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Original article

# A person-centered approach to achievement goal orientations in competitive tennis players: Associations with motivation and mental toughness

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## Highlights

- Latent profile analysis revealed three distinct configurations of achievement goal orientations that varied primarily in valence of competence (i.e., approach *vs.* avoidance).

- Athletes oriented by approach types of goals (irrespective of their orientation towards avoidance goals) reported higher levels of autonomous motivation and mental toughness.
- Competitive tennis players tend to pursue a number of achievement goals in combination rather than in isolation.
- Avoidance goals may also be associated with desirable psychological characteristics, provided they are pursued in conjunction with approach goals.

**Abstract**

***Background*:** Research on achievement goal orientations in sport has typically relied on the use of variable-centered approaches that tend to overlook population heterogeneity. In this study, we

used a person-centered approach to identify subgroups of competitive tennis players according to unique combinations of achievement goal orientations and tested for subgroup differences in motivation and mental toughness.

***Methods*:** A sample of 323 competitive tennis athletes (male, 69.35%) between 15 and 25 years of age (17.60 ± 2.40, mean ± SD) completed the 3 × 2 Achievement Goal Questionnaire for Sport, Sport Motivation Scale II, and Mental Toughness Inventory. Latent profile analysis (LPA) was used to identify unique combinations of achievement goal orientations. Comparisons between latent subgroups on autonomous motivation, controlled motivation, and mental toughness were performed using analysis of variance (ANOVA).

***Results:*** LPA supported three distinct patterns of achievement goal profiles that were primarily distinguishable based on valence of competence (i.e., approach versus avoidance). ANOVAs indicated that athletes who were classified into subgroups that endorsed approach types of goals (regardless of the types of avoidance goals they endorsed) reported higher levels of autonomous motivation and mental toughness.

***Conclusion*:** Results indicated that athletes tend to pursue a number of achievement goals collectively rather than in isolation. Although approach goals are more commonly linked to adaptive psychological functioning and positive outcomes, avoidance goals may also be associated with desirable psychological characteristics if they are pursued in conjunction with approach types of achievement goals.

***Keywords***: Achievement goals; Latent profile analysis; Mental toughness; Motivation; Sport

## 1. Introduction

Competitive sports offer athletes the opportunity to demonstrate competence by influencing, controlling, and mastering the athletic environment.[1] Athletes' need for competence

is typically fulfilled by attaining an objective or subjective standard of performance that they set and evaluate themselves against.[2] Scholars commonly refer to internalized performance standards as achievement goals,[3] the orientation of which may vary based on athletes' underlying motives for achievement. Contemporary achievement goal models have developed from the dichotomous mastery (i.e., emphasis on the development of skills and self-improvement) and performance (i.e., emphasis on outperforming others) framework that distinguished between self- and other-dependent achievement goals.[4] Subsequent research further differentiated mastery and performance goals into avoidance and approach dimensions.[5] This 2 × 2 framework classified mastery and performance goals according to whether they are positively-toned (i.e., attaining success) or negatively-toned (i.e., avoiding failure).[6]

Recent perspectives suggest that utilizing a broad mastery dimension may confound self-dependent (e.g., expected self-referenced improvements in performance) and task-dependent (e.g., expected task-referenced improvements in performance) goal orientations.[3] Offering a framework for discerning between each type, Elliot and colleagues[7] proposed a 3 × 2 model that designates competence (self, task, other (akin to performance goals)) and valence of competence (positive (approach), negative (avoidance)) into one of six classifications of achievement goals (see Mascret et al.[3] for detailed descriptions and examples of each type). Several studies have found preliminary support for distinctions between self- and task-orientations among athletes. For example, Mascret et al.[3] found task-approach goals, but not self-approach goals, were positively associated with self-perceived competence. These findings highlight the progress that has been made, yet the existing body of research on achievement goal orientations in sport has disproportionately focused on inter-individual (as opposed to intra-individual) differences.

