CHANGES TO AGILITY RUNNING TECHNIQUE DURING REACTIVE PERFORMANCE CONDITIONS

Keane Wheeler

National Institute of Sport Studies, University of Canberra, Australia

The purpose of this study was to examine agility running technique during planned and reactive conditions specific to rugby union. The variation to running technique of 8 highly trained rugby union players was compared between agility conditions (pre-planned and reactive) and also agility performance speeds (fast, moderate and slow). The development of lateral movement during the side-step was less (planned = 0.69 ±0.43 m/s vs. reactive = 0.25 ±0.42 m/s, p <.001) with a decision-making element. Fast performances exhibited greater lateral movement during the side-step (0.52 ±0.34 m/s) compared to moderate (0.20 ±0.37 m/s, p = .034) and slow (-0.08 ±0.31 m/s, p <.001) for reactive conditions. The differences between planned and reactive conditions highlight the need to incorporate decision-making in rugby union agility programs.

KEY WORDS: decision-making, kinematic analysis, locomotion, side-step.

INTRODUCTION: Evading the defence, breaking tackles and advancing the ball beyond the advantage line are crucial agility skills in rugby union (Sayers & Washington-King, 2005). The open skilled nature of match-play means that effective decision-making strategies are key components of agility in rugby union (Abernaty, 1991). Research suggests that the reactive conditions associated with rugby union would likely alter agility technique compared to planned movements (Farrow, Young & Bruce, 2005). However, there is considerable scope to examine reactive agility skill execution and with specific reference to technical proficiency. This study examined the differences in agility (side-stepping manoeuvres) running technique between reactive and planned performance conditions during a rugby specific task. In addition, the modification to running technique during reactive conditions (evasive side-stepping manoeuvres) was examined with respect to the speed of agility performance (fast, moderate and slow).

METHODS: Eight high level rugby union athletes completed planned and reactive agility conditions. Participants carried a rugby ball and ran at maximal effort through an agility course (Figure 1). The initial task did not include decision-making elements. The second task included the presence of a decision-making element, where the attacker reacted and traversed the opposite running line to the movements of a defender.

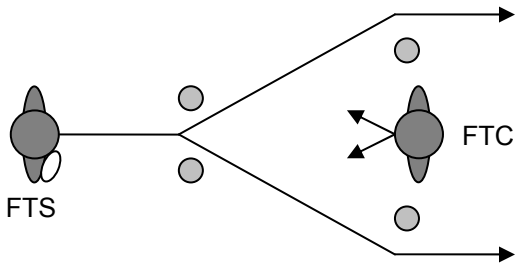

Figure 1: Overhead view of agility course.

Six digital video cameras (Panasonic Nv-GS180GN, Matsushita Electric Industrial Co., Ltd., Japan) operating at 50 Hz and with the shutter speed manually set to capture at 1/2000th s were used to record each trial. The video cameras were positioned at oblique angles to the agility testing area. Three dimensional analysis using the APAS system examined foot position (relative to the centre of mass as a percentage of leg length) and lateral movement (lateral velocity of the centre of mass). Variations to agility skill execution with respect to performance speed (fast, moderate and slow) were then explored. The mean coefficient of

variation for intra-tester reliability of digitising ranged between 0.42 - 3.12% for the raw position of landmarks and was 3.60% for joint angular displacement.

RESULTS: The inclusion of the decision-making element to testing meant that the development of lateral movement during the side-step was less (planned = 0.69 ±0.43 m/s vs. reactive = 0.25 ±0.42 m/s, p <.001) (Table 1). This was accommpanied with a decrease in the lateral position of foot-strike observed during reactive conditions (reactive = 41.35 ±5.85 % leg length vs. planned = 44.52 ±6.10 % leg length, p = .011).
Despite this, fast performances exhibited greater lateral movement during the side-step (0.52 ±0.34 m/s) compared to moderate (0.20 ±0.37 m/s, p = .034) and slow (-0.08 ±0.31 m/s, p <.001) for reactive conditions. It was then shown that the lateral foot position when side-stepping did not vary significantly between speed groups. However, fast performances did execute the side-step earlier and closer to the initial change of direction markers (0.01 ±0.38 m) than slow performances (-0.53 ±0.43 m, p = .003).

Table 1: Velocity and foot position for planned and reactive agilty conditions.

	Agility Condition	
	Planned	Reactive
Foot-strike		
Running speed ($m \cdot s^{-1}$)	5.22 (.62)	5.25 (.52)
Lateral movement speed ($m \cdot s^{-1}$)	0.69 (.43)	0.25 (.42) *
Anteroposterior foot position (%)	41.24 (11.20)	37.94 (13.32) *
Lateral foot position (%)	-41.35 (5.85)	44.52 (6.10) *
Toe-off		
Running speed ($m \cdot s^{-1}$)	4.04 (.74)	4.12 (.77)
Lateral movement speed ($m \cdot s^{-1}$)	2.36 (.42)	2.13 (.47) *
Anteroposterior foot position (%)	-22.92 (15.52)	-32.10 (13.44)
Lateral foot position (%)	74.04 (8.34)	75.15 (8.43) *

* Significant difference between agility conditions.

DISCUSSION: The decision-making element in testing limited the development of lateral movement during the agility side-step. Despite this, fast performances exhibited greater lateral movement compared to slow and moderate for reactive conditions. This finding concurs with other studies that have shown the inclusion of decision-making elements differentiates between speeds of agility performance (Farrow et al., 2005; Sheppard, Young, Doyle, Sheppard & Newton, 2006). This highlights the need to include reactive conditions in assessment procedures of running ability in rugby union.
Reactive agility performances rely on anticipation to enhance decision-making abilities (Abernathy, 1991). Such skill is vital to outmanoeuvring the defence and advancing the ball beyond the advantage line during attacking ball carries in rugby union (Meir, 2005). Building on this, the current study showed that anticipation strategies that enhance performance can be measured using the spatiotemporal characteristics of performance, such as foot positions and velocity profiles. Hence, it is important that agility assessment protocols asses the effectiveness of agility running technique when presented with decision-making elements that resemble athletic performance within a specific sporting context.

CONCLUSION: Agility running technique is modified during reactive conditions compared to pre-planned conditions. The presence of a decision-making element limited lateral movement when side-stepping and as such, the foot placement patterns were different compared to pre-planned conditions. Importantly, the anticipation abilities during reactive conditions provided a means to differentiate between agility performance speed, with faster performances executing the side-step earlier and with greater lateral movement directed towards the required running line. It is recommended that appropriate agility training methods and assessment procedures in rugby union consider the ability of players to anticipate and implement the correct evasive agility manoeuvre generating rapid lateral movement through accurate foot placement patterns.

REFERENCES:

Abernathy, B. (1991). Visual search strategies and decision-making in sport. *International Journal of Sport Psychology*. 22: 189-210.

Farrow, D., Young, W., & Bruce, L. (2005). The development of a test of reactive agility for netball: a new methodology. *Journal of Science and Medicine in Sport*. 8(1): 52-60.

Meir, R. (2005). Conditioning the visual system: a practical perspective on visual conditioning in rugby football. *Strength and Conditioning Journal.* 27:86-91.

Sayers, M.G.L. & Washington-King, J. (2005). *International Journal of Performance Anaysis in Sport*. 5:126-138.

Sheppard, J.M., Young, W., Doyle, T. L. A., Sheppard, T. A. & Newton, R. U. (2006). An evaluation of a new test of reactive agility and its relationship to sprint speed and change of direction speed. *Journal of Science and Medicine in Sport.* 9:342-349.

Acknowledgement: Thank you to New Zealand Rugby Union for funding this project.