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Interactive effects of perfectionism on competitive golf performance: A multi-level analysis

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ABSTRACT

Perfectionism is a multidimensional personality characteristic comprised of two higher-order factors termed perfectionistic strivings (PS) and perfectionistic concerns (PC). Research has typically found perfectionistic strivings to be related to better sport performance, while concerns are usually unrelated. However, many of the tests of this relationship use non-athletes, contrived tasks, and one-off performances, and have also focused on the separate, rather than interactive, effects of PS and PC. The present study was designed to address these limitations by testing the interactive effect of indicators of PS and PC in predicting performance across two rounds of competitive golf. Eighty-nine male golf athletes (M_{age} = 28.42 years, SD = 11.87) completed measures of perfectionism and then competed in a regional golf competition. Their cumulative score, relative to par, across two rounds determined their performance. Hierarchical linear modelling, nesting performances within individuals, holes, and rounds, showed a significant three-way interaction between self-oriented performance perfectionism (indicator of PS), socially prescribed performance perfectionism (indicator of PC), and round (b = 0.36, SE = 0.17, p = .039). At low levels of socially prescribed performance perfectionism, self-oriented performance perfectionism predicted improved performance; however, at high levels of socially prescribed performance perfectionism, self-oriented performance perfectionism predicted poorer performance. Findings highlight the importance of assessing the relationship between perfectionism and sport performance in real-world competitive contexts over time, while accounting for the interplay between indicators of PS and PC.

Performance is the most important aspect of competitive sport for most athletes, coaches, and wider sport organisations. Understandably, a considerable amount of time and effort has therefore been dedicated to identifying factors that contribute to sport performance. One current area of contention is whether perfectionism helps or hinders sport performance (e.g., Flett and Hewitt, 2014). Unfortunately, most research on this topic has utilized non-athlete samples (e.g., Stoll et al., 2008) or athletes participating in sports outside of their expertise in contrived laboratory-based tasks (e.g., Lizmore et al., 2019). In addition, when studies have included athletes competing in their sports, performance is often only measured once (e.g., 10 km road race, Waleriańczyk & Stolarski, 2021) and, critically, studies have typically examined the effects of different dimensions of perfectionism separately (e.g., Mallinson-Howard et al., 2020). The current study is designed to address these limitations by examining the interactive effects of dimensions of perfectionism on performance in skilled athletes participating across two rounds and 36 holes of competitive golf.

1. Multidimensional perfectionism

Perfectionism is a multidimensional personality characteristic comprised of excessively high personal standards and overly critical self-evaluations (Frost et al., 1990). Since its conceptualisation as a multidimensional characteristic, perfectionism has been operationalized in several ways, including both personal and inter-personal components. Frost and colleagues (1990) proposed the first model of

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multidimensional perfectionism that is composed of high personal standards, doubting one's actions, and a preference for organization and order (as well as other etiological factors). At a similar time, Hewitt and Flett (1991) proposed a multidimensional model that differentiated between dimensions based on whether perfectionistic standards originate from within the self (self-oriented perfectionism) or others (socially prescribed perfectionism) or are imposed on other people (other-oriented perfectionism). These models have subsequently been the basis for other approaches and domain-specific models, including those measuring perfectionism in sport, such as Stoeber et al. (2006) who distinguish between striving for perfection and negative reactions to imperfection.

To consolidate different conceptualisations of perfectionism, a two-factor, or higher-order model was proposed as an organising framework (Stoeber & Otto, 2006). The first factor is termed *perfectionistic strivings* (PS) and encompasses self-oriented striving for perfection and the setting of excessively high personal performance standards. The second factor, termed *perfectionistic concerns* (PC), is associated with concerns over making mistakes, fear of negative social evaluation, feelings of discrepancy between one's expectations and performance, and negative reactions to imperfection (Gotwals et al., 2012). The higher-order model is of particular use as it accounts for both theoretical and statistical overlap between prior models (Hill, 2016). In sport, recent work from Hill and colleagues (2024) has demonstrated that a two-factor model of perfectionism adequately represents the structure of scales designed to measure perfectionism in athletes including Hewitt and Flett's (Perfectionism Performance Scale - Sport, PPS-S; Hill et al., 2016) and Stoeber's approaches (Multidimensional Inventory of Perfectionism in Sport, MIPS; Stoeber et al., 2003).

However, despite this unifying approach to conceptualizing perfectionism, many measurement instruments contain subtle differences in their design and structure. For example, the MIPS captures perfectionism in relation to training or competition whereas the PPS-S directly measures perfectionism as it relates to sport performance. We would expect the dimensions of MIPS and PPS-S to be related to how athletes perform in a manner reflective of PS and PC. However, notable differences between the two instruments are also evident (Hill et al., 2024). In this regard, striving for perfection (MIPS) and self-oriented perfectionism (PPS-S) are quite similar indicators of PS, while negative reactions to imperfection (MIPS) and socially prescribed perfectionism (PPS-S) represent more discernible elements of PC (e.g., intrapersonal *versus* interpersonal focus). The most notable difference between the instruments, though, is the explicit focus on performance in the PPS-S. This difference potentially positions the PPS-S as the most relevant instrument to questions of how perfectionism might impact sport performance and justifies analysing the two instruments separately as indicators of PS and PC, as opposed to in combination (Mallinson-Howard et al., 2025).

