000). In other words, there should both be a match between job demands and job resources on the one hand (cf. Frese, 1999), and a match between job demands/resources and outcomes on the other hand. In line with the triple-match principle, it is hypothesized that:

**Hypothesis 2**: The lagged relationship between emotional job demands and emotional exhaustion will be moderated by emotional job resources, such that this relationship will be weaker for employees with high emotional job resources than employees with low emotional job resources (two-way interaction).

Apart from the above mentioned work characteristics (i.e. emotional job demands and emotional job resources), personal characteristics may also play a moderating role in the prediction of emotional exhaustion (Cooper, Dewe, & O'Driscoll, 2001). More specifically, elaborating on the triple-match principle (De Jonge & Dormann, 2006), we hypothesize that matching personal characteristics (i.e. emotional support seeking) will moderate the stress-buffering effect of emotional job resources on the relation between emotional job demands and emotional exhaustion (cf. Daniels, Harris, & Briner, 2004; Frese, 1999). Emotional support seeking is a form of problem-focused coping and is aimed at evoking empathy and companionship from one’s social network to assist in the management of emotional stressors and the maintenance of one’s emotional equilibrium. (Greenglass, Schwarzer, Jakubiec, Fiksenbaum, & Taubert, 1999). As empathy and companionship from colleagues is what typically constitutes emotional job resources (cf. Peeters & Le Blanc, 2001; Tuckey & Hayward, 2011), it follows that employees who score high on emotional support seeking are more likely to use emotional job resources and, as a result, to benefit from the stress-buffering effect of emotional job resources than employees who score low on emotional support seeking. One may argue
that the mere perception that one has sufficient emotional job resources to cope with emotional job demands may already offset the impact of job demands (cf. Cohen & Wills, 1985). However, because employees high on emotional support seeking are keen on emotional job resources, it seems reasonable to assume that this will be first and foremost the case for these employees. Therefore, a three-way interaction effect between emotional job demands, emotional job resources, and emotional support seeking in the prediction of emotional exhaustion is hypothesized:

Hypothesis 3: The relationship between emotional job demands, emotional job resources, and emotional exhaustion will be moderated by emotional support seeking, such that the buffering effect of emotional job resources will be stronger for employees who score high on emotional support seeking than for employees who score low on emotional support seeking (three-way interaction).

In sum, the present chapter adds to the existing literature by investigating the lagged relation between emotional job demands and emotional exhaustion as well as the moderating role of emotional job resources and emotional support seeking on this relation. The present study will investigate these research questions in a large, heterogeneous occupational sample in the technology sector.

**METHOD**

**PROCEDURE AND PARTICIPANTS**

Data were gathered in a large Belgian organization in the technology sector using a two-wave panel survey with a one-year time lag. This time lag was chosen to control for possible seasonal fluctuations and to give natural changes a fair chance to occur (cf. De Jonge, et al., 2001; De Lange, Taris, Kompier, Houtman, & Bongers, 2004). Both at Time 1 (4912 employees) and at Time 2 (4622 employees) all participants received a paper-and-pencil questionnaire with an accompanying letter that explained the purpose of the
study. Voluntary participation was emphasized and confidentiality was guaranteed. Three weeks later, a reminder letter was sent to increase response rates. At Time 1, 1,533 employees returned a completed questionnaire (response rate of 31.2 %) and at Time 2, 1,254 employees responded (response rate of 27.1 %). Note that Time 2 questionnaires were sent to all employees, regardless of whether they had completed and returned a Time 1 questionnaire. The final panel sample (respondents to both panels) consisted of 711 respondents (46.4 % of the initial Time 1 sample). Management representatives in the organization indicated that the demographic characteristics of the sample were consistent with those of their organization population at the time of data collection.

Potential effects of attrition in the longitudinal data were assessed by a multiple logistic regression analysis. More specifically, it was determined whether participation at Time 2 was related to any of the Time 1 variables under study (Goodman & Blum, 1996). Because the Time 1 variables did not predict participation at Time 2, it was concluded that there was no attrition. In the final sample 237 employees (33.3 %) were French speaking versus 474 Dutch speakers (67.3 %). A vast majority was male (94.5 %) and the mean age at Time 1 was 44.49 years ($SD = 9.39$). Most respondents were married or lived together with a partner (82.8 %). Lower educated and higher educated employees comprised 66.8 % and 33.2 % of the sample, respectively. Mean seniority at Time 1 was 16.71 years ($SD = 10.84$). The sample consisted of 259 employees with leading responsibilities at Time 1 (36.5 %).

**Measures**

*Emotional job demands and emotional job resources* were measured using the DISC Questionnaire (DISQ) 2.0 (De Jonge, et al., 2007). Earlier versions of this questionnaire have shown good psychometrical properties in previous studies (De Jonge & Peeters, 2009; Van den Tooren & De Jonge, 2008). Emotional job demands were measured with six items. An example item is “having to do a lot of emotionally draining work”. Emotional job resources were measured with five items. An example item is “getting emotional support from others (e.g. clients, colleagues or supervisors) when a threatening situation
at work occurs”. Items were scored on a 5-point frequency scale, ranging from 1 (never or very rarely) to 5 (very often or always). The Cronbach’s alpha for emotional job demands was .83, and the Cronbach’s alpha for emotional job resources was .81.

**Emotional support seeking** was measured with five items derived from the emotional support seeking scale in the proactive coping inventory (Greenglass, et al., 1999). Greenglass (2002) reports acceptable psychometric properties for the subscales including their cross-cultural validity. An example item is “When I'm depressed at work I get out and talk to others.” Items were scored on a 4-point frequency scale, ranging from 1 (completely disagree) to 4 (completely agree). Cronbach’s alpha was .80.

