Psychology of Sport & Exercise 79 (2025) 102863

Contents lists available at ScienceDirect

Psychology of Sport & Exercise

journal homepage: www.elsevier.com/locate/psychsport

"Why am I doing this anyway?" A control-value perspective on boredom in endurance sports

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ARTICLE INFO

Keywords:
Sports and exercise
Affective processes
Control and value appraisals
Endurance running and cycling
Psychometric network analysis

ABSTRACT

Boredom is a common experience in daily life, yet it has been largely overlooked in the context of sports and exercise. This neglect is perplexing, especially considering that endurance sports can have characteristics conducive to boredom. To fill this gap, we investigated boredom in endurance sports, along with its antecedents and consequences, through the lens of control-value theory (CVT). In a study involving 667 predominantly recreational runners and cyclists, we found support for CVT's predictions. Specifically, lower levels of self-concept, greater levels of underchallenge and overchallenge, as well as lower levels of value were all linked to increased boredom. In turn, higher levels of boredom were associated with more negative psychological (e.g., less satisfaction) and behavioral consequences (e.g., reduced training). Few differences emerged between runners and cyclists, and these differences were primarily in the magnitude of effects. Overall, our research demonstrates that CVT is a promising theoretical framework for studying boredom in sports and exercise. Conversely, endurance sports provides a natural environment in which people experience boredom, and studying boredom in this context might thus provide novel insights into boredom research and CVT. This perspective also suggests actionable insights for practitioners and researchers to mitigate boredom more effectively.

1. Introduction

Boredom is a ubiquitous sensation in daily life and experienced in various contexts (Bieleke et al., 2024). For example, people report feeling bored while waiting for public transport, during their leisure time, while studying for school or university, and when performing their jobs (Chin et al., 2017). Boredom is inherently aversive and unpleasant (Eastwood et al., 2012), prompting people to avoid or escape it whenever possible (Bieleke, Ripper, et al., 2022). Due to its unpleasant nature, boredom plays a crucial role in the regulation of human behavior: It serves as a powerful and difficult to ignore signal that the current course of action might not be worthwhile (Bench & Lench, 2013), urging individuals to explore potential alternatives (Bieleke & Wolff, 2021; Danckert, 2019). Any change in action can address this signal, even a mental escape from the situation (Martarelli & Baillifard, 2024) and regardless of whether the consequences of this change are positive or negative (Bieleke, Ripper, et al., 2022). This impartiality is reflected in empirical research linking boredom not only to negative outcomes, such as self-harming behavior (Wilson et al., 2014) and sadistic aggression (Pfattheicher et al., 2021), but also to some positive outcomes, such as creativity (Gasper & Middlewood, 2014) and prosociality (Van Tilburg & Igou, 2017). Given its prevalence and significance in orienting human behavior, boredom has become a major focus of research across various disciplines in the behavioral sciences (for an overview, see Bieleke et al., 2024).

Ideally, people would swiftly adjust their activities to keep boredom at bay, which is considered crucial for well-being (Elpidorou, 2018). However, the introductory examples suggest that this is often not possible, as people can become stuck in situations with limited freedom. Prototypical examples include academic contexts (Pekrun et al., 2010) and work settings (Van Hooff & Van Hooft, 2014), where students and workers cannot readily leave the environment or change their activities. Consequently, academic boredom and workplace boredom are common and predominantly linked to negative outcomes (for reviews, see Goetz et al., 2024; Stempfer et al., 2025; Van Hooft & Van Hooff, 2024). The COVID-19 pandemic is another relevant example, where behavioral restrictions led to peak boredom levels and numerous negative consequences, such as reduced compliance with social-distancing regulations

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https://doi.org/10.1016/j.psychsport.2025.102863
Received 23 November 2024; Received in revised form 24 April 2025; Accepted 26 April 2025
Available online 30 April 2025

that were implemented to slow down the spread of the pandemic (Martarelli, Wolff, & Bieleke, 2021; Wolff et al., 2020). Beyond situations that make most people bored, some people experience boredom more frequently and more intensely than others (Farmer & Sundberg, 1986). This tendency is consistently linked to low levels of self-control (Bieleke, Wolff, & Bertrams, 2024), making it difficult to adjust activities to address boredom effectively (Bieleke, Wolff, & Keller, 2022; Mugon et al., 2018). Self-control is essential for the adoption and maintenance of adaptive behaviors (Moffitt et al., 2011), and this might explain why people who frequently experience intense boredom are less likely to engage in adaptive behaviors like physical activity (Wolff, Bieleke, Stähler, & Schüler, 2021) and are more likely to engage in maladaptive behaviors instead, such as problematic eating, drug use, and excessive media consumption (Bieleke, Ripper, et al., 2022; Vodanovich & Watt, 2016). This combination of engaging in fewer adaptive and more maladaptive behaviors is associated with poor mental and physical health and shortened life expectancy (e.g., Britton & Shipley, 2010; Schwartze et al., 2021; Sommers & Vodanovich, 2000).

1.1. Boredom in endurance sports

Taken together, boredom is a common and impactful experience across many areas of life. However, sports and exercise are typically not associated with boredom, probably because people report being bored during these activities less often than during other activities (Chin et al., 2017). Unlike at school or at work, people seem to be able to decide freely when, where, and how to be active. Yet, sports and exercise is often performed within the confines of training programs, fitness guidelines, environmental conditions, club requirements, coach instructions, and more. It is thus not surprising that boredom can play an important role in sports and exercise as well (Wolff, Bieleke, Martarelli, & Danckert, 2021; Wolff et al., 2024), and even professional athletes experience sport-related boredom with detrimental effects on their performance (Velasco & Jorda, 2020). Among the different types of sports and exercise, endurance sports have specific properties that make boredom a particularly likely occurrence. For example, Loewenstein (1999, p. 320) described long-distance mountaineering as “the worst possible combination of long periods of stultifying boredom punctuated by brief periods of terror. On a typical ascent, the vast majority of time is spent in mind-bogglingly monotonous activities”. Associating endurance sports with boredom is by no means a new phenomenon, however, nor one restricted to mountaineering. Nearly a century ago, the repetitive and monotonous movements in endurance training were compared to tedious assembly line work (Davies, 1926). Endurance training requires the performance of low-to-moderate intensity movements over long periods of time, which can feel monotonous and underchallenging (Martarelli et al., 2023). At the same time, endurance performance requires the successful regulation of a multitude of physiological, nutritional, and psychological demands (Konopka et al., 2022), which can lead to overchallenge (Hirsch et al., 2021), trigger action crises (Weich et al., 2022), and elicit feelings of inadequacy regarding one’s abilities (McCarville, 2007).

