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SPORT AND EXERCISE PSYCHOLOGY

A new measure of causality orientations: Development and validation in the sport context

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ABSTRACT

According to the Self-Determination Theory, causality orientations are stable motivational individual differences that shape how athletes interpret and act upon key features of their sport environment, such as coach feedback, practice structure, or competitive demands. These orientations influence athletes' participation, motivation, and their sport experience. However, there is currently no specific instrument for sport that assesses causality orientations. The objective of this article was to develop and validate the Sport Causality Orientations Scale (SCOS). In Study 1, academic experts created an initial pool of items based on previous literature and athlete feedback, forming a preliminary version. This version was administered to adolescents. To ensure an optimal fit of the scale, a stepwise reduction of situations was conducted using confirmatory factor analysis. In Study 2, the final version of the scale was administered to a larger sample in conjunction with the Sport Enjoyment Scale, demonstrating factorial and convergent validity, internal consistency, and satisfactory measurement invariance across sex and adolescent developmental stages. In conclusion, this study provides initial evidence suggesting that the SCOS is a valid and useful instrument for measuring causality orientations (autonomy, controlled and impersonal) in the sport context and for exploring their implications for a positive sport experience.

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Self-determination theory; causality orientations; positive experiences; youth sport; enjoyment

Sport can provide the foundation for establishing a healthy lifestyle, a process that begins in adolescence and continues throughout the lifespan (Telama et al., 2005). Adolescence represents a critical period for the development of behaviours and habits that will shape the adoption of healthy lifestyles. According to the World Health Organization (WHO, 2016), behaviours and habits that are established during childhood and adolescence have a significant impact on the adoption of healthy lifestyles during adulthood. Similarly, motivation has been identified as an essential construct for understanding participation and experiences related to sport practice from childhood and adolescence onward (e.g., Alvarez et al., 2021; Raimundi et al., 2024). To properly examine motivational phenomena, it is necessary to consider not only socio-contextual factors (i.e., interpersonal styles) but also personal factors (i.e., causality orientations and regulatory styles).

According to Self-Determination Theory (SDT; Deci & Ryan, 1985a; Ryan & Deci, 2017) psychological development is driven by the ongoing satisfaction of three basic needs that underlie growth, integrity, and well-being: autonomy (a sense of volition and self-endorsement), competence (a sense of efficacy and capability), and relatedness (experiencing mutual care and belonging). In early childhood, the social environment, throughout the interaction with significant others, may satisfy or thwart these needs. As children develop, they learn to pay attention to contextual affordances, incentives, and demands. Consequently, they diverge in how they are oriented within identical settings and adopt distinct approaches to regulating emotions and behaviours. These differences ultimately shape the psychological determinants that guide their actions (Ryan & Deci, 2017). These individual differences are what SDT calls causality orientations.

Causality Orientations Theory (COT; Deci & Ryan, 1985b), is one of the mini-theories of SDT that focuses on individual aspects of motivation. As individuals develop and their psychological needs are either satisfied or thwarted, they learn to understand and interpret their contexts beyond their objective characteristics.

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They focus more on certain affordances, rewards, or pressures and less on others. Individuals develop characteristic approaches to regulating their emotions and behaviours, as well as what is psychologically salient in their organisation of actions, in three possible ways: (1) focusing on those features that allow the individual to initiate and regulate their behaviour in a self-determined way, tending to act by integrating behaviour into their own values and interests (autonomy orientation); (2) paying attention to those features of the context that can provide the individual with rewards or punishments, regulating their behaviour in a more controlled way (control orientation); (3) directing their focus towards obstacles that diminish their potential to achieve their goals, thereby considering themselves to be incompetent and without control over their environment (impersonal orientation), with no intention of connection with the context. Each individual has all three causality orientations, which differ in terms of their relative strength, indicating the extent to which an individual is likely to orient themselves towards motivational cues in their environment (for an extensive review, see Hagger & Hamilton, 2020; Hagger et al., 2014; Ryan & Deci, 2017).

Those who are high in autonomy orientation tend to regulate their behaviour through autonomous motivation. In contrast, those high in control orientation tend to regulate their behaviour through controlled motivation. Finally, those high in impersonally orientation are amotivated (Deci & Ryan, 1985b). Although causality orientations are relatively stable in nature, they can be altered through sustained exposure to specific social contexts; thus, promoting autonomy-supportive contexts could enhance autonomy orientation (Deci & Ryan, 1985b; Ryan & Deci, 2017). As Deci and Ryan pointed out in their seminal paper, 'causality orientations may be different in different domains (for example, in domain of achievement versus that of interpersonal relations)' (1985b, p. 113). This idea has been further developed in the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997), which distinguishes three levels of motivation (i.e., global or personality, life contexts or domain, and situational or state). For instance, an individual may have learned that the school environment is a more controlling context than the family, or that leisure activities are autonomy-supportive domains, whereas the school is an amotivational domain (in such a case, the individual may self-categorise and be categorised in the school as a bad student). Consequently, in order to gain insight into the individual-level (i.e., causality orientations) disposition of athletes in relation to their sport practice (Standage & Ryan, 2020), and considering the role of sports in adolescents' lives, it would be interesting to have a specific domain instrument to assess sport as a life context (Vallerand, 1997).

Previous causality orientations scales

The General Causality Orientation Scale (GCOS) was developed by Deci and Ryan (1985b) to measure the strength of three different causality orientations, labelled autonomy, controlled and impersonal (which included 12 situations focused on achievement situations and 36-items). Hodgins et al. (1996) added five situations related to social interactions, because the first version was heavily oriented towards achievement situations, resulting in a new 17 situations version with 51 items. The GCOS has been validated in various languages and populations, including Spanish (Brenlla et al., 2013), Italian (Deponte, 2004), Turkish (Şen & Dag, 2016), French (Vallerand et al., 1987), and Chinese (Wu & Hwang, 2000). Those adaptations of the GCOS scale have been developed and validated for specific groups, including university students (Bruno et al., 2022), a clinical population (Cooper et al., 2015; Tkhostov & Rasskazova, 2013), and workers (Halvari & Olafsen, 2020). In the context of physical activity, Rose et al. (2001) developed an adapted version of the GCOS scale for exercise (i.e., the ECOS), which included seven situations. Busch et al. (2019) subsequently validated the G-ECOS in German, which included four situations. Physical exercise and sport are two types of physical activity with different purposes. Physical exercise is a planned, structured and repetitive activity aimed at improving some component of physical fitness, such as running, dancing, or cycling (Caspersen et al., 1985), whereas sport is a rule-regulated, structured physical activity involving competition, such as football, handball, tennis, etc. (WHO, 2020). The ECOS is developed for application in the context of physical exercise and therefore does not capture the aspects of competition and rule-regulation.