Despite these measurement complexities, a large body of research has examined the associations between perfectionism and a range of outcome variables in sport. In general, this work shows that when using the MIPS and PPS-S, along with other instruments, PS is typically associated with a variety of adaptive *and* maladaptive outcomes for participants in sport, dance, and exercise (Hill et al., 2018). These include positive associations with markers of high- and low-quality motivation (e.g., intrinsic and introjected motivation regulation, task and ego orientation) and mixed wellbeing (e.g., positive and negative affect, confidence and worry; Hill et al., 2020). Conversely, again using various instruments, research shows PC to exhibit consistent positive associations with maladaptive outcomes. Notably, this includes low-quality motivation (e.g., amotivation) and poorer wellbeing (e.g., somatic anxiety and worry, cognitive anxiety, depressive symptoms, and self-criticism). As such, perfectionism appears to be an important variable when aiming to understand athlete experiences in sport.

2. Perfectionism and performance

A growing body of sport psychology research is now being dedicated to understanding the complex relationship between perfectionism and sport performance. Although a contentious issue (e.g., Flett & Hewitt, 2014), empirical evidence suggests that PS, and its indicators, have a small positive relationship with sport performance, while PC, and its indicators, are unrelated to sport performance (Hill, 2023a). With the former relationship reflecting a potentially energising or motivational element of perfectionism (Stoeber et al., 2006). Studies examining this relationship have employed diverse methods. For instance, researchers have often recruited undergraduate students or student-athletes to participate in performance-based tasks (e.g., basketball, golf putting, fitness-based field tests; Stoll et al., 2008; Lizmore et al., 2019; Mallinson-Howard et al., 2020). While these studies provide a glimpse into the relationship between perfectionism and sport performance, they may be best viewed as assessing the relationship with novel sport performance or sport performance in novices. In addition, whether we can consider students, and to a lesser degree student-athletes, a suitable basis for understanding the relationship in motivated, competitive, and high-level athletes is questionable.

A related limitation of many studies is that they utilize contrived, laboratory-based tasks to measure performance. Although these protocols offer insight into the relationship between perfectionism and performance under controlled conditions, they can have limited ecological validity. That is, due to their contrived nature, studies so far have not provided a close enough approximation to real-world, competitive scenarios encountered by athletes from those sports. As such, the degree of validity and generalizability of current findings is unclear. For instance, Stoll and colleagues (2008) recruited undergraduate sport science students to participate in a laboratory-based basketball task and found, using the MIPS, that PS was related to better performance and PC was unrelated to performance other than for their first attempt, in which case it was negatively related. As the task was novel to students, it controlled for previous experience but, as the authors highlighted, this also meant that the student's appraisal of the task as meaningful or not was unknown. Furthermore, in the task, participants were awarded points for an attempt that hit the basket rim but did not score. While potentially useful for differentiating between performance in a laboratory-based setting, this is less meaningful for real-world basketball performance where points are only scored for successful attempts.

There are other studies that better address this issue. Stoeber and colleagues (2009), Waleriańczyk (2023), and Waleriańczyk and Stolarski (2021) are notable examples. These studies examined the relationship between multidimensional perfectionism and performance in runners and triathletes competing in a trail running competition, a 10 km road race, half-marathon, and an ironman competition. Similarly, Nordin-Bates and colleagues (2024) recently examined the relationship between perfectionism and performance in track and field athletes in their specialist events. With regards to the findings, the first three studies found that PS, as comprised by combinations of its indicators, were positively related to performance whereas Nordin-Bates and colleagues (2024) found that PS were unrelated (linearly) and both positively and negatively related (non-linearly) to performance in two separate samples.

While these aforementioned studies are extremely useful, one aspect that can be improved is the number of times performances are observed. All these studies used single, one-off, sport performances. This is potentially problematic as one-off performances are more likely to include uncharacteristically high or low performances (Malcata & Hopkins, 2014). In addition, it is only a snapshot of the relationship that might conceal complexities evident only over time. To better understand the relationship between perfectionism and performance, we ideally need to observe performance on multiple occasions and show how perfectionism is related to different performance trajectories. In doing so we also better capture the relationship as it might typically unfold in context of the ongoing and frequent performance feedback athletes experience during contests, events, and seasons.

One final issue is the degree to which previous studies have fully examined the way PS and PC, or their respective indicators, interact to determine performance. Based on the idea that there will be instances in which the interaction between PS and PC, or their respective indicators, would be more important than their individual effects, Hill (2021) proposed the concept of perfectionistic tipping points – whereby the effects of PS can change at specific levels of PC. Some of the most revealing studies in this area has found evidence of tipping points for sport performance. For instance, among student athletes, Lizmore and colleagues (2019) found that while PS predicted better golf putting performance when PC was low, its effects became non-significant when PC was high. Waleriańczyk (2023) also found the same in competitive runners. The concept of a perfectionistic tipping for sport performance may also be especially important in explaining why sometimes PS is related to better performance and at other times is unrelated or even negatively related (Hill, 2023b). However, more work is required to identify how common perfectionistic tipping points are for sport performance and to what degree any performance enhancing effects of PS depend on PC in sport.

