

# On the Empirical Substantiation of the Definition of “Deliberate Practice” (Ericsson et al., 1993) and “Deliberate Play” (Côté et al., 2007) in Youth Athletes

Arne Güllich, Laura Faß, Christina Gies, and Veronika Wald  
Department of Sports Science, University of Kaiserslautern, Germany

Correspondence: Arne Güllich, [guellich@sowi.uni-kl.de](mailto:guellich@sowi.uni-kl.de)

## Abstract

The concepts of deliberate practice (Ericsson, Krampe, & Tesch-Römer, 1993) and deliberate play (i.e., informal youth-led sport play with peers, but without a coach, such as backyard soccer, basketball in the driveway; Côté, Baker, & Abernethy, 2007) have been influential on research into the acquisition of athletic expertise. Deliberate practice was defined to be undertaken for the extrinsic motive to achieve an improved performance, with the further criteria that it be physically and mentally highly effortful and not inherently enjoyable. Deliberate play was defined to be highly enjoyable and to be undertaken for the intrinsic motive to maximize enjoyment. However, the authors *ascribed* these attributes *a priori* to athletes' involvement in the activities but did not *empirically measure* the ascribed attributes. In this study, we examined whether these *a priori* pre-supposed attributes are underpinned by empirical correspondence in youth athletes. A total of 208 athletes (13.6 years;  $SD = 2.6$ ) from several sports reported their motives and inherent enjoyment of coach-led practice and youth-led sport play in a questionnaire. The empirical findings did not provide support for some of the premises of the definitions of deliberate practice and deliberate play. Inherent enjoyment was high in both activities and did not differ. Youth athletes' motives to engage in both sport activities comprised a broad *multi-dimensional* spectrum including health, general fitness, aesthetic experiences, social interaction, and recreation from daily hassle, not just performance or inherent enjoyment. Within the performance motive for coach-led practice, the *intrinsic* component was very pronounced while the *extrinsic* component was not. Furthermore, more successful youth athletes showed *less* empirical correspondence with premises of the deliberate practice concept than less successful athletes. The findings suggest that the definitions of deliberate practice and deliberate play should be *empirically* substantiated, rather than defining them by untested *a priori* premises.

## Keywords

Deliberate practice, deliberate play, youth athletes, empirical correspondence

## Introduction

The concept of deliberate practice (Ericsson et al., 1993) and the Developmental Model of Sport Participation (DMSP; Côté et al., 2007) have been the most popular (i.e., most-cited) frameworks for talent development in the sport

science literature (Bruner, Erickson, Wilson, & Côté, 2010). The heart of both concepts is the role of different types of developmental sport activities. While both approaches agree that extensive deliberate practice is necessary to

develop athletic expertise, they differ in the proposed childhood/adolescent sport activities. Ericsson et al. (1993) suggested that domain-specific deliberate practice should begin early in childhood to achieve expertise. By contrast, Côté et al. (2007) proposed little or no deliberate practice and extensive ‘deliberate play’ in various sports during childhood and adolescence to achieve expertise.

In the original articles on these concepts, four criteria appeared to be critical to the definition and distinction of deliberate practice and deliberate play (Table 1): Supervision by a coach, domain-specificity, athletes’ goals and motives to engage in the activity, and their enjoyment in the activity.

**Table 1.** Characteristics of deliberate practice (Ericsson et al., 1993) and deliberate play (Côté et al., 2007) in sports.

	<b>Deliberate Practice</b>	<b>Deliberate Play</b>
Supervision, feedback, corrections	Supervised, instructed and monitored by a coach; coach-led, externally regulated	Not supervised by a coach; youth-led, intrinsically regulated
Sport-specificity	In the athlete’s main sport	In various sports
Motives to participate	Extrinsic, instrumental to improving performance and winning	Intrinsic, child’s own interest in the activity itself, maximize inherent enjoyment
Inherent enjoyment	Not inherently enjoyable	High inherent enjoyment
Effort	Full attention and concentration, tasks near or beyond current capability, high physical and maximal mental effort	N.A.

*Deliberate practice* in sports can be defined as sport-specific practice that is designed, instructed, and monitored by a coach (i.e., *coach-led*; Ericsson et al., 1993; also Ericsson, 2002, 2006, 2014; see Ericsson, 2003, 2007, 2013, 2016, 2019 for descriptions specific to *athletic expertise*). Young athletes engage in deliberate practice for the purpose of improving their performance. Deliberate practice consists of frequent repetitions and corrections of a task near or beyond the athlete’s current capability, is physically and mentally highly effortful and not inherently enjoyable. Ericsson et al. (1993) allowed that participants may perceive enjoyment from the anticipated improved performance, but not from the practice activity itself. They suggested that deliberate practice was the most effective activity in improving performance and should therefore be maximized.

Côté et al. (2007) adopted Ericsson et al.’s definition of deliberate practice and contrasted it with *deliberate play* (also Côté & Erickson, 2015; Côté, Baker, & Abernethy, 2003; Côté, Lidor, & Hackfort, 2009; Côté, Turnnidge, & Evans, 2014; Côte & Hay, 2002; Erickson,

Côté, Turnnidge, Allan, & Vierimaa, 2017). *Deliberate play* is the involvement in informal sports play with peers (such as playing leisure time backyard soccer, street hockey, basketball in the driveway, ice-hockey on a frozen lake, etc.). It is not designed or supervised by a coach but by the participants themselves (i.e., *youth-led*). Children and adolescents engage in deliberate play activities for the purpose of maximizing inherent enjoyment in the activity itself and not for the purpose of improving performance. Participation is freely chosen and intrinsically motivated by the child’s own interest in the activity. Participants regulate intrinsically what to do and how to do it and they adapt the rules of the original formal sports to ensure maximization of enjoyment. Côté et al. (2007) proposed that extensive childhood/adolescent deliberate play in various sports facilitates later intrinsic motivation, prolonged engagement and long-term development of elite performance.

One of the issues of both definitions (Côté et al., 2007; Ericsson et al., 1993) is that the authors *ascribed* some of the central components of their definitions to children’s and adoles-

cents' involvement in deliberate practice and deliberate play, but did not empirically *measure* the ascribed attributes. Specifically, the researchers made *assumptions* about the presence or absence of children's/adolescents' motive to improve performance, intrinsic or extrinsic motivation, and the presence or absence of perceived inherent enjoyment, but these assumptions were not underpinned by empirical *measurement*. The purpose of the present study is therefore to provide an *empirically* substantiated description of coach-led practice and peer-led sports play of young competitive athletes.

Ericsson et al. (1993) proceeded in four steps. (1) They developed criteria defining deliberate practice by way of a synthetic *a priori* (Kant, 1787) (task-specific, teacher-led, purpose to improve performance, high effort and low pleasure in the activity; Ericsson et al., 1993, pp. 367-372). (2) Violinists reported their perceptions of different music-related activities regarding relevance to improving performance, required effort, and inherent enjoyment (pp. 373-374). (3) Out of a number of activities that met the criteria of the *a priori* definition of deliberate practice, Ericsson et al. (1993) chose "practice alone" as a supposed empirical indicator of deliberate practice (while omitting other activities, pp. 375, 380). (4) The violinists (mean age 23 years) belonged to three groups who differed in the potential for future long-term performance that their teachers ascribed to them. To test predictions of their deliberate practice hypothesis, Ericsson and colleagues compared the groups regarding their self-reported amount of "practice alone" accumulated from 4 to 18 years of age (p. 379). That is, (4.1) the authors assumed that the musicians' estimates of the activity's *effect* on performance directly implied that this was their *purpose* of engaging in it. Next, (4.2) by summing up the hours from 4 to 18 years of age, Ericsson and colleagues *extrapolated* this (ascribed) motive and the perceptions of the *adult* violinists to the engagement during *childhood and adolescence*. For example, the authors' claims implied that the effort, lack of enjoyment and motives to engage in practice were identical in a 6-year old child as in a 23-year old music academy student. Finally, (5) the attributes of

deliberate practice were extrapolated to other domains including sports (pp. 371-372, 387-391; also Ericsson, 2003, 2013, 2016).

Côté et al. (2007, pp. 185-187) referenced literature on general *non-sport* childhood play and extracurricular engagement while introducing the DMSP. They then *extrapolated* these characteristics and outcomes to sporting deliberate play. Empirical evidence on the ascribed attributes of deliberate play in sports is, however, lacking to date.