*1.1. A person-centered approach to achievement goals*

An important limitation of most studies on achievement goals in sport has been the use of variable-centered analyses that assume population homogeneity with regard to the relations among variables.[8] Notwithstanding the value of variable-level analyses, such approaches tend to overlook population diversity and intra-individual variability.[9] Whereas variable-centered analyses clarify associations among variables and focus on generalizing conclusions across the population, person-centered approaches consider population heterogeneity and identify configurations of variable relations at the within-person level.[10] Thus, person-centered analyses are useful for identifying subpopulations of individuals based on within-group similarities and between-group differences in the patterns of association among variables.[11]

Applying a person-centered approach to achievement goals in sport is warranted for several reasons. First, prior studies have reported considerable variability in the covariance among achievement goal orientations,[3] as well as fluctuations in the goal types that dominate athletes' achievement goal pursuits.[12] Second, even though achievement goal pursuits may be dominated by a single preferred type, people typically pursue a combination of achievement goals.[13] Third, interventions usually focus on fostering mastery-approach (i.e., self- and task-approach) achievement goal pursuits.[3] By identifying within-person differences in achievement goal orientations, a more nuanced perspective may be developed about the types of achievement goals that should form the basis of targeted interventions. Fourth, in contrast to studying achievement goal types in isolation, person-centered approaches allow unique achievement goal arrangements to be examined in relation to predictors or outcomes.[14] In this study, we examine associations between configurations of achievement goals and auxiliary variables of motivation and mental toughness.

*1.2. Achievement goal correlates: motivation and mental toughness*

Directed by the motives that give energy to human behavior,[15] athletes may be motivated to participate in competitive sport for a variety of reasons. Motivation is often classified on a continuum of motivational subtypes from most self-determined (i.e., intrinsic regulation) to least self-determined (i.e., amotivation).[16,17] Internalization of self-determined motives (e.g., participation out of pleasure, interest, or meaning derived from sport participation) reflects autonomous motivation, whereas adoption of non-self-determined motives (e.g., participation out of intra- and inter-personal pressures, prospects of external gains, or avoidance of negative consequences) corresponds with controlled motivation.[17] Although autonomous and controlled forms of motivation represent opposing ends of the motivational spectrum, athletes' participation in competitive sport may be regulated by combinations of each type.[18]

Research on motivational orientations in sport has consistently distinguished between the adaptive outcomes associated with autonomous motivation and the maladaptive outcomes linked to controlled motivation.[19] Specifically, while controlled motivation has yielded positive associations with unfavorable outcomes including burnout, moral disengagement, and perceived injury susceptibility,[20-22] positive relationships have been found between autonomous motivation and desirable outcomes such as coping with adversity, confidence, and athletic performance.[23,24] Considering that mastery-oriented achievement goals are more closely aligned with self-determined motives, it's not surprising that athletes who pursue mastery (i.e., self- and task-based) types of goals tend to report higher levels of autonomous types of motivation.[12] However, findings with regard to the approach-avoidance valence of competence have generally been mixed. Some studies have exclusively linked mastery-approach goals to autonomous motivational orientations,[25] while others have also found positive associations between mastery-avoidance goals and motivational types that are more autonomous.[26] Applying a person-centered

approach to achievement goals may clarify the types of motivational tendencies that correspond with different configurations of achievement goals that athletes pursue.

Another construct associated with adaptive outcomes in sport is mental toughness, a psychological resource that promotes goal-directed efforts and success in sport.[27-29] Although debate continues on the dimensionality and traitness of mental toughness,[30,31] evidence indicates that athletes with higher levels of mental toughness are self-confident and believe in their ability to control the environment, approach obstacles as opportunities for self-growth, and strive to attain the challenging goals they set for themselves.[32,33] Mentally tough athletes tend to emphasize and pursue self-referenced (as opposed to norm-referenced) competencies, thrive on competitive environments and opportunities to demonstrate competence, and remain committed to their goals despite adversity.[34-36] Taken together, these findings suggest that mental toughness is more closely tied to establishing and pursuing approach types of achievement goals. This has been supported in previous research, with higher levels of mastery- and performance-approach-oriented achievement goals reported among athletes classified as high in mental toughness.[37] However, previous research on achievement goal orientations and mental toughness have examined achievement goal types in isolation rather than collectively, and it is unclear how different combinations of achievement goals relate to mental toughness.

*1.3. The current study*

The purposes of this study were to (a) identify unique profiles of athletes based on different combinations of achievement goal orientations and (b) compare the subgroups identified on auxiliary variables linked to favorable sport performance outcomes (i.e., motivation and mental toughness).[15,28] Because the types of achievement goals athletes pursue have consequences for athletic performance,[2] identifying differences between these subgroups on

motivation and mental toughness might highlight the need for performance-enhancing psychological interventions that target achievement goal orientations in combination rather than in isolation. We expected that autonomous motivation and mental toughness would be higher, and controlled motivation lower, among athletes with achievement goal profiles that emphasized approach types of goals.

