State space grids: First application of a novel methodology to examine coach-athlete interactions in competitive youth sport

by

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Abstract

The purpose of this study was to compare the coach-athlete interaction structures of two competitive youth synchronized swimming teams, one more successful with regard to athletes’ performance and personal development than the other. This comparison was conducted through the first application of state space grid (SSG) observational methodology (Hollenstein, 2007; Lewis, Lamey, & Douglas, 1999) in field-based sport psychology research. Both teams (two head coaches and 17 athletes in total) were observed over multiple training sessions. Both coach and athlete behaviour was coded continuously for the duration of each training session. Measures of coach athlete interaction structure, based on dynamic systems concepts, were derived from these coded behaviours and compared between teams. Results revealed significant differences between the two teams on measures of interaction variability, behavioural content patterns, and the sequencing of coach behaviours. The more successful team was characterized by less variable, more patterned interactions between coaches and athletes. This patterning took the form of more individualized technical and positive reinforcement feedback information and significantly less use of negative feedback by the head coach, interspersed with substantial periods of silent observation. The athletes of the more successful team more actively acknowledged the receipt of this feedback from their coach. The sequencing of coach behaviours was more patterned for the coach of the more successful team, with heavy emphasis on the pairing of technical correction and positive reinforcement statements. The findings suggest that a respectful, deliberate pattern of coach-athlete interaction may be associated with youth sport environments producing more positive performance and personal development outcomes for athletes.
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Chapter 1: Introduction

Over the last 20 years, researchers in developmental psychology have examined the experiences and factors that influence the development of youth from a positive or asset-promoting perspective (Benson, 1997; Damon, 2004; Dworkin, Larson, & Hanson, 2003) rather than a deficit reduction approach. Given its popularity and the significant amount of time youth spend in sport compared to other organized activities (Eccles & Barber, 1999; Larson & Verma, 1999), sport is a context through which positive youth development can be fostered. Fraser-Thomas, Côté, and Deakin (2005) highlighted the significant role played by coaches, parents, and administrators in ensuring a developmentally appropriate environment. In particular, the role of sport coaches in fostering positive outcomes (covering both performance and personal development) in youth through their behavior and interactions with these athletes has been stressed for over 30 years (e.g., Conroy & Coatsworth, 2006; Curtis, Smith, & Smoll, 1979; Gould, Collins, Lauer, & Chung, 2007). Based on this literature Côté & Gilbert, (2009) proposed a definition of effective coaching as primarily concerned with athlete development, summarized as:

‘The consistent application of integrated professional, interpersonal, and intrapersonal knowledge to improve athletes’ competence, confidence, connection, and character in specific coaching contexts.’ (Côté & Gilbert, 2009, pg. 316)

Thus, athlete development by this definition refers not only to performance-related skills and abilities, but also to athletes’ overall intra- and interpersonal growth and is the primary targeted outcome of the coaching process. Jowett and Poczwardowski (2007) similarly highlight that the quality of coach-athlete relationships should be defined according to both performance success and effectiveness in promoting personal growth.
But how do sport coaches go about promoting this holistic development in actual practice? Côté, Young, North, and Duffy (2007) and Côté, Bruner, Erickson, Strachan, and Fraser-Thomas (in press) recently outlined a typology of 4 different categories of coaches based on different developmental contexts: (a) participation coaches for children, (b) participation coaches for adolescents, (c) performance coaches for young adolescents, and (d) performance coaches for older adolescents and adults. Each of these coaching contexts has different athlete needs and considerations, and therefore different requisite coaching knowledge and abilities in order to produce positive athlete outcomes. Thus, the methods through which coaches promote positive outcomes will differ, depending on the specific coaching context as determined by the age and competitive level of the athletes they coach. With this typology in mind, the present study sought to address the question of how performance coaches’ interaction with young adolescent athletes is associated with performance and personal developmental outcomes. The objective of this work was to increase our understanding of the coaching process in youth sport. Results might serve to guide future research, as well as provide a basis for preliminary recommendations for coach education and practice.
Chapter 2: Literature review

Youth sport coaching and athlete outcomes

A substantive body of research has addressed the influence of youth sport coaches on athlete outcomes and noted a consistent effect of coaches’ behaviour and interaction style on the outcomes athletes experience in their sport participation (Horn, 2008). Though not specifically targeting athlete development, research using the Leadership Scale for Sport questionnaire (Chelladurai & Saleh, 1980) consistently found athlete satisfaction to be positively associated with a democratic leadership style as perceived by athletes and negatively associated with an autocratic leadership style (Chelladurai, 2007). Work with young swimmers (Pelletier, Fortier, Vallerand, & Brière, 2001) and gymnasts (Gagné, Ryan, & Bargmann, 2003) highlighted the positive relationship between an autonomy-supportive interpersonal coaching style as perceived by athletes and more self-determined forms of motivation and persistence.

Using qualitative methods to more directly address positive athlete development, McCallister, Blinde, and Weiss (2000) interviewed youth sport coaches with no formal coach training and found that while coaches valued the teaching of life skills, they struggled to enact these lessons, both behaviourally and in formulating strategies to do so. Gould Collins, Lauer, and Chung (2007) used similar qualitative interviews with award-winning high school football coaches and found these coaches had definite and specific strategies for holistic player development which were not separate from performance goals. These strategies related to working with players and building relationships with them, dealing respectfully with significant others in the sport environment (officials, assistant coaches, and parents), utilizing appropriate performance enhancement strategies, and directly teaching life skills. The contrast between the coaches interviewed by
McCallister et al. (2000) and by Gould et al. (2007) may reflect the learning of necessary behaviours required for coaches to effectively promote positive youth development. With regard to performance, coaches of winning youth sport teams and athletes demonstrate high levels of instructive behaviours, often using more questioning-style instruction than less successful coaches (Claxton, 1988; Lacy & Darst, 1985).

In perhaps the most notable line of research on youth sport coaching, Smith, Smoll, and colleagues (Curtis, Smith, & Smoll, 1979; Smith & Smoll, 1990; Smoll, Smith, Curtis, & Hunt, 1978; Smith, Zane, Smoll, & Coppel, 1983) made use of observational techniques to elucidate the relationship between specific coaching behaviours and positive youth sport experiences. To observe coaching behaviour, Smith, Smoll, and colleagues developed the now widely used Coaching Behavior Assessment System (CBAS; Smith, Smoll, & Hunt, 1977a). A systematic observation instrument, the CBAS consists of 12 coach behaviour categories (eight in response to athlete behaviour, four initiated by the coach not in response to immediately preceding athlete behaviour) developed through detailed content analysis of coaches in a number of youth sports. The program of research coded coaching behaviours recorded using the CBAS and generated behavioural profiles for youth sport coaches by calculating the relative frequency of expression of each of the behavioural categories. This was paired with administration of interviews and questionnaires to youth regarding their perceptions of their coach, their sport experience, and themselves. In general, Smith, Smoll, and colleagues concluded that youth sport coaches who exhibited high levels of supportive and instructional behaviours were rated most positively by their athletes. They also noted that athletes of coaches who demonstrated more supportive and instructive behaviours reported having more fun and
liking their teammates more than athletes of coaches who were more punitive in their interactions.

Based on results from these descriptive and correlative studies, Smith, Smoll and colleagues developed the Coach Effectiveness Training program (CET: Smith & Smoll, 1997; Smith & Smoll, 2002; Smith, Smoll, & Curtis, 1979) to educate coaches to better promote positive psychosocial outcomes in the athletes they coach. By training coaches to be more supportive, instructive, and less punitive in a number of controlled intervention studies (Barnett, Smoll, & Smith, 1992; Smith & Smoll, 1997; Smith, Smoll, & Barnett, 1995; Smoll, Smith, Barnett, & Everett, 1993; Smith et al, 1979), these authors were able to alter coaches’ actual behaviour and produce a number of positive outcomes in athletes to a greater degree than with untrained coaches. They found that athletes with trained coaches had more fun, decreased performance anxiety, were less likely to drop out, and evaluated their coaches, teammates, and the sport more positively than athletes with untrained coaches. These results were found despite no differences in won/lost records between the trained and untrained coaches, suggesting a significant causal role was played by the CET program in producing these differential athlete outcomes. The influential line of research conducted by Smith, Smoll, and colleagues, in concert with the other previously reviewed studies of coaching behaviour, demonstrates how coach behaviour can be both a determinant of athlete outcomes and a productive avenue for intervention and positive change.

Despite the valid formulation of empirically-derived principles to guide coach training interventions, the supporting data has been presented through frequency counts, providing little information about the dynamic nature of such behaviours. While CET has solid theoretical foundations for the recommended modes of translating this content into
practice in actual coaching situations, there remains a dearth of empirical evidence related to these behavioural processes – how these behaviours should be enacted over time (e.g., the course of a training session). Smith (2006) made a significant step in this regard through the re-analysis of older CBAS-derived data. By examining intra-individual variability in coaching behaviours in relation to game situation (i.e., winning, tied, losing), Smith was able to generate contextually linked behavioural signatures for individual coaches. These signatures represented the manner in which the frequency of specific coach behaviour occurrence changed over the course of a game. While this analysis provided valuable insight into the dynamic, shifting nature of coach behaviour and represents an important step forward conceptually, the data were presented in a primarily theoretical paper and were not linked to athlete outcomes, nor did the analysis take temporal sequencing into account. Thus, much remains to be done to complete our understanding of the influence of dynamic coach behaviour on athlete outcomes and to best inform more effective training of coaches in the promotion of positive personal and psychosocial development in youth.

Conceptualizations of the coaching process and implications for athlete development

Additionally, it is important to note how the coaching process - the act of coaching - has been conceptualized by previous researchers. Most previous research on coaching behaviours has taken a unidirectional view of influence (also see Kahan, 1999; Horn, 2008). That is, the influence of coaches’ behaviours on athletes’ experiences has been the focus, without regard for how athletes’ reactions and responses may in turn influence future coach behaviours, and thus athletes’ development. In this view, the coaching process is done by coaches to athletes, which reduces athletes to non-contributing recipients of outcomes and ignores the ability of the athlete to influence or contribute to
their own development. This unidirectional view also does not offer insight into how the effects of a particular coach behaviour may be influenced by preceding or subsequent athlete behaviours. For example, is positive reinforcement always necessary or effective in promoting positive outcomes, even if an athlete is gloating excessively?

