

**The Interplay between Normative Feedback and Self-critical perfectionism in Predicting  
Competitive Tennis Players' Competence, Tension and Enjoyment: An Experimental Study**

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**Abstract**

Feelings of competence play a key role in youth athletes' sport experiences and behaviors. Although competence is affected by both contextual and personal characteristics, most studies have focused on the role of either context or athletes' personality in competence. To study competence from a person-x-context perspective, the current experimental field study examined the unique and interactive role of self-critical perfectionism and normative feedback in youth competitive tennis players' ( $N = 59$ ,  $M_{\text{age}} = 15.47$ ,  $SD = 1.63$ ) competence need satisfaction and subsequent tension and enjoyment. Participants first filled out a measure of self-critical perfectionism and then performed a series of tennis exercises, presented as a competition in which their results were compared to an interpersonal standard. Positive, compared to negative, normative feedback enhanced competence need satisfaction, while self-critical perfectionism yielded a negative relation. Both predictors interacted such that self-critical perfectionism exacerbated the impact of negative normative feedback on competence. In turn, competence played an intervening role in the association between normative feedback and self-critical perfectionism on the one hand, and players' experienced enjoyment and tension on the other hand. Overall, the results testify to the importance of studying competence dynamics from a person-x-context perspective.

*Keywords:* person-x-context interactions, perfectionism, feedback valence, Self-Determination Theory

**The Interplay between Normative Feedback and Self-Critical Perfectionism in Predicting Competitive Tennis  
Players' Competence, Tension, and Enjoyment: An Experimental Study**

In competitive sports, feeling competent is a key factor underlying athletes' motivation and performance (Mageau & Vallerand, 2003). From a Self-Determination Theory perspective (SDT, Ryan & Deci, 2017) this is not surprising, as competence represents, together with autonomy and relatedness, a basic psychological need. SDT postulates that the satisfaction of these basic psychological needs is critical for athletes to preserve their motivation and to grow and actualize their potential (Vansteenkiste et al., 2020). In SDT, competence need satisfaction is denoted by feelings of effectiveness in carrying out activities. The more youth athletes report feeling competent, the more they enjoy their sports and, consequently, the longer they stay active in competitive sports (Pelletier et al., 2001). Furthermore, competence need satisfaction relates to less tension, better coping with setbacks, and greater perseverance (De Muyne et al., 2017; Whitehead & Corbin, 1991).

Given the crucial role of competence in sports, it is important to examine its sources, thereby paying attention to both contextual and personal factors. An important contextual source is the feedback athletes receive. If athletes are informed that they performed well (i.e., positive feedback), their competence need satisfaction typically increases (Mouratidis et al., 2008), whereas their competence typically stagnates or even gets undermined when athletes receive negative or demeaning feedback (Gernigon & Delloye, 2003). Further, personal factors, including personality traits, also play a key role in shaping competence-based experiences (Allen et al., 2013). One personality dimension receiving much attention in research on athletes' competence, motivation, and performance is perfectionism (Flett & Hewitt, 2005). Self-critical perfectionism in particular is considered a risk factor for poor motivation, anxiety, and underachievement in sports (Stoeber, 2011). Athletes high on self-critical perfectionism set excessively high standards for themselves and at the same time attach their self-worth to the attainment of these standards, thereby engaging in harsh self-scrutiny when failing to meet standards (Blatt, 1995). Therefore, they might benefit less from positive feedback and performance success in terms of competence satisfaction, while being

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hurt more severely by negative feedback or performance failure.

While research has addressed the role of feedback valence (e.g., Vallerand & Reid, 1984) and the role of self-critical perfectionism (e.g., Koivula et al., 2002) in the prediction of athletes' competence satisfaction in isolation, few studies to date addressed the role of both sources of influence simultaneously. These studies found that highly self-critical perfectionistic people respond with diminished confidence and increased negative affect to failure, indicating that they may be more susceptible to the impact of external events, such as feedback (e.g., Lo & Abbott, 2019). Adopting a person-x-situation perspective (Mischel & Shoda, 1995) on competence feelings among competitive youth athletes, the present experimental study aimed to contribute to this nascent research line by examining the unique and interactive role of experimentally induced feedback and athletes' self-critical perfectionism in the prediction of their perceived competence, tension, and enjoyment.

**Feedback as a Source of Competence-Related Information**

During a competitive game, athletes receive a great amount of feedback, which is defined as the provision of competence-related information about athletes' performance on a particular task (Kluger & DeNisi, 1996). The motivating impact of directly communicated feedback has been examined extensively. Especially the valence of feedback (i.e., positive versus negative feedback) was found to affect competence need satisfaction (De Muynck et al., 2017). Positive feedback comes with a host of benefits, including greater effort-expenditure, enjoyment, and better performance (Standage et al., 2005; Vallerand & Reid, 1984), presumably because athletes of coaches who provide feedback that is more positive report greater feelings of competence (Mouratidis et al., 2008). Research has examined various standards used to evaluate athletes' performance (Elliot, 2005), showing that athletes benefit in terms of competence when feedback conveys good skill execution (i.e., task-based feedback; Tzetsis et al., 2008), personal progress (i.e., intrapersonal feedback; Tenenbaum et al., 2001) or successful outperformance of others (i.e., normative feedback; Lewthwaite & Wulf, 2010).