Previous studies based on causality orientation theory

Standage and Ryan (2020) noted that the application of COT in the sport context is quite sparse. Hence, we will centre our literature review on other domains. Brenlla et al. (2013) and Bruno et al. (2022) conducted studies on general population and university students respectively, which indicated that causality orientations were related to well and ill being. The autonomy orientation was found to be negatively associated with depression and psychoticism (Brenlla et al., 2013), and positively associated with intrinsic motivation (Bruno et al., 2022). Additionally, the controlled orientation was positively associated with extrinsic motivation and showed weak

correlations with several psychopathological symptoms. Finally, the impersonal orientation was found to be negatively associated with intrinsic motivation, and positively associated with extrinsic motivation and various types of psychopathological symptoms, including somatizations, obsessions and compulsions, personal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism (Brenlla et al., 2013; Bruno et al., 2022).

Some studies mentioned above, along with others (Busch et al., 2019; Kwan et al., 2011; Rose et al., 2001, 2005), found that autonomy orientation in exercise, was correlated with intrinsic, identified and introjected regulation, positive affective response to exercise, satisfaction of autonomy, competence, and relatedness needs. These studies found that a controlled orientation was associated with external and introjected regulation and lower levels of exercise (as measured in minutes per day). Finally, it was found that an impersonal orientation was negatively correlated with intrinsic, identified, and introjected regulation, as well as positive affect response to exercise. Additionally, there were small negative correlations with autonomy and competence needs satisfaction. Conversely, an impersonal orientation was positively correlated with external regulation and amotivation (Busch et al., 2019; Kwan et al., 2011; Rose et al., 2001, 2005).

Causality orientations and enjoyment

Enjoyment has been largely identified in previous literature as an indicator of positive sport practice experience (Visek et al., 2017), with implications for adherence to sport participation (Keegan & Knight, 2018).

As Kawabata and Mallett (2022) proposed, enjoyment is an affect that is proactive in nature; therefore, the motivational mechanisms are key aspects to understand their antecedents. As was previously stated, autonomy orientation was found to be positively associated with intrinsic motivation (Bruno et al., 2022). Furthermore, fostering intrinsic motivation tends to focus on experiencing the present (rather than future goals), which is associated with human growth tendencies that emerge through the interest and enjoyment intrinsic to motivated behaviour (White, 1959). Conversely, controlled and impersonal orientations promote motivational behaviour focused on the consequences of this behaviour (i.e., extrinsic) or barriers to engage with it (i.e., impersonal). This, in turn, will cause the person to focus on the future consequences of the motivated behaviour, thereby minimising the chances of enjoyment. Consequently, it seems reasonable for enjoyment to be positively associated with autonomy orientations and negatively associated with controlled and impersonal orientations. The present study will therefore examine the novel relationship between causality orientations and enjoyment as evidence of validity.

Present study

The objective of this study was to develop and validate a new scale, the Sport Causality Orientations Scale (SCOS). To our knowledge, no scale had yet been created to specifically assess causality orientations within the sport domain. To this end, a preliminary study (Study 1) was carried out to develop and test the first version of the scale. Subsequently, a further study (Study 2) was conducted, applying the final scale to a larger sample. This was done to confirm its construct validity, structural validity, and internal consistency, as well as measurement invariance across sex and adolescent stages.

Materials and methods

Instrument development (Study 1)

Item generation

A sports-adapted scale was developed taking into account earlier iterations of causality orientation scales, including the original GCOS (Deci & Ryan, 1985b), its Argentine adaptation (Brenlla et al., 2013), the exercise version (Rose et al., 2001), and a German adaptation of the exercise version (Busch et al., 2019). The format used in the SCOS follows a characteristic pattern in which a situation is described, and three different responses are presented representing the three causality orientations (see Appendix). The user rates each response using a seven-point Likert scale, ranging from 1 (very unlikely) to 7 (very likely) to indicate how likely they are to respond in that way. The instruction in the scale was, 'Below, we present a series of sports situations. Please imagine yourself in each situation and indicate how likely you are to react in way a, way b, and way c. If it is very unlikely that you would respond that way, mark 1 or 2. If it is moderately likely, select a number from 3 to 5, and if it is very likely that you would respond that way, mark 6 or 7'.

A pool of 20 situations was initially generated by the first author, resulting in a total of 60 items (see Figure 1). These situations were adapted to the sports context from previous scales, as previously mentioned, and new ones were created to represent relevant collective sporting events. The created situations were thought of, taking into consideration events before, during, or after a competition or practice, during longer periods of physical activity, and social experiences with teammates or the coach.

Content validity and pilot study

The items were presented to five experts on SDT (professionals and academics) from the sport sciences and sport psychology who work regularly with adolescent athletes as consultants and/or researchers. The experts assessed, commented on, and made suggestions regarding the scale's general instructions, situations, and items. They were instructed to evaluate the accuracy and variety with which the relevant constructs were represented. Based on these evaluations, the wording of some situations and items was modified, resulting in a scale with 18 situations (54 items, three items for each situation) to be applied to Study 1's sample (see Figure 1). During the process of applying the scale with the participants, comments and questions were recorded on a notepad by the test administrators. In general, the adolescents indicated that the scale was easy to understand. Furthermore, their comments and concerns were taken into consideration during the formulation of the final scale.

Sample sizes justification

In order to recruit an adequate sample size, a minimum of 250 participants for Study 1 and 500 participants for Study 2 were selected following Green's (1991) recommendations. Analysis of the database eliminated approximately 10% of cases from the initial data collection. After performing data analysis, a series of sensitivity power analysis were conducted to identify the smallest misfit detectable and minimum effect sizes of interest under fixed amounts of participants.