In contrast, a multidirectional conceptualization of coach-athlete interactions (Bowes & Jones, 2006; Cushion, Armour, & Jones, 2006; Jones & Wallace, 2005) suggests that coaching is, in fact, a complex, reciprocally-influential process based on systems of social interaction. Poczwardowski, Barott, and Jowett (2006) identified a number of pertinent research directions to incorporate this conceptualization into the study of coach-athlete relationships. In particular, they suggest shifting from a focus on the individual to the inter-individual, specifically coach-athlete dyads, as the central unit of study and diversifying methodological approaches in order to best reflect the dyadic unit and its functioning. Both Poczwardowski (Poczwardowski, Barott, & Henschen, 2002; Poczwardowski, Barott, & Peregoy, 2002) and Jowett (e.g., Jowett, 2003; Jowett & Meek, 2000; Jowett & Ntoumanis, 2004) have utilized this orientation in their own work with high performance athletes, using both qualitative and quantitative questionnaire methods. The adoption of this perspective led to Jowett’s conceptualization of the 3 + 1 C’s (closeness, commitment, and complementarity + co-orientation) model of coach-athlete relationships, whereby the quality of a coach-athlete relationship is determined by its degree of interdependence as measured by the 3 + 1 C’s. Work by D’Arripe-Longueville and colleagues (D’Arripe-Longueville, Fournier, & Dubois, 1998; D’Arripe-Longueville, Saury, Fournier, & Durand, 2001) with elite French sport teams has taken a similarly interactive approach, examining the communication and perceptions of both coaches and athletes in a given situation. Notably, their innovative qualitative study of coach-athlete
interactions during elite archery competitions (D’Arripe-Longueville et al., 2001) recorded the actions and perceptions of both coaches and athletes through self-confrontation interviews while each viewed video-recorded competition situations and then aligned the two data streams temporally. In doing so, the researchers revealed the give-and-take nature of these interactions over time, whereby interactive behaviour by the coach or athlete influenced subsequent behaviours by the other and thus the overall path of the interaction. Neither coach nor athlete acted as an independent unit but were instead highly interdependent in the selection of their interactive behaviour. Thus, the goals and objectives of either actor in isolation do not explain the mutually constructed interactive environment. A full understanding of coach-athlete relationships and interactions must take into account both parties and recognize the interdependent nature of this milieu.

Further, the chosen methodology must be able to capture and reflect this interdependence. Despite the theoretical relevance of such an inclusive view in a more developmental setting, the same body of work does not yet exist for the youth sport context.

Bronfenbrenner (Bronfenbrenner, 1979; Bronfenbrenner & Morris 1998) posited that the study of youth development must take into account all members of the developmental environment from an interactive perspective. Bronfenbrenner (Bronfenbrenner, 1979; Bronfenbrenner & Morris 1998) further suggested that reciprocal and mutually influential interactions between members occurring over time, which he labelled proximal processes, are the primary drivers of development. The application of Bronfenbrenner’s perspective to guide developmentally-focused sport research has been encouraged (e.g., Garcia Bengoechea, 2002), but not yet manifested on a large scale. Similarly, Lerner (2002) highlighted the necessity of taking a developmental systems approach, whereby the individual cannot be understood in isolation from the context in which he/she is
developing and developmental outcomes are the product of continuing interactions between the individual and their context(s). Ford and Lerner (1992) summarized a number of guiding principles for understanding youth development. These principles focus on the necessity of studying the varying relations between levels of organization (i.e., the individual and their context) and individual’s self-construction of their own development. Despite these theoretical initiatives and the recognition of the coach as a primary component of the developmental context in sport, no research has addressed coach-athlete interactions in youth sport from a reciprocally interactive view.

Coach-athlete interactions as dynamic systems

In response to similar gaps relating to interactive relationships and their variability over time, researchers in developmental psychology have proposed dynamic systems views as melding and accounting for children’s development as being driven by both children themselves and by significant others (Van Geert, 1998). A dynamic system is composed of the reciprocal interaction of individual components of the system which influence and are subsequently influenced by each other to produce the functioning of the entire system (Lewis, 2000). In this instance, the dynamic system in question is the coach-athlete dyad, with coach and athlete as individual components. Through these direct lower order interactions between components, dynamic systems self-organize over time into stable higher order patterns of functioning (Granic & Hollenstein, 2003). This emergent self-organization, the idea that a system creates its own structure rather than being guided by some existing pattern, is a central principle of dynamic systems theory (Thelen & Smith, 1998). In developmental psychology, researchers have productively examined reciprocal dyadic interaction between children and parents (e.g., Fogel & Branco, 1997; Granic, Hollenstein, Dishion, & Patterson, 2003; Hollenstein & Lewis,
and between peers (e.g., Caprara, Dodge, Pastorelli, Zelli, 2007; Dishion, Nelson, Winter, & Bullock, 2004; Steenbeek & Van Geert, 2005, 2007) by conceptualizing them as dynamic systems.

While any system has a large range of potential patterns in which it may theoretically function, systems tend to stabilize within a limited range of these possibilities. Known as attractors, these limited ranges represent states to which the system is drawn and returns to frequently. For example, a dysfunctional coach-athlete dyad might often function in a mutually negative or hostile state and have trouble maintaining interaction outside of this range (i.e., mutually positive or supportive behaviour) for any length of time. As primary characteristics of the functioning of the system, identifying attractors is often a central focus of dynamic systems-oriented research. However, a system is not limited to a single attractor state. Multiple attractors may exist for any system and it is possible to measure the variability of the system at any point in time; its tendency to function in more than one state. This variability and related measures are qualities of a system’s dynamic structure. While previous research (e.g., the work of Smith, Smoll, and colleagues) on coach behaviours in youth sport has provided an excellent account of the general content of coach behaviours (e.g., being supportive and not punitive), little is known about the dynamic structure of that content - how coaches’ behaviour varies over the course of an interaction in relation to athlete responses.

An example from developmental psychology may further illustrate the content versus structure discrepancy. Hollenstein, Granic, Stoolmiller, and Snyder (2004) took a dynamic systems approach to observe parent and child affect during a series of interactive tasks (playing a novel game, discussing a conflict, discussing the child’s day at home, working on a school-type task, and snack time). Prior to this study, it was generally
accepted that parent-child interactions consistently characterized by harsh or hostile content contribute to maladaptive externalizing and internalizing coping behaviours in children. Through the application of observational measures targeted at interaction structures from a dynamic systems perspective, Hollenstein and colleagues were able to go beyond content analysis and revealed that such behaviours were associated with the structural rigidity (or lack of flexibility) of parent-child interactions, regardless of content. That is, children in parent-child dyads whose interactions tended to get ‘stuck’ in a dyadic state (positive or negative) were more likely to develop and exhibit these problem behaviours.

*Dynamic systems in sport research.* While the dynamic structure of effective coach-athlete interactions has not been examined, dynamic systems perspectives have been used in sport science research to reveal the structural characteristics of a number of sport-related constructs. For example, the biomechanics (e.g., Schiffman, Chelidze, Adams, Segala, Hasselquist, 2009) and motor learning and control (e.g., Huys, Daffertshofer, & Beek, 2004) fields have made extensive use of systems frameworks to examine the coordination of movement. Similarly, a number of researchers have applied dynamic systems concepts to the analysis of game play and tactical decisions in sport competitions (e.g., Gréhaigne, Bouthier, & David, 1997; McGarry & Perl, 2004). Gernigon, D’Arripe-Longueville, Delignières, and Ninot (2004) were among the first to apply a dynamic systems approach within sport psychology. In their study, they examined athlete-reported goal involvement states as they varied and covaried over the course of a judo sparring session between two athletes. Each athlete continuously tracked their involvement for three different types of goal states (mastery, performance-achievement, and performance-avoidance) while watching a video of the sparring session immediately
following its completion. This technique allowed the researchers to examine the dynamic interplay between the three different goal states over the course of a real time sporting situation and the fluctuating nature of the relationship between the goal states through time. In doing so, the complexity and dynamic functioning of goal state involvement was revealed, far beyond the scope of traditional single measurement assessment. Smith (2006) also recently advocated a dynamic systems approach in sport psychology to explain both intra- and inter-individual variation in behaviour through the use of the Cognitive-Affective Processing System model (CAPS; Mischel & Shoda, 1995). The CAPS model proposes that behavioural regulation within an individual is composed of five processing and behaviour-generation units that interact with each other and with the external environment as a dynamic system. This dynamic, reciprocally influential interaction of elements over time produces individualized patterns of behavioural variation that are not captured by traditional measures of central tendency, but can be explained if conceptualized as the product of a dynamic system. With work such as that of Gernigon et al. (2004) and Smith (2006), the value of systems-type approaches in sport psychology is beginning to be recognized. In spite of this recognition, the conceptualization of dyadic interactions in sport as systems, particularly coach-athlete dyads, has not received similar research attention.

Methodological considerations

Observational methods. For this systems-guided research to occur, the methodology must capture the full nature of dyadic coach-athlete interaction (Poczwardowski et al., 2006). Given the recent view of coach-athlete interactions as a reciprocally influential dynamic system, any method must account for the explicit communicative behaviours exhibited by both parties. While this may be attempted
through self-report-type methods, the direct observation of interactions provides an unmediated account of behaviors as they occur in real time. This is especially important given the findings of Curtis, Smith, and Smoll (1979), who noted a consistently low correlation between coaches’ observed and self-reported behavior. Coaches’ perceptions of their own behaviors had little congruence with the objective behaviors they exhibited and their observed behaviors were much more strongly related to athlete outcomes. Thus, to truly understand the interactive behavior of coaches and athletes we must have an accurate picture of that behavior. This is best accomplished through direct observation of these interactions.

The importance of direct observation in coaching research has been recognized for some time (Kahan, 1999) and dates back to work by Tharp and Gallimore (1976) who studied teaching behaviors of UCLA basketball coach John Wooden. Since then, a number of systematic observation instruments have been developed and put to use within the field (Darst, Zakrajsk, & Mancini, 1989). The Coaching Behavior Assessment System (CBAS; Smith et al., 1977) and Arizona State University Observation Instrument (ASUOI; Lacy & Darst, 1984) are the most commonly used coaching observation instruments, with the CBAS being highly employed in the study of youth sport coaches. As noted earlier, the CBAS is the foundation of the line of research by Smith, Smoll, and colleagues on the effects of youth sport coaches’ behavior on the outcomes young athletes experience from sport. Use of the CBAS enabled the identification of supportiveness, instructiveness, and punitiveness as critical dimensions of coach behavior. Despite the significant contributions of previous observational coaching research, this body of literature has been heavily focused on the coach as the primary significant contributor to coach-athlete interactions, relying on the unidirectional
conceptualization of influence mentioned earlier. No research has yet addressed the relationship between coach-athlete interactions and athlete outcomes from a dynamic systems perspective and consequently many questions remain unanswered. For instance, how much behavioural variability do effective coaches exhibit? Do coach-athlete dyads get ‘stuck’ in problematic interaction patterns or do they adapt and adjust to each other? How are these interactions typically sequenced? The observational methodologies and analytic strategies currently in use have been unable to address these questions.

*State space grid methodology.* In response to traditional observational methodologies not well suited to the study of dynamic systems, researchers have developed a number of innovative methods to examine the structural features of interactions. One application of dynamic systems perspectives to observational research methodology is the use of state space grids (SSG’s: Hollenstein, 2007; Lewis, Lamey, & Douglas, 1999). Following dynamic systems principles, SSG’s are designed to account for both the reciprocal nature and structure (as opposed to simply content) of interactions over time. Developed by Marc Lewis and colleagues, the SSG technique involves constructing a “state space” for the system in question; a grid which characterizes all possible states in which the system could function.

The system, in this case the coach-athlete dyad, is composed of two or more categorical variables representing the elements of the system (i.e., coach interactive behaviour and athlete interactive behaviour). All potential values for one variable (i.e., coach behaviour) comprise the x-axis of the grid while all potential values for the other (i.e., athlete behaviour) comprise the y-axis. The location of the system at any point in time is determined by values of the x (coach)- and y (athlete)-axis variables, which combine to form coordinates specifying a specific cell within the grid. In observing the
location of the system in real time, it is possible to determine the patterns and qualities of
the system’s functioning by recording where in the total possible state space the system is
actually functioning at multiple sequential points in time. The ability to measure these
patterns and qualities holds significant potential as the structure of coach-athlete
interactions within youth sport it is not yet fully understood. To date, SSG’s have been
used only within developmental psychology and primarily in laboratory-based settings
(Dishion, et al, 2004; Hollenstein & Lewis, 2006; Granic, et al, 2003; Granic & Lamey,
2002; Hollenstein et al, 2004; Lewis et al, 1999; Lewis, Zimmerman, Hollenstein, &
Lamey, 2004).