## 2. Methods

### *2.1. Participants and procedure*

The sample ($n$ = 323) consisted of male ($n$ = 224) and female ($n$ = 99) tennis players who were actively partaking in national-level singles tennis tournaments at the time of the study. Participants were between 15 and 25 years of age (17.60 ± 2.40, mean ± SD) and were competing in U16 ($n$ = 119), U18 ($n$ = 91), and Open (i.e., ≥18 years) ($n$ = 109, unspecified = 4) age brackets of participation. Institutional ethical approval was granted by the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee. The directors of national tournaments were contacted to obtain permission to access relevant tennis players. A team of experienced research assistants trained in standardized survey administration procedures recruited and administered the survey items to tennis players while attending selected national tournaments. Written informed consent was obtained *prior to* administering the survey to participants, and all participants were provided an opportunity to inquire about the nature of the study and their participation in it. When eligible minors (i.e., <18 years of age) agreed to partake in the study, we acquired parental consent and child assent. The survey items were administered individually to participants in a standardized format, and items were administered in the same order to all athletes.

### *2.2. Measures*

*2.2.1. Achievement goals*

The 3 × 2 Achievement Goal Questionnaire for Sport (3 × 2 AGQ-S[3]) measured athletes' achievement goal orientations. Oriented by an opening phrase (i.e., "In tennis, my goal is…"), participants used a 7-point response format (1 = *Strongly disagree*, 7 = *Strongly agree*) to rate the 18 items included on the 6 subscales (3 items for each subscale) of task-approach ((TAP), e.g., "…to obtain good results"); self-approach ((SAP), e.g., "…to be more effective than before"); other-approach ((OAP), e.g., "…to do better than others"); task-avoidance ((TAV), e.g., "…to avoid bad results"); self-avoidance ((SAV), e.g., "…to avoid doing worse than I usually do"); and other-avoidance ((OAV), e.g., "…to avoid doing worse than others"). The 3 × 2 factor structure of the AGQ-S has been supported over other achievement goal orientation models,[3] and evidence of construct validity has been provided on a number of occasions.[38] Past research has reported acceptable levels of internal consistency (0.76 to 0.95) for each of the subscales.[3,38] In this study, omega point estimates for the 6 subscales were between 0.79 and 0.90.

*2.2.2. Motivation*

A total of 12 items from 4 of the Sport Motivation Scale II (SMS II[17]) subscales (3 items for each subscale) were used to assess motivational regulation. Consistent with previous research,[1] the items (each of which contained the same orienting statement, "I participate in tennis") included on the intrinsic regulation subscales (e.g., "…Because it is very interesting to learn how I can improve") and integrated regulation subscales (e.g., "…Because through tennis, I am living in line with my deepest principles") were aggregated for an index of autonomous motivation, whereas the introjected regulation items (e.g., "…Because I would not feel worthwhile if I did not") and external regulation items (e.g., "…Because people I care about

would be upset with me if I did not") were summed for a measure of controlled motivation. Items are rated using a 7-point response format (1 = *Does not correspond at all*; 7 = *Corresponds completely*). Research has confirmed the factor structure and provided evidence supporting the construct validity of the PMS II,[17,39] and estimates of test–retest reliability (1-week interval) and internal consistency have been ≥0.70.[17,39] For the subscales included in this study (i.e., intrinsic, integrated, introjected, and extrinsic regulation), omega point estimates ranged from 0.77 to 0.84. Internal consistency reliability for the autonomous and controlled motivation indices used in this study were $\omega = 0.91$ and $\omega = 0.89$, respectively.

*2.2.3. Mental toughness*

Participants completed the Mental Toughness Inventory (MTI[30]), an 8-item unidimensional measure of mental toughness. Items (e.g., "I strive for continued success in tennis") are rated on a 7-point response scale from 1 (*False, 100% of the time*) to 7 (*True, 100% of the time*). Evidence from several studies supports the factorial, construct, and cross-cultural validity of the MTI.[30,40] Internal consistency estimates reported in prior studies have been within appropriate limits (>0.80).[40,41] For the sample included in the current study, internal consistency was estimated at $\omega = 0.91$.

