

An investigation of the unique, synergistic and balanced relationships between basic psychological needs and intrinsic motivation

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Abstract

The purpose of this study was to empirically investigate the relationship between psychological need satisfaction and intrinsic motivation as proposed by self-determination theory. Three competing hypotheses regarding the relations between need satisfaction and intrinsic motivation were tested: additive, synergistic, and balance. Two cross-sectional studies involving 1,254 employees from a broad range of Norwegian service organizations partly supported the first two hypotheses. Although the relationship between satisfaction of the needs for autonomy and relatedness with intrinsic motivation were significant, the one with satisfaction of the need for competence was not. Instead, competence was only related to intrinsic motivation when autonomy was high. Implications for practice and future research are discussed.

Theories of work motivation seek to explain the set of energetic forces that originate both within as well as beyond an individual's being, and that initiate work-related behavior in terms of direction, intensity, and duration (Pinder, 1998). As work becomes more complex and potentially more interesting, intrinsic motivation, or the motivation to perform an activity for itself in order to experience the pleasure and satisfaction inherent in the activity (Deci, Connell, & Ryan, 1989), has become an increasingly relevant source of work motivation (Sheldon, Turban, Brown, Barrick, & Judge, 2003). Several important contributions have been made in terms of describing and explaining intrinsic motivation over recent decades, but of particular interest for this study is self-determination theory (SDT; Deci & Ryan, 2000; Gagné & Deci, 2005). SDT proposes that intrinsic motivation emerges when employees fulfill innate psychological needs for autonomy, competence, and relatedness. These needs are seen as universal necessities, and empirical work suggests that they are among the most salient needs and those most closely associated with event-based affect and well-being (Sheldon, Elliot, Kim, & Kasser, 2001).

This understanding of individual needs gradually developed from the seminal work of White (1959). Addressing the lack of prior theories' ability to explain exploratory or playful behaviors, White proposed a different set of needs that he proposed to be innate and essential to an individual's benefi-

cial functioning, but nondrive-based and universal (Deci & Moller, 2005). In line with this, SDT defines basic psychological needs as "nutrients that are necessary for effective healthy functioning" (Deci, Ryan, & Williams, 1996, p. 172). According to SDT, individuals are by nature active, curious, and interested, and need fulfillment will contribute to feelings of success that are personally satisfying and rewarding (Deci & Ryan, 2008). Thus, need satisfaction is deemed essential for humans to actualize their potential, to flourish, and to be protected from ill-being and maladaptive functioning (Ryan & Deci, 2002).

While SDT postulates that the three psychological needs are distinct (Deci & Ryan, 2000) and hold unique influences on intrinsic motivation (Deci & Ryan, 1985; Deci et al., 1989, 2001; Gagné & Deci, 2005; Gagné, Koestner, & Zuckerman, 2000; Phillippe & Vallerand, 2008; Ryan & Deci, 2000, 2002, 2006), the majority of empirical SDT studies of need fulfillment in the domain of work has employed a unidimensional need satisfaction scale (e.g., Baard, Deci, & Ryan, 2004; Deci et al., 2001; Kasser, Davey, & Ryan, 1992; Van den Broeck, Vansteenkiste, De Witte, & Lens, 2008; Vansteenkiste, Lens, Soenens, & Luyckx, 2006; Vansteenkiste et al., 2007). Analyzing need satisfaction unidimensionally, however, is inconsistent with the foundation of SDT, which argues that all three needs are important. Typically, researchers have averaged items representing satisfaction of each need, thereby creating

an indicator of need satisfaction that does not take into account possible additive, relative or synergistic effects. Accordingly, the purpose of this study was to address this gap in the literature by empirically examining the unique relationships between each of the three psychological needs and intrinsic motivation in the domain of work. In this way, we hope to contribute to SDT by conducting an empirical test of one of its basic assumptions, namely that satisfaction of the needs for autonomy, competence, and relatedness possesses different and unique explanatory powers in predicting intrinsic motivation.

Theory and hypotheses

Central to SDT is the distinction between autonomous motivation (doing something because it is interesting and/or meaningful) and controlled motivation (doing something out of internal and/or external pressure), where intrinsic motivation represents autonomous motivation in its purest form (Gagné & Deci, 2005). Employees who are intrinsically motivated work on tasks because they find them enjoyable and interesting, and that engagement in these tasks is rewarding in itself (Deci et al., 1989). This state reflects an inherent tendency to seek out novelty and challenge, to extend and exercise one's capacities, to explore, and to learn (Ryan & Deci, 2000). In order for intrinsic motivation to emerge, it requires that the psychological needs for autonomy, competence, and relatedness be fulfilled (Deci et al., 1996). Satisfaction of these needs serves the purpose of predicting the influence of contextual factors on individual growth-oriented processes and well-being. It is important to note that in SDT, the satisfaction of the need is more important than whether there are individual differences in need strength. To say that a need is universal and necessary to well-being implies that there should not be high variation in need strength, and that individuals are likely to suffer more or less equally from need thwarting. Indeed, research shows that it is the satisfaction that is related to important outcomes, such as motivation and well-being (Sheldon & Niemiec, 2006).

The first of the needs is the need for autonomy, which means to feel like the origin or source of one's own behaviors (Ryan & Deci, 2002, p. 8). The need for autonomy is actually alluded to in many other psychological theories (Gagné & Bhave, 2011), particularly one that emphasizes the experience of oneself as the locus of causality for one's own behaviors (deCharms, 1968). This sense of volition is fulfilled when employees perceive that they have the opportunity to make personal choices or when fully endorsing an externally induced request (Gagné & Deci, 2005). The need for autonomy is regarded as the most salient need and a necessity and requirement to be fulfilled in order for intrinsic motivation to emerge (Ryan & Deci, 2006). This need is also represented in other theories with parallel constructs, such as job

autonomy (e.g., Hackman & Oldham, 1976; Warr, 1987) and has been found to be a potent predictor for intrinsic or internal motivation (Gagné & Deci, 2005; Humphrey, Nahrgang, & Morgeson, 2007).

The second need is the need for competence, or feeling effective in one's ongoing interactions with the social environment and experiencing opportunities to exercise and express one's capacities (Ryan & Deci, 2002, p. 7). This need aligns well with well-established concepts in other theoretical traditions. For instance, both White's (1959) concept of effectance motivation and Bandura's (1986) concept of self-efficacy entail the importance of perceived competence. Competence perception may lead individuals both to seek challenges optimal for their capacities and to maintain their skills persistently (Elliot, McGregor, & Thrash, 2002). In several studies, perceived competence has been found to predict intrinsic motivation (e.g., Guay, Boggiano, & Vallerand, 2001; Vallerand & Reid, 1984).