Purpose of the study

The purpose of the current study was twofold: 1) to identify and compare the
dynamic coach-athlete interaction structures of two youth sport teams differentiated by
athlete performance and personal development outcomes, and 2) to explore the utility of
the dynamic systems-based state space grid (SSG) methodology for field-based sport
psychology research. Specifically, the current study sought to address the following
research questions regarding the nature of dyadic coach-athlete interactions associated
with more versus less positive performance and personal development youth sport
environments: 1) how variable are these dyadic interactions? 2) to what attractor states do
these dyads tend to be drawn? and 3) are these interactions characterized by particular
behavioural sequences?
Chapter 3: Methods

Participants

Participants were female head coaches \( (n = 2) \) and athletes \( (n = 17) \) from two competitive youth synchronized swimming teams (team A – 10 athletes and team B – seven athletes) in southern Ontario. Athletes were female, 11-17 years of age \( (M = 15 \) years, \( SD = 1.6) \), and averaged 6.5 years of previous experience in synchronized swimming \( (SD = 1.5) \). The teams did not significantly differ on athletes’ age or previous experience. At the time of data collection, all athletes were classified as either Tier 6 or 7 (second from highest or highest junior ability classifications) according to Synchro Swim Ontario (www.synchroontario.com) competition grouping guidelines. Team A and B, while competing in the same division, were differentiated by team performance and athlete personal development.

Performance. Performance was based on the head coach’s description of the team’s typical competitive ranking within the last several years. A general measure over a span of recent years was chosen rather than a precise account of competition results in the current season in order to tap into a more consistent impression of the typical performance environment within the team. Team A has been highly competitive at the national level, having won an age-group national championship the previous season. Team B, while competitive, has not had quite the same level of recent team success, typically finishing in the middle of the pack at the provincial level.

Personal development. Personal development was compared through scores on the Youth Experience Survey 2.0 (YES 2.0; Hansen & Larson, 2005) The YES 2.0 is a 70-item questionnaire that provides measures of positive and negative developmental experience within a specific organized activity. Measures of positive developmental
experiences are centred around three domains of personal development (identity work, initiative, and basic skills) and three domains of interpersonal development (teamwork and social skills, positive relationships, and adult networks and social capital). Also included are measures of negative developmental experiences within five domains (stress, inappropriate adult behaviour, negative influences, social exclusion, and negative group dynamics). Each positive and negative domain is represented by a single subscale. These subscales have been found to be reliable (Cronbach’s alphas between .75 and .94) and have been cross validated with observations from adult leaders (Hansen & Larson, 2005).

While no differences on any subscales reached statistical significance (set at $p = .003$ after a Bonferonni correction for multiple comparisons) - possibly expected given the small sample size in each group – potentially meaningful trends on the YES 2.0’s 4-point Likert scale were noted for several subscales. In particular, team A reported trends toward higher perceptions of problem solving experiences ($M = 3.33$, $SD = .77$ versus $M = 2.62$, $SD = .49$ for team B; $t(15) = 2.17$, $p = .014$, partial $\eta^2 = .24$) and lower perceptions of social exclusion ($M = 1.70$, $SD = .46$ versus $M = 2.10$, $SD = .50$ for team B; $t(15) = -1.70$, $p = .110$, partial $\eta^2 = .16$) and inappropriate adult behaviour ($M = 1.50$, $SD = .50$ versus $M = 2.00$, $SD = .60$ for team B; $t(96) = -1.88$, $p = .080$, partial $\eta^2 = .19$).

Thus, while athletes’ experiences on team B were not excessively negative, team A may represent a more positive personal development as well as performance environment.

Procedure

All athletes, their parents, and coaches were required to provide written consent prior to participation. Five practices within two weeks for each of the two participating teams were videotaped, with each coach wearing an omni-directional wireless
microphone to capture both their own and their athletes’ verbalizations. Practices two, three, and four were analyzed, with coaches unaware as to which practices were to be used for analysis. Multiple practice sessions within a short time period for each team were analyzed in an effort to ensure some measure of stability and/or consistency in reported structures. The first session served to acclimate coaches and athletes to the presence of the researcher and to the recording process in an effort to minimize reactivity (Smith, Smoll, & Hunt, 1977b). The fifth session was used to provide material for coder training, also serving as a backup in case any of the videos for session two, three, or four were unusable. The video for each of the middle three practices was then used to code coach and athlete behaviours in accordance with SSG methodology. Two 30-minute segments were selected from each of the three videos designated for analysis, resulting in a total of six hours of observation time spread over 12 video segments to be coded. The rationale for the selection of two 30-minute segments from each video was based on several factors; first, the minimum length of an observed practice was approximately 90 minutes. The first 20-30 minutes of each practice was usually spent in conditioning drills and/or swimming lengths, with little to no coach interaction and were therefore excluded from analysis. Thus, all practices had at least 60 minutes of practice time with analyzable density of coach-athlete interaction. These 60 minutes were split into two 30-minute segments in consideration for the coders, as the coding process requires sustained intense concentration. The state variables of interest (coach behaviour and athlete behaviour, each defined by content and affect, as well as the context in which the behaviour took place, defined as in-pool, poolside, or out of pool) were then recorded continuously for each participant using real time duration-based coding. Each behaviour variable was coded separately.
Coach-athlete interaction measure

Coding of video data involved the development of a new, contextually-based coding system following a number of Brewer and Jones’ (2002) recommendations for the development of contextually valid systematic observation instruments in sport psychology. Brewer and Jones (2002) suggest that any systematic coding system must fit the sporting context in which it will be used in order to produce valid data, thus precluding the use of previous observation instruments without modification. They propose that the process of a contextually valid observation instrument development should include amendment of an existing instrument, establishing context-specific validity, extensive observer training, and testing of observer reliability. The newly developed Coach-Athlete Interaction Coding System (CAICS) (see Appendix A) is intended for observation of in-pool practice time in a synchronized swimming team environment. The CAICS provides an exhaustive categorization of coach and athlete behaviour content, coach and athlete affect, and athlete context in relation to location in or around the pool. All categories within a particular behavioural dimension (i.e., content, affect, or context) are mutually exclusive. The selection of behavioural categories within each dimension is discussed below; for detailed descriptions of each category refer to the attached coding manual (Appendix A).

Coach behaviour content. The process of developing the CAICS began with the modification of the Coaching Behavior Assessment System (CBAS; Smith, Smoll, & Hunt, 1977a) to capture coach behaviour content. The CBAS contains 12 behavioural categories within two larger classes: reactive behaviours and spontaneous behaviours. Within reactive behaviours, coaches are responding to either a desirable performance (1. positive reinforcement or 2. non-reinforcement) or to mistakes and errors (3. mistake-
contingent encouragement, 4. mistake-contingent technical instruction, 5. punishment, 6. punitive technical instruction, or 7. ignoring mistakes), as well as responding to misbehaviour (8. keeping control). Spontaneous coach behaviours are either game/practice related (9. general technical instruction, 10. general encouragement, or 11. organization) or are game/practice irrelevant (12. general communication). The CBAS is one of the most widely used instruments for the observation of coaching behaviours (Kahan, 1999) and the behavioural categories have been shown to differentiate between different psychosocial outcomes in young athletes (Curtis et al., 1979; Smith & Smoll, 1990; Smith et al., 1978; Smith et al., 1983).

Two concerns necessitated the modification of the original CBAS for use in the current study. First, the CBAS was initially developed in male youth baseball contexts for use during competition. As such, the categories were not completely representative of the coaching behaviours occurring in a female youth synchronized swimming context during practice situations. For instance, a number of studies (e.g., Nicaise, Cogérino, Fairclough, Bois, & Davis, 2007; Solomon, DiMarco, Ohlson, & Reece, 1998; Solomon & Kosmitzki, 1996; Solomon, Striegel, Eliot, Heon, Maas, & Wayda, 1996) did not use the non-reinforcement and ignoring mistakes categories as they are not represented by overt behaviours and are difficult to identify in a sport where mistakes or desirable performances are purely subjective judgements on behalf of the coach. As well, a number of the categories were renamed to better reflect the synchronized swimming context. Given that affect was coded separately, the punitive technical instruction category (characterized by technical instruction given in a hostile or punitive tone) was not coded. Second, the CBAS was intended for event-based coding targeting behavioural frequency, without regard for the duration of behaviours or when they occur during the observed
coaching session. As the SSG analysis for the current study required exhaustive, continuous, duration-based coding, some modifications were essential in order to fully account for all behaviours exhibited by coaches during a coaching session. As such, two categories (‘observation’ and ‘not engaged’) were created to account for time coaches spent not directly interacting with athletes, thus ensuring the exhaustive nature of the coding categories. Modification of the CBAS resulted in a final total of 12 behavioural categories to classify coach behaviour content: 1) positive reinforcement, 2) corrective encouragement, 3) future encouragement, 4) corrective technical, 5) future technical, 6) organization, 7) observation, 8) general communication, 9) not engaged, 10) keeping control, 11) error technical, and 12) negative evaluation.

**Athlete behaviour content** While there are a number of observational systems used in physical education settings that code student as well as teacher behaviours (e.g., CAFIAS: Cheffers & Mancini, 1989; RIAS: Rankin, 1978; BAT: Goldberger, 1989), no comprehensive measure like the CBAS exists for interactive athlete behaviour content. Student behaviour categories in existing physical education observation systems are often either not directly related to interaction with the teacher/coach (e.g., “student is off task”), or are too broad for the purposes of the present study (e.g., “student predictable response”). Given that no single observation system exists that meets the needs of the current study with regard to athlete behaviour content, we drew several categories from different physical education observation systems to serve as an initial base grouping of categories.

Informal observation of a variety of youth sport training sessions served to expand upon this initial grouping. Exploratory qualitative interviews were then conducted with four coaches of athletes in the 13-15 age range not included in the study sample to
identify and define a complete range of athlete reactive (in response to a coach behaviour) and spontaneous (athlete initiated) interactive behaviours. The combination of previously defined and newly generated categories led to a final listing of six categories of interactive athlete behaviour content directed at the coach: 1) technical talking, 2) clarification, 3) acknowledgement, 4) general talking, 5) engaged and 6) disengaged.

**Affect and context.** Coach and athlete affect were classified according to four categories: 1) positive, 2) neutral, 3) withdrawn, or 4) hostile. Athlete context was defined by three possible code categories: 1) in-pool, 2) poolside (all or part of their body in the water but in contact with the pool deck), or 3) other (encompassing anytime athletes are not in contact with the water in any way, regardless of location). Coach context was not coded for as it was assumed that the coach would be in the ‘other’ category, not in contact with the water for the entire observation period.

**Contextual validity.** In keeping with Brewer and Jones’ (2002) recommendations, the resulting coding instrument, comprised of content, affect, and context behavioural dimensions, was then discussed with an experienced synchronized swimming coach to gauge the face validity of the chosen categories. The instrument was then pilot tested using sample video of competitive youth synchronized swimming practices to assess its validity in the synchronized swimming context; its ability to adequately capture, categorize and differentiate all behaviours relevant to the research question (Brewer & Jones, 2002).