### Earlier Sport Science Research

Unsurprisingly, some of the defining criteria have been debated in the literature. For example, deliberate practice in sports may include individual or team practice (Helsen, Starkes, & Hodges, 1998; Ward, Hodges, Williams, & Starkes, 2007). Ericsson et al. (1993) focused on "practice alone" for their *empirical* study because young musicians typically have one weekly lesson with their teacher and they practice tasks instructed by the teacher between the meetings. "Practice with others" also fully met the defined criteria for deliberate practice. The authors omitted "practice with others" in their empirical study because they assumed (but did not empirically substantiate) that the learner has little or no control over the availability of others for practice. This latter assumption does not apply to youth sports because the multiple weekly practice sessions of young athletes are typically done as group practice with the coach. Thereby, doing a coach-instructed exercise, such as practicing the serve in tennis or a somersault in gymnastics, does not change its nature and turn it into non-deliberate practice by another teammate doing the same exercise. Accordingly, several studies on deliberate practice in sports that were co-authored (Duffy, Baluch, & Ericsson, 2004; Hutchinson, Sachs-Ericsson, & Ericsson, 2013; Law, Côté, & Ericsson, 2007) or supervised by Ericsson (Ureña, 2004) subsumed diverse individual and group activities as indicators of deliberate practice.

Next, both the framework of deliberate practice and the DMSP regarded the intention to improve performance and the perception of inherent enjoyment as a dichotomous contrast: Strong

motive to improve performance and no inherent enjoyment in deliberate practice versus no motive to improve performance but high inherent enjoyment in deliberate play. However, athletes typically perceive highly demanding and effortful deliberate practice as highly enjoyable (Helsen et al., 1998; Hodges & Starkes, 1996; Young & Salmela, 2010).

Of particular interest are athletes' goals and motives. Ericsson et al. (1993) as well as Côté et al. (2007) clearly attributed the goal to improve performance through deliberate practice to be an *extrinsic* motive (e.g., Ericsson et al., 1993, p. 368: "Engagement in deliberate practice is not inherently motivating. Performers consider it instrumental in achieving further improvements in performance"; Côté et al., 2007, p. 186, Table 8.1: "Deliberate practice: Done to achieve a future goal"; p. 187: "[...] external reasons such as improving performance [...]"). However, other research has suggested that engaging in the improvement of one's performance may have intrinsic and extrinsic motivational components. For example, athletes may perceive pleasure and satisfaction from the factual or anticipated *result* of a high performance and *subsequent outcomes* such as social recognition and prestige (Ericsson et al., 1993, pp. 370, 374). But they may, as well, perceive pleasure and satisfaction from the *activity itself* of learning and working on their performance (e.g., Duda & Nicholls, 1992; Pelletier et al., 1995; Thomas & Güllich, 2019; for a review: Vallerand, 2007).

Athletes' performance motive is often regarded in association with the aim to perform in competitions (just as in musicians, Ericsson et al., 1993, pp. 372-374, 382, 388). Intrinsic and extrinsic components of the motive to compete and to perform in competitions therefore merit closer reflection. Côté and colleagues (Côté et al., 2007; Erickson et al., 2017) assumed that competition games within deliberate play were intrinsically motivated, in that the focus was on the *act* or *process* of competing while "adult-driven structured sport" was extrinsically motivated because the focus was on the *result* of winning (Erickson et al., 2017, pp. 401-402).

Drawing on Tenbruck's (1978) "anthropology of acting", Emrich and Prohl (2008) worked

out an anthropological interpretation of acting in sports competitions. In short, only uncertainty of processes and results of actions can invigorate persistent incitement, interest, attention, and engagement in an activity (i.e., the "unresolved task" so to say; consistent: Ericsson et al., 1993, p. 367). Sports competitions are a cultural institution where athletes attempt to master a movement task while the opposing party attempts to hinder the successful performance of the movement task, where the task and permitted actions are defined by sport-specific rules. Thereby, sports competitions are able to ensure persistent uncertainty of the processes and results even at increasing levels of mastery and performance. It is this *paradox* that many athletes particularly love: Investing extensive time and effort to increase the certainty of one's performance to then purposefully seek out situations that jeopardize the certainty of their performance—competitions.

The implication is that action in competition is not only instrumental to winning, but the act of competing itself possesses a value of its own that is the more up-valued the more uncertain its success is. Hence, success in a competition is not just an *end* of competing, but it is also a *means* to the end of enabling the act of competing for the success. The conclusion for the present study is that the distinction between the *situation* (being competing, the result is uncertain) and the *results* (winning or losing, placing) and *subsequent outcomes* (social recognition, prestige) of the competition has relevant implications to athletes' different motives for competing, both in competition games within deliberate play and formal, organized competitions. Athletes may seek out competitions because they experience pleasure and satisfaction from the excitement and thrill of the uncertainty of the *situation* of the competition or from its *results* and *subsequent outcomes*.

Finally, both Ericsson et al. (1993) and Côté et al. (2007) considered only a narrow range of motives focusing on (a) the pursuit of an improved performance and (b) experiencing enjoyment, which were viewed as poles of just *one dimension* (the performance-enjoyment dichotomy). Research has, however, shown since as

early as the 1960s (e.g., Kenyon, 1968; Schmid, Gut, Conzelmann, & Sudeck, 2018) that goals and motives for engaging in different sport activities are typically *multi-dimensional* and include a composition of different motives such as social interaction, pleasure in the physical activation, distraction and recreation from the strain of the daily routine, health and fitness, physical appearance, aesthetic experiences, and performance/competition. It is thus questionable whether young athletes' goals and motives for engaging in different sport activities can be adequately described by the "performance vs. enjoyment dichotomy" alone.

### Purpose of the Present Study

The present study addresses the issues discussed above by considering multi-dimensional goals and motives for engaging in coach-led practice and youth-led sport play, taking account of potential intrinsic and extrinsic components of the "performance" motive, while also considering the perception of effort and inherent enjoyment in each activity. The purpose was to investigate to what extent the premises of the definitions of deliberate practice and deliberate play are underpinned by empirical correspondence in youth athletes. In addition, we wanted to examine whether athletes competing at higher levels showed greater correspondence to Ericsson et al.'s (1993) and Côté et al.'s (2007) premises than their lower performing peers, as expected.

## Methods

### Participants

Participants were 208 competitive youth athletes (age  $M = 13.6$  years;  $SD = 2.6$ ; 66 females), 101 of whom were members of an elite sport school accredited by the German Olympic Sports Confederation and the Rhineland-Palatine ministry of education, and 107 were from five other regional sport clubs. The youth athletes participated in game sports ( $n = 169$ ; badminton, basketball, golf, handball, soccer, tennis and volleyball) and non-game sports ( $n = 39$ ; artistic gymnastics, dance, equestrian, judo, race cycling, taekwondo, track and field athletics). On average, they had been practicing their main sport

for 8.6 years ( $SD = 3.2$ ) and competing for 7.6 years ( $SD = 3.3$ ) and were currently engaging in 8.0 ( $SD = 4.1$ ) hours/week of sport-specific coach-led practice. Twenty-five were competing at a national level, 128 at regional / federal state, 42 at a district / county level and 13 below the district / county level.

One hundred and eighty-one participants (87%) engaged in youth-led play in their main sport for 9.0 years ( $SD = 3.5$ ; currently 2.4 times/week [ $SD = 1.4$ ]). One hundred sixteen athletes (56%) participated in other sports. Of these, 95 engaged in coach-led practice in other sports for 5.4 years ( $SD = 2.7$ ; currently 1.6 times/week [ $SD = 1.1$ ]), 64 in competitions for 4.9 years ( $SD = 2.5$ ), and 73 in youth-led play in other sports for 6.0 years ( $SD = 3.1$ ; currently 1.4 times/week [ $SD = 0.9$ ]). The sports that were most often reported as other sports were soccer ( $n = 17$ ), basketball ( $n = 15$ ), tennis ( $n = 15$ ), handball ( $n = 13$ ), swimming ( $n = 12$ ) and volleyball ( $n = 11$ ).

### Procedure

The athletes completed a paper-and-pencil questionnaire that included sections addressing their developmental sport activities, their goals and motives for current participation, and their perceptions of these activities. The data were collected in small groups in a quiet setting supervised by members of the research team so they could provide clarification and assistance as needed. Participants were verbally informed about the voluntary nature and anonymity of participation. Their parents/guardians were given an information sheet about the procedure of the study and an informed consent form. Active informed consent was provided for all invited athletes. The study received ethical approval from the institutional ethics committee (No. 2019/17).

**Developmental sport activities.** Engagement in the different types of sport activities were estimated using a previously described instrument (Güllich & Emrich, 2014; Thomas & Güllich, 2019). Respondents reported their starting age for coach-led practice and for competitions in their respective main sport and their practice

amount through the last twelve months (hours/week). They also reported whether or not they participated in youth-led play in their main sport and in coach-led practice and/or youth-led play in other sports and in each case the age of start and cessation (if applicable) of an activity as well as the amount of engagement (frequency as times/week). It is important to note that we gave detailed verbal instructions and examples to the participants to define exactly each type of sport activity (coach-led practice: the practice sessions with your coach that you attend in your sport club or sport academy week by week, for example Monday, Tuesday, Thursday 5-7 p.m.; youth-led play: for example, when you kick around with friends in the schoolyard or play table tennis with friends in the park in your leisure time, without a coach or any instruction of a coach to do so).

