A COMPARISON OF REACTIVE AGILITY IN THREE STEPS FOR RUGBY PLAYERS

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1. Introduction
In open-skill sports such as soccer, basketball, handball, and rugby football, recognizing the play and making decisions can be as important as physical performance. For example, in rugby, there are various factors that determine proper play, such as the position of the ball and player, the number of opponents and support players, the time remaining, the score, and even the weather conditions. In particular, the number and position of the opponents and support players and the location of the ball are consistently important factors for the ball carrier in determining what play to make. The opponents are usually in front of the ball carrier, whereas the support players are behind him/her because of the unique rules of rugby football. Therefore, the ball carrier must pass backwards. Some studies have investigated decision-making among football players, such as in regard to changes in direction speed and reactive agility. The purpose of this study was to compare three steps (side-step, shuffle, and split-steps) in reactive agility.

2. Methods
1) The subjects
The subjects were five (mean age: 20.4 years±1.5) rugby athletes (scrum-half, stand-off, centre, wing, and fullback) belonging to the university first division rugby league. The subjects had more than five years of experience in competing in rugby. Because comparatively larger-bodied forward athletes do not perform many movements to evade the opponent, such as steps and feints, we selected rugby athletes who were used to doing such stepping movements.

2) Measurement conditions
Measurements were carried out on the artificial-grass playing field for rugby at the Shonan Campus of T University. With regard to the measurement conditions, we used the previous studies of Bradshaw et al. as our guide. In order to investigate the effect of each step requiring judgement, we ensured that the entire distance to be run was sufficiently short so that the endurance and techniques necessary for running would have no bearing on the measurements. We set Gate 1 at a location 30 cm from the start line. We set Gate 2 a meter from there (see Figure 1). We set Gate 3 three meters directly in front of Gate 2. We set Gate 4 at a 40–50˚ angle from the middle of Gate 2. Each gate was one-meter wide.
3) **Data measured and the measurement devices**

The time necessary to complete each stage was measured: the first stage was the distance from Gate 1 to Gate 2 while the second stage was the distance from Gate 2 to either Gate 3 or 4. We used the Smartspeed device created by Fusion Sport Pty Ltd. to measure movements made to change direction. According to computerised controls, the Smartspeed device emits multiple light flashes, randomly or at specified intervals, to instantly record the time a gate (the position of the gates can be set freely) is passed. The signals flashed within 0.1 seconds of Gate 2 being passed.

4) **Three types of step**

Measurements were carried out on the three types of step: the side step, shuffle step, and split step; all were carried out by the subjects.

① Sidestep: The subjects ran straight ahead and without making any preparatory movements, changed direction by making a crosscutting step once.

② Shuffle step: The subjects ran straight ahead and repeated small steps before changing direction.

③ Split step: The subjects ran straight ahead and made little jumps (hopping movements) immediately before changing direction.

5) **Measurement process**

After performing their own warm-up exercises, the subjects carried out a total of six test runs, twice for each type of step. After a suitable interval, we measured a total of 18 test runs, three times each for left and right directional changes for the three types of steps per subject. After the subjects passed through Gate 2, a signal flashed at either Gate 3 or Gate 4. This indicated to them the necessity of passing through the gate that flashed the signal as quickly as possible. The frequency of the randomly flashed left and right signals was evenly distributed.

6) **Data collection and statistical processing**

Data on the time players took from Gate 1 to Gate 2, which was the first stage, and the time players took from Gate 2 to either Gate 3 or 4, which was the second stage, were collected. For the statistical processing, we calculated the mean value of the total time for each step and for each stage, carried out one-way variance analysis, and subsequently carried out Tukey's multiple comparison test. Furthermore, we set the statistical significance level (i.e., p value) at 5%. After measurement, we recorded the subjects’ reflections with regard to the measurements.
3. Results

Figure 2 shows the average elapsed time (in seconds) for each step carried out during the first stage. In the first stage, the mean time for the side step (0.28±0.04 seconds) was significantly shorter than for the shuffle step (0.32±0.04 seconds) or for the split step (0.31±0.03 seconds; p<.05).

![Figure 2](image)

For the second stage, no significant differences were seen: sidesteps had a mean time of 1.10±0.16 seconds, shuffle steps had an average of 1.13±0.16 seconds, and split steps had a mean time of 1.14±0.17 seconds (Figure 3).

![Figure 3](image)

Furthermore, after combining the total times from the first and second stages, no significant differences were seen: sidesteps had a mean time of 1.37±0.14 seconds, shuffle steps had a mean time of 1.45±0.17 seconds, and split steps had a mean time of 1.45±0.18 seconds (Figure 4).

![Figure 4](image)
4. Discussion

In the present study, we divided the measurements into two stages: the first stage, which is before the step is made, and the second stage, which is after the step is made. We measured the time that it took from the start, to changing direction to run in response to a signal ahead, to passing through the final gate; this time was considered the agility to respond with judgement. It was discovered that in the first stage, sidesteps had significantly shorter running times before the change in direction in comparison with the other two kinds of step. These results were consistent with the research results of Bradshaw et al. (1) on step movements that do not require judgement. Even in movements requiring judgement, sidesteps were significantly faster than the other steps.

We surmised that the primary factor for this was the fact that sidesteps require no preparatory movements for the change in direction, such as moving the feet in small increments in the shuffle step and the small jumps of the split step; moreover, sidesteps can be made without losing speed. The first stage is the interval before the step is made. The results may be ascribed to the necessity, or lack thereof, of preparatory movements during this interval.

Although we established conditions in the present study to remove the factor of running, as much as possible, to compare the change in direction movements by step, the results of our study still showed significant differences. In ball games that involve taking positions, such as in rugby, forward advancement is the rule. Playing without dropping one’s running speed is essential. Marks (2) divides the situation in which the holder of the ball from the offensive side changes direction to avoid the other team’s defender into three steps: namely, ‘approach’, ‘foot work’, and ‘pathway’. Furthermore, he indicates that when the ball holder comes near the defensive player, he observes his opponent’s movements and in order to react quickly, controls his speed through the shuffle step or short step. This holds true in the moment before the signal is flashed in our research. It was surmised that speed is lost due to the preliminary movements that are made in order to respond quickly to the signal.

In addition, the subjects reported that they were unable to execute the steps well due to having directed their focus on the lamp in order to react to the signal ahead. Because they were too concentrated on the signal, they were unable to smoothly carry out the preparatory movements for the split step or shuffle step and lost speed in the process. However, it was surmised that in performing sidesteps, which do not require preliminary movements, they were able to focus their attention solely on responding to the signal and therefore maintained their speed while making the change in direction. It was surmised that the shuffle steps and split steps, which require preliminary movements in order to respond quickly, are effective in the second stage as well as in the sum of the stages, but no statistically significant differences were seen among the steps. However, because it is possible that the number of test subjects was insufficient, it is the author’s opinion that there is still room to reinvestigate this subject with the current number of test subjects and processed data.

5. Conclusion

There are various kinds of player who can run sprints fast but perform poorly, or who cannot run fast but perform well. Good players can incorporate a range of information, such as distance, time, the opposing team, and the position of his/her own support players, in decision-making. In game performance, selecting the appropriate play based on this range of information constitutes total ability. Thus, decision-making refers to total ability, such as in regard to visual recognition, anticipation, and coordination. Future studies should objectively evaluate performance ability alongside decision-making.

6. References