Repetitiveness, monotony, low value, diminished perceptions of ability, and the presence of underchallenging and overchallenging demands – all of these characteristics are key ingredients of boredom inductions typically used in experimental research (e.g., Markey et al., 2014; Struk et al., 2021; Westgate & Wilson, 2018). Put differently, endurance sports could likely serve as a natural setting for studying boredom under real-life conditions. Supporting this idea, individual links between boredom and sports-related psychological factors have been established in physical education (e.g., monotony, control and value appraisals; Duda & Nicholls, 1992; Lye & Kawabata, 2021; Morales-Sánchez et al., 2021) and physical performance research (e.g., self-control, mental fatigue; Hunte et al., 2022; Mangin et al., 2021; Pickering et al., 2024; Wolff, Bieleke, Martarelli, & Danckert, 2021). Unfortunately, systematic and theory-driven research on boredom in endurance sports is currently lacking.

1.2. Control-value theory of boredom

To address this gap, we investigated boredom in endurance sports through the lens of control-value theory (CVT; Pekrun, 2006; 2018, 2023), a well-established theory that accounts for the causes and consequences of boredom (Pekrun et al., 2010; Pekrun & Goetz, 2024). As shown in Fig. 1, CVT considers aspects of the environment as distal antecedents of boredom, whereas control and value appraisals are considered proximal antecedents. Boredom itself is seen as an emotion with a unique signature of affective (aversive, unpleasant), cognitive (e.g., distorted time-perception, mind-wandering), motivational (e.g., failure to start, urge to quit), and physiological components (e.g., tiredness, depletion). Experiencing boredom is further assumed to have downstream effects on attention, information processing, motivation, action, and performance. Finally, CVT assumes that the links between boredom, its outcomes, and its antecedents are reciprocal through both positive and negative feedback loops (e.g., boredom can impair performance, which in turn decreases value and control appraisals). These feedback loops imply that boredom can be regulated through strategies that target either the antecedents and consequences of boredom or directly address one of the components of boredom.

CVT has been developed and primarily applied in academic settings, including the domain of physical education (Simonton & Garn, 2019). However, to our knowledge, no research has yet examined CVT’s propositions in sports and exercise contexts in general or in endurance sports in particular. To gauge the potential relevance of CVT in these domains, we interviewed endurance athletes to understand how they perceive boredom and to examine whether their descriptions were compatible with CVT’s assumptions. Fig. 1 summarizes the responses we received, showcasing exemplary statements from the interviews that illustrate various ways in which CVT relates to athletes’ experience of boredom, including its causes, consequences, and regulation. The interviews suggest a broad consensus between the core aspects of CVT and the athletes’ descriptions of their experiences, indicating that CVT could indeed be valuable for understanding boredom in endurance sports. This observation encouraged us engage in an empirical investigation of CVT’s predictions in this domain.

1.3. CVT predictions regarding boredom

The literature on CVT allows us to derive specific predictions for boredom in endurance sports: Specifically, these predictions pertain to how boredom is linked to perceptions of control and value appraisals as antecedents, and how boredom, in turn, is linked to psychological and behavioral outcomes as consequences. In the following, we outline these predictions one by one.

1.3.1. Control appraisals

First, boredom should be linked to perceived control, which pertains to one’s perceived causal impact on activities and outcomes. For example, having the expectation that more vigorous training will lead to better performance indicates a higher level of perceived control. Many studies on CVT operationalize control in terms of one’s self-concept (“I’m good in doing XY”) and generally find a monotonically negative link between control and boredom, where more positive self-perceptions are associated with lower levels of boredom (e.g., Forsblom et al., 2022; Pekrun et al., 2010). Similar patterns have been observed in physical education research (e.g., Simonton et al., 2017). While this finding is in line with CVT, an individual’s self-concept might not capture the entire spectrum of control, particularly the extremes of very high (underchallenge) and very low (overchallenge) levels of control. According to CVT, higher levels of both underchallenge and overchallenge should be linked to higher levels of boredom. Studies that have directly measured or induced perceived control through over- and underchallenge (“Doing

