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Benefits of All Work and No Play: The Relationship Between Neuroticism and Performance as a Function of Resource Allocation

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The authors evaluate a model suggesting that the performance of highly neurotic individuals, relative to their stable counterparts, is more strongly influenced by factors relating to the allocation of attentional resources. First, an air traffic control simulation was used to examine the interaction between effort intensity and scores on the Anxiety subscale of Eysenck Personality Profiler Neuroticism in the prediction of task performance. Overall effort intensity enhanced performance for highly anxious individuals more so than for individuals with low anxiety. Second, a longitudinal field study was used to examine the interaction between office busyness and Eysenck Personality Inventory Neuroticism in the prediction of telesales performance. Changes in office busyness were associated with greater performance improvements for highly neurotic individuals compared with less neurotic individuals. These studies suggest that highly neurotic individuals outperform their stable counterparts in a busy work environment or if they are expending a high level of effort.

Keywords: neuroticism, resource allocation, performance, telesales, air traffic control

Over the last decade, there has been increasing consensus regarding the importance and usefulness of personality for predicting both job performance (De Fruyt & Salgado, 2003; Hough & Oswald, 2000; Revelle, 1995; Tett, Jackson, & Rothstein, 1991) and other organizational criteria, such as motivation, job satisfaction, and absenteeism (Ones, Viswesvaran, & Schmidt, 2003; Salgado, 2002). Within H. J. Eysenck's *Psychoticism–Extraversion–Neuroticism* (PEN) system (H. J. Eysenck, 1967, 1991, 1992, 1997), meta-analyses indicate that Extraversion is a consistent predictor of job performance (e.g., De Fruyt & Salgado, 2003), and there is some evidence that Psychoticism may interact with intelligence to predict creative achievement (e.g., H. J. Eysenck, 1993, 1994). Neuroticism, however, does not appear to have a clear relationship with performance. That is, despite occasional negative (e.g., Salgado, 1997; Tett et al., 1991) or positive (e.g., Corr & Gray, 1995; Furnham, Jackson, & Miller, 1999) predictiveness, findings typically demonstrate little or no association between Neuroticism and job performance (e.g., Barrick & Mount, 1991; Barrick, Stewart, & Piotrowski, 2002; Gallagher, 1996; Salgado, 2003; Vinchur, Schippmann, Switzer, & Roth, 1998). Neuroticism has, however, been strongly linked to undesirable work outcomes, including low performance motivation (Judge & Ilies, 2002), burnout, and emotional exhaustion (Wright & Cropanzano, 1998; Wright & Staw, 1999). Overall, therefore, this personality trait is widely supposed to have negative implications for performance in the work environment.

In the laboratory, the relationship between Neuroticism and various performance criteria is also ambiguous. Using similar experimental paradigms, researchers have found evidence for a *positive* relationship between Neuroticism and performance (e.g., M. W. Eysenck & Calvo, 1992) as well as the more prevalent finding of a *negative* relationship (e.g., Newton, Slade, Butler, & Murphy, 1992). Nevertheless, other findings suggest that there is no unequivocal relationship between Neuroticism and performance (e.g., Corr, 2003). Indeed, it has been suggested that the relationship between Neuroticism and performance is poorly understood, first because it was not clearly specified in H. J. Eysenck's (1967) theory (i.e., his greater focus was Extraversion–Introversion and related arousal processes) and second because the methods used to investigate this relationship have often been problematic (Matthews & Gilliland, 1999). It is therefore not surprising that associations between Neuroticism and performance are often weak or absent in an organizational context.

To understand how Neuroticism may relate to work performance, one must first consider the theoretical nature of this trait. H. J. Eysenck (1967) first conceptualized Neuroticism as a bipolar dimension of emotional stability, whereby highly neurotic individuals are emotionally reactive when compared with their stable counterparts. Much research exists to support the assumption that highly neurotic individuals show strong or aversive responses to stimulation (H. J. Eysenck & M. W. Eysenck, 1985; Stelmack,

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1990). It has also been widely observed that highly neurotic individuals are disposed toward negative cognitions, intrusive thoughts, and a pessimistic interpretation of stimuli and events (Beck, 1976; Gilbert, 1989; Luminet, Zech, Rimé, & Wagner, 2000; Matthews, Derryberry, & Siegle, 2000; Rusting & Larsen, 1997). Similarly, "clinically" neurotic or anxious individuals show stronger tendencies to interpret ambiguous stimuli in a negative manner, such as the tendency to select the more aversive interpretation from a pair of homophones (e.g., "die" rather than "dye"; M. W. Eysenck, MacLeod, & Matthews, 1987). With this emphasis on emotionality, the causal basis of Neuroticism has been linked to physiological substrates responsible for emotional responses, chiefly the limbic system and visceral brain (H. J. Eysenck, 1967; H. J. Eysenck & M. W. Eysenck, 1985). However, given the potentially indirect explanation provided by such physiological bases, the need for more proximal cognitive explanations has been highlighted (Matthews & Gilliland, 1999).

To date, cognitive accounts of Neuroticism appear to be underutilized, possibly because emotional processes have traditionally been considered to be separate from cognitive processes. However, there is mounting evidence to suggest that emotional and cognitive processes are interrelated (e.g., Gray, 1990). Recently, Wallace and Newman (1997, 1998) put forward a cognitive model of Neuroticism, which explains the emotional characteristics of highly neurotic individuals in terms of attentional processes. Here it is suggested that optimal functioning requires ongoing regulation of negative thoughts and that the emotionality of Neuroticism has a basis in *unsuccessful* regulation of such cognitions, termed *dysregulation*. According to Wallace and Newman, this is because highly neurotic individuals are particularly susceptible to the automatic orienting of attention, which disrupts these regulatory processes. Wallace and Newman (1997) define "automatic orienting of attention" as any instance where attention and cognitive resources are redirected from an ongoing process to distractor stimuli (pp. 139–140) or cognitions (p. 142). As Wallace and Newman state that dysregulation of negative cognitions influences affect and behavior, it is plausible that this also includes the performance of highly neurotic individuals in a work environment. In this case, the susceptibility of highly neurotic individuals to dysregulation may translate into a tendency for such individuals' performance (in comparison with that of their stable counterparts) to be more strongly influenced by factors relating to the allocation of attentional resources.

Wallace and Newman's model, considered here in the context of work performance, raises an interesting possibility: If the redirection of attentional resources *impairs* the performance of highly neurotic individuals more strongly than for their counterparts, then highly neurotic individuals may be able to *gain* larger performance improvements than their counterparts when more resources are directed to the task at hand. From general principles of resource allocation (e.g., Kahneman, 1973; Kanfer & Ackerman, 1989; Norman & Bobrow, 1975) it is understood that attentional resources comprise a limited set of cognitive processes, which can be directed toward on-task, off-task, and self-regulatory activities. Therefore, as more resources are directed toward a given task, there should be fewer remaining to be directed elsewhere, thereby preventing dysregulation and facilitating effective regulation of negative cognitions. As such, when highly neurotic employees are immersed in their work, busy, or otherwise engaged in effortful processing, they might improve their performance considerably owing to less interference from negative thoughts. On the other hand, when these employees are less occupied, less busy, or otherwise disengaged from their work, more resources may be available to be redirected, leading to dysregulation and potentially poorer performance. As such, the performance of individuals with high Neuroticism, in comparison with their emotionally stable counterparts, could be expected to vary more as a function of resource allocation.

Our analysis suggests a complex relationship among Neuroticism, resource allocation, and performance. Specifically, given that resource allocation and performance can vary within individuals over time as well as between individuals, an interaction between Neuroticism and resource allocation in the prediction of performance may emerge at the between-person level or across the between- and within-person levels. As such, the relationship we have conceptualized is hierarchical and requires examination through multilevel modeling. That is, repeated measurements of resource allocation and performance need to be nested within single measurements of Neuroticism so that we can assess changes in resource allocation and performance *within* individuals as well as differences in average levels of these constructs *between* individuals, along with determining how the relationships among these constructs differ for individuals with high versus low Neuroticism. To our knowledge, there has been no attempt to test such a model. However, it has been noted that performance (e.g., Deadrick & Madigan, 1990) and some of its antecedents, including resource allocation (Yeo & Neal, 2004), affect (Fisher, 2000, 2002), and self-efficacy (Vancouver, Thompson, & Williams, 2001), can vary over time and should be measured accordingly. Furthermore, some research has demonstrated that individual differences can account for the nature of these within-person relationships (e.g., Deadrick & Madigan, 1990; Yeo & Neal, 2004).

Broadly, we propose that increased allocation of resources toward a task should reduce the amount of resources available for redirection toward task-irrelevant stimuli or cognitions. We expect that this will result in greater performance improvements for highly neurotic individuals in comparison with their counterparts, because highly neurotic individuals are particularly susceptible to the automatic orienting of attention. It is important to note that this prediction, although significantly influenced by Wallace and Newman's (1997, 1998) model, is neither a direct implication of their conclusions nor a test of their postulations. Specifically, their model espouses that when automatic orienting of attention occurs, there are fewer resources available for the self-regulation of dysfunctional thoughts. We are suggesting that when one allocates more resources to a task, there should be fewer resources available to be redirected elsewhere, thus reducing the likelihood of dysregulation.

