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The Advantages of Partialling Perfectionistic Strivings and Perfectionistic Concerns: Critical Issues and Recommendations

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Abstract

According to the two-factor theory of perfectionism (Stoeber & Otto, 2006), perfectionism comprises two superordinate dimensions—perfectionistic strivings (PS) and perfectionistic concerns (PC)—that show different, and often opposite, relations with psychological adjustment and maladjustment, particularly when their overlap is partialled out. Recently, Hill (2014) raised concerns about the interpretation of the relations that PS show after partialling. The present article aims to alleviate these concerns. First, we address the concern that partialling changes the conceptual meaning of PS. Second, we explain how the relations of residual PS (i.e., PS with PC partialled out) differ from those of PS, and how to interpret these differences. In this, we also discuss suppressor effects and how mutual suppression affects the relations of both PS and PC with outcomes. Furthermore, we provide recommendations of how to report and interpret findings of analyses partialling out the effects of PS and PC. We conclude that, if properly understood and reported, there is nothing to be concerned about when partialling PS and PC. On the contrary, partialling is essential if we want to understand the shared, unique, combined, and interactive relations of the different dimensions of perfectionism.

Keywords: two-factor theory of perfectionism; perfectionistic strivings; perfectionistic concerns; partialling; mutual suppression; psychological adjustment; psychological maladjustment; 2 × 2 model of perfectionism

1. Introduction

Perfectionism comes in different forms which requires a multidimensional framework to conceptualize the various aspects of this personality characteristic (Frost, Marten, Lahart, & Rosenblate, 1990; Hewitt & Flett, 1991; see also Enns & Cox, 2002). When examining different measures of multidimensional perfectionism, however, researchers soon realized that the different forms, aspects, and subordinate dimensions of perfectionism can be organized in two superordinate factors: perfectionistic strivings and perfectionistic concerns (Frost, Heimberg, Holt, Mattia, & Neubauer, 1993; Stoeber & Otto, 2006; see also Cox, Enns, & Clara, 2002; Dunkley, Blankstein, Halsall, Williams, & Winkworth, 2000). Perfectionistic strivings (PS)—also called personal standards perfectionism—capture forms, aspects, and subordinate dimensions of perfectionism reflecting a self-oriented striving for perfection and exceedingly high personal standards of performance. In contrast, perfectionistic concerns (PC)—also called evaluative concerns perfectionism—capture forms, aspects, and subdimensions of perfectionism reflecting concerns over making mistakes, fear of negative social evaluation if not perfect, doubts about actions, feelings of discrepancy between one's high standards and actual performance, and negative reactions to imperfection (Stoeber & Otto, 2006; see also Table 1).

Differentiating PS and PC is important because the two superordinate dimensions frequently show different, and often opposite, relations with indicators of psychological adjustment and maladjustment (e.g., Frost et al., 1993; Stoeber & Otto, 2006). PC consistently show positive relations with indicators of maladjustment, and may show negative relations with indicators of psychological adjustment. In contrast, PS often show positive relations with indicators of psychological adjustment, and may show negative relations with indicators of psychological maladjustment. Of particular interest, all of the aforementioned relations tend to be stronger when the overlap between PS and PC is partialled out, controlled for, or otherwise taken into account statistically (e.g., Gotwals, Stoeber, Dunn, & Stoll, 2012; R. W. Hill, Huelsman, & Araujo, 2010; Stoeber & Otto, 2006).

In a recent article titled "Perfectionistic strivings and the perils of partialling," Hill (2014)[1] raised a number of questions regarding the potentially undesirable effects associated with the practice of partialling out the effect of PC from the relations of PS with psychological adjustment and maladjustment. In particular, Hill raised two main concerns. First, partialling out PC changes the "conceptual meaning" of PS, to the extent that what is left after partialling no longer represents PS. In fact, Hill argued that the conceptual meaning of PS becomes unclear after partialling out the effect of PC. Second, Hill raised the concern that the evidence supporting the adaptive outcomes of PS may be the result of suppression effects that may have no correspondence to reality, thus suggesting that partialling creates spurious relations (i.e., relations that did not exist before partialling) that should not be interpreted.

Although criticism is a healthy indicator of the maturity of our field, we feel that a careful examination is required before rejecting an approach that has been used in many of the theoretical and empirical advances over the last three decades. Constructive criticisms, if proven defendable and valid, should be accompanied with solutions and/or alternatives to steer research in promising directions. Given the current state of the evidence, we feel that it would be premature, if not

[1]Throughout this article, to improve readability, Hill is always A. P. Hill unless otherwise indicated.

entirely inappropriate, for researchers who are concerned about the issues raised in the Hill's (2014) article to refrain from interpreting the partialled effects of PS (when controlling for PC) and PC (when controlling for PS).

Therefore, our overarching goal in the present article was to address these concerns and provide guidance to ensure that researchers can reliably interpret observed effects after partialling. Because we intended this article as guidance for a general readership interested in research on multidimensional perfectionism, we kept our presentation largely non-technical with the exception of discussing the differences between bivariate correlations and partial correlations in greater detail. Moreover, we did not elaborate on the practice that the effects of partialling are considered problematic only when there is a change in the statistical significance ($p < .05$) of the relations that PS show after partialling (Hill, 2014) which is questionable given the well-known problems of null hypothesis significance testing (e.g., Nickerson, 2000).