**Emotional exhaustion** was assessed with a subscale of the well-validated Maslach Burnout Inventory General Survey (Maslach & Jackson, 1986; Schaufeli & Van Dierendonck, 2000). The scale contained five items with a 7-point response scale ranging from 0 (never) to 6 (always, daily). An example item is: “I feel emotionally drained from my work”. Internal consistencies for the scale were .87 at Time 1 and .88 at Time 2.

Measures were adopted or translated to the native language of the participants (Dutch or French), using the multistage translation/back-translation procedure (Brislin, 1980).

**Statistical Analyses**

To explore the main and interactive effects of emotional job demands, emotional job resources and emotional support seeking on emotional exhaustion one year later, a hierarchical regression with emotional exhaustion as criterion was conducted following procedures outlined by Aiken and West (1991). Prior to conducting the analysis, interaction terms were calculated by creating product terms from the standardized main effects (i.e. emotional job demands, emotional job resources, and emotional support seeking) to avoid multicollinearity (Aiken & West, 1991; Dawson & Richter, 2006). In the first step of the analysis the control variables age, gender and Time 1 emotional...
exhaustion were entered into the model. The main effects of emotional job demands and resources, and emotional support seeking were entered in the second step and all possible two-way interaction terms between emotional job demands, emotional job resources, and emotional support seeking were entered in the third step. Finally, the three-way interaction between emotional job demands, emotional job resources, and emotional support seeking was added in the fourth and final step.

**RESULTS**

Descriptive statistics and Pearson product moment correlations of all variables are displayed in Table 5.1.

| Table 5.1. Means, standard deviations (SD), and Pearson intercorrelations (n = 711). |
|---------------------------------|-----|-----|-----|-----|-----|
| 1. Emotional Job Demands (Time 1) | 2.87 | 0.71 | – | – | – |
| 2. Emotional Job Resources (Time 1) | 2.96 | 0.74 | - .15** | – | – | – |
| 3. Emotional Support Seeking (Time 1) | 2.19 | 0.62 | -.05 | .46** | – | – |
| 4. Emotional Exhaustion (Time 1) | 2.90 | 1.19 | .34** | -.24** | -.14** | – |
| 5. Emotional Exhaustion (Time 2) | 2.88 | 1.21 | .29** | -.16** | -.10** | .69** |

*Note.** p < .01.

In general, the employees in our sample had moderate levels of emotional job demands (M = 2.87, SD = 0.71), emotional job resources (M = 2.96, SD = 0.74), and emotional support seeking (M = 2.19, SD = 0.62) at Time 1. Additionally, they experienced rather high levels of emotional exhaustion (cf. Schaufeli & Van Dierendonck, 2000), both at Time 1 (M = 2.90, SD = 1.19) and at Time 2 (M = 2.88, SD = 1.21). Pearson product moment correlations revealed that emotional job demands at Time 1 were positively related to emotional exhaustion, both at Time 1 (r = .34, p < .01) and at Time 2 (r = .29, p < .01). By contrast, Time 1 emotional job resources were negatively related to emotional exhaustion, both at Time 1 (r = -.24, p < .01) and at Time 2 (r = -.16, p < .01). Similarly, emotional support seeking was also negatively related to emotional exhaustion, both at Time 1 (r = -.14, p < .01) and at Time 2 (r = -.10, p < .01).
Finally Time 1 and Time 2 emotional exhaustion were highly correlated ($r = .69, p < .01$).

Table 5.2. Hierarchical regression of Time 2 emotional exhaustion on Time 1 emotional job demands, Time 1 emotional job resources, and Time 1 emotional support seeking.

<table>
<thead>
<tr>
<th></th>
<th>Time 2 Emotional Exhaustion</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Step 1</td>
<td>Step 2</td>
<td>Step 3</td>
<td>Step 4</td>
</tr>
<tr>
<td><strong>Control variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>- .003</td>
<td>- .003</td>
<td>- .003</td>
<td>- .004</td>
</tr>
<tr>
<td>Gender (0 = male, 1 = female)</td>
<td>- .120</td>
<td>- .118</td>
<td>- .124</td>
<td>- .108</td>
</tr>
<tr>
<td>Time 1 Emotional Exhaustion</td>
<td>.702**</td>
<td>.687**</td>
<td>.689**</td>
<td>.686**</td>
</tr>
<tr>
<td><strong>Main effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1 Emotional Job Demands (ED)</td>
<td>–</td>
<td>.060#</td>
<td>.061#</td>
<td>.101**</td>
</tr>
<tr>
<td>Time 1 Emotional Job Resources</td>
<td>–</td>
<td>.023</td>
<td>.026</td>
<td>.027</td>
</tr>
<tr>
<td>Time 1 Emotional Support Seeking</td>
<td>–</td>
<td>- .018</td>
<td>- .020</td>
<td>- .028</td>
</tr>
<tr>
<td><strong>Two Way Interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDxER</td>
<td>–</td>
<td>–</td>
<td>- .014</td>
<td>- .024</td>
</tr>
<tr>
<td>EDxESS</td>
<td>–</td>
<td>–</td>
<td>.083*</td>
<td>.080*</td>
</tr>
<tr>
<td>ERxESS</td>
<td>–</td>
<td>–</td>
<td>- .017</td>
<td>- .013</td>
</tr>
<tr>
<td><strong>Three-way interaction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDxERxESS</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>- .065*</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.478</td>
<td>.480</td>
<td>.485</td>
<td>.490</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>.476</td>
<td>.476</td>
<td>.479</td>
<td>.483</td>
</tr>
<tr>
<td>$\Delta R^2$</td>
<td>.478**</td>
<td>.002</td>
<td>.005#</td>
<td>.005*</td>
</tr>
</tbody>
</table>

*Note.* The B values in the table are unstandardized regression weights; # $p < .10$, * $p < .05$, ** $p < .01$

Table 5.2 displays the results of the hierarchical regression analysis. It was shown that the fourth model, including the three-way interaction, was the best model compared to the model with only main effects and the model with main effects and two-way interactions, according to the incremental F-test procedure ($F_{inc} (1.692) = 6.35, p < .05$). In this model, emotional job demands are positively related to emotional exhaustion ($B = .10, p < .01$), confirming our first hypothesis. Contrary to our expectations in hypothesis 2, the interaction
between emotional job demands and emotional job resources did not reach statistical significance.