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Research has also documented evidence for the explanatory role of competence need satisfaction in accounting for the benefits of positive feedback. Both tennis players participating individually in a series of tennis exercises (De Muynck et al., 2017) and basketball players engaging in an interactive dribble and shooting task (Fransen et al., 2018) reported greater competence satisfaction when receiving positive feedback, with this improved competence satisfaction accounting for the observed benefits of positive feedback on task enjoyment (see also Mouratidis et al., 2008; Vallerand & Reid, 1984).

When athletes receive negative feedback, they face the risk of experiencing lowered competence need satisfaction (Gernigon & Delloye, 2003), preventing them from experiencing the merits that come along with it (Blanchard et al., 2009). Reduced competence need satisfaction involves multiple costs, including a motivational deficit, as indexed by lowered effort-expenditure and reduced enjoyment, and an affective cost, as indexed by greater tension and more burnout (Bartholomew et al., 2011). In addition to feedback valence and type of reference standard, the way feedback is communicated might also play a role. Cross-sectional research has shown that athletes' perceived use of an inviting style to communicate feedback (compared to a more controlling style) relates positively to vitality, competence, and intentions to persevere and negatively to negative affect and depressive symptoms (Carpentier & Mageau, 2013; Mouratidis et al., 2010). Experimental studies did not provide evidence for the role of communication style in affecting athletes' competence satisfaction, but inviting language did promote greater autonomy satisfaction and intrinsic motivation (De Muynck et al., 2017).

### **Self-Critical Perfectionism and Competitive Sport Experiences**

Self-critical perfectionism is characterized by the setting of unrealistically high standards, in combination with pervasive doubts about actions and concerns about mistakes (Dunkley & Blankstein, 2000). Given that individuals high on self-critical perfectionism attach their self-worth to the attainment of standards for performance and engage in harsh self-scrutiny when encountering failure, they are at risk for lowered competence and self-worth (Blatt, 1995). Research in the context

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of sports clearly showed that self-critical perfectionism relates to decreased competence in athletes from various sports and skill levels (Koivula et al., 2002; Mallinson & Hill, 2011). Furthermore, self-critical perfectionism was found to contribute to athletes' threat appraisals, negative affect, and avoidance coping among intercollegiate athletes (Crocker et al., 2014) and to lower enjoyment among youth athletes (Mallinson et al., 2014).

Beyond these direct associations between perfectionism and athletes' experiences, it is important to consider the interplay between perfectionism and feedback. Research on personality in general (Mischel & Shoda, 1995) and on perfectionism in particular (Sagar & Stoeber, 2009) increasingly considers the role of personality traits in interaction with contextual influences. It is assumed that personality affects the appraisal of situational events, thereby modifying the effect of the situation on individuals' outcomes. With regard to self-critical perfectionism in particular, it can be assumed that individuals scoring high on this trait will have more critical and dysfunctional appraisals of negative feedback, resulting in elevated feelings of incompetence. Similarly, it can be reasoned that negative feedback awakens the tendency to engage in negative self-evaluation, which is characteristic for athletes' high on self-critical perfectionism. Accordingly, the combination of negative feedback and high levels of self-critical perfectionism would have a surplus undermining effect on competence need satisfaction.

Consistent with this reasoning, athletes high on self-critical perfectionism have been found to experience more negative reactions to mistakes during competition and greater motor performance decrements after receiving negative feedback (Anshel & Mansouri, 2005). Given that the number of studies addressing the interactive interplay between feedback and self-critical perfectionism in general and in sport in particular is still limited, more research is clearly needed.

**The Present Study**

The general aim of this study is to examine athletes' competence development from a person-x-context perspective by simultaneously considering the role of experimentally induced feedback valence and self-critical perfectionism. To enhance the ecological validity of the study,

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competitive tennis players were sampled in an experimental field study. As the sport literature is replete of correlational studies on coach feedback, the present study helps to shed light on the causal role of feedback. We choose to manipulate normative feedback because normative comparisons are inevitable in competitive sports with results, rankings, and competition tables being easily available for athletes, allowing them to compare their own performance with those of others. Such interpersonal comparison is easier for athletes than inferring whether they made any progress in terms of skill execution as such intrapersonal performance indicators (e.g., number of winners, (unforced) errors, serve speed, and serve percentage) are neither directly measured nor available in racket sports such as tennis.

The following hypotheses were formulated. First, regarding the main effects, it was hypothesized that positive, compared to negative, normative feedback will enhance tennis players' competence need satisfaction and enjoyment, and will reduce their experienced tension (Hypothesis 1). Second, self-critical perfectionism is hypothesized to relate negatively to competence need satisfaction and enjoyment, and to relate positively to experienced tension (Hypothesis 2). Third, in terms of their interaction effect, we hypothesized that negative feedback would be more detrimental for athletes high on self-critical perfectionism (Hypothesis 3), given these athletes' increased sensitivity for and reactions to negative information. Finally, competence need satisfaction was hypothesized to play an intervening role in the associations of feedback valence and self-critical perfectionism with enjoyment and experienced tension (Hypothesis 4).

## Method

### Participants

Fifty-nine competitive tennis players (69.5% boys) from Belgium, aged between 13 and 19 years ( $M = 15.47$ ,  $SD = 1.63$ ) were included in the current study. With respect to participants' skill level, 45 players (76.3%) had a low national ranking (i.e. playing tennis at the regional level), while 14 players (23.7%) had a high national ranking (i.e. playing tennis at the (inter)national level). Tennis players trained on average 3.46 hours a week ( $SD = 3.45$ ), with weekly training hours ranging from 1

to 15.