**Goals and motives.** We used the original German version of the Bernese Motives and Goals Inventory for exercise and sport activity (BMZI; Lehnert, Sudeck, & Conzelmann, 2011; see Schmid et al., 2018 for the English version). The 24-item inventory was developed to measure target-group specific goals and motives in seven areas: (1) Performance and competition (PerfComp), (2) enjoyment of the physical activation (PhysActiv), (3) physical fitness and health (FitHealth), (4) physical appearance and weight reduction (PhysApp), (5) aesthetic experiences (i.e., to experience beautiful and harmonious movements; Aesth), (6) social interaction (subdivided into two components: interaction and communication while pursuing an activity [SocInt] and the opportunity to establish new social contacts/relationships through the activity [SocCont]), and (7) catharsis (distraction and recreation from daily routine; Cath). We omitted dimension (4) “physical appearance and weight reduction” because we expected that these competitive youth athletes would not consider it applicable to them and might perceive these questions as unserious.

The stem “Why do you participate in ... coach-led practice in your main sport / youth-led play in your main sport / coach-led practice in other sports / youth-led play in other sports?” was followed by different phrases tied to the

motive dimensions, such as: “Because I enjoy to be competing with other participants”; “To achieve goals in sports”; “Because of the enjoyment of being in motion”; “Primarily for health reasons”; “Primarily to do something for my physical fitness”; “Because it offers me opportunities for beautiful movements”; “To do something in a group”; “To make new friends”; “To reduce stress”; “To distract myself from the strain of the daily routine”. Response scales were 7-point Likert scales from 0 “does not correspond at all” to 6 “corresponds exactly.”

We were particularly interested in potential intrinsic and extrinsic components of the performance motive. In the BMZI, the performance motive is partly connected with performance in competitions as a potential goal of participants. Two of the four items of the original BMZI dimension “performance / competition” reflect the intrinsic competition motive related to the *situation* of the competition (as opposed to its *results*) and were extracted separately: “To experience the exciting and thrilling situations in a competition” and “Because I enjoy to be competing with other participants” (hereafter: CompIntr). Furthermore, we added four items while maintaining the identical stem and response format. They were supposed to reflect the extrinsic competition motive related to the *result* of the competition (“Because it gives me satisfaction to achieve a higher placing than other participants” and “Because it gives me satisfaction to outperform other participants”; hereafter: CompExtr) and the intrinsic motive to be practicing on one’s performance (“Because it gives me pleasure to be working on my performance”; “Because I enjoy to be working on the improvement of my performance”; PerfIntr). Note that CompIntr and CompExtr reflected exactly the distinction Côté et al. (2007, 2009; Erickson et al., 2017) and Ericsson et al. (1993) discussed. A confirmatory factor analysis with varimax rotation revealed a total cleared variance of 70.4% and acceptable factor loadings of 0.84 and 0.68 (PerfIntr), 0.89 and 0.66 (CompExtr) and 0.82 and 0.56 (CompIntr).

**Perceptions of the sport activities.** The youth athletes reported how much inherent enjoyment

they perceived while they were doing each of the sport activities (drawing on the instrument of Ericsson et al., 1993; Helsen et al., 1998; and Hodges & Starkes, 1996, but on a 5-point Likert scale from 0 “no enjoyment at all” to 4 “very much enjoyment”). We explicitly instructed the participants verbally to relate “inherent enjoyment” in an activity exclusively to their perception of the *activity itself while doing the activity* and to explicitly blank out any perception relative to expected *results* or *outcomes* of the activity (cf. Ericsson et al., 1993, pp. 368, 372). Furthermore, mean physical and mental effort (attention, concentration) were reported for each sport activity on a 15-point scale from 6 “very, very light” to 20 “very, very hard”. This scale was adapted from the CR-15 Session RPE scale (reported perceived exertion; Borg, 1982) which the athletes were familiar with from the continuous monitoring of their training. The idea of using a 6-20 scale rather than, for example, 0-10, was that the hardness of competitive athletes’ training is actually virtually never “0” which was intuitively better represented by the 6-20 scale.

**Reliability.** Cronbach’s alpha was determined for the dimensions of the BMZI. Internal consistency was acceptable for all dimensions ( $0.66 < \alpha < 0.79$ ) except for the dimension “pleasure in the physical activation” (PhysActiv,  $\alpha = 0.30$ ) which was therefore omitted from subsequent analyses. In addition, 67 athletes participated in a retest after four weeks. Retest reliability was acceptable for all variables (developmental sport activities  $0.96 < r_{tt} < 1.00$ ; goals and motives  $0.88 < r_{tt} < 0.98$ ; perceptions of activities  $0.72 < r_{tt} < 0.99$ ).

### Data Analysis

Descriptive statistics include means and standard deviations. We conducted three further analyses. First, goals, motives and perceptions were compared between the activity types using paired *t*-test (coach-led practice and youth-led play in the main sport and other sports). Second, goals, motives and perceptions of the activities were compared between athletes with different performance levels, as reflected by their competition level. For this analysis, performance level

was dichotomised by a median-split (regional or higher competition level and below). We carried out preliminary 2-factorial ANOVAs (age, performance level) which revealed no significant interactive effects of age and performance level on goals, motives or perceptions of the activities. We therefore compared performance groups with unpaired *t*-test. Third, potential associations between effort and inherent enjoyment were examined by Spearman’s correlation analyses within each activity type. All analyses concerning youth-led play in the athlete’s main sport and other sports and coach-led practice in other sports included only the athletes who were currently still involved in the activity ( $n = 174$ ,  $n = 68$  and  $n = 68$ ).

Bortz and Schuster (2010, pp. 156-162) demonstrated that the parametric *t*-test is very robust towards deviations from the original assumptions regarding symmetry of data distribution (given  $n \geq 30$ ) and scaling of the data (ordinal versus interval scale, given  $>4$ -point scales) and can be used for the present data.

Although analyses involved multiple hypothesis testing among sets of partly related perceptions and motives, we decided not to adjust for potential alpha accumulation (e.g., Bonferroni adjustment). First, Côté’s and Ericsson’s and their colleagues’ perception was dimensionally very clear, in that they regarded the performance motive and perceived enjoyment as a one-dimensional dichotomy associated with extrinsic motivation to engage in deliberate practice and intrinsic motivation to engage in deliberate play. Second, the motive dimensions of the BMZI were only weakly to moderately correlated (main sport coach-led practice  $0.06 \leq r_s \leq 0.56$ , youth-led play  $0.00 \leq r_s \leq 0.47$ , other sports coach-led practice  $0.08 \leq r_s \leq 0.46$ , youth-led play  $0.25 \leq r_s \leq 0.49$ ).

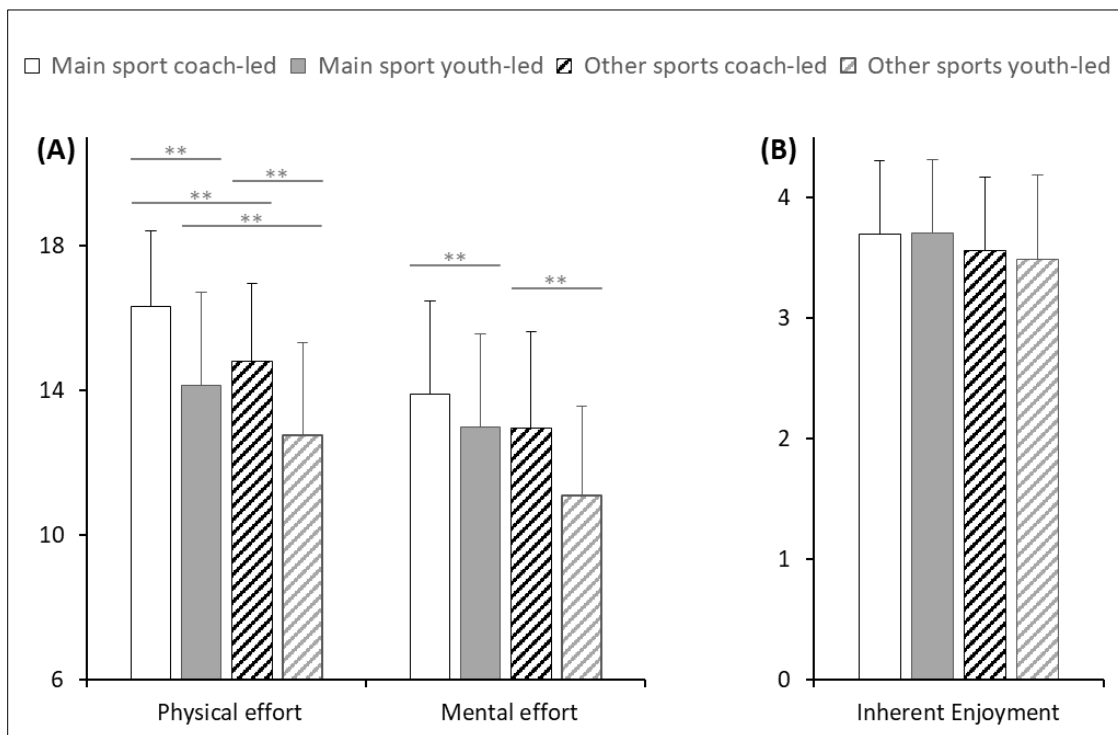
Effect sizes are reported as Cohen’s *d* and correlation coefficients. Analyses were performed with SPSS 26.0. All statistical hypothesis testing was two-tailed. A value of  $p < 0.05$  was considered statistically significant.