In accordance with Lakens's (2022) recommendations and based on the CFA conducted to assess the structural validity of the SCOS, a sensitivity analysis was conducted to quantify the smallest misfit (RMSEA) detectable with the achieved sample sizes. This analysis was performed using the R package semPower (Moshagen & Bader, 2023), implemented via a custom R function (see Supplementary Materials for the full script). The present analysis was based on the following fixed a priori parameters: a significance level of $\alpha = .05$, a desired statistical power of $1\text{-}\beta = .80$, and the measurement model's degrees of freedom ($df = 162$). Considering the sample used in Study 1 ($n = 276$), the minimal detectable misfit corresponded to RMSEA = .034 under H_0: RMSEA ≤.05. For the Study 2 sample ($n = 447$), the minimal detectable misfit corresponded to RMSEA = .026 under H_0: RMSEA ≤.05. Collectively, the achieved samples are adequate for the primary CFA objective and provide reasonable sensitivity (see Figure 2).

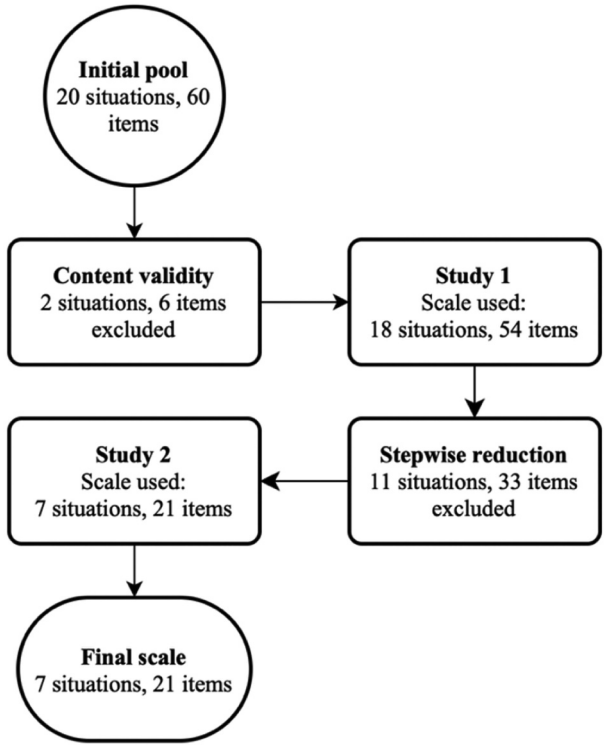

Figure 1. Visual flowchart of the scale development process.

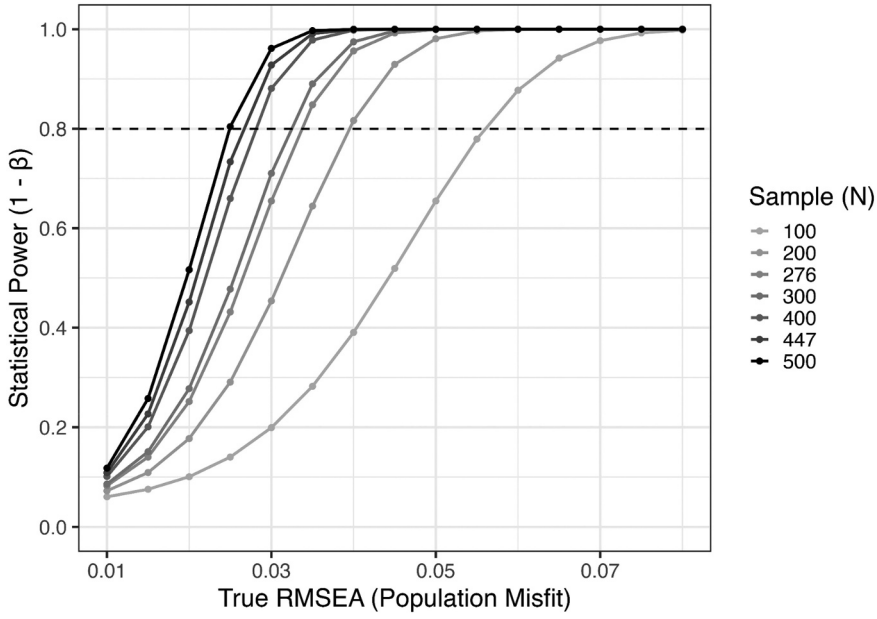

Figure 2. Results of sensitivity power analyses (power curves) for a test of close fit (H_0: RMSEA ≤.05) of the SCOS measurement model, based on a conventional α-level of .05 and the model's degrees of freedom (df = 162).

Participants

Study 1

Participants were 276 youth basketball players (83.70% male) aged 14 to 19 years old (M = 15.90, SD = 1.37) from clubs in the Buenos Aires Metropolitan Area (Argentina).

Study 2

Participants included 447 adolescents (52.80% female) aged 14 to 19 years old (M = 16.14, SD = 1.49) from clubs in the same area. Participants were involved in various sports including grass field hockey (46.98%), basketball (37.81%), futsal (7.61%), football (5.37%) and handball (2.24%). Most participants (86.34%) had been practicing their sport for at least four years, while only 13.66% had three years or less of experience.

Measures

Socio-demographic variables including sex, age, sport, years of sport practice, and hours of sport practice per week were collected.

The *Sport Causality Orientations Scale* (SCOS) was used to assess autonomy, controlled, and impersonal orientations (three subscales). The development and adaptation of the scale to the sport context is documented in this research. The items were rated on a seven-point Likert scale, ranging from 1 (very unlikely), 4 (moderately likely) to 7 (very likely). Higher scores on each subscale indicate that the athlete has more of that orientation.

The *Sport Enjoyment Scale* (SES; Schmidt et al., 2021) was used to assess the experience of enjoyment in sports and its defining components: positive affect and involvement. The scale consists of 17 items rated on a five-point Likert scale, ranging from 1 (totally disagree) to 5 (totally agree). The latent variable was created by calculating the mean of all the items. The scale has an acceptable reliability coefficient (ω = .81).