Overview of Studies

In Study 1, we tested our hypothesis in a controlled laboratory setting to enable direct measurement of resource allocation. Specifically, we collected temporally spaced verbal ratings of protocols to provide ratings of effort intensity and also took repeated measurements of performance while participants completed an air traffic control simulation. We hypothesized that effort intensity would interact with Neuroticism, such that the relationship between effort and performance would be stronger for highly neurotic participants. Given that effort intensity and performance in this context may vary both within and between individuals, this interaction could emerge as either a cross-level interaction or a between-person interaction. A cross-level interaction would emerge if changes in effort intensity *within* individuals are more strongly related to changes in performance scores for highly neurotic individuals in comparison with less neurotic individuals. However, if our laboratory context induced a greater proportion of variance in effort intensity between individuals, this relationship could materialize as a between-person interaction. In this case, the positive effect of overall levels of effort intensity on overall performance scores would be stronger for highly neurotic individuals in comparison with less neurotic individuals. The important point to note is that the substantive interpretation is the same whether we find a cross-level interaction or a between-person interaction; both would provide support for our first hypothesis:

> *Hypothesis 1:* The positive effect of effort intensity on performance will be stronger for highly neurotic individuals compared with less neurotic individuals.

In Study 2, we used a longitudinal field study to evaluate the extent to which situational factors likely to influence resource allocation might interact with Neuroticism in the prediction of work performance. Using daily indices of office busyness to indicate likely resource allocation, we expected that the relationship between busyness (in the workplace as a whole) and employee productivity (at the individual level) would be stronger for highly neurotic employees. We used two measures of office busyness to investigate this relationship: (a) the total number of quotes made within the office (office quotes) and (b) the total number of sales made within the office (office sales). Given that office busyness in this context does not vary between individuals,[1] our hypothesized relationship could emerge only as a cross-level interaction: Changes in office busyness across days were expected to be more strongly related to changes in individual sales for highly neurotic individuals in comparison with less neurotic individuals. The two hypotheses for the field study were as follows:

> *Hypothesis 2a:* The positive effect of office quotes on individual sales will be stronger for highly neurotic individuals in comparison with less neurotic individuals.

> *Hypothesis 2b:* The positive effect of office sales on individual sales will be stronger for highly neurotic individuals in comparison with less neurotic individuals.

Study 1

Participants in this study performed a simulated air traffic control (ATC) task that was both complex and novel. Additionally, performance for this study was assessed during the early phase of skill acquisition. Given these parameters, it was expected that high levels of effort would be required to perform well (Anderson, 1982; Kanfer & Ackerman, 1989). As such, this task was considered appropriate for investigating the interaction between resource allocation and Neuroticism. We measured the degree of resource allocation by gathering self-report estimates of effort intensity throughout the experiment. It was predicted that the positive effect of effort intensity on performance would be stronger for highly neurotic individuals compared with less neurotic individuals (see Hypothesis 1).

Method

Participants

The sample used for this study comprised 69 undergraduate psychology students who participated in exchange for course credit (41 women, 28 men; age: $M = 19.43$, $SD = 2.63$). These participants were taken from a larger pool of 101 individuals, described elsewhere (Yeo & Neal, 2004). The results relating to Neuroticism have not previously been presented.

Experimental Task

Participants performed 30 2-min trials of the low-fidelity conflict recognition task, which is part of the ATC-lab suite (Loft, Hill, Neal, Humphreys, & Yeo, 2004). Conflict recognition is one of the key elements of an air traffic controller's job (Griffin, Neal, & Neale, 2000). For each trial, participants were presented with four pairs of aircraft (labeled A to D). Each of these four aircraft events had six variations (three conflicts and three nonconflicts), with durations of 100, 95, or 90 s. Participants were informed that an aircraft pair was called a "conflict" if the aircraft involved came within 5 km of one another. The task objective was to decide whether each pair of aircraft would eventually pass safely or violate a separation standard, while maximizing a speed–accuracy trade-off. Further details of this task are provided in Yeo and Neal (2004).

Measures

Task performance. To measure performance, points were awarded for correct decisions, on the basis of the participant's reaction time. A maximum of 40 points were attainable for a decision made during the first quarter of an aircraft event. Ordinally slower correct decisions received 30, 20, and 10 points, respectively. For each incorrect decision or failure to make a decision, a fixed amount of 25 points was deducted; this value was chosen as it represents the average of the four possible scores for a correct decision. This scoring system was used so that scores would be comparable across items and trials. Simpler scoring systems (such as awarding points purely on the basis of reaction time) would have been inappropriate given that they would not have taken into account the varying durations of the aircraft events.

Neuroticism. The feature of Neuroticism of most theoretical interest was the putative tendency for neurotic individuals to experience dysregulation of negative or anxious cognitions. For this reason we selected the Anxiety subscale of Neuroticism from the Eysenck Personality Profiler (EPP; H. J. Eysenck, Barrett, Wilson, & Jackson, 1992; H. J. Eysenck, Wilson, & Jackson, 2000), which reflects the tendency for individuals to worry unnecessarily about unpleasant things. Low scorers are defined as placid, serene, and resistant to irrational fears and anxieties, whereas high scorers are defined as easily upset by things that go wrong. They are somewhat "jumpy" and are inclined to worry unnecessarily about unpleasant things that may or may not happen (H. J. Eysenck et al., 2000). EPP Anxiety is a widely used 20-item scale with sound psychometric characteristics (H. J. Eysenck et al., 2000; Jackson, Furnham, Forde, & Cotter, 2000; Petrides, Jackson, Furnham, & Levine, 2003). In terms of construct validity, multivariate studies show that EPP Anxiety is a central and primary scale of Neuroticism (H. J. Eysenck et al., 2000; Jackson et al., 2000; Petrides et al., 2003). Petrides et al. (2003) reviewed the reliability of EPP Anxiety across four different studies and reported that alpha varied between .80 and .85. The reliability for the EPP Anxiety subscale in this study was .83.

Effort intensity. To measure effort intensity, self-report estimates were collected from the participants as they completed the task. Specifically, the

[1] The individuals in this study worked in the same office, and so office busyness varied across the days of the study for each individual but *overall* office busyness did not vary between individuals.

program was frozen twice during each 2-min trial (at 30 and 90 s), and participants were asked to respond to the following question: "How hard were you trying just before the screen froze?" Participants responded on an 11-point scale ranked from 0 (*not at all*) to 10 (*extremely hard*). These ratings were averaged within each trial to calculate a single effort intensity score for each participant on each of the 30 trials. The internal consistency reliability of these 30 average scores was .98. The internal consistency was also calculated for the two raw scores across each of the 30 trials. These reliability estimates ranged from .67 (Trial 1) to .94 (Trial 30) (M = .82, SD = .06).

Control variables. The measures of prime interest in this study were task performance, EPP Anxiety, and effort intensity. In addition, perceived difficulty, the linear and quadratic effects of practice, impulsivity, gender, and age were included as control variables.

We argue that effort intensity and perceived difficulty should be positively related to one another yet have different implications for performance, and thus the relationship between effort intensity and performance could be confounded if perceived difficulty is not controlled for. Research indicates a positive link between difficulty (actual or perceived) and resource allocation (Locke, 1997; Maynard & Hakel, 1997; Rasch & Tosi, 1992; Weingart, 1992). However, even though perceived difficulty is expected to prompt increased effort, these perceptions do not necessarily lead to better performance. This is because perceived difficulty is also expected to relate directly to performance, in a *negative* direction. That is, resource allocation theory predicts that performance should decline in association with difficulty (actual or perceived) owing to the associated load on resource capacity. In support of this theory, empirical studies demonstrate that both actual (e.g., Steele-Johnson, Beauregard, Hoover, & Schmidt, 2000) and perceived (e.g., Mangos & Steele-Johnson, 2001; Maynard & Hakel, 1997) task difficulty are negatively associated with task performance.

From a within-person perspective, when individuals increase their effort above their average level, we expect an associated increase in their performance score. However, this increase in effort is also expected to coincide with perceptions of high task difficulty—that is, individuals increase their effort when extra resources are required to enhance their performance. Given that perceived difficulty is expected to relate negatively with performance, the within-person association between effort and performance could appear negative, because people put in high levels of effort when they perceive the task as difficult (and thus are performing poorly). From a between-person perspective, we would normally expect the individuals who put in the most effort overall to be the best performers. However, without controlling for perceived difficulty, we could see a negative association, because the people who put in high levels of effort might also be those who perceived the task as very difficult (e.g., more internal distractions, lower ability). Overall, therefore, if perceived difficulty is not controlled for, effort could display a negative association with performance (as demonstrated by Yeo & Neal, 2004). This would indicate that the relationship between effort and performance is confounded by perceived difficulty.

Perceived difficulty was measured in the same manner as effort intensity. Twice during each trial, participants were asked, "How difficult did you find the task just before the screen froze?" and again responded on an 11-point scale ranked from 0 (*not at all*) to 10 (*extremely difficult*). The internal consistency reliability of the 30 average scores was .98. The internal consistency for the two scores within each trial ranged from .62 (Trial 1) to .97 (Trial 30) (M = .84, SD = .06).

The effects of practice were controlled for, because effort intensity is expected to change throughout the process of skill acquisition (Kanfer & Ackerman, 1989). Impulsivity was included to control for any effects relating to disinhibitory processes reflected by the EPP Anxiety subscale. That is, it was theoretically important that our operationalization of Neuroticism was not simply capturing "inhibition" (low impulsivity), which may have an entirely unrelated relationship with performance.

Procedure

Participants were tested in small groups of up to six individuals. First, they completed the personality and demographic paper-and-pencil measures in a small classroom. Next, the participants were seated in separate cubicles of a computer laboratory, and instructions for the ATC task were read aloud from a prepared script. Participants then completed the thirty 2-min trials, which included the self-report questions for effort intensity and perceived difficulty. The first was treated as a practice trial, and therefore only 29 trials were included in the analyses.