The third need is the need for relatedness, or feeling connected to others and refers to caring for and being cared for by others as well as having a sense of belongingness to groups, communities or organizations (Ryan & Deci, 2002, p. 7). Experiencing satisfaction of this need plays an important role in the internalization of work-related rules and regulations (Gagné & Deci, 2005), but it is nonetheless theorized that intrinsic motivation will more likely emerge in contexts characterized by secure relatedness (Deci & Ryan, 2000). Accordingly, employees who feel part of a team and feel free to express their work-related and personal troubles have been found to experience satisfaction of the need for relatedness (Baumeister & Leary, 1995). This need aligns well with other concepts such as high quality connections at work (Dutton & Heaphy, 2003), which also emphasizes the importance of positive emotions and connectivity among employees in order to facilitate their well-being at work, and with attachment theory (e.g., Lopez & Brennan, 2000), which emphasizes the need for a secure attachment to a significant other (characterized by a positive view of the self and of the other) as a basis from which a person can then explore their environment.

Several empirical studies have found need satisfaction to be positively related to individuals' effective functioning in terms of well-being, attitudes, and behaviors (see Deci & Ryan, 2000 for a review). With respect to work settings, a number of studies support the proposition that autonomy supportive (rather than controlling) work environments promote need satisfaction and intrinsic motivation (see Gagné & Deci, 2005 for a review). According to SDT, *all* three needs are essential for the facilitation of intrinsic motivation (Gagné & Deci, 2005). The manner in which the needs are postulated to interact, however, remains unclear. Should their effects be additive or synergistic? In some writings (e.g., Sheldon & Niemiec, 2006), researchers interchangeably allude to additive and synergistic effects, and the

majority of studies examining relations between the three needs and outcomes only examine main effects, which only test the additive hypothesis, and fail to test for interaction effects, which would test the synergistic hypothesis (e.g., Sheldon et al., 2001).

Yet, some writings allude to the possibility of interaction effects, e.g., between competence and autonomy. As noted by Deci and Ryan (2000, p. 235), "Perceived competence tends to enhance intrinsic motivation, although people must feel responsible for the competent performance in order for perceived competence to have positive effects on intrinsic motivation." An exception is an experimental study by Sheldon and Filak (2008), which used a 2 (autonomy) \times 2 (competence) \times 2 (relatedness) between-subjects design to find that all three needs had a main effect on intrinsic motivation, but had no interactive effects (thereby supporting the additive hypothesis over the synergistic hypothesis). Sheldon and Niemiec (2006) tested another interesting hypothesis: that the balance among the needs is more important than the total amount of need satisfaction in predicting well-being. They found support for this hypothesis in cross-sectional, longitudinal, and diary samples. Would we find the same results for intrinsic motivation?

One reason why researchers have not tested for interactions between the needs is that many of the existing need satisfaction measures did not allow them to separate the three needs in order to create interaction terms. The Basic Needs Satisfaction Scale (BNSS), which has been adapted for many domains, including the work context, contains items to measure the satisfaction of the three needs that often load on only one factor instead of loading on three separate, although related factors (e.g., Baard et al., 2004; Deci et al., 2001; Van den Broeck et al., 2008; Vansteenkiste et al., 2006, 2007). A review of studies that have used this scale reveals that it was never formally validated, and has been used in different ways with confusing results as to its dimensionality (Johnston & Finney, 2010). Confirmatory factor analyses of a shorter version of the BNSS, which eliminates several of the original items, showed that a three-factor model (controlling for negatively worded items) fit the data better than a one-factor model (Johnston & Finney, 2010). Although it may be normal in a real-world situation for the satisfaction of each need to co-occur, which may in part cause these multi-collinearity problems, there is still a need to be able to empirically separate the satisfaction of each need in order to provide solid validation evidence for the theory. Experimental work has succeeded in separating the needs through manipulations, which does provide validation evidence for the theory, yet being able to separate the needs psychometrically would help test some of the above hypotheses in field studies.

Vlachopoulos and Michailidou (2006) developed an exercise need satisfaction scale that shows better psychometric properties (i.e., a three-factor structure with high internal

reliabilities) and validity evidence than the original BNSS. In the work domain, Van den Broeck, Vansteenkiste, De Witte, Soenens, and Lens (2010) succeeded in developing a need satisfaction measure where items load on three distinct, yet correlated, factors. Still, in their validation study, they did not report any analysis to show that each of the needs plays a unique role in predicting intrinsic motivation, but only provide bivariate correlations between each of the needs and autonomous motivation. We used this scale in the present research because it is the only measure that allows us to test our three alternative hypotheses in the work domain.

Hypothesis 1 (the additive hypothesis)

This hypothesis proposes that each need uniquely contributes to motivation, regardless of the level of satisfaction of the other needs. This is the hypothesis that has most often been tested, but most of the time by adding the satisfaction of the three needs together. This method may have masked whether each need really contributed to the effect need satisfaction had on the outcomes, as they could have made up for each other's contribution. Wilson, Longley, Muon, Rodgers, and Murray (2006) did test their effects separately, and found all three to be related to well-being during exercise. In the present study, we tested the contribution of each need separately to extend Wilson et al.'s findings, by examining if each is significantly related to intrinsic motivation in the work domain when controlling for the other two needs.

Hypothesis 1a. There will be a positive relationship between satisfaction of the need for autonomy and intrinsic motivation after controlling for satisfaction of the needs for competence and relatedness.

Hypothesis 1b. There will be a positive relationship between satisfaction of the need for competence and intrinsic motivation after controlling for satisfaction of the needs for autonomy and relatedness.

Hypothesis 1c. There will be a positive relationship between satisfaction of the need for relatedness and intrinsic motivation after controlling for satisfaction of the needs for autonomy and competence.

Hypothesis 2 (the synergistic hypothesis)

This hypothesis proposes that all three needs must be satisfied for a person to be intrinsically motivated. In other words, each need is necessary, but not sufficient to increase intrinsic motivation. This contrasts with the previous hypothesis that argues that each need is necessary, but that it could possibly be sufficient to increase intrinsic motivation. This hypothesis implies the test of a three-way interaction, but we also tested three possible two-way interactions, which would partially support the hypothesis.