## **Procedure**

A detailed description of the procedure can be found in supplementary material. Tennis players and their head coaches were informed about the study and signed an informed consent when willing to participate. For underage tennis players, active parental informed consent was obtained. Directly following the provision of consent, tennis players filled out a pre-experimental questionnaire and made an appointment with the experimenter for the experimental phase. In the experimental phase, which was held at tennis players' own tennis club, they individually performed a warming up trial and three series of tennis exercises against a ball machine. The exercises were framed as a competition, as to increase the relevance of implementing normative feedback in the operationalization of the study. Participants, matched for gender and skill level, received randomly provided negative or positive feedback following both the first and the second tennis exercise. The normative feedback informed them they did worse (negative feedback condition) or better (positive feedback condition) than 73 and 76 percent of tennis players of their ranking and age, respectively. Immediately following each round of feedback provision, tennis players completed a measure tapping into their competence need satisfaction. Following the second measure of competence need satisfaction, participants were informed how many additional points they needed to score in the last tennis exercise to make a fair chance to win the competition. As this target refers to the top position of all participants, it should be sufficiently high to be credible, but not too high to be perceived as totally infeasible. From previous research using a similar design with a tennis ball machine, we knew that participants perform on average 17% better during the second exercise (De Muynck et al., 2017). In order to provide a similar challenge for each participant, the target was based on the participants' average performance on the two previous exercises by adding forty percent to that performance.

Directly upon completion of the third tennis exercise, tennis players completed a post-experimental questionnaire tapping into their enjoyment and tension. Finally, participants were debriefed and thanked for their participation. The ethical committee of Ghent University, Belgium,



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approved the study.

### Instruments

#### ***Trait-Competence Need Satisfaction (Pre-Experimental)***

The Perceived Competence Scale (Williams & Deci, 1996) was adapted to fit within the context of competitive tennis. This scale used a Likert scale ranging from 1 (*totally disagree*) to 7 (*totally agree*) and encompassed four items (e.g., “I believe in my abilities as a tennis player”;  $\alpha = .81$ ).

#### ***Self-Critical Perfectionism (Pre-Experimental)***

Participants were administered the ‘Doubts about Actions’ (4 items; e.g., “It takes me a long time to do something “right””) and ‘Concerns over Mistakes’ (9 items, e.g., “Other people will not respect me if I do not perform well all of the time”) subscales from the Frost Multidimensional Perfectionism Scale (Frost et al., 1990). Items were rated on a five point Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). Taken together, the self-critical perfectionism measure showed good internal consistency ( $\alpha = .80$ ).

#### ***State Competence Need Satisfaction (During the Experiment)***

Items measuring competence need satisfaction from the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) were adapted to the age group and to the specific context of the current experiment. This questionnaire was administered after both the first and the second tennis exercise, more or less one minute after feedback provision. Items were rated on a Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The scale included 2 items measuring need satisfaction (e.g., “after receiving feedback regarding the first/second tennis exercise, I feel capable”) and 2 items measuring need frustration (e.g., “after receiving feedback regarding the first/second exercise, I am unsure about my tennis abilities”). Because competence need satisfaction and frustration were moderately negatively correlated ( $r = -.51, p \leq .01$ ), a composite measure was created over the two questionnaires by averaging the need satisfaction items with the reversed scored need frustration, as done in previous research using this scale (Van

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der Kaap-Deeder et al., 2016). Internal consistency of this 8-item scale was good ( $\alpha = .84$ ).

### ***Perceived Enjoyment (After the Experiment)***

The intrinsic experience subscale from the Flow State Scale (Jackson & Marsh, 1996) was used to measure tennis players' enjoyment during the tennis exercises. Using a Likert scale ranging from 1 (*totally disagree*) to 7 (*totally agree*), four items tapped into tennis players' enjoyment (e.g., "During participation in this competition, I really enjoyed playing tennis";  $\alpha = .81$ ).

### ***Perceived Tension (After the Experiment)***

Four self-created items were used to measure perceived tension during the tennis exercises. Two items tapped into feelings of tension (e.g., "During participation in this competition, I felt tensed"), whereas the other two tapped into perceived relaxation (e.g., "During participation in this competition, I felt relaxed"). The latter items were reverse scored and averaged with the former items in order to create a composite score of perceived tension, which was internally reliable ( $\alpha = .79$ ). This procedure was also justified by the moderate negative correlation between those two constructs ( $r = -.52, p \leq .01$ ).

### **Data Analysis**

Given that previous studies found background characteristics such as gender to relate to key outcomes in the present study (e.g., Mouratidis et al., 2010), we began by examining their associations before turning to our primary hypotheses. Specifically, independent-samples t-test were used to examine differences regarding gender and skill level, while bivariate correlations inspected associations between variables of interest and age, training frequency, and trait competence. In addition, univariate ANOVA analyses were performed to test for mean level differences between the two feedback conditions regarding age, training frequency, trait competence need satisfaction, and self-critical perfectionism. No analyses for gender and skill level were performed at this stage, as participants were matched for these two characteristics between the two conditions.

To address the effects of feedback valence (hypothesis 1), univariate ANOVA analyses were conducted, hereby controlling for relevant background characteristics. With regard to the

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examination of associations for self-critical perfectionism and the interaction between valence and self-critical perfectionism (hypotheses 2 and 3) linear regression analyses were used. For each outcome variable, background characteristics, feedback valence, and self-critical perfectionism were entered simultaneously as independent variables in Step 1, while the interaction term between self-critical perfectionism and feedback was entered in Step 2. The interaction term was created by multiplying the standardized variables of feedback and self-critical perfectionism. For significant interactions, regions of significance analyses were performed.

