Stoeber, J., & Eysenck, M. W. (2008). Perfectionism and efficiency: Accuracy, response bias, and invested time in proof-reading performance. *Journal of Research in Personality, 42*(6), 1673-1678.

Perfectionism and Efficiency:

Accuracy, Response Bias, and Invested Time in Proof-Reading Performance

Joachim Stoeber
University of Kent

Michael W. Eysenck
Royal Holloway
University of London

Author Note

The present research was supported by a small research grant from the University of Kent's Faculty of Social Sciences to the first author. Thanks go to Jason Lauder for help with the signal detection analysis and to Kathleen Otto and three anonymous reviewers for helpful comments on earlier versions of this article. Correspondence concerning this article should be addressed to Joachim Stoeber, Department of Psychology, University of Kent, Canterbury, Kent CT2 7NP, United Kingdom; phone: +44-1227-824196; fax: +44-1227-827030; e-mail: J.Stoeber@kent.ac.uk

Abstract

Investigating problem-solving performance, Ishida (2005) found high levels of perfectionism were associated with lower efficiency. Aiming to replicate and further explore this finding, the present study investigated how two dimensions of perfectionism (high standards, discrepancy between expectations and performance) predicted efficiency in proof-reading performance. *N* = 96 students completed a proof-reading task involving the detection of spelling, grammar, and format errors. When error-detection performance was subjected to signal detection analysis, high standards correlated positively with the number of incorrectly detected errors (false alarms). Moreover, when task-completion time was taken into account, high standards were negatively correlated with efficiency (accuracy/time). In comparison, discrepancy correlated negatively with the number of correctly detected errors (hits) and positively with a conservative response bias. The findings show that perfectionistic standards are associated with reduced efficiency demonstrating the importance of considering invested time, errors, and response bias when investigating the relationship between perfectionism and performance.

Keywords: Perfectionism; Performance; Efficiency; Errors; Signal Detection Analysis; Bias

Perfectionism and Efficiency:

Accuracy, Response Bias, and Invested Time in Proof-Reading Performance

Perfectionism is as a multidimensional and multifaceted characteristic (see Enns & Cox, 2002, for a review). According to Slaney and colleagues' multidimensional model (Rice & Ashby, 2007; Slaney, Rice, Mobley, Trippi, & Ashby., 2001), two main dimensions of perfectionism need to be differentiated: high standards and discrepancy. High standards capture perfectionistic personal standards and performance expectations. This dimension has been shown to be related to positive characteristics such as conscientiousness (Rice, Ashby, & Slaney, 2007). In contrast, discrepancy captures perceptions that one is consistently failing to meet the perfectionistic standards and expectations one has set for oneself and associated negative emotions (e.g., feeling disappointed/frustrated). This dimension has been shown to be related to negative characteristics such as neuroticism (Rice et al., 2007).

The distinction between high standards and discrepancy may also be important when investigating how perfectionism relates to performance. High standards have been shown to be positively correlated with academic performance whereas discrepancy has been shown to be negatively correlated (e.g., Leenaars & Lester, 2006; Rice & Ashby, 2007).

When regarding performance, however, it is important to consider not only absolute performance, but also relative performance (or *efficiency*) by taking into account the effort invested to achieve the level of performance (Eysenck & Calvo, 1992). Aiming to explain divergent findings in the literature on anxiety and performance, Eysenck and Calvo found that individuals high in anxiety may achieve the same absolute performance as individuals low in anxiety but invest more effort in so doing. Consequently, when effort is taken into account and performance is set relative to invested effort (e.g., dividing absolute performance by effort), individuals high in anxiety typically show reduced efficiency.

The distinction between absolute performance and efficiency has greatly furthered our understanding of the relationship between anxiety and performance (see Eysenck, Derakshan, Santos, & Calvo, 2007, for review). Because individuals high in perfectionism have also been shown to invest more effort (e.g., Stoeber & Eismann, 2007), the investigation of efficiency also holds promise for the understanding of the relationship between perfectionism and performance.

So far all studies on perfectionism and performance have only investigated absolute performance disregarding efficiency, with one exception. Ishida (2005) investigated perfectionism and efficiency examining how perfectionism was related to problem-solving performance. In a computer-based problem-solving task, participants were instructed to search for information to solve the task. They were provided with files containing relevant information (information necessary to solve the task) and files containing irrelevant information (information unnecessary to solve the task). Based on their scores on the Perfectionism Cognitions Inventory (PCI; Flett, Hewitt, Blankstein, & Gray, 1998), participants were divided into perfectionists (high PCI scores) and nonperfectionists (low PCI scores). Perfectionists scored lower on the problem-solving task and invested more time looking at irrelevant information than nonperfectionists (H. Ishida, personal communication dated 15 August 2005) which Ishida interpreted as evidence that perfectionism was associated with reduced efficiency.