Hypothesis 2. There will be a three-way interaction effect on intrinsic motivation.

Hypothesis 3 (the balance hypothesis)

This hypothesis proposes that the satisfaction of the three needs must be equal across the three needs in order for a person to be intrinsically motivated. Sheldon and Niemiec (2006) tested the hypothesis that balance in need satisfaction is associated with higher well-being. They argued that two people with the same total score on need satisfaction could have different “profiles” of need satisfaction that could differentially affect their well-being. A balanced profile is one where there are low satisfaction discrepancies between the three needs. For example, someone with a total score of 5 out of 7 points on need satisfaction could have a profile with low relatedness satisfaction, but high autonomy and competence satisfaction, whereas another person with the same total score could have a profile with medium satisfaction on the three needs. Which one would experience higher well-being? According to Sheldon and Niemiec’s results, the second should experience higher well-being. They argue that this occurs because it is important to have balance in one’s life to decrease stress and conflicts. Research on harmonious and obsessive passion, work–life balance, and eudaimonic well-being hold similar arguments (Linville, 1987; Milyavskaya et al., 2009; Ryan & Deci, 2000; Ryff, 1995; Vallerand et al., 2003; Waterman, 1993). We tested whether balanced need satisfaction also influences intrinsic motivation, which has been associated with well-being in numerous studies (Sheldon et al., 2003).

Hypothesis 3. Balance in need satisfaction will account for variance in intrinsic motivation beyond the main effects of the three needs.

We tested the hypothesized relationships in two field studies, in line with recent calls by Kline (2004) for an increase of replication studies in organizational behavior research. The details for each study are presented earlier.

Study 1

Method

Sample and procedure

The respondents were drawn from 1,140 employees of a large Norwegian transport service organization in the year 2007. Representatives of the organization distributed a questionnaire to their employees by use of a web-based tool (Conconfirm; <http://www.conconfirm.com/>) and paper inventories, which resulted in a data set with 625 employees and a response rate of 55%. Of the respondents, 119 were women and 499 were men (seven respondents failed to report their gender). Approximately, 56% were baseline operators, 10%

held office functions, 30% held staff positions, and 14% held managerial positions. With regard to education level, approximately, 25% held a university degree of three years’ study or more. Average tenure was three years.

Measures

All the items were answered using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A description of each item included in Study 1 is presented in Appendix A.

Need satisfaction

The 18-item Work-related Basic Need Satisfaction Scale (W-BNS) validated by Van den Broeck et al. (2010) was used to measure the satisfaction of the needs for autonomy, competence, and relatedness. We adopted a systematic translation and back-translation procedure (Brislin, 1970) for the English-language scales that had not been previously used in Norway.

Intrinsic motivation

We used a measure of intrinsic motivation that emphasizes the pleasure and satisfaction inherent in jobs. In addition, the scale includes items that directly tap the content of the core of the construct, namely that intrinsic motivation emanates from the work itself (e.g., “the tasks that I do at work in themselves represent a driving power in my job”). This scale was originally created in Norwegian and has demonstrated sound psychometric properties (Dysvik & Kuvaas, 2010; Kuvaas, 2006a,b, 2007, 2009; Kuvaas & Dysvik, 2009, 2010). The original scale consists of six items, but owing to restrictions with respect to the size of the survey instrument imposed by the transport service organization, we used the four items that typically have the highest factor loadings (see Appendix A).

Control variables

Previous studies suggest that age may influence employee motivation (Kanfer & Ackerman, 2004). We therefore asked respondents to report their age by way of 11 categories where 1 represented “below 20 years” and 11 represented “60 years and above.” With regard to the relationship between gender and motivation, the results appear equivocal. Gender was nevertheless included as a dichotomous control variable where 1 represented “women” and 2 “men.” Intrinsic motivation has previously been suggested to be more likely to emerge in higher-level jobs and among employees with higher education (Gagné & Deci, 2005). We therefore asked the respondents to state their position, work experience, and formal educational level. Staff position was measured using a 1 (baseline operators) to 12 (managerial positions) categorical scale. Work experience was reported by asking respondents to report number of years in the workforce. Formal

education level was measured using a 1 (basic mandatory education) to 6 (higher degree from university or college) categorical scale. Finally, we included a 4-item scale measuring extrinsic motivation previously used in Norwegian settings (Kuvaas & Dysvik, 2011).

Results

An exploratory principal components analysis with promax rotation (as the three needs were expected to be related) was performed on the need satisfaction scale to verify that the Norwegian version had the same factor structure as the original Dutch version. We applied relatively stringent rules of thumb and retained only items with a strong loading of .50 or higher on the target construct (Nunnally & Bernstein, 2007), a cross loading of less than .35 on other included factors (Kiffin-Petersen & Cordery, 2003), and a differential of .20 or more between included factors (Van Dyne, Graham, & Dienesch, 1994). Results revealed that two of the items we used to measure satisfaction of the need for autonomy, two of the items used to measure satisfaction of the need for competence, and one of the items used to measure satisfaction of the need for relatedness did not meet our inclusion criteria. Furthermore, given that one of the items we used to measure satisfaction of the need for relatedness attenuated our ability to achieve satisfactory levels of reliability, this item, along with the items mentioned earlier, were removed before the need satisfaction subscales were computed by averaging the subscale items (see Appendix A for details).

The means, standard deviations, bivariate correlations, number of items in the final scales, and reliability estimates are reported in Table 1. Eleven percent of the respondents failed to report their tenure. These missing responses were replaced with the mean value. Pairwise and multiple variable collinearity were inspected by collinearity diagnostics prior to analyses. The lowest tolerance value was .55, which is well above the commonly accepted threshold value of .10 (Hair,

Anderson, Tatham, & Black, 2005). The results from the regression models are presented in Table 2.

Test of Hypothesis 1 (additive effects)

For this test, we simply entered the control variables in a first block and the three needs in a second block. The results in Table 2 show that the relationship between satisfaction of the need for competence and intrinsic motivation was nonsignificant ($\beta = .04, p = .34$), providing no support for Hypothesis 1b. In contrast, the relationships between satisfaction of the need for relatedness and intrinsic motivation ($\beta = .19, p < .001$) and need for autonomy and intrinsic motivation ($\beta = .27, p < .001$) were significant, thereby supporting Hypotheses 1a and 1c.