Before we come to the core of the matter, however, we need to clarify the terminology we selected for this article. We used the term "relations" for any statistical associations between variables (e.g., bivariate and partial correlations in correlational analyses; regression coefficients and semipartial correlations in regression analyses; path coefficients in structural equation models). We used the term "adaptive relations" as a shorthand to denote the positive and negative relations of PS with variables that are usually considered adaptive (e.g., conscientiousness, active coping, positive affect) and maladaptive (e.g., neuroticism, avoidant coping, negative affect), respectively. Conversely, we used the term "maladaptive relations" to denote the positive relations with variables that are considered maladaptive and the negative relations with variables that are considered adaptive. Finally, we used the term "residual PS" for what Hill (2014) called residualized PS (i.e., PS after PC have been partialled out) and the term "residual PC" for what Hill called residualized PC (i.e., PC after PS have been partialled out).

Regarding the structure of this article, we will first present arguments supporting our position that partialling does not change the conceptual meaning of PS. Next, we will offer some non-technical explanations to help readers understand what partialling does when we vary the correlations between PS and PC on the one hand, and the correlations of both PS and PC with outcomes on the other. We think that clearly delineating different scenarios is needed to demonstrate that the suppression effects, outlined as a potential problem by Hill (2014), are substantially informative rather than spurious. In addition, we will take the opportunity to point out that the suppression effects of PS and PC are mutual rather than exclusive (R. W. Hill et al., 2010). As a matter of fact, controlling for PS can augment the maladaptive relations of PC as much as controlling for PC can augment the adaptive relations of PS. Informed by this substantial and theoretically-based reinterpretation of partialling, we will conclude by presenting recommendations on how to report and interpret the results of partialling PS and PC in future research.

2. Is partialling perilous or a theoretically informative approach?

2.1. Does partialling change the "conceptual meaning" of PS?

As a first main concern, Hill (2014) contended that partialling out PC from PS changes the "conceptual meaning" of PS. According to Hill, PS share some definitional features (e.g., conditional self-acceptance, self-criticism) with PC. Hence, what is left after partialling out these shared features is conceptually different from PS. Furthermore, Hill regarded some of the features that PS share with PC as core conceptual characteristics that define the "perfectionistic" in PS. After partialling, PS are thought to be left without these core definitional features to the extent that PS now represent some kind of "conscientious achievement strivings" that are essentially non-perfectionistic and thus can tell us little, if anything, about perfectionism (for similar arguments, see Flett & Hewitt, 2014; Hall, 2006).

There are a number of reasons why we do not share Hill's (2014) concerns and do not agree with his line of argument. First, it is possible to define PS and PC without making reference to the features that Hill considered defining characteristics of perfectionism (e.g., conditional self-acceptance, self-criticism). People can strive for perfection without making their self-worth contingent upon achieving perfection, or without criticizing themselves if they fail to reach perfection. Consequently, the characteristics that Hill claimed to be defining characteristics of PS are better conceptualized as correlates of perfectionism to be studied separately from PS and PC. Take, for example, conditional self-acceptance. Conditional self-acceptance and closely related constructs (e.g., contingent self-worth) have shown positive correlations with PS and PC, but the correlations are not so large as to suggest that they should be defining characteristics. Instead, such constructs are better examined separately from PS and PC (e.g., DiBartolo, Frost, Chang, LaSota, & Grills, 2004; Sturman, Flett, Hewitt, & Rudolph, 2009) as demonstrated by Hill and his colleagues in the case of unconditional self-acceptance (Hill, Hall, Appleton, & Kozub, 2008). For self-criticism, the relation with PS is even weaker. Like conditional self-acceptance, self-criticism has shown positive correlations with PS and PC. The correlations with PS, however, are considerably smaller than those with PC (e.g., Dunkley, Zuroff, & Blankstein, 2006). This pattern of relations suggests that self-criticism is closely related to PC, but not to PS (Dunkley et al., 2006; Sherry, Stoeber, & Ramasubbu, 2016). Consequently, evidence is lacking to suggest that either conditional self-acceptance or self-criticism should be considered defining characteristics of PS.

Second, we believe that accepting the line of argument put forward by Hill (2014) has the potential of steering perfectionism research in the wrong direction. If the characteristics that PS share with PC are core defining characteristics of PS—and if everything that is "perfectionistic" about PS is contained in the parts that PS share with PC—there would be little need to invest theoretical and empirical effort to study PS. Consider the Venn diagram in Figure 1 representing the relations of PS, PC, and an outcome variable Y. If the core defining characteristics of PS are those shared with PC (Figure 1, a + d), everything that is perfectionistic in PS would be contained in PC. If researchers were to accept this argument as valid, this would mean a return to the one-dimensional conceptions of perfectionism of the 1980s that either exclusively focused on PC or did not differentiate PS and PC (Burns, 1980; Garner, Olstead, & Polivy, 1983; Pacht, 1984).