3. The present study

The aim of the present study was to examine the interactive effects of multidimensional perfectionism on performance across holes and rounds (time) in a real-world, competitive, golf setting. In line with existing work, we hypothesized that: (Hypothesis 1) indicators of PS (striving for perfection and self-oriented performance perfectionism) would predict better performance, (Hypothesis 2) indicators of PC (negative reactions to imperfection and socially prescribed performance perfectionism) would be unrelated to performance, and (Hypothesis 3) perfectionism dimensions would interact with time to predict performance whereby indicators of PS would predict better performance only at lower levels of indicators of PC.

4. Method

4.1. Participants

Participants (N = 89) were 100 % male with a mean age of 28.32 years (*SD* = 11.90). Participants had been playing golf for 18.33 years (*SD* = 11.33) on average with a mean handicap of 1.27 (*SD* = 2.09) and were competing at the regional level in England. and no a priori power analysis was performed. However, Hox and McNeish (2020) have offered suggestions relating to the minimum number of participants/units required at the top level of a hierarchical linear model (HLM). For models fit using the maximum likelihood estimator and including random components, Hox and McNeish (2020) suggest that at least 75 units be included. Therefore, the 89 participants at the highest level in the present study would be deemed appropriate. As for the hierarchical nature of the data, recommendations have been provided for intraclass correlations (ICC) and meaningful levels of variance due to nesting. Julian (2001) suggests an ICC above 0.05 as evidence for the need to account for the nested structure and adoption of a multilevel model. As evidenced below, the ICC in the current study well exceeds this benchmark.

4.2. Procedure

Upon receipt of institutional ethical approval, participants were contacted prior to the commencement of the regional golf competition athletes were provided with information outlining the purpose and procedures of the research. After providing written informed consent, athletes were asked to complete participant characteristics and measures of their own perfectionism. Questionnaires were completed online within a two-week window prior to the competition.

4.3. Measures

The following outline the variables collected at each of the two levels observed in the present study. The hierarchical structure of the data is illustrated in Table 1.

Level 1 Variables. In HLM, outcome variables are always at the first level of the hierarchy (Bixler, 2019). Participants competed in two rounds of golf, consisting of eighteen holes each, over the course of two days. In keeping with the structure of the competition, these scores were recorded as a cumulative performance as they progressed through the competition, with each hole score being added to their performance (i.e. higher scores equate to poor performance, and the winner had the lowest score at the end of the event). All scores were recorded relative to par (the number of shots expected to be needed to complete each hole), which was coded as 0. Therefore, an albatross (three shots under par) was coded as −3, an eagle (two shots under par) was coded as −2, and a birdie (one shot under par) was coded as -1. Scores over par, such as a bogey (one shot over par) or a double bogey (two shots over par) were 1 and 2, respectively. The hole number and round number variables serve as the time variables in the analyses, spanning from hole 0 (universal start point before hole 1 is played and all athletes' scores are 0) to hole 36, with holes 0−18 representing round 1, and holes 19−36 representing round 2. See Fig. 1 for a person profile plot of each participant's performance across all 36 golf holes and illustration of the structure of the data.

Level 2 Variables. Athlete perfectionism was measured using two instruments. The first instrument was the Multidimensional Inventory of Perfectionism in Sport (MIPS, Stoeber et al., 2006). Two subscales from the MIPS were utilized: Striving for Perfection (SFP, 5 items, e.g. "I strive to be as perfect as possible") and Negative Reactions to Imperfection (NRI, 5 items, e.g. "I feel extremely stressed if everything does not go perfectly"). Responses to items are on a 5-point Likert scale. Prior work has demonstrated that these subscales serve as reliable and valid indicators of PS and PC (see Gotwals et al., 2012; Madigan, 2016; Stoeber & Madigan, 2016). The second instrument was the Performance Perfectionism Scale for Sport (PPS-S, Hill et al., 2016). Two subscales from the PPS-S were used: Self-Oriented Performance Perfectionism (SOPP, 4 items, e.g. "I am tough on myself when I do not perform perfectly"), and Socially Prescribed Performance Perfectionism (SPPP, 4 items, e.g. "People always expect my performances to be perfect"). Responses to items are on a 7-point Likert scale. Evidence for the validity and reliability of the scores has been offered by Hill et al. (2016) and Olsson et al. (2021). Previous work has identified SOPP and SPPP as suitable indicators of the higher-order dimensions PS and PC respectively (Waleriańczyk, 2023).

4.4. Data analysis

Data were analysed using a two-level HLM with a hierarchical

Table 1
Variables for hierarchical levels.

Hierarchical Level	Hierarchical Level Description	Variables
Level 2	Athlete	SP NRI SOPP SPPP
Level 1	Time Variable and DV	Hole Number Round Number Performance

Note. SP = Striving for perfection, NRI = Negative reactions to imperfection, SOPP = Self-oriented performance perfectionism, SPPP = Socially prescribed performance perfectionism, DV = Dependent Variable.