As far as hypothesis 3 is concerned, results revealed that emotional support seeking moderated the relation between emotional job demands, emotional job resources, and emotional exhaustion ($B = -.07, p < .05$). This is in line with our predictions. To find out whether emotional support seeking moderated the stress-buffering effect of emotional job resources in the predicted direction, the four regression lines were plotted in Figure 5.1 following recommendations by Aiken and West (1991). The two regression lines for low emotional support seeking are plotted on the left side of Figure 5.1 and the two regression lines for high emotional support seeking on the right side of Figure 5.1. Next, slope difference tests were conducted to analyze which of the slopes in Figure 5.1 significantly differed from each other (Dawson & Richter, 2006). As can be inferred from the parallel lines on the left side of Figure 5.1, results revealed that at low levels of emotional support seeking the slopes of low and high emotional job resources did not differ significantly from each other (slope difference test: $t = 0.17, p = ns$). In contrast, at high levels of emotional support seeking the slopes of low and high emotional job resources did differ significantly from each other. More specifically, emotional job resources buffered the relation between emotional job demands and emotional exhaustion (slope difference test: $t = -2.92, p < .01$). Because the stress-buffering effect of emotional job resources only seems to apply to employees who score high on emotional support seeking, the proposed moderating effect of emotional support seeking in hypothesis 3 was not only supported; it was even stronger than expected.
Figure 5.1. Three-way interaction effect of Time 1 (T1) emotional job demands, Time 1 emotional job resources and Time 1 emotional support seeking on Time 2 (T2) emotional exhaustion
DISCUSSION

The goals of the present study were to investigate the main effect of emotional job demands on emotional exhaustion one year later, as well as the moderating roles of emotional job resources and emotional support seeking on this relation. The first hypothesis, which stated that emotional job demands would be positively related to emotional exhaustion, was confirmed by our analysis. This finding is in line with previous studies (Zapf & Holz, 2006; Zapf, Seifert, Schmutte, Mertini, & Holz, 2001) and shows that emotional job demands do also deserve careful attention in the technology sector, because they can result in emotional exhaustion.

Our second hypothesis stated that the lagged positive relationship between emotional job demands and emotional exhaustion would be weakened by the availability of emotional job resources. This hypothesized interaction between emotional job demands and emotional job resources did not reach statistical significance and could therefore not be confirmed. This is in line with the study by Van Vegchel, De Jonge, Söderfeldt, Dormann, and Schaufeli (2004), in which the moderating role of emotional job resources (social support) on the relationship between emotional job demands and emotional exhaustion was not found in a large sample of employees from the Social Insurance Organization in Sweden. A first possible explanation for this lack of empirical support in our study is that emotional job resources were measured at a too global level. In a recent study by Tuckey and Hayward (2011), for instance, general emotional resources and an occupation-specific emotional resource were tested as potential buffers against the negative effects of emotional demands on volunteer fire fighters. Results revealed that the occupation-specific resource had the most consistent protective effects against poor psychological health, whereas the effects of global emotional resources were not as consistent. Possibly, our results would have supported hypothesis 2 if we had measured more occupation-specific job resources. A second possible explanation for why we did not find support for the stress-buffering effect of emotional job resources
was already proposed in hypothesis 3; emotional support seeking moderates the relation between emotional job demands, emotional job resources, and emotional exhaustion. Possibly, the stress-buffering effect of emotional job resources was suppressed due to individual differences in emotional support seeking. Results for hypothesis 3 indeed showed a three-way interaction effect between emotional job demands, emotional job resources and emotional support seeking on emotional exhaustion. Slope difference tests revealed that the buffering effect of emotional job resources only applies to employees who score high on emotional support seeking. As such, the moderating effect of emotional support seeking was stronger than expected, suggesting that the lack of support for hypothesis 2 could indeed be explained by individual differences in emotional support seeking. However, one should be careful interpreting these results, as our finding contradicts previous research by Van den Tooren, De Jonge, Vlerick, Daniels, and Van de Ven (in press). In their study, no evidence was found for the moderating effect of emotional active coping style on the longitudinal relation between emotional job demands, emotional job resources, and emotional exhaustion. One possible explanation for these mixed results is that the present study differs from Van den Tooren et al. (in press) in using a more heterogeneous sample of technology employees who were on average more experienced than the beginning teachers in their study. Furthermore, in contrast to the study by Van den Tooren et al. (in press), in the present study the moderator variables were all continuous (rather than dichotomous), resulting in less statistical power problems.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

There are some limitations in this study that need to be acknowledged. A first limitation of the present study is that there was little variance left to explain after the inclusion of Time 1 emotional exhaustion in the first step of the hierarchical regression analyses. Though this may have interfered with finding significant results, it should be noted that we did find a significant three-way interaction. Given our conservative way of testing (i.e. including Time 1 emotional exhaustion as control variable) this finding emphasizes the strength
of the moderating effect of emotional job resources and emotional support seeking on the relation between emotional job demands and emotional exhaustion, indicating that this effect was quite strong. A second limitation of the present study is its reliance on self-report measures. As a result, common method variance might have affected our results. However, in line with recommendations of Brannick, Chan, Conway, Lance, and Spector (2010) we took precautions to reduce possible sources of common method variance (e.g. protecting participants’ anonymity, using different response scales and anchors, using valid scales from previous research). A final limitation of the current study is that there could be a sampling bias. To determine the possible influence of attrition effects, it was investigated whether participation at Time 2 was related to the Time 1 variables under study (Goodman & Blum, 1996). Though results revealed that there were no attrition effects, we cannot rule out with certainty that high stressor levels may have influenced participation in our study (Barr, Spitzmuller, & Stuebing, 2008).