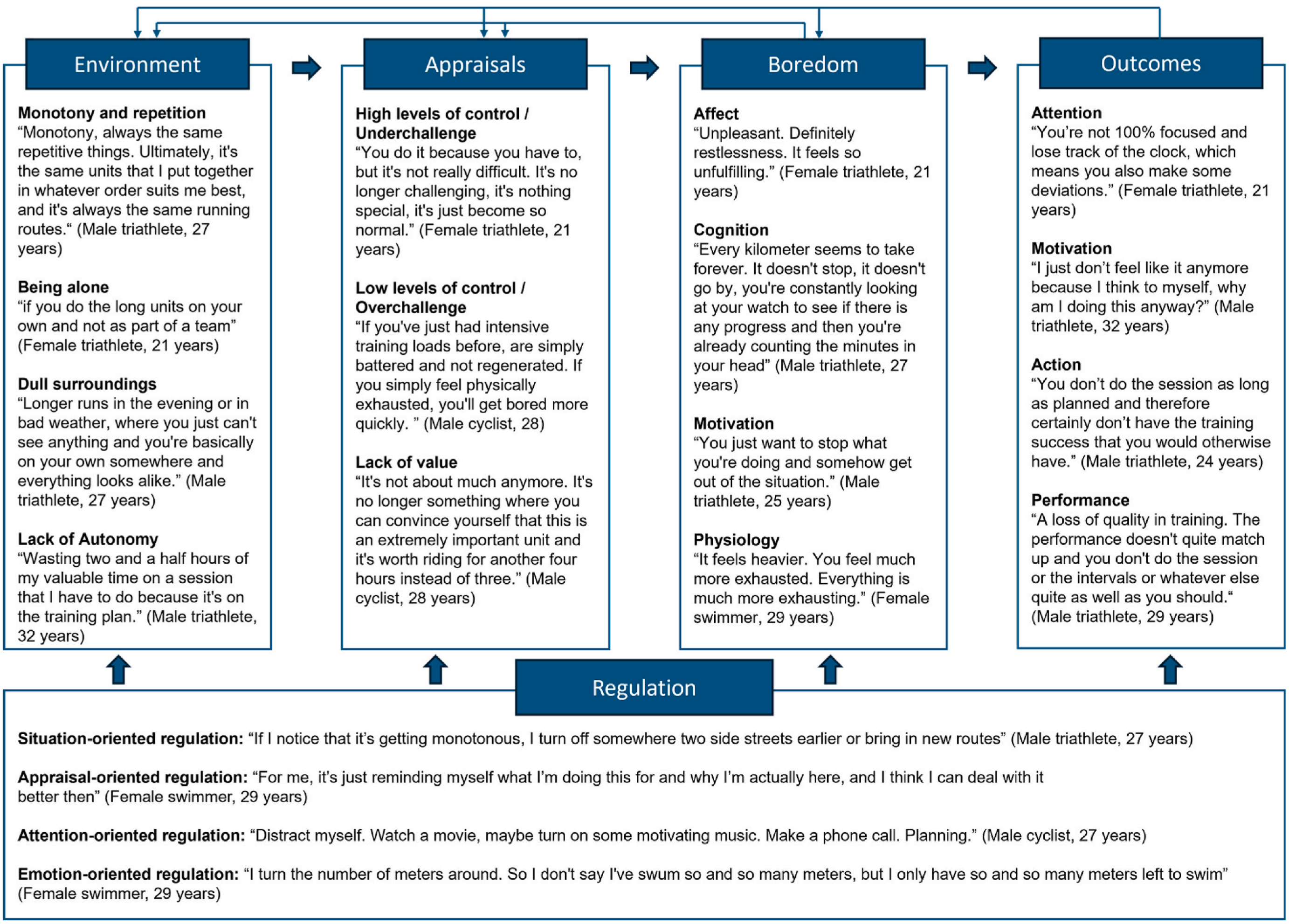

Fig. 1. The control-value theory (CVT) of boredom with examples from endurance sports.
Note. The quotes are taken from semi-structured interviews conducted with 15 experienced endurance athletes, mostly triathletes. They reported on their experience of boredom along the lines of the control value theory (CVT). The interviews were conducted in German, selected quotes were translated to English and edited for clarity. We provide the complete original German interview transcripts on OSF (https://osf.io/m3a7g/). See main text for a detailed description of CVT.

XY underchallenging/overchallenging for me”) support this assumption, revealing a positive link between boredom and both underchallenge and overchallenge (Goetz et al., 2023; Krannich et al., 2019; Struk et al., 2021). Therefore, we measured perceived control through both self-concept and under-/overchallenge, expecting that the relationship between control and boredom depends on the operationalization as in previous research on CVT. Specifically, when control is measured in terms of self-concept, we expect a negative relationship with boredom. Conversely, when control is measured via under- and overchallenge, we predict a positive relationship with boredom.

1.3.2. Value appraisals

Second, boredom in endurance sports should be linked to perceived value, which pertains to the valence of achievement activities and outcomes. For instance, considering endurance sport as personally important or as instrumental for attaining one’s fitness goals reflects higher levels of value. According to CVT, boredom is the only emotion associated with low rather than high levels of value. In line with this idea, there is ample evidence for a monotonic negative link between value and boredom in research on CVT (Pekrun et al., 2010). Accordingly, we hypothesized a negative association between boredom and value in endurance sports.

1.3.3. Interaction between control and value appraisals

In addition to the individual links of control and value with boredom outlined so far, CVT predicts interactive effects between these factors in their relationship to boredom. Specifically, the theory suggests that the impact of control on boredom is moderated by the level of value (Pekrun & Goetz, 2024). The relationship between control and boredom—such that lower self-concept and higher levels of underchallenge and overchallenge are linked to higher boredom—should be especially strong when perceived value is low. Conversely, when value is high, the link between control and boredom should weaken. Given that this interaction has been rarely tested in empirical research, we examine the interplay between control and value in an exploratory manner.

1.3.4. Psychological and behavioral outcomes

According to CVT, boredom has various negative psychological and behavioral consequences (Pekrun & Goetz, 2024). It impairs cognitive resources and taxes self-regulation capacities (Bieleke, Wolff, & Bertrams, 2024; Wolff & Martarelli, 2020), increasing perceived exertion while simultaneously reducing the amount of effort individuals are willing to invest (Bieleke et al., 2021). Moreover, boredom diminishes motivation to engage with the task at hand (Bench & Lench, 2013; Pekrun et al., 2010), suggesting reduced goal setting, planning, and a lack of satisfaction from the activity (Bieleke, Wolff, & Keller, 2022). Consequently, boredom can undermine individuals’ overall engagement in their activities. Based on these findings, we predict that higher levels of boredom will be linked to negative psychological and behavioral outcomes in endurance sports. Specifically, we expect that increased boredom will correlate with reduced satisfaction with the activity, less frequent goal setting and planning, and a heightened perception of physical exertion accompanied by reduced cognitive effort. Additionally, we assume that people who associate sports with boredom will also train less and have fewer years of experience with their sports.

2. Present research

To test CVT predictions in the context of endurance sports, we measured boredom alongside control (self-concept, under- and overchallenge) and value appraisals, alongside potential psychological and behavioral consequences, in a sample of recreational endurance athletes. We focused on running and cycling, two of the most popular recreational endurance activities, anticipating a large number of participants engaging in these sports. This study aims to shed light on how CVT concepts apply to endurance sports and the role boredom plays in influencing motivation and engagement. We expected that lower levels of self-concept, greater perceptions of underchallenge and overchallenge, and lower levels of value would be associated with higher levels of boredom. In turn, we predicted that boredom would be linked to negative psychological and behavioral consequences. Additionally, we explored the potential interactions between control and value in their relationship to boredom and examined differences between runners and cyclists in how they experience and respond to boredom. The study was not preregistered.

3. Methods

3.1. Participants

Our goal was to recruit as many participants as possible to maximize the precision of our estimates. The sample comprised 851 predominantly recreational endurance athletes from German-speaking countries, recruited through social media postings (e.g., Facebook, Instagram). Participants who specified either running (n = 354, 41.6 %) or cycling (n = 409, 48.1 %) as their main sport were included in the analyses. The remaining participants reported to perform no sport at all (n = 8, 0.9 %), a different kind of sport (e.g., skiing, hiking; n = 64, 7.5 %), or failed to answer the question (n = 16, 1.9 %). Of the eligible runners and cyclists, n = 94 (12.3 %) were excluded because they provided no data on the analyzed measures and n = 2 (0.3 %) were excluded for providing implausible data.