Test of Hypothesis 2 (synergistic effects)

For this test, we repeated the analysis mentioned earlier, adding a third block with the three two-way interactions and a three-way interaction. Interaction terms often create multicollinearity problems because of their correlations with main effects. We thus computed the interaction terms by centering the variables before multiplying them with each other. All two-way interactions were significant and the three-way interaction was not significant (see Table 2). To probe the form of the significant interactions, we followed the procedure recommended by Cohen, Cohen, West, and Aiken (2003) and plotted low versus high scores on satisfaction of the need for competence and need for autonomy, need for relatedness and need for autonomy, and need for competence and need for relatedness (one standard deviation below and above the means using standardized scores).

The slopes depicted in Figure 1a suggest that the relationship between satisfaction of the need for competence and intrinsic motivation was only positive for employees high in satisfaction of the need for autonomy. A *t* test revealed that

Table 1 Descriptive Statistics, Correlations, and Scale Reliabilities for Study 1

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	
1 Gender	1.81	0.36	—										
2 Age	5.10	2.24	-.10*	—									
3 Position	4.84	3.87	-.31**	.36**	—								
4 Tenure	3.85	1.76	-.10*	.66**	.26**	—							
5 Education	2.04	0.85	-.05	-.01	.29**	-.11**	—						
6 Extrinsic motivation (4)	3.19	1.00	.06	-.13**	-.15**	-.05	.01	(.79)					
7 Need for autonomy (4)	3.64	0.77	-.12**	.18**	.22**	.15**	-.04	-.17**	(.67)				
8 Need for relatedness (4)	3.85	0.78	-.16**	.08*	.14**	.13**	-.07	-.07	.36**	(.71)			
9 Need for competence (4)	4.29	0.67	-.02	.09*	.03	.13**	-.04	.08*	.24**	.15**	(.86)		
10 Balance	5.20	1.19	-.01	.06	.13**	.06	.04	-.07	.24**	.30**	.06	—	
11 Intrinsic motivation (4)	3.51	0.98	-.11**	.25**	.26**	.23**	-.02	-.12**	.41**	.26**	.18**	.15**	(.90)

Note. Coefficient alphas are displayed on the diagonal. Number of items included in the final scales in parentheses. *SD*, standard deviation.

* $p < .05$. ** $p < .01$.

Table 2 Results of Regression Analyses Study 1

	Intrinsic motivation			
	Step 1	Step 2	Step 3	Step 4
Gender	-.02	.01	.02	.01
Age	.11*	.09*	.10*	.10*
Position	.20***	.12**	.12**	.12**
Tenure	.09	.05	.03	.03
Education	-.07	-.03	-.01	-.01
Extrinsic motivation	-.07	-.03	-.05	-.05
Need for autonomy (Aut)		.27***	.27***	.27***
Need for competence (Com)		.06	.04	.04
Need for relatedness (Rel)		.19***	.20***	.19***
Com × Aut			.09*	.09*
Com × Rel			-.10*	-.10*
Aut × Rel			.14***	.14***
Aut × Rel × Com			.07	.07
Balance				.01
R^2	.11	.26	.29	.29
ΔR^2		.15	.04	.00
F	12.41***	23.37***	19.26***	17.87***

Standardized regression coefficients are shown.

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

the two slopes were significantly different from each other ($t = 2.56$, $p < .01$). The slopes depicted in Figure 1b suggest that the high satisfaction of the need for relatedness always led to high intrinsic motivation, regardless of satisfaction of the need for competence, whereas competence was positively related to intrinsic motivation when satisfaction of the need for relatedness was low. A t test revealed that the two slopes were significantly different from each other ($t = -2.35$, $p < .05$). Finally, the slopes depicted in Figure 1c suggest that the relationship between satisfaction of the need for relatedness and intrinsic motivation was only positive for employees high in satisfaction of the need for autonomy. A t test revealed that the two slopes were significantly different from each other ($t = 3.56$, $p < .001$). Thus, Hypothesis 2 was partly supported, because synergistic relationships were found between each pair of needs, but not for the three needs combined.

Test of Hypothesis 3 (balance effects)

For this test, the analysis mentioned earlier was repeated, adding balance in a fourth step. We used Sheldon and Niemiec's (2006) analysis strategy to test the contribution of balance to intrinsic motivation, beyond level of need satisfaction. We computed the difference between each pair of needs and then added the absolute values of these three scores. In order to create a variable where higher values indicate more balance (in effect reversing the variable), the resulting scores were subtracted from the highest observed score, which in this sample was 7.3. Although we found the zero-order

correlation between balance and intrinsic motivation to be significant ($r = .15$, $p < .01$), it did not account for any additional variance in the regression analysis. Thus, Hypothesis 3 was not supported.

Study 2

Method

Sample and procedure

In the second study, we decided to assess whether the results found in Study 1 could replicate in a sample of employees from multiple organizations. The respondents were drawn from 4,500 employees participating in training activities offered by a large Norwegian training institution in the year 2007. These employees represent more than 400 organizations from different industrial sectors. Representatives of the training institution provided the e-mail addresses for 965 randomly drawn employees. A questionnaire was distributed to these employees by way of a web-based tool (Confermit), which resulted in data from 629 employees and a response rate of 65%. Of the respondents, 188 were women and 431 were men (ten respondents failed to report their gender). Approximately, 20% were baseline operators, 22% held office functions, 38% held staff positions, and 21% held managerial positions. With respect to educational level, approximately 42% held a university degree of three years' study or more. Average age and tenure were approximately 43 and 6 years, respectively.