Procedure

The authorities of sports clubs and coaches of the sports federations were contacted to invite them to participate in the study. All athletes agreed to participate voluntarily and responded anonymously, with the prior written consent of their parents in the case of underage practitioners. The administration of the questionnaires took place either prior to, during or following the training hours, in a quiet, comfortable and familiar setting in proximity to the training grounds. During the administration of the questionnaires, two researchers were always present to provide information on how to fill out the questionnaires and to resolve any doubts that might arise during the process. It was emphasised that participation was voluntary and anonymous, that they could withdraw from the study at any time without consequence, and that the data collected would be processed only by the researchers. To guarantee the participants' freedom and confidentiality when answering, coaches, club managers, and parents were not

allowed to be present during the data collection. Although data collection was carried out in the groups formed by each of the teams, each athlete freely answered their own questionnaire protocol. The time required to fill out the scales was approximately 20 min, varying according to the age of the athlete.

In acknowledgement of the athletes' participation and in accordance with the Psychodiagnostician's Code of Ethics (ADEIP, 1999), which emphasises the importance of communicating the results, reports on the general results were compiled and distributed to coaches in the majority of the teams or training groups, with the exception of those comprising a limited number of members. In all instances, the athletes who had participated could not be identified. The present research was based on local and international ethical and deontological standards and was approved by the Responsible Conduct in Research Committee of the Faculty of Psychology at University of Buenos Aires for Study 1 and the approval of the Ethics Committee of the National University of Tres de Febrero for Study 2.

Data analysis

The inspection of data was primarily followed by the two most similar validations of Causality Orientations scales (for more information, see Busch et al., 2019; Rose et al., 2001). Confirmatory Factor Analysis (CFA) with multi-trait, multi-method was used to assess the scale's performance. The correlated Traits/Correlated Uniquenesses model was assumed to represent the best fit for the vignette format (i.e., situations and their three responses). Due to the ordinal nature of the Likert scale, the presence of ceiling and floor effects in some items, the highly specific measuring format (i.e., vignette), and the relative small sample size, the Maximum Likelihood with Robust standard errors (MLR) estimator was chosen for calculating CFA (Lloret-Segura et al., 2014; Viladrich et al., 2017). The chosen criterion for retaining each item in each factor was a loading greater than .30 (Hair et al., 2019). Evidence of reliability for SCOS was calculated using *compRelSEM* function (Terrence et al., 2022), following suggestions from Flora (2020) and Viladrich et al. (2017). McDonald's Omega was used due to the tau-equivalence assumption not holding true. To be considered acceptable, values are expected to range between .70 and .90 (Campo-Arias & Oviedo, 2008).

Study 1

In *Study 1*, the data's normality, skewness and kurtosis were analysed using Mardia tests (Korkmaz et al., 2014). The normalised Mardia coefficients were $\chi 2 = 4270.38$ for skewness ($p < .001$) and $z = 27.87$ for kurtosis ($p < .001$). The skewness of individual items ranged from −3.16 to 1.58, and the kurtosis ranged from −1.15 to 12.87. In *Study 2*, the normalised Mardia coefficients were $\chi 2 = 4032.66$ for skewness ($p < .001$) and $z = 27.42$ for kurtosis ($p < .001$). For each individual item, the skewness ranged from −2.25 to 1.07, and the kurtosis ranged from −1.25 to 5.48. Due that the assumptions of multivariate normality were not met, the MLR estimator was applied in the CFA.

For *Study 1*, a stepwise reduction of situations was conducted to ensure a good fit to the scale. Situations including items that had the weakest covariation with the corresponding factor (i.e., causality orientation) and the strongest covariation with the other two factors, were excluded. The content of the situation was also considered. The Lavaan package (Rosseel, 2012) was used to conduct this process until an acceptable model fit was achieved, following Brown's cutoff criteria (Bowen & Masa, 2015): CFI and TLI > .90, and RMSEA and SRMR < .08.

Study 2

For *Study 2*, a CFA with multi-trait, multi-method was also used to assess the scale's performance. Multigroup confirmatory analysis was used to test measurement invariance across sex and adolescent stages (Milfont & Fischer, 2010). Adolescent stages are defined according to Arnett (2012) as early adolescence (ages 14–15) and late adolescence (ages 16–19). Configural, metric, scalar, and strict invariance were tested by examining changes in model fit ($\Delta CFI \leq .010$; $\Delta TLI < .010$, $\Delta RSMEA < .015$, and $\Delta SRMR < .030$; Chen, 2007; Cheung & Rensvold, 2002). To obtain additional evidence on scale performance, Pearson correlations between orientations, and Mann-Whitney U tests were performed to examine causality orientations with respect to sex and adolescent stage. Evidence of convergent validity (Sireci & Benítez, 2023) was tested by calculating Pearson correlations between causality orientations and enjoyment. All analyses were performed using R Statistical Software (v4.2.3; R Core Team 2023).

Results

Study 1

The process of stepwise reduction began with 18 situations and ended with seven (see Figure 1 and Table 1). To achieve an acceptable fit and keep most of the situations, residual correlations were added to the seven-situation model (21 items, three items for each situation). These correlations are between items 1b and 5b, 3c and 5a and 9c and 12b. They all correspond to responses that represent the same causality orientations. For example, 1b and 5b represent an autonomy orientation response, 3c and 5a represent an impersonal

Table 1. Model fit indices for each step of reduction process (Study 1; n = 276).

Step	Model	Excluded situation	R-CFI	R-TLI	SRMR	R-RMSEA	90% CI for RMSEA
1	18 situations	–	.742	.720	.085	.049	[.045, .053]
2	17 situations	7	.752	.730	.085	.050	[.046, .055]
3	16 situations	10	.756	.733	.084	.053	[.048, .057]
4	15 situations	11	.773	.749	.084	.053	[.049, .058]
5	14 situations	17	.781	.757	.084	.055	[.050, .060]
6	13 situations	2	.798	.773	.081	.055	[.050, .060]
7	12 situations	13	.815	.790	.077	.055	[.049, .060]
8	11 situations	14	.832	.807	.073	.054	[.047, .060]
9	10 situations	4	.833	.805	.074	.057	[.050, .064]
10	9 situations	8	.846	.816	.072	.058	[.050, .066]
11	8 situations	15	.877	.850	.067	.054	[.045, .063]
12	7 situations	18	.890	.860	.062	.053	[.042, .064]
13	7 situations	–	.929	.907	.058	.043	[.030, .055]

Note. Comparative Fit Index; R-TLI = Robust Tucker-Lewis Index; R-RMSEA = Robust Root Mean Square Error of Approximation; 90% CI = 90% Confidence Interval for RMSEA; SRMR = Standardized Root Mean Square Residual.