### Results

Figure 1 highlights the exerted effort (A) and inherent enjoyment (B) in each of the types of sport activities. The physical effort in coach-led

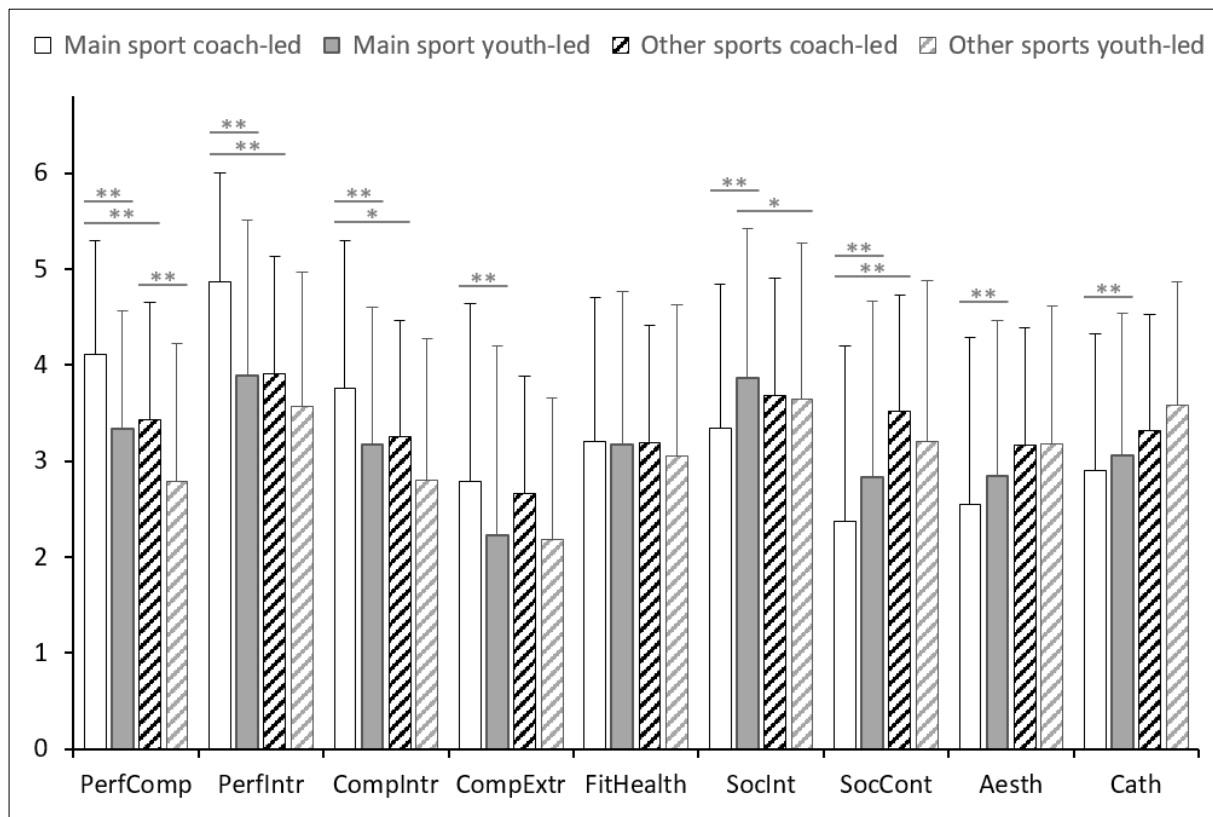
practice in the athlete's main sport was relatively high but not maximal, while mental effort (attention, concentration) was not particularly high. Physical and mental effort was generally perceived as significantly greater in coach-led practice than in youth-led play (main sport: Cohen's  $d = 0.92$ ; other sports:  $d = 0.92$ ) and physical effort was greater in the athlete's main sport

than in other sports (coach-led practice:  $d = 0.51$ ; youth-led play:  $d = 0.53$ ). The inherent enjoyment (Figure 1B) was very high in each of the sport activities and there was no significant difference between any of the activity types. In particular, inherent enjoyment did not differ between coach-led practice and youth-led play.



**Figure 1.** Youth athletes' exerted physical and mental (attention, concentration) effort (left: A; scale: 6 to 20) and experienced inherent enjoyment (right: B; scale 0 to 4) in different types of sport activities. Descriptive statistics for the entire sample (means, error bars represent standard deviations); paired  $t$ -test: \*\*  $p < 0.01$ . Range of variables: Physical effort (left to right): 7-20, 6-20, 9-20, 6-19; mental effort: 7-19, 6-19, 6-18, 7-17; enjoyment: 0-4, 0-4, 1-4, 1-4.





**Figure 2.** Youth athletes' goals and motives to engage in different types of sport activities (scale: 0 to 6). Descriptive statistics for the entire sample (means, error bars represent standard deviations); paired *t*-test: \*  $p < 0.05$ , \*\*  $p < 0.01$ .

The youth athletes' goals and motives to engage in each of the sport activities are shown in Figure 2. *All dimensions* of motives were present to a considerable extent for coach-led practice in the athlete's main sport as well as for all the other types of sport activities. Even among these competitive athletes, the motives to engage in main-sport coach-led practice and in the different other sport activities were clearly *multi-dimensional*. Interestingly, the *intrinsic* component of the motive to be working on the *performance improvement* (PerfIntr) was a particularly pronounced motive for engagement in coach-led practice in the athlete's main sport while the *extrinsic* motive to outperform others in competition (CompExtr) was not. Furthermore, the motives to be working on one's performance (PerfIntr) as well as to enjoy the *situation* of the competition (Complntr) were considerable motives for engagement in youth-led sport play. Finally, engaging in social interaction (SocInt) and general health and fitness

(FitHealth) were considerable motives for all types of sport activities.

Coach-led practice differed from youth-led play in the main sport in significantly higher values of all performance / competition-related motives (PerfComp  $d = 0.74$ ; PerfIntr  $d = 0.83$ , Complntr  $d = 0.46$ ; CompExtr  $d = 0.31$ ) and lower motives for social interaction, establishing new social relationships, having aesthetic experiences, and distraction and recreation from the daily routine (SocInt  $d = 0.37$ ; SocCont  $d = 0.27$ ; Aesth  $d = 0.26$ ; Cath  $d = 0.14$ ). Coach-led practice and youth-led play in other sports did not differ significantly in any motive. Coach-led practice in the main sport differed from coach-led practice in other sports in a higher composite performance / competition dimension (PerfComp  $d = 0.53$ ), stronger intrinsic motives to improve performance and to compete (PerfIntr  $d = 0.84$ ; Complntr;  $d = 0.38$ ) and a weaker motive to establish new social relationships (SocCont;  $d = 0.51$ ).

**Table 2.** Perceived inherent enjoyment, physical and mental effort, and goals and motives to engage in main-sport coach-led practice and youth-led play among youth athletes with higher and lower performance level (regional or higher competition level vs. below). Group comparison:  $d$  = Cohen's  $d$ ; \*\*  $p < 0.01$ .

	Higher competition level		Lower competition level		$d, p$
	$M$	$SD$	$M$	$SD$	
Main sport coach-led practice					
Perception					
Inherent enjoyment (scale 0 to 4)	3.78	0.49	3.47	0.84	0.52**
Physical effort (scale 6 to 20)	16.48	1.98	15.89	2.35	0.29 <sup>ns</sup>
Mental effort (scale 6 to 20)	13.92	2.56	13.80	2.66	0.05 <sup>ns</sup>
Motives and goals (scale 0 to 6)					
Performance, competition	4.13	1.17	4.06	1.25	0.06 <sup>ns</sup>
Performance intrinsic	4.99	1.08	4.50	1.23	0.44**
Competition intrinsic	3.70	1.58	3.78	1.52	0.06 <sup>ns</sup>
Competition extrinsic	2.43	1.81	3.76	1.62	0.77**
Fitness, health	3.21	1.55	3.21	1.38	0.00 <sup>ns</sup>
Social interaction	3.58	1.37	2.69	1.64	0.63**
Establish new social relations	2.17	1.80	2.92	1.83	0.42**
Aesthetic experiences	2.47	1.82	2.75	1.53	0.16 <sup>ns</sup>
Catharsis	2.73	1.38	3.40	1.45	0.48**
Main sport youth-led play					
Perception					
Inherent enjoyment (scale 0 to 4)	3.75	0.60	3.58	0.62	0.28 <sup>ns</sup>
Physical effort (scale 6 to 20)	14.16	2.47	14.09	2.89	0.03 <sup>ns</sup>
Mental effort (scale 6 to 20)	11.01	2.26	11.51	3.32	0.20 <sup>ns</sup>
Motives and goals (scale 0 to 6)					
Performance, competition	3.22	1.21	3.64	1.26	0.35 <sup>ns</sup>
Performance intrinsic	3.68	1.67	4.49	1.33	0.51**
Competition intrinsic	3.09	1.38	3.40	1.57	0.22 <sup>ns</sup>
Competition extrinsic	1.90	1.91	3.12	1.90	0.64**
Fitness, health	3.10	1.70	3.38	1.27	0.18 <sup>ns</sup>
Social interaction	4.08	1.42	3.23	1.76	0.57**
Establish new social relations	2.78	1.87	2.96	1.77	0.09 <sup>ns</sup>
Aesthetic experiences	2.72	1.60	3.18	1.68	0.28 <sup>ns</sup>
Catharsis	2.85	1.46	3.65	1.38	0.56**