*2.3. Data analyses*

*2.3.1. Preliminary analyses*

Statistical analyses were performed using R.[42] Item-level responses were screened for missing values. Each was replaced using an iterative random forest approach with 10,000 replications.[43] Standardized values at the univariate level (critical value = |3.29|, $p < 0.001$), and Mahalonobis distance at the multivariate level ($p < 0.001$), were used to detect gross outliers.[44] Skewness and kurtosis estimates provided an indication of univariate normality, with values ≥ |2|

for skewness and ≥ |7| for kurtosis signaling variables non-normal in distribution.[45] Internal consistency was estimated using McDonald's omega, an approach that assumes a congeneric model and one that has a lower likelihood of under- or over-estimating reliability.[46]

*2.3.2. Primary analyses*

Latent profile analysis (LPA) was performed to identify subgroups based on the underlying achievement goals consistent with the 3 × 2 framework. After specifying a single-profile baseline model, additional profiles were successively added to identify the model that offered the greatest parsimony and optimal level of fit.[47] Model fit was evaluated using the bootstrapped (10,000 repetitions) likelihood ratio test (BLRt) and a combination of relative fit indices (the uncorrected and corrected Aikake Information Criterion (AIC, cAIC) and the unadjusted and sample-size adjusted Bayesian Information Criterion (BIC, aBIC)). Entropy values provided an indication of the quality of fit across models. Values that approach one reflect clearer delineation of classes.[48] Models with statistically significant BLRt *p* values ($p < 0.05$), lower relative fit index values, and higher entropy values were prioritized in model selection.[49] In addition, we inspected mean posterior probabilities of the profiles for each model when deciding on the optimal class structure. Values > 0.70 indicate that there is a strong likelihood that a participant belongs to the assigned class and not any of the other classes.[50] We also examined the proportion of participants assigned to each profile, as there is an increased likelihood of superfluous profile extraction when small subsamples (i.e., <5%) are assigned to profiles.[51]

The subgroups that emerged from the LPA analysis formed the *achievement goal orientation* variable. Chi-square tests of independence were used to determine whether age group and sex differences existed based on achievement goal orientation subgroups. Analysis of variance (ANOVA) tests were performed to identify mean differences between achievement goal

orientation groups on the criterion variables of autonomous motivation, controlled motivation, and mental toughness. To statistically control for potential effects of age group and sex, both variables were included in each model. Visual inspection of Wally plots[52] for each model indicated that homogeneity of variance could not be assumed. As such, ANOVAs were performed using the HC4 heteroscedasticity-consistent covariance matrix estimator.[53] ANOVAs that yielded significant effects for achievement goal orientation were followed by *post hoc* pairwise comparisons using the Games-Howell procedure.

## 3. Results

### *3.1. Preliminary analyses*

Missing data diagnostics identified a small percentage of missing values (0.85%), which were replaced (proportion falsely classified = 0.32). One univariate outlier ($z$ = -3.42) was removed. A total of 10 cases were flagged as multivariate outliers, $\chi^2$ (9) = 27.88, $p < 0.001$, which were omitted before proceeding. Univariate skewness (maximum = -0.43) and kurtosis (maximum = -1.23) statistics revealed that the measures were approximately normal in distribution.[45] Descriptive statistics and bivariate associations between the measures are reported in Table 1.

### *3.2. Primary analyses*

The LPA model fit indices are displayed in Table 2. The BLRt $p$ values reached statistical significance for models with 2, 3, and 5 profiles. The cAIC and BIC values indicated a superior level of fit for 3-profile solution, whereas AIC and aBIC fit indices were lower for the 5-profile model. However, one of the classes associated with the 5-profile solution was not assigned any cases, a scenario characteristic of spurious profile extraction.[51] A comparison of entropy values and mean posterior probabilities suggested that class allocation was clearer for the 3-profile

structure than for the model in which 5 profiles were specified. Overall, the 3-profile solution provided the best fit to the data.

Fig. 1 displays the levels of each achievement goal subtype (mean centered) as a function of subpopulation. Profile 1 (48.08%) comprised participants with low approach (TAP = 12.70 ± 2.47, SAP = 12.33 ± 2.37, OAP = 13.34 ± 2.30, mean ± SD) and low avoidance goals (TAV = 13.46 ± 2.32, SAV = 13.33 ± 2.14, OAV = 13.39 ± 2.69), which represented athletes with a low achievement goal orientation. Participants classified into Profile 2 (8.33%) reported high approach (TAP = 19.31 ± 1.38, SAP = 19.00 ± 1.30, OAP = 19.00 ± 2.12) and low avoidance (TAV = 16.00 ± 3.64, SAV = 14.23 ± 1.82, OAV = 13.77 ± 3.66) goals. This configuration reflected tennis players with an approach-dominant achievement goal orientation. Conversely, the remaining participants (43.59%), who fit Profile 3, reported high approach (TAP = 18.88 ± 1.92, SAP = 19.17 ± 1.46, OAP = 19.66 ± 1.95) and high avoidance (TAV = 19.74 ± 1.89, SAV = 19.69 ± 1.56, OAV = 18.82 ± 2.66) goals. This pattern represented athletes with a high achievement goal orientation. These three profiles were used to categorize participants on the *achievement goal orientation* variable.