This results in a final sample size of N = 667 participants (305 female, 358 male, 4 diverse) with a mean age of M = 39.3 years (SD = 11.2). The majority of participants was from German-speaking countries (n = 637, 95.5 %) and reported engaging in their sport on a hobby level (n = 647, 97.0 %) rather than professionally (n = 20, 3.0 %).[1] Participants had an average of M = 12.1 (SD = 11.2) years of sport-specific experience, with n = 247 (37.0 %) actively competing at local (n = 77, 11.5 %), regional (n = 59, 8.9 %), national (n = 51, 7.7 %), and international levels (n = 39, 5.9 %).The remaining n = 420 (63.0 %) did not aim to compete. On average, participants trained M = 3.5 (SD = 1.4) times per week, with sessions lasting M = 80.5 (SD = 44.5) minutes on average.

3.2. Materials

Participants completed all questionnaires online via SoSciSurvey (Leiner, 2024). In the questionnaires, we either referred to running or cycling depending on the main sport participants had indicated at the beginning of the study. We report the materials used for answering the present research question, a full overview of the survey materials is available on OSF (https://osf.io/m3a7g/). Participants provided informed consent before taking part in the study and confirmed their voluntary participation. The study was conducted in accordance with the Declaration of Helsinki and adhered to guidelines for ethical research involving human participants as set by the local ethics committee.

3.2.1. Boredom

We assessed sport-specific boredom with the Bored of Sports Scale (BOSS; Wolff, Bieleke, Stähler, & Schüler, 2021), which is an adapted version of the Achievement Emotions Questionnaire's (AEQ; Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) boredom scale. The BOSS comprises 11 items that cover the affective (e.g., "Running/cycling bores me to death"), cognitive (e.g., "Running/cycling is so boring that I find myself daydreaming"), motivational (e.g., "Because I'm bored, I have no desire to go running/cycling"), and physiological aspects of boredom (e.g., "While running/cycling I seem to drift off because it's so boring"). Participants responded on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*). The internal consistency was ω = 0.90 (95 % CI [0.89, 0.91]).

3.2.2. Control appraisals

We administered eight items of the Physical Abilities subscale (e.g., "I'm a good runner/cyclist") of the German version of the Self-Description Questionnaire III (Marsh & O'Neill, 1984; Schwanzer et al., 2005) to measure participants' control appraisal in terms of their sport-specific self-concept. The internal consistency was ω = 0.86 (95 % CI [0.85, 0.88]). Additionally, we assessed the degree of under- and overchallenge as indicators of control with single items ("I'm underchallenged when running/cycling" and "I'm overchallenged when running/cycling") (Goetz et al., 2023). Participants responded on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*).

3.2.3. Value appraisals

We administered seven items measuring value adapted from Gaspard et al. (2015). These items reflect both intrinsic value (e.g., "I like running/cycling") and value due to importance ("Running/cycling is important to me personally"). Participants responded on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*). The internal consistency was ω = 0.86 (95 % CI [0.85, 0.88]).

3.2.4. Satisfaction

We measured satisfaction with six items (e.g., "I'm satisfied with my running/cycling achievements", "I'm satisfied with the improvement in my running/cycling skill levels") adapted from the Athlete Satisfaction Questionnaire (ASQ; Riemer & Chelladurai, 1998). Participants responded on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*). The internal consistency was ω = 0.87 (95 % CI [0.85, 0.88]).

3.2.5. Physical exertion and cognitive effort

We adapted the Perception of Distributed Effort of Team Sports Questionnaire (DETSQ; Beniscelli, Alcaraz, Torregrosa, & Tenenbaum, 2018) to measure physical exertion with five items (e.g., "After running/cycling, I felt physically exhausted", "After running/cycling, I had tired legs") and cognitive effort with four items (e.g., "During running/cycling, I have controlled my emotions in crucial moments", "During running/cycling, I stayed focused"). The instruction referred to how participants felt during their recent training sessions. Participants responded on a 5-point Likert scale (1 = *completely disagree*, 5 = *completely agree*). The internal consistency was ω = 0.82 (95 % CI [0.80, 0.85]) for physical exertion and ω = 0.77 (95 % CI [0.74, 0.80]) for cognitive effort.

[1] The small percentage of athletes in our sample who identified as professional (3 %) could potentially influence the results. To address this, we conducted all regression analyses with professional status as a covariate. However, as this did not affect the pattern of effects or their significance, we retained these participants and report results without this covariate.

3.2.6. Goal setting and planning

We adapted six items from the Olympic Goal Practices Questionnaire (OGPQ; Burton, Pickering, Weinberg, Yukelson, & Weigand, 2010) to measure participants' usage of psychological goal setting and planning strategies (e.g., "How often do you set daily goals to improve your running/cycling performance?", "How often do you develop specific plans to improve your running/cycling performance?"). Participants responded on a 5-point Likert scale (1 = *never*, 5 = *always*). The internal consistency was ω = 0.92 (95 % CI [0.90, 0.93]).

3.2.7. Demographics

Participants reported their gender (female, male, diverse) and their age in years. We also assessed participants' nationality and employment status.

3.2.8. Sports and exercise behavior

Participants indicated whether their primary sport was running, cycling, both, or a different sport. If participants engaged in both running and cycling, a follow-up question asked them to select which sport they performed more regularly, with subsequent questions based on that choice. We assessed the frequency (1–7 times per week) and the duration (minutes per day) of training for their primary sport and combined these measures to calculate the overall training load in minutes per week (frequency x duration). Additionally, participants reported how long they had been practicing their main sport (in years) to gauge their experience. Although we collected other sports-related variables (e.g., reasons for engaging in their sport, competition experience), these were not analyzed as they were not relevant to the current research.