Finally, the intervening role of competence need satisfaction between feedback valence and self-critical perfectionism, and their interaction on the one hand, and enjoyment and tension on the other, path analyses were performed using MPlus 7 (Muthén & Muthén, 2010). Solutions were generated on the basis of maximum likelihood estimation and model fit was evaluated on the basis of the  $\chi^2$  test, the comparative fit index (CFI), the standardized root mean square residual (SRMR), and the root mean square error of approximation (RMSEA). An acceptable fit was indicated by  $\chi^2$  /df ratio of 2 or below, CFI values of .90 or above, and SRMR and RMSEA values of .08 or below (Hu & Bentler, 1999). To ensure sufficient power with the relatively low sample size, a path model with manifest variables was estimated, modeling state competence need satisfaction as an intervening variable (see Figure 2). To do so, contrast coded feedback valence, self-critical perfectionism, their interaction, and background variables were modeled as predictors of state competence need satisfaction. In turn, state competence need satisfaction was modeled as a predictor of enjoyment and tension.

## Results

### Preliminary Analyses

The independent-samples t tests, examining the associations between gender and variables of interest, showed that men and women did not differ in terms of outcome variables. Independent-samples t-tests regarding tennis players' ranking revealed that highly ranked tennis players reported higher state competence need satisfaction, compared to their lowly ranked counterparts ( $M_{\text{high}} =$

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3.70,  $SD_{\text{high}} = .72$ ;  $M_{\text{low}} = 3.21$ ,  $SD_{\text{low}} = .67$ ;  $t(56) = -2.31$ ,  $p \leq .05$ ). Next, bivariate correlations, which can be found in Table 1, showed that tennis players who trained more frequently reported greater competence and enjoyment during the tennis exercises. In addition, trait competence related positively to competence and enjoyment during the tennis exercises and negatively to tension. As such, in the main analyses we controlled for significant background characteristics (i.e., for trait competence need satisfaction in the case of all outcome variables; training frequency and skill level in the case of state competence need satisfaction; and training frequency in the case of enjoyment). Finally, univariate ANOVA analyses showed that the two feedback conditions did not differ on any of the pre-experimental measures (see the upper half of Table 2).

### **Main Analyses**

#### ***Effects of Feedback Valence***

A series of three univariate ANOVA analyses with feedback valence (0 = negative; 1 = positive) as a predictor and state competence need satisfaction, enjoyment, and tension as dependent variables was performed, hereby controlling for relevant background characteristics. As presented in the lower half of Table 2, results showed that positive, compared to negative normative feedback enhanced state competence need satisfaction<sup>1</sup> and perceived enjoyment during play, whereas it did not impact perceived tension<sup>2</sup>. Furthermore, in an exploratory way, we broke down the composite scale of state competence need satisfaction into its subcomponents to examine whether the overall effect would already be observed after the first round or only after the second round of feedback. Results indicated that feedback conditions differed regarding state competence need satisfaction on both the first ( $M_{\text{neg}} = 3.14$ ,  $SD = .68$ ;  $M_{\text{pos}} = 3.65$ ,  $SD = .59$ ;  $F(1,53) = 8.01$ ,  $p \leq .01$ ,  $\eta_p^2 = .13$ ) and second moment ( $M_{\text{neg}} = 2.85$ ,  $SD = .81$ ;  $M_{\text{pos}} = 3.67$ ,  $SD = .61$ ;  $F(1,53) = 16.98$ ,  $p \leq .001$ ,  $\eta_p^2 = .24$ ). However, the effect size was twice as large for the second assessment.

#### ***Associations with Self-Critical Perfectionism***

Results of the linear regression analyses indicated that self-critical perfectionism related negatively to state competence need satisfaction ( $\beta = -.31$ ,  $p \leq .01$ )<sup>3</sup>, while being positively related to

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perceived tension ( $\beta = .31, p \leq .05$ )<sup>4</sup>, and unrelated to perceived enjoyment ( $\beta = -.15, p = .21$ ). The findings for feedback mirrored those reported in the ANOVA-analysis, indicating that positive feedback related to higher state competence ( $\beta = .40, p \leq .001$ ) and enjoyment ( $\beta = .37, p \leq .01$ ), but was unrelated to tension ( $\beta = -.16, p = .20$ ). As for the interaction between feedback valence and self-critical perfectionism, one out of three possible interactions reached significance. Specifically, the interaction between feedback valence and self-critical perfectionism was significant in the case of state competence need satisfaction ( $\beta = .23, p \leq .05$ )<sup>3</sup>, but not in the case of either enjoyment ( $\beta = .05, p = .68$ ) or tension ( $\beta = -.17, p = .17$ )<sup>4</sup>. The significant interaction showed that the main effect of feedback valence on competence should be interpreted with caution, as the effect does not apply for all athletes. For tennis players scoring low (i.e. -1 SD) on self-critical perfectionism, negative, relative to positive, feedback did not affect their competence need satisfaction (see Figure 1). Specifically, regions of significance analyses indicated that positive and negative feedback differentially affected tennis players scoring 2 or higher on self-critical perfectionism on a scale ranging from 1 to 5, yet did not have a differential effect for those scoring lower than 2. This effect corresponds with a differential impact for 71% of the total sample and a non-differential effect for the remaining 29% of the participants. Again in an exploratory way, we examined the relation between self-critical perfectionism and state competence need satisfaction for each measurement moment separately. Results indicated that self-critical perfectionism related negatively to state competence need satisfaction on both the first ( $\beta = -.39, p \leq .01$ ) and the second moment ( $\beta = -.22, p \leq .05$ ). Yet, the interaction term between feedback valence and self-critical perfectionism was significant only on the second ( $\beta = .29, p \leq .01$ ) and not on the first moment ( $\beta = .14, p = .21$ ).