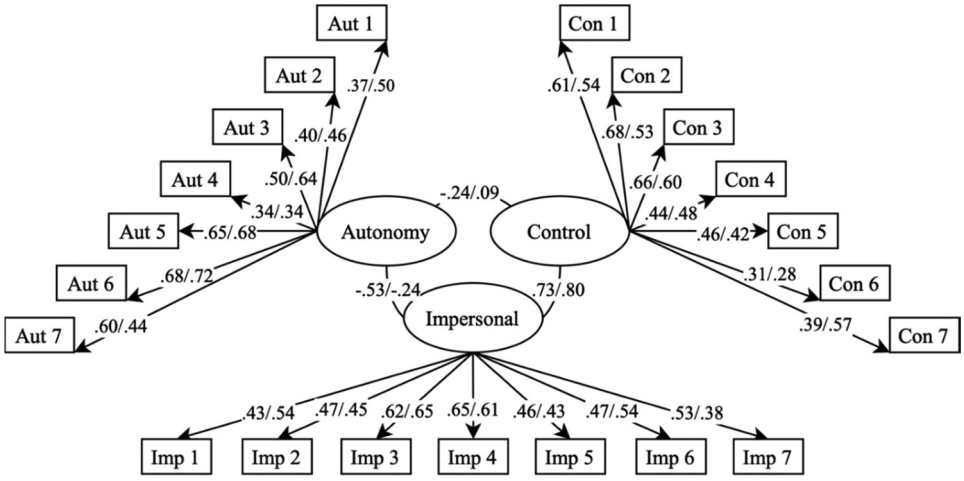

Figure 3. Confirmatory factor analysis from Study 1 (n = 276) and Study 2 (n = 447). Standardised factor loadings and covariances from Study 1 and 2 are presented separated by /. They are all significant ($p < .01$) except for the covariance between autonomy and control in Study 2 ($p = .209$).

orientation response, and 9c and 12b represent a controlled orientation response. The results showed that all the items loaded significantly on their respective orientation, thereby confirming satisfactory factor loadings scores. The standardised factor loadings of the seven-situation model were .34 to .68 for autonomy, .31 to .68 for controlled, and .43 to .65 for impersonal orientation (see Figure 3).

Table 2 provides the descriptive statistics for the subscales of the seven-situation questionnaire. Results showed a moderate negative correlation between autonomy and impersonal orientation ($p < .001$) and a moderate positive correlation between control and impersonal orientation ($p < .001$). Autonomy and control orientation were not found to be correlated ($p = .14$). The reliability coefficients (omega) were satisfactory for all the causality orientations (see Table 2).

Study 2

The seven-situation model (21 items, three items for each situation) was tested with corresponding residual correlations between items 2c and 3a, 5c and 6b and 5a and 6c to achieve an acceptable fit. These correlations

Table 2. Descriptive statistics, Pearson correlations and internal consistency of the causality orientations dimensions (Study 1; n = 276).

Orientations	*M*	*SD*	Skewness	Kurtosis	1	2	3
1. Autonomy	5.80	0.81	−0.52	−0.17	*.78*	−.09	−.43***
2. Control	3.69	1.15	0.26	−0.29		*.70*	.53***
3. Impersonal	2.73	1.09	0.65	0.01			*.74*

Note. Range orientations = 1–7. Omega coefficients are presented in the diagonal and in italics. ***$p < .001$.

correspond to responses that represent the same causality orientations, specifically 2c and 3a for impersonal orientation, and 5c and 6b for controlled orientation, as well as 5a and 6c for impersonal orientation. The scale presented an acceptable fit ($n = 447$; Robust CFI = .923; Robust TLI = .900; SRMR = .053; Robust RMSEA = .044; 90%-CI [.036; .053]). The results showed that all the items loaded significantly on their respective orientation, thereby confirming acceptable factor loadings scores. Standardised factor loadings were .34 to .72 for autonomy, .28 to .60 for controlled, and .38 to .65 for impersonal orientation (see Figure 3).

Before testing measurement invariance, CFA were conducted for both sexes and two adolescent stages (Table 3). Acceptable fit indicators were found for males and females, except for females' TLI, which was below the cut-off criteria. Comparisons with the configural model were satisfactory, resulting in measurement invariance across sex up to the scalar model. To achieve strict invariance, residual variances of items 1a, 2a, 2b, 2c, 3a, 3b, 4c and 6a, were freely estimated across sex. The new partial strict invariance model (M4p) showed an acceptable difference when compared to the configural model. The items indicated above were found to exhibit differential item functioning (DIF) across sex. Therefore, the practical significance of the DIF detected across sex was tested comparing across groups the standardised mean difference across groups, with and without the items in question. The resulting difference in *d* provides an index of the practical significance of the DIF detected. The DIF is considered trivial when the d value is lower than .20 (Chan, 2000). In the present study, the *d* difference was .089 for autonomy, .050 for control and .130 for impersonal. This suggests that the scale is valid and can be applied equally to both females and males, thus allowing for the assessment of sex-related differences.

The models of both early and late adolescents exhibited acceptable fit indices, except for the TLI of late adolescents. These results support measurement invariance across adolescent stages.

The results of the univariate analysis on sex and adolescent stage are presented in Table 4. All significant differences between sex for each orientation had a small effect size. There were no differences between adolescent stages for any orientation.

Pearson correlations between variables showed a significant negative correlation between autonomy and impersonal orientation, and a significant positive

Table 3. Tests of measurement invariance for sex and adolescent stages (Study 2; n = 447).