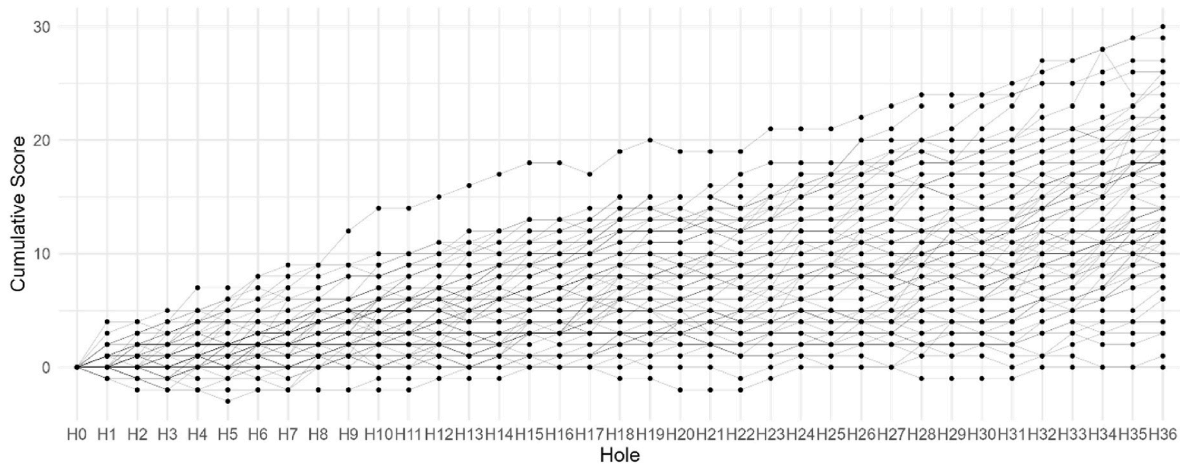

Fig. 1. Person profile plot of score across all 36 competitive holes. H0 indicates a starting score of 0 for all participants prior to the completion of hole 1.

structure of longitudinal performance data nested within athletes. All analyses were conducted in R version 4.3.1 (R Core Team, 2024) with the assistance of the `tidyverse`, `lme4`, `mice`, `psych`, `visdat`, and `interactions` packages (Bates et al., 2015; Long, 2019; Revelle, 2022; Tierney, 2017; Van Buuren & Groothuis-Oudshoorn, 2011; Wickham et al., 2019). To preserve participant data, and therefore statistical power, missing data were replaced through predictive mean matching (PMM) multiple imputation (Van Buuren & Groothuis-Oudshoorn, 2011). A total of five iterations were imputed as any more beyond this have been shown to produce similar results (He et al., 2009). A seed was set prior to imputation to ensure replicable results. Perfectionism variables were then computed and inspected for univariate and multivariate outliers, as per the recommendations of Tabchnick and Fidell (2014). Finally, perfectionism scales were screened for reliability using both MacDonald's Omega and Cronbach's Alpha (Hayes & Coutts, 2020).

We first fit a null model using the restricted maximum likelihood estimator (REML) which contained only random intercepts for id (a unique athlete identifier) to calculate the intra class correlation (ICC). This was done to understand the amount of between-level variance associated with the nested structure with no predictor variables (ICCs can be categorized as small [0.05], medium [0.10], and large [0.20]; Preacher et al., 2010). The null model was then refit with the maximum likelihood estimator and compared to two models containing the fixed effects of perfectionism and either hole *or* round along with a random slope for the relevant time variable, with id modelled as a random intercept. From here on, we included either hole *or* round in the model as a 'time' variable to avoid conflating two measures of time (Stoel et al., 2003). The modelling process was repeated identically for both time measures, resulting in four sets of models (one for each time measure for both the MIPS and PPS-S). More complex models were compared to the prior simpler model using the likelihood ratio test (LRT) to identify the most parsimonious model. If at any point the results of the LRT were non-significant, the previous model was accepted as the final model. As the modelling process was identical for each unit of time, from this point we refer to 'time' to avoid repetition.

As interaction terms were to be tested to understand if the relationship between PS and performance over time depended on the level of PC. Perfectionism values were grand mean-centered to mitigate the potential effects of multicollinearity between highly correlated variables when testing moderation (Afshartous & Preston, 2011). All three combinations of two-way interactions were fit between perfectionism and time. This was followed by fitting a three-way interaction between perfectionism dimensions and time. In the event of a significant two- or three-way interaction, the Johnson-Neyman technique was used to identify regions of significance.

5. Results

5.1. Preliminary analyses

Upon inspection, 0.7 % of data were missing, with 88.8 % of cases complete. Total missingness varied from 1.03 % to 3.37 % for any given perfectionism item or hole score. All missing points were imputed using PMM (final missingness = 0.0 %). Descriptive statistics, MacDonald's Omega and Cronbach's Alpha values, and correlations for perfectionism variables and hole 36 performance are provided in Table 2.

5.2. Hierarchical linear models

ICC. The ICC in the null model was calculated at 0.338, representing 33.8 % of variance attributable to between person differences and supporting an approach that adopts a nested structure (a large effect, Preacher et al., 2010).

MIPS Modelling. Striving for Perfection (SFP) was a significant predictor of worse performance in both the hole ($b = 0.17$, 95 % CI [0.07–0.28], $SE = 0.05$, $p = .001$), and round model ($b = 0.29$, 95 % CI [0.01, 0.57], $SE = 0.14$, $p = .045$). By contrast, Negative Reactions to Imperfection (NRI) was not a significant predictor in either model. These models were deemed better than the null model according to the results of LRT.

