Theory to practice - Sports expertise

Author: Bruce Abernethy, Institute of Human Performance, University of Hong Kong and School of Human Movement Studies, University of Queensland

Issue: Volume 28 Number 3

At least three major themes can be identified in the contemporary study of sports expertise. The first theme, which has attracted most attention, is concerned with identifying the limiting factors to skill performance. A second theme, which builds on the first, is concerned with identifying the underlying differences in information usage between experts and novices. A third theme, which requires quite different investigative methods, is concerned with identifying the essential conditions for the development of expertise.

What attributes differentiate expert performers from non-experts?

There now appear to be a number of attributes that reliably and consistently differentiate the expert in motor skills from the non-expert. Studies reveal that experts have both superior declarative (factual) and procedural knowledge compared to that of non-experts; that the knowledge possessed by experts is organised in a different, more richly differentiated and structured manner than is the knowledge possessed by non-experts; sports experts are superior in the rapid encoding, retrieval, recall and recognition of patterns from their domain of expertise; and experts are superior in the advance prediction/anticipation of the actions of an opponent.

In all cases, the expert advantage is explicable in terms of the development of strategies, either implicitly or explicitly, that help to circumvent known information-processing constraints (Salthouse 1991). For instance, the chunking of knowledge and patterns overcomes known memory capacity constraints; automaticity helps overcome conscious processing capacity constraints; and anticipation helps alleviate the well-known constraints imposed by reaction time delays.

A number of other attributes (for example, rapid detection, knowledge of subjective probabilities) have also been demonstrated, on occasions, to differentiate experts from non-experts, but the overall evidence on these attributes is less compelling both in quantity and consistency. It appears infinitely more sensible to devote practice time with less skilled performers to the enhancement of attributes, such as pattern recognition (‘reading the play’) and anticipation, which are clearly essential for expert performance than to the enhancement of basic visual attributes, such as acuity or depth perception, which do not need to be at supra-normal levels to support expert performance (Wood and Abernethy 1997).

Do experts use different information from non-experts?

Introspective reports by skilled performers on what cues they use and how they control movement are notoriously inaccurate. Fortunately, however, there is now a variety of experimental techniques that can be used to more
precisely determine what perceptual information is picked up and used by different individuals. The converging evidence from these different techniques is that not only are experts superior at processing the same information used by non-experts, but that experts are also able to pick up and use different (and additional) sources of information to those used by novices.

In racquet sports, experts have been shown to be able to pick up useful anticipatory information from both the pre-contact motion of the racquet and the arm holding the racquet, while non-experts were only able to utilise information from the racquet motion (Abernethy 1991). In cricket batting, highly skilled batsmen have been shown to be able to pick up information from some specific early cues (the motion of the bowling arm and hand) that lesser-skilled players cannot (Müller, Abernethy and Farrow 2005). Collectively, such findings suggest a close link between expert perception and the kinematics of the action being viewed.

Expertise-related differences in information usage may or may not be related to performers' visual search patterns. Expert–novice differences are quite frequently reported in respect to the location, distribution and duration of eye movements. However, eye-movement patterns are only a modest proxy for information pick-up, with it being possible for the allocation of attention and the distribution of ocular fixations to be quite dissociated. Information pick-up rather than visual focus appears to be the key element of perceptual expertise, with clear expert–novice differences in skills such as anticipation being possible in the absence of systematic differences in eye movement.

At a practical level, the existing evidence suggests that systematic training of sport-specific pattern recognition and anticipatory skills should be a priority. Such training is more likely to be successful if it can help less-expert performers learn the information pick-up strategies of experts rather than simply their visual search patterns. A growing number of studies now exist to demonstrate that through the use of repeat exposures to video simulation of the displays normally encountered by athletes, it is possible to bring about improvements in sport-specific pattern recognition and anticipation. Some evidence has now been accrued to suggest that for perceptual learning of anticipatory skills, just as in learning of self-paced motor skills such as golf putting, superior learning of expert-like characteristics may be achieved in conditions in which verbal, conscious attention to task rules and procedures is minimised rather than maximised (Farrow and Abernethy 2002; Smeeton et al. 2005).

How do experts become expert?

Existing developmental studies of expertise suggest that the amount and type of practice undertaken are especially critical in determining whether or not expertise is likely to emerge. Ericsson, Krampe and Tesch-Romer (1993) have proposed, on the basis of studies of musicians, that expertise is directly attributable to the sheer amount of deliberate practice one undertakes, where deliberate practice is practice that is relevant to promoting positive skill development, is specifically undertaken for the sole purpose of improving performance (rather than for enjoyment or other rewards), and requires significant physical and/or cognitive effort.

In addition to deliberate practice, it appears that a number of contextual factors in early experience may also have an enduring influence on the likelihood of any individual progressing to the level of an expert. It is well known that relative age can have a powerful influence on who does and does not become an elite athlete. Recent evidence suggests that the size of the community/city in which one is raised can have an even more powerful effect — with a disproportionate number of elite team sport athletes growing up in areas of lower population (Chet et al. in-press). One plausible explanation of this effect is that smaller cities, towns and rural areas provide many of the conditions that are most favourable to the acquisition of expertise. Recent studies of Australian team sport players (Abernethy, Chet and Baker 2002) and Australian football players (Berry and Abernethy 2003) suggest that these conditions may include early sampling of a wide range of different sports, abundant early unstructured play and practice opportunities especially in invasion-type sports, and early exposure to playing with and against adults.

References


Berry, J and Abernethy, B 2003, *Expert Game-based Decision-making in Australian Football: how is it developed and how can it be trained?*, Report to the Australian Football League Research Board, Melbourne.

Côté, J, MacDonald, D, Baker, J and Abernethy, B in-press, ‘When “where” is more important than “when”: birthplace and birthdate effects on the achievement of sporting expertise’, *Journal of Sport Sciences*.


Müller, S, Abernethy, B and Farrow, D 2005, How do world-class cricket batsmen anticipate a bowler’s intention?, Manuscript submitted for publication.


This is an edited version of a paper presented by Professor Abernethy at the Australian Institute of Sport’s Applied Sport Expertise and Learning Workshop, conducted in August 2005.