Statistical Analyses

Analyses for this study were conducted using hierarchical linear modeling (HLM; Bryk & Raudenbush, 1992). HLM is a multilevel regression analysis technique (Goldstein, 1987, 1995; Goldstein et al., 1998), which is optimal for analyzing data collected at two different levels. In this study, the dependent variable was the total number of points accrued per person, for each of the 29 trials. The Level 1 independent variable was effort intensity, with one measurement per person for each of the 29 trials. The Level 2 independent variables were the single measure of EPP Anxiety and the single measure of overall effort intensity for each individual.

The reason we include effort intensity as a Level 1 and Level 2 predictor is that self-reports of effort intensity may vary between and within individuals. Indeed, the intraclass correlation coefficient for this variable was .62, indicating that 62% of the variance in effort intensity was at the between-person level while 38% varied within individuals. Therefore, the interaction of interest could materialize either as cross-level or at the between-person level. Under these circumstances, Hofmann and Gavin (1998) advise researchers to test these two types of interactions separately. The method they suggest involves centering effort intensity around the group (or in this case, the individuals') means, such that the pure within-person relationship is tested at Level 1, and then reintroducing the between-person variance into the model by entering the individuals' overall effort intensity scores as a Level 2 predictor of the intercept. The cross-level interaction is tested by specifying EPP Anxiety as a predictor of the effort intensity slope, while the between-person interaction is tested by entering the cross-product of overall effort intensity and EPP Anxiety as a Level 2 predictor of the intercept.

The proportion of within-person or between-person variance accounted for by each set of variables is assessed via the reductions in magnitude of the intercept, slope, and Level 1 variance components where appropriate. More specifically, if a group-centered Level 1 variable is specified as a fixed effect, it can account only for Level 1 variance, but if it is specified as a random effect, the random component can account for Level 2 variance. If a Level 1 variable is grand-mean-centered rather than group-mean-centered, it can explain variance at Level 2 even if it is specified as a fixed effect, providing that some of its variance exists at Level 2. Level 2 variables can account only for Level 2 variance (around the intercept and slopes). As discussed in Yeo and Neal (2004), these reductions are analogous to effect sizes. All predictors were standardized (around the individuals' means at Level 1 and the grand mean at Level 2) so that the relative magnitude of the coefficients could be compared. As recommended by Aiken and West (1991) for the analysis of interactions between continuous variables, we conducted simple slope analyses by creating arbitrary variables at one standard deviation above and below the mean. In line with previous research using multilevel analyses (e.g., Yeo & Neal, 2004), we set the criterion for cross-level interaction effects at the $p < .10$ level and for other effects at $p < .05$. This was done because the power required to detect cross-level interactions in multilevel research is frequently low, owing to reductions in parameter reliability (Snijders & Bosker, 1999).

Table 1
Air Traffic Control Task: Descriptive Statistics and Intercorrelations Among the Variables at the Between-Person Level (N = 69)

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Overall perceived difficulty[a]	4.91	2.10	—						
2. Gender			.06	—					
3. Age	19.43	2.63	.08	−.05	—				
4. Impulsivity	20.12	7.98	−.15	−.10	−.09	—			
5. Overall effort intensity[a]	4.80	2.18	.91***	.08	.10	−.20	—		
6. Anxiety	15.44	8.37	.02	.40**	−.15	.01	−.00	—	
7. Overall performance[a]	57.13	49.70	−.36**	−.23	−.04	.14	−.34**	−.05	—

Note. Men are coded as 0; women are coded as 1.
[a] Overall perceived difficulty/effort intensity/performance represent the individual's average score for perceived difficulty/effort intensity/performance across the 29 trials.
** $p < .01$. *** $p < .001$.

To address potential power concerns, the Power in Two-Level Designs program (PINT; Bosker, Snijders, & Guldemond, 2003)[2] was used to estimate whether the 69 participants in this study would provide a sufficient sample size to detect the cross-level interaction of interest. PINT requires the user to estimate numerous parameters (e.g., means of predictor variables and the within-individual covariance matrix) and then provide estimates of the standard errors for main effects and cross-level interactions, for various sample sizes. Yeo (2003) reported two studies that investigated the effect of similar variables on performance in an ATC conflict *prevention* task (our present study used a conflict *recognition* task). Therefore, these results were used to estimate the required parameters. According to the formulas provided by Bosker et al. (2003), to detect a small effect size with $\alpha = .05$ (one-tailed,[3] i.e., equivalent to .10 two-tailed) and high power (.80), a sample size large enough to produce the effect with a standard error of less than or equal to .08 is required. The PINT results for our sample size in this study reported a standard error of .04 for the EPP Anxiety × Effort Intensity cross-level interaction, indicating sufficient power to detect a cross-level interaction with a small effect size. This conclusion is in line with the guidelines provided by Kreft and De Leeuw (1998). Unfortunately, these authors do not refer to the size of effects but instead recommend that "60 groups with 25 observations per group (total sample size = 1,500) will produce sufficiently high power" (p. 125). Our sample size of 69 participants with 29 observations each yields a total of 2,001 data points, thus meeting their requirements. The PINT results also indicated that the Study 1 sample size would provide power of .71 to detect a between-person interaction between EPP Anxiety and overall effort, with a small effect, tested at $\alpha = .025$ (one-tailed, i.e., equivalent to .05 two-tailed).

Results

Tables 1 and 2 show the means and standard deviations of each variable as well as the intercorrelations among the variables, at the between- and within-person levels, respectively. As detailed in Table 1, the mean of the EPP Anxiety subscale of Neuroticism is 15.44, and the standard deviation is 8.37. Therefore, participants scoring one standard deviation above the mean have a score of 23.81. The published mean of EPP Anxiety is 11.65, with a standard deviation of 8.61 (H. J. Eysenck et al., 2000), although students typically score slightly higher than this (Jackson, Levine, & Furnham, 2003). Our sample is similar to the published norms, and therefore it is appropriate to define participants scoring more than one standard deviation above the sample mean as highly anxious.

Table 2
Air Traffic Control Task: Descriptive Statistics and Intercorrelations Among the Variables at the Within-Person Level (N = 2,001)

Variable	*M*	*SD*	1	2	3	4
1. Perceived difficulty	4.91	2.64	—			
2. Practice			−.37***	—		
3. Effort intensity	4.80	2.72	.72***	−.34***	—	
4. Performance	57.13	78.63	−.25***	.50***	−.19***	—

Note. To calculate the within-persons correlations, variables were standardized around the individuals' mean scores.
*** $p < .001$.

The intraclass correlation coefficient for performance scores was .41, which indicates that 41% of the variance in performance scores was at the between-person level, while 59% of the variability was at the within-person level. Tables 3 and 4 show the results from the unconditional model for performance scores. Effort intensity was not a significant predictor of performance scores at the between-person level, $t(64) = 0.18$, *ns*. At the within-person level, the effect of effort intensity approached significance, $t(68) = 1.75$, $p = .08$. More important, the random effect for effort intensity was significant, $\chi^2(68, N = 69) = 219.34$, $p < .001$, indicating that the within-person effect of effort intensity varied across individuals. In combination, the Level 1 control variables accounted for 32.12% of the within-person variability in performance scores, and the Level 2 control variables in this model accounted for 12.76% of the between-person variability in performance scores. Effort intensity accounted for an additional 2.17% of the within-person variability; however, it did not explain additional variance at the between-person level.

Tables 5 and 6 show the results from the conditional model. The cross-level interaction between effort intensity and EPP Anxiety was not significant, $t(67) = 1.39$, $p > .10$; however, the between-person interaction among these variables was significant, $t(61) = 2.58$, $p < .05$. Simple slope analyses indicated that this between-person interaction supported Hypothesis 1. Specifically, the positive effect of overall effort intensity was stronger for highly anxious individuals, $\beta = 20.18$, $t(61) = 1.69$, $p < .10$, in comparison with those of low anxiety, $\beta = -7.34$, $t(61) = -0.72$, *ns*. This finding indicates that an increase of one standard deviation in the EPP Anxiety score is associated with an increase in the effect

[2] The user's manual for PINT can be located at http://stat.gamma.rug.nl/snijders/

[3] The PINT calculations use one-tailed tests.

Table 3
Air Traffic Control Task: Unconditional Model—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}		
Intercept, λ_{00}	71.29***	6.47
Gender, λ_{01}	−9.76†	5.35
Age, λ_{02}	−3.58	6.01
Overall perceived difficulty, λ_{03}	−19.84†	10.35
Overall effort intensity, λ_{04}	1.97	10.70
Perceived difficulty, π_{10}	−8.44***	2.11
Practice, π_{20}	30.72***	3.17
Quadratic practice, π_{30}	−14.55***	1.86
Effort intensity, π_{40}	4.37†	2.50

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared.
† $p < .10$. *** $p < .001$.

of overall effort intensity by 13.76 standardized points. For example, the effect of overall effort intensity for an individual with an average anxiety score is $\beta = 6.42$. For these individuals, a one standard deviation increase in overall effort is associated with a 6.42-point increase in overall performance score. However, the effect of overall effort for individuals with an anxiety score that is one standard deviation above average is 13.76 points larger, $\beta = 20.18$, indicating that a similar increase in their overall effort is associated with a 20.18-point increase in overall performance score. This between-person interaction is shown in Figure 1.

Neither the Level 2 control variable, impulsivity, nor the main effect of EPP Anxiety accounted for additional between-person variance in performance scores. However, the between-person interaction between overall effort intensity and anxiety accounted for an additional 4.66% of the between-person variance in average performance scores, and EPP anxiety accounted for 1.67% of the parameter variance around the effort intensity slope.