Model	χ2 (*df*)	R-CFI	R-TLI	R-RMSEA	ΔCFI	ΔTLI	ΔRMSEA
Sex							
M0 - Females	248.614 (162)	.897	.866	.051			
M0 - Males	218.799 (162)	.924	.902	.043			
M1	524.518 (324)	.910	.883	.047			
- Configural invariance (CM)							
M2 - Metric invariance	553.196 (342)	.905	.884	.047	.005	.001	.000
M3 - Scalar invariance	580.295 (360)	.900	.884	.047	.010	.001	.000
M4 - Strict invariance	680.082 (381)	.858	.844	.054	.052	.040	.009
M4p – Partial Strict invariance	532.969 (373)	.899	.886	.047	.011	.003	.001
Adolescent stages							
M0 – Early adolescents	195.671 (162)	.940	.923	.037			
M0 – Late adolescents	285.364 (162)	.894	.862	.055			
M1 - Configural invariance (CM)	536.095 (324)	.908	.881	.049			
M2 - Metric invariance	556.269 (342)	.909	.889	.048	.001	.007	.002
M3 - Scalar invariance	569.126 (360)	.912	.898	.046	.004	.017	.003
M4 - Strict invariance	610.122 (381)	.904	.894	.046	.004	.013	.003

Note. R-CFI = Robust Comparative Fit Index; R-TLI = Robust Tucker-Lewis Index; R-RMSEA = Robust Root Mean Square Error of Approximation; 90% CI = 90% Confidence Interval of RMSEA; SRMR = Standardized Root Mean Square Residual. CM = Comparison model used to calculate Δ.

Table 4. Univariate analyses for sex and adolescent stages (Study 2; n = 447).

Sex				
	Female *Median* (*iqr*)	Male *Median* (*iqr*)	*U*	*r*
Autonomy	5.57 (1.43)	5.86 (1.29)	21,571*	.12
Control	3.86 (1.57)	3.71 (1.57)	28,644***	.13
Impersonal	3.29 (1.75)	2.71 (1.29)	32,536***	.27
Adolescent stages				
	Early	Late		
Autonomy	5.71 (1.32)	5.71 (1.29)	23,044	–
Control	3.86 (1.57)	3.71 (1.50)	23,977	–
Impersonal	3.00 (1.61)	3.00 (1.57)	24,669	–

Note. iqr: interquartile range. *$p < .05$, ***$p < .001$.

Table 5. Descriptive statistics, Pearson correlations between causality orientations and enjoyment, and internal consistency (Study 2; n = 447).

	M	*SD*	Skewness	Kurtosis	1	2	3	4
1. Autonomy	5.58	1.01	−0.74	0.39	*.75*	.09	−.21***	.39***
2. Control	3.79	1.16	0.13	−0.21		*.67*	.56***	−.08
3. Impersonal	3.18	1.20	0.51	−0.16			*.68*	−.34***
4. Enjoyment	4.17	0.56	−0.97	1.48				*.81*

Range orientations = 1–7; range enjoyment = 1–5. Omega coefficients are presented in the diagonal and in italics. *$p < .05$, ***$p < .001$.

correlation between control and impersonal orientation. Autonomy and control orientation were not found to be correlated ($p = .057$). Additionally, enjoyment was positively correlated with autonomy orientation and negatively correlated with impersonal orientation. Enjoyment and control orientation were not found to be correlated ($p = .113$) (see Table 5).

Translation of SCOS items from Spanish into English

In order to expand its scope, the SCOS items originally developed in Spanish (see Appendix A) were translated into English for research with English-speaking populations. This process was conducted in accordance with the double translation and reconciliation procedure (ITC, 2018). This procedure is intended to address the shortcomings and risks of relying on idiosyncrasies of individual translations. A third independent translator, not a co-author of the paper, has resolved the discrepancies between the two translations and reconciled them into a single English version shown in the appendix (see Appendix B). Future studies employing English-speaking samples are necessary to confirm the validity and reliability of this SCOS English version.

Discussion

The aim of this work was to develop and validate the Sport Causality Orientations Scale (SCOS), a new measure grounded in SDT and applied in the sport setting (Study 1), and to confirm evidence of validity (Study 2) in a larger sample. Study 1 supported the validity and reliability of the preliminary version of the SCOS with adolescent' athletes. The SCOS consists of seven situations: one before competition, one during, and two after; two situations related to practice and one addressing general motivation. The SCOS contains 21 items for evaluating the three orientations: autonomy, controlled and impersonal orientations. This study provides evidence that causality orientations are represented by three separate and related dimensions.

Evidence of validity, reliability and measurement invariance

Study 2 aimed to assess the validity and reliability of the SCOS in a larger sample of adolescents participating in different sports. The seven-situation model showed good fit, acceptable standardised factor loadings and reliability. Moreover, the results supported measurement invariance across sex and adolescent stages. These results suggest that athletes responded similarly regardless of their sex or adolescent stage, allowing for comparison of average item and scale scores (Bowen & Masa, 2015). When comparing across sex, males exhibited greater autonomy orientation, while females exhibited more controlled and impersonal orientation. The literature on causality orientations across all domains (i.e., exercise, work, education, etc.) shows a lack of consensus in relation to differences by sex. Some studies suggested that females exhibited more autonomy orientation (Deci & Ryan, 1985b; Soenens et al., 2005; Wong, 2000), while males presented more controlled orientation (Deci & Ryan, 1985b). Another study found no differences by sex (e.g., Brenlla et al., 2013). Specifically in the exercise domain, some studies suggested more controlled orientation in females (e.g., Rose et al., 2001).

Beyond this inconsistency in the literature on causality orientations, these sex differences can be explained regarding gender stereotypes. The practice of sport has been stereotypically linked to masculinity (e.g., Chalabaev et al., 2013). This phenomenon exerts its influence on female athletes through two distinct pathways: the internalisation pathway, wherein an individual internalises a gender role and attempts to align her identity with it, and the situational pathway, where through priming processes, female athletes are influenced by stereotypical contexts, irrespective of their internalisation of such gender stereotypes (Chalabaev et al., 2013). These processes may explain why women are more oriented towards external sources of validation that reinforce athletes' self-perceptions, thus further promoting orientations towards control.

Finally, when considering the influence of sport contexts on variables related to intrinsic motivation,

enjoyment and engagement (which imply positive sport experiences), men tend to exhibit higher scores (Raimundi et al., 2024; Raimundi, Celsi, et al., 2021; Raimundi, Schmidt, et al., 2021). Furthermore, in accordance with previous studies (Brenlla et al., 2013; Halvari & Olafsen, 2020), no differences in causality orientations were found between adolescent stages. While Ryan and Deci (2017) propose that causality orientations may evolve over time, it is possible that a more extensive timespan is required to evidence variations in causality orientations. According to Sheldon and Prentice (2019), a 4-year period may be required to identify any differences.