**Practical Implications and Conclusion**

The current findings have some practical implications for employees in the technology sector. Employees who are often confronted with high emotional job demands and who have low job resources seem to be at risk for emotional exhaustion. This seems, however, first and foremost the case for those employees who score high on emotional support seeking. As decreasing emotional job demands is often difficult or even impossible, organizations could focus on increasing emotional job resources. One way to accomplish this would be to enable employees to talk to colleagues and supervisors about client interactions, for instance, during (specially arranged) work meetings. One should keep in mind though that employees high on emotional support seeking will probably use this opportunity more often and more effectively than employees low on emotional support seeking. On the other hand, meetings that promote interactions among colleagues may allow employees high on emotional support seeking to serve as a role model for employees low on emotional support seeking.
To conclude, the current study shows that employees in the technology sector are faced with emotional job demands and that these demands may have deleterious effects on their emotional well-being. To prevent emotional exhaustion among technology employees, emotional job resources are of great importance. However, this study also revealed that mainly employees who score high on emotional support seeking are likely to benefit from these resources. Therefore, job redesign interventions should not merely evolve around the availability of emotional job resources in the work environment, but also around ways to stimulate employees to evoke empathy and companionship from their social network at work (i.e. colleagues and supervisors). Particularly with respect to this latter issue, an important role seems to be reserved for future research.
REFERENCES


Peeters, M. C., & Le Blanc, P. M. (2001). Towards a match between job demands and sources of social support: A study among oncology care


CHAPTER 6
GENERAL DISCUSSION

This final chapter provides a summary and critical discussion of the main findings from the empirical studies in Chapter 2 through Chapter 5. The four main research objectives of this doctoral dissertation (cf. Chapter 1) will guide this overview and general discussion. The main research objectives were (1) to test the generalizability and relevance of the triple-match principle in the technology sector, (2) to investigate the balance principle, (3) to investigate the compensation principle, and (4) to investigate the role of personal characteristics on the relations between work characteristics and job strain. Furthermore, some strengths and limitations are discussed and directions for future research are identified. The chapter concludes with an overview of theoretical and practical implications.
RESEARCH OVERVIEW

This doctoral dissertation started with a research-based overview of the literature on job demands and job resources in the prediction of job strain and employee well-being. More specific, the Demand-Induced Strain Compensation (DISC) Model (De Jonge & Dormann, 2003, 2006) was discussed both in terms of what is known from the current literature, as in terms of possibilities for further research. In the present dissertation four main research questions and research objectives were addressed. The first research objective was to test generalizability and relevance of the triple-match principle (TMP) in the technology sector. The second research objective was to investigate the, previously less studied, balance principle in the technology sector (cf. Van den Tooren, De Jonge, & Dormann, 2011). The third research objective was to investigate the compensation principle in the technology sector. The fourth research objective was to investigate the role of personal characteristics on the relations between work characteristics and job strain. The following paragraphs briefly summarize the findings of the four empirical chapters in this dissertation in terms of these four objectives.

RESEARCH OBJECTIVE 1: TRIPLE-MATCH PRINCIPLE

With regard to the first research objective, two empirical studies are reported in the present doctoral dissertation (i.e. Chapters 2, and 4). In order to find evidence for the TMP, we expected that the likelihood of finding a valid significant interaction effect between job demands and job resources in the prediction of job related outcomes increased as the number of matching variables increased. In Chapter 2, a cross-sectional study among a heterogeneous sample of employees in the technology sector investigated this issue of match in a large sample of employees in the technology sector. Results regarding the TMP provided partial support. More specific, 33.3 % of triple-match interactions were significant, while only 11.1 % of double matches (of common and extended kind) and 16.7 % of non-matching interactions were significant. In other words, triple-match interactions are more likely to occur than other kinds of interactions, but non-matching interactions do occur more
often than double-matches. In Table 6.1 an overview of valid interactions (in boldface) and tested interactions is provided.

**Table 6.1. Overview of valid interactions / interactions tested in Chapter 2.**

<table>
<thead>
<tr>
<th></th>
<th>Cognitive Failure</th>
<th>Emotional Exhaustion</th>
<th>Physical Health Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x</td>
<td>TM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Cognitive JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional JD x</td>
<td>DMe</td>
<td>TM</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>TM</td>
</tr>
<tr>
<td>Physical JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>NM</td>
</tr>
<tr>
<td>Emotional JR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive JD x</td>
<td>DMe</td>
<td>NM</td>
<td>DMe</td>
</tr>
<tr>
<td>Physical JR</td>
<td></td>
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</tr>
<tr>
<td>Emotional JD x</td>
<td>DMe</td>
<td>DMe</td>
<td>NM</td>
</tr>
<tr>
<td>Cognitive JR</td>
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<tr>
<td>Emotional JD x</td>
<td>NM</td>
<td>DMe</td>
<td>DMe</td>
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<tr>
<td>Physical JR</td>
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<tr>
<td>Physical JD x</td>
<td>DMe</td>
<td>NM</td>
<td>DMe</td>
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<tr>
<td>Cognitive JR</td>
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</tr>
<tr>
<td>Physical JD x</td>
<td>NM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Emotional JR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. JD = job demands; JR = job resources; TM = triple-match interaction; DMc = double-match interaction of common kind; DMe = double-match interaction of extended kind; NM = non-matching interaction; Boldface = significant valid interactions found in Chapter 2.