The athletes who achieved higher and lower performance levels are compared in Table 2. Youth athletes competing at higher levels experienced significantly *greater inherent enjoyment* in the coach-led practice in their main sport ( $d = 0.52$ ), their *intrinsic* motive to be working on their performance was stronger regarding coach-led practice (PerfIntr  $d = 0.44$ ) but weaker regarding youth-led play in their main sport ( $d = 0.51$ ). In both coach-led practice and youth-led play in their main sport, the higher performing athletes had a weaker *extrinsic* motive to outperform others (CompExtr  $d = 0.76$  and  $d = 0.64$ ) and also to distract and recreate from the daily routine (Cath  $d = 0.48$  and  $d = 0.56$ ), but a significantly stronger motive to engage in social interaction (SocInt  $d = 0.63$  and  $d = 0.57$ ) compared to their lower performing peers. Finally, the athletes with

higher performance levels had a weaker motive to establish new social relationships in main-sport coach-led practice (SocCont  $d = 0.42$ ). The performance groups did not differ significantly in any perception or motives for coach-led or youth-led engagement in other sports (not displayed in the table).

Inherent enjoyment was widely uncorrelated to physical and mental effort within main sport-specific practice ( $r_s = 0.01$ ;  $r_s = -0.04$ ) and youth-led play ( $r_s = 0.10$ ;  $r_s = 0.04$ ) as well as within coach-led practice ( $r_s = -0.01$ ;  $r_s = 0.01$ ) and youth-led play in other sports ( $r_s = 0.37$ ,  $p < 0.01$ ;  $r_s = 0.06$ ). There was only one significant correlation (youth-led play in other sports) and it indicated that *greater physical effort* was associated with *greater inherent enjoyment*.

## Discussion

The original definitions of deliberate practice (Ericsson et al., 1993) and deliberate play (Côté et al., 2007) were very influential, in that most of the sport science research investigating the acquisition processes underpinning high performance has relied on these frameworks. Ericsson et al. and Côté et al. similarly *ascribed*—but did not empirically *measure*—defined attributes to deliberate practice and deliberate play and these characteristics were interpreted to be *causal* to the proposed outcomes (Ericsson et al., 1993: performance; Côté et al., 2007: future intrinsic motivation, prolonged engagement and performance). However, the present findings do not provide support for some of the central premises underlying the definitions of deliberate practice and deliberate play. First, inherent enjoyment in coach-led practice was just as pronounced as in youth-led play and did not differ. Second, the motives of the competitive youth athletes to engage in sport-specific coach-led practice and in other types of sport activities were clearly multi-dimensional and cannot be adequately described by a one-dimensional “performance-enjoyment dichotomy.” Third, competitive youth athletes were foremost motivated to engage in sport-specific coach-led practice by *intrinsic* motives such as the pleasure and satisfaction they experience while working on their performance, while experiencing the exciting situations in a competition, and while engaging in social interactions, rather than extrinsic motives such as winning in competitions. This was even more pronounced in athletes achieving higher performance levels—that is, the more successful youth athletes exhibited even less empirical correspondence with the premises of the frameworks of deliberate practice and the DMSP than the less successful athletes. Fourth, motives related to performance and competition, but also social interaction and general health and fitness were considerable in youth-led sport play as well. Fifth, effort and inherent enjoyment were widely uncorrelated within the various sport activities.

Ericsson, Côté and their colleagues might object (as Ericsson did in several occasions; e.g., Ericsson, 2014, 2016, 2019) that we may

not have recorded “proper” (or “actual”) deliberate practice in their terms. For example, deliberate practice is, by definition, undertaken for the extrinsic motive of achieving improved performance and is not inherently enjoyable. So, if athletes engaged in practice for intrinsic motives and / or enjoyed practice it was not ‘proper’ deliberate practice. Likewise, Côté and colleagues might object that deliberate play is by definition more inherently enjoyable than deliberate practice. So, if inherent enjoyment was not higher in deliberate play, it was not ‘proper’ deliberate play. These objections would, however, clearly be circular reasoning that prevents their hypotheses from empirical testing. In addition, the present study adhered stringently to the original definitions of the activities and our methods corresponded closely to the protocol Côté, Ericsson and Law (2005) suggested. Above that, the definition of the different sport activities and recording of their attributes also corresponded closely to the methods of studies Côté and/or Ericsson themselves authored (Baker, Côté, & Abernethy, 2003; Baker, Côté, & Deakin, 2005; Barreiros, Côté, & Fonseca, 2013; Duffy et al., 2004; Ericsson et al., 1993; Hutchinson et al., 2013; Law et al., 2007; Soberlak & Côté, 2003). Our methods were only refined in one aspect, in that coach-led practice and youth-led play were not only distinguished in the athlete’s respective main sport but also in their engagement in other sports.

It would be interesting to reflect our findings against earlier research that investigated the proposed effects of the ascribed *attributes* of deliberate practice and deliberate play on the hypothesised *outcomes* (Ericsson et al., 1993: performance; Côté et al., 2007: future intrinsic motivation, prolonged engagement and performance). However, this reflection was not possible because the question has not been empirically investigated in competitive sports to date, simply because these attributes of the activities were not empirically recorded. However, studies have investigated the different postulated outcomes of the *activities* of deliberate practice and deliberate play themselves. For example, while empirical evidence supporting the suggested positive effect of childhood deliberate play on

later, adolescent intrinsic motivation (Côté et al., 2007, 2009; Côté & Erickson, 2015; Erickson et al., 2017) is lacking up to date, dissenting empirical findings have been variously published (Hendry & Hodges, 2019; Hendry, Crocker, & Hodges, 2014; Thomas & Güllich, 2019). Furthermore, the DMSP framework suggested an association of childhood deliberate play with prolonged engagement while referring to retrospective studies involving youth ice hockey players (Wall & Côté, 2007) and swimmers (Fraser-Thomas, Côté, & Deakin, 2008). However, dropouts and engaged ice hockey players did not differ significantly in earlier deliberate play (Wall & Côté, 2007). The swimmers who persisted had, on average, about 0.3 to 1.1 more weekly hours of youth-led swimming through childhood and adolescence compared to the dropouts (Fraser-Thomas et al., 2008). The latter study did, however, not consider withdrawal from sport in general, but only sport-specific dropout from swimming. Nevertheless, the dropout group of swimmers engaged in an average of 2.8 other sports at the time of quitting swimming. On the other hand, based on a 10-year longitudinal study, Butcher, Lindner, & Johns (2002) showed that *coach-led* engagement in various sports was associated with persistent engagement and less dropout from sport in general.

Relative to the postulated effects of the amounts of both deliberate play and deliberate practice on later performance, empirical findings are heterogeneous and inconsistent. Relevant studies are reviewed in Table 3. Both activities correlated with later performance in some studies but not in others. For example, positive correlations of childhood / adolescent youth-led sport play with later performance were noted in

several studies of players in game sports, while results from many other studies including the same sports and a variety of others showed that youth-led play was not correlated or was negatively correlated with performance (Table 3). The accumulated amount of main sport-specific coach-led practice had a strong effect on performance differences in most of the studies comparing extreme contrast performance groups within junior or adult age. Furthermore, among the studies comparing narrower performance bandwidths, sport-specific coach-led practice correlated with *junior* performance in many cases and also – but more modestly – with *adult* performance as far as *moderate* performance levels up to the national level were involved. However, within the highest performance ranges, i.e., in the studies comparing adult world class and national class, the accumulated amount of sport-specific coach-led practice was mostly not correlated or was negatively correlated with performance, while the amount of non-specific coach-led practice in *other sports* consistently facilitated the development of world class performance (Table 3).

In summary, central attributes supposed to define and distinguish deliberate practice and deliberate play were not reflected by empirical correspondence among competitive youth athletes in the present study. In addition, the presumed effects of these ascribed attributes on hypothesised outcomes are empirically unstudied up to date. Finally, empirical findings from existing studies investigating the suggested effects of the amounts of deliberate practice and deliberate play on performance were inconsistent, but in parts falsified central tenets of both frameworks.