Third, even though PS and PC often show large-sized positive correlations, we are convinced that it is possible to strive for perfection without being concerned about imperfection (and vice versa). Both conceptual arguments and empirical evidence can be called upon to defend this position. On conceptual grounds, the positive correlations between PS and PC can easily be misinterpreted as evidence that everyone who has a high (or a low) score on PS also has a high (or a low) score on PC and vice versa. This is not the case. As a example, imagine two students, Student A and Student B, who are about to take a multiple choice exam. Both students are high in PS and consequently strive to achieve a perfect result (say, 100 points out of 100). However, only Student B is also high in PC and consequently worries about what will happen upon failing to achieve a perfect result (i.e., 100 points). If you follow the line of argument put forward by Hill (2014), only individuals with a pattern of perfectionism comparable to Student B would show PS because they also show high levels of PC. In contrast, individuals like Student A would not show PS because they do not show PC. Note that PS and PC are different pieces of the perfectionism puzzle. As such, returning to our example, we would argue that both students—Student A and Student B—show PS because both are striving for a perfect result. One cannot substitute, guess, or infer an individual's PS score on the basis of their PC score (or vice versa). The positive correlations between PS and PC should be taken as evidence that, on average, individuals who have a high (or a low) score on PS also have a high (or a low) score on PC and vice versa. It should not be taken as evidence that studying either PS or PC is a sufficient condition to understand the whole picture of the perfectionism construct.

On empirical grounds, it is important to note that the positive correlations between PS and PC are usually not higher than r = .60 (Gotwals et al., 2012; Stoeber & Otto, 2006), meaning that PS explain no more than 36% of variance in PC (and vice versa). This means that there will be many individuals who are high in PS, but not high in PC. Furthermore, consider the 2 × 2 model of perfectionism (Gaudreau & Thompson, 2010; see also Gaudreau, 2012, 2013) which presents a theoretical and analytic framework to examine the shared, unique, combined, and interactive effects of PS and PC. To this end, the model differentiates four within-person combinations (called "subtypes") of perfectionism: pure PS (high PS, low PC), pure PC (low PS, high PC), mixed perfectionism (high PS, high PC), and non-perfectionism (low PS, low PC). Recently, Gaudreau (2015) published findings from two studies in which participants were asked to self-categorize into one of the four subtypes of the 2 × 2 model. Results showed that 37-46% of participants self-classified as the pure PS subtype and 11-16% as the pure PC subtype whereas only 23-24% self-classified as the mixed perfectionism subtype (and 18-25% as the non-perfectionism subtype). The fact that a substantial percentage of individuals have unmatched mental representations about their levels of PS and PC (that is, representations where their level of PS does not match their level or PC, or vice versa) indicates that the two superordinate dimensions of perfectionism are not as closely intertwined as suggested based on the fact that PS and PC often show large-sized positive correlations.

Overall, in principle, people can show PS without PC as much as they can show PS with PC. Therefore, as researchers, we can statistically remove PC from PS and still have PS (if residual PS). However, we agree with Hill (2014) that residual PS need to be differently interpreted from PS, which leads us to the second main concern expressed in Hill's article.

2.2. How can we (better) understand the effects of partialling?

Following Lynam, Hoyle, and Newman (2006), Hill (2014) used multiple regressions to compute residual PS and then compared the correlations of residual PS and raw scores of PS with indicators of psychological adjustment and maladjustment. In line with previous research (Gotwals et al., 2012; R. W. Hill et al., 2010; Stoeber & Otto, 2006), Hill found that residual PS show larger adaptive relations than PS. Differently from previous research, however, Hill concluded that these findings show that partialling PS is "perilous" because removing PC from PS makes PS look more adaptive than they actually are. On the one hand, this argument implies that the correlations estimated with residual PS are less real or less valid than those estimated with raw scores of PS. On the other hand, this criticism makes partialling look like some statistical trickery that has no correspondence in (or relevance for) the real world.

Although we disagree with the argument that partialling is perilous, we nonetheless concur that proper interpretation of residual PS is warranted if we want to move perfectionism research forward. To that intent, in the next section we will try to demonstrate the appropriate conceptual meaning and substantive interpretation of residual PS using both conceptual scenarios and a real-life "anxiety scenario."

2.2.1. What to expect when partialling PS

To our knowledge, both theory and empirical research have never delineated and analyzed what relations should be expected across varying scenarios of relations between PS, PC, and adjustment/maladjustment. Therefore, we created Table 2 in order to (better) understand what should happen—and what to expect—when PC are partialled out of the relations between PS and an outcome variable (hereafter denoted as Y). Table 2 shows the expected partial correlation pr(PS, Y) for all combinations of zero-, small-, medium-, and large-sized correlations between PS, PC, and Y and small-, medium-, large-sized, and very-large-sized (r = .70) positive correlations between PS and PC.[2] All these combinations are realistic patterns that have been reported in the perfectionism literature (e.g., Gotwals et al., 2012; Stoeber & Otto, 2006).

Two things are noteworthy in the pattern of partial correlations in Table 2. First, as Hill (2014) already pointed out, the effect of partialling increases with the size of the positive PS-PC correlation: As the PS-PC correlation increases, so does the difference between r(PS, Y) and pr(PS, Y). To understand this point, imagine a scenario in which PS and performance show a small positive correlation (r = .10) and PC and performance show a small negative correlation (r = –.10). When PS and PC show a very large correlation (r = .70), the relation between residual PS and performance will be moderate (pr = .24) whereas it will be small (pr = .14) when PS and PC show only a medium-sized correlation (r = .30). Second, the effect of partialling also increases with the difference between the PS-Y correlation and the PC-Y correlation: As the difference between the PS-Y correlation and the PC-Y correlation increases, so does the difference between

[2]In this, we followed Cohen (1992) who regarded correlations with absolute values of .10, .30, and .50 as small-, medium-, and large-sized.

r(PS, Y) and pr(PS, Y). Imagine that the PS-PC correlation is of medium size (r = .30). When PC show a small negative correlation with performance (r = –.10; as in our previous example), the relation between residual PS and performance will be small (pr = .14 versus r = .10). However, when PC show a large negative correlation with performance (r = –.50), the relation between residual PS and performance (pr = .30) will be three times the size of the relation between PS and performance (r = .10).