**Coder Training and Reliability**

Consistent with Brewer and Jones’ instrument development guidelines, two independent coders not involved in study design or data collection were trained over a period of three weeks on use of the newly developed CAICS coding system and tested for
reliability before coding data to be analyzed. Coders initially familiarized themselves with the coding manual through three days of independent study. Coders then met with the primary researcher to clarify category differentiation or any concerns regarding the coding system through open discussion. Coders viewed segments of pilot video to see examples of coding category behaviours as expressed in real-world synchronized swimming situations. Coders then took a paper-and-pencil test in which they were asked to code written descriptions of coach and athlete behaviours according to the CAICS coding system. The written descriptions were purposely selected to provide maximal ambiguity with regard to behavioural criteria in order to target perceived ‘grey areas’ between adjacent code categories.

The coders then used the CAIC coding manual to code several 10-minute representative segments of video taken from sessions not intended for analysis (i.e., observed practices one or five for either team). The decision to use video of the teams selected for the study was made to familiarize the coders with the (possibly) idiosyncratic expression of interactive behaviour exhibited by these specific coaches and athletes. The resulting coded data was compared to a ‘gold standard’ coding of each segment completed by the primary researcher. The coders’ data was compared to the gold standard data for inter-rater reliability of both frequency and duration of behaviours in terms of percentage agreement. Frequency agreement between coders referred to the total number of occurrences of both coders activating the same specific behavioural category within a three second window. Duration agreement referred to the total number of seconds of coded video in which both coders had the same specific behavioural code active for each participant. Any disagreements during training were resolved through meetings where the coders and primary researcher reviewed and discussed the video in question until
consensus was reached on categorization. Coders were required to meet a minimum agreement of 75% on frequency and 90% on duration pre-discussion reliability checks for two 10-minute video segments before being allowed to code full video segments to be used in study analysis (Hollenstein et al., 2004).

Once both coders met the required reliability standard in relation to the primary researcher (frequency agreement = 75%, duration agreement = 90% on two training segments), they began coding the segments designated for analysis. Two full 30-minute segments were randomly selected to be coded by both coders, after which the coded data for these segments was compared in a further inter-rater reliability check. Again, percentage agreement for both frequency and duration of behaviours was calculated, with both meeting adequate reliability standards given the longer durations coded for segments used in analysis (freq. = 70%, 72%, dur. = 99%, 97%).

Data Analysis

Individual coach-athlete dyads were the primary unit of analysis, comprised of the coach and each individual athlete for each team. As such, 17 dyads were analyzed in total, formed by one coach and ten athletes from team A and one coach and seven athletes from team B. An example of the standard state space grid on which each coach-athlete dyadic interaction was tracked is presented in Figure 1 with the trajectory of one dyad’s interaction during a practice session. Each cell in the grid represents a distinct interactive state defined by the mutual occurrence of specific coach and athlete behaviours (the x- and y-coordinates). Dyad measures as dependent variables were grouped by team for comparison purposes. Measures of coach-athlete interaction structures were calculated using GridWare software (Version 1.1; Lamey, Hollenstein, Lewis, & Granic, 2004), designed for the SSG method. Measures were calculated for each team based on three
structural concepts: 1) variability, 2) attractor states, and 3) transitions and sequences. These measures were derived from SSG’s constructed for each coach-athlete dyadic pair (i.e., coach and athlete A, coach and athlete B, etc) during each practice.

Variability. The variability of the interactions was assessed by two whole grid parameters. The first flexibility parameter was the number of cells visited over the course of the interaction with higher numbers of cells visited indicating a more variable interaction style, less consistent in patterning. The second parameter was the number of transitions between cells, with more transitions indicating a more variable interaction. This second parameter provides additional and different information than the first parameter, as an interaction might be characterized by presence in only a low number of cells (i.e., few but strong attractors) but frequent transitions between those cells.

Figure 1. Example of SSG trajectory for one coach-athlete dyad during a practice with general classification of coaches’ and athletes’ behavioural categories.
**Attractor states.** Unlike variability, which was measured across the whole grid, attractor states were identified by computing and comparing parameters for each cell. Attractor states, areas in the state space to which the interaction tends to be drawn, were identified through two parameters, which were averaged across athletes and practices for each team. The first is mean total duration (in seconds) spent in each cell, with longer times indicating a stronger attraction. Duration per visit (with visits representing distinct occurrence of the behavioural state) was the second parameter, with stronger attractor cells reporting longer durations per visit. The two teams were compared with regard to differences or similarities in the cells (or groups of cells) that exert the most pull on the interaction.

**Transitions and sequences.** Sequences of coach behaviour specifically were analyzed via lagged phase plots, whereby coach behaviour at any given time ‘t’ was plotted along the x-axis and the subsequent coach behaviour (t +1) plotted along the y-axis. Each cell then represented the transition from the x-axis category to the y-axis category, from one coach behaviour to another, with more events in a particular cell indicating a more frequently occurring transition. The probability for individual transitions was also calculated by dividing the number of transitions from an origin behaviour to a specific subsequent behaviour by the number of total transitions from the origin behaviour to all subsequent behaviours. Thus, transitional probability = # of A-B transitions / # of total transitions from A. The frequently occurring transitions represent coach behaviour sequences, with the potential for overlapping frequently occurring transitions to be linked in three or more behaviour sequences. For example, a frequent transition from corrective encouragement to corrective technical instruction linked with a
frequent transition from corrective technical instruction to future encouragement might indicate the traditional ‘sandwich’ approach to constructive feedback.
Chapter 4: Results

Due to a lack of variance in affect for both coaches and athletes (predominantly neutral) and the absence of differences in content pattern between contexts (i.e., in pool, poolside, other), both affect and context were excluded from main analysis. The analyses presented below focuses exclusively on coach and athlete behaviour content categories. Results of coach-athlete dyadic interaction analyses are presented first with regard to overall variability of the interactions across the whole grid, followed by measures of specific attractor regions of the grid, and finally sequences of coach behaviours. Differences between team A and team B were tested statistically with independent samples $t$-tests, using Bonferroni-corrected alpha values for multiple comparisons within each conceptual grouping.

Variability

Team A was characterized by less variability in coach-athlete interaction during practices than team B on both whole grid variability measures (averaged across athletes and practice sessions). Using a corrected alpha value of .025, team A demonstrated a significantly lower mean number of cells visited ($M = 38.33, SD = 9.80$) than those of team B ($M = 43.37, SD = 10.24$; $t(96) = -2.44$, $p = .017$). As well, the mean number of transitions between cells was significantly lower for team A ($M = 311.53, SD = 41.66$) than for team B ($M = 415.42, SD = 55.18$; $t(63.35) = -9.95$, $p < .001$). See Figure 2 for example trajectories of one dyadic coach-athlete interaction for each team summed across training sessions.

Attractor states

The alpha value for attractor state comparisons was set at .002. Based on inspection of all coach-athlete dyad grids, potential attractor states and regions of
Figure 2. SSG’s for one coach-athlete dyad on team A (top) and team B (bottom) displaying summed trajectories for all practices.

theoretical interest were identified for each team. The average duration (in seconds) per practice session spent in each of these cells or regions of cells were then compared between teams, followed by comparison of the average duration per visit.
Athletes engaged in practice activities. All athletes across both teams spent the vast majority of their time engaged in practice activities (represented by the dark horizontal band across the middle of the grids in Figures 2), not directly interacting with the coach or peers. As such, differences in coach behaviour patterns while the athlete in each dyad was engaged will be presented first. Table 1 displays comparisons of mean durations per practice session for identified attractors while athletes were engaged. Note that the coach of team A spent significantly more time observing her athletes and less time organizing practice activities than did the coach of team B, who showed the opposite pattern. The difference between the two teams on technical feedback (TFB), a composite region comprised of the cells representing corrective TFB to the team, corrective TFB to individual athletes, and future-oriented technical instruction to the team, did not reach statistical significance. However, the trend toward greater duration in TFB for the coach of team B may be accounted for by significantly more time spent giving corrective TFB to the team than the coach of team A. In contrast, the coach of team A displayed significantly longer durations per visit to the TFB region ($M = 8.96, SD = 2.32$) compared to the coach of team B ($M = 5.53, SD = 1.27; t(94.37) = 9.44, p < .001$). Table 1 also shows that the coaches of the two teams did not significantly differ on the time they spent giving positive reinforcement (PR) overall. A difference lay in the target of this PR, with the coach of team A directing more PR time to individual athletes and the coach of team B directing more to the team as a whole. The coach of team B also spent more time giving negative feedback than the coach of team A. The ratio of PR to negative feedback differed between the two coaches as well, with the coach of team A spending more time giving PR than negative feedback while the reverse was observed for the coach of team B. Finally, it should be noted that the coach of team B spent significantly more time
Table 1.

Comparison of mean duration (seconds) per practice session for coach behaviours while athletes were engaged in practice activities

<table>
<thead>
<tr>
<th>Coach Behaviour</th>
<th>Team A M (SD)</th>
<th>Team B M (SD)</th>
<th>t(df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>426.44 (151.89)</td>
<td>264.95 (81.68)</td>
<td>6.82(93.95)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Organization</td>
<td>323.58 (107.11)</td>
<td>428.92 (128.34)</td>
<td>-4.39(96)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Technical feedback (TFB)</td>
<td>375.99 (84.39)</td>
<td>418.80 (63.13)</td>
<td>-2.86(93.24)</td>
<td>.005</td>
</tr>
<tr>
<td>Team corrective TFB</td>
<td>74.78 (46.19)</td>
<td>129.03 (81.46)</td>
<td>-3.74(52.25)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ind. corrective TFB</td>
<td>155.66 (46.58)</td>
<td>148.86 (51.11)</td>
<td>.68(96)</td>
<td>.500</td>
</tr>
<tr>
<td>Team technical instruction</td>
<td>145.56 (45.24)</td>
<td>140.90 (22.19)</td>
<td>.68(91.32)</td>
<td>.499</td>
</tr>
<tr>
<td>Total positive reinforcement (PR)</td>
<td>64.76 (26.53)</td>
<td>67.77 (14.90)</td>
<td>-.72(94.88)</td>
<td>.474</td>
</tr>
<tr>
<td>Team PR.</td>
<td>25.84 (9.47)</td>
<td>43.91 (28.15)</td>
<td>-3.82(42.36)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Ind. PR.</td>
<td>38.92 (19.50)</td>
<td>23.86 (19.55)</td>
<td>3.72(96)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Negative feedback</td>
<td>19.92 (12.12)</td>
<td>105.54 (41.78)</td>
<td>-12.31(40.98)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Not engaged</td>
<td>57.50 (59.92)</td>
<td>192.66 (105.10)</td>
<td>-7.22(52.41)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

disengaged from her athletes (i.e., not interacting with or observing athletes).

Athletes’ interaction. The distribution of all variables representing athletes’ interaction with their coach was severely positively skewed (i.e., all skewness values > 2, where normal distribution = 0). Thus, while raw means and standard deviations are provided, the reported comparison t-tests were conducted on inverse transformations of the raw scores.
Overall, the athletes of the two teams did not differ on the average duration per practice spent talking to their respective head coaches regarding technical, performance related matters (team A - $M = 4.78, SD = 9.34$; team B - $M = 8.67, SD = 11.30$; $t(96) = -2.09$, ns.) or general, non-sport related topics (team A - $M = 5.21, SD = 15.94$; team B - $M = 2.08, SD = 4.91$; $t(96) = -1.21$, ns.). The athletes of team A, however, did spend significantly more time directly acknowledging the receipt of information from the coach (e.g., “Ok, got it”; $M = 3.25, SD = 4.19$) than did the athletes of team B ($M = 1.09, SD = 1.58$; $t(96) = -3.69, p < .001$).