Discussion

This study supported Hypothesis 1. Results indicated that the positive effect of overall effort intensity on overall performance was stronger for individuals with high Neuroticism (as measured by EPP Anxiety) in comparison with less neurotic individuals. We interpret these findings in terms of our theoretical rationale for the influence of resource allocation on performance for highly neurotic individuals. On the basis of recent explanations of Neuroticism (Wallace & Newman, 1997, 1998) and arguments from resource allocation theory (e.g., Kanfer & Ackerman, 1989), we had predicted that when individuals with high Neuroticism direct a large proportion of their resources toward a task, their performance would be considerably better than when they expend less resources toward a task. This is because when these individuals are more strongly engaged in the task at hand, there are fewer resources available for attentional shifts that would induce *dysregulation*. As individuals with low Neuroticism are not susceptible to dysregulation, the performance of such individuals should not be as contingent on effort. Our results support this overall rationale.

Our findings are novel, as they suggest that highly neurotic individuals may benefit to a greater extent from expending high levels of effort in comparison with their counterparts. What is particularly interesting, however, is that this effect was strong enough for neurotic individuals to outperform their counterparts at high levels of effort intensity. Specifically, a follow-up simple slopes analysis showed that at high levels of overall effort, those with high EPP Anxiety scores performed *better* than those with low EPP Anxiety scores, $\beta = 13.40$, $t(61) = 2.13$, $p < .05$. On the other hand, the relationship between EPP Anxiety and performance scores at low levels of overall effort was not significant, $\beta = -19.54$, $t(61) = -1.81$, $p = .07$. This is an interesting finding, because it suggests that Neuroticism may actually be a positive predictor of performance in certain circumstances. This implication contrasts with the tendency to perceive this trait negatively in a work context and with the substantial proportion of empirical research that demonstrates a nonsignificant relationship between Neuroticism and job performance.

Table 5
Air Traffic Control Task: Conditional Model—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}		
Intercept, λ_{00}	71.29***	6.23
Gender, λ_{01}	−5.63	5.94
Age, λ_{02}	−3.79	5.97
Overall perceived difficulty, λ_{03}	−22.52*	9.50
Overall effort intensity, λ_{04}	6.42	9.75
Impulsivity, λ_{05}	5.04	4.69
Anxiety, λ_{06}	−3.07	6.32
Anxiety × Overall Effort, λ_{06}	13.76*	5.34
Perceived difficulty, π_{10}		
Intercept, λ_{10}	−8.35***	2.10
Practice, π_{20}		
Intercept, λ_{20}	30.70***	3.16
Quadratic practice, π_{30}		
Intercept, λ_{30}	−14.51***	1.86
Effort intensity, π_{40}		
Intercept, λ_{40}	4.30†	2.48
Anxiety, λ_{41}	2.71	1.95

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared.
† $p < .10$. * $p < .05$. *** $p < .001$.

Table 4
Air Traffic Control Task: Unconditional Model—Random Effects

Random effect	Variance component	Reliability coefficient
Intercept, π_{00}	2,084.93***	.96
Effort intensity, π_{40}	187.44***	.69
Level 1 error	2,434.52	

*** $p < .001$.

Table 6
Air Traffic Control Task: Conditional Model—Random Effects

Random effect	Variance component	Reliability coefficient
Intercept, π_{00}	2,013.72***	.96
Effort intensity, π_{40}	184.31***	.69
Level 1 error	2,434.45	

*** $p < .001$.

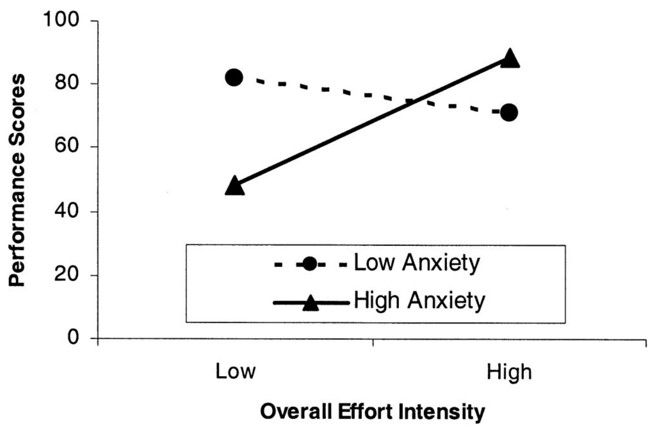

Figure 1. Air traffic control task: Between-persons interaction between the Anxiety subscale of the Eysenck Personality Profiler and overall effort intensity.

It is also worth noting that the relationship between overall effort intensity and performance for individuals with *low* EPP Anxiety was nonsignificant. This is an interesting finding, but it is consistent with our theoretical rationale. Specifically, we have suggested that neurotic individuals have lower performance when they allocate fewer resources toward a task and that this is because they are more likely to experience dysregulation of negative cognitions under such conditions. This effect is not predicted for stable individuals, and therefore we have no particular reason to expect that emotionally stable people will perform considerably worse when they expend below-average levels of effort throughout a task. If emotionally stable people were to expend extremely low levels of effort overall, then we would expect performance to suffer, but we believe that our laboratory study had sufficiently motivating demand characteristics such that participants were likely to sustain a reasonable amount of effort throughout the task.

Given that perceived difficulty and effort intensity are expected to be positively related to each other yet have different implications for performance, we argued that perceived difficulty may confound the relationship between effort and performance. Specifically, we suggested that effort may display a negative association with performance because individuals are expected to exert more effort at times when they perceive the task as more difficult and are thus performing poorly. Consistent with this argument, the correlation between effort and performance in Study 1 was negative, yet the HLM analyses indicated that the association between these two variables was positive after controlling for perceived difficulty. There are alternative explanations for the negative correlation between effort and performance, including fatigue or serial dependencies across trials (such that high effort is related to poor performance only because individuals expend high effort at the beginning of practice).[4] Nevertheless, given the brief duration of the experiment and the lack of evidence for fatigue effects (e.g., performance was positively correlated with trials and perceptions of difficulty were negatively correlated with trials), it is unlikely that fatigue influenced the interpretation of our results. Serial dependence is not a viable explanation either, because we controlled for practice.

As effort intensity and perceived difficulty were highly correlated in this study, it is worth considering how this might have affected the interpretation of our results. Although multicollinearity can pose problems in multiple regression research, the more problematic effects are restricted to estimation of interaction terms (e.g., Cortina, 1993; Dunlap & Kemery, 1987), which is not a problem for our study because we partialed the collinear variable out of the target predictor prior to assessing such terms. A recent article addressing this issue shows that this also holds for multilevel modeling research (Shieh & Fouladi, 2003)—Level 1 parameters were estimated with minimal bias resulting from multicollinearity. Nevertheless, given their high overlap, can the two constructs as measured in this study be considered divergent? Furthermore, how meaningful are the effects relating to effort given that so much of its variance was removed after controlling for perceived difficulty (i.e., does effort retain construct validity)? Supporting the convergent and divergent validity of both effort and perceived difficulty, we note that performance was predicted negatively by perceived difficulty ($\beta = -8.44$, $p < .001$) and positively by effort ($\beta = 4.37$, $p < .10$). In addition, both effort and perceived difficulty were negatively correlated with trials (which is in line with Kanfer and Ackerman's, 1989, resource allocation theory). Furthermore, though not discussed in the present project, conscientiousness was measured in this sample of participants. Conscientiousness correlated with effort ($r = .23$, $p < .10$) but not perceived difficulty ($r = .12$, *ns*), a finding that is in line with motivation theory (Yeo & Neal, 2004). Future research should determine whether these effects can be replicated within a context where effort and difficulty are less correlated. For instance, a context in which there is a great deal of volition may permit individuals to exert more or less effort despite how difficult they perceive the task to be. Indeed, Yeo (2003) showed that the correlations between effort and perceived difficulty were .57 and .64 (at the between-person level) in two conflict prevention tasks that allowed individuals to change the speeds of the aircraft.

In this study, the hypothesized interaction between effort and EPP Anxiety in the prediction of performance emerged at the between-person level and not as a cross-level relationship. That is, the performance differences associated with lower versus higher levels of effort expended throughout the task *as a whole* were more pronounced for individuals with high EPP Anxiety in comparison with individuals with lower scores on this measure. Conversely, the relationship between *changes* in effort intensity from trial to trial and associated changes in performance scores did not appear to differ systematically for individuals with high versus low EPP Anxiety. A potential explanation for the absence of a cross-level interaction in this study is that the 60-min ATC laboratory task was not sufficiently lengthy to capture considerable variation within individuals. The fact that the majority of the variance (62%) in effort intensity scores was at the between-person level in this study supports this explanation. Accordingly, the relationship of interest may be more likely to emerge as a cross-level interaction in contexts where measures are taken over a longer time period. In Study 2, we addressed this possibility using a field study of much longer duration.

Study 2

The findings of Study 1 raise an important implication concerning the explanatory role of Neuroticism in work performance.

[4] We thank an anonymous reviewer for these suggestions.

Specifically, employees with high Neuroticism may benefit more than those with low Neuroticism when they allocate high levels of cognitive resources toward the task at hand. The purpose of our second study was to determine whether situational factors likely to influence resource allocation interact with Neuroticism in the prediction of performance in the workplace. This investigation enabled examination of the extent to which the between-person interaction found in the applied laboratory task of short duration is transferable to a cross-level interaction in a real-world environment.