3.3. Data analysis

All analyses were conducted in the statistical programming environment R (R Core Team, 2023). The data and analysis scripts, including the specific packages and functions used, are available on OSF (https://osf.io/m3a7g/). We conducted a psychometric network analysis (Borsboom et al., 2021) to explore the relationships between the various questionnaires and the psychometric properties of our sports-related boredom measure. To ensure that network structures were comparable between runners and cyclists, we conducted an invariance test to assess global network structure, individual edges, global strength, and various measures of centrality (closeness, betweenness, strength, and expected

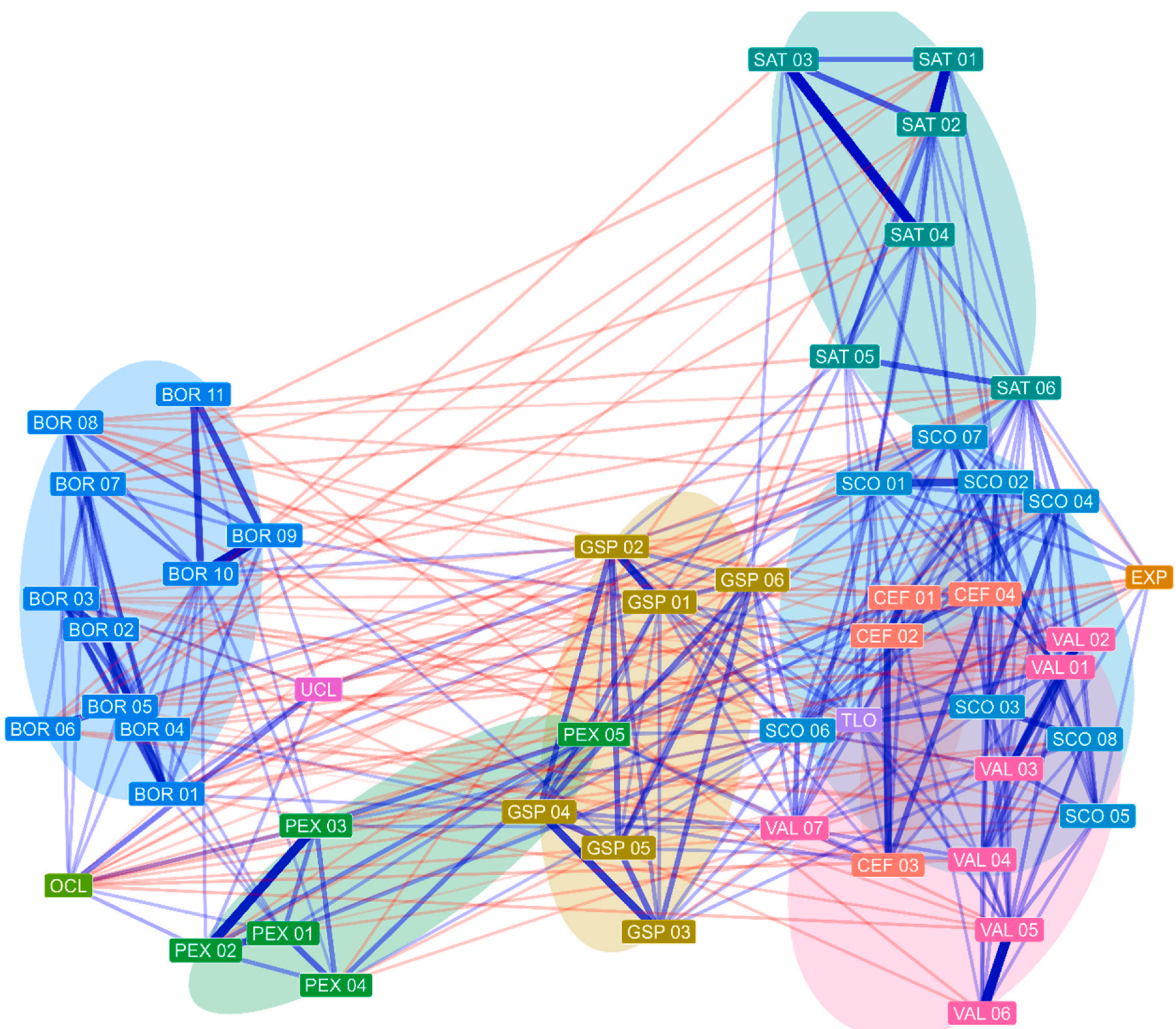

Fig. 2. Psychometric network of the assessed variables

Note. BOR = boredom, CEF = cognitive effort, EXP = experience, GSP = goal setting and planning, OCL = overchallenge, PEX = perceived exertion, SAT = satisfaction, SCO = self-concept, TLO = training load, UCL = underchallenge, VAL = value. Blue lines represent positive associations, red lines represent negative associations. Line thickness represents the strength of the association. Ellipses are drawn to highlight the items belonging to a multiitem scale. We used multidimensional scaling (MDS) to make distances between nodes more interpretable, such that highly related nodes are displayed closer together than unrelated nodes (Jones et al., 2018). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

influence). The Holm adjustment was applied to control for multiple testing of edges and centrality measures. To test our main hypotheses, we examined the links between boredom and its potential causes and consequences using multiple linear regressions. To explore potential differences between these two endurance sports, we also included a dummy variable (baseline = runners) and its interactions with the associations of interest, testing these links separately for each sport.

4. Results

Supplementary Table 1 shows descriptive statistics and bivariate correlations of the variables included in the analyses.

4.1. Psychometric network analysis

Items belonging to different constructs formed coherent and distinguishable communities throughout the psychometric network (Fig. 2), indicating that the employed questionnaires items effectively captured the intended content domains. The strongest associations appeared within constructs, as shown by the thicker edges between nodes belonging to the same instrument, while numerous connections also emerged between constructs. Supporting the core assumptions of control-value theory (CVT), boredom was closely linked to its presumed causes and consequences. There was notable overlap between items measuring self-concept and value, indicating a close relationship between these constructs. The items measuring underchallenge and overchallenge were located closer to boredom and perceived exertion. Additionally, items tapping into the presumed consequences of boredom—reduced satisfaction, increased perceived exertion, decreased cognitive effort, and diminished goal setting and planning—formed distinct communities. Their position in relation to both boredom and control and value appraisals may reflect their involvement in reciprocal links described by CVT. For example, experiencing boredom might cause people to train less, which could have detrimental effects on their self-concept. Overall, the psychometric network analysis indicates that the employed scales measured the constructs as intended, revealing content domains and interrelations both within and across constructs that are consistent with CVT.

We established the invariance of psychometric networks for runners and cyclists in terms of the global network structure, $M = 0.22$, $p = .437$, and the global strength, $S = 0.84$, $p = .332$. Corroborating these findings, no significant differences between edges and centrality indices emerged after applying Holm's adjustment. This invariance test suggests that the relationships between constructs were comparable between runners and cyclists, allowing us to proceed with testing our hypotheses.