### ***Intervening Role of Competence***

To test whether state competence need satisfaction fulfills an intervening role between feedback valence, self-critical perfectionism, and their interaction on the one hand, and enjoyment and tension on the other hand, a path model was estimated (see Figure 2). Results showed that the model had a good fit ( $\chi^2(3) = 2.46$ ; RMSEA = .00, 90% CI [.00, .20]; SRMR = .022; CFI = 1.00). The

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indirect effects from feedback valence through state competence need satisfaction to enjoyment ( $\beta = .29, p \leq .001$ ) and tension ( $\beta = -.22, p \leq .001$ ) were both significant. The same holds true for self-critical perfectionism ( $\beta_{enjoyment} = -.27, p \leq .01$ ;  $\beta_{tension} = .21, p \leq .01$ ) and the interaction between feedback valence and self-critical perfectionism on enjoyment ( $\beta = .17, p \leq .05$ ). However, the interaction on tension was not significant ( $\beta = -.13, p = .06$ ). A graphical representation of the final model can be found in Figure 2.

## Discussion

Feelings of competence play a crucial role in youth-athletes' sporting experiences, as competence relates to enhanced vitality and intrinsic motivation (Mageau & Vallerand, 2003). Therefore, the current study aimed to identifying factors in the competitive sports environment that potentially affect competence need satisfaction and, subsequently, youth athletes' enjoyment and tension. To do so, the current experimental study relied on a person-x-context perspective. This is important because most studies on athletes' competence development still focus either on contextual sources of influence or on athletes' personal traits, without considering the intricate interplay between these factors.

### How Demotivating is Negative Normative Feedback?

In line with expectations, positive, compared to negative, normative feedback increased tennis players' competence need satisfaction and enjoyment. This finding is in line with previous correlational (Mouratidis et al., 2008; Study 2), longitudinal (Gillet et al., 2009), and experimental work (Fransen et al., 2018; Vallerand & Reid, 1984). The current finding builds on the existing evidence base by sampling competitive tennis players for a tennis-specific drill, performed on tennis courts, rather than using university students to participate in a competition-like activity in a laboratory context. As such, the ecological validity of correlational studies was combined with the methodological rigor of experimental research.

In line with self-determination theory, competence need satisfaction played an intervening role between normative feedback valence and perceived enjoyment (Whitehead & Corbin, 1991). In

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contrast to the effects on competence need satisfaction and enjoyment, no direct effects on perceived tension were found, although normative feedback valence had an indirect effect on tension, through competence need satisfaction (see also Quested et al., 2011). One possible explanation for the lack of a direct association between feedback and tension is that the perceived importance of the exercises was too low for negative feedback to elicit tension. Another explanation might be the lack of a human opponent, as tennis players played against a tennis ball machine. Although competing against a human opponent is inconvenient for standardization, it would further enhance ecological validity and might increase levels of tension in the face of negative feedback. Finally, the negative feedback may not be demotivating for all individuals, an explanation that received evidence herein through the observed effects for self-critical perfectionism.

**Self-Critical Perfectionism as a Vulnerability Factor**

Congruent with a person-x-context perspective, we found that personal factors might affect youth athletes' perceptions of negative feedback. We specifically examined the role of self-critical perfectionism, both because this personal factor is heavily implied in participants' skill development (Hall, 2006) and because it is highly prevalent in athletes (Szymanski & Chrisler, 1991). Regarding the unique contribution of self-critical perfectionism, tennis players who step on the court with more elevated levels of self-critical perfectionism reported less competence need satisfaction and more tension during the tennis exercises, findings in line with past research (e.g., Jowett et al., 2016; Mallinson & Hill, 2011). A novel finding in the current study is that competence need satisfaction functioned as an intervening variable between self-critical perfectionism and perceptions of tension.

Yet, at odds with the formulated hypotheses and some previous studies (Mallinson et al., 2014), self-critical perfectionism was unrelated to enjoyment in the tennis exercises. Possibly, self-critical perfectionism relates more strongly to unfavorable outcomes given its dysfunctional nature (Mouratidis & Michou, 2011; Vansteenkiste et al., 2010). Despite the lack of a direct relationship between self-critical perfectionism and enjoyment, an indirect relationship via competence need satisfaction was found.