**Table 3.** Effects of developmental amounts of coach-led practice and youth-led sport play in the athlete's main sport and in other sports on performance among adult (A) and junior (B) athletes.<sup>(1)</sup> Symbols: ○: no relevant effect (Cohen's  $|\text{d}| < 0.20$ ); +: positive effect; -: negative effect. Single symbol (+/-): weak effect ( $0.20 \leq |\text{d}| < 0.50$ ); double symbol (+ +/- -): medium effect ( $0.50 \leq |\text{d}| < 0.80$ ); triple symbol (+ + +/- - -): strong effect ( $|\text{d}| \geq 0.80$ ).<sup>(2)</sup>

<b>(A) ADULT PERFORMANCE</b>		Main sport		Other sports	
	Sports <sup>(3)</sup>	coach-led	youth-led	coach-led	youth-led
<b>Narrow / medium bandwidth of compared performance levels<sup>(4)</sup></b>					
World class vs National class					
Güllich, 2014	Field hockey (m)	--	○	++	+
Güllich, 2017	Multiple sports	-		++	○
	Cgs sports	---		+++	○
	Game sports	--		++	++
	Combat sports	---		+++	-
	Art. comp. sports	---		++	-
	Other types	---		+++	○
Güllich, 2018	Track and field	-	-	+++	○
Güllich, 2019	Soccer (f)	--	+++	+++	○
Hardy et al., 2013	Multiple	+	○	+	+
Hornig et al., 2016	Soccer (m)	-	○	+	○
Johnson et al., 2006 <sup>(5)</sup>	Swimming	○		++	
Moesch et al., 2011	Cgs	○			
National class, Regional class and below Regional class					
Baker et al., 2005	Triathlon (m)	++			
	Triathlon (m)	+++			
Baker et al., 2006	Triathlon (m)	+			
	Triathlon (m)	+++			
Barreiros et al., 2013	Multiple sports	○	○	+	+
Berry et al., 2008	Football (m)	++	+++	+	+
Cathey & French, 2014	Baseball (m)	+++			
Coutinho et al., 2014	Volleyball	++			
Drake & Breslin, 2017	Field hockey (f)	++	+		
Harris, 2008	Bowling	+++	++		
Helsen et al., 1998	Soccer (m)	++			
	Soccer (m)	+++			
	Field hockey (m)	○			
	Field hockey (m)	++			
Hendry & Hodges, 2018	Soccer (m)	○	+++		
Hendry et al., 2018	Soccer (m)	++	+		
Hodges et al., 2015	Triathlon	++			
Hornig et al., 2016	Soccer (m)	++	○	○	○
Memmert et al., 2010	Game sports	+	--		
	Game sports	--	-		
	Game sports	-	---		
Roca et al., 2012	Soccer (m)	+	++		
	Soccer (m)	+++	++		
	Soccer (m)	+++	+++		
Smith, 2012	Basketball (f)	--	-		
<b>Extreme contrast performance levels<sup>(4)</sup></b>					
Baker et al., 2003	Game sports	+++	--		
Baker et al., 2005	Triathlon (m)	+++			
Baker et al., 2006	Triathlon (m)	+++			
Bruce et al., 2013	Netball (f)	+++		---	---
Coutinho et al., 2016	Volleyball (m)			++	○
	Volleyball (f)			○	○
Da Matta, 2004	Volleyball (f)	+++			
Duffy et al., 2004	Darts (m)	+++	○		
	Darts (f)	+++	+++		
Helsen et al., 1998	Soccer (m)	+++			
	Field hockey (m)	+++			
Hornig et al., 2016	Soccer (m)	+	○	+	○
Weissensteiner et al., 2008	Cricket (m)	+++	-	-	○

Table 3, continued.

<b>(B) JUNIOR PERFORMANCE</b>		Main sport		Other sports	
	Sports <sup>(3)</sup>	coach-led	youth-led	coach-led	youth-led
<b>Narrow / medium bandwidth of compared performance levels <sup>(4)</sup></b>					
World class vs National class					
Güllich & Emrich, 2014 <sup>(6)</sup>	Multiple sports	++		o	-
	Cgs sports	+++		o	-
	Game sports	+		o	o
	Combat sports	+		o	o
	Art. comp. sports	+		-	o
	Other types	++		-	-
Güllich, 2018 <sup>(6)</sup>	Track and field	+	o	o	o
National class, Regional class and below Regional class					
Baker et al., 2012	Handball (m)	o			
	Handball (f)	o			
Ford & Williams, 2012	Soccer (m)	+	++		
Ford et al., 2009	Soccer (m)	-	+++		
Ford et al., 2010	Cricket (m)	+++	++		
Haugaasen et al., 2014	Soccer (m)	+			
Hendry, 2012	Soccer (m)	+++	-		
	Soccer (m)	+	o		
	Soccer (m)	o	+		
Hendry & Hodges, 2018	Soccer (m)	++	o		
Hendry et al., 2018	Soccer (m)	o	o		
Mendes et al., 2018	Volleyball (m)	-		---	
San & Lee, 2014	Swimming	+++	o		
Young & Salmela, 2010	Track and field (m)	+			
	Track and field (m)	++			
<b>Extreme contrast performance levels <sup>(4)</sup></b>					
Ford et al., 2009	Soccer (m)	+++	+		
Hutchinson et al., 2013	Ballet	+++			
Ward et al., 2007	Soccer (m)	+++		---	---
Weissensteiner et al., 2008	Cricket (m)	++	-	o	o
	Cricket (m)	+++	++	+	+
Young & Salmela, 2010	Track and field	+++			

**Notes.** <sup>(1)</sup>Systematic search for studies in electronic data bases and citation chains through Dec. 31, 2018. Inclusion of original study reports that compared athletes across higher and lower performance levels within a defined age category and sex on one or more predictors. World class: Top ten in international championships (Olympic Games, world, continental championships); National class: national team, national squad, 1<sup>st</sup> national league, national championships; Regional class: 2<sup>nd</sup> national division to regional, federal state, provincial championships.

<sup>(2)</sup>Unless reported in the papers, effect sizes were calculated from published descriptive statistics or converted from other figures of effect sizes (e.g., correlation). For some studies, descriptive statistics (M, SD) were recorded from published diagrams. For studies with multiple indicators of an activity (e.g., across different age categories) we calculated the composite effect size. <sup>(3)</sup>Cgs sports: performance is measured in centimeters, grams or seconds; Art. comp.: Artistic composition sports (artistic gymnastics, figure skating, platform diving, etc.); Combat sports: e. g. fencing, judo, wrestling, etc. <sup>(4)</sup>Bandwidth of compared performance levels: narrow / medium = within a level, across neighbored levels or two levels; extreme contrast = across three or four levels. <sup>(5)</sup>The three *junior age* swimmers in the sample were excluded from the analysis. <sup>(6)</sup>Data for the athletes with world class and national class junior performance extracted from the original data. Unpublished data on youth-led play in other sports were complemented from Güllich (2017).

## Methodological Considerations and Future Directions

The study was not without limitations. It involved competitive childhood/adolescent athletes. Although we found no significant effect of age differences, it may be that perceptions and

motives are more associated to the premises of the concept of deliberate practice and of the DMSP among younger children (or older athletes) or among recreational (or higher-level) athletes. One of the BMZI dimensions (PhysActiv) was omitted from analyses because it lacked

internal consistency. It may therefore be that the study rather under-estimated the breadth of the youth athletes' multi-dimensional composition of different motives to engage in the sport activities. Furthermore, other factors that potentially influence motives and perceptions of the sport activities were not considered, such as coaching style or peer relationships.

Future research may seek to enable more robust empirical substantiation of the underlying premises of the frameworks of deliberate practice (Ericsson et al., 1993) and the DMSP (Côté et al., 2007) among competitive athletes. Empirical research should *measure*, rather than ascribe, the relevant characteristics of deliberate practice and deliberate play. Each of the ascribed characteristics of deliberate practice and deliberate play may thereby be considered as *dimensional* rather than categorical variables. The *multi-dimensional composition* of different goals and motives may be adequately considered and perhaps be complemented by taking the satisfaction of the motives into account. This will enable empirical investigation into the question to what extent individual differences in the characteristics that were hypothesised to be causal to the supposed outcomes actually lead to individual differences in the manifestations of the expected future outcomes (deliberate practice: performance; deliberate play: intrinsic motivation, prolonged engagement, performance), be it individually or in multivariate interaction.

### Acknowledgement

The authors wish to express their sincere thanks to the anonymous reviewers and to Brooke Macnamara and Zach Hambrick for valuable feedback on an earlier draft of this paper.

### Author's Declarations

The authors declare that there are no personal or financial conflicts of interest regarding the research in this article.

The authors declare that they conducted the research reported in this article in accordance with the [Ethical Principles](#) of the Journal of Expertise.

The authors declare that they are not able to make the dataset publicly available but are able to provide it upon request.

