

Defining, Developing and Measuring Agility

Anthony Turner, MSc, ASCC

Defining Agility

Agility may be defined as the ability to change direction rapidly, without losing balance, using a combination of strength, power and neuromuscular coordination.^{7,8,12,17} Until recently, these types of definition have dominated and greatly affected the way in which agility is trained and tested. However, recent developments have questioned whether these definitions truly reflect the nature of agility in a sports context, and as such, new definitions retain these movements but also add a reactive element. For example, Young *et al.*,¹⁶ and Sheppard and Young¹³ also add that agility is further affected by the athlete's perceptual and decision-making skills (see *Caption 1* and *Figure 1*). What is not in question is that agility plays a major role in the performance of many sports and indeed, for team sports such as soccer⁹ and racquet sports such as tennis, agility may be the best single indicator of overall performance.

The significance of these more recent definitions may be illustrated by the fact that many agility drills are pre-planned and therefore only assess an athlete's ability to change direction (and not respond to a sport-specific stimulus). However, in most sports, a change in direction is produced in response to a stimulus such as an opponent's actions, and is influenced by perceptual and decision-making skills.^{13,15,16} For this reason, the ability to change direction and speed in a pre-planned movement, such as that demonstrated in certain agility tests (e.g. T-test, Pro-agility, 5-0-5), may be better described as change of direction (COD) speed.¹⁵

Developing Agility

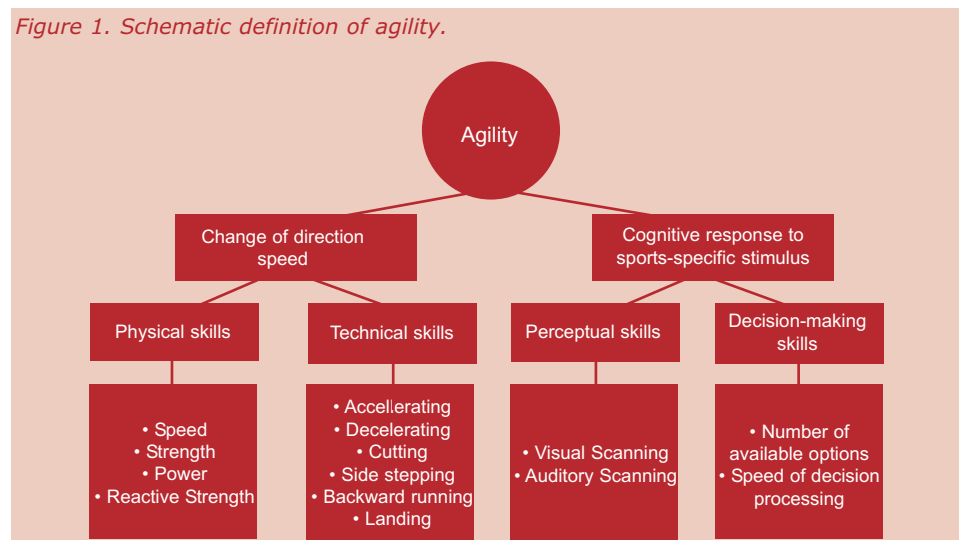
As a consequence of this updated definition of agility, several tests and drills have been developed^{5,3} that require athletes to change direction in response to a stimulus such as a light, thus incorporating reaction time within the agility task. Again, this may not replicate on-field play as reaction time will

Agility may be defined as the ability to change direction in response to a sport-specific stimulus, incorporating physical, technical, perceptual and decision-making skills.

Anthony Turner is a Strength & Conditioning Coach and a Senior Lecturer and Programme Leader for the MSc in Strength & Conditioning at Middlesex University, London, England.



Figure 1. Schematic definition of agility.



Progression Steps	Definition	Example Drills
Technical Drills	Focusing and developing specific movements in a closed environment	• Acceleration • Deceleration • Cutting left and cutting right • 180° turns • Side stepping
Pattern Running	Involves two or more technical drills sequenced in a sport-specific pattern. This is taught as a closed skill.	• Tennis: Accelerate over 3m, decelerate, side step left over 2m, 180° turn, accelerate over 5m • Soccer: Side step to the right over 2m, accelerate over 10m, cut to the right, accelerate over 3m, decelerate
Reactive agility training (RAT)	An open skill designed to reinforce game-like situations which compel athletes to respond to random, sport-specific stimuli	• Tag • Copy cat • Mirror image • Shadows
Temporal occlusion training (TOT)	Enables athletes to learn the association between an early cue and its resultant outcome	Using video footage, an athlete can watch an opponent try to dodge in front of him. However, the step before the opponent initiates his COD, the video is stopped. The athlete must react on the basis of the available cues.