Ishida's (2005) study is a first important step in understanding how perfectionism is related to efficiency, but it has some limitations. First, the sample was rather small ($N = 28$) calling into question the reliability of the findings. Second, the PCI is a one-dimensional measure of perfectionism. Consequently, it remains unclear what dimensions of perfectionism were associated with reduced efficiency. Finally, it is uncertain whether inspection of irrelevant information is a good indicator of invested effort. Consequently, further research with multidimensional measures of perfectionism and established measures of effort is needed to further elucidate the relationship between perfectionism and efficiency.

Against this background, the aim of the present study was twofold: (a) to replicate Ishida's (2005) finding of an inverse relationship between perfectionism and efficiency and (b) to further explore the relationships between perfectionism, performance, and efficiency by investigating how two dimensions of perfectionism—high standards and discrepancy—predicted overall performance, effort, and efficiency in a proof-reading task that required participants to detect spelling, grammar, and format errors. To measure overall performance, error detection was subjected to signal detection analysis, which allowed us to contrast the number of hits (correctly detected errors) with the number of false alarms (incorrectly detected errors) and to distinguish between accuracy and response bias. The time participants took to complete the proof-reading task served as a proxy measure of invested effort. To determine efficiency, overall performance (accuracy) was divided by effort (time).

Method

Participants

A sample of $N = 96$ students (9 male, 87 female) was recruited at a British university. Their mean age was 20.5 years ($SD = 6.0$; range = 18-51 years). In exchange for participation, students received extra course credit or £5 (approx. US $10).

Procedure

Participants were tested individually. Upon arrival in the laboratory, participants were informed that the investigation was concerned with how personality is related to academic performance and that proof-reading is an important skill to achieve high academic performance. Then participants received the instructions for the proof-reading task. Afterwards, they completed the proof-reading task while the experimenter recorded the time with a stop watch. When participants indicated that they had finished, the experimenter stopped the watch, and participants were thanked, debriefed, and paid.

Measures

Perfectionism. To measure the two dimensions of perfectionism, high standards and discrepancy, the revised Almost Perfect Scale (APS-R; Slaney et al., 2001) was employed that contains a 7-item scale capturing high standards (e.g., "I set very high standards for myself") and a 12-item scale capturing discrepancy (e.g., "Doing my best never seems to be enough"). With Cronbach's alphas of .87 (high standards) and .93 (discrepancy), both scores showed high reliability (internal consistency).

Proof-reading performance. To measure proof-reading performance, a proof-reading task was constructed that required participants to find three types of errors: spelling, grammar, and APA format errors. From a psychological journal article on taste potentiation in mice (Davis, Bailey, Becker, & Grover, 1990), the abstract, introduction, method, results, and discussion sections were extracted to form a text comprising 1,126 words (6,073 characters) distributed over 107 lines. After revising the text to conform with British spelling and APA format (American Psychological Association, 2001), the text was modified by inserting 30 errors: 11 spelling errors, 9 grammar errors, and 10 APA format errors. Instructions informed participants that their task was to proof-read a scientific text in which three kinds of errors had been inserted: (a) spelling errors, that is, instances where common English words are misspelled (e.g., "expreiment" instead of "experiment"); (b) grammar errors, that is, instances where the subject and verb of a sentence do not match (e.g., "errors was analysed" instead of "errors were analysed"); and (c) APA format errors, that is, instances in which one of six APA rules had been violated (see "6 APA Rules" in the Appendix). In addition, instructions stressed that spelling errors were restricted to common English words, and that all uncommon words such as "saccharide" or scientific abbreviations such as "LiCL" had been left intact. At the end of each line of text, participants found three tick-boxes labeled "S" for spelling error, "G" for grammar error, and "A" for APA format error. Participants were instructed to tick the respective box if they found an error in spelling, grammar, or APA format. They were instructed that a line of text could contain more than one type of error (e.g., it could contain a spelling error *and* an APA format error) in which case they had to tick the respective boxes (e.g., "S" and "A"). Participants kept the instructions so they could refer to them during proof-reading.