More specifically, the two teams did not differ on the average amount of time per practice where coaches and athletes were simultaneously talking (i.e., conversation-type interaction), either about technical, performance related topics (team A - $M = 1.55, SD = 3.63$; team B - $M = 3.43, SD = 5.59$; $t(67.33) = 1.98$, ns.) or general, non-sport related topics (team A - $M = 3.21, SD = 11.95$; team B - $M = .89, SD = 2.86$; $t(96) = -.97$, ns.). While the focus of the present analysis is primarily on direct coach-athlete interaction, it was noted that the athletes of team B spent significantly more time talking to each other about general, non-sport related matters while the head coach was disengaged from team practice activities (team A - $M = 2.29, SD = 4.48$; team B - $M = 18.49, SD = 22.15$; $t(96) = 5.24, p < .001$).

**Transitions and sequences**

The lagged phase plot SSG (coach behaviour plotted against subsequent coach behaviour - same categories on each axis) for each coach summed across all practices is presented in Figure 3. Though not accounting for changes in athlete behaviour, the cells in the lagged phase plot are a rough proxy for the lines connecting cells in the first variability analysis (Figure 2), the transitions between behaviours. Each cell in the lagged
Figure 3. The lagged phase plot SSG’s for the coach of team A (top) and team B (bottom) summed across all practices, with coach behaviour at a given time on the x-axis and the subsequent coach behaviour (lag) on the y-axis.
phase plot represents the consecutive pairing of two distinct coach behaviours, a direct first order transition from one behaviour to another. The lines between cells in the lagged phase plot then represent second order transitions linking these first order transitions between individual behaviours into longer sequences of three or more behaviours.

The coach of team A visited a significantly lower number of cells ($M = 88.50, SD = 6.22$) than did the coach of team B ($M = 119.17, SD = 12.83; t(10) = -5.27, p < .001$), indicating less variability in the sequencing of interactive behaviours. However, there were no significant differences in the mean total number of first order transitions per practice session, the number of transitions between any two coach behaviours overall (team A $M = 425.83, SD = 53.48$; team B $M = 486.50, SD = 74.95; t(10) = -1.61, ns.$). That is, the coach of team A regularly used a smaller pool of specific behavioural transitions while the coach of team B made use of a greater variety of specific behavioural transitions, though both exhibited an approximately equal number of first order transitions overall.

The nature of this difference in variability between coaches is reflected in measures of frequently occurring specific first order transitions, identified as dark areas on the SSG’s in Figure 3. Both teams shared a similarly high frequency of transitions from the organization and observation categories into the technical feedback categories (TFB) (team A $M = 30.00, SD = 8.97$; team B $M = 33.50, SD = 14.90; t(10) = -.49, ns.$) and the reverse transitions (team A $M = 29.50, SD = 8.60$; team B $M = 34.50, SD = 12.88; t(10) = -.79, ns.$), represented by the dark central portion of both grids. The coaches of the two teams differed, however, in the pattern of most frequently used sequences outside the organization/observation-TFB pairing. In this regard, the coach of team A most often combined observation with subsequent positive reinforcement (PR) to individual athletes.
followed by corrective TFB to individual athletes ($M = 7.17$, $SD = 3.49$; transitional probability = .35) or by observation again ($M = 6.00$, $SD = 3.16$; transitional probability = .27). The coach of team A also commonly used the related sequence of corrective TFB to individual athletes followed by PR to individual athletes ($M = 5.67$, $SD = 1.86$; transitional probability = .18). This pattern indicates the consistent use of positive feedback for the coach of team A, either in concert with individualized corrective information regarding skill performance or as a stand-alone communication (as in the transition to and from observation). Such sequences of behaviour are represented by lines connecting two cells, two frequently occurring first order transitions, on the lagged phase plot (Figure 3).

The coach of team B also used this corrective TFB to individual athletes followed by PR to individual athletes behavioural sequence ($M = 5.83$, $SD = 5.85$; transitional probability = .12), but additionally used sequences including less positive behaviour categories to an equal or greater degree. Specifically, practices of the coach of team B included relatively high frequencies of organization followed by disengagement from athletes’ practice activities (i.e., not interacting with or observing athletes; $M = 12.67$, $SD = 13.13$; transitional probability = .12) and the reverse transition ($M = 13.33$, $SD = 10.91$; transitional probability = .42). Also commonly used were the sequences of organization to technical error identification (without corrective TFB, e.g., “You messed up the leg lift”; $M = 5.83$, $SD = 4.96$; transitional probability = .06) and the reverse ($M = 5.17$, $SD = 2.48$; transitional probability = .20). In real-world terms, these sequences represent getting athletes started on a drill, then either not paying attention for a period of time before moving the athletes to another drill without providing any feedback (organization-
disengagement-organization), or immediately providing only negative feedback without any sustained observation (organization-technical error identification-organization).

Again, these sequences of behaviour represent the combination of two first order transitions (two cells in Figure 3).
Chapter 5: Discussion

The purpose of the present study was to compare the coach-athlete interaction structures of two competitive youth synchronized swimming teams, one more successful with regard to performance and aspects of athlete personal development (team A) than the other (team B). This comparison was conducted using SSG observational methodology, novel to sport psychology research. It was observed that the two teams differed on a number of measures of coach-athlete interaction structure, which were effectively identified through the use of SSG analysis. The results will be discussed in relation to variability, behavioural content patterns (or attractor states), and coach behaviour sequences individually. This will be followed by discussion of these concepts as part of a coherent larger picture of coach-athlete interaction processes for each team, thus differentiating the two environments. While no explicit causal links between coach-athlete interaction structures and athletes’ performance and personal development outcomes can be made based on this differentiation, noted differences will be used to characterize the two different youth sport environments. Finally, reflections on the initial application of SSG methodology to field-based sport psychology will be considered.

Variability

It was observed that the coach-athlete interactions of team A, the more successful team, exhibited less variability within each dyadic pairing over the course of a training session than did the interactions of team B, the less successful team. The coach-athlete dyadic ‘systems’ of team A functioned in fewer mutually-defined states (simultaneous coach behaviour-athlete behaviour pairings) than did those of team B. These interactions were constrained to a smaller area of the total potential state space in which these dyadic systems could potentially function on the more successful team. In real-world terms, the
coach-athlete interactions of the more successful team were more consistent and patterned than those of the less successful team.

While no previous coaching research has directly measured behavioural variability, the developmental psychology literature on parent-child interactions may be an interesting comparison. In particular, Hollenstein and colleagues (2004) found that parent-child interaction rigidity, a behavioural dimension conceptually similar to variability, was associated with negative psychopathological outcomes for children in the form of increased externalizing and internalizing behaviours. The tendency toward fixation in a particular interaction state (e.g., mutually positive or mutually negative) was associated with these maladaptive outcomes, over and above the particular content of the interaction (i.e., positive vs. negative). The authors attributed the observed association to the role parents play in the direct regulation and learning of self-regulation of social behaviour for their children (Hollenstein et al., 2004). Parents of well-adjusted children may exhibit up- or down-regulatory behaviours in response to children’s heightened negative or positive arousal, thus varying the interaction state in an effort to maintain equilibrium. Further, parental acceptance of a wide degree of emotional states may allow children greater opportunities to develop their self-regulatory capacities.

While not directly tested as a causal mechanism in the present study, increased interactional variability within dyads in the more successful environment, as might be tentatively expected based on the work of Hollenstein and colleagues (2004) with parents and children, was not observed for coach-athlete dyads. It is possible that age differences may account for this discrepancy; the study of parent-child interactions was conducted with young children (mean age = 5.5 years) compared to adolescents in the present study. However, the nature of the sporting environment and the role of the coach in that
environment may more directly influence the structural characteristics associated with positive outcomes. In contrast to the parenting context, one might argue that the sporting environment is more directly goal-oriented, with performance and athletic development as central drivers of coach-athlete interaction. Both coaches and athletes engage in mutual interaction under the premise of working toward sporting or personal objectives (though these are not necessarily congruent between both parties; Cushion, Armour, & Jones, 2006). With this focus, coaches are tasked with the role of teaching and facilitating motor performance (Jones, 2006). Being tied to concrete motor performance events introduces an element of temporal constraint: feedback must be linked and limited to the action that it targets in order to promote meaningful reflection and influence future performance. This temporal constraint may influence the amount, type, and timing of feedback necessary for optimal learning. Perhaps a more patterned, consistent behavioural repertoire is more conducive to performance and personal development in sport, given this temporally constrained, goal-driven focus.

The idea of reduced variability as more effective may initially seem to run counter to the conclusions of some recent qualitative and theoretical studies highlighting the complexity of the coaching process (Bowes & Jones, 2006; Jones, 2004). These authors argue that successful coaching is characterized by a high degree of flexibility necessitated by ever-changing situations and circumstances. The results of the current study do not directly negate this characterization but instead provide a more detailed view of how coaches actually respond to the inherent complexity of contexts in which they work. Two previous studies offer insight that aids the interpretation of the present results. First, D’arripe-longueville and colleagues (2001) qualitatively identified a number of archetypal courses of interaction between coach and athlete, consistently manifested
across highly unstable performance conditions in elite level archery competitions. Second, Saury and Durand (1998) concluded that expert sailing coaches’ operating (decision-making) modes while running training sessions were enacted as flexible routines and plans based on higher-order general principles. These authors argued that it was this flexible application of larger plans that allowed coaches to accomplish set objectives within complex, aleatory (dependant on unpredictable events/actions) situations. Interpreting the present results in this manner, it might be argued that successful coaches respond to the unpredictability of the coaching context in relatively patterned, predictable ways designed to further their coaching aims. The flexibility characteristic of the coaching process therefore relates to the situations in which it takes place rather than the specific behaviours of successful coaches themselves. Part of coaches’ success may lie in the ability to apply consistent modes of practice to a wide variety of circumstances. In this light, coaching behaviour is not pre-determined (i.e., mechanistic steps), just anticipated. The reduced variability in interaction states measured in the present study might then be thought of as constrained flexibility or ‘bounded instability’ (Bowes & Jones, 2006, pg. 241).

**Behaviour content patterns**

For both team A, the more successful team, and team B, the less successful team, the largest duration across all sessions was characterized by athlete engagement in practice activities (on-task), as would be expected of traditional sport training sessions. It was the differences in coach behaviours while athletes were on task and in athlete communication to the coach that most effectively discriminated between the two teams. While athletes were on-task, the coach of the more successful team spent the most time of all coaching behaviours observing her athletes. In contrast, the coach of the less
successful team spent the most time organizing practice activities. Cushion and Jones (2001) highlighted the crucial role of observation in successful coaching, whereby periods of silence allow for careful analysis and reflection on appropriate intervention. These authors argued that not only was observation necessary for optimal analysis of athlete performance, but also an essential part of feedback sequencing such that any presented information was not “diluted by continuous interaction” (Cushion & Jones, 2001, pg. 369). It appeared that the coach of the less successful team in the present study spent more time concerned with the mechanics of running a practice (organization) rather than in-the-moment evaluation of skill acquisition and improvement. This difference is consistent with Claxton (1988) who reported that more successful high school tennis coaches in terms of winning percentage used far fewer instances of management behaviour than did less successful coaches. Similarly, Lacy and Darst (1985) noted that management behaviours occurred far less frequently than instruction (observation/silence was not accounted for) in their observation of winning high school football coaches.