In Chapter 4, a two-wave panel study is reported that investigated the issue of match in the technology sector in a longitudinal manner, with six different outcome variables (i.e. three job strain outcomes and three employee well-being outcomes). Our findings in this chapter were similar to the longitudinal findings of both Chrisopoulos, Dollard, Winefield, and Dormann (2010) and De Jonge and Dormann (2006), and the cross-sectional findings of Van den Tooren and De Jonge (2008) with regard to the pattern of significant interactions found. Similarly to these three studies, the results in Chapter 4 showed that the likelihood of finding interaction effects was nearly linearly related to the degree of match. Table 6.2 provides an overview of valid and tested interactions (in boldface) in Chapter 4.
Table 6.2. Overview of valid interactions / interactions tested in Chapter 4.

<table>
<thead>
<tr>
<th></th>
<th>Cognitive strain</th>
<th>Emotional strain</th>
<th>Physical strain</th>
<th>Cognitive well-being</th>
<th>Emotional well-being</th>
<th>Physical well-being</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive JD x Cognitive Jr</td>
<td>TM</td>
<td>DMe</td>
<td>DMe</td>
<td>TM</td>
<td>DMe</td>
<td>DMe</td>
</tr>
<tr>
<td>Cognitive JD x Emotional Jr</td>
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<tr>
<td>Emotional JD x Cognitive Jr</td>
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<td>Emotional JD x Emotional Jr</td>
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<tr>
<td>Physical JD x Cognitive Jr</td>
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<tr>
<td>Physical JD x Emotional Jr</td>
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<tr>
<td>Physical JD x Physical Jr</td>
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<tr>
<td>Cognitive JD x Emotional Jr</td>
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<td>Emotional JD x Cognitive Jr</td>
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<td>Emotional JD x Emotional Jr</td>
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<tr>
<td>Physical JD x Cognitive Jr</td>
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<tr>
<td>Physical JD x Emotional Jr</td>
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<tr>
<td>Physical JD x Physical Jr</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* JD = job demands; JR = job resources; TM = triple-match interaction; DMe = double-match interaction of common kind; DMe = double-match interaction of extended kind; NM = non-matching interaction; Boldface = significant valid interactions found in Chapter 4.

The empirical results in Chapter 2 and Chapter 4 lead us to conclude that the TMP holds in the technology sector. Confirming the TMP in yet another sector (i.e. technology sector) and in non-human service workers brings this core principle of the DISC Model a step closer to generalization. However, as we did not find empirical evidence for a physical triple-match interaction throughout this dissertation, further research is needed to identify the impact of physical job demands on employee well-being and job strain, and to identify which kind of job resources are suitable for or actually used by employees in the technology sector in order to deal effectively with their physical job demands.
Apart from the as most likely hypothesized triple-match interactions, other valid interactions between job demands and job resources are also found in the studies in Chapter 2 and Chapter 4. It needs to be noted that the triple-match principle is a probabilistic principle (cf. De Jonge, Dormann, & Van den Tooren, 2008). Triple-match interactions are considered to appear most likely, but not solely in this type of research. Findings other than triple-match interactions are therefore no counterevidence to the DISC Model.

Concerning these non-triple-match interactions it is remarkable that, both in Chapter 2 and in Chapter 4, emotional job resources often moderate the relation between job demands and job-related outcomes, regardless of whether the job demands or job-related outcomes were cognitive, emotional or physical in nature. Earlier studies investigating the DISC Model have found similar results (Van den Tooren, et al., 2011). Emotional job resources largely comprise aspects of social support. These findings are therefore in line with the Demand-Control-Support model (Johnson & Hall, 1988; Johnson, Hall, & Theorell, 1989), in which social support was added to the original Demand-Control model (Karasek, 1979). Social support is assumed to be a key variable moderating the impact of job characteristics such as psychological demands and job control on employee health and well-being (cf. also Viswesvaran, Sanchez, & Fisher, 1999). The dominant role of emotional job resources in the prediction of employee health and well-being, reflected in the relatively large amount of significant interactions including emotional job resources, can further be explained by the fact that emotional job resources might be perceived by employees as a panacea against various types of job demands (cf. Cohen & Wills, 1985). This has been argued before in a human service context (Van den Tooren & De Jonge, 2010), but seems to apply to a non-human service context, too. Indeed workers in the technology sector faced with either cognitive or physical job demands will often benefit from emotional support from colleagues or supervisors, despite the fact that the probabilistic triple-match principle would argue that successively cognitive and physical resources are more likely to have such an effect on employee health and well-being.
RESEARCH OBJECTIVE 2: BALANCE PRINCIPLE

The second research objective was to investigate the balance principle in the DISC Model within the technology sector. Two studies in the present doctoral dissertation addressed this issue (i.e. Chapters 3 and 4). In Chapter 3, two hypotheses regarding the balance principle were tested. It was hypothesized that the positive relation between informatics’ cognitive job demands and their cognitive well-being (i.e. learning motivation and professional efficacy) would be stronger when cognitive job resources were higher. Results only fully confirmed the hypothesis (i.e. balance principle) concerning professional efficacy. In other words, a positive relation was found between cognitive job demands and professional efficacy. This positive relation was strengthened by the availability of cognitive job resources. In Chapter 4, three hypotheses regarding the balance principle were tested. Specifically, positive associations between job demands and (matching) well-being outcomes, strengthened by the availability of matching job resources, were expected. This hypothesis was tested with regard to cognitive, emotional and physical employee well-being. Findings did not support this hypothesis, thereby not confirming the balance principle in the technology sector in a two-wave panel study.