Participants were informed that they had 35 minutes for the task and that this was sufficient to complete the task. Moreover they were told that, even though the experimenter would record the time they took to complete task, they should not feel pressurized, but work at their own preferred pace. When participants started proof-reading, the experimenter started the stop watch. When participants completed proof-reading, the experimenter stopped the watch and recorded the minutes and seconds that participants worked on the task.

Preliminary Analyses

All analyses were performed with SPSS (Version 15.0). First, a signal detection analysis was performed to differentiate accuracy and response bias in participants' error-detection performance. To this aim, the number of hits (hit = error correctly detected: error indicated for a text line that did contain an error) and the number of false alarms (false alarm = error incorrectly detected: error indicated for a text line that did not contain an error) were computed. Then, hit rates and false alarm rates were computed. To avoid problems arising in the computation of signal detection parameters when hit and false alarms rates are 0 or 1, we added 0.5 to the nominator and 1 to the denominator and computed hit rate = (hits + 0.5)/(lines with errors + 1) and false alarm rate = (false alarms + 0.5)/(lines with no error + 1) (see Snodgrass & Corvin, 1988). Then values for accuracy and response bias were computed (in SPSS syntax): accuracy = IDF.NORMAL(hit rate, 0, 1) – IDF.NORMAL(false alarm rate, 0, 1); response bias = –0.5 × (IDF.NORMAL(hit rate, 0, 1) + IDF.NORMAL(false alarm rate, 0, 1)). Note that response bias captures participants' bias against reporting errors and thus assesses conservative responding. Finally, efficiency of performance was computed by dividing participants' overall proof-reading performance (accuracy) by the time that they took to complete proof-reading task. To give accuracy and time equal weight when calculating efficiency, both indicators were subjected to a linear transformation so they had a variance of 1 and a minimum value of 1 following the formula x' = *z*-value of x + sample's minimum value of x + 1 (see Craig & Condon, 1985). Consequently, efficiency was computed as accuracy'/time'. Table 1 shows the descriptive statistics.

Results

First, zero-order correlations were inspected (see Table 1). Time was positively correlated with hits and accuracy, and negatively with response bias. This indicated that participants who took more time invested more effort in finding errors in the proof-reading task compared to those taking less time. As expected, perfectionism was negatively correlated with efficiency. However, this relationship was restricted to high standards: only high standards showed the expected inverse relationship with efficiency. Moreover, high standards showed a positive correlation with the number of incorrectly detected errors (false alarms). Discrepancy showed no significant zero-order correlations with the indicators of proof-reading performance, but showed a significant positive correlation with high standards (see Table 1). Consequently, we followed recommendations by Stoeber and Otto (2006) and additionally inspected partial correlations to control for the overlap between the two dimensions of perfectionism (see Table 2). Results showed that, once overlap with high standards was controlled for, discrepancy showed a negative correlation with the number of correctly detected errors (hits) and a positive correlation with response bias against reporting errors. Thus, high standards and discrepancy displayed differential relationships with proof-reading performance: high standards was associated with lower efficiency and more false alarms, and discrepancy with fewer hits and with a more conservative response bias.

Discussion

The present study investigated how two dimensions of perfectionism—high standards and discrepancy—predicted performance in a proof-reading task requiring participants to detect spelling, grammar, and format errors in a scientific text. When performance was analyzed using signal detection analysis to differentiate accuracy and response bias, high standards showed a positive correlation with false alarms (incorrectly detected errors). Moreover, when the time that participants took to complete the task was taken into account and overall performance (accuracy) was divided by effort (time) to measure efficiency, high standards showed a negative correlation with efficiency. The findings suggest that individuals who have perfectionistic standards and performance expectations tend to find fault even when everything is alright. Moreover, they are overall less efficient in their performance. In contrast, discrepancy showed a negative correlation with hits (correctly detected errors) and a positive correlation with response bias against reporting errors. This finding suggests that individuals who have the perception that they are consistently failing to meet the perfectionistic standards and expectations they set for themselves are more cautious and conservative and tend to be unwilling to find fault, even when things are not alright.