In line with previous studies (Busch et al., 2019; Deci & Ryan, 1985b; Halvari & Olafsen, 2020; Rose et al., 2001; Vallerand et al., 1987), Study 2 found a negative and significant correlation between autonomy and impersonal orientation, and a positive and significant correlation between control and impersonal orientation. This correlation pattern suggests that the causality orientation dimensions are linked but independent variables (Hagger & Hamilton, 2020). This is consistent with the theoretical tenet that individuals endorse each orientation to varying degrees, and that it is plausible that they also exhibit profiles of scores on all three dimensions (Deci & Ryan, 1985b). In the Argentinean validation of the GCOS (Brenlla et al., 2013), a positive correlation was found between autonomy and controlled orientation, while no significant correlation was found between controlled and impersonal orientation. These differences may be due to the comparison of causality orientation measures from general versus specific domains, from different domains, or even from different populations.

As further evidence of scale validity, correlations were found between causality orientations and a relevant construct in sport, such as enjoyment, which is comprised of two dimensions: positive affect and involvement. The results showed expected associations in the anticipated direction, indicating that a higher score on the autonomy orientation was associated with a higher level of enjoyment. Furthermore, the present study found evidence that impersonal orientation was related to a reduced level of enjoyment. According to empirical evidence from SDT (Busch et al., 2019; Kwan et al., 2011; Rose et al., 2001, 2005; Ryan & Deci, 2017), autonomy orientation leads to greater psychological need satisfaction, promoting improved performance and well-being. High autonomy orientations have been related to higher levels of self-esteem, and self-actualisation (Deci & Ryan, 1985b). Also, Halvari and Olafsen (2020) found a positive correlation between autonomy orientation and work engagement, and a negative correlation between impersonal orientation and work engagement. Interestingly, in such study work engagement is measured by vigour, absorption and dedication, dimensions that conceptually resemble with those of the enjoyment scale used in this study: positive affect and involvement.

Limitations and future directions

Despite the strengths of the present research in the development and validation of the SCOS, it is important to note some limitations. Firstly, the sample used in this study was composed only of adolescents up to 19 years old. Therefore, it is recommended to apply this scale to a sample of older participants to better represent the sports community and test the scale's performance. Additionally, an imbalance between sexes was observed in Study 1, which should be considered when interpreting the results. The sample from Study 2 was properly balanced in terms of sex. However, due to sport culture in the country where this study was developed, most of the women came from field hockey, while most of the men came from basketball or football. This underscores the importance of conducting a comparative analysis of causality orientations across different sports and countries. Such an investigation would facilitate cross-cultural comparative research and enhance our understanding of the diverse cultural variations in causality orientations that underlie sports participation.

A further consideration is that certain items appear to reflect the consequences of a specific orientation (e.g., controlled orientation) rather than accurately capturing how individuals with that orientation would interpret the situation. This feature has also been documented in previous causality orientations instruments, including GCOS. Future research should examine whether rewording such items (e.g., item 6 of the controlled orientation, which had a significant factor loading, albeit below .30, was retained on the basis of its relevance to sporting contexts) to better align with the interpretative lens of each orientation could enhance the scale's psychometric performance.

Given the the cross-sectional nature of this study, it is not possible to draw conclusions about cause-and-effect relationships. Longitudinal studies would provide insight into the degree of stability of causal orientations and explore whether the autonomy orientation, which is associated with healthier outcomes, can be intentionally developed through an intervention. Such an intervention would aim not only to train individuals to modify how they interpret motivationally relevant information – whether stemming from the context or from within – but also to promote changes in the environment that support autonomy. Moreover, these studies can test the stability of causal orientations throughout adolescence, as Sheldon and Prentice (2019) did in the academic context.

To the best of our knowledge, the efficacy of autonomy-supportive coaching styles considering athletes' causality orientations in high performance has not yet been studied. Therefore, exploring the role of athletes' causality orientations could help us better understand the associations between coaches' autonomy-supportive or controlling styles and, for instance, athletes' well-being, engagement, and performance at this competitive level. This would answer coaches' everyday question: Is autonomy-supportive style always the best option?

Furthermore, there is a need for empirical evidence to support the effectiveness of coach training programmes in promoting autonomy support in athletes who exhibit a high degree of control or impersonal causality orientations.

Practical implications

A potential application of SCOS lies in its use within high-performance and professional sports settings, where the assessment of causality orientations can assist practitioners in targeting their interventions.

For example, a coach of a professional team would benefit from knowing the causality orientation of their athletes. In case that a coach implements an autonomy-supportive training programme in a highly control oriented team, the coach may need to exert additional effort to accentuate the autonomous motivational aspects of the training tasks, roles within the team, and the sport outcomes as a consequence of work focused on internal logic, mastery and striving for excellence. This is in contrast to a team that is comprised exclusively of athletes with high autonomy orientations.

Moreover, the SCOS can be useful in cases of coaching athletes with a high impersonal orientation. These athletes often perceive sport outcomes as uncontrollable, experience low efficacy, and demonstrate amotivation in the face of training and competition demands (Ryan & Deci, 2017). The identification of these profiles through the SCOS enables practitioners to implement early and targeted interventions aimed at restoring perceptions of autonomy and competence. This includes setting optimally challenging goals, providing structure and clear feedback, and emphasising effort over outcome to rebuild perceived control. Practitioners should focus on re-establishing autonomy, competence, and relatedness by teaching coaches' autonomy-supportive communication (e.g., offering choices), skill mastery experiences that generate small, repeated successes, and relational strategies (e.g., empathetic listening). Impersonal orientation is linked to ill-being, therefore monitoring such profiles may help flag athletes at psychological risk, prompting timely referral to psychological support services. Athletes with high impersonal orientation may benefit from reflective work on why they engage in sport, helping them reconnect with intrinsic or personally endorsed values. This can be facilitated by mental skills training and motivational interviewing approaches. Coaches working with these athletes should be trained to avoid controlling practices such as punitive feedback and pressure. Instead, they should provide structured environments that promote involvement and autonomy support practices, which have been shown to be negatively associated with amotivation (Mossman et al., 2022).