The most novel aspect of the present study involved the examination of whether athletes with a different personality would react differently to the manipulated feedback. Evidence for an interaction was obtained in the prediction of competence. We reasoned that tennis players scoring higher on self-critical perfectionism would be more vulnerable to the competence-undermining impact of negative feedback, as reported in prior correlational work (e.g., Lizmore et al., 2016). This is the first study to our knowledge to examine the role of self-critical perfectionism in reaction to experimentally induced success or failure in the context of sports. One potential explanation for this finding is that self-critical perfectionism urges athletes to use less favorable attributions in response to failure, including a greater tendency to attribute success externally and a reduced tendency to attribute success internally or failure externally (Stoeber & Becker, 2008). By doing so, it might be that self-critical perfectionistic people take less credit for their successful performances while holding themselves more responsible for failures. These attributions may in turn explain why negative normative feedback does more harm for people with more self-critical perfectionistic traits. This line of reasoning might also explain why people who score extremely low on self-critical perfectionism were not differentially affected by positive or negative feedback. These participants might attribute failure almost completely to external factors, which enables them not to be impacted by it at all. Because attribution processes were not measured in this study, these explanations remain speculative and should be addressed in future research. While attribution processes might explain why highly self-critical perfectionistic athletes immediately react with a more profound reduction in feelings of competence, rumination processes, as captured by negative self-talk during tennis play (De Mynck et al., 2020), might further pronounce this difference over time. Indeed, individuals high in self-critical perfectionism were found to ruminate more about the received critical feedback and to accept it less, suggesting that they display poorer coping in reaction to competence frustrating experiences (Van der Kaap-Deeder et al., 2016). The significant interaction between self-critical perfectionism and valence feedback after the second, but not after the first trial is interesting in this regard as it may signal that self-critical perfectionism is perhaps especially detrimental when athletes



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405 have sufficient time to reflect on the negative feedback.

406         Despite the person-x-context interaction for competence need satisfaction, no direct  
407 interaction effect was found on enjoyment or perceived tension. This non-significant effect might be  
408 attributable to competence being a more proximal outcome, compared to enjoyment or tension.  
409 Indeed, the interaction between normative feedback and self-critical perfectionism was found to be  
410 indirectly relevant for enjoyment through its effect on competence. Specifically, the interaction  
411 affected tennis players' competence, which, in turn, affected their enjoyment. The lack of a direct  
412 effect might also be attributable to the limited sample size, as only 59 participants were included in  
413 this analysis. Future research might want to examine this interaction with a more extensive sample.

414         A final note on the findings regarding self-critical perfectionism has to do with how this  
415 concept was operationalized within the current study. Tennis players' self-critical perfectionism was  
416 measured in a global, trait-like fashion (e.g., "Performing worse than others means that I am an  
417 inferior as person"). In other words, the items lacked context-specificity, such that it is unclear which  
418 particular situation participants had in mind when completing the self-critical perfectionism  
419 questionnaire. Although trait-like and domain-specific perfectionism have been shown to be strongly  
420 interrelated (Boone et al., 2012), they do not overlap perfectly. Possibly, a more sport-specific  
421 measure of self-critical perfectionism results in stronger associations with athletes' enjoyment and  
422 tension, and interacts more easily with feedback valence in contributing to these outcomes. Future  
423 research might address this reasoning.

424         The findings of the current study can be used to inform practitioners, such as coaches, to  
425 deal with self-critical perfectionism among their athletes. First, the current study points to the  
426 importance of coaches' awareness regarding self-critical perfectionists' vulnerability in terms of  
427 competence to negative normative feedback, such as losing a game or not attaining an interpersonal  
428 performance standard. From this awareness, coaches can try to buffer these athletes' sensitivity to  
429 failure. This can be done by complementing negative normative feedback with tips and strategies to  
430 improve performance in the future (Tzetzis et al., 2008). Furthermore, even in the case of failing to

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win a game or to attain an interpersonal performance standard, coaches can stress positive aspects of their athletes' performance, such as good skill execution (Allen & Howe, 1998) or personal progress (Tenenbaum et al., 2001), as positive feedback has been shown to increase competence need satisfaction (De Muyne et al., 2017; Mouratidis et al., 2008). Furthermore, coaches can be advised not, or only sparingly, to use normative feedback towards athletes with more self-critical perfectionism. The use of normative feedback, even when positive in valence, has been shown to backfire in terms of competence when these athletes subsequently experience failure (Mueller & Dweck, 1998). Therefore, coaches are generally advised to predominantly rely on tasks-based or intrapersonal feedback. Future research might examine whether self-critical perfectionists are also less sensitive to negative feedback when formulated in a process-oriented or intrapersonal way.

**Limitations**

The current study has a number of limitations. First, although the study sampled competitive tennis players and was held on tennis courts to enhance ecological validity, having them play against a ball machine might hinder ecological validity. However, using a ball machine was necessary to standardize the pattern of strokes across participants and to eliminate errors from the 'opponent' for all participants, such that participants' were unable to infer their own performance. Second, the generalization of the current study's findings is limited in two ways. As only tennis players were sampled for the current study, it is unclear if the findings also hold for other individual and team sport athletes. Because normative feedback was used in the current study, the question arises whether feedback valence has similar effects in case performance of athletes is compared to task standards (Tzetzis et al., 2008) or previous personal accomplishments (Tenenbaum et al., 2001). Previous research already indicated some pitfalls of feedback comparing athletes' performance with the performance of others or a norm table (Ames, 1992). However, normative feedback is relevant in competitive sports because rankings and competition tables are omnipresent in this context. Furthermore, normative feedback is most useful to ensure a good balance between credibility and standardization in experimental research. A third limitation of the current study concerns the small