Table 1. Developing Agility

be preceded by an athlete's ability to anticipate what is about to occur and for example, the direction in which an opponent is about to move.¹⁵ Abernethy *et al.*,² suggested that more skilled athletes produce quicker and more accurate responses because of their ability to pick up anticipatory cues, especially the posture or kinematics of an opponent (e.g. the angle of the hips, the lower legs and the chest). Specifically, studies show that high level soccer players have superior visual search strategies.^{4,10,11,14} For example, Williams and Davids¹⁴ showed that elite soccer players scan their environment before utilising longer ocular fixation durations to task relevant cues. In addition, they demonstrate reduced reaction times during a one-on-one situation, due to an enhanced ability to extract relevant cues from their opponent's kinematics, thus enabling them to better anticipate the opponent's next move.¹⁴ Similarly, high level goalkeepers demonstrate superior accuracy in predicting the direction of penalty kicks through a greater ability to recognise and focus on relevant visual cues such as the head, kicking leg and ball.¹⁰ Due to the significance of these cues, Young and Farrow¹⁵ question the value of using non-sport-specific training stimuli such as lights and auditory cues, let alone those that do not involve a reaction time component. Therefore, unless the agility drill is sport-specific, high level athletes are unable to use their perceptual and decision-making skills to their advantage.¹

Further evidence for the need to progress towards sport-specific random stimuli may be gleaned from the study of Besier *et al.*³ These investigators analysed planned vs. unplanned cutting movements. The unplanned movements were consequent to a light stimulus and thus imposed a time constraint on the subjects. The investigators concluded that because of inadequate time to make the appropriate postural

adjustments and to position the leg in an optimum position, significantly greater loads on the knee joint were experienced in the unplanned cutting task. This in turn is likely to increase the risk of knee ligament injury. The authors summarised that learning to respond more quickly to a COD stimulus in sport may not only enhance performance but also reduce the risk of injury.

Despite the need for sport-specific stimuli, a progression from closed to open agility drills is still recommended as this provides the athlete with the time and focus needed to develop and consolidate the individual components that define agility. For example, Holmberg⁶ suggests that agility is best developed by progressing through the following phases:

1. Technical drills
2. Pattern running
3. Reactive agility training (RAT)

Technical drills involve focusing and developing specific movements, for example, acceleration, top speed, decelerating and cutting, (these can be taught within a closed environment). Pattern running generally involves several of the aforementioned technical movements sequenced in a sport-specific pattern and are generally considered very effective for novice athletes (this is also taught as a closed skill). However, when technical mastery is attained, agility drills that simulate competition-like situations whilst compelling athletes to react to random stimuli are a more optimal method of training. Holmberg⁶ suggests that these RAT sessions enable athletes' to relocate their attention to the kinematics of an opponent and force the athlete to make a choice in response to the early appearance of such information. Therefore these drills will improve anticipatory skills and fundamental movement actions.^{15,17}

An agility test for netball was devised by Farrow et al.,⁴ in which players had to respond to a life-size video clip of an attacking player about to pass a ball. Via video analysis, total time and decision time, (defined as the time taken between ball release and the instant the foot was planted to change direction), was measured. In line with the aforementioned studies, it was found that the highly-skilled players were faster partly because of faster decision times. Interestingly, the better players anticipated the pass direction and thus were able to move before ball release. However, the less-skilled players initiated their movement after ball release, thereby increasing both total time and decision time.