### References

- Baker, J., Bagats, S., Büsch, D., Strauss, B., & Schorer, J. (2012). Training differences and selection in a talent identification system. *Talent Development & Excellence, 4*, 23-32.
- Baker, J., Côté, J., & Abernethy, B. (2003). Sport-specific training, deliberate practice and the development of expert decision-making in team ball sports. *Journal of Applied Sport Psychology, 15*, 12-25. doi: 10.1080/10413200305400
- Baker, J., Côté, J., & Deakin, J. (2005). Expertise in ultra-endurance triathletes early sport involvement, training structure, and the theory of deliberate practice. *Journal of Applied Sport Psychology, 17*, 64-78. doi: 10.1080/10413100590907577.
- Baker, J., Côté, J., & Deakin, J. (2006). Patterns of early involvement in expert and nonexpert masters triathletes. *Research Quarterly for Exercise and Sport, 77*, 401-404.
- Barreiros, A., Côté, J., & Fonseca, A. M. (2013). Training and psychosocial patterns during the early development of Portuguese national team athletes. *High Ability Studies, 24*, 49-61. doi: 10.1080/13598139.2013.780965.
- Berry, J., Abernethy, B., & Côté, J. (2008). The contribution of structured activity and deliberate play to the development of expert perceptual and decision-making skill. *Journal of Sport & Exercise Psychology, 30*, 685-708.
- Borg, G. (1982). Psychophysical bases of perceived exertion. *Medicine and Science in Sports and Exercise, 14*, 377-381.
- Bortz, J., & Schuster, C. (2010). *Statistik für Sozialwissenschaftler* [Statistics for researchers in human and social sciences] (7th edition). Berlin, GER: Springer.
- Bruce, L., Farrow, D., & Raynor, A. (2013). Performance milestones in the development of expertise: Are they critical? *Journal of Applied Sport Psychology, 25*, 281-297. doi: 10.1080/10413200.2012.725704.
- Bruner, M. W., Erickson, K., Wilson, B., & Côté, J. (2010). An appraisal of athlete development models through citation network analysis. *Psychology of Sport and Exercise, 11*, 133-139.
- Butcher, J., Lindner, K. J., & Johns, D. P. (2002). Withdrawal from competitive youth sport: A

- retrospective ten-year study. *Journal of Sport Behavior*, 25, 145-163.
- Cathey, R. M., & French, K. E. (2014). Retrospective practice histories of expert and novice baseball pitchers. *Research Quarterly for Exercise and Sport*, 85, sup1, A-108.
- Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice: a developmental framework for the acquisition of expertise in team sport. In J. L. Starkes & K. A. Ericsson (Eds.), *Expert performance in sports. Advances in research on sport expertise* (pp. 89-114). Champaign, US: Human Kinetics.
- Côté, J., Baker, J., & Abernethy, B. (2007). Practice and play in the development of sport expertise. In R. Eklund & G. Tenenbaum (Eds.), *Handbook of Sport Psychology* (pp. 184-202). Hoboken, US: Wiley.
- Côté, J. & Erickson, K. (2015). Diversification and deliberate play during the sampling years. In J. Baker & D. Farrow (Eds.), *The Routledge handbook of sport expertise* (pp. 305-316). New York, US: Routledge.
- Côte, J., & Hay, J. (2002). Children's involvement in sport: a developmental perspective. In J. M. Silva & D. E. Stevens (Eds.), *Psychological foundations of sport* (pp. 484-502). Boston, US: Allyn & Bacon.
- Côté, J., Lidor, R., & Hackfort, D. (2009). ISSP position stand: To sample or to specialize? Seven postulates about youth activities that lead to continued participation and elite performance. *International Journal of Sport and Exercise Psychology*, 9, 7-17. doi: 10.1080/1612197X.2009.9671889.
- Côté, J., Turnnidge, J., & Evans, M. B. (2014). The dynamic process of development through sport. *Kinesiology Slovenica* 20, 14-26.
- Coutinho, P., Mesquita, I., Davids, K., Fonseca, A. M., & Côté, J. (2016). How structured and unstructured sport activities aid the development of expertise in volleyball players. *Psychology of Sport and Exercise*, 25, 51-59.
- Coutinho, P., Mesquita, I., Fonseca, A. M., & De Martin-Silva, L. (2014). Patterns of sport participation in Portuguese volleyball players according to expertise level and gender. *International Journal of Sports Science & Coaching*, 9, 579-592.
- Da Matta, G. B. (2004). *The influence of deliberate practice and social support systems on the development of expert and intermediate women volleyball players in Brazil*. Doctoral dissertation, University of South Carolina, Columbia, US.
- Drake, D., & Breslin, G. (2017). Developmental activities in the acquisition of perceptual-cognitive expertise in international field hockey players. *International Journal of Sports Science and Coaching*, 13, 636-642. doi: 10.1177/1747954117711093.
- Duda, J. L., & Nicholls, J. G. (1992). Dimensions of achievement motivation in schoolwork and sport. *Journal of Educational Psychology*, 84, 290-299.
- Duffy, L. J., Baluch, B., & Ericsson, K. A. (2004). Dart performance as a function of facets of practice amongst professional and amateur men and women players. *International Journal of Sport Psychology* 35, 232-245.
- Emrich, E., & Prohl, R. (2008). Agonality: Competitive sport in the conflict area between success, moral and aesthetics [in German: Agonalität: Wettkampfsport im Spannungsfeld zwischen Erfolg, Moral und Ästhetik]. *Leipziger Sportwissenschaftliche Beiträge*, 49, 67-88.
- Erickson, K. J., Côté, J., Turnnidge, J., Allan, V., & Vierimaa, M. (2017). Play during childhood and the development of expertise in sport. In D. Z. Hambrick, G. Campitelli, & B. N. Macnamara (Eds.), *The science of expertise: Behavioral, neural, and genetic approaches to complex skill* (pp. 398-415). New York, US: Routledge.
- Ericsson, K. A. (2002). Attaining excellence through deliberate practice: Insights from the study of expert performance. In M. Ferrari (Ed.), *The educational psychology series. The pursuit of excellence through education* (pp. 21-55). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
- Ericsson, K. A. (2003). Development of elite performance and deliberate practice: An update from the perspective of the expert performance approach. In J. L. Starkes, & K. A. Ericsson (Eds.), *Expert performance in sports. Advances in research on sport expertise* (pp. 49-81). Champaign, US: Human Kinetics.
- Ericsson, K. A. (2006). The influence of experience and deliberate practice on the development of superior expert performance. In K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 685-705). Cambridge, UK: Cambridge University Press.
- Ericsson, K. A. (2007). Deliberate practice and the modifiability of body and mind: Toward a science of the structure and acquisition of expert



- and elite performance. *International Journal of Sport Psychology*, 38, 109-123.
- Ericsson, K. A. (2013). Training history, deliberate practice and elite sports performance: An analysis in response to Tucker and Collins Review – “What makes champions?” *British Journal of Sports Medicine*, 47, 533-535. doi: 10.1136/bjsports-2012-091767.
- Ericsson, K. A. (2014). *Challenges for the estimation of an upper-bound on relations between accumulated deliberate practice and the associated performance of novices and experts: Comments on Macnamara, Hambrick, and Oswald's (2014) published meta-analysis*. Retrieved from <https://psy.fsu.edu/faculty/ericsson/ericsson.hp.html>.
- Ericsson, K. A. (2016). Summing up hours of any type of practice versus identifying optimal practice activities: Commentary on Macnamara, Moreau, & Hambrick (2016). *Perspectives on Psychological Science* 11, 351-354. doi: 10.1077/1745691616635600.
- Ericsson, K. A. (2019). Towards a science of the acquisition of expert performance in sports: Clarifying the differences between deliberate practice and other types of practice. *Journal of Sports Sciences* 37, Epub ahead of print Nov. 12, 2019. doi: 10.1080/02640414.2019.1688618.
- Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100, 363-406. doi:10.1037/0033-295X.100.3.363
- Ford, P. R., Low, J., McRobert, A. P., & Williams, A. M. (2010). Developmental activities that contribute to high and low performance by elite cricket batters when recognizing type of delivery from bowlers' advanced postural cues. *Journal of Sport & Exercise Psychology*, 32, 638-654.
- Ford, P. R., Ward, P., Hodges, N. J., & Williams, A. M. (2009). The role of deliberate practice and play in career progression in sport: the early engagement hypothesis. *High Ability Studies*, 20, 65-75. doi: 10.1080/13598130902860721.
- Ford, P. R & Williams, A. M. (2012). The developmental activities engaged in by elite youth soccer players who progressed to professional status compared to those who did not. *Psychology of Sport and Exercise*, 13, 349-352. doi: 10.1016/j.psychsport.2011.09.004.
- Fraser-Thomas, J., Côté, J., & Deakin, J. (2008). Examining adolescent sport dropout and prolonged engagement from a developmental perspective. *Journal of Applied Sport Psychology*, 20, 318-333. doi: 10.1080/ 10413200802163549.
- Güllich, A. (2014). Many roads lead to Rome – Developmental paths to Olympic gold in men's field hockey. *European Journal of Sport Science*, 14, 763-771. doi: 10.1080/17461391.2014.905983.
- Güllich, A. (2017). International medallists' and non-medallists' developmental sport activities – a matched-pairs analysis. *Journal of Sports Sciences*, 35, 2281-2288. doi: 10.1080/02640414.2016.1265662.
- Güllich, A. (2018). Sport-specific and non-specific practice of strong and weak responders in junior and senior elite athletics – A matched-pairs analysis. *Journal of Sports Sciences*, 36, 2256-2264. doi: 10.1080/02640414.2018.1449089.
- Güllich, A. (2019). “Macro-structure” of developmental participation histories and “micro-structure” of practice of German female world-class and national-class football players. *Journal of Sports Sciences*, 37, 1347-1355. doi: 10.1080/02640414.2018.1558744.
- Güllich, A., & Emrich, E. (2014). Considering long-term sustainability in the development of world class success. *European Journal of Sport Science*, 14(S1), 383-397. doi: 10.1080/17461391.2012.706320.
- Hardy, L., Laing, S., Barlow, M., Kincheva, L., Evans, L., Rees, T., ... Kavanagh, J. (2013). *A comparison of the biographies of GB serial medal and non-medalling Olympic athletes*. London: UK Sport.
- Harris, K. R. (2008). *Deliberate practice, mental representations, and skilled performance in bowling*. Doctoral dissertation, Florida State University, Tallahassee, US.
- Haugaasen, M., Toering, T., & Jordet, G. (2014). From childhood to senior professional football: A multi-level approach to elite youth football players' engagement in football-specific activities. *Psychology of Sport & Exercise*, 15, 336-344. doi: 10.1016/j.psychsport.2014.02.007.
- Helsen, W. F., Starkes, J. L., & Hodges, N. J. (1998). Team sports and the theory of deliberate practice. *Journal of Sport & Exercise Psychology*, 20, 12-24.
- Hendry, D. T. (2012). *The role of developmental activities on self-determined motivation, passion and skill in youth soccer players*. Master Thesis, University of British Columbia, Vancouver, CAN.
- Hendry, D. T., Crocker, P. R. E., & Hodges, N. J. (2014). Practice and play as determinants of self-determined motivation in youth soccer