4.2. Causes of boredom

4.2.1. Individual effects of control and value appraisals

A more positive self-concept was associated with lower levels of boredom, $\beta = -0.52$, SE = 0.03, $p < .001$, with no difference between runners and cyclists, $\beta = 0.13$, SE = 0.107, $p = .073$. Higher levels of both underchallenge, $\beta = 0.18$, SE = 0.04, $p < .001$, and overchallenge, $\beta = 0.31$, SE = 0.04, $p < .001$, were associated with higher levels of boredom. While the link between underchallenge and boredom was similar for runners and cyclists, $\beta = -0.13$, SE = 0.08, $p = .083$, a statistically significant interaction emerged for overchallenge, $\beta = -0.26$, SE = 0.08, $p < .001$, reflecting a stronger link between overchallenge and boredom among runners, $\beta = 0.41$, SE = 0.05, $p < .001$, than among cyclists, $\beta = 0.15$, SE = 0.05, $p = .005$. Finally, higher levels of value were associated with lower levels of boredom, $\beta = -0.57$, SE = 0.03, $p < .001$, with no difference between runners and cyclists, $\beta = 0.04$, SE = 0.08, $p = .608$. An overview of individual links of boredom with self-concept, underchallenge, overchallenge, and value is displayed in Supplementary Table 2.

4.2.2. Interactive effects of control and value appraisals

An overview of interactions between control and value appraisals is displayed in Fig. 3 (see also Supplementary Table 3). A two-way interaction between self-concept and value emerged, $\beta = -0.05$, SE = 0.02, $p = .014$, but was governed by a three-way interaction signifying differences between runners and cyclists, $\beta = 0.29$, SE = 0.07, $p < .001$. Following up on this result, a negative interaction of self-concept and value emerged for runners, $\beta = -0.10$, SE = 0.02, $p < .001$. Increasing levels of value were associated with less boredom, and this link was stronger at high compared to low self-concept scores. For cyclists, the interaction of control and value was positive, $\beta = 0.19$, SE = 0.06, $p = .002$. Increasing levels of value were associated with less boredom, and this link was weaker at high compared to low self-concept scores. This suggests that a more positive self-concept is accompanied by a stronger negative link between value and boredom among runners and vice versa among cyclists.

Additionally, there was an interaction of underchallenge and value, $\beta = -0.08$, SE = 0.03, $p = .008$, with no differences between runners and cyclists, $\beta = 0.05$, SE = 0.07, $p = .481$. The negative link between value and boredom was stronger at higher levels of underchallenge. No interaction of overchallenge and value emerged, $\beta = -0.002$, SE = 0.03, $p = .929$, both for runners and cyclists, $\beta = -0.03$, SE = 0.08, $p = .741$.

4.3. Consequences of boredom

Across runners and cyclists, boredom was associated with reduced satisfaction, $\beta = -0.37$, SE = 0 0.04, $p < .001$, more perceived exertion, $\beta = 0.16$, SE = 0 0.04, $p < .001$, lower cognitive effort, $\beta = -0.31$, SE = 0 0.04, $p < .001$, less training, $\beta = -0.23$, SE = 0 0.04, $p < .001$, and less sport-specific experience, $\beta = -0.15$, SE = 0 0.04, $p < .001$, while no link emerged with goal setting and planning, $\beta = -0.07$, SE = 0 0.04, $p = .097$. Differences between runners and cyclists emerged for satisfaction, $\beta = 0.21$, SE = 0 0.08, $p = .011$, and for cognitive effort, $\beta = 0.18$, SE = 0 0.08, $p = .034$, indicating that their association with boredom was weaker among cyclists than among runners (but still statistically significant). An overview of these findings is displayed in Supplementary Table 4.

5. Discussion

Millions of individuals worldwide engage in endurance sports, with the number of endurance event participants and members of exercise networks like Strava on the rise (e.g., Curry, 2024; Vitti et al., 2020). This popularity may stem in part from the inherent challenges of endurance performance, which encompass not only physiological and nutritional demands but also significant psychological challenges (Konopka et al., 2022). Endurance sports are often marked by repetitive and monotonous movements that are performed over prolonged periods, repeatedly exposing athletes to situations of little value and inadequate levels of control over their actions and outcomes. This provides fertile grounds for experiencing boredom, making endurance sports well suited for studying boredom alongside its causes and consequences. To date, boredom is increasingly studied in the context of sports, exercise, and physical education (for an example in endurance sports, see Weich et al., 2022), and is linked to key behavioral and performance-related factors (e.g., monotony, control and value, self-control, mental fatigue; Hunte et al., 2022; Lye & Kawabata, 2021; Pickering et al., 2024). However, it is often treated as an auxiliary outcome (e.g., as a potential confound in self-control studies; Hunte et al., 2022), and dedicated research with a strong conceptual framework remains limited. To address this gap, we used control-value theory (CVT) to systematically derive and test hypotheses about the antecedents and consequences of boredom among endurance athletes. In a study with predominantly recreational endurance runners and cyclists, we found consistent support for CVT predictions.