Why is this important to know? It is rather easy to get surprised and understandable to feel skeptical when PS show larger adaptive relations after partialling out PC, particularly when these relations contradict the theoretical viewpoint that perfectionism is through and through maladaptive (cf. Blatt, 1996; Greenspon, 2000). However, from a mathematical standpoint, there is nothing to be surprised or skeptical about because this is exactly what is to be expected in the potential scenarios shown in Table 2. Thus, Table 2 not only helps to prevent surprises. It also can be used to generate—and test—specific hypotheses about the relations that residual PS (and, as we will discuss later, residual PC) are expected to show with indicators of psychological adjustment and maladjustment based on prior knowledge of the bivariate correlations between PS, PC, and Y.

2.2.2. How the effects of partialling translate to individuals

Furthermore, we think that concerns about partialling are potentially aggravated when this technique is described as "removing" the variance that PS share with PC, because this suggests that common aspects are removed and consequently the construct is changed (see Figure 1 and imagine removing a + d from PS). This, however, is not the case. PS, as a predictor, is not changed. The reason is that partialling removes the variance in the dependent variable that is already explained by the other predictor (here PC) rather than variance in the predictors themselves. Therefore, a better way to describe partialling, which may avoid these concerns, is to describe partialling as a statistical technique that controls for the PS-PC overlap by keeping PC constant (see again Figure 1, but now imagine keeping a + d constant).

Statistically removing variance and keeping a variable constant are the same thing, but the latter may help us better understand what exactly happens when PC are partialled and why the relations of residual PS often show stark differences to those of PS. In the case of two independent variables (PS and PC), statistically controlling for one independent variable (PC) is like holding this variable constant and examining only the effects that the other variable (PS) has on the outcome variable. This is like statistically creating a sample in which all participants have the same level of PC (= constant) and then examining the relations that PS would show in such a sample. It is also similar to creating an experiment in which the conditions are tightly controlled by the experimenter to ensure that the observed effect can be solely attributed to the primary independent variable (see Bernerth & Aguinis, 2016). Of course, personality traits cannot be manipulated by the experimenter, so holding constant using statistical methods has been the preferred approach of researchers studying individual differences.

Some of the arguments presented by Hill (2014) are likely to be interpreted as if suggesting that the results of partialling create statistical constellations that have no correspondence in the real world. We disagree with this criticism but concede that the idea of "holding constant" deserves to be explained in non-technical language that everyone can easily understand. To this end, consider the following "anxiety scenario." This scenario presents a constellation that, at a first glance, might appear counterintuitive because partialling turns a maladaptive relation into an adaptive relation. For this scenario, let us assume a hypothetical study in which PS and PC show a large-sized positive correlation of $r = .50$, which is frequently the case in the literature (e.g., Stoeber & Otto, 2006). Let us further assume that PS and PC both show positive bivariate correlations with anxiety (a maladaptive outcome), but PS show a small-sized positive correlation ($r = .10$) whereas PC show a large-sized positive correlation ($r = .50$), which is approximately the pattern of correlations that was found in a study on competitive anxiety in athletes (Stoeber, Otto, Pescheck, Becker, & Stoll, 2007). As shown in Table 2, partialling out PC would result in PS showing a negative partial correlation of $pr = –.20$ with anxiety: The maladaptive relation of PS has disappeared and turned into an adaptive relation. Before partialling, PS showed a positive relation with anxiety (indicating that people high in PS are more anxious than people low in perfectionist strivings), but after partialling PS show a negative relation (indicating that people high in PS are less anxious).

We agree that such differences between PS and residual PS might appear counterintuitive. However, both findings are mathematically appropriate and substantially interpretable. In fact, they provide different yet complementary information that deserves to be wholeheartedly interpreted and considered for theoretical development. If we take any two individuals from the study's sample, the individual with higher PS will on average be more anxious than the individual with lower PS (because PS show a positive bivariate relation with anxiety). However, if we take two individuals who have the same level of PC (= constant), the individual with higher PS will on average be less anxious than the individual with lower PS (because PS show a negative relation with anxiety when PC are partialled out, that is, held constant). As this example demonstrates, bivariate correlations and partial relations (i.e., partial correlations, unique effects in multiple regressions, paths in structural equation models) have their own substantive meaning and deserve to be interpreted accordingly. Partialling does not create relations that have no correspondence in reality or are "not there" before partialling. On the contrary, partialling uncovers relations that can only be discovered and interpreted with a multivariate statistical approach that matches the multidimensional nature of the perfectionism construct.