In light of these considerations, the SCOS can be used in the context of coach education and supervision to raise awareness about how coaching styles may differentially foster or undermine athletes' motivational orientations. The identification of high impersonal orientation in adolescent athletes can function as an early indicator of potential risks, including but not limited to dropout, emotional disengagement, or burnout. The scale provides a theoretically grounded and context-sensitive framework to inform and optimise applied work in youth sport settings.

Conclusions

The Sport Causality Orientations Scale (SCOS) is a reliable and valid scale for assessing causality orientations in the sport domain. The results of the study provide evidence that causality orientations in sport are a multidimensional construct represented by three separate orientations: autonomy, controlled and impersonal dimensions.

The study also confirms the positive associations between autonomy orientations and enjoyment (as a positive experience indicator) and negative associations between impersonal orientations and enjoyment, thus confirming the tenets of the Causality Orientation Theory (COT; Deci & Ryan, 1985b) and previous literature that offered evidence of associations between causality orientations and well/ill being (e.g., Brenlla et al., 2013; Bruno et al., 2022).

Given the potential influence of causality orientations on perceptions of interpersonal styles (Deci & Ryan, 1985b), this instrument will facilitate a deeper understanding of the motivational mechanisms, underlying sports participation during adolescence. This, in turn, will enable the design of interventions that promote positive adolescent development.

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Appendix A

Sport Causality Orientations Scale – Spanish version

A continuación, te presentamos una serie de situaciones deportivas. Imaginate en cada una de ellas e indica la probabilidad de que reacciones de la manera a, b o c. Si es muy improbable que respondas de esa manera, marca 1 o 2. Si es moderadamente probable, seleccioná un número del 3 al 5, y si es muy probable que respondas de esa manera, marca 6 o 7.

Situation 1	Te avisaron que no vas a formar parte de una convocatoria para una competencia (partido o torneo). Pensarías:
a) Control.	"Me avergüenza lo que mis compañeros puedan pensar de mí".
b) Autonomy	"Veré lo que puedo mejorar para que la próxima vez me convoquen".
c) Impersonal	"No soy lo suficientemente bueno para que me convoquen".
Situation 2	Durante una competencia estás cometiendo muchos errores. Lo primero que se te viene a la mente es:
a) Autonomy	"Sé que lo puedo hacer mejor".
b) Control	"Ojalá nadie note estos errores".
c) Impersonal	"Ya no quiero seguir jugando".
Situation 3	Luego de un mal resultado competitivo es probable que pienses:
a) Impersonal	"No sirvo para esto".
b) Autonomy	"Voy a repasar lo que hice bien y lo que hice mal para saber cómo mejorar".
c) Control	"Ojalá el/la entrenador/a no se enoje".
Situation 4	Tuviste una gran actuación en una competencia. Probablemente:
a) Control	Esperes algún reconocimiento del entrenador/a y/o de tus compañeros.
b) Autonomy	Sientas satisfacción y disfrute por tu rendimiento.
c) Impersonal	Pienses: "Fue pura suerte".
Situation 5	Estuviste practicando tu deporte regularmente desde hace mucho tiempo, pero recientemente faltaste a algunos entrenamientos y te está costando motivarte para seguir la rutina de entrenamiento. Es probable que:
a) Impersonal	Ignores el problema, ya que no se puede hacer nada para mejorar tu motivación.
b) Autonomy	Uses tus propias estrategias para motivarte.
c) Control	Esperes a que alguien te ayude a motivarte.
Situation 6	Te dicen que establecer objetivos es una buena forma de motivarse para practicar deporte. Probablemente:
a) Autonomy	Te propongas tus propios objetivos.
b) Control	Le pidas a tu entrenador/a que te establezca objetivos.
c) Impersonal	No te propongas objetivos porque será difícil cumplirlos.
Situation 7	Estás practicando una nueva técnica o táctica. Probablemente:
a) Autonomy	Te interese aprender algo nuevo.
b) Impersonal	Te sientas nervioso/a por practicar algo nuevo.
c) Control	Estés pendiente de la evaluación de tu entrenador/a.

Appendix B

Sport Causality Orientations Scale – English version

Below, we present a series of sports situations. Please imagine yourself in each situation and indicate how likely you are to react in way a, way b, and way c. If it is very unlikely that you would respond that way, mark 1 or 2. If it is moderately likely, select a number from 3 to 5, and if it is very likely that you would respond that way, mark 6 or 7"

Situation 1	You were informed that you will not be on the roster for a competition (match or tournament). You would think:
a) Control.	"I'm ashamed of what my teammates might think of me".
b) Autonomy	"I'll see what I can do better so that next time I'll be called up".
c) Impersonal	"I'm not good enough to be called up".
Situation 2	During a competition, you are making many mistakes. The first thing that comes to your mind is:
a) Autonomy	"I know I can do better".
b) Control	"I hope no one notices these mistakes".
c) Impersonal	"I don't want to keep playing anymore".
Situation 3	After a bad competitive result, you would think:
a) Impersonal	"I'm not good at this".
b) Autonomy	"I'm going to review what I did well and what I did wrong to figure out how to improve".
c) Control	"I hope the coach doesn't get mad".
Situation 4	You had a great performance in a competition. Probably:
a) Control	You would expect some recognition from your coach and/or teammates.
b) Autonomy	You would feel satisfaction and enjoyment from your performance.
c) Impersonal	You would think: "It was pure luck".
Situation 5	You have been practicing your sport regularly for a long time, but recently you missed some training sessions and are finding it hard to stay motivated to follow your training routine. Chances are, you would:
a) Impersonal	Ignore the problem, since nothing can be do to improve your motivation.
b) Autonomy	Use your own strategies to motivate yourself.
c) Control	You wait for someone to help motivate you.
Situation 6	You are told that setting goals is a good way to motivate yourself to practice sports. Probably:
a) Autonomy	You would set your own goals.
b) Control	You would ask your coach to set goals for you.
c) Impersonal	You wouldn't set goals because it will be difficult to achieve them.
Situation 7	You are practicing a new technique or tactic. Probably:
a) Autonomy	You would feel interested in learning something new.
b) Impersonal	You would feel nervous about practicing something unfamiliar.
c) Control	You would be aware of your coach's evaluation.