Chi-square tests of independence revealed age group differences, $\chi^2$ (4) = 36.11, $p <$ 0.001, but not sex differences, $\chi^2$ (2) = 4.87, $p$ = 0.088, in achievement goal orientation subgroups. While the majority of tennis players competing in the Open age group (65.69%) were in the high achievement goal orientation group, the largest proportion of players in the U16 (55.93%) and U18 (62.50%) age groups were in the low achievement goal orientation group. The proportion of males and females was similar across the low achievement goal orientation (male, 64.67%), approach-dominant achievement goal orientation (male, 73.08%), and high achievement goal orientation (male, 76.47%) subgroups.

ANOVA model summary statistics and descriptive statistics for the criterion variables used to test for differences in achievement goal orientation are reported in Table 3. Significant differences in means between achievement goal orientation subgroups were found on autonomous motivation, controlled motivation, and mental toughness. *Post hoc* pairwise comparisons indicated the low achievement goal orientation group scored lower in autonomous motivation than did the approach-dominant achievement goal orientation group ($p = 0.038$) and the high achievement goal orientation group ($p < 0.001$). Controlled motivation was higher among the high achievement goal orientation group than the low achievement goal orientation group ($p < 0.001$). Compared to the low achievement goal orientation group, mental toughness scores were higher for the approach-dominant achievement goal orientation group ($p < 0.001$) and the high achievement goal orientation group ($p < 0.001$). The high and approach-dominant groups did not differ with regard to autonomous motivation ($p = 0.252$), controlled motivation ($p = 0.125$), or mental toughness ($p = 0.910$). Controlled motivation scores were similar among the low and approach-dominant achievement goal orientation groups ($p = 0.983$).

## 4. Discussion

The purpose of the current study was to identify latent profiles of athletes based on within-person patterns of achievement goal orientations and test for differences in motivation and mental toughness across each of the subgroups. The results supported three unique configurations that reflected variations in athletes' achievement goal preferences. Based on the profiles extracted, a number of subgroup differences in motivation and mental toughness were identified.

### *4.1. Heterogeneity in achievement goal orientations*

The findings revealed three distinct achievement goal orientation profiles that varied primarily in approach-avoidance valence. Whereas two of the subgroups were characterized by high and low levels of achievement goal-oriented pursuits on all six dimensions, respectively, the third group preferred approach goals over avoidance goals. Supplementing the substantive literature that has typically utilized variable-centered approaches to study achievement goal orientations in sport, these findings demonstrate that athletes pursue an assortment of achievement goals and highlight the importance of examining goal orientations collectively rather than in isolation. The approach-dominant grouping comprised a relatively low proportion of athletes (<10%), and the majority of athletes tended to report similar levels on both approach and avoidance valences of the achievement goal orientations they pursue.

Of particular interest is that many athletes endorsed high levels of both approach and avoidance goals. With emerging evidence supporting situational fluctuations in athletes' achievement goal pursuits,[12] there may be circumstances in which athletes consider avoidance goals to be useful. Avoidance motives induce attention to detail, systematic information processing, vigilance, and the recruitment of cognitive resources.[54] This may be particularly relevant in the competitive tennis context because the sport requires athletes to execute complex and accurate motor movements.[55] Indeed, avoidance goals may result in the immediate recruitment of cognitive resources to deal with problems arising during sports tasks with strong time constraints and to avoid failure and its negative effects.[56,57] Middle-to-late adolescents are more sensitive to insecurity and failure, especially if they are competitive athletes.[58] Participants were mainly young tennis players (65.02% were under 18 years of age), and they were actively partaking in national-level singles tennis tournaments. Consequently, they may more likely to

endorse avoidance goals (complementing approach goals) if these goals have immediate positive effects on their sport performance.