Next, two-way interaction terms were included between either SFP or NRI and time (hole or round). In the hole model, neither interaction terms between SFP and hole ($b = -0.03$, $SE = 0.19$, $p = .132$) or NRI and hole ($b = -0.02$, $SE = 0.02$, $p = .398$) were statistically significant. This was also the case for the interaction terms between SFP and round ($b = -0.49$, $SE = 0.26$, $p = .063$) as well as NRI and round ($b = -0.39$, $SE = 0.31$, $p = .221$). In this case, the main effects model was identified as the final model. These models are presented in Table 3.

PPS-S Modelling. SPPP was a significant predictor of worse performance in both the hole ($b = 0.14$, 95 % CI [0.05, 0.23], $SE = 0.05$, $p = .002$) and round models ($b = 0.46$, 95 % CI [0.28, 0.81], $SE = 0.13$, $p < .001$). SOPP was not a significant predictor of performance in either model. LRT supported these models over the null model.

Next, models containing two-way interaction terms between SOP and either hole or round, and SPP and either hole or round were fit. Significant interactions between SPP and both hole ($b = -0.04$, $SE = 0.02$, 95 % CI [−0.07, −0.01], $p = .016$, and round ($b = -0.74$, 95 % CI [−1.18, −0.29], $SE = 0.17$, $p < .001$) were identified. Again, LRT supported the use of these models over the main effects models.

Subsequently, models containing three-way interaction terms between SOP, SPP, and either hole or round were fit. No significant three-way interaction was present in the hole model, but there was a

Table 2
Means, standard deviations, MacDonald's Omega, Cronbach's Alpha, and correlations with confidence interval for study variables.

Variable	*M (SD)*	Omega	Alpha	1	2	3	4
1.SP	3.43 (1.14)	0.90	0.90				
2.NRI	2.50 (0.94)	0.82	0.80	0.39** [0.20, 0.56]			
3.SOPP	4.07 (1.14)	0.78	0.77	0.67** [0.54, 0.77]	0.60** [0.45, 0.72]		
4.SPPP	2.86 (1.25)	0.77	0.76	0.15 [-0.07, 0.34]	0.25* [0.04, 0.44]	0.30** [0.10, 0.48]	
5.Performance	14.57 (6.31)			−0.19 [-0.39, 0.02]	−0.14 [-0.34, 0.07]	−0.15 [-0.35, 0.06]	−0.23* [-0.42, −0.02]

Note. SFP = Striving for perfection, NRI = Negative reactions to imperfection, SOPP = Self-oriented performance perfectionism, SPPP = Socially prescribed performance perfectionism, Performance = Cumulative score for 36 holes.

Table 3
Results of MIPS final models.

	B	*SE*	*95 % CI*	*t*	*p*
Null Model					
(Intercept)	6.79	0.37	[6.06, 7.51]	18.42	<0.001
Hole Main Effects					
(Intercept)	−0.01	0.06	[-0.12, 0.10]	−0.24	0.809
SP	0.17	0.05	[0.07, 0.28]	3.22	0.001
NRI	0.09	0.06	[-0.04, 0.22]	1.39	0.165
Hole Number	0.38	0.01	[0.34, 0.42]	18.81	<0.001
Round Main Effects					
(Intercept)	−3.32	0.16	[-3.64, −3.01]	−20.86	<0.001
SP	0.29	0.14	[0.01, 0.57]	2.00	0.045
NRI	0.24	0.17	[-0.10, 0.59]	1.40	0.163
Round Number	6.80	0.28	[6.25, 7.35]	24.44	<0.001
Hole Random Effects					
ID - Hole	0.04				
Residual	2.63				
Round Random Effects					
ID – Round	2.45				
Residual	8.50				

Note: *B* = parameter estimate; *SE* = standard error; CI = confidence interval; SFP = striving for perfection; NRI = negative reactions to imperfection.

Table 4
Results of PPS-S final models.

	B	*SE*	*95 % CI*	*t*	*p*
Null Model					
(Intercept)	6.76	0.37	[6.03, 7.49]	18.21	<0.001
Hole 2-Way Interaction					
(Intercept)	−0.01	0.06	[-0.12, 0.10]	−0.24	0.810
SOPP	0.03	0.04	[-0.05, 0.11]	0.71	0.475
SPPP	0.14	0.05	[0.05, 0.23]	3.03	0.002
Hole Number	0.38	0.02	[0.33, 0.41]	19.50	<0.001
Hole Number * SOPP	−0.01	0.01	[-0.04, 0.02]	−0.86	0.391
Hole Number * SPPP	−0.04	0.02	[-0.07, −0.01]	−2.45	0.016
Round 3-Way Interaction					
(Intercept)	−3.093	0.17	[-3.42, −2.76]	−18.38	<0.001
SOPP	0.01	0.12	[-0.23, 0.24]	0.06	0.956
SPPP	0.54	0.14	[0.28, 0.81]	4.03	<0.001
Round Number	6.59	0.28	[6.03, 7.14]	23.52	<0.001
SOPP * SPPP	−0.41	0.10	[-0.61, −0.21]	−3.99	<0.001
Round Number * SOPP	−0.12	0.20	[-0.52, 0.28]	−0.59	0.557
Round Number * SPPP	−0.74	0.23	[-1.18, −0.29]	−3.28	0.001
Round Number * SOPP * SPPP	0.36	0.17	[0.02, 0.70]	2.08	0.039
Hole Random Effects					
ID – Hole	0.04				
Residual	2.65				
Round Random Effects					
ID – Round	5.28				
Residual	8.39				

Note: *B* = Parameter estimate; *SE* = standard error; CI = confidence interval; SOPP = self-oriented performance perfectionism; SPPP = socially prescribed performance perfectionism.

significant interaction three-way interaction in the round model, b = 0.36, 95 % CI [0.02, 0.70], SE = 0.17, p = .039. LRT also supported the use of this model over the round two-way interaction model as the final model for round performance. As there was no significant three-way interaction for the hole model, the model containing the two-way interaction was considered the final model. The null and final models are shown in Table 4.