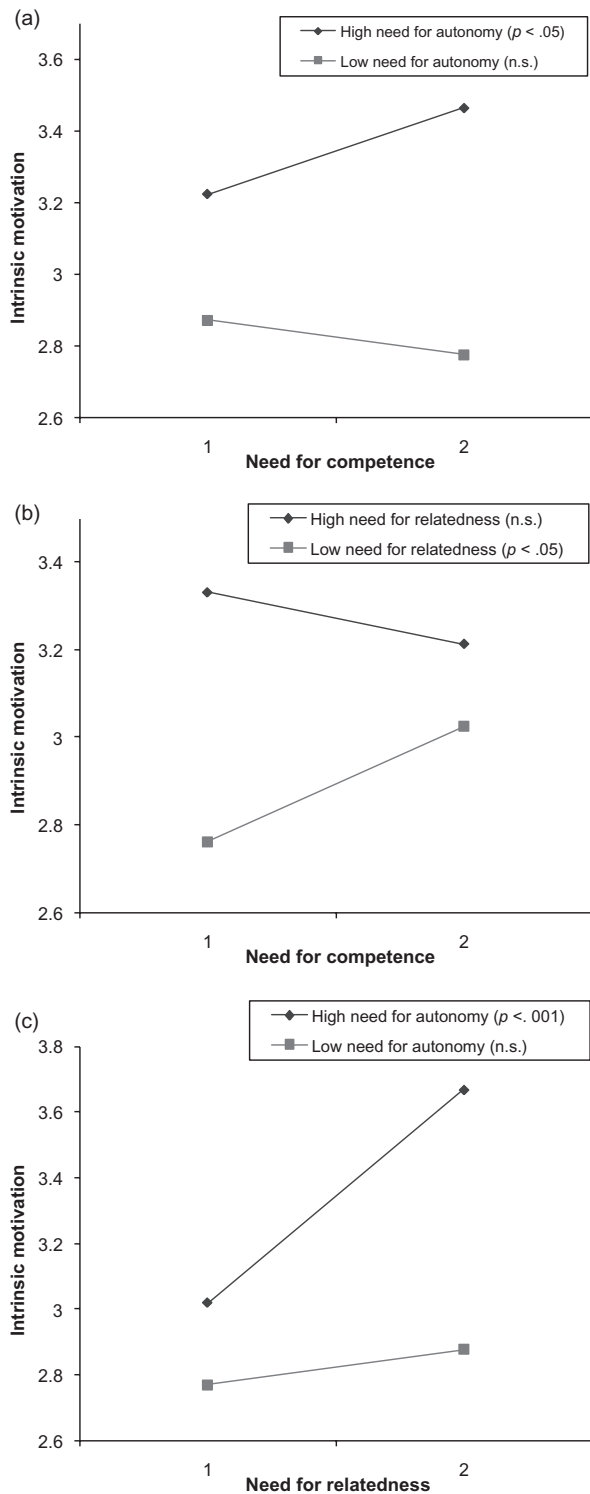


Figure 1 (a) The synergistic roles of need for competence and need for autonomy as predictors of intrinsic motivation in Study 1. (b) The synergistic roles of need for competence and need for relatedness as predictors of intrinsic motivation in Study 1. (c) The synergistic roles of need for relatedness and need for autonomy as predictors of intrinsic motivation in Study 1. n.s., not significant.

Measures

All the items were assessed using a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Need satisfaction

As in Study 1, the subscales for measuring satisfaction of the needs for relatedness and competence were derived from the W-BNS (Van den Broeck et al., 2010). In the first study, however, two of the items used to measure satisfaction of the need for autonomy failed to load on the appropriate factor. This, in combination with relatively weak factor loadings for the remaining autonomy items on its own factor, resulted in a less than acceptable coefficient alpha value of .67 (Nunnally & Bernstein, 2007). To remedy this shortcoming we decided to adopt another measure of autonomy, and used eight items from the previously validated Work Design Questionnaire (Morgeson & Humphrey, 2006). Example items include “The job allows me to decide on my own how to go about doing my work,” “The job gives me a chance to use my personal initiative or judgment in carrying out the work” and “The job allows me to make a lot of decisions on my own.”

Intrinsic motivation

Intrinsic motivation was measured with the same 6-item scale. The two items omitted in Study 1 were added this time and are: “My job is so interesting that it is a motivation in itself” and “Sometimes I become so inspired by my job that I almost forget everything else around me.”

Control variables

Like in Study 1, we included age, gender, position, work experience, education, and extrinsic motivation as controls. Position was reported by selecting one of five options, where 1 represented “baseline operator” and 5 “senior advisor”. In addition, we asked the respondents to state their base pay, as previous research findings suggest that there is a positive relationship between base pay and intrinsic motivation (Kuvaas, 2006b), and organizational size and sector to account for organizational context. Base pay was reported by selecting one of five options, where 1 represented “below 300,000” and 5 represented “over 500,000” Norwegian kroner (NOK)¹ per year. Size was measured with a categorical scale, where 1 represented “below 100 employees” and 5 represented “above 500 employees.” We computed a dichotomous variable coded such that 1 represented “public sector” and 2 “private sector.”

Results

We used the same analytical procedures as in Study 1. Because a new measure of job autonomy was introduced, we

¹100 NOK equals 17.99 USD as of 18.5.2011.

conducted an exploratory PCA with promax rotation in order to ensure that we had a three-factor structure for need satisfaction. The same two items as in Study 1 used to measure satisfaction of the need for competence did not meet our inclusion criteria. Thus, the same four items used in Study 1 were included to assess satisfaction of the need for competence. In order to accurately compare the results across studies, we used the same four items to measure satisfaction of the need for relatedness as in study one because their loadings were similar to those in Study 1.² The means, standard deviations, bivariate correlations, number of items in the final scales, and reliability estimates are reported in Table 3. Nine percent of the respondents failed to report their age and tenure. These missing responses were replaced with the mean values. Pairwise and multiple variable collinearity were inspected by collinearity diagnostics prior to analyses. The lowest tolerance value was .37, above the commonly accepted threshold value of .10 (Hair et al., 2005). The results from the regression models are presented in Table 4.

Test of Hypothesis 1 (additive effects)

Results show that relationship between satisfaction of the need for competence and intrinsic motivation was nonsignificant ($\beta = .07, p = .06$), providing no support for Hypothesis 1b. In contrast, the relationship between satisfaction of the need for relatedness ($\beta = .28, p < .001$) and perceived job autonomy ($\beta = .30, p < .001$) and intrinsic motivation were significant, thereby supporting Hypotheses 1a and 1c. Thus, results from the second study replicated results derived from the first study.

Test of Hypothesis 2 (synergistic effects)

Using the same analytic strategy as in Study 1, we found one significant two-way interaction between satisfaction of the need for competence and perceived job autonomy (see Table 4). To probe the form of this interaction, we plotted low versus high scores on satisfaction of the need for competence and perceived job autonomy (one standard deviation below and above the means using standardized scores). The slopes depicted in Figure 2 suggest that the relationship between satisfaction of the need for competence and intrinsic motivation is only positive for employees high in perceived job autonomy, replicating the results in Study 1. A *t* test revealed that the two slopes were significantly different from each other ($t = 4.11, p < .001$). However, the other two interaction effects found in Study 1 did not replicate in this study.