*4.2. Validity of achievement goal orientation profiles*

Profile comparisons were consistent with the expectation that autonomous motivation would be higher among athletes who reported higher levels of approach types of goal orientations. Participants in the approach-dominant and high achievement goal orientation groups (who endorsed all 3 types of approach goals) self-reported similar levels of autonomous motivation, yet the approach-dominant group endorsed comparably lower levels of avoidance types of goals. Although self- and task-based goals have been more closely aligned with autonomous forms of motivation in prior research,[12] the present findings suggest that other-based goals are not necessarily detrimental to autonomous motivation, provided that athletes are also oriented by mastery forms of goals. This coincides with research indicating that intrinsic forms of motivation are positively related to performance-approach goals,[59] but not to other types of goal orientations,[26] and has evidenced no clear pattern of relations with avoidance-based goals.[3] Only the low and high achievement goal orientation groups differed in controlled motivation, with the approach-dominant group reporting similar levels of controlled motivation to each group. Even though avoidance goals, as compared to approach goals, have typically been associated with forms of motivation that are more controlled,[37] controlled motivation may also be influenced by athletes' pursuit of approach types of goals.

The subgroups of participants in the approach-dominant and high achievement goal orientation groups reported higher levels of mental toughness than the low achievement goal orientation group. Mental toughness differences between the three profiles were in the expected direction, as athletes who favored approach types of goals (irrespective of avoidance goal

preferences) reported greater mental toughness. These findings coincide with previous research suggesting that mental toughness is associated with self-, task-, and other-oriented approach goals,[37] yet provide an indication of the mix of achievement goals that are favored by athletes with higher levels of mental toughness. Another advantage of the person-centered approach used was the finding that mentally tougher athletes may also pursue avoidance types of goals, suggesting that avoidance types of achievement goals, when favored alongside approach goals, may not necessarily detract from mental toughness. Although prior research has advocated emphasis on approach goals in developing mental toughness,[37] evidence suggests that there may be different ways to cultivate mental toughness.[60,61] Thus, mental toughness might also arise from a collection of approach and avoidance achievement goal preferences.

Research has also found state-like fluctuations in mental toughness,[62] suggesting there may also be changes in athletes' mental toughness over time and across situations. Although athletes high in mental toughness may emphasize approach types of achievement goals more consistently, even athletes who have achieved the highest accolades in their sporting code (many of whom have been described as mentally tough) have been oriented by avoidance types of achievement goals during the course of their careers.[63] Perhaps situational variations in mental toughness affect the types of achievement goal orientations athletes emphasize. An important follow-up to this study would be to ascertain whether athletes who strictly favor approach goals are more inclined to display consistent levels of mental toughness across situations.

*4.3. Limitations and future research directions*

A key strength of this study was the use of a person-centered approach to profile athletes according to the unique configurations of achievement goals. The findings extend upon prior research that has typically relied on variable-centered approaches to examine achievement goal

orientations in sport. There are, however, selected methodological limitations that need to be considered when interpreting the present findings. First, causal-effect conclusions are precluded by the cross-sectional design used in this study. Second, the sample consisted of national-level competitors participating in an individual, non-contact racquet sport. Even though there were several similarities between the findings in the present study and prior research involving athletes participating in other kinds of sports (e.g., Australian Rules football[37]), caution should be applied when generalizing the findings to other sport types and levels of competitive participation. However, goal orientations are often held in a particular life domain[64] and may be sport-specific. Measurement precision and predictive utility may be reduced when achievement goals are assessed at a broad level (i.e., "when you play *sport*") rather than at a sport-specific level (e.g., "when you play *tennis*").[3] Third, our measurement approach did not account for contextual or temporal changes in the constructs included in this study. Research is needed to identify the stability of the achievement goal profiles identified in this study and changes in relations with auxiliary variables of interest, such as whether certain combinations of achievement goals relate more strongly to mental toughness in some competitive situations than in others. Further investigations are also necessary to examine achievement goal profiles in relation to objective sport performance, which is a highly valued outcome in the approach-avoidance goals literature.[2] Longitudinal designs may be an interesting way of determining whether the performance of athletes who strictly endorse approach types of achievement goals follows the same temporal pattern as athletes who tend to pursue both approach and avoidance goals. Fourth, each of the variables was measured using athletes' self-report ratings, which may have resulted in socially desirable response sets or self-report bias. In future studies, researchers might consider using other-informant ratings or observations to accompany athletes' self-reports.

## 5. Conclusion

We found evidence of three subgroups of athletes that favored unique combinations of achievement goals, which were primarily distinguishable based on valence of competence preferences (i.e., approach *vs.* avoidance). Differences on auxiliary outcome variables were largely consistent with expectations, such that higher levels of autonomous motivation and mental toughness were reported among groups of athletes who endorsed approach types of goals (irrespective of whether or not they endorsed avoidance goals). Overall, the findings indicate that athletes tend to pursue a number of achievement goals collectively rather than in isolation, and that avoidance goals may also be associated with desirable psychological characteristics provided they are pursued in conjunction with approach goals.