Final models were refit with non-centered perfectionism variables with the REML estimator and interactions were probed using the Johnson-Neyman technique. Fig. 2A depicts the significant interaction between SPPP and hole. Johnson-Neyman probing reveals that the relationship between SPPP and the slope of hole number is significant across all observed values of SPPP with higher SPPP values predicting better performance. In addition, to aid interpretation, when examining panels B and C of Fig. 2, there is a difference of 1.86 strokes (5.65 versus 7.51) at the mid-point of the response scale for SOPP (4.00) when SPPP is high versus low.

We provide additonal analyses and graphical representation of the findings in the supplemenary materials (S2). This includes presenting the equivelent of Fig. 2A based on the observed interaction, but with SOPP as the moderator (as opposed to SPPP) and analyses using composites (indicators in combation) of PS and PC, as opposed to single indicators. In regards to the findings from the latter analyses, these were similar but not the same. Notably, there was no significant interaction between perfectionism dimensions and time in the hole level model. However, we observed a 2-way interaction between perfectionistic concerns and round where increased PC was associated with better performance.

6. Discussion

The aim of the present study was to examine the interactive effects of multidimensional perfectionism on performance across holes and rounds (time) in a real-world, competitive, golf setting. In line with extant literature, we hypothesized that: (Hypothesis 1) indicators of PS (striving for perfection and self-oriented perfectionism) would predict better performance, (Hypothesis 2) indicators of PC (negative reactions to imperfection and socially prescribed perfectionism) would be unrelated to performance, and (Hypothesis 3) perfectionism dimensions would interact with time to predict performance whereby indicators of PS would predict better performance only at lower levels of indicators of PC.

In regard to our findings, hypothesis 1 was not supported in that striving for perfection was associated with higher scores (indicating worse performance), while self-oriented performance perfectionism was not associated with performance. Hypothesis 2 was partially supported. Negative reactions to imperfection were unrelated to performance at both the hole and round levels, supporting hypothesis 2. Unexpectedly, though, socially prescribed performance perfectionism predicted worse performance at both levels but improved performance when interacting