²The results from the PCA for the second study are available on request from the first author.

Table 3 Descriptive Statistics, Correlations, and Scale Reliabilities for Study 2

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Gender	1.70	0.46	—												
2 Age	42.57	9.80	.10*	—											
3 Position	2.96	1.25	-.03	.36**	—										
4 Tenure	5.60	6.25	.03	.44**	.08	—									
5 Education	3.93	1.41	-.13**	.06	.41**	-.14**	—								
6 Size	2.84	2.05	.00	-.09*	-.11**	-.20**	.00	—							
7 Sector	1.92	0.26	-.01	-.02	-.02	-.06	-.08*	.00	—						
8 Base pay	3.25	1.17	.25**	.26**	.33**	-.05	.31**	.15**	.10*	—					
9 Extrinsic motivation (4)	2.56	0.88	.06	-.20**	-.15**	-.13**	-.06	.04	.01	-.13**	—				
10 Perceived job autonomy (8)	4.12	0.77	-.03	.14**	.32**	.04	.23**	-.08*	.06	.26**	-.19**	—			
11 Need for relatedness (4)	4.06	0.76	-.04	.07	.03	.02	-.02	.08*	-.08	.12**	-.21**	.27**	—		
12 Need for competence (4)	4.17	0.62	-.04	.02	.05	.02	.04	-.05	.06	.07	-.11**	.33**	.15**	—	
13 Balance	5.44	1.31	.06	.18**	.20**	.04	.10*	.01	.03	.22**	-.09*	.39**	.39**	.15**	—
14 Intrinsic motivation (6)	3.85	0.79	-.03	.14**	.27**	.02	.19**	.01	-.03	.26**	-.25**	.44**	.38**	.19**	.17**

Note. Coefficient alphas are displayed on the diagonal. Number of items included in the final scales in parentheses. SD, standard deviation. * $p < .05$. ** $p < .01$.

Table 4 Results of Regression Analyses Study 2

	Intrinsic motivation			
	Step 1	Step 2	Step 3	Step 4
Gender	-.05	-.02	-.02	-.01
Age	.00	.00	.01	.02
Position	.17***	.12**	.12**	.13**
Tenure	.00	-.01	-.02	-.03
Education	.04	.04	.04	.04
Size	.01	.02	.02	.02
Sector	-.04	-.03	-.04	-.03
Base pay	.18***	.09*	.10*	.10*
Extrinsic motivation	-.20***	-.11**	-.11**	-.11**
Perceived job autonomy (Aut)		.27***	.26***	.30***
Need for competence (Com)		.04	.06	.07
Need for relatedness (Rel)		.26***	.24***	.28***
Com × Aut			.17***	.18***
Com × Rel			-.05	.00
Aut × Rel			-.09*	-.07
Aut × Rel × Com			.07	.09
Balance				-.13**
R ²	.15	.32	.34	.35
ΔR ²		.17	.02	.01
F	12.56***	24.20***	19.96***	19.55***

Standardized regression coefficients are shown.

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

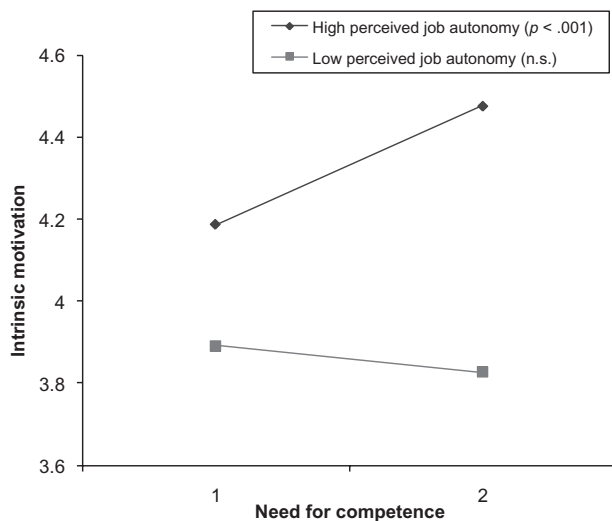


Figure 2 The synergistic roles of need for competence and perceived job autonomy as predictors of intrinsic motivation in Study 2.

Test of Hypotheses 3 (balance effects)

Balance scores were calculated in the same manner as in Study 1. In order to create a variable where higher values indicate more balance, the resulting scores were subtracted from the highest score obtained in this study, which was 7.42. Though the zero-order correlation was positive ($r = .17$, $p < .01$), a negative relationship was found in the regression analysis

between the balance score and intrinsic motivation ($\beta = -.13$, $p < .01$), indicating a suppression effect that precludes us from adequately testing Hypothesis 3.

Supplementary analyses

It should be noted that the relatively high levels of satisfaction of the need for competence and a restriction of range could explain the lack of influence on intrinsic motivation. Tests of normality showed that the distribution of scores for this variable was in slight violation of a normal distribution in the second study. In ordinary multiple regression, it is known that moderate violations of these assumptions do not necessarily lead to inaccurate parameter estimates or standard errors. Thus, provided that the sample size is not too small, standard multiple regression analysis can be regarded as a robust analysis method even when assumptions of normality are not met (Tabachnick & Fidell, 1996). Nevertheless, we ran supplementary analyses consisting of regression analyses with transformed variables. We followed recommended practice (e.g., Field, 2009) and transformed the predictor (need for competence) variable with the natural logarithm of the predictor variable. The results derived from these supplemental analyses did not differ from the reported results. Furthermore, in order to ensure that the results in the two studies were not caused by the omission of items from the satisfaction of need for competence scale, we ran supplementary analyses with all items from that subscale. The results

from these supplementary analyses did not differ from the reported results.

Finally, we wanted to explore the relationship between the three psychological needs and extrinsic motivation to show how intrinsic and extrinsic motivation contrast in terms of their relations to need satisfaction. We ran regression analyses where the control variables and the three psychological needs (and perceived job autonomy in the second study sample) predicted extrinsic motivation. The results from these analyses showed that the satisfaction of the need for autonomy was negatively related with extrinsic motivation in the first sample ($\beta = -.10, p < .05$) and perceived job autonomy did not relate to extrinsic motivation in the second sample ($\beta = -.04, p = .41$). The satisfaction of need for relatedness was unrelated to extrinsic motivation in the first study sample ($\beta = .00, p = .96$), and negatively related in the second study sample ($\beta = -.12, p < .01$). Finally, satisfaction of the need for competence was positively related to extrinsic motivation in the first study sample ($\beta = .10, p < .05$) and unrelated in the second study sample ($\beta = -.04, p = .28$). Taken together, these observations support the differential value of intrinsic and extrinsic motivation proposed in SDT.