2.2.3. A short note on suppression

A final, albeit closely related concern of Hill (2014) was that the effects described in the previous section (and detailed in Table 2) represent suppression effects which researchers are often uncomfortable with because they can be difficult to understand (Meyers, Gamst, & Guarino, 2005). The classic suppressor situation (Horst, 1941) is when a first predictor X1 shows no bivariate relation with the dependent variable Y ($r = .00$), but shows a bivariate relation with a second predictor X2 that shows a bivariate relation with Y. When X1 and X2 are simultaneously entered into a regression predicting Y, X1 will show a regression weight differently from zero indicating that X1 has a relation with Y when the overlap with X2 is controlled for. Because mathematically equivalent (R. L. Smith, Ager, & Williams, 1992), the same effect occurs when X2 is partialled out of the relations between X1 and Y: The bivariate correlation of X1 and Y is zero, but the partial correlation of X1 and Y is different from zero (see the entries in Table 2 for $r[PS, Y] = .00$ and any $r[PC, Y] \neq .00$).

The classic explanation for suppression effects is that the predictor responsible for the suppressor effect (the suppressor variable, here X2) enhances the importance of the other predictor (here X1) because it (X2) suppresses variance that is "irrelevant" to the prediction of Y (Tabachnick & Fidell, 2007). This explanation, however, is not helpful in the present context, for two reasons. First, it is difficult to imagine what the irrelevant variance should be that PC suppress when partialled out of the relations that PS show with Y. (Looking at Figure 1, for example, d is surely not irrelevant.) Second, and more importantly, both PS and PC are suppressor variables. Hence, PS and PC create a "suppression situation" (Tzelgov & Henik, 1991) mutually enhancing their predictive validity (see Section 3 below). Suppression situations go beyond the classic suppressor situation described above. Instead, suppression situations include all situations where both predictors change their predictive validity when entered together in predicting an outcome, for example, by changing signs (a significant positive predictor becomes a significant negative predictor and vice versa), by showing increased validity (the predictor's partial correlation is larger than its bivariate correlation), or both—as is the case when partialling PS and PC (see Table 2).

Fortunately, the suppression situation created by partialling the effects of PS and PC is not difficult to understand and is easily explainable. PS have adaptive aspects, as is demonstrated by the many studies that found PS to show adaptive relations when bivariate correlations are examined (i.e., without PC being partialled out; e.g., Gotwals et al., 2012; Stoeber & Otto, 2006; see also Hill, 2014; Hill & Curran, 2016). However, because PS and PC overlap, PS' adaptive relations are often suppressed by the maladaptive relations that PC show, and consequently may only show when PC are partialled out (Gotwals et al., 2012; Hill, 2014; Stoeber & Otto, 2006; see also Stoeber, Kobori, & Brown, 2015). Because PS show positive relations with PC, the overlap with PC often "masks" the adaptive relations of PS—particularly as the adaptive relations that PS show are usually weaker than the maladaptive relations that PC show.

The suppression effects of PS and PC are theoretically interpretable and empirically replicable. There are not many reliable and replicable suppression situations in personality research (Paulhus, Robins, Trzesniewski, & Tracy, 2004). Consequently, we see the discovery that PS and PC represent a reliable and replicable suppression situation—with findings replicated across different research groups (e.g., Gotwals et al., 2012; Hill, 2014; R. W. Hill et al., 2010; Stoeber & Otto, 2006)—as a significant achievement of perfectionism research, particularly in light of the current crisis of confidence regarding the replicability of findings in psychological science (e.g., Asendorpf et al., 2013; Pashler & Wagenmakers, 2012). Moreover, the suppression effects in the PS-PC relations are not spurious effects that unexpectedly appear in multivariate analyses and are difficult (if not impossible) to explain. They are effects that should be expected (see Table 2) and are, as shown in the previous paragraph, easily explained. Furthermore, the suppression effects are theoretically important because they are mutual. Not only do PC suppress the adaptive relations of PS, but PS also suppress the maladaptive relations of PC.

3. What about residual PC?

Although the effects that partialling has on the relations of PS have received considerable attention and are regarded as problematic by some researchers (Hill, 2014; see also Flett & Hewitt, 2014; Molnar & Sirois, 2016), researchers often ignore that partialling also affects the relations of PC. Residual PC—that is, PC with PS partialled out—usually show larger maladaptive relations than PC (Hill, 2014; R. W. Hill et al., 2010). Yet, Hill (2014) argues that the effects that partialling has on the relations of PC are unproblematic because PC are "less controversial" (p. 310). We find this a peculiar argument. Researchers who accept the argument that partialling PC from PS is problematic (because partialling changes the conceptual meaning of PS) should logically accept the mirror argument that partialling PS from PC is equally problematic (because partialling changes the conceptual meaning of PC). If partialling is perilous, the perils should apply equally to PS and PC.

Three main reasons could explicate why the mirror argument has not been equally accepted and defended by researchers. First, the effects of partialling PS from the relations of PC are not as "dramatic" as those of partialling PC from the relations of PS. The differences between PC and residual PC are usually not as large as those between PS and residual PS (Hill, 2014; R. W. Hill et al., 2010). Second, PC do not become less maladaptive when PS are partialled out. Instead, they become more maladaptive. What is more, partialling PS from PC does not turn maladaptive relations into adaptive relations. Third, and perhaps more importantly, the effect that partialling has on PC—making PC more maladaptive—is consistent with the traditional view of perfectionism as a personality disposition that is essentially maladaptive (e.g., Burns, 1980; Horney, 1950; Pacht, 1984). In contrast, the effect that partialling has on PS—making PS more adaptive—is inconsistent with the traditional view.