The present findings have important implications for research on perfectionism and performance. First, they provide further empirical support for the view that perfectionism is inversely related to efficiency (Ishida, 2005). In addition, they suggest that it is the high standards associated with perfectionism that are responsible for perfectionists' reduced efficiency. Second, the present findings demonstrate the importance of treating perfectionism as a multidimensional personality characteristic and of investigating the differential relationships that central dimensions of perfectionism, such as high standards and discrepancy (Slaney et al., 2001), display with performance. Finally, the present findings underline the importance of considering not only absolute performance, but also relative performance (efficiency: absolute performance relative to invested effort) and of considering not only correct answers, but also incorrect answers when investigating the perfectionism-performance relationship. Without considering efficiency and correct versus incorrect answers, the present study might have concluded that there were no significant differences in proof-reading performance as a function of perfectionism, and the differential relationships that high standards and discrepancy show with proof-reading performance indicators would not have been revealed.

The present study has some limitations. First, it is the first study to investigate perfectionism and efficiency using time to determine effort and employing signal detection analysis to determine overall performance. Consequently, future studies need to replicate the findings to establish their robustness. Moreover, time is only one possible indicator of invested effort. Future studies should therefore investigate further indicators of effort such as subjective effort, attentional load, and physiological indicators (see Eysenck et al., 2007) to indicate the extent to which the present findings are generalizable. Second, the present study did not control for the influence of other, broader personality traits such as the Big Five (John & Srivastava, 1999). Because the Big Five have been shown to predict job performance (Barrick, Mount, & Judge, 2001) and both high standards and discrepancy have shown substantial correlations with the Big Five (high standards with conscientiousness, discrepancy with neuroticism; Rice & Ashby, 2007), future studies would profit from controlling for broad personality dimensions when investigating the relationship between perfectionism and performance. Finally, and most importantly, future studies need to explain why high standards and discrepancy displayed differential relationships with hits and false alarms. One possible explanation is provided by the dual process model of perfectionism (Slade & Owens, 1998) which posits that there are two forms of perfectionism, positive perfectionism and negative perfectionism, that differ in regulatory focus (Higgins, 1998). Positive perfectionism is characterized by approach motivation and a promotion focus (pursuing perfection) whereas negative perfectionism is characterized by avoidance motivation and a prevention focus (avoiding imperfection). Research on regulatory focus and decision making found that a promotion focus was associated with a riskier response bias whereas a prevention focus was associated with a more conservative response bias (Crowe & Higgins, 1997). If we take high standards to represent positive perfectionism and discrepancy to represent negative perfectionism (Stoeber & Otto, 2006), this could explain why high standards were associated with more false alarms and discrepancy with fewer hits and a more conservative response bias.

To conclude, it is premature to call for a re-evaluation of high standards as the dimension that represents those aspects of perfectionism associated with overall higher performance (Rice & Ashby, 2007; Stoeber & Otto, 2006). However, future studies should consider effort and efficiency and, where possible, analyze correct and incorrect answers to gain a fuller and more detailed understanding of how multidimensional perfectionism relates to performance.

References

American Psychological Association. (2001). *Publication manual* (5th ed.). Washington, DC: Author.

Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment, 9*, 9-30.

Craig, A., & Condon, R. (1985). Speed-accuracy trade-off and time of day. *Acta Psychologica, 58*, 115-122.

Crowe, E., & Higgins, E. T. (1997). Regulatory focus and strategic inclinations: Promotion and prevention in decision-making. *Organizational Behavior and Human Decision Processes, 69*, 117-132.

Davis, S. F., Bailey, S. A., Becker, A. H., & Grover, C. A. (1990). Taste/taste potentiation as a function of age and stimulus intensity. *Bulletin of the Psychonomic Society, 28*, 201-203.

Enns, M. W., & Cox, B. J. (2002). The nature and assessment of perfectionism: A critical analysis. In G. L. Flett & P. L. Hewitt (Eds.), *Perfectionism: Theory, research, and treatment* (pp. 33-62). Washington, DC: American Psychological Association.

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion, 6*, 409-434.

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion, 7*, 336-353.

Flett, G. L., Hewitt, P. L., Blankstein, K. R., & Gray, L. (1998). Psychological distress and the frequency of perfectionistic thinking. *Journal of Personality and Social Psychology, 75*, 1363-1381.

Higgins, E. T. (1998). Promotion and prevention: Regulatory focus as a motivational principle. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 30, pp. 1-46). New York: Academic Press.

Ishida, H. (2005). College students' perfectionism and task-strategy inefficience: Why their efforts go unrewarded? *Japanese Journal of Social Psychology, 20*, 208-215. Abstract obtained from the PsycINFO 2005 database, Accession No. 2005-05565-005.