General discussion

The purpose of this study was to contribute to the impressive body of empirical research testing SDT by extending this knowledge through testing the relations of need satisfaction to intrinsic motivation in novel ways. We tested, through three alternative hypotheses, a basic assumption of the theory, which states that satisfaction of the needs for autonomy, competence, and relatedness possess different and unique explanatory powers in predicting intrinsic motivation. We tested this in the work domain, although we advise that future research attempt to replicate the present findings in other domains, such as sport, exercise, and education. The first hypothesis stated that the effects of the satisfaction of the three needs on intrinsic motivation would be additive. We found good support for this hypothesis, with regards to autonomy and relatedness, although we found nonsignificant effects for competence satisfaction in two distinct samples.

The second hypothesis stated that satisfaction of the needs only act positively upon intrinsic motivation in synergy with one another. We obtained partial support for the synergistic hypothesis, in that we did not find a three-way interaction in either study, but found a two-way interaction between satisfaction of the needs for competence and autonomy in both studies. This finding showed that workers are intrinsically motivated only when they experienced both satisfaction of the needs for autonomy and competence. Competence alone was not enough for workers to be intrinsically motivated. We also found that the other two-way interactions were significant in the first study, although we were unable to replicate these find-

ings in the second study. The first one indicated that workers were intrinsically motivated only when they experienced both satisfaction of the needs for relatedness and autonomy. The second indicated that in the absence of satisfaction of the need for relatedness, satisfaction of the need for competence still led to high intrinsic motivation. It is interesting to note that although we found a nonsignificant main effect for competence, in all three interaction effects, competence was essential to intrinsic motivation (the only exception being high relatedness satisfaction, which may act as a buffer against feelings of incompetence). These results point to the importance of exploring synergistic effects between satisfaction of the different psychological needs, especially when faced with nonsignificant main effects. These results imply that organizations should pay close attention to the work context in which their employees work and ensure that this context affords the satisfaction of all three needs. This can be achieved with adequate selection and training, access to resources and information to work efficiently, frequent feedback, minimal monitoring, opportunities for initiative, frequent interactions between employees, and empathic management.

The third hypothesis stated that balanced need satisfaction could predict intrinsic motivation above and beyond level of need satisfaction. We found mitigated support for this hypothesis. Although we found significant positive zero-order correlations between balance and intrinsic motivation in both studies, balance did not predict intrinsic satisfaction beyond level of need satisfaction in regression analyses. Moreover, we found a suppression effect in the second sample. We therefore did not replicate Sheldon and Niemiec's (2006) findings. It is worth noting that the results obtained in Sheldon and Niemiec (2006), although they showed that balance was related to well-being above and beyond level of need satisfaction, were small in terms of effect size (explaining between 1% to 3% of the variance in well-being). It is also possible that balance may affect well-being, but not intrinsic motivation, even though these two outcomes are typically positively related. Finally, it is also possible that this effect is not applicable to the work domain.

When examining more closely some of the research that examined the effects of competence on intrinsic motivation, we discover that the tasks used in experiments were inherently interesting (e.g., Sheldon & Filak, 2008; Vallerand & Reid, 1984), which could explain the positive findings for competence in these studies. In support of our synergistic findings, Ryan (1982) also reported that controlling positive feedback (high competence – low autonomy) undermines intrinsic motivation, while informational positive feedback (high competence – high autonomy) enhances it. Finally, Gagné, Senecal, and Koestner (1997) unexpectedly found that feelings of competence were negatively related to intrinsic work motivation among telecommunication workers. Perhaps they would have found a positive effect for

competence had they tested its interaction with feelings of autonomy (which was positively related to intrinsic motivation in their study).

Another possibility is that our findings illuminate an even more fundamental problem with the way the satisfaction of need for competence is measured in SDT-derived scales. It is well-known that individuals feel stimulated and intrinsically motivated through novelty and exploration (e.g., deCharms, 1968). In other words, one may feel intrinsically motivated only *during* the process of achieving work mastery, not *after* having mastered it (which in extreme cases may even lead to boredom). For instance, the absence of self-doubt and the feeling of being sufficiently prepared for a challenge has been shown to increase self-efficacy, but at the same time to reduce performance (Vancouver & Kendall, 2006). Furthermore, flow theory (e.g., Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005) suggests that people are most likely to experience flow when they stretch their competencies by selecting goals that are slightly above their current skill level. Recently, Spreitzer, Sutcliffe, Dutton, Sonenshein, and Grant (2005) developed the concept of thriving to describe the experience of energization and growth through activity engagement. In this description, the *process* of mastering an activity is what constitutes thriving. If this proposition is valid, conceptualizations and measures of satisfaction of the need for competence or competence perceptions should distinguish between the process of mastery, and the perception of having acquired necessary competencies. In current need satisfaction scale, it seems that the latter is favored over the former, which may possibly lead to a null association with intrinsic motivation.

Another potentially interesting finding from our research is the predictive role of the satisfaction of the need for relatedness. Whereas, this need has been portrayed as the most peripheral one of the three, especially in relation to intrinsic motivation as opposed to internalization of extrinsic motivation, our findings suggest that it is as important to intrinsic motivation as the satisfaction of the other two needs. Accordingly, structuring work environments to allow for interdependence and identification among employees, in addition to showing respect and concern for employees, may be even more important for intrinsic motivation than originally posited by SDT, at least in the work domain (e.g., Gagné & Deci, 2005). This interpretation also aligns well with the meta-analytical findings by Humphrey et al. (2007), in which they confirm the vital role of both autonomy *and* a trusting and inclusive work environment for predicting a range of positive outcomes for employees in work settings, including intrinsic or internal motivation.