In sum, regarding the second research objective, we conclude that matching job resources do not (always) enhance employee well-being. In other words, based on our findings in Chapter 3 (i.e. partial support for the balance principle) and Chapter 4 (i.e. no support for the balance principle), we conclude that the balance principle does not seem to hold in the technology sector. As this is in line with previous research overviews of the DISC Model in other sectors (cf. Van den Tooren, et al., 2011), future research should further investigate this issue in order to make definite conclusions about the activation enhancing potential of matching job resources on the relation between job demands and employee well-being.
RESEARCH OBJECTIVE 3: COMPENSATION PRINCIPLE

The third research objective was to investigate the compensation principle in the DISC Model within the technology sector. Two studies in the present doctoral dissertation address this issue (i.e. Chapters 2 and 4). In Chapter 2, three hypotheses regarding the compensation principle were tested. It was hypothesized that the positive relation between job demands and job strain (i.e. cognitive failures, emotional exhaustion and physical health complaints) would be weakened by the availability of matching job resources. Results confirmed the compensation principle with regard to emotional exhaustion. At high levels of emotional job resources, the positive association between emotional job demands and emotional exhaustion became substantially weakened. In Chapter 4, a similar hypothesis was tested in a longitudinal manner for cognitive, emotional and physical job-strain outcomes. Results confirmed the compensation principle with regard to cognitive job strain. The positive relation between cognitive job demands and cognitive strain only remained if cognitive resources were low.

With the study results in the current dissertation we conclude that the compensation principle holds within the technology sector. In other words, the negative effects of particular job demands can be best compensated by matching job resources.

RESEARCH OBJECTIVE 4: PERSONAL CHARACTERISTICS

The fourth research objective was to investigate the role of personal characteristics on the relations between work characteristics and job strain. More specific in Chapter 5, the influence of emotional support seeking on the stress-buffering effect of emotional job resources on the relation between emotional job demands and emotional exhaustion was examined. Previous studies in search of refinements of the DISC Model by including personal characteristics did not find evidence for the added value yet (Van den Tooren, 2010; Van den Tooren & De Jonge, in press). Results in Chapter 5 revealed that emotional job demands were least likely to result in emotional exhaustion when
employees were provided with high emotional job resources and scored high on emotional support seeking. In other words, from our results in Chapter 5 we can carefully conclude that personal characteristics do play an important moderating role in the relation between (emotional) work characteristics and emotional job strain.

**STRENGTHS, LIMITATIONS, AND DIRECTIONS FOR FUTURE RESEARCH**

Strengths of the present doctoral dissertation include the use of both cross-sectional (Chapters 2 and 3) and longitudinal designs (Chapters 4 and 5), homogeneous (Chapter 3) as well as heterogeneous samples (Chapter 2, 4, and 5), large sample sizes (cf. Shen, et al., in press; Chapters 2, 4, and 5), different analytical strategies to analyze the data (i.e. hierarchical regression analyses and structural equation modeling), and innovative samples for the research questions under study (i.e. non-human service).

In spite of these strengths, this dissertation has a number of limitations which need to be acknowledged. Five main limitations of the studies in the present doctoral dissertation are discussed.

First, all studies in the present dissertation were based on self-report assessments of job demands, job resources, and job strain and employee well-being. Common method variance may therefore have led us to overestimate the size of the relationships (Semmer, Grebner, & Elfering, 2004). However, Spector (2006) stated that the influence of common method variance is not as high as could be expected and he found that using self-report methodology – as applied here – is no guarantee of finding significant results, even with very large samples. Furthermore, a temporal separation of measurement – as applied in Chapters 4 and 5 – is also beneficial for the prevention of common method variance (cf. Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Second, the cross-sectional research designs of the studies in Chapter 2 and Chapter 3 precludes causal interpretations (Edwards, 2008; Taris &
Kompier, 2003). In Chapters 4 and 5 longitudinal designs (i.e. two-wave panel studies) were used to overcome this issue. However, to establish causal interpretations with more certainty, future research could complement longitudinal studies with experimental and quasi-experimental research designs (e.g. intervention studies).

Third, in all studies of this dissertation the DISQ-questionnaire (De Jonge, et al., 2007) was used to measure job demands and job resources. Although psychometrical properties of this questionnaire have been shown in previous studies (e.g. De Jonge & Peeters, 2009; Van den Tooren & De Jonge, 2008), some internal consistencies, mainly with regard to the cognitive job resources scale, were quite low. This shows the necessity for further empirical research into the psychometrical properties of the DISQ-questionnaire (De Jonge, et al., 2007). In Chapter 3, the DISQ 1.1 (De Jonge, et al., 2004) was used, whereas we used the DISQ 2.0 (De Jonge, et al., 2007) in Chapters 2, 4, and 5. Meanwhile, later versions of the DISQ-questionnaire (i.e. DISQ 2.1 and DISQ-S 2.1, a shortened version) have been developed and further validated (De Jonge, et al., 2009a, 2009b).

Fourth, interactions in our empirical studies only explain limited variance in the outcome variables. However, according to Frazier, Tix, and Barron (2004), effect sizes for interactions are generally small. Furthermore, it is important to point out that the lagged effects of job demands and job resources on job strain and employee well-being are tested in a very conservative way. By including Time 1 levels of our outcome variables, Time 1 – Time 2 stability effects were partialled out. Therefore, by definition these effects will be small, as many phenomena will be relatively stable across the 1-year time lags employed in our two-wave studies. This conservative way of testing may have interfered with the probability of finding significant interaction effects, implying that the moderating effects found in the two-wave studies in this dissertation are quite strong. We therefore believe that the interactions found in our empirical studies are important from a theoretical as well as practical perspective.
Fifth, in the two longitudinal studies in this doctoral dissertation (i.e. Chapters 4 and 5) a one-year time lag was used. Key reasons for choosing this time lag were controlling for possible seasonal fluctuations and giving natural changes a fair chance to occur (cf. De Jonge, et al., 2001). Variables under study were measured at two fixed time points, while the processes we observed are continuous. This implies that, if the time lag between the two measurements does not match with the actual causal lag, it is possible that our results are not completely valid (cf. Kessler & Greenberg, 1981). As De Lange, Taris, Kompier, Houtman and Bongers (2004) have noted, there is little information available about the ‘right’ length of time-lags in research on job strain and employee well-being. Ideally, the time-lag of a research study encompasses the potential true change in the organization. A suggestion for future research arising from this issue is to conduct more longitudinal multi-wave studies with different time lags to test the DISC Model's core principles (cf. De Jonge, et al., 2008; Dormann & Zapf, 2002).