## Authors' contributions

RGC and NM conceived of the article ideas and design, and drafted, revised, and edited the manuscript. TRD assisted in revising and editing the manuscript. All authors have read and approved the final version of the manuscript, and each agrees with the order in which the authors are presented.

## Competing interests

The authors declare that they have no competing interests.

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Table 1

*Descriptive statistics, internal consistency estimates, and bivariate analyses among study variables*

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| (1) Task approach | | | | | | | | | |
| (2) Self approach (95% CI) | 0.83 (0.79, 0.86) | | | | | | | | |
| (3) Other approach (95% CI) | 0.75 (0.70, 0.79) | 0.79 (0.74, 0.83) | | | | | | | |
| (4) Task avoidance (95% CI) | 0.68 (0.62, 0.74) | 0.76 (0.71, 0.80) | 0.79 (0.75, 0.83) | | | | | | |
| (5) Self avoidance (95% CI) | 0.70 (0.64, 0.75) | 0.77 (0.72, 0.81) | 0.75 (0.70, 0.79) | 0.80 (0.76, 0.84) | | | | | |
| (6) Other avoidance (95% CI) | 0.55 (0.47, 0.62) | 0.64 (0.57, 0.70) | 0.64 (0.57, 0.70) | 0.70 (0.64, 0.75) | 0.73 (0.67, 0.78) | | | | |
| (7) Autonomous motivation (95% CI) | 0.47 (0.38, 0.55) | 0.45 (0.36, 0.53) | 0.42 (0.32, 0.51) | 0.40 (0.30, 0.49) | 0.43 (0.33, 0.52) | 0.41 (0.31, 0.50) | | | |
| (8) Controlled motivation (95% CI) | 0.21 (0.10, 0.31) | 0.19 (0.08, 0.29) | 0.27 (0.16, 0.37) | 0.26 (0.15, 0.36) | 0.23 (0.12, 0.33) | 0.31 (0.21, 0.41) | 0.29 (0.18, 0.39) | | |
| (9) Mental toughness (95% CI) | 0.38 (0.28, 0.47) | 0.42 (0.32, 0.51) | 0.39 (0.29, 0.48) | 0.39 (0.29, 0.48) | 0.33 (0.23, 0.43) | 0.35 (0.25, 0.44) | 0.47 (0.39, 0.55) | 0.15* (0.04, 0.26) | |
| Mean ± SD | 15.95 ± 3.80 | 15.87 ± 3.92 | 16.57 ± 3.78 | 16.41 ± 3.78 | 16.18 ± 3.62 | 15.79 ± 3.84 | 29.84 ± 7.16 | 28.51 ± 7.37 | 39.65 ± 8.44 |
| Skewness | -0.40 | -0.43 | -0.30 | -0.20 | -0.07 | -0.16 | 0.20 | -0.39 | 0.31 |
| Kurtosis | -1.15 | -1.10 | -1.09 | -1.12 | -1.23 | -0.88 | -0.91 | 0.37 | -0.71 |
| ω | 0.86 | 0.90 | 0.85 | 0.84 | 0.79 | 0.81 | 0.91 | 0.89 | 0.91 |

Note: $^{*}p < 0.05$. All other Pearson correlations statistically significant at $p < 0.001$.

Abbreviation: 95% CI = 95% confidence interval.

Table 2

*Fit indices for latent profile analysis models*

| Model | AIC | cAIC | BIC | aBIC | BLRt | Entropy | nMPAP ≤ 0.70 | nP < 5% |
|---|---|---|---|---|---|---|---|---|
| 1-Profile | 8655.42 | 8783.49 | 8756.49 | 8670.85 | — | 1.00 | — | — |
| 2-Profile | 8537.39 | 8698.65 | 8664.65 | 8556.82 | <0.001 | 0.978 | 0 | 0 |
| **3-Profile** | **8484.83** | **8679.29** | **8638.29** | **8508.25** | **<0.001** | **0.965** | **0** | **0** |
| 4-Profile | 8499.14 | 8726.80 | 8678.80 | 8526.56 | 0.999 | 0.818 | 2 | 0 |
| 5-Profile | 8444.26 | 8705.13 | 8650.13 | 8475.69 | <0.001 | 0.803 | 2 | 1 |
| 6-Profile | 8424.74 | 8718.81 | 8656.81 | 8460.16 | 0.071 | 0.776 | 2 | 0 |

Note: Entries in boldface reflect selected model.