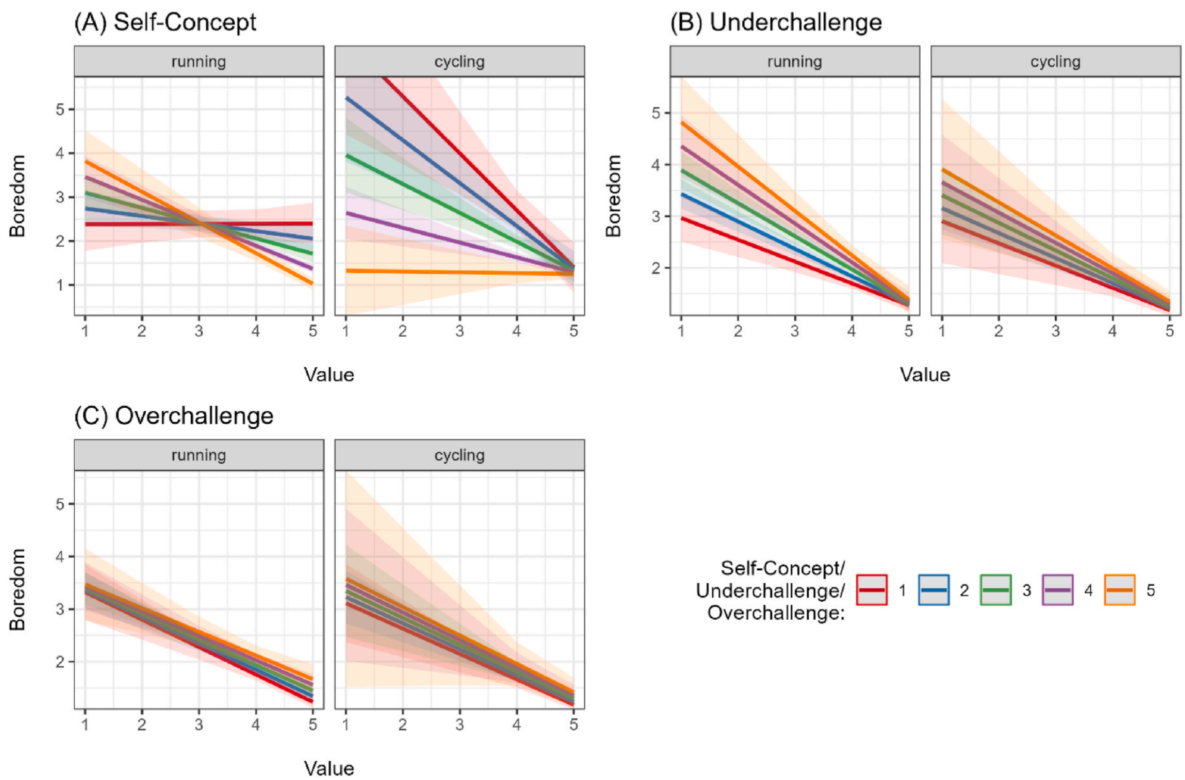

Fig. 3. Interactions between control and value among runners versus cyclists
Note. Model-predicted values of boredom for various combinations of value with self-concept, underchallenge, and overchallenge (all assessed on 5-point scales). For both runners and cyclists, higher levels of value were generally associated with lower levels of boredom. (A) At lower levels of value, runners with a more positive self-concept reported higher boredom, while the opposite pattern was observed for cyclists. In other words, a more positive self-concept reinforced the negative relationship between value and boredom among runners and attenuated this link among cyclists. (B) An interaction between underchallenge and value emerged similarly for runners and cyclists. Specifically, the negative relationship between value and boredom was more pronounced at low levels of underchallenge. (C) No interaction was observed between overchallenge and value, neither for runners nor for cyclists. Shaded regions represent 95 % confidence intervals around the predicted values of boredom.

5.1. Control and value as causes of boredom

Regarding control, we found the expected negative link between boredom and self-concept as well as the anticipated positive links of boredom with both underchallenge and overchallenge (Krannich et al., 2019; Pekrun et al., 2010; Simonton et al., 2017). A closer look at the correlations revealed that athletes with a more positive self-concept experienced less overchallenge, suggesting that they feel equipped to manage the demands of endurance sports. However, there was no association between self-concept and underchallenge, indicating that even with a positive self-concept, athletes might not necessarily find endurance sports overly easy. Thus, a more positive self-concept appears to be linked to rather optimal levels of challenge, explaining its negative association with boredom, in contrast to the positive links of under- and overchallenge with boredom. Regarding value, we observed the expected negative link with boredom, indicating that endurance athletes experience boredom when they perceive their activities or outcomes as not worthwhile. A similar link has been reported in previous CVT research as well (Pekrun et al., 2010).

We additionally explored potential interactions between control and value, which revealed a different pattern for runners compared to cyclists with respect to self-concept. Among runners, a more positive self-concept intensified the negative relationship between value and boredom, while among cyclists, a more positive self-concept weakened this negative relationship (see Fig. 2). This finding is surprising from the perspective of Control-Value Theory (CVT), which assumes structural equivalence in the relationships between boredom and its antecedents and consequences across samples and contexts (Pekrun, 2006). However, this differential pattern did not replicate when control was operationalized in terms of underchallenge and overchallenge. The inconsistency of these interactions, combined with their relatively low effect sizes and the exploratory nature of the analysis, makes an interpretation of this finding difficult. Furthermore, ancillary analyses revealed that cyclists tended to have more experience than runners, which might contribute to the unexpected finding. Nevertheless, our findings suggest that there may be sport-specific differences in the causes of boredom, albeit mostly in terms of magnitude rather than in terms of direction. For instance, runners experienced higher levels of boredom than cyclists as well as lower levels of self-concept and value, a finding that merits further investigation.

5.2. Psychological and behavioral consequences of boredom

Experiencing boredom frequently and intensively has been linked to numerous negative consequences and maladaptive behaviors (Bieleke, Ripper, et al., 2022; Vodanovich & Watt, 2016). Our results suggest that this conclusion also holds for sport-specific boredom. Higher levels of boredom were associated with negative psychological and behavioral outcomes, including lower satisfaction, increased physical exertion, reduced cognitive effort, less training, and fewer years of experience. These findings are consistent with research on CVT in other contexts (e.g., academic performance; Tze et al., 2016), and align with previous research findings suggesting that boredom negatively affects sports participation and performance (Velasco & Jorda, 2020; Wolff, Bieleke, Stähler, & Schüler, 2021). Interestingly, runners appeared more susceptible to the negative effects of boredom than cyclists, with stronger relationships between boredom and reduced satisfaction and cognitive effort. Future research could explore the reasons behind this difference in magnitude, potentially shedding light on sport-specific factors influencing how boredom impacts athletes.

5.3. Practical considerations

The observed differences between runners and cyclists in the magnitude of control and value appraisals and boredom make sense from a practical perspective, as running and cycling differ in the experience they provide and the challenges they impose. For instance, road cycling provides more variation than road running, as athletes are able to cover greater distances in the same time, resulting in more dynamic and varied environmental stimuli. Additionally, endurance cycling offers greater flexibility in pacing, including opportunities for coasting and brief reductions in effort, whereas endurance running necessitates sustained effort. Importantly, road cycling might offer more of an 'adrenaline rush', as athletes travel at much higher speeds, facing higher risks of crashes and accidents. This can influence attentional and cognitive processes that in turn affect boredom by reducing monotony and increasing novelty. Indeed, cyclists in our study reported generally lower levels of boredom than runners.

Besides environmental aspects, physiological differences between running and cycling may also contribute to variations in boredom. Running engages larger muscle groups, involves higher impact forces, and imposes greater whole-body mechanical stress compared to cycling, which could contribute to differences in experienced discomfort and effort. Additionally, sport-specific differences in physiological processes—including ventilatory response, metabolic costs, and fatigue patterns (e.g., Millet et al., 2009)—may amplify differences in such perceptual experiences. For instance, runners and cyclists differ in their trajectories of heart rate and perceived exertion (Hassmén, 1990). These physiological and biomechanical differences likely interact with cognitive and affective factors of endurance performance (Marcora, 2008), shaping the experience of boredom in sport-specific ways.