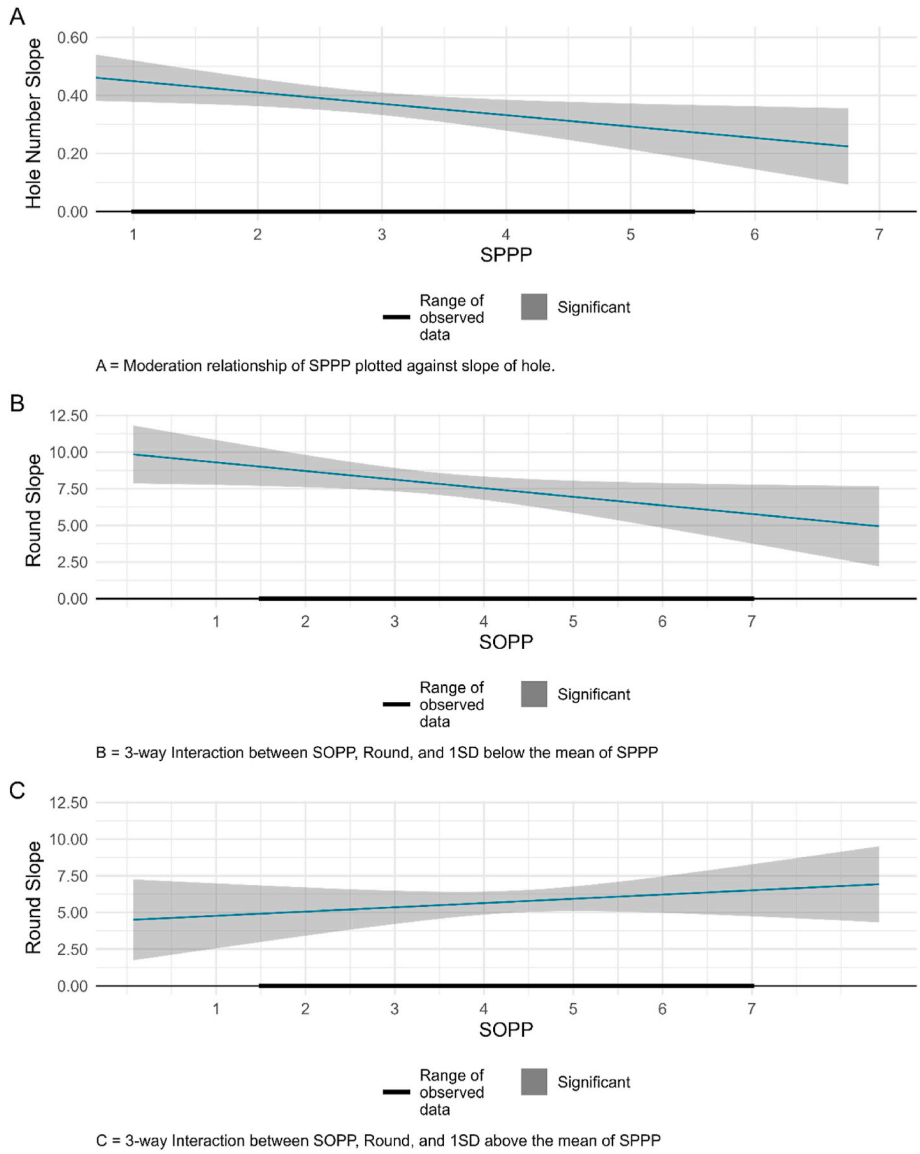

Fig. 2. Johnson-Neyman plot of significant interaction terms. (A) Moderation relationship between SPPP and hole, plotted against the slope of hole number. (B). Johnson-Neyman plot of the 3-way interaction between SOPP, round, and 1 standard deviation below the mean of SPPP. (C) Johnson-Neyman plot of the 3-way interaction between SOPP, round, and 1 standard deviation above the mean of SPPP. Significance threshold set to 0.05. Slopes are unstandardised. Effects are significant across all observed values.

with time at the round level. Finally, hypothesis 3 was also partially supported. Specifically, self-oriented performance perfectionism predicted better performance over time at low levels of socially prescribed performance perfectionism and worse performance over time at elevated levels of socially prescribed performance perfectionism. The same effects were not evident for striving for perfection.

6.1. Multidimensional perfectionism and golf performance

Attempts to determine the effects of perfectionism on sport performance have been hindered by a reliance on non-athletes, contrived tasks, and one-off performances. The present study was designed to address these issues by recruiting competitive athletes performing in a regional golf competition. The nature of the golf competition we observed allowed for one of the most ecologically valid tests of the perfectionism-performance relationship so far. In addition, by considering the effects of different dimensions of perfectionism we were able to understand any interactive relationships and the complex ways perfectionism might help or hinder sport performance. In doing so, we have uncovered findings both similar and dissimilar to existing literature. This relates to both the effects of indicators of PS and PC, as well as their interaction when predicting sport performance.

In regard to the effect of higher-order PS and PC, studies have typically shown PS to be positively related to sport performance and PC to be unrelated to sport performance (e.g., Stoeber et al., 2009; Waleriańczyk, 2023; Hill, 2023a). However, this was not observed in the current study. Notably, the striving for perfectionism subscale from the MIPS, an indicator of PS, was shown to be a predictor of *worse* performance (higher score indicating worse performance in the context of golf). The degree to which this is surprising partly depends on the theoretical position. Several researchers have highlighted the various ways in which striving for perfectionism may undermine performance (e.g., Gaudreau, 2019) and recent attempts to disentangle perfectionism from striving for excellence suggests that this may be the case (e.g., Gaudreau et al., 2022). However, to our knowledge, this is only the second time this effect has been found empirically in a sport context (see Thompson et al., 2011). It is possible that more tests of this relationship in ecologically valid ways may yield further evidence of this kind.

An even more unusual finding from the present study is that socially prescribed performance perfectionism, an indicator of PC, predicted better hole-to-hole performance (or a slower worsening in performance more accurately). Indicators of PC are typically unrelated to performance in existing literature (Hill, Mallinson-Howard, et al., 2020). In addition, while significant positive effects on sport performance have been found (e.g., Van Dyke, 2019), they are extremely rare. On one hand, perhaps there are factors that make this effect credible. Links to an ego orientation, which has on occasion been associated with improved performance in sport (Knoblochova et al., 2021), for example, may partly explain this effect. On the other hand, indicators of PC are associated with a range of motivation and wellbeing issues that will almost certainly inhibit performance (see Hill, Mallinson-Howard, et al., 2020). In addition, as illustrated in the J-N figures, the change in unstandardised slopes as SPP increases is extremely small. It could reasonably be described as marginal. Overall, we suggest extreme caution in considering this effect an indicator of the usefulness of socially prescribed perfectionism for sport performance. In addition to this unexpected finding, PC was shown to be negatively associated with performance at the round level in our supplementary analysis, indicating improved performance.

One of the primary goals of this study was to examine potential interaction effects between dimensions of perfectionism when predicting performance. Prior research has offered evidence that the effects of dimensions of perfectionism depend on each other (e.g., Lizmore et al., 2019). In these works, PS predicted better performance when PC were low. However, when PC were high, the positive effects of PS were nullified. In support of these types of findings, we also found that the relationship between self-oriented perfectionism and performance over time depended on the level of socially prescribed perfectionism in a similar way, even predicting worse performance at high levels of socially prescribed perfectionism. In doing so, in addition to being consistent with the aforementioned research, our findings appear to support the notion of a perfectionistic tipping point for sport performance (Hill, 2021). That is, there is a discernible point at which PC renders PS problematic for sport performance. This is also supported in our supplementary findings analysis, identifying PC as the moderating variable in round level performance.