An important environment for research in organizational psychology is the sales industry. This is not only because sales itself accounts for a significant proportion of the workforce but also because the *task* of selling or marketing is common to many job functions. The work environment selected for this study was telesales, as it provides a field setting within which work performance can be objectively measured. Although a field study does not permit direct measurement of resource allocation, we were able to assess one situational factor that is likely to affect resource allocation. Specifically, we used indices of office busyness to measure variations in the volume of work within the office on any single day. Research indicates that higher workloads elicit an increase in resources allocated to the task (Hockey, 1997; Zakay, Block, & Tsal, 1999). It is therefore reasonable to expect that on busy days, employees will be more task focused in comparison with quieter days. Accordingly, we predicted that Neuroticism would interact with measures of office busyness in the prediction of job performance in the same manner as was observed in Study 1 for effort intensity.

For this study, job performance was operationalized in terms of the number of sales made by an individual. Office busyness was operationalized in terms of (a) the total number of quotes issued within the whole office (*office quotes*) and (b) the total number of sales made within the whole office (*office sales*). These indices were selected because they are objective measures that are closely aligned with the task of selling insurance policies. It is possible that there are other types of measures that might influence a telesales worker's perception of busyness (e.g., time spent filing), but these activities do not occur when making telesales and are less likely to have a direct or immediate influence on the allocation of resources toward the task of closing sales while on the phone. In this study, we predicted first that the positive effect of office quotes on individual sales would be stronger for highly neurotic individuals in comparison with less neurotic individuals (see Hypothesis 2a) and second that the positive effect of office sales on individual sales would be stronger for highly neurotic individuals in comparison with less neurotic individuals (see Hypothesis 2b).

Method

Participants

Sixty-two telesales staff volunteered for participation in this study (69% women, 31% men; age: $M = 28.95$ years, $SD = 8.91$). On average, the participants had spent 2.6 years with the company, with a range of 0–5 years. Three sales staff were identified as outliers in terms of tenure with the company (one of 10 years and two of 18 years) and were therefore removed from all analyses.[5] Therefore, the final sample size was 59 (68% women, 32% men; age: $M = 28.49$ years, $SD = 8.77$). Assurance was given to the employees that their results would be anonymous and used for research purposes only.

Work Environment

Employees in this company were required to sell car insurance policies directly to callers who were responding to various marketing campaigns. The work environment was an open-plan office displaying calls in progress and calls waiting on a large screen visible to all staff members. Calls were received by the call center and then transferred to the next available member of staff. Accordingly, the volume of work entering the office was distributed among all employees. Upon receiving a call, a telesales worker would calculate a quote for the customer. Some of these quotes would result in a sale at a later point in time.

Measures

Job performance. The performance criterion was the number of car insurance policy sales made by each individual telesales employee. This measure was recorded on a daily basis over 24 consecutive working days (4 weeks of Monday to Saturday).

Neuroticism. To determine whether the relationships observed in Study 1 for the EPP Anxiety subscale of Neuroticism could generalize to a broad-focus measure of Neuroticism, each participant completed the Neuroticism Scale from the Eysenck Personality Inventory (EPI; H. J. Eysenck & Eysenck, 1964). The EPI has been very widely used over the last 40 years, and there is considerable evidence for its reliability and validity. The manual of the EPI (H. J. Eysenck & Eysenck, 1964) states that the Neuroticism Scale has a test–retest reliability of .84 over a period of a year ($n = 92$) and a split-half reliability of .81 ($n = 2{,}000$). Rocklin and Revelle (1981) reported that the Neuroticism Scale of the EPI is highly correlated with the EPQ Neuroticism Scale ($r = .83$, $n = 838$) and has a very low correlation with EPQ Extraversion ($r = -.07$, $n = 838$) and EPQ Psychoticism ($r = -.20$, $n = 838$). It is also said to provide purer measurement of its scales compared with subsequent measures of these constructs (H. J. Eysenck & M. W. Eysenck, 1985; Rocklin & Revelle, 1981), and it continues to be used often (e.g., Nietfeld & Bosma, 2003). As the company provided only total scores for data analysis, we were unable to compute alpha for our sample.

Office busyness. To measure office busyness, we calculated, for each day of the study, the total number of sales (office sales) made by and the total number of quotes (office quotes) issued in the open-planned office, to represent how busy the workplace was on any particular day. However, given that the total number of office sales per day is not strictly independent from each individual's performance score (i.e., the number of sales closed by each individual per day), a unique office busyness measure was computed for each person, which excludes their own sales/quotes from the total calculation.[6] Figure 2 shows the office sales and office quotes across the 24 days, clearly indicating that quotes and sales are not entirely codependent. A one-way analysis of variance showed that individual sales, $F(23, 1488) = 4.77$, $p < .001$, and quotes, $F(23, 1488) = 8.10$, $p < .001$, were significantly different across time. Furthermore, Figure 2 indicates that sales and quotes were lower on a Saturday than any other day. This finding is consistent with employee perceptions of Saturday being noticeably less busy than the working weekdays and suggests that our indices of office busyness have ecological validity.

Control variables. As in Study 1, a number of control variables were included. These were gender, age, tenure, EPI Extraversion, and the EPI Lie Scale. We entered the other scales of the EPI to ensure that our measure of Neuroticism was pure and that reported effects were confined to the

[5] Removing these outliers did not change the substantive interpretation of our hypotheses; however, there were some differences. For example, the main effects of tenure and the Lie Scale were not significant when the outliers were included. Given that these outliers seemed to be influential, we have presented the results with the outliers removed.

[6] We thank an anonymous reviewer for this suggestion.

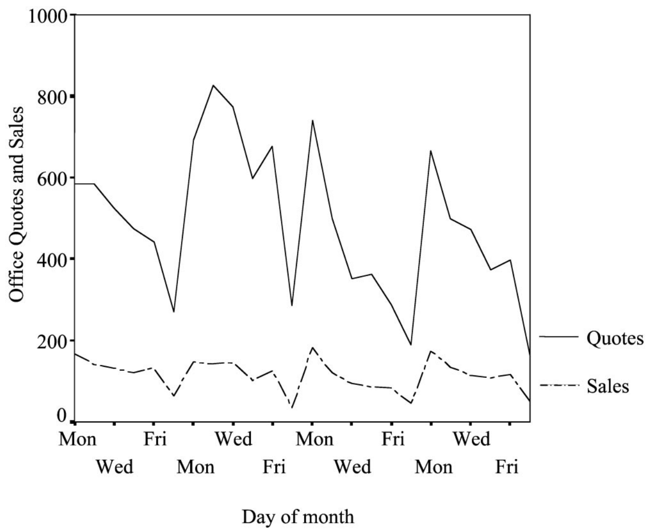

Figure 2. Office quotes and office sales on each of the 24 days.

scale of Neuroticism. Tenure was entered to ensure that our model accounted for job experience.

Statistical Analyses

As in Study 1, HLM was used to conduct our multilevel analyses. Our dependent variable was the number of individual sales made by each participant on each of 24 days of the study. Our Level 1 independent variables were (a) the total number of quotes issued in the office and (b) the total number of sales made in the office for each of 24 days. Our Level 2 independent variable was the single Neuroticism score for each individual. The significance levels used were the same as in Study 1. Over the 24 days, there were 24 cases of missing data owing to a variety of causes (e.g., absenteeism, attendance at training courses). For each case, we imputed missing values with grand-mean-centered data so that the full data set could be analyzed.

As indicated in Study 1, the group mean standardized approach outlined by Hofmann and Gavin (1998) can be very useful for determining whether a given interaction is cross-level or between person (or between groups, etc., depending on level of interest). However, this approach is not appropriate for the present study because office busyness scores do not vary between individuals. That is, the office busyness scores varied across the 24 days, yet on any particular day, each staff member had the same score for office busyness. Therefore, Level 1 variables and Level 2 variables in this study were standardized around their grand means. The cross-level interaction between office busyness and EPI Neuroticism was tested by specifying office busyness as a Level 1 predictor and Neuroticism as a Level 2 predictor of the intercept and the office busyness slope.

As in Study 1, the PINT program was used to determine whether the 59 participants in Study 2 would provide sufficient power. Specifically, we required our sample size to produce standard errors less than or equal to .08 in order to detect a small effect size with $\alpha = .05$ (one-tailed) and power = .80 (Bosker et al., 2003). The PINT results for the Study 2 sample size estimated a standard error of .07 for the cross-level interaction between office busyness and Neuroticism, suggesting that this study also has sufficient power to detect a small effect size.

Results

Tables 7 and 8 show the means and standard deviations as well as the intercorrelations among the variables, at the between- and within-person levels, respectively. The mean of EPI Neuroticism is 8.36, and the standard deviation is 5.68. This finding compares with norms provided by H. J. Eysenck and Eysenck (1964), who reported a mean for salespersons of 8.38, with a standard deviation of 4.72. Therefore we can be confident that individuals who are one standard deviation above the mean in our sample, having a Neuroticism score of 14.04, are highly neurotic individuals relative to a broader population. None of the EPI scales were highly related to any of the other variables, although it should be noted that office quotes and office sales were quite highly and significantly correlated. Additionally, both of these indices of busyness had moderate correlations with our performance criterion.

The intraclass correlation coefficient for individual sales was .13, indicating that 13% of the variance in individual sales was at the between-person level while 77% was within individuals. We now present the results from two models—one that tested the interaction between office quotes and Neuroticism and another that tested the interaction between office sales and Neuroticism.