From an applied perspective, these considerations could be useful in designing interventions to mitigate boredom in endurance sports. For example, incorporating novelty and pacing strategies may enhance value and control appraisals by decreasing monotony and increasing autonomy. Training approaches on this basis could include structured variation in routes, group-based training, interval-based pacing, or immersive experiences (e.g., virtual environments, guided runs) to counteract boredom among endurance athletes (e.g., Deelen et al., 2019; Lemmens, 2023). Beyond these contextual strategies, athletes can also benefit from effective self-regulation strategies (Brick et al., 2016) that might be used for dealing with boredom. For instance, athletes could be trained to shift their attention strategically—alternating between internal (e.g., effort perception) and external cues (e.g., surroundings)—or to apply techniques such as self-talk and goal-setting to enhance control and value and thereby reduce boredom.

5.4. Implications and further directions

Our research suggests that CVT can be effectively applied to sports and exercise settings. The theory's elements readily align with athletes' lived experiences, as demonstrated by the examples in Fig. 1. Moreover, CVT offers several testable predictions about the conditions under which boredom should arise and its consequences in endurance sports. Our findings support many of CVT's central predictions, reinforcing recent claims that the theory is applicable beyond the academic settings for which it was originally developed (Pekrun, 2024). This makes CVT a promising foundation for dedicated research on boredom in sports and exercise. For instance, future research could focus on the feedback loops and regulatory strategies outlined by CVT, an aspect that emerged in our interviews with athletes (see Fig. 1) but was not part of our present research. The regulation of boredom has been largely overlooked in sports and exercise (for an exception, see Green-Demers et al., 1998), and CVT provides a systematic approach to address this gap. It suggests strategies that target environmental aspects, cognitive appraisals, the consequences of boredom, or the emotional experience itself.

CVT further encompasses a wide range of emotions relevant for sports and exercise beyond boredom, such as enjoyment and anger. This conceptual breadth allows researchers to compare different emotions within the same framework, rather than studying them in isolation. Overall, CVT offers a comprehensive approach to understanding various emotions in sports and exercise. Conversely, insights from sports and exercise can enhance CVT research as well. For example, academic settings rarely present situations where students experience very high levels of control (i.e., underchallenge), which limits the ability to fully test CVT predictions. In contrast, endurance sports include training elements with both high control (e.g., low-intensity training) and low control (e.g., interval sprints). Training is typically periodized in terms of a build phase (i.e., focus on low-intensity endurance) and a peak phase (i.e., focus on high-intensity endurance) (Issurin, 2010; Mølmen et al., 2019). Accordingly, endurance sports might offer a larger variety of angles to study boredom and test CVT predictions across the different demands of these training phases. This would allow for more comprehensive testing of CVT predictions, thereby advancing our understanding of emotions in sports and contributing to the refinement of CVT.

Another important future direction is to integrate our findings with other concepts and theories in sports and exercise psychology. One promising perspective is CVT's emphasis on the role of several environmental aspects in the emergence of boredom (see Fig. 1). These aspects align well with research on psychological factors such as relatedness (e.g., training alone versus training with others), autonomy (e.g., self-set goals versus prescribed goals), or competence (e.g., optimally challenging versus mismatched tasks) in relation to sports and exercise behavior (e.g., Standage & Ryan, 2020; Vasconcellos et al., 2020). According to CVT, higher levels of relatedness, autonomy, and competence should be associated with lower levels of boredom. Our interviews suggest that all of these factors play a role for athletes, and future quantitative research could examine their relationship with boredom systematically. A promising starting point might be novelty, a psychological factor that has been increasingly recognized as relevant in physical activity and sports behavior (e.g., González-Cutre et al., 2016, 2025). Empirical evidence suggests that novelty is negatively linked to monotony and boredom in sports and exercise (e.g., Fierro-Suero et al., 2020, 2024; Lye & Kawabata, 2021). Moreover, novelty seeking has been conceptually tied to boredom in general (Bench & Lench, 2013; Seiler & Dan, 2024), highlighting its relevance in this context. A crucial next step for future research is to further investigate the interplay between boredom and various established psychological factors in sports and exercise.

Our research is not without limitations. First, we relied on cross-sectional, correlational data, which prevents us from drawing causal conclusions. For example, based on our data we cannot determine whether the negative relationship between boredom and cognitive effort is due to boredom reducing cognitive effort, cognitive effort increasing boredom, or the influence of an unobserved third variable. Second, we focused on running and cycling as two prominent examples of endurance sports, leaving open whether our findings apply to other endurance activities such as long-distance skiing, swimming, or mountaineering. Third, while we broadly categorized participants as endurance runners or cyclists, we did not differentiate between specific modalities (e.g., trail vs. city running, road cycling versus mountain biking) or contextual factors (e.g., training distance, environmental variation). CVT assumes that the fundamental mechanisms of boredom remain consistent across these variations (e.g., lower perceived value being associated with higher levels of boredom), a principle known as relative universality assumption, which has received broad empirical support (for a review, see Pekrun, 2018). Nevertheless, the level of boredom experienced may vary based on environmental factors and training conditions. Future research on boredom in endurance sports would benefit from considering these variations. Fourth, we concentrated on trait boredom rather than state boredom. While trait boredom is often associated with negative outcomes, state boredom can have both negative and positive effects depending on features of the situation and the individual (Bieleke, Ripper, et al., 2022). Future research could explore whether state boredom in endurance sports might lead to beneficial outcomes as well, such as prompting athletes to increase training variety.

6. Conclusion

We demonstrate that boredom plays a significant role among endurance athletes and that its antecedents and consequences can be effectively explained by control-value theory (CVT). CVT provides a useful framework for understanding how athletes' perceptions of control and the value they assign to their training influence their experience of boredom, and how boredom in turn affects psychological and behavioral outcomes. This perspective not only deepens our conceptual understanding of boredom in the context of sports and exercise but also offers actionable insights for practitioners and researchers aiming to mitigate boredom during training phases. By applying CVT to the context of endurance sports, our research aims to inspire both theoretical advancements and practical strategies for comprehensively understanding and managing boredom.

CRediT authorship contribution statement

Maik Bieleke: Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Wanja Wolff:** Writing – review & editing, Conceptualization. **Catharina Cremer:** Methodology, Investigation. **Fanni Kaisinger:** Methodology, Investigation. **Thomas Goetz:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization.

Code availability

Materials, data, and code are available via OSF (https://osf.io/m3a7g/).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2025.102863.

Data availability

Materials, data, and code are available via OSF (https://osf.io/m3a7g/).

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