Abbreviations: AIC = Akaike Information Criterion; cAIC = Corrected Akaike Information Criterion; BIC = Bayesian Information Criterion; aBIC = Sample Size Adjusted Bayesian Information Criterion; BLRT = *p* value for bootstrap likelihood ratio test; nMPAP ≤ 0.70 = number of profiles with mean posterior assignment probabilities at or below 0.70; nP < 5% = number of profiles assigned less than 5% of the cases.

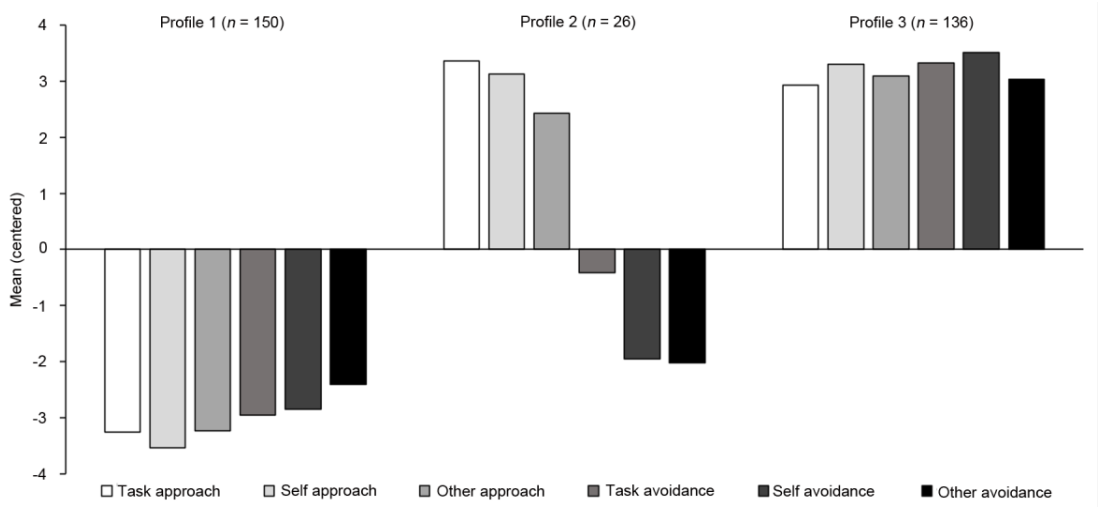


Fig. 1. Achievement goal orientation profiles.

able 3

ummary statistics for univariate analyses and *post hoc* pairwise comparisons by achievement goal orientation

| Predictor | Autonomous motivation | | Controlled motivation | | Mental toughness | |
|---|---|---|---|---|---|---|
| | *F* (*df*) | Mean ± SD | *F* (*df*) | Mean ± SD | *F* (*df*) | Mean ± SD |
| **ge group** | 0.08 (2, 302) | | 2.07 (2, 302) | | 2.01 (2, 302) | |
| U16 | | 29.29 ± 7.13 | | 27.64 ± 7.77 | | 39.88 ± 8.15 |
| U18 | | 29.02 ± 6.18 | | 29.03 ± 5.86 | | 39.12 ± 8.37 |
| Open | | 31.38 ± 7.86 | | 29.18 ± 8.11 | | 40.03 ± 8.96 |
| **ex** | 1.43 (1, 302) | | 0.18 (1, 302) | | 0.81 (1, 302) | |
| Male | | 29.92 ± 7.25 | | 28.79 ± 7.45 | | 39.69 ± 8.47 |
| Female | | 29.88 ± 7.05 | | 27.97 ± 7.32 | | 39.77 ± 8.50 |
| **chievement goal orientation** | 38.81* (2, 302) | | 7.53* (2, 302) | | 38.40* (2, 302) | |
| Low | | 26.59 ± 4.79 | | 26.96 ± 5.50 | | 35.92 ± 6.15 |
| Approach-dominant | | 30.65 ± 7.74$^{\#}$ | | 27.23 ± 7.44 | | 43.73 ± 7.90$^{\#\#}$ |
| High | | 33.32 ± 7.61$^{\#\#}$ | | 30.51 ± 8.66$^{\#\#}$ | | 43.01 ± 9.02$^{\#\#}$ |

Note: *$p < 0.001$.

$^{\#}p < 0.05$, $^{\#\#}p < 0.001$, mean values differ significantly from the low achievement goal orientation group.