Nevertheless, we think that researchers (particularly those interested in the maladaptive relations of perfectionism) should take greater note of these effects because they indicate that PC are even more maladaptive than is apparent from their bivariate correlations with indicators of psychological adjustment and maladjustment. The reason is that PC overlap with PS which often show adaptive relations, and consequently the maladaptive relations of PC are often attenuated. Only when we examine the relations of residual PC (i.e., the unique relations of PC when holding PS constant) does the true extent of PC' maladaptiveness become apparent.[3] Consequently, partialling is important because it shows us not only the extent to which residual PS are adaptive, but also the extent to which residual PC are maladaptive.

4. Further considerations and reflections

Despite our confident stance toward partialling, there are two issues that warrant further attention. First, Hill (2014) questioned the reliability of the residual scores of PS and PC. We

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[3]Interchange PS and PC in Table 2 and you get the effects that partialling has on PC, and how residual PC differ from PC.

agree this could be problematic in multiple regressions, although this type of generic concern should not be seen as specific to partial correlations and regression analyses involving PS and PC. Moreover, the scales used to measure PS and PC usually show high internal consistency (i.e., Cronbach's alphas > .80), particularly when multiple subscales capturing indicators of PS and PC are combined (cf. Table 1). As such, the residual scores of PS and PC should have sufficient reliability. Furthermore, there are nowadays statistical techniques (e.g., confirmatory factor analysis, exploratory structural equation modeling) widely available to create latent variables in which measurement error can be separated from the true score. As such, concerns for the lack of reliability of residual scores can be directly addressed and minimized by taking into account the imperfect nature of measures. As eloquently expressed by Asparouhov, Muthén, and Morin (2015, p. 1563), "psychometric indicators are seldom perfectly pure construct indicators." If anything, our desire to blindly treat PS and PC as if they were naturally existing "things" rather than "latent properties" has potentially lead to a situation in which the effects of PS and PC on adjustment and maladjustment have been conservatively underestimated (e.g., Fan, 2003).

Second, there is the issue that the relations that residual PS and residual PC show do not take into account the shared variance between PS and PC (cf. Molnar & Sirois, 2016). This variance, however, can be substantial (see Figure 1, a + d). When regression approaches are used (e.g., ordinary least square regression) and PS and PC are simultaneously entered as predictors of an outcome variable Y, only the resulting R^2 (which multiplied by 100 represents the percentage of variance in Y explained by PS and PC) includes the shared variance between PS, PC, and Y (Figure 1, d). The regression coefficients—representing the unique relations of PS (Figure 1, b) and PC (Figure 1, c)—do not include the shared variance (Figure 1, d), and neither do the respective partial correlations. Consequently, the relations resulting from partialling underestimate the overall contribution that PS and PC make in explaining variance in Y. Some statistical procedures may present a solution to this problem (e.g., regression communality analysis; Nimon, 2010) which we will leave for future research to explore because they require a discussion of advanced statistics that goes far beyond the scope of the present article. Furthermore, this requires addressing the question what the overlap of PS and PC represents theoretically and conceptually. One possibility would be that the overlap represents the common qualities that make PS and PC "perfectionistic" (e.g., strong personal beliefs about the importance of perfection; Campbell & Di Paula, 2002). Another possibility is that the overlap represents a "general factor of perfectionism" (similar to Spearman's g factor representing a general factor of intelligence in research on mental abilities) as suggested by a recent publication (M. M. Smith & Saklofske, in press).

5. Recommendations and concluding comments

5.1. Recommendations

Although we believe that—once properly understood and interpreted—the advantages clearly outweigh the disadvantages of partialling, we agree with a number of recommendations proposed by Hill (2014). First, researchers need to differentiate between PS and residual PS when reporting and discussing findings where the two show different relations.[4] Furthermore, we agree with Hill that more caution needs to be exerted when discussing the relations of residual PS by making clear to readers that these relations are the relations that PS show when PC are held constant (see also Lynam et al., 2006). One way to do so is to follow Hill (2014) and describe these relations as relations of residual PS and residual PC (compared to relations of PS and PC) which to some ears may sound rather "technical." Another way would be to describe the relations as the unique relations of PS and PC (compared to their bivariate relations) which we think is preferable.

Second, to give readers the full picture, it is important to always report the bivariate correlations upon which the multivariate model involving partialling is built. This is pivotal for ensuring that readers can see the relations of PS with Y including PC (Figure 1, b + d) and compare them to the unique relations of PS excluding PC (Figure 1, b). Reporting all bivariate correlations on which multivariate analyses are based is not only considered good practice in multivariate statistics (Tabachnick & Fidell, 2007), but is essential if we want to understand the effects that partialling has on the relations that PS show and how the relations of residual PS differ from those of PS. The same holds for the relations of PC and residual PC.

These recommendations should also help researchers report and understand the results of analyses not only when two dimensions of perfectionism—PS and PC or their respective indicators (Table 1)—are regarded, but also when the unique relations of more than two superordinate dimensions of perfectionism are regarded (e.g., M. M. Smith, Saklofske, Stoeber, & Sherry, in press) as well as when more than two forms, aspects, and subordinate dimensions of perfectionism are investigated and their bivariate and unique relations with relevant criterion variables are examined (e.g., Stoeber, 2014a; Stoeber & Childs, 2010).

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[4]The same goes, of course, for PC and residual PC.