As for potential mechanisms that may explain these relationships, research is ongoing. Hill (2025) has recently argued that the effects of PC in context of perfectionistic tipping points may be underpinned by emotional and motivational dysregulation. Specifically, increased difficulties in both modulating emotions in order to meet individual goals and related skill of controlling behaviours conducive to goal achievement (Gratz & Roemer, 2004; Wolters, 2003). In support of this position, he has highlighted the possible usefulness of longstanding models in sport psychology as a basis for studying these effects further (e.g., individual zones of optional functioning; Hanin, 1997). Such approaches may also aid our understanding of the momentary effects of perfectionism such as hole-to-hole differences in the current study. So, too, might work outside of sport which has identified specific mechanisms that explain the influence of PC via state experiences of rumination, distress, and effort, and also provide evidence of a perfectionistic tipping point for performance (Nols et al., 2024). Future work is needed, particularly in sport, to model these types of mechanisms.

Although the present study offers unique findings in relation to perfectionism and performance, it also adds to the literature regarding the behaviour of different indicators of PS and PC. Hill and colleagues (2020) have highlighted that there are many indicators of perfectionism being used simultaneously in the field that may produce different findings despite the same higher-order dimensions being captured. Although it may be expected that indicators of the same higher-order dimension should behave similarly (Gaudreau, 2016), this has been shown to not necessarily be the case when examining a range of outcome variables, including performance (Hill et al., 2018). These effects are demonstrated again in the present study with different results from the same modelling procedure for the MIPS and PPS-S. One potential explanation is the specificity of the scales used. The PPS-S was designed to be focus on sport performance, rather than sport competition and training generally (as is the case for the MIPS). This could explain the difference in findings and may mean the PPS-S is better suited to examining the effects of perfectionism on sport performance. Further work is required to better understand the different roles of the many indicators of perfectionism on sport performance.

6.2. Applied implications

The findings of the present study are likely of interest to practitioners, particularly in service of increasing sport performance. In this regard, we consider the current study to provide a clear indication of the futility of promoting perfectionism in order to boost performance. The effects of perfectionism on performance are complex and both PS and PC need to be taken into account. Monitoring levels of PC may be especially useful as it appears to be influential in determining overall effects on sport performance and effects of perfectionism generally. In the current study, "high" PC corresponded to a score of 4.11 on the response scale of 1–7 with a practical difference illustrated of a 1.86 stroke difference between golfers with modest PS. This level of PC is reasonably modest and is similar to levels found to trigger comparable effects in other studies (e.g., Waleriańczyk, 2023). As such, the findings signal the need to better manage PC in order to boost athlete performance. To do so, practitioners may wish to consider the benefits of approaches shown to be useful at reducing perfectionism among athletes. To date, this includes compassion-, CBT-, and ACT-based interventions (Donachie & Hill, 2020; Mosewich et al., 2013; Watson et al., 2023). Practitioners may also generally need a greater awareness of the challenges perfectionism can pose in a sport context and to encourage perfectionism among the athletes they work with (see Hill & Grugan, 2020; Klockare et al., 2022; Watson, 2024).

6.3. Limitations and future directions

The present study explores perfectionism and performance in male, regional level athletes competing in golf. The findings are therefore specific to that context. Future work should be designed to examine these relationships in athletes at varying competitive levels in different sports – both team and individual – to ascertain their generalizability. A second limitation of the present study is the nuance that is lost in the analyses. A valuable focus for future studies would be to explore patterns of performance, conservative play versus risk taking or slumps versus high form, for instance, to further uncover some of the complexities of how perfectionism might affect performance. The concept of excellencism (Gaudreau, 2019) - and perhaps other variables that were not considered in the present study such as competitive stress - appears to have potential to influence performance above and beyond perfectionism in some contexts (i.e., academic domain, Gaudreau et al., 2022). The inclusion of both excellencism and perfectionism in future studies of this nature could help scholars understand whether these effects transcend achievement domains. Third, the present study examined only dimensions of perfectionism in relation to performance. Given the number of variables that may directly or indirectly influence these relationships, future work may be designed to incorporate and test possible moderating or mediating variables alongside perfectionism in an ecologically valid context. Finally, given the interest in detecting interaction effects in the present study, and the reporting of non-significant effects, it may be beneficial to recruit larger sample sizes for future studies to increase statistical power.

7. Conclusions

The present study offers new insight into how dimensions of perfectionism interact to predict sport performance. These findings add to a growing number of studies testing this relationship in ecologically valid settings and over time. Consistent with emerging evidence of perfectionistic tipping points in sport, the effects of PC nullify any performance benefits of PS. Researchers and practitioners will need to be mindful of the complexity of this relationship which strongly signal the need to manage and reduce PC. Existing evidence points to the availability of effective intervention strategies that could be deployed in sport more widely in the aid of reducing perfectionism and boosting performance.

CRediT authorship contribution statement

Daniel J.M. Fleming: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Andrew P. Hill:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Luke F. Olsson:** Writing – review & editing, Writing – original draft, Resources, Project administration, Investigation, Data curation, Conceptualization. **Sarah H. Mallinson-Howard:** Writing – review & editing, Conceptualization. **Travis E. Dorsch:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors have no existing conflicts of interest that would have the potential to influence the present study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2025.102952.

Data availability

The authors do not have permission to share data.

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