Apart from the avenues for future research that arise from the overview of limitations both in this general discussion as well as in the discussions of the studies in Chapters 2 through 5, four more avenues for future research are formulated in the following paragraphs.

First, the current dissertation moved the DISC Model a step closer to generalization beyond human service contexts. However, further research is necessary to investigate generalizability of the DISC Model in general. Adaptations may be needed to fit the model to the specific sectors under study, but most of all more research in other occupational groups and sectors are needed to answer the question of generalizability.

Second, further research is needed to open the so-called black box of job stress and employee well-being. Research is often limited to laundry-list approaches of possible antecedents of job strain and employee well-being, while theoretical progress has been limited (Bakker & Demerouti, 2007). The current dissertation, with its emphasis on the DISC Model, puts the idea of match forward as a possible explanation of why certain job demands lead to job strain
and employee well-being, while others don’t and why certain job resources moderate this relation. However, further research into the black box of job strain and employee well-being is necessary to increase our understanding of why matching seems an important factor in this type of research. Vignette studies by Van den Tooren and De Jonge (2010) and Van den Tooren, De Jonge, and Dormann (2010) have recently addressed this issue. Findings indicate that employees prefer matching resources, when faced with specific demands, both in terms of use and relevance (Van den Tooren & De Jonge, 2010). Findings in a student sample showed that people tend to use matching job resources when faced with specific high job demands, and that non-matching job resources are often used as a supplement on matching job resources rather than as a substitute for matching job resources (Van den Tooren, et al., 2010). Applying the concept of means efficacy, defined as employees’ belief in the utility of particular tools available for task performance (Eden, Ganzach, Flumin-Granat, & Zigman, 2010), seems to be another possible avenue for further research.

Third, expanding the DISC Model with personal characteristics seems to make sense (cf. research objective 4; Chapter 5). However, in Chapter 5, our research question was only focused on emotional job demands, resources, support seeking and outcomes. Other studies examined whether workers who differed on active coping style (Van den Tooren, De Jonge, Vlerick, Daniels, & Van de Ven, in press) or regulatory focus (Van den Tooren & De Jonge, in press) also differed on the number and types of stress-buffering effects of job resources that were found for these workers. Both studies did not find such differences. Given the inconsistency of these findings with our findings in Chapter 5, further research into the role of personal characteristics is advised. Another addition to the DISC Model was recently made by De Jonge, Spoor, Sonnentag, Dormann, and Van den Tooren (in press), by adding cognitive, emotional and physical detachment from work to the DISC Model. It was concluded that, in order to cope with specific job demands, employees need corresponding job resources and detachment from work to maintain and improve employee well-being, health, and performance-related outcomes. This also is a very promising new avenue for further research.
Fourth, in the current doctoral dissertation all job resources were measured at an individual or micro-level. Future research could look into different measurement levels of resources such as a meso-level (e.g. team resources or resources at company level) or even macro-level (e.g. general job resources might differ between countries and cultures).

**THEORETICAL AND PRACTICAL IMPLICATIONS**

From a theoretical perspective, and with regard to the four main research objectives formulated in the current doctoral dissertation, certain conclusions can be made. First, we conclude that the TMP holds in the technology sector and that confirming the TMP in yet another sector (i.e. technology sector) and in non-human service workers brings this core principle of the DISC Model a step closer to generalization. Second, the balance principle of the DISC Model does not seem to hold in our empirical studies (i.e. matching job resources do not (always) enhance employee well-being). Third, the compensation principle is largely confirmed in our studies (i.e. the negative effects of job demands can be best compensated by matching job resources). Fourth, personal characteristics do play an important moderating role in the relation between (emotional) work characteristics and emotional job strain.

From a practical perspective, the present dissertation indicates that enhancing specific job resources enables employees to deal with their high job demands. Reducing or redesigning job demands in order to combat job strain is often difficult or even impossible from an employers’ point of view. Increasing cognitive, emotional and physical job resources in order to combat cognitive, emotional or physical job demands, respectively, however does make a difference in job strain outcomes in employees. Therefore, our results suggest that employers in the technology sector should be sensitive for offering matching job resources to their employees in order to combat the particular job demands to which they are exposed.
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Psychosociaal welzijn van werknemers wordt al meerdere decennia onderzocht. In het verleden werden, door arbeids- en organisatiepsychologen, vooral mogelijke negatieve psychologische gevolgen van de werkomgeving onderzocht (b.v. burnout, depressie, …). In het laatste decennium wordt er echter ook meer en meer aandacht besteed aan positieve gevolgen van de werkomgeving op het welzijn van werknemers (Schaufeli & Bakker, 2001). Dit doctoraatsonderzoek richt zich zowel op de negatieve gevolgen van de werkomgeving (die in dit doctoraat “job strain” genoemd worden) als op de positieve gevolgen (die in dit doctoraat “welzijn” genoemd worden). Het meeste wetenschappelijk onderzoek richt zich op twee cruciale componenten van de werkomgeving: taakeisen en hulpbronnen (e.g. Schaufeli & Bakker, 2004). Taakeisen worden gedefinieerd als die aspecten van het werk die een zekere emotionele, cognitieve of fysieke inspanning vergen. Hulpbronnen zijn mogelijkheden, data, personen of dingen die kunnen worden ingezet om met de taakeisen om te gaan.