In addition, we would recommend that researchers also probe for possible interactions effects of PS and PC. The reason is that a significant multiplicative PS × PC effect—a moderating effect—should be taken as evidence that the valence and/or strength of the relation of PC varies across levels of PS. Moderating effects are symmetrical (Cohen, Cohen, Aiken, & West, 2003) which implies that the valence and/or strength of the relation of PS also varies across levels of PC. In the presence of a moderating effect, simple slopes analyses are recommended to properly estimate the effect of PS across different levels of PC as well as the effect of PC across different levels of PS. For that matter, the 2 × 2 model of perfectionism (Gaudreau & Thompson, 2010) offers a series of testable hypotheses that can help reinterpret the effects of PS and PC when the multiplicative PS × PC is statistically significant (see also Gaudreau, 2012; Gaudreau, Franche, & Gareau, in press) as well as when it is not statistically significant (e.g., Gaudreau, 2012). In each case, the 2 × 2 model was proposed as a way to investigate the effect of different within-person combinations of PS and PC (i.e., "subtypes" of perfectionism) in order to embrace the richness of a multidimensional conceptualization of perfectionism when examining the effects of PS and PC using multiple regression, structural equation modeling, and multilevel modeling.

5.2. Concluding comments

Hill's (2014) critique of partialling PS ends with the statement that it is unclear what residual PS measure. We hope that the present article provides some necessary clarification to alleviate the major concerns that Hill's article raised about partialling. Perfectionism is a multidimensional construct. Hence, it requires a multidimensional theory and multivariate reasoning and analyses. The numerous studies that used partialling techniques to examine residual PS and residual PC—which include many studies by Hill and colleagues (e.g., Hill & Curran, 2016; Hill et al., 2008; Hill, Hall, Appleton, & Murray, 2010)—have yielded important insights into the complexities of multidimensional perfectionism and the different, often opposite, relations that PS and PC show with indicators of psychological adjustment and maladjustment.

To us, there are currently no satisfactory alternatives to partialling if we want to understand the shared (bivariate) and unique (partialled) relations that different dimensions of perfectionism show with psychological adjustment and maladjustment (cf. Appendix). Furthermore, there is no alternative to partialling if we also want to understand their combined and interactive relations. Note that the 2 × 2 model of perfectionism (Gaudreau & Thompson, 2010), which is a theoretical and analytic framework expanding on the two-factor theory of perfectionism, uses a regression approach to examine the unique, combined, and interactive effects of residual PS and residual PC

(Gaudreau, 2012, 2013; Gaudreau et al., in press). Studies following this framework—which again include studies by Hill and colleagues (e.g., Hill, 2013; Hill & Davis, 2014)—have provided important new insights into the adaptive relations of residual PS (particularly when combined with low levels of residual PC) as well as the maladaptive relations of residual PC (particularly when combined with low levels of residual PS). These insights help us better understand the dual nature of perfectionism and why perfectionism has been described as a "double-edged sword" (Molnar, Reker, Culp, Sadava, & DeCourville, 2006; Stoeber, 2014b) that not only has maladaptive aspects that undermine psychological health, promote psychological maladjustment, and put people at risk of developing physical and mental health problems, but also has adaptive aspects that may protect psychological health and promote psychological adjustment. Partialling perfectionistic strivings and perfectionistic concerns helps us better understand this dual nature.

Appendix

No Satisfactory Alternatives to Partialling

Some researchers have suggested to employ person-centered approaches allowing researchers to examine different configurations of high versus low PS and PC without losing the variance shared by PS and PC (e.g., Boone, Soenens, Braet, & Goossens, 2010; Molnar & Sirois, 2016). Person-centered approaches, however, have the problem that they cannot differentiate between the shared, unique, and interactive contributions that PS and PC make in predicting an outcome. Furthermore, person-centered approaches based on cluster analytical procedures usually arrive at clusters with significant differences in PS and PC leaving it unclear whether the differences that the clusters show in the outcome are attributed to differences in PS or differences in PC. Take, for example, the study by Boone et al. (2010) that used cluster analysis, arrived at a four-cluster solution, and found that the mixed perfectionism cluster (high PS, high PC) showed higher levels of disordered eating than both the high PS cluster (high PS, average PC) and the high PC cluster (average PS, high PC). Unfortunately, the mixed perfectionism cluster also showed higher levels of PS than the high PS cluster, and higher levels of PC than the high PC cluster, leaving it unclear whether the higher levels of disordered eating the mixed perfectionism cluster showed were attributable to PS, to PC, or to some combination of PS and PC. (Readers who may contemplate employing median-split procedures to PS and PC scores in order to create groups with comparable levels of high vs. low PS and PC should note that such procedures are not advisable because they decrease reliability, introduce classification errors, and often yield misleading results; Cohen, 1983; MacCallum et al., 2002.)

Furthermore, researchers have suggested to employ factor-analytic approaches differentiating PS and PC while keeping a "general factor" of perfectionism that would contain the shared variance (e.g., Molnar & Sirois, 2016). One such approach was recently tested by M. M. Smith and Saklofske (in press) who presented a bifactor model of perfectionism differentiating PS, PC, and a general perfectionism factor. Note, however, that bifactor models—while providing reliable scores for the general factor (here general perfectionism)—have problems providing reliable scores for the specific factors (here PS and PC) when the specific factors are highly correlated (as was the case for PS and PC) or are estimated with indicators that show low loadings on the specific factors (as was the case for two indicators used to model PC). In this case, a correlated factor model (without a general factor) provides more reliable scores for the specific factors (DeMars, 2013). Further note that bifactor models also involve partialling—the specific factor scores are residual scores controlling for the general factor—and hence would be subject to the same concerns that Hill raised in his 2014 article and we addressed in the present article.