Limitations

The results of the present study should be interpreted in light of several limitations. First, the data in this study were gath-

ered at one point in time, making it impossible to make causality inferences or rule out the possibility of reverse causality. In order to remedy these shortcomings, more longitudinal or experimental studies are needed, such as the one by Sheldon and Filak (2008). Another limitation is the reliance on self-reported questionnaire data, which raises concerns about possible mono-method bias and percept–percept inflated measures (e.g., Crampton & Wagner, 1994). In Study 1, a principal components analysis generated six factors with eigenvalues of 1 or more, with variance explained ranging from 4 to 24% per factor. This indicates that common method variance was not a serious threat in this study (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Besides, the constructs investigated in the present studies are best assessed by the employees themselves as it is their perceptions that count the most (Chan, 2009).

It may represent a limitation that the scale used to measure autonomy perception in the second study was not developed to measure satisfaction of the need for autonomy. Job autonomy is a measure of a perception of affordances of autonomy through job design. In contrast, feelings of autonomy at work can emerge from job autonomy and other work factors, such as leadership style (Baard et al., 2004), organizational structure (Parker, 1998), team work (Janz, Colquitt, & Noe, 1997), peer pressure (Grant & Parker, 2009), and compensation systems (Gagné & Forest, 2008). On the other hand, the fact that we found the same moderator effect of autonomy on competence satisfaction using two different measures of autonomy strengthens the validity of the results.

A related limitation could be the stringent selection criteria used for item inclusion. Given that an existing scale was translated in a new language, it was necessary to assess its factorial structure and reliability in this new language. Moreover, given that the purpose of our study was to explore the unique and relative influence of psychological need satisfaction on intrinsic motivation, the latent variables needed to demonstrate acceptable levels of discriminant validity (Farrell, 2010). We cannot, however, disregard the possibility that our results may have been influenced by the selection of a limited number of items from an existing scale, although supplementary analyses including all need for competence items unveiled similar results as those for the limited scale. Also, the items used to measure the satisfaction of need for competence, the satisfaction of need for relatedness and intrinsic motivation in the first study were included in the second study, making the results comparable. Nonetheless, the restriction of range and the deviation from a normal distribution found in the second study for satisfaction of the need for competence imply that these results should be interpreted with caution.

Finally, it should be noted that the measure of intrinsic motivation employed in the two studies differs from what is usually applied in SDT research. From an SDT point of view,

meaning would probably reflect identified regulation. We can still assert that the scale focused more strongly on intrinsic than on identified motivation. Future research should attempt to replicate the present research using other assessments of intrinsic motivation, but also possibly extend the results to other forms of autonomous motivation.

Future research

Future empirical SDT research should measure and analyze satisfaction of the needs for autonomy, competence, and relatedness in a way that captures their unique qualities and influences. Furthermore, an interesting avenue for future research would be to design studies in order to explain better the relative effects of different types of need satisfaction among different types of employees. The samples in our two studies consisted of relatively highly educated employees, and we cannot rule out the possibility that our findings would have been different in less knowledge-intensive samples. As a proposition, knowledge work could represent a condition under which satisfaction of the needs for autonomy and relatedness is more salient than satisfaction of the need for

competence, because most knowledge workers would probably perceive themselves as competent to carry out their job. It may also be that satisfaction of the need for competence may be more influential in samples with greater variance in satisfaction of that particular need. Finally, satisfaction of the need for relatedness deserves increased research attention (Dutton & Heaphy, 2003). One particularly interesting hypothesis is that satisfaction of the need for relatedness can compensate for jobs with less potential for satisfying other needs, making it an even more powerful explanation of intrinsic motivation.

Although much research has examined relations between need satisfaction and well-being (e.g., Johnston & Finney, 2010), studies examining relations between need satisfaction and intrinsic motivation remain relatively rare (Greguras & Diefendorff, 2009). The present studies attempted to fill this gap, but more research in different domains and targeting different tasks is needed to draw more definitive conclusions. For example, would the same hypotheses be supported in the education domain, where mastery is a crucial feature? Would the same hypotheses be supported for tasks that are of different levels of complexity? Many questions remain unanswered.

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Appendix A

Factor Loadings from a Principal Components Analysis with Promax Rotation in Study 1

Items	IM	COM	REL	EM	AUT	
IM3: My job is meaningful	<u>.96</u>					
IM2: The tasks I do at work are enjoyable	<u>.95</u>					
IM4: The tasks I do at work represent in themselves a driving power in my job	<u>.91</u>					
IM1: My job is very exciting	<u>.85</u>					
AUT4: The tasks I have to do at work are in line with what I really want to do	.66					
COM3: I feel competent at my job		<u>.91</u>				
COM5: I am good at the things I do in my job		<u>.90</u>				
COM2: I really master my tasks at my job		<u>.89</u>				
COM6: I have the feeling that I can even accomplish the most difficult tasks at work		<u>.77</u>				
AUT1: I feel like I can be myself at my job		.53				
REL3: I don't really mix with other people at my job (R)			<u>.83</u>			
REL5: I often feel alone when I am with my colleagues (R)			<u>.77</u>			
REL1: I don't really feel connected with other people at my job (R)			<u>.73</u>			
REL6: Some people I work with are close friends of mine			.54		-.34	
REL4: At work, I can talk with people about things that really matter to me			<u>.50</u>			
REL2: At work, I feel part of a group			.43			
EM3: External incentives such as bonuses and provisions are essential for how well I perform my job				<u>.88</u>		
EM2: It is important for me to have an external incentive to strive for in order to do a good job				<u>.80</u>		
EM4: If I had been offered better pay, I would have done a better job				<u>.77</u>		
EM1: If I am supposed to put in extra effort in my job, I need to get extra pay				<u>.66</u>		
AUT3: If I could choose, I would do things at work differently (R)					<u>.79</u>	
AUT2: At work, I often feel like I have to follow other people's commands (R)					<u>.74</u>	
AUT6: In my job, I feel forced to do things I do not want to do (R)					<u>.68</u>	
AUT5: I feel free to do my job the way I think it could best be done					<u>.50</u>	
COM1: I don't really feel competent in my job (R)		.41			.68	
COM4: I doubt whether I am able to execute my job properly (R)		.44			.64	
Eigenvalues	6.23	3.13	2.41	1.91	1.43	1.03
% of variance	23.97	12.06	9.29	7.36	5.51	3.95

Note. Factor loadings less than .30 are not shown; bold and underlined loadings included in the final scales. AUT, need for autonomy; COM, need for competence; EM, extrinsic motivation; IM, intrinsic motivation; REL, need for relatedness.