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sample size, which precluded using a latent variable SEM-model. As data collection was time-consuming, collecting a larger sample was unrealistic. A fourth limitation has to do with only looking into self-critical perfectionism, thereby ignoring personal standards perfectionism (Dunkley et al., 2000), which shows a more ambivalent outcome pattern in sport, exercise, and dance (Stoeber, 2011). Future research might explore the role of this dimension of perfectionism in reaction to feedback in a sports context. Further, because the experimenter was not blind to the hypotheses, his communication style may – apart from the content of the provided feedback as such – have driven some of the observed effects in the present study. Assuming that the negative feedback would be undermining for the participants' motivation, the experimenter would then communicate the negative feedback in a more demotivating fashion than the positive feedback. For example, the experimenter may have given the negative feedback with a harsher intonation than the positive feedback, such that the observed effect of negative feedback could also be explained by its accompanying different tone of voice. Indeed, previous research has shown that both the content and the intonation of the message matter and can work in a synergistic fashion (Weinstein et al., 2019). Finally, although some scholars may consider a measure of competence purely as a manipulation check, this variable has been considered as a basic psychological need and as a substantive mediating mechanism in past work (Mabbe et al., 2018; Vallerand & Reid, 1984). For instance, in a classic experimental study on the impact of positive feedback on intrinsic motivation, Vallerand and Reid (1984) modeled competence as a central mediating variable. The reason why competence should not be reduced to a manipulation check is because there exists considerable variation in the way how individuals perceive the same standardized feedback. Indeed, the present study was set up precisely to examine such variations as a function of interindividual differences in self-critical perfectionism, with individuals high on self-criticism perceiving the negative feedback as more evaluative, resulting in reduced competence satisfaction. At the same time, we do recognize that competence satisfaction is content-wise closely associated with the manipulation and future

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research could move beyond such proximal mediators by including other processes, such as players' attribution pattern or their engagement in self-talk (Zourbanos et al., 2011).

**Conclusion**

This study showed that contextual and personal factors affect uniquely and in conjunction tennis players' competence need satisfaction and subsequent enjoyment and tensions. Regarding the unique contributions, both negative feedback and self-critical perfectionism were found to be detrimental for tennis players' competence need satisfaction. Regarding their interplay, results showed that tennis players' self-critical perfectionism further aggravated the competence undermining effect of negative feedback. In turn, competence need satisfaction was found to serve as an intervening variable between both negative feedback and self-critical perfectionism on the one hand and perceived tension and enjoyment on the other hand.

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## Footnotes

<sup>1</sup> In addition, we examined whether the findings obtained with the composite score were primarily driven by the need satisfaction items, by the need frustration items, or by both. As for the main effects of feedback manipulation, a pattern in the expected direction was obtained for both competence satisfaction ( $M_{neg} = 3.03$ ,  $SD = .65$ ;  $M_{pos} = 3.55$ ,  $SD = .62$ ;  $F(1,53) = 7.39$ ,  $p < .01$ ,  $\eta_p^2 = .12$ ) and competence frustration ( $M_{neg} = 3.04$ ,  $SD = 1.02$ ;  $M_{pos} = 2.23$ ,  $SD = .66$ ;  $F(1,53) = 11.77$ ,  $p < .001$ ,  $\eta_p^2 = .18$ ).

<sup>2</sup> We re-ran the analyses for relaxation and tension separately. Regarding the main effects of feedback valence, no significant effects were found for either relaxation ( $M_{neg} = 3.59$ ,  $SD = .92$ ;  $M_{pos} = 4.00$ ,  $SD = .72$ ;  $F(1,55) = 2.58$ ,  $p = .11$ ,  $\eta_p^2 = .05$ ) or tension ( $M_{neg} = 2.10$ ,  $SD = .85$ ;  $M_{pos} = 1.86$ ,  $SD = .72$ ;  $F(1,55) = .56$ ,  $p = .46$ ,  $\eta_p^2 = .01$ ). As such, the conclusion remained the same.

<sup>3</sup> We repeated the regression analyses to examine for the effect of self-critical perfectionism on competence with separate scores for need satisfaction and need frustration. Results of these analyses indicated that self-critical perfectionism related positively to state competence need frustration ( $\beta = .36$ ,  $p \leq .01$ ), but was not related to state competence need satisfaction ( $\beta = -.15$ ,  $p = .23$ ), although the latter effect was in the expected (i.e., opposite) direction. The interaction effect between feedback valence and self-critical perfectionism did not reach significance in any of both competence indicators ( $\beta_{sat} = .21$ ,  $p = .10$ ;  $\beta_{frus} = -.20$ ,  $p = .07$ ). Yet, both interactions were in the expected direction.

<sup>4</sup> When re-running all analyses for relaxation and tension separately, self-critical perfectionism related positively to tension ( $\beta = .32$ ,  $p \leq .01$ ), but not to relaxation ( $\beta = -.22$ ,  $p = .10$ ). On the contrary, the interaction between feedback valence and self-critical perfectionism was significant only in the case of relaxation ( $\beta = .27$ ,  $p \leq .05$ ), but not in the case of tension ( $\beta = -.02$ ,  $p = .85$ ).

