# COACH AND BIOMECHANIST KNOWLEDGE OF SPRINT RUNNING TECHNIQUE

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The purpose of this study was to establish how coaches and biomechanists assess sprint running technique to increase understanding of current coaching and biomechanical practice leading to an identification of ways to improve coach-practitioner relationships. Australian sprint coaches (n=56) and international sport biomechanists (n=12) completed an online survey that asked questions relating to their knowledge of sprint running, current biomechanical-based practices and the coach-biomechanist relationship. A level of congruence was found in the two group's understanding of sprinting technique with a number of similarities between aspects of the stance and swing phases especially around the instance of contact. There were key differences in the relative importance of the stance phase, arm movement and postural alignment of the body. The potential gaps in knowledge and practice suggested in this initial research create a foundation for further research into the coach-practitioner relationship and its overall effectiveness.

**KEYWORDS:** knowledge networks, coach-practitioner relationship, technique assessment, sprinting, survey.

**INTRODUCTION:** The role of an applied sport biomechanist can be more successful when integrated and linked to the goals of a sport coach, especially in the high performance environment. These coach-biomechanist interactions are important for both parties; coaches are able to intensely investigate technical issues relating to an athletes' performance with an evidence-informed approach and biomechanists are able to see and assist in translating their research and other sprinting literature into practice, and monitor changes in performance. Biomechanists can also gain a greater appreciation of their studied skill and the issues coaches may have.
Despite these benefits, it has been previously reported that relationships between coaches and sport scientists, including biomechanists, could be improved (Reade, Rodgers, & Hall, 2009). Both coaches and biomechanists possess the knowledge to improve an athlete's technique and overall performance, what is unknown is how these individuals, with diverse knowledge backgrounds, approach this task. An understanding of current coaching and biomechanical practice is a step towards identifying ways of improving coach-biomechanist relationships. By identifying where the two professions' ideas and current practice converge and diverge there will be a starting place to build connections and improve communication between them. Therefore, the aim of this research was to establish the sprinting technique working knowledge of coaches and biomechanics.

**METHODS:** Fifty-six Australian sprint coaches (average age: 50 ± 14yrs, experience: 17 ± 12yrs) and 12 International sport biomechanists (average age: 42 ± 12yrs, experience: 14 ± 11yrs) took part in the study. Each participant completed an online survey that was specific to their profession, with a majority of questions were comparable in both versions of the survey. Both versions consisted of 3 sections:

- Section one established the participant's experience, qualifications, and achievements with multiple choice and single word answer questions.
- Section two asked open-ended questions about participant's current sprinting technique assessment and evaluation practices, (e.g., "What would you consider elite sprinting technique?").
- Section three investigated the relationship between coaching and sports biomechanists, using open and closed questions.

This paper will focus on section two of the larger research project. The open-ended questions in section two were explored inductively with major and minor themes inferred from the coaches and biomechanists answers separately. Individual comments were read and coded into themes using NVivo 11 (QSR International, 2015) as parallels emerged, these initial groupings were then reviewed by another member of the research team and revised a number of times until consistency was achieved.

**RESULTS:** A number of differences were observed between the coaches and biomechanists responses to the questions in section two of the survey, relating to their knowledge on elite sprinting technique. Biomechanists had a larger percentage of their total comments on the stance phase of the sprinting cycle, while coaches had a larger percentage of their comments related to the arms contribution to sprinting (Table 1). There was also a noticeable disparity in the number of comments relating to the overall posture of an elite sprinter with coaches describing posture through the concept of body alignment whereas the biomechanists did not.

**Table 1**
**Frequency of Responses**

| Theme | Coaches | Biomechanists |
|---|---|---|
| Stance Phase | 13.5% | 20.1% |
| Swing Phase | 20.4% | 19.5% |
| At Contact | 10.1% | 11.4% |
| Arms | 17.5% | 11.4% |
| Posture | 27.4% | 21.5% |
| *Body Alignment* | *21%* | *3%* |
| Other | 11% | 16.1% |

An example of the variation in the theme based knowledge networks extrapolated from the coaches and biomechanists responses to questions relating to elite sprinting technique is presented in Figures 1 and 2.