Both coaches spent the second highest amount of time giving technical feedback (TFB), consistent with the conclusions of Douge and Hastie’s (1993) comprehensive review of coach behaviour research that effective coaches exhibit high levels of instructive behaviour. Though the two coaches did not differ on the total time spent giving TFB, the coach of the more successful team spent less time giving TFB to the team as a whole unit and more time on each instance of TFB, primarily to individual athletes. The lack of differences on total TFB is in slight contradiction with the findings of Smith, Smoll, and colleagues (Curtis et al., 1979; Smith & Smoll, 1990; Smoll et al., 1978; Smith et al., 1983), who proposed that degree of coach instructiveness was one of the primary determining factors for athlete outcomes. However, Claxton (1988) was also
unable to differentiate more and less successful high school tennis coaches with regard to the frequency with which they provided TFB, both groups being uniformly high. With the longer instances of more individually-focused TFB observed for the coach of the more successful team in the present study, one might infer that, given adequately high levels of instruction, the direction (individual vs. team) and duration then become salient qualities in determining the efficacy of that TFB.

Similarly, while no differences were noted for total time spent giving positive reinforcement (PR), the coach of the more successful team spent more of this time directing PR to individual athletes rather than the entire team or groups of individuals. The coach of the less successful team also spent more time giving negative feedback without any corrective information. Further, the coach of the less successful team spent more time giving negative feedback than PR, while the reverse pattern was observed for the coach of the more successful team. The higher degree of negative feedback from the coach of the less successful team and the differing ratios of PR to negative feedback between the teams are both consistent with the findings of Smith, Smoll, and colleagues (Curtis et al., 1979; Smith & Smoll, 1990; Smoll et al., 1978; Smith et al., 1983). However, the lack of differences regarding total PR duration alone, which was postulated as a primary differentiator of athlete outcomes by Smith, Smoll, and colleagues, suggests that that the individualization of this PR may be a key aspect of its effectiveness.

Finally, the coach of the less successful team spent far more time disengaged from the practice activities of her athletes. While previous studies have often attributed silence (if reported at all) to disengagement, the present study allowed for the differentiation of potentially more positive silence in the form of observation from potentially more
negative disengagement. This differentiation proved worthwhile in relation to the relative occurrence of both categories on the more and less successful teams in the present study.

In more general terms, the findings of the present study also lend new insight into the nature of coaching behaviours and the critical dimensions that best reflect their differential occurrence. For further depth of understanding, the coach TFB and PR results support the utility of conceptualizing behaviour as a function of direction (to whom?) and duration as well as content, rather than simply an instantaneous occurrence by an isolated actor as in simple frequency counts.

With respect to athlete interactions, the two teams were very similar in the amount of time athletes spent communicating with their coach, both on technical/performance matters and more general non-sport related conversation. The teams only differed in coach-directed communication in the form of acknowledging receipt of technical information, often a head nod or “Got it”, with the athletes of the more successful team exhibiting significantly more of this type of communication. Though this difference may be purely an artefact of the youth culture within each team, it is possible that the athletes of the more successful team feel that this confirmation is necessary, that their understanding is important to the coach. While little, if any, previous research has directly observed the communication between coach and athlete, this pattern may reflect aspects of what Saury and Durand (1998) refer to as the joint process of coaching. This joint process represents a shared understanding on the part of the coach and the athlete that both are active agents in determining the outcomes of training sessions. In taking this approach, the coach tacitly acknowledges that she is peripheral to actual performance and that her influence is only enacted with the acceptance of the athlete. This cooperative focus also reflects Jowett’s (2007) notion of complementarity as central to the quality of
coach-athlete relationships. Complementarity is the behavioural component of the 3 + 1 C’s model of coach-athlete relationships and is represented by actions of cooperation; the observed acknowledgement of information received might be conceived as such.

*Coach behaviour sequences*

The lower variability in behavioural sequencing observed for the coach of the more successful team is consistent with the overall decreased behavioural variability noted earlier. In particular, this finding extends the notion of a more patterned interaction style characterizing the coaching process of the more successful team. Not only did this coach utilize fewer behavioural options in her interactions with her athletes, she also limited the way in which she combined them. In essence, her choices to pair specific behaviours on a regular basis indicate a prescribed pattern of communication. Given the significant difference between the two teams on this measure, the reduced variability of the coach of the more successful team would seem to be a conscious, or at least intended, mode of practice. The consistency of this patterning across practice sessions supports the idea of successful coaching as consistent application of principles in complex, unpredictable situations (Saury & Durand, 1998).

The content of this consistent pattern of reduced variability can be understood through examination of the most commonly used specific sequences of behaviours and pairings of sequences, linking two frequently occurring first order transitions into a string of three behaviours. Both coaches commonly transitioned from the neutral observation and organization behaviours to technical feedback (TFB) and back; basically stand-alone TFB as might be expected given the mutually high levels of overall TFB. However, the coach of the more successful team also relied heavily on pairings of positive reinforcement (PR) with TFB, often beginning and ending interactive sequences with PR.
This prototypical ‘positive sandwich’ was a key component of coach of the more successful team’s patterned mode of practice. In contrast, within the significantly increased sequencing variability displayed by the coach of the less successful team were the outlines of a pattern that paints a different picture. Pairings of disengagement-organization and the reverse suggest periods of relative disinterest (or other competing interests) in the performance and progress of the athletes, so long as they are doing the assigned activity. This is combined with pairings of organization-negative feedback and the reverse, which implies a flurry of information (often purely negative) contained within interactive bouts, without any sustained observation. As mentioned earlier, one might wonder if the intended message is not “diluted by continuous interaction” (Cushion & Jones, 2001, pg. 369).

In one of the few examinations of coaching behaviour sequences, D’Arripe-Longueville and colleagues (2001) identified what they called archetypal sequences comprising coaches’ courses of action in archery competitions. The sequences identified by D’Arripe-Longueville and colleagues relate to serial goals directed at gaining appropriate information or conveying it to the athlete. As such, these sequences provide a macro or higher-order view of the sequencing of coaching interaction. The findings of the present study complement this approach by laying groundwork for the understanding of the micro or lower-order interactions (i.e., patterning of specific speech content) contained within each serial goal.

*Integrated pictures of coach-athlete interaction*

While it may be interesting to compare the different aspects of coach-athlete interaction structures separately, it is likely that their combination, the overall gestalt, has the greatest influence on the athlete outcomes produced within youth sport environments.
Certainly from a practical standpoint it is easiest to conceptualize these qualities in practice as a coherent whole, rather than as a long series of individual components.

In considering the interaction characteristics described in depth in the preceding sections, the overall picture developed of team A, the more successful team, is one of mutual respect and purposeful, deliberate action. Respectful in the individualized, positive-oriented behaviours of the coach and in the complementary (Jowett, 2007) acknowledging behaviours of the athletes. Deliberate in the heavily patterned modes of practice demonstrated by the coach, characterized by a large proportion of silent observation. The picture of team B, on the other hand, while not excessively negative, implies a more disconnected, impersonal environment. Disconnected in the degree of active disengagement by the coach and the decreased acknowledging communication from the athletes. This is further exemplified by the increased incidence of off-task related talking amongst the athletes while the coach was disengaged. Impersonal in the flurried and unpredictable patterning combined with lower prevalence of individualized interaction from the coach and more negative interaction content. Again, however, this description is intended to highlight the differences between the two environments. It must be remembered that there were many positive features noted for team B (e.g., high degree of TFB and overall PR) and the athletes themselves reported a predominantly positive sport experience.

With these pictures of the coach-athlete interactions characterizing the two team environments, one wonders about the guiding frameworks behind the differences. Jones (2004) used Erving Goffman’s (1959) dramaturgical metaphor to present the notion that coaches’ interactions with their athletes are highly intentional ‘presentations of self’. By presenting a ‘front’ through consistent behavioural patterns, coaches attempt to sustain
specific impressions they would like their athletes to have of them. Through this impression management, coaches engineer their relationships with their athletes toward specific objectives. It is conceivable that the behavioural characteristics displayed by the coach of the more successful team are neither completely derived from personality nor the result of following a schematic coaching plan. Rather, these characteristics may be part of a regulated performance designed to elicit specific responses from her athletes. In this sense, the guiding force behind her patterned mode of practice is the intended ‘front’ it represents. In a similar vein, Jones and Wallace (2005, 2006) have presented the coaching process as one of orchestration. Based on theories of change management within organizations, they highlight that coaches work to produce change in their athletes in complex, constantly changing environments over which they have very little control. Fitting with the previously discussed notion of consistent modes of practice implemented in flexible circumstances, the concept of orchestration provides a functional grounding for the structural patterns observed of the two coaches. In combination, the dramaturgical and orchestration metaphors act as a heuristic device to understand the presented integrated pictures of coach-athlete interaction. By measuring how coaches’ different ‘presentations of self’ are used to orchestrate coaching environments that produce different athlete outcomes, we can begin to understand some of the complexity of the coaching process (Bowes & Jones, 2006; Cushion, Armour, & Jones, 2006). The results of the present study are a first step in this direction.

Methodological reflections

Overall, the use of a dynamic systems framework and SSG methodology allowed us to address Poczwardowski and colleagues’ (2006) recommendations for the productive study of coach-athlete relationships. Specifically, we were able to focus on the dyad as
the central unit of analysis rather than individuals, with a methodology targeted to the research question of interest. In this case, the dynamic and structural characteristics of coach-athlete interaction were of primary interest, objective measures of which were unavailable from traditional observational methods. Through the first application of SSG methods to field-based sport psychology research, we were able for the first time to measure behavioural variability, time-based content patterns, and sequences of coach-athlete interactions. These measures proved informative in differentiating between two youth sport environments characterized by different athlete outcomes.
Chapter 6: Conclusions

The purpose of this study was to compare the coach-athlete interaction structures of two youth sport environments producing different performance and personal development athlete outcomes. This comparison utilized state space grid (SSG) observational methodology, based on a dynamic systems framework, and was the first application of this methodology in field-based sport psychology research. Differences between groups were noted on the degree of variability of interactions, the behavioural content patterns contained within them, and the sequencing of coach behaviours.

The coach-athlete interactions of the more successful team were less variable, suggesting that the use of relatively patterned, consistent modes of practice across flexible situations may be associated with more positive athlete outcomes. Within this consistent mode of practice, the coach of the more successful team spent more time in silent observation, focused on the actions of her athletes, than in organization of or disengagement from practice activities. While interacting with athletes, this coach provided more individualized technical and positive reinforcement feedback information and made significantly less use of negative feedback. In response, her athletes were more active in their acknowledgement of receiving this information. The coach of the more successful team was also more consistent in the sequencing of her behaviours, making judicious use of the ‘positive sandwich’ feedback approach. Overall, the more successful environment was characterized by what appeared to be mutually respectful and deliberate interactions between the coach and athletes.