**Table 1***Bivariate Correlations among Background Characteristics and Study Variables*

Variables	1	2	3	4	5	6
<b>Pre-experimental measures</b>						
1. Age						
2. Training frequency	-.06					
3. Trait competence	-.05	.42**				
4. Self-Critical Perfectionism	.30*	-.18	-.27*			
<b>Experimental measures</b>						
5. State competence	-.19	.29*	.46**	-.42**		
6. Enjoyment	.02	.34**	.30*	-.26*	.72**	
7. Tension	.02	-.20	-.37**	.39**	-.64**	-.56**

\* $p < .05$ , \*\* $p < .01$

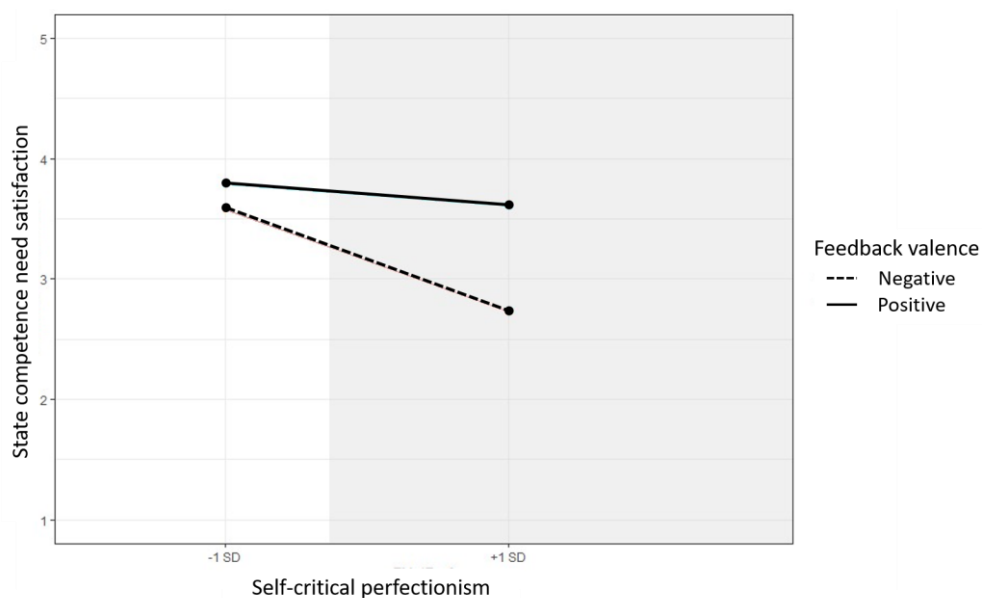
**Table 2**

*Differences between Negative and Positive Feedback in Competence Need Satisfaction, Enjoyment, and Tension*

Variables	Negative		Positive		<i>F(df)</i>	<i>p</i>	$\eta_p^2$
	feedback		feedback				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
<b>Pre-experimental measures</b>							
Age	15.50	1.61	15.45	1.68	.02 (1,57)	.90	.00
Training frequency	3.24	3.23	3.69	3.72	.25 (1,57)	.62	.00
Trait competence	5.40	.86	5.65	.69	1.47 (1,57)	.23	.03
Self-critical perfectionism	2.38	.43	2.27	.59	.67 (1,57)	.42	.01
<b>Experimental measures</b>							
State competence	3.00	.71	3.66	.55	14.69 (1,53)	≤.001	.22
Enjoyment	3.81	1.06	4.71	.94	10.80 (1,55)	.002	.16
Tension	2.26	.80	1.93	.58	1.95 (1,55)	.17	.03

**Figure 1**

*Graphical Representation of the Relationship Between Self-Critical Perfectionism and State Competence Need Satisfaction under Different Feedback Conditions, with Region of Significance Analysis*

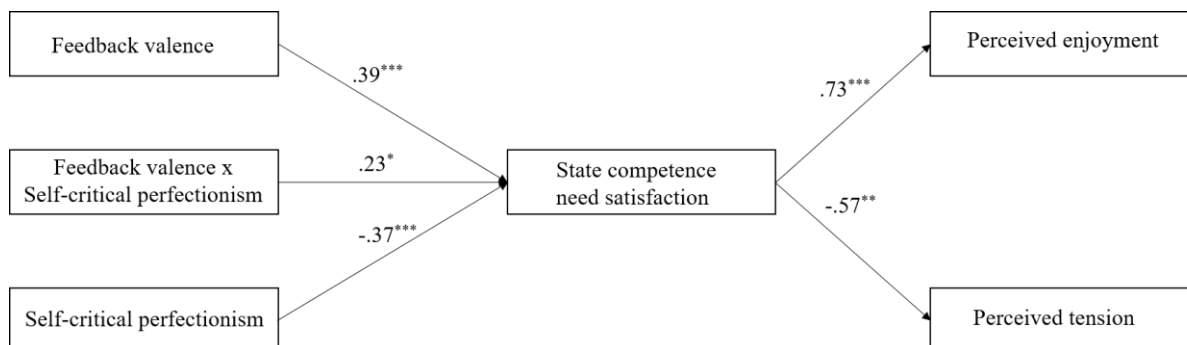


*Note.* Differences for both feedback conditions are significant within the gray background area range (i.e. standardized x-values of  $-.63$  or higher, representing a value on self-critical perfectionism ranging between 2 and 5).

**Figure 2**

*Graphical Representation of the Path Analyses Examining the Intervening Role of State Competence*

*Need Satisfaction*



*Note.* Values provided are standardized and controlled for the role of significant background

variables. Direct pathways are not displayed as none of the six direct pathways were significant.

Explained variances were  $R^2_{\text{competence}} = .53$ ,  $R^2_{\text{enjoyment}} = .57$ , and  $R^2_{\text{tension}} = .43$ .

\* $p \leq .05$ , \*\* $p \leq .01$ , \*\*\* $p \leq .001$