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Table 1

Indicators of Perfectionistic Strivings and Perfectionistic Concerns: Examples

Scale	Perfectionistic strivings	Perfectionistic concerns
FMPS	Personal standards	Concern over mistakes
	Pure personal standards[a]	Concern over mistakes + doubts about actions[b]
HF-MPS	Self-oriented perfectionism[c]	Socially prescribed perfectionism
APS-R	High standards	Discrepancy
PI	Striving for excellence	Concern over mistakes
MIPS	Striving for perfection	Negative reactions to imperfection

Note. Scales are listed in chronological order of their first publication. FMPS = Frost Multidimensional Perfectionism Scale (Frost et al., 1990); HF-MPS = Hewitt-Flett Multidimensional Perfectionism Scale (Hewitt & Flett, 1991, 2004); APS-R = revised Almost Perfect Scale (Slaney, Rice, Mobley, Trippi, & Ashby, 2001); PI = Perfectionism Inventory (R. W. Hill et al., 2004); MIPS = Multidimensional Inventory of Perfectionism in Sport (Stoeber, Otto, Pescheck, Becker, & Stoll, 2007). Table adapted from Stoeber and Damian (2016, p. 276).

[a]See DiBartolo, Frost, Chang, LaSoto, and Grills (2004).

[b]See Stöber (1998).

[c]particularly the subscale capturing striving for perfection (cf. Stoeber & Childs, 2010)

Table 2

Partial Correlations of Perfectionistic Strivings (PS) and Y Controlling for Perfectionistic Concerns (PC) for Different Combinations of Correlations of PS, PC, and Y

		r(PS, PC)[a]			
r(PS, Y)	r(PC, Y)	.10	.30	.50	.70
.50	.50	.52	.42	.33	.24
	.30	.50	.45	.42	.43
	.10	.49	.50	.52	.61
	.00	.50	.52	.58	.70
	–.10	.52	.56	.64	.80
	–.30	.56	.65	.79	—
	–.50	.64	.79	—	—
.30	.50	.29	.18	.07	–.08
	.30	.28	.23	.18	.13
	.10	.29	.28	.29	.32
	.00	.30	.31	.35	.42
	–.10	.31	.35	.41	.52
	–.30	.35	.43	.54	.75
	–.50	.41	.54	.73	—
.10	.50	.06	–.06	–.20	–.40
	.30	.07	.01	–.06	–.16
	.10	.09	.07	.06	.04
	.00	.10	.10	.12	.14
	–.10	.11	.14	.17	.24
	–.30	.14	.21	.30	.46
	–.50	.17	.30	.47	.73
.00	.50	–.06	–.18	–.33	–.57
	.30	–.03	–.10	–.18	–.31
	.10	–.01	–.03	–.06	–.10
	.00	.00	.00	.00	.00
	–.10	.01	.03	.06	.10
	–.30	.03	.10	.18	.31
	–.50	.06	.18	.33	.57

–.10	.50	–.17	–.30	–.47	–.73
	.30	–.14	–.21	–.30	–.46
	.10	–.11	–.14	–.17	–.24
	.00	–.10	–.10	–.12	–.14
	–.10	–.09	–.07	–.06	–.04
	–.30	–.07	–.01	.06	.16
	–.50	–.06	.06	.20	.40
–.30	.50	–.41	–.54	–.73	—
	.30	–.35	–.43	–.54	–.75
	.10	–.31	–.35	–.41	–.52
	.00	–.30	–.31	–.35	–.42
	–.10	–.29	–.28	–.29	–.32
	–.30	–.28	–.23	–.18	–.13
	–.50	–.29	–.18	–.07	.08
–.50	.50	–.64	–.79	—	—
	.30	–.56	–.65	–.79	—
	.10	–.52	–.56	–.64	–.80
	.00	–.50	–.52	–.58	–.70
	–.10	–.49	–.50	–.52	–.61
	–.30	–.50	–.45	–.42	–.43
	–.50	–.52	–.42	–.33	–.24

Note. r = bivariate correlation. The numbers in the table cells show the partial correlation pr(PS, Y) resulting from partialling perfectionistic concerns (PC) from the relations of perfectionistic strivings (PS) and Y following the formula pr(PS, Y) = {r(PS, Y) – [r(PS, PC) × r(PC, Y)]} ÷ {√[1 – r(PS, PC)^2] × √[1 – r(PC, Y)^2]}. — = not computable (computing the partial correlation results in out-of-range values).

[a]When PS and PC are uncorrelated (r = .00), partialling has no effect and the partial correlations are identical to the bivariate correlations. Hence r(PS, PC) = .00 was omitted from Table 2.

Figure 1. Venn diagram representing the shared variance of perfectionistic strivings (PS), perfectionistic concerns (PC), and an outcome variable (Y). Partialling controls for the shared variance of PS and PC indicated by a + d and uncovers the unique relations that PS (indicated by b) and PC (indicated by c) have with Y.