The findings of this in-depth examination of coach-athlete interactions provide insight into the nature of different youth sport environments and the outcomes they produce. In particular, by analyzing the structural qualities of these interactions from a
dynamic systems perspective, the results of the present study add new dimensions to our understanding of the coaching process in youth sport. The application of SSG methodology has significantly increased our ability to measure and analyze these structural qualities.

Limitations and future directions

The implications of these findings should be considered in light of the limitations inherent to the study. First, the study was conducted as a comparison of only two youth sport environments, comprised of two head coaches and their athletes (17 dyads analyzed in total). Comparison across a greater number of environments would certainly be beneficial and would strengthen the arguments regarding the nature of coach-athlete interactions most conducive to producing positive athlete outcomes. However, the depth of analysis and the research time and effort required to carry it out necessitated the limiting of the sample to two teams. Given the exploratory nature of this study, this depth was judged to be of greatest importance. This prioritization of depth of analysis in exploratory phases is consistent with previous research of this sort in sport psychology (e.g., D’Arripe-Longueville et al., 2001; Gernigon et al., 2004). The direction provided by the resulting findings might now be studied in greater breadth in future research.

Second, it is uncertain how generalizable the present findings are to other sports or competitive contexts. It may be that the observed structural qualities are reflective only of the synchronized swimming environment. Even within synchronized swimming, these patterns may not represent good practice in older, more elite or younger, more recreational athletes. It is important to remember, though, that it was not the intention of the study to provide recommendations beyond the competitive youth context. Given the recent recognition of the uniqueness of different coaching contexts (determined by athlete
age and competitive level; Côté, Bruner, Erickson, & Strachan, in press; Côté, Young, North, & Duffy, 2007), the present study provides justification for a range of previously unconsidered measures that may be useful in the analysis of these different contexts.

Third, it was beyond the scope of the present study to analyze the larger social and cultural forces that may impact the observed qualities of coach-athlete interaction. Several researchers have highlighted the influence of differing power structures (coach-athlete, coach-administration, etc.) and organizational or sporting cultures, among other aspects, on the conduct of coaches (e.g., D’Arripe-Longueville et al., 1998; Potrac & Jones, 2009). Analysis of such elements may shed light on the genesis and reasoning behind the findings of the present study.

As a final thought, in considering the contribution of the present study to the direction of future research, the involvement of SSG methodology must be recognized. By allowing the measurement of previously unquantifiable qualities of coach-athlete interaction, SSG methods open a host of avenues for future examination. In particular, the present study analyzed a relatively short period of time. The use of SSG’s in a longitudinal manner to capture change over time is certainly warranted and consistent with other dynamic systems concepts as of yet unexplored in sport psychology research. For instance, the idea that dynamic systems such as coach-athlete dyads develop through phase transitions - periods of instability in patterning as the transition from one predominant pattern to another – has yet to be examined in sport contexts.
References


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Appendix A
Coach-Athlete Interaction Coding (CAIC) Manual

Aug. 5, 2009
CAIC – Coding Crib Sheet

Subject (letters)
1 – Team
z – Coach
a, b, c... – Athlete A, B, C...

Coach Content (10's and 20's)
11 – Positive Reinforcement:
• Verbal (e.g., “good job”, “well done”, etc.)
• Non-verbal (e.g., thumbs up, high five, etc.)

12 – Corrective Encouragement:
• E.g., “you’ll do better next time”, “don’t worry about it”, etc.

13 – Future Encouragement:
• E.g., “let’s go guys”, “You can do it”, etc.

14 – Corrective Technical:
• E.g., “pull your shoulders back and down”, etc.

15 – Future Technical:
• E.g., “it’s important to keep your head back in this skill”, etc.

16 – Organization:
• E.g., “now we’re doing ___ drill”, “go over there”, etc.

17 – Observation:
• Default code if coach is engaged in practice but criteria not met for any actively communicative code.

18 – General Communication:
• E.g., joking with athletes, talking about school, etc.

19 – Not Engaged:
• E.g., talking to other coaches (even if talking about practice-related content), adjusting music, etc.

21 – Keeping Control:
• E.g., “hurry up!”, “stop talking!”, etc.

22 – Error Technical:
• E.g., “you did ____ wrong”, “your leg was too low”, etc.

23 – Negative Evaluation:
• Verbal (e.g., “that was terrible”, sarcasm, etc.)
• Non-verbal (e.g., shaking head, etc.)

Athlete Content (30’s)
31 – Technical Talking:
• E.g., “I like that”, “why don’t we do ____ instead”, offering answer to coach’s technical question/quiz, etc.

32 – Clarification:
• Question (e.g., “how do I do that again?”, “how many are we doing?”, etc.).
• Statement (e.g., “I don’t understand”, etc.)

33 – Acknowledgement:
• E.g., “ok”, “got it”, etc.

34 – General Talking:
• E.g., talking about school, etc.
• Default actively communicative code if coder cannot hear content of interaction (with other athletes or coach).

35 – Engaged:
• E.g., doing drills, resting during assigned rest or break times, moving to new pool location on direction from coach, etc.
• Default code for anytime athlete not actively interacting with coach or other athletes.

36 – Disengaged:
• E.g., actively disrupting practice, ignoring coach instructions, etc.
• Requires athlete to be in opposition to current practice activity.

Affect – Coach or Athlete (70’s, 80’s, and 90’s)
77 – Positive:
• E.g., smiling, laughing, etc.

88 – Neutral:
• Default category if no indications of positive or negative affect.

97 – Withdrawn:
• E.g., head down, avoiding eye contact, shoulders hunched, etc.

99 – Hostile:
• E.g., yelling, scowling, angry/sarcastic tone, etc.

Context – Athletes only (letters)
p – In Pool:
• Athlete fully in water, not in any contact with side of pool deck.

s – Poolside:
• Athlete in water, in contact with side of pool deck.

o – Other:
• Athlete out of water.

Notes
- 10, 30 (UNCODABLE)
- 3-second rule for: 17, 35, 10, 3
General Coding Guidelines

Overview
The Coach-Athlete Interaction Code (CAIC) was developed for observations of athletes and coaches in a team sport environment, specifically synchronized swimming. Thus, this coding manual contains features endemic to synchronized swimming (e.g., in-pool context) that may not be generalizable to all sports. This coding manual is intended for observation of primarily in-pool practice time, not competitions or dry-land training.

The codes in the CAIC are based on behaviours across six (6) dimensions:

1. Initiator Subject (who’s behaviour is being coded)
2. Recipient Subject (to whom a coded behaviour is directed)
3. Coach content (the interactive content of a given coach behaviour)
4. Athlete content (the interactive content of a given athlete behaviour)
5. Affect (coach and athlete – the affect of a given coach or athlete behaviour)
6. Context (athlete only – the context in which a given athlete behaviour occurs, relative to the pool)

Rules

• 3-second rule
  o Wait three (3) seconds before coding ‘observation’ (coach content) or ‘engaged’ (athlete content) when changing from any actively communicative code. Code for either of these behaviours only if they continue past the three (3) second waiting period. If within three (3) seconds a different actively communicative behaviour occurs, do not wait to code that behaviour.
  
o Wait three (3) seconds before coding ‘uncodable’ (coach content) or ‘not codable’ (athlete content) when changing from any other code. Code for either of these behaviours only if they continue past the three (3) second waiting period. If within three (3) seconds a different behaviour visibly or audibly occurs, do not wait to code that behaviour.

• Default codes
  o For coach content, athlete content, and affect (coach or athlete) dimensions, specific behaviour codes are to be coded by default if criteria for any other behaviour within the dimension are not met. That is, use the default codes in the absence of any other codable behaviour:
    • (coach content) – ‘observation’
    • (athlete content) – ‘general communication’ if interacting with coach/other athletes; ‘engaged’ if not interacting with coach/other athletes.
    • (affect) – ‘neutral’
  o No default categories exist for subject (initiator or recipient) or context dimensions as these must be directly observed.
**Subject – Initiator or Recipient (letters)**

As there are multiple participants in all videos (i.e., individual athletes and microphone-wearing coach), the coder must specify which subject’s behaviour is being coded. Once assigned a subject ID, athletes must be coded as same subject for all videos. This will be determined for all athletes on all teams prior to the initiation of coding and referenced by name, cap colour, and bathing suit colour for each video. As well, athlete and coach content codes must be qualified by a recipient subject code. For all recipient subject codes, code as ‘team’ unless the behaviour is directly targeted at a specific individual (i.e., if coach is talking to two or more athletes). The subject codes are as follows:

**CODE**

- z – Coach
- a – Athlete A
- b – Athlete B
- c – Athlete C
- d – Athlete D
- e – Athlete E
- f – Athlete F
- g – Athlete G
- h – Athlete H
- i – Athlete I
- j – Athlete J
- t – Team
Coach Content (10’s and 20’s)

POSITIVE CODES

11 – Positive Reinforcement: Positive reaction by coach to desirable performance by athlete(s).

Notes
- Focus is on success.
- Verbal (e.g., “good job”, “well done”, etc.)
- Non-verbal (e.g., thumbs up, high five, etc.)
- If non-verbal, must be very obvious communication.

12 – Corrective Encouragement: Non-technical encouragement from coach after athlete(s) mistake.

Notes
- Focus is on error.
- E.g., “you’ll do better next time”, “don’t worry about it”, etc.

13 – Future Encouragement: Non-technical encouragement from coach, not in response to athlete(s) mistake (coach-initiated). Relates to future behaviour rather than response to previous behaviour.

Notes
- E.g., “let’s go guys”, “You can do it”, etc.
Coach Content (10’s and 20’s) CONT.

TECHNICAL CODES

14 – Corrective Technical: Corrective technical feedback from coach after athlete(s) mistake. Requires specific instruction regarding how the athlete can perform the skill correctly/avoid the mistake.

Notes
- E.g., “pull your shoulders back and down”, etc.
- Can include pointing out athlete mistake (normally coded as ‘error technical’; see code 22), but must be directly preceded or followed (3-second rule) by corrective information (i.e., how to fix the mistake) to be coded as ‘corrective technical’ (e.g., “Your leg was too low. Push your hips up to keep the leg high”).
- If technical coach behaviour occurs during a drill/activity or if it is unclear if behaviour was initiated in response to an athlete mistake, only code ‘corrective technical’ if there is clear reference to previous performance (i.e., higher, faster). If in doubt, code as ‘future technical’ (see code 15).

15 – Future Technical: Technical/teaching instruction from coach, not in response to athlete(s) mistake (coach-initiated). Requires specific instruction regarding how the athlete can perform the skill correctly. Relates to future behaviour rather than response to previous behaviour.

Notes
- E.g., “it’s important to keep your head back in this skill”, etc.
- Code any performance cues or technique focus points given during explanation of a drill/activity as ‘future technical’
- Can also occur during a drill/activity if no reference to previous performance.
**Coach Content (10’s and 20’s) CONT.**

**NEUTRAL CODES**

16 – **Organization**: Communication from coach related to organization of practice tasks and athlete actions, NOT intended to directly influence performance.

**Notes**
- E.g., “now we’re doing ___ drill”, “go over there”, etc.
- Cannot include any technical instruction or encouragement. Code for each separately, even if they occur in immediate sequence. (e.g., “Get set up for line drills now. Focus on pointing your toes. I know you guys can do it!” to be coded as ‘organization’, then ‘future technical’ (code 15), then ‘future encouragement’ (code 13).
- If coach is verbally counting or keeping time/beat while athletes are engaged in a drill/activity, code as ‘organization’.