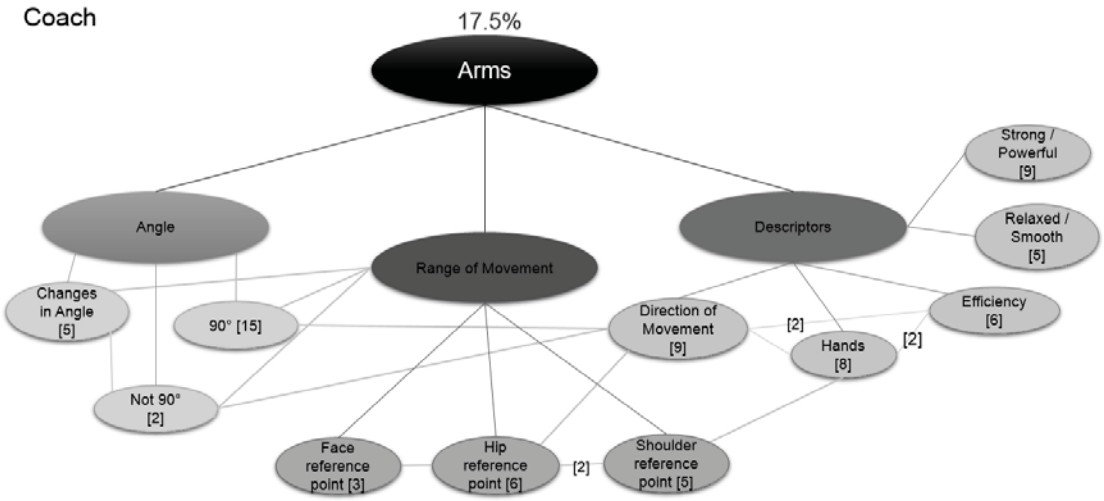


**Figure 1: Coach knowledge network for "Arms" theme, [n] represents number of comments.**

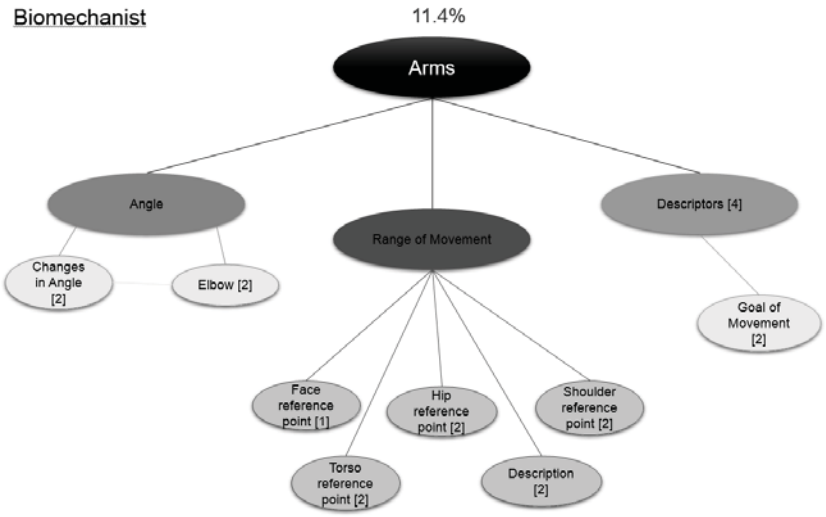


**Figure 2: Biomechanist knowledge network for "Arms" theme, [n] represents number of comments.**

**DISCUSSION:** The analysis of the coaches and biomechanists responses to questions relating to elite sprinting biomechanics revealed similarities and differences in the way the two professions describe ideal technique and therefore their working knowledge of sprint running. The stance phase is considered an important aspect of sprinting technique in the literature, this is reflected in these results with biomechanists having a larger percentage of their comments related to the stance phase than the coaches. While sprinting literature on the stance phase seems to focus on the kinetics of the sprinting action it is currently unrealistic to measure and interpret this in the daily training environment and, therefore, did not feature strongly in both biomechanists and coaches responses. The biomechanists did cover topics found in the literature with multiple comments relating to the activation of muscles (Wiemann & Tidow, 1995), flexing movement (Novacheck, 1998), and stiffness of the leg in contact with the ground (Kuitunen, Komi, & Kyröläinen, 2002). Comparably the coaches did not include these concepts in their explanations of the stance phase, emphasising a more macro descriptive perspective (e.g., "full leg extension during the drive phase.") There is some common ground between the biomechanists, coaches and the literature, with the extension of the stance leg and the position of the contact foot during stance appearing frequently in both professions responses, and in the literature (Bezodis, Kerwin, & Salo, 2008; Hunter, Marshall, & McNair, 2005) indicating their overall importance for elite sprinting technique. Future biomechanics research could investigate methods of incorporating stance phase kinetics knowledge and feedback, using technology such as inertial sensors, into a coaches' daily training environment.

The number of comments relating to the role and movement of the arms during elite sprinting is where there appears to be a key divergence in understanding of elite sprinting between coaches and biomechanists; coaches made more comments describing the arm action in detail than biomechanists. The published sprinting literature appears to support the biomechanists lack of detail in describing the arm action as there has been very little scientific investigation into the ideal arm action, (e.g. Hinrichs, Cavanagh, & Williams, 1987). This lack of detail, indicates that biomechanists do not consider this movement to be influential on the overall biomechanics of an elite sprinter. This contrasts strongly with the coaches responses who frequently described the elbow angle as primarily being at 90 degrees with a smaller number elaborating on the changes in angle across the range of movement. Despite this irregularity and lack of scientific evidence it is clear that coaches consider the movement of the arms to be a key factor in elite sprinting technique and is potentially an avenue for future research by biomechanists (Thompson, Bezodis, & Jones, 2009), or an area where biomechanists can play a role in educating coaches.

Another notable difference between the coaches and biomechanists knowledge of elite sprinting was the theme of body alignment which was part of the wider postural theme. Comments relating to body alignment described the vertical alignment of the segments of the body and how they relate to one another in regards to the posture of an athlete when sprinting. A typical body alignment comment was “upright posture with head, neck and back aligned,” other key words included “in-line” and “neutral”. This method of describing the ideal posture when sprinting is prevalent in coaching based literature (Collier, 2002; Young, 2007) whereas biomechanics literature focuses on postural movements, or lack of movement (Kuitunen et al., 2002; Novacheck, 1998). These differences in describing posture and alignment when sprinting in the literature are reflected in the coaches and biomechanists comments. This link between working knowledge, literature and profession highlights a gap in the way coaches and biomechanists approach the dissemination of sprinting knowledge and could have implications for the way future biomechanics research is communicated to coaches and the role biomechanists play in educating coaches.

**CONCLUSION:** Coaches and biomechanists displayed differences in the importance of various sprint running movements with only some concepts from both professions being supported in the relevant literature. However, qualitative analyses indicated there are gaps in approaches and understanding between the coaches, biomechanists and the literature that should be explored. Further insight into these professions’ working knowledge and current practice could be gained by investigating whether these differences transfer to the way coaches and biomechanists use their knowledge to visually perceive the skill of sprinting. This contributes to the ongoing communication between the two professions and the potential integration of coaching practice and research directions.

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