John, O. P., & Srivastava, S. (1999). The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 102-138). New York: Guilford.

Leenaars, L., & Lester, D. (2006). Perfectionism, depression, and academic performance. *Psychological Reports, 99*, 941-942.

Rice, K. G., & Ashby, J. S. (2007). An efficient method for classifying perfectionists. *Journal of Counseling Psychology, 54*, 72-85.

Rice, K. G., Ashby, J. S., & Slaney, R. B. (2007). Perfectionism and the five-factor model of personality. *Assessment, 14*, 385-398.

Slade, P. D., & Owens, R. G. (1998). A dual process model of perfectionism based on reinforcement theory. *Behavior Modification, 22*, 372-390.

Slaney, R. B., Rice, K. G., Mobley, M., Trippi, J., & Ashby, J. S. (2001). The revised Almost Perfect Scale. *Measurement and Evaluation in Counseling and Development, 34*, 130-145.

Snodgrass, J. G., & Corwin, J. (1988). Pragmatics of measuring recognition memory: Applications to dementia and amnesia. *Journal of Experimental Psychology: General, 117*, 34-50.

Stoeber, J., & Eismann, U. (2007). Perfectionism in young musicians: Relations with motivation, effort, achievement, and distress. *Personality and Individual Differences, 43*, 2182-2192.

Stoeber, J., & Otto, K. (2006). Positive conceptions of perfectionism: Approaches, evidence, challenges. *Personality and Social Psychology Review, 10,* 295-319.

Table 1

Descriptive Statistics and Zero-Order Correlations

					Correlation						
Variable	*M*	*SD*	Min	Max	1	2	3	4	5	6	7
Perfectionism											
1. High standards	38.89	6.13	15	49							
2. Discrepancy	43.08	14.48	14	84	.41***						
Proof-reading performance											
3. Time	16.36	5.72	5.82	34.27	.14	–.05					
4. Hits	16.50	4.14	5	24	–.02	–.20	.51***				
5. False alarms	11.91	11.28	1	72	.21*	.10	.16	–.15			
6. Accuracy	1.95	0.51	0.34	3.27	–.13	–.15	.22*	.76***	–.69***		
7. Response bias	0.85	0.23	0.32	1.54	–.12	.15	–.53***	–.69***	–.55***	–.05	
8. Efficiency	1.41	0.61	0.17	3.60	–.27**	–.08	–.65***	.07	–.56***	.49***	.43***

Note. $N = 96$. Time = time (in minutes) taken to complete the proof-reading task. Response bias = bias against reporting errors. Efficiency = accuracy'/time' (see *Preliminary Analyses*). Min = minimum, Max = maximum.

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$, two-tailed.

Table 2

Perfectionism and Proof-Reading Performance: Partial Correlations

	Perfectionism	
Proof-reading performance	High standards	Discrepancy
Time	.18	–.12
Hits	.07	–.21*
False alarms	.19	.01
Accuracy	–.08	–.10
Response bias	–.19	.21*
Efficiency	–.27**	.03

Note. N = 96. Time = time taken to complete the proof-reading task. Response bias = bias against reporting errors. Efficiency = accuracy'/time' (see *Preliminary Analyses*).

*p < .05, **p < .01, two-tailed.

Appendix

6 APA Rules

References with two or more authors

1. When citing the authors' names in the text, separate their names with "and", for example, "Kahneman and Tversky (1982) suggest".
2. When citing the authors' names in parentheses, use "&", for example, "Prospect theory (Kahneman & Tversky, 1982) suggests".

References with three or more authors

3. Use all the names the first time you cite a reference, for example, "Smith, Lee, and Hull (1989)". After that, when citing the same reference, use "et al.", for example, "Smith et al. (1989)".

Italics

4. Abbreviations for statistics such as N, n, M, SD, F, t and p (sample size, subsample size, mean, standard deviation, ANOVA *F*, *t* test, error level) are to be set in italics, that is, *N*, *n*, *M*, *SD*, *F*, *t* and *p*.

Statistics

5. All statistics are to be reported with two decimal places, for example, "M = 1.<u>05</u>" (not "M = 1.1" or "M = 1.047").
6. All statistics that are limited to a range between 1 and –1 such as correlations and error levels (*p* values) are to be reported without a zero before the decimal point, for example, "$p < .01$" (not "$p < 0.01$"), whereas all other statistics are to be reported with a zero before the decimal point, for example, "$t = 0.78$" (not "$t = .78$").