17 – **Observation**: Coach engaged in observing/watching athletes during practice activities, though not directly communicating with athletes.

**Notes**
- Default code if coach is engaged in practice but criteria not met for any actively communicative code.
- 3-second rule in effect before coding for ‘observation’ from an actively communicative code.
- If coach is counting or keeping time/beat by tapping on poolside, etc. with an implement, NOT verbally counting or communicating, code as ‘observation’.

18 – **General Communication**: Communication from coach unrelated to task or performance.

**Notes**
- E.g., joking with athletes, talking about school, etc.

19 – **Not Engaged**: Coach not engaged in practice activities directed at athletes and not directly communicating with athletes.

**Notes**
- E.g., talking to other coaches (even if talking about practice-related content), adjusting music, etc.
Coach Content (10’s and 20’s) CONT.

DISAPPROVAL CODES

21 – Keeping Control: Verbal reaction by coach intended to maintain order in response to athlete(s) inattentiveness, disruptive non-task related conduct, etc.

Notes
• E.g., “hurry up!”, “stop talking!”, etc.

22 – Error Technical: Technical negative reaction by coach to an undesirable performance by athlete(s) WITHOUT any corrective information; pointing out mistake.

Notes
• E.g., “you did ___ wrong”, “your leg was too low”, etc.
• Code as ‘corrective technical’ (see code 14) if directly preceded or followed (3-second rule) by corrective information (i.e., how to fix the mistake).

23 – Negative Evaluation: Non-technical negative reaction by coach to an undesirable performance by athlete(s).

Notes
• Verbal (e.g., “that was terrible”, sarcasm, etc.)
• Non-verbal (e.g., shaking head, etc.)
• If non-verbal, must be very obvious communication.
10 – **Uncodable:**

**Notes**
- To be coded if coach is out of view with no verbal communication detected or microphone cuts out.
- 3-second rule in effect before coding for ‘uncodable’.

Note - All coach content codes must be qualified by recipient subject code. Code all recipient subject codes as ‘team’ unless the behaviour is directly targeted at a specific individual (i.e., if coach is talking to two or more athletes).
**Athlete Content (30’s)**

**CODE**

31 – **Technical Talking**: Communication discussing task/technique, with athlete providing input/opinion.

**Notes**
- E.g., “I like that”, “why don’t we do ____ instead”, offering answer to coach’s technical question/quiz, etc.
- Can be coded if body language indicates, even if not heard (MUST be very obvious though). If in doubt, code as ‘general talking’.

32 – **Clarification**: Communication intended to elicit more information regarding how athlete is expected to perform task/technique.

**Notes**
- Can be question (e.g., “how do I do that again?”, “how many are we doing?”, etc.).
- Can also be statement (e.g., “I don’t understand”, etc.)

33 – **Acknowledgement**: Communication intended to confirm that other’s communication content is understood WITHOUT any other technical information.

**Notes**
- Verbal (e.g., “ok”, “got it”, etc.)
- Non-verbal (e.g., thumbs up, nodding, etc.)
- If non-verbal, must be very obvious communication.
- Cannot include any technical talking, clarification, or general talking. Code for each separately, even if they occur in immediate sequence.

34 – **General Talking**: Communication unrelated to task or performance.

**Notes**
- E.g., talking about school, etc.
- Default actively communicative code if coder cannot hear content of interaction (with other athletes or coach).

35 – **Engaged**: Engaged in practice activities and not directly communicating with peers or coach.

**Notes**
- E.g., doing drills, resting during assigned rest or break times, moving to new pool location on direction from coach, etc.
- Default code for anytime athlete not actively interacting with coach or other athletes unless actively disrupting practice, ignoring coach instructions, etc. (e.g., code for ‘engaged’ when coach talking to group, even if athlete may appear to not be looking at coach, unless actively not listening/being disruptive)
- 3-second rule in effect before coding for ‘engaged’ from an actively communicative code.
• Code athletes as ‘engaged’ if talking to an assistant coach. Do not code the content of that interaction (not the target coach).

36 – **Disengaged**: Not engaged in practice activities and not directly communicating with peers or coach.

**Notes**
- E.g., actively disrupting practice, ignoring coach instructions, etc.
- Requires athlete to be in opposition to current practice activity (e.g., code athlete resting during as assigned rest period as ‘engaged’, code athlete hanging off diving board after being told not to by coach as ‘not engaged’).
- Must be very obvious.

30 – **Not Codable**:

**Notes**
- To be coded if athlete is out of view with no verbal communication detected.
- 3-second rule in effect before coding for ‘not codable’.

Note – All athlete content codes must be qualified by recipient subject code. Code all recipient subject codes as ‘team’ unless the behaviour is directly targeted at a specific individual (i.e., if coach is talking to two or more athletes). When athlete-athlete communication occurs (i.e., a conversation), code both as actively communicating, even when listening, unless blatantly not interacting.
Affect – Coach or Athlete (70’s, 80’s, and 90’s)

CODE
77 – **Positive**: Must be very obviously positive affect.
   Notes
   - E.g., smiling, laughing, etc.

88 – **Neutral**: No obvious indications of positive or negative affect.
   Notes
   - Default category if no indications of positive or negative affect.

97 – **Withdrawn**: Negative affect characterized by very obvious withdrawal from interaction behaviour.
   Notes
   - E.g., sulking, head down, avoiding eye contact, shoulders hunched, etc.

99 – **Hostile**: Negative affect characterized by very obvious openly hostile behaviour.
   Notes
   - E.g., yelling, scowling, angry/sarcastic tone, etc.
**Context – Athletes only (letters)**

**CODE**

**p – In Pool**: Athlete fully in water, not in any contact with side of pool deck.

**Notes**
- To code ‘in pool’, no part of the athlete’s body may be in contact with the side of the pool deck.
- Code ‘in pool’ as soon as last part of athlete’s body breaks contact with the side of the pool deck when changing from ‘poolside’.
- Code ‘in pool’ as soon as any part of athlete’s body comes in contact with the water when changing from ‘other’ due to athlete jumping into water (bypassing ‘poolside’).

**s – Poolside**: Athlete in water, in contact with side of pool deck.

**Notes**
- To code ‘poolside’, some part of the athlete’s body must be in contact with the side of the pool deck.
- Code ‘poolside’ as soon as any part of athlete’s body comes in contact with the side of the pool deck when changing from ‘in pool’.
- Code ‘poolside’ as soon as any part of athlete’s body enters the water when changing from ‘other’.

**o – Other**: Athlete out of water.

**Notes**
- To code ‘other’, no part of the athlete’s body may be in contact with the water.
- Code ‘other’ as soon as last part of athlete’s body breaks contact with the water when changing from ‘poolside’.

Note – Context is not coded for coach behaviour as it is assumed to remain ‘other’ at all times.
Appendix B
Information Sheet (athletes and parents) – Examining the influence of coach behaviours on youths’ positive developmental experiences in sport

The purpose of this study is to examine how different coach behaviours affect youth’s development in sport. Specifically, the goal is to understand how the different ways coaches interact with athletes during practices leads to athletes’ experiences in sport.

The study will have each athlete complete a questionnaire related to his/her experience in a specific sport (i.e., on a specific team with a specific coach). Five (5) practices in that sport setting will then be videotaped. Coaches will be wearing a microphone to record any talking. The videotaped practices will then be watched by the research team to understand the different coach-athlete interactions (i.e., patterns and sequences of coach/athlete interactions). There are no known or foreseeable risks involved by participating in this study.

This is part of a study for which Karl Erickson is the researcher. Information collected from participants will remain completely confidential. For the entire study, all information collected will be kept in a locked filing cabinet by the primary researcher. Items will be available to the primary researcher and his supervisors.

The study will regroup information collected by all participants to keep individuals identity secure. While the information collected may be presented at academic conferences and published in relevant academic journals, anonymity and confidentiality of all participants will be maintained.

Should you have further questions or concerns regarding any aspect of this study, you may contact any of the individuals listed below.

Primary Researcher: Karl Erickson
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Queen’s University
(613) 533-6081
Email: chair.greb@queensu.ca
Examining the influence of coach behaviours on youths’ positive developmental experiences in sport

The purpose of this study is to examine how different coach behaviours affect youth’s development in sport. Specifically, the goal is to understand how the different ways coaches interact with athletes during practices leads to athletes’ experiences in sport.

The study will have each athlete complete a questionnaire related to his/her experience in synchronized swimming (i.e., on a specific team with a specific coach). Five (5) practices in that sport setting will then be videotaped. As a coach, you will be wearing a microphone to record any talking. The videotaped practices will then be watched by the research team to understand the different coach-athlete interactions (i.e., patterns and sequences of coach/athlete interactions). There are no known or foreseeable risks involved by participating in this study.

This is part of a study for which Karl Erickson is the primary researcher. Information collected from coaches will remain completely confidential. For the entire study, all information collected will be kept in a locked filing cabinet by the primary researcher. Items will be available to the primary researcher and his supervisors.

The study will regroup information collected by all participants to keep individuals identity secure. While the information collected may be presented at academic conferences and published in relevant academic journals, anonymity and confidentiality of all participants will be maintained.

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PARTICIPANT CONSENT FORM - ATHLETE

Examining the influence of coach behaviours on youths’ positive developmental experiences in sport

I have read the information letter and understand that this study requires my child to complete a survey regarding their experience in a specific sport setting (i.e., on a specific team, with a specific coach). I also understand that the second part of this study involves the videotaping of five (5) of my child’s practices in order to examine interactions between coaches and athletes.

I have been informed that my child’s confidentiality will be protected throughout the study, and that the information he/she provides will be available only to the primary researcher and his supervisors. While the results of this study may be presented at academic conferences and/or in academic journals, I am aware that any results will be presented for the group only (i.e., no individual data will ever be reported) – thereby maintaining my child’s anonymity.

I understand that my child’s participation in this research project is completely voluntary and that he/she has the right not to answer any question(s) that he/she does not feel comfortable with. I also recognize that my child may stop participating at any time without explanation or consequence.

Finally, any questions I have about this research project and my child’s participation have been answered to my satisfaction. I understand that I can contact the primary researcher, the project supervisors, and/or the General Ethics Review Board should any further questions or concerns about my child’s participation in this research project arise.

I consent to participate in this research project.

Participant’s Signature: _________________________ Date: _____________

Parent/Guardian Signature: _________________________ Date: _____________

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I have read the information letter and understand that this study requires the athletes I coach to complete a survey regarding their experiences in our specific sport setting (i.e., on this specific team, with me as a coach). I also understand that the second part of this study involves the videotaping of five (5) of our practices in order to examine interactions between coaches and athletes.

I have been informed that my confidentiality will be protected throughout the study, and that the information I provide will be available only to the primary researcher and his supervisors. While the results of this study may be presented at academic conferences and/or in academic journals, I am aware that any results will be presented for the group only (i.e., no individual data will ever be reported) – thereby maintaining my anonymity.

I understand that my participation in this research project is completely voluntary and that I reserve the right not to answer any question(s) I do not feel comfortable with. I also recognize that I may stop participating at any time without explanation or consequence.

Finally, any questions I have about this research project and my participation have been answered to my satisfaction. I understand that I am invited to contact the primary researcher, the project supervisors, and/or the General Ethics Review Board should any further questions or concerns about this research project or my participation arise.

I consent to participate in this research project.

Name of Participant: [Name]
Signature: [Signature]
Date: [Date]

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