- players. *Journal of Sports Sciences*, 32, 1091-1099. doi: 10.1080/02640414.2014.880792.
- Hendry, D. T., & Hodges, N. J. (2018). Early majority engagement pathway best defines transitions from youth to adult elite men's soccer in the UK: A three-point retrospective and prospective study. *Psychology of Sport and Exercise*, 36, 81-89.
- Hendry, D. T., & Hodges, N. J. (2019). Pathways to expert performance in soccer. *Journal of Expertise*, 2019, 2(1): 1-13.
- Hendry, D. T., Williams, A. M., & Hodges, N. J. (2018). Coach ratings of skills and their relations to practice, play and successful transition from youth-elite to adult-professional status in soccer. *Journal of Sports Sciences*, 36, 2009-2017. doi: 10.1080/02640414.2018.1432236.
- Hodges, N. J., Augaitis, L., & Crocker, P. R. E. (2015). Sport commitment and deliberate practice among male and female triathletes. *International Journal of Sport Psychology*, 46, 652-665. doi: 10.7352/IJSP2015.46.652.
- Hodges, N. J. & Starkes, J. L. (1996). Wrestling with the nature of expertise: A sport-specific test of Ericsson, Krampe, and Tesch-Römer's (1993) theory of deliberate practice. *International Journal of Sport Psychology*, 27, 400-424.
- Hornig, M., Aust, F., & Güllich, A. (2016). Practice and play in the development of German top-level professional football players. *European Journal of Sport Science*, 16, 96-105. doi: 10.1080/17461391.2014.982204.
- Hutchinson, C. U., Sachs-Ericsson, N. J., & Ericsson, K. A. (2013). Generalizable aspects of the development of expertise in ballet across countries and cultures: A perspective from the expert-performance approach. *High Ability Studies*, 24, 21-47. doi: 10.1080/13598139.2013.780966.
- Johnson, M., Tenenbaum, G., & Edmonds, W. A. (2006). Adaptation to physically and emotionally demanding conditions: the role of deliberate practice. *High Ability Studies*, 17, 117-136. doi: 10.1080/13598130600947184.
- Kant, I. (1787). Critique of pure reason [in German: Kritik der reinen Vernunft] (2nd ed.). Riga: Hartknoch.
- Kenyon, G. S. (1968). Six scales for assessing attitude toward physical activity. *Research Quarterly*, 39, 566-574.
- Law, M. P., Côté, J., & Ericsson, K. A. (2007). Characteristics of expert development in rhythmic gymnastics: A retrospective study. *International Journal of Sport & Exercise Psychology*, 5, 82-103. doi: 10.1080/1612197X.2008.9671814.
- Lehnert, K., Sudeck, G., & Conzelmann, A. (2011). BMZI - Bernese Motives and Goals Inventory for exercise and sport activity [in German: BMZI – Berner Motiv- und Zielinventar im Freizeit- und Gesundheitssport]. *Diagnostica*, 57, 146-159.
- Memmert, D., Baker, J., & Bertsch, C. (2010). Play and practice in the development of sport-specific creativity in team ball sports. *High Ability Studies*, 21, 3-18. doi: 10.1080/13598139.2010.488083.
- Mendes, F. G., Nascimento, J. V., Souza, E. R., et al. (2018). Retrospective analysis of accumulated structured practice: A Bayesian multilevel analysis of elite Brazilian volleyball players. *High Ability Studies*, 29, 255-269. doi: 10.1080/13598139.2018.1507901.
- Moesch, K., Elbe, A.-M., Hauge, M.-L. T., & Wikman, J. M. (2011). Late specialization: the key to success in centimeters, grams, or seconds (cgs) sports. *Scandinavian Journal of Medicine and Science in Sport*, 21, e282-290. doi: 10.1111/j.1600-0838.2010.01280.x.
- Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Brière, N. M., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The sport motivation scale (SMS). *Journal of Sport & Exercise Psychology*, 17, 35-53.
- Roca, A., Williams, A. M., & Ford, P. R. (2012). Developmental activities and the acquisition of superior anticipation and decision making in soccer players. *Journal of Sports Sciences*, 30, 1643-1652.
- San, A. T. I. & Lee, J. L. F. (2014). Developmental practice activities of elite youth swimmers. *Movement, Health & Exercise*, 3, 27-37.
- Schmid, J., Gut, V., Conzelmann, A., & Sudeck, A. (2018). Bernese motive and goal inventory in exercise and sport: Validation of an updated version of the questionnaire. *PLoS ONE* 13, e0193214. doi: 10.1371/journal.pone.0193214.
- Smith, A. (2012). *Retrospective practice histories of Division I and Division II female basketball players in the Carolinas*. Doctoral thesis, University of South Carolina, US.
- Soberlak, P., & Côté, J. (2003). The developmental activities of elite ice hockey players. *Journal of Applied Sport Psychology*, 15, 41-49. doi: 10.1080/10413200390180053.
- Tenbruck, F. (1978). On the anthropology of acting [In German: Zur Anthropologie des Handelns]. In H. Lenk (Ed.), *Interdisciplinary theories of*

- acting* [In German: *Handlungstheorien interdisziplinär*] (pp. 89-138). Munich, GER: Fink.
- Thomas, A., & Güllich, A. (2019). Childhood practice and play as determinants of adolescent intrinsic and extrinsic motivation among elite youth athletes. *European Journal of Sport Science*, *19*, 1120-1129. doi: 10.1080/17461391.2019.1597170.
- Ureña, C. A. (2004). *Skill acquisition in ballet dancers: The relationship between deliberate practice and expertise*. Doctoral dissertation. Tallahassee, US: Florida State University.
- Vallerand, R. J. (2007). Intrinsic and extrinsic motivation in sport and physical activity. A review and a look at the future. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology (3<sup>rd</sup> edition)* (pp. 59-83). New York: Wiley.
- Wall, M., & Côté, J. (2007). Developmental activities that lead to drop out and investment in sport. *Physical Education and Sport Pedagogy*, *12*, 77-87.
- Ward, P., Hodges, N. J., Starkes, J. L., & Williams, A. M. (2007). The road to excellence: deliberate practice and the development of expertise. *High Ability Studies*, *18*, 119-153.
- Weissensteiner, J., Abernethy, B., Farrow, D., & Müller, S. (2008). The development of anticipation: A cross-sectional examination of the practice experiences contributing to skill in cricket batting. *Journal of Sport & Exercise Psychology*, *30*, 663-684.
- Young, B. W., & Salmela, J. H. (2002). Perception of training and deliberate practice of middle distance runners. *International Journal of Sport Psychology*, *33*, 167-181.

Received: 11 August 2019

Revision received: 14 December 2019

Accepted: 31 January 2020