Office Quotes as a Measure of Office Busyness

Tables 9 and 10 show the results from the unconditional model for individual sales, with office quotes as the measure of office

Table 7
Telesales: Descriptive Statistics and Intercorrelations Among the Variables at the Between-Person Level (N = 59)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Gender			—								
2. Age	28.49	8.77	.29*	—							
3. Years in company	2.60	1.52	.23	.36**	—						
4. Extraversion	14.64	3.52	.08	−.23*	−.08	—					
5. Lie Scale	3.07	1.68	.20	.24	−.18	−.39**	—				
6. Overall office sales[a,b]	109.04	0.95	−.29*	−.03	−.21	.05	−.01	—			
7. Overall office quotes[a,b]	462.44	3.76	−.32*	.04	−.25†	.01	−.02	.71***	—		
8. Neuroticism	8.36	5.68	.02	−.06	.11	−.04	−.42**	−.14	.06	—	
9. Overall individual sales[c]	1.88	0.96	−.29*	.04	.21	−.05	.01	−1.00	−.71***	.14	—

Note. Men are coded as 0; women are coded as 1.
[a] The daily measures of office sales and office quotes were computed by removing each individual's office sales/quotes score from the summation of busyness for that individual.
[b] Overall office sales/quotes represent the average number of sales/quotes made/received in the office across the 24-day period.
[c] Overall individual sales represent the average number of sales made by individuals across the 24-day period.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 8

Telesales: Descriptive Statistics and Intercorrelations Among the Variables at the Within-Person Level (N = 1,416)

Variable	*M*	*SD*	1	2	3	4
1. Day of month	—	—	—			
2. Office sales[a]	109.04	36.44	−.31***	—		
3. Office quotes[a]	462.44	169.90	−.39***	.86***	—	
4. Individual sales	1.88	2.37	−.08***	.20***	.20***	—

Note. In line with the centering approach used for the Study 2 hierarchical linear modeling analyses, these within-person correlations were based on grand-mean-centered scores. Dashes indicate data were not applicable.
[a] The daily measures of office sales and office quotes were computed by removing each individual's office sales/quotes score from the summation of busyness for that individual.
*** $p < .001$.

busyness. Office quotes was a significant predictor of individual sales, $t(58) = 6.78$, $p < .001$, indicating that individuals made more sales on busy days. Specifically, an increase of one standard deviation in office quotes is associated with an increase in individual sales of 0.49 standardized points. For example, on an average day in terms of how many quotes the office receives, an individual is expected to make 1.89 sales. However, when office busyness (in relation to quotes) is one standard deviation above average, individuals are expected to make 2.38 sales (1.89 + 0.49).

The random effect for office quotes was significant, $\chi^2(58, N = 59) = 93.60$, $p < .01$, indicating that the effect of office quotes varied between individuals. Office quotes accounted for 7.35% of the within-person variability in individual sales. The three Level 2 control variables and the office quotes random slope explained 11.69% of the between-person variability.

Tables 11 and 12 show the results from the conditional model. In support of Hypothesis 2a, EPI Neuroticism was a significant moderator of the relationship between office quotes and individual sales, $t(57) = 2.07$, $p < .05$. Furthermore, simple slope analyses indicated that an increase in this measure of office busyness was associated with a greater performance improvement for the highly neurotic individuals, $\beta = .61$, $t(57) = 7.34$, $p < .001$, in comparison with individuals with low Neuroticism, $\beta = .36$, $t(60) = 3.63$, $p < .001$. This finding indicates that an increase of one standard deviation in the EPI Neuroticism score is associated with an increase in the effect of office quotes by .12 standardized points. For example, the effect of office quotes for an individual with an average Neuroticism score is $\beta = .49$. For these individuals, a one standard deviation increase in office quotes is associated with a 0.49-point increase in the number of individual sales. However, the effect of this measure of office busyness for an individual with a Neuroticism score that is one standard deviation above average is 0.12 points larger, $\beta = .61$, indicating that a similar increase in office busyness is associated with a 0.61-point increase in the number of individual sales.

The additional Level 2 control variables, EPI Extraversion and EPI Lie Scale, did not account for additional between-person variance in individual sales. However, EPI Neuroticism accounted for an additional 3.59% of the between-person variability in average sales and 7.89% of the parameter variance around the office quotes slope. This cross-level interaction is shown in Figure 3.

Office Sales as a Measure of Office Busyness

Tables 13 and 14 show the results from the unconditional model for individual sales, with office sales as the measure of office busyness. Office sales was a significant predictor of individual sales, $t(58) = 8.10$, $p < .001$, indicating that individuals made more sales on busy days. Specifically, an increase of one standard deviation in office sales was associated with an increase in individual sales of 0.51 standardized points. For example, on an average day in terms of how many sales the office makes, an individual is expected to make 1.89 sales. However, when office busyness (in relation to sales) is one standard deviation above average, individuals are expected to make 2.40 sales (1.89 + 0.51).

The random effect for office sales was not significant, $\chi^2(58, N = 59) = 70.35$, $p > .05$. However, a deviance test indicated that inclusion of this random effect improved the model fit, $\chi^2(2, N = 59) = 9.97$, $p < .01$, suggesting that it was appropriate to specify Neuroticism as a potential moderator. Office sales accounted for 6.5% of the within-person variability in individual sales. The Level

Table 9

Telesales: Unconditional Model With Office Quotes—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}	1.89***	.11
Gender, λ_{01}	−0.31**	.11
Age, λ_{02}	0.05	.13
Years in company, λ_{03}	0.22*	.11
Office quotes, π_{10}	0.49***	.07

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 10

Telesales: Unconditional Model With Office Quotes—Random Effects

Random effects	Variance component	Reliability coefficient
Intercept, π_{00}	.63***	.77
Office quotes, π_{10}	.12**	.38
Level 1 error	4.58	

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

Table 11
Telesales: Conditional Model With Office Quotes—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}		
Intercept, λ_{00}	1.89***	.11
Gender, λ_{01}	−0.39**	.11
Age, λ_{02}	0.02	.14
Years in company, λ_{03}	0.31*	.12
Extraversion, λ_{05}	0.14	.11
Lie Scale, λ_{06}	0.27*	.13
Neuroticism, λ_{04}	0.22†	.13
Office quotes, π_{10}		
Intercept, λ_{10}	0.49***	.07
Neuroticism, λ_{11}	0.12*	.06

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared. † $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

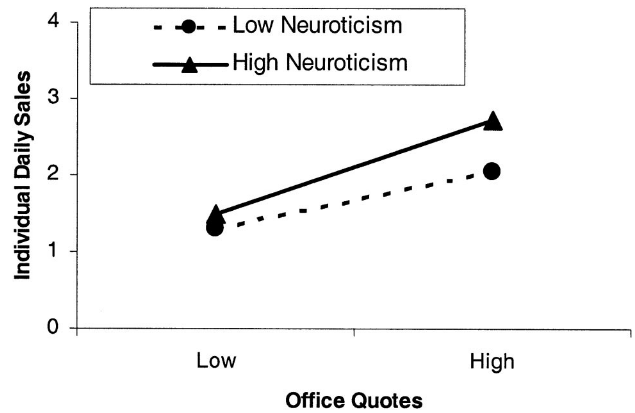

Figure 3. Telesales: Cross-level interaction between Eysenck Personality Inventory Neuroticism and office quotes.

2 control variables and the office sales random slope explained 8.89% of the between-person variance in individual sales.

Tables 15 and 16 show the results from the conditional model. In support of Hypothesis 2b, EPI Neuroticism was a significant moderator of the relationship between office sales and individual sales, $t(57) = 2.46$, $p < .05$. Simple slope analyses showed that an increase in this measure of office busyness was associated with a greater performance improvement for individuals with high Neuroticism, $\beta = .64$, $t(57) = 8.88$, $p < .001$, in comparison with less neurotic individuals, $\beta = .38$, $t(57) = 4.32$, $p < .001$. This finding indicates that an increase of one standard deviation in the EPI Neuroticism score is associated with an increase in the effect of office sales by 0.13 standardized points. For example, the effect of office sales for an individual with an average Neuroticism score is $\beta = .51$. For these individuals, a one standard deviation increase in office quotes is associated with a 0.13-point increase in the number of individual sales. However, the effect of this measure of office busyness for an individual with a Neuroticism score that is one standard deviation above average is 0.13 points larger, $\beta = .64$, indicating that a similar increase in office busyness is associated with a 0.64-point increase in the number of individual sales.

The additional Level 2 control variables, EPI Extraversion and EPI Lie Scale, did not account for additional between-person variance in individual sales. However, EPI Neuroticism accounted for an additional 3.72% of the between-person variability in average sales and 21.75% of the parameter variance around the office sales effect. This cross-level interaction is shown in Figure 4.

Table 12
Telesales Data: Conditional Model With Office Quotes—Random Effects

Random effect	Variance component	Reliability coefficient
Intercept, π_{00}	.60***	.76
Office quotes, π_{10}	.11**	.36
Level 1 error	4.58	

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

Discussion

This study supported Hypotheses 2a and 2b. EPI Neuroticism interacted with two different measures of office busyness (total quotes made in the office and total sales made in the office) in the prediction of daily sales made by individuals. In both cases the positive effect of busyness on performance was stronger for individuals with high Neuroticism. As in Study 1, we interpret these results as suggesting that the impact of factors relating to the allocation of resources on performance is conditional on Neuroticism. On quieter days, employees with high Neuroticism could be expected to display less effective work patterns in comparison with those demonstrated on busy days, owing to dysregulation of negative cognitions caused by attentional shifts, to which highly neurotic individuals are thought to be susceptible. These individuals are less likely to demonstrate relatively ineffective work patterns on busy days because there are fewer resources available to be shifted, and therefore effective regulation of negative cognitions should be facilitated. In comparison, the performance of individuals with low Neuroticism should not be as contingent on busyness, as they are not similarly affected by the automatic orienting of attention. These findings converge with the results from Study 1 and add further support for our broad hypothesis.