Young and Farrow¹⁵ suggest an alternate mode of RAT known as 'temporal occlusion training' (TOT), whereby athletes learn the association between cues and resultant outcomes. For example, via edited video footage, an athlete can watch an opponent try to dodge in front of him, however, the tape is paused prior to the opponent initiating his COD and the athlete must react on the basis of the available cues.¹⁵

To summarise, Young and Farrow¹⁵ offer 2 principle guidelines when training agility. Firstly, they suggest the strength and conditioning coach identifies the specific movement patterns used by successful athletes in a particular sport, as the practice of these would likely optimise the transfer to on-field play compared to a more generalised approach. Secondly, they suggest athletes' practice agility skills under the time constraints of game situations, because this causes the athlete to make fast postural adjustments specific to the demands of competition. It is recommended however, that athletes are first able to demonstrate technical mastery of the many movements encompassed by agility within a closed environment before progressing to the introduction of random, sport-specific stimuli (see *Table 1*).

Testing Agility

At present, agility is largely tested via closed skills such as performing the T-test, Pro-agility or 5-0-5 in the quickest time possible. However, following the recent adaptations to the definition of agility, this therefore defines them as COD speed test. Nevertheless, despite the reported methods to test and train 'true' agility, e.g. via edited video footage projected onto a large screen (see *Caption 2* for details), it is difficult to advocate its use within a testing environment. For example, apart from issues concerning cost and resources, a plethora of video clips would need to be developed and standardised and a familiarisation period granted to each player. Moreover, these factors would also significantly influence the reliability of the test and thus, this value would first have to be quantified. Alternatively, if hand signals from

a coach are used, then again reliability issues regarding timing of signal and clarity may be questioned. Furthermore, this form of stimuli, including that generated from electronically controlled signals, would still not qualify as a true indication of agility as they do not incorporate the kinematic cues of an opponent which are considered fundamental.

As a final note, when testing agility, the strength and conditioning coach should exert caution when incorporating sport-specific movements which utilise a sports implement such as striking a ball. Under these conditions, when only time is recorded, this movement is often neglected and does not reflect 'in play' mechanics (thus the validity of the test may be compromised). For example, the athlete may not jump as high to volley a ball, or kick a ball with the necessary power or accuracy required to score a goal. In summary, until such tests are rigorously validated, the use of COD speed tests is advised, with true agility used as a vital component of agility training.

In Conclusion

- Agility may be defined as the ability to change direction in response to a sport-specific stimulus, incorporating physical, technical, perceptual and decision-making skills. Unless the athlete responds to a sport-specific stimulus, agility should be defined as change of direction speed.
- It is recommended that agility is trained by progressing from closed to open skills, whereby the athlete is eventually exposed to random, sport-specific stimuli following mastery of the many technical skills.
- Due to time, cost and resource constraints, coupled with issues regarding validity and reliability, it is currently recommended that testing is conducted in a closed environment utilising COD speed tests.

References

1. Abernethy, B., Thomas, K. T., & Thomas, J. T. (1993). Strategies for improving understanding of motor expertise (or mistakes we have made and things we have learned!!). In J. L. Starkes, & F. Allard, *Cognitive Issues in Motor Expertise* (pp. 317-356). Amsterdam, The Netherlands: Elsevier Science Publishers.
2. Abernethy, B; Wann, J; Parks, S. (1998). Training perceptual motor skills for sport. In B. Elliott, *Training for Sport: Applying Sport Science* (pp. 1-68). Chichester: John Wiley.
3. Besier, T. F., Lloyd, D. G., Cochrane, J. L., & Ackland, T. R. (2001). External loading of the knee joint during running and cutting manoeuvres. *Medicine and Science in Sports and Exercise*, 1168-1175.
4. Farrow, D., Young, W., & Bruce, L. (2002). The development of a test of reactive agility for netball: A new methodology. *Journal of Medicine and Science in Sports and Exercise*, 8 (1), 52-60.
5. Hertel, J., Denegar, C. J., Johnson, P. D., Hale, S. A., & Buckley, W. E. (1999). Reliability of the Cybex reactor in the assessment of an agility task. *Journal of Sport Rehabilitation*, 8, 24-31.
6. Holmberg, P. (2009). Agility training for experienced athletes: A dynamical systems approach. *Strength and Conditioning Journal*, 31, 73-78.
7. Jullien, H., Bisch, C., Largouet, N., Manouvrier, C., Carling, C. J., & Amiard, V. (2008). Does a short period of lower limb strength training improve performance in field-based tests of running and agility in young professional soccer players? *Journal of Strength and Conditioning Research*, 22 (2), 404-411. (continued on page 31)