De twee meest prominente modellen voor het verklaren van welzijn en job strain van werknemers zijn het Demand-Control (DC) Model (Karasek, 1979; Karasek & Theorell, 1990) en het Effort-Reward Imbalance (ERI) Model (Siegrist, 1996; Siegrist, Siegrist, & Weber, 1986). Kort gesteld voorspellen beide modellen dat werknemers die hoge taakeisen ervaren en onvoldoende hulpbronnen ter beschikking hebben om met deze taakeisen om te gaan, een hoger risico hebben om job strain (b.v. burnout) te ontwikkelen. Wanneer echter genoeg hulpbronnen beschikbaar zijn, kunnen deze hulpbronnen de negatieve
gevolgen van hoge taakeisen tegengaan en kunnen stressvolle situaties uitdagingen worden en mogelijk het welzijn van werknemers bevorderen. Met andere woorden, hulpbronnen beïnvloeden de relatie tussen taakeisen en uitkomsten op zo’n manier dat deze taakeisen zowel tot job strain als tot welzijn kunnen leiden.


In het DISC model worden taakeisen, hulpbronnen en uitkomsten (welzijn en job strain) beschouwd als multidimensionele begrippen die in de eerste plaats behoren tot een cognitieve, een emotionele of een fysieke dimensie. Dit principe wordt het multidimentionaliteitsprincipe genoemd. Het tweede principe van het DISC model is het “drievoudige match principe”. Dit principe stelt dat de sterkste interactieve relaties tussen taakeisen en hulpbronnen gevonden worden als taakeisen, hulpbronnen en uitkomstmaten zich allemaal op eenzelfde dimensie bevinden (b.v. cognitief, emotioneel of
fysiek). Dit wordt een “match” genoemd. Ten derde stelt het *compensatie principe* dat de negatieve effecten van taakeisen op job strain het best kunnen worden gecompenseerd door matchende hulpbronnen. Tot slot stelt het *balans principe* dat een gebalanceerde mix van taakeisen en hulpbronnen samenhangt met positief welzijn van werknemers.

Tot dusver is er voor het DISC model al behoorlijk wat empirische steun gevonden. Maar, er zijn verschillende tekortkomingen in de bestaande studies en verschillende mogelijke onderzoeksvragen blijven open. Zo is het meeste onderzoek naar het DISC model bijvoorbeeld gebaseerd op steekproeven in de gezondheidssector. De tekortkomingen in de bestaande literatuur vormen de basis van de onderzoeksdoelstellingen in dit doctoraat. Er werden vier doelstellingen voorop gesteld.

Ten eerste wil dit doctoraat nagaan of het drievoudige match principe ook van toepassing is in de technologiesector. Een tweede onderzoeksdoelstelling is om het, tot dusver minder onderzochte, balans principe na te gaan. Een derde doelstelling is om het compensatie principe te onderzoeken. De vierde en laatste doelstelling is om na te gaan of persoonlijke karakteristieken van werknemers een invloed hebben op de modererende rol van hulpbronnen op de relatie tussen taakeisen en job strain.

Vier empirische hoofdstukken proberen antwoorden te bieden op deze onderzoeksvragen.

In Hoofdstuk 2 en Hoofdstuk 4 werd nagegaan of het drievoudige match principe geldt in de technologiesector (cf. eerste onderzoeksdoelstelling). Samengevat werd er inderdaad empirische evidentie gevonden voor dit principe. Dit zowel in een cross-sectionele studie (Hoofdstuk 2) als in een longitudinale studie (Hoofdstuk 4).

In Hoofdstuk 3 en Hoofdstuk 4 werd het balans principe onderzocht (cf. tweede onderzoeksdoelstelling). Net als bij eerdere studies naar dit principe werd er ook in de studies in dit doctoraat nauwelijks evidentie gevonden voor het balans principe.
In Hoofdstuk 2 en Hoofdstuk 4 werd het compensatieprincipe onderzocht (cf. derde onderzoeksdoelstelling). In beide studies werd evidentie voor dit principe teruggevonden en we kunnen dan ook concluderen dat dit principe overeind blijft in de technologie sector.

In Hoofdstuk 5 werd de vierde onderzoeksdoelstelling onderzocht. Meer bepaald werd onderzocht wat de rol is van persoonlijke karakteristieken (de mate waarin men op zoek gaat naar sociale steun) op de relatie tussen werkkarakteristieken (taakeisen en hulpbronnen) en job strain. De resultaten toonden aan dat emotionele taakeisen het minst tot emotionele uitputting leiden als werknemers veel emotionele hulpbronnen ter beschikking hebben en tegelijk hoog scoren op de mate waarin ze op zoek gaan naar sociale steun.

Samengevat levert dit doctoraatsonderzoek empirische evidentie voor de toepasbaarheid van het drievoudige match principe en het compensatieprincipe van het DISC Model, met het oog op het beter begrijpen van welzijn en job strain bij werknemers in de technologie sector. Tevens werd aangetoond dat bepaalde persoonlijke karakteristieken een betekenisvolle impact kunnen hebben op het samenspel tussen specifieke taakeisen en hulpbronnen op het werk.

Vanuit een praktisch perspectief toont dit doctoraat aan dat het verhogen van specifieke hulpbronnen werknemers in staat kan stellen om beter om te gaan met hoge taakeisen. Dit is van belang aangezien het verminderen van deze taakeisen vaak onmogelijk of moeilijk is voor werkgevers. Onze resultaten suggereren dan ook dat werkgevers zich best bewust zijn van het drievoudige match principe en zouden moeten proberen te zorgen dat de passende (matchende) hulpbronnen worden aangeboden bij de taakeisen die ze aan hun werknemers opleggen.
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