Also consistent with Study 1, these results show that the highly neurotic individuals outperformed their counterparts in a busy work environment. That is, a simple slopes analysis showed that at high levels of office busyness, the highly neurotic individuals

Table 13
Telesales: Unconditional Model With Office Sales—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}	1.89***	.12
Gender, λ_{01}	−0.28**	.10
Age, λ_{02}	0.10	.13
Years in company, λ_{03}	0.22*	.11
Office sales, π_{10}	0.51***	.06

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 14
Telesales: Unconditional Model With Office Sales—Random Effects

Random effect	Variance component	Reliability coefficient
Intercept, π_{00}	.65***	.77
Office sales, π_{10}	.05*	.21
Level 1 error	4.62	

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

Table 16
Telesales Data: Conditional Model With Office Sales—Random Effects

Random effect	Variance component	Reliability coefficient
Intercept, π_{00}	.62***	.76
Office sales, π_{10}	.04	.17
Level 1 error	4.44	

*** $p < .001$.

performed *better* than their stable counterparts, $\beta = .35$, $t(52) = 2.12$, $p < .05$, and $\beta = .36$, $t(52) = 2.21$, $p < .05$ (for office quotes and office sales, respectively), whereas at low levels of office busyness, these individuals performed at the same level regardless of their Neuroticism, $\beta = .10$, $t(52) = 0.89$, *ns*, and $\beta = .10$, $t(52) = 0.87$, *ns* (for office quotes and office sales, respectively). Given the potential implications of these findings and the fact that the same pattern emerged in both of our studies, we consider them further in the General Discussion section.

In this study, the office busyness measures were computed separately for each individual, by excluding his or her own performance score from the calculation. A potential problem with this method is that it may not reflect the construct we wished to operationalize. Specifically, we wanted to assess the effect of busyness in the office (in interaction with Neuroticism) on individual sales performance. By creating individualized measures of office busyness, it may be the case that we examined the effect of the busyness of everyone *else* in the office (in interaction with Neuroticism) on each individual's performance (i.e., irrespective of his or her own busyness). To evaluate the potential impact of this slight conceptual difference, we performed analyses using *total* office sales/quotes as the measures of busyness, rather than the *individualized* measures already reported. None of the results were substantively different from those already reported. It is important to note that the key finding of an interaction between Neuroticism and measures of busyness did not differ if total office quotes/sales were computed. For office sales, the effect size was .13 for the individualized measure and .14 for the original measure; for office quotes, the effect size was .12 for both methods of calculation.

Although the findings from Study 2 are largely consistent with those from Study 1, some differences between the results are worth noting. First, overall effort intensity was not related to performance for individuals with low EPP Anxiety in Study 1, whereas our measures of office busyness were positively related to individual daily sales for all individuals in Study 2. As effort and performance in Study 1 were not as directly related as our indices of busyness and performance in Study 2, it is not surprising that a positive main effect of busyness emerged for both indices used in Study 2.

Second, it is of interest that a between-person interaction among resource allocation and Neuroticism was found in Study 1, whereas a cross-level interaction was demonstrated in Study 2. In Study 2, the interaction could emerge only as cross-level given that all of the variance in our office busyness measures resided at the within-person level (because all participants worked in the same office). In Study 1, most of the variance in effort intensity was at the between-person level. As noted earlier, a greater proportion of within-person variability in effort and an associated cross-level interaction might have emerged if the task had been performed over a longer time period such as that examined in the field study. Another possible explanation is that our index of resource allocation in Study 1 was under more voluntary control than our indices in Study 2. That is, Study 1 participants could choose how much effort to expend, whereas the employees in Study 2 could not choose how busy their office was. According to perceptual control theory (Powers, 1991), individuals aim to conserve their energy.

Table 15
Telesales Data: Conditional Model With Office Sales—Fixed Effects

Fixed effect	Coefficient	*SE*
Intercept, π_{00}		
Intercept, λ_{00}	1.89***	.11
Gender, λ_{01}	−0.37**	.10
Age, λ_{02}	0.07	.15
Years in company, λ_{03}	0.29*	.12
Extraversion, λ_{05}	0.14	.12
Lie Scale, λ_{06}	0.26†	.14
Neuroticism, λ_{04}	0.23†	.13
Office sales, π_{10}		
Intercept, λ_{10}	0.51***	.06
Neuroticism, λ_{11}	0.13*	.05

Note. Men are coded as 0; women are coded as 1. Predictor scores were standardized so the relative magnitude of the effects could be compared.
† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

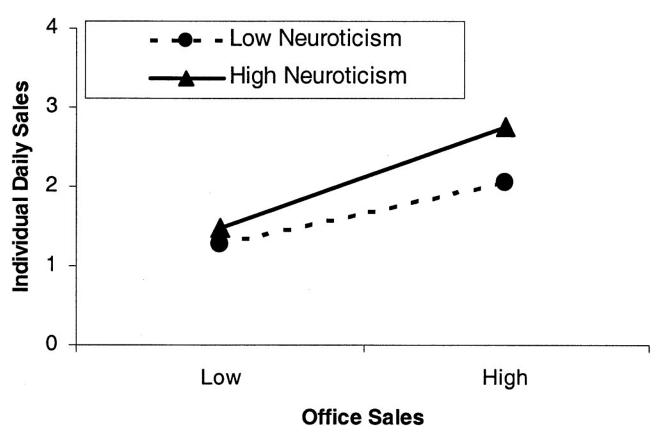

Figure 4. Telesales: Cross-level interaction between Eysenck Personality Inventory Neuroticism and office sales.

This suggests that when resource allocation is under voluntary control, individuals will generally choose to expend sufficient effort to complete the task and only increase their effort when absolutely necessary. Thus, in addition to the time period, the level at which our interaction of interest exerts its influence may depend on the task context.

Despite these differences, both interactions provide the same substantive interpretation: In both studies, the relationship between resource allocation (as measured by effort intensity or office busyness) and performance (as measured by scores on an ATC simulation or individual sales) was stronger for individuals with high Neuroticism in comparison with their counterparts. It would be interesting for future investigations to assess the key relationship across multiple offices to determine whether the difference between individuals who generally experience busy days (i.e., because they work in a "busy" office) versus those who generally experience quiet days (i.e., because they work in a "quiet" office) is more pronounced for individuals with high Neuroticism. That is, do highly neurotic individuals benefit more than their counterparts from working in a busy office (i.e., a between-person interaction)? Conversely, if performance on our ATC task was measured over various sessions (e.g., across multiple days) or we influenced the variability in resource allocation via manipulations (e.g., by systematically varying the number of decisions to be made in each trial), it may be possible to determine whether *changes* in effort intensity have a stronger effect on *changes* in performance for highly neurotic individuals in comparison with their counterparts (i.e., a cross-level interaction).

A final difference between our two studies is that in Study 1, 41% of the variability in performance scores was at the between-person level, whereas in Study 2, only 13% of the variability in individual sales was at the between-person level. A potential explanation for this difference may be that individual differences in performance are more likely to emerge in a laboratory task than in a workplace. Performance homogeneity is typical of established workplaces owing to contextual factors, including company policies and human resource practices (e.g., selecting applicants who are expected to perform to a given standard and dismissing those who do not meet that standard; Kozlowski & Klein, 2000). In contrast, these organizational factors are absent in a laboratory context, as individuals are randomly selected for participation and are not under any external pressure to perform to a specific criterion level. These factors are likely to facilitate the emergence of greater individual differences in performance when compared with a work setting.

General Discussion

The objective of this research was to investigate the multiplicative effect of Neuroticism and resource allocation on performance. Extrapolating from Wallace and Newman's (1997, 1998) model and general principles of resource allocation theory (Kanfer & Ackerman, 1989), we theorized that highly neurotic individuals would improve their performance more so than their counterparts when they allocated more cognitive resources to the task at hand, and in situations that elicit high task-focused resource allocation. Study 1 showed that the Anxiety subscale of EPP Neuroticism interacted with overall effort intensity in the prediction of task performance, such that highly neurotic people benefited more from expending high levels of effort throughout the task in comparison with individuals with low Neuroticism. Study 2 assessed the generalizability of these findings to a sales environment and demonstrated that EPI Neuroticism interacted with office busyness to predict an objective job performance criterion, such that the effect of increased office busyness on sales was stronger for highly neurotic individuals in comparison with less neurotic individuals. These are novel findings with important implications.

Theoretical and Practical Implications

The present results contribute to the understanding of personality in the workplace. There is much agreement that Neuroticism is a fundamental dimension of temperament (Costa & McCrae, 1991, 1992; Eysenck, 1991; Wallace & Newman, 1997) and therefore a pervasive and enduring facet of human behavior. As such, it is surprising that Neuroticism has not emerged as a clear predictor of job performance. A potential explanation for this concerns the empirically driven nature of the personality–performance literature we have cited, which often draws on bivariate relationships between trait and performance measures to build an understanding of personality in the workplace (potential problems with this, with a specific focus on meta-analysis, have been noted by Tett, Jackson, Rothstein, & Reddon, 1999). We argue that a more sensitive alternative to this approach is to use a theoretical explanation of the trait in question to derive predictions of *when* or under *what circumstances* the trait might relate to performance, and what the *nature* of that relationship is likely to be. In this article, we predicted an interactive effect of Neuroticism and resource allocation on performance by delineating the possible implications for performance of an attentional process theory of Neuroticism. A less theoretical approach would have been unlikely to identify resource allocation as an important moderating variable and consequently might have failed to detect any relationship between Neuroticism and performance. As a demonstration of this, in Study 1 the EPP Anxiety subscale of Neuroticism did not directly predict performance on the ATC task, $t(61) = -0.49$, *ns*. Similarly, in Study 2, EPI Neuroticism did not directly predict performance for the model that included office quotes, $t(52) = 1.77$, *ns*, or for the model that included office sales, $t(52) = 1.77$, *ns*. This underlines the importance of theory for understanding the role of personality within the workplace (a point that is also emphasized elsewhere; Barrett, 1998; Hogan & Holland, 2003).

An important implication of our theoretical position and empirical findings concerns perceptions of Neuroticism. Traditionally, Neuroticism has had a distinctly negative connotation, and "neurotics" are usually labeled negatively as worriers or anxious individuals (H. J. Eysenck et al., 1992). These value judgments are also apparent in a work environment (Hough & Oswald, 2000), despite the fact that much research has failed to identify a clear relationship between Neuroticism and performance (e.g., Barrick & Mount, 1991; Vinchur et al., 1998). Against this view, our findings suggest that highly neurotic individuals can improve their performance more so than their stable counterparts in environments that facilitate more intense work engagement. Furthermore, we found that at higher levels of resource allocation, highly neurotic individuals outperformed those with lower scores on Neuroticism, an effect that was consistent across both of our studies. It seems, therefore, that the benefits of increased resource allocation for highly neurotic individuals are potentially large enough to give such individuals a performance advantage. A potential explanation for this outcome is that any negative effects of being neurotic (e.g., dysregulation) are partly compensated for by other potentially positive features of this trait. Though they are seldom emphasized in the literature, these include vigilance and attention to potential threat, caution, impulse control, and avoidance of errors (H. J. Eysenck, 1967; Gray, 1987; Perkins & Corr, 2005). These characteristics can be valuable and may provide a performance advantage to highly neurotic individuals when any negative effects of being neurotic are minimized. Overall, our findings suggest that a global pessimistic view of Neuroticism may not withstand close examination in a work context.

It is interesting to note that although both of our studies show that highly neurotic individuals performed worse at low (as opposed to high) levels of resource allocation, they did not perform significantly worse than their stable counterparts at low levels of resource allocation. However, in Study 1 there was a clear negative trend between Neuroticism and performance ($p = .07$) at low levels of effort, which was significantly different from the positive relationship at high levels of effort. In comparison, our field study showed that there was a near zero association between Neuroticism and individual sales at low levels of office busyness that was significantly different from the positive association between these two variables on busy days. That is, there was no trend to suggest that highly neurotic individuals were performing worse than their counterparts on quiet days despite the assumption that highly neurotic individuals are susceptible to dysregulation in such contexts. A potential explanation for this finding is that the Study 2 data were collected from a real-world organization demonstrating considerable performance homogeneity (only 13% of the variability in individual sales was at the between-person level). Therefore, it is possible that some or even most highly neurotic individuals do perform poorly on quiet days but that they were not included in our sample owing to processes inherent to the work environment (such as voluntary and involuntary turnover, as Schneider's *attraction–selection–attrition* model would predict; Schneider, 1987).

It is worth noting that these explanations assume that the effect of dysregulation is sufficiently detrimental for highly neurotic individuals that it will make them perform worse than their counterparts. However, such an effect does not necessarily follow from our broad hypothesis (that the effect of resource allocation should be different for low vs. high scorers on Neuroticism) or the empirical literature to date. Indeed, although Wallace and Newman (1998) suggested that highly neurotic individuals may perform worse than stable individuals on a visual search task that includes distractors in the search field, results from their two studies were mixed. Specifically, the predicted effect was observed only for females, and in one study, this was dependent on the participants' Extraversion scores. Similarly, Perkins and Corr (2005) demonstrated that the negative relationship between Neuroticism and performance in a sales environment was nonsignificant for individuals with low cognitive ability. It is interesting to note that this relationship was positive for individuals with high cognitive ability, and as such, their findings are broadly congruent with ours. A possible implication of these investigations is that cognitive explanations of Neuroticism (e.g., resource allocation and cognitive ability) do not account for the occasions on which highly neurotic individuals have performed worse than their counterparts (e.g., Tett et al., 1991).

The present research contributes to clarification of the relationship between Neuroticism and performance, but how does it align with strong evidence suggesting that neurotics react negatively to stress (H. J. Eysenck, 1967) and are susceptible to emotional exhaustion and burnout (e.g., Wright & Cropanzano, 1998)? Although the impact of highly stressful stimuli is beyond the scope of the present research, our findings do not negate the possibility that individuals with higher Neuroticism could be more distressed by extreme work overload or effort intensity. We investigated the possibility of a curvilinear relationship between Neuroticism and performance by testing the effects of a squared Neuroticism term in our multilevel models of Study 1 and Study 2, but neither was significant. Nevertheless, it remains plausible that a curvilinear relationship might be detected if a larger spectrum of office busyness were to be examined. Similarly, as the "highly neurotic" individuals in this sample are those who scored above average on trait Neuroticism measures but nonetheless fall within the general population, our findings should not be taken to imply that clinically anxious or neurotic individuals will enjoy the same performance benefits. Equally, if it is the case that any links between Neuroticism and negative outcomes such as burnout are specific to highly stressful situations (or clinically anxious individuals), then it would not be appropriate to identify such outcomes as ubiquitous consequences of being highly neurotic. Future research should provide clarification to this issue.

Strengths and Limitations

Broadly, the design of both of our studies engenders confidence that our findings can best be explained by differential benefits of resource allocation for high and low scorers on Neuroticism. For the ATC task, we were able to gather relatively direct markers of resource allocation using concurrent reports of effort intensity, while maintaining a number of experimental controls, including practice, gender, impulsivity, and perceived difficulty. In the telesales field study, we compensated for the logistical constraints of sampling direct measures of resource allocation by identifying two indirect measures. If we had operationalized office busyness in terms of office sales alone, it could simply be the case that when neurotic employees are "on task" they close more sales, thereby increasing the total number of sales in the office. In this case it would be the higher performance of neurotics that results in a busier workplace, and not vice versa. We can reject this explanation given that we also operationalized office busyness in terms of actual quotes received, a variable that is independent of whether the sales staff are on task (i.e., it is difficult to see how individuals could increase the number of customers calling the office to request a quote by closing more sales). Both indicators of office busyness interacted with Neuroticism in the same pattern as that found for effort intensity in Study 1, suggesting that our findings are specific neither to effort intensity nor to office quotes or office sales but something that is common to all three.

The fact that we have tested our hypothesis in two studies is a particular strength of this research. We found multiplicative effects in both a laboratory and a field setting within designs of sufficient power to detect interactions. These findings are impressive given the inherent difficulty of detecting complex interactions such as these (Evans, 1985; McClelland & Judd, 1993). Detection of interactions is especially noteworthy when they are in line with theoretical expectations (Champoux & Peters, 1987) and able to be replicated (Schwartz & Dalgleish, 1982). As noted, however, our findings do not comprise exact replication. Study 1 demonstrated a *between-person* interaction between an index of resource allocation and Neuroticism, and Study 2 demonstrated a *cross-level* interaction between these variables. As we have argued, the absence of a cross-level interaction in Study 1 may be explained by the fact that a relatively small proportion of the variability in effort intensity was at the within-person level, possibly because the measures were taken over a shorter timeframe, and our index of resource allocation was under less voluntary control in comparison with Study 2. Nevertheless, given that the interaction between resource allocation and Neuroticism was observed in both studies, we have provided converging evidence in support of our broad hypothesis. More generally, these results highlight the complexity of relationships that may vary across multiple levels in applied contexts, and they emphasize the importance of developing theories for when and in what form multilevel constructs could be expected to exert their influence.

A noteworthy caveat to these studies concerns the relationship our research has with Wallace and Newman's (1997, 1998) attentional process model of Neuroticism. The first is a challenge we share with all research concerned with the regulatory processes underlying Neuroticism, in that we did not directly measure negative thinking, a key feature of Neuroticism according to Wallace and Newman. Accurate measurement of negative cognitions would, however, be very difficult, as these are understood to be automatic and thus nonretrievable cognitive processes (Gilbert, 1989; Gotlib & McCann, 1984; Wallace & Newman, 1997). Furthermore, it was of prime interest to examine the effect of increased office busyness and effort intensity insofar as these should minimize the likelihood of poor regulation of negative cognitions. Prompting participants to report or otherwise internally access their negative cognitions could therefore have had a deleterious effect on our research aims. Finally, to clarify the intended scope of this project, it is worth reiterating that our results do not constitute—and therefore should not be interpreted as—a direct test of Wallace and Newman's (1997, 1998) perspective. Whereas their focus was on the theoretical bases of Neuroticism, we were principally concerned with the interaction among resource allocation and Neuroticism in the prediction of task and job performance.

Conclusion

To summarize, we have shown that Neuroticism interacts with factors relating to resource allocation in the prediction of performance. This relationship was demonstrated using multilevel modeling in a controlled laboratory experiment and a longitudinal field study. Our results indicate that Neuroticism may not have the negative implications for job performance that are widely assumed and in some situations may actually be a positive predictor. Overall, this research clarifies some of the ambiguity regarding Neuroticism and performance in the workplace. More broadly, our approach underlines the importance of developing theory and appropriate methodology in order to understand the role of personality in applied psychology.

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