Is there such a thing as a "perfect" golf swing?

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"Sometimes you go searching for the perfect golf swing. I won't go searching for something that doesn't exist" –

Thomas Bjorn, PGA Professional

Introduction

A commonly held belief in many sports is that there is one 'perfect' technique that is suitable for every performer, and of all sports, this view is arguably most prevalent in golf. Most anecdotal coaching texts and instructional videos describing the golf swing emphasise a set grip, stance, backswing, downswing and follow-through. Although slight variations are inevitable owing to personal beliefs of the authors and instructors, and the influence of ever-changing modern coaching trends, the techniques being advocated in the instructional media are essentially the same and are generally considered to characterise an 'ideal' golf swing.

The golf-related scientific literature, too, appears to perpetuate this traditional 'one size fits all' view. For example, in a book by Ralph Mann, of CompuSport International, and Fred Griffin, a well-respected golf instructor, the techniques of over 100 US PGA, LPGA and Senior PGA tour players were analysed with the aim of identifying the characteristics of the golf swing most related to performance. Although minor differences in patterns of movement between golfers were acknowledged, Mann & Griffin (1998) reported a number of commonalities in their techniques that were used to construct a computer-generated 3-D model of the 'perfect' golf swing. This model, now more widely known as the 'ModelPro', has since been promoted as *the* template or criterion golf swing that all golfers should aspire to achieve.

In this article, we argue against the existence of one 'perfect' golf swing owing to the variability in technique within and between golfers (Riley & Turvey, 2002; Glazier, Davids & Bartlett, 2003; Davids, Glazier, Araújo & Bartlett, 2003). Rather than viewing any deviation from a perceived 'common optimal movement pattern' as being undesirable—'noise in the system' as it were—and a potential weakness in a golfer's technique, we suggest that movement variability should be

viewed in a more positive light, as it may reflect how the golfer uniquely satisfies the confluence of constraints acting on performance in the best possible way (Newell, 1986; Newell, van Emmerik & McDonald, 1989).The view that movement variability may be beneficial to performance has also been supported by recent models of motor control, which have suggested that inter- and even intra-performer movement variability may play a functional role in helping each individual adapt to specific performance contexts (Davids, Bennett & Newell, 2005). In the following sections, we provide a brief exposition of the constraints concept before explaining how the various sources of constraints impact on the golf swing. We conclude by discussing the implications of adopting a constraints-led approach for golf practitioners and their students.

The role of constraints in shaping and guiding the golf swing

The concept of constraints is central to many branches of science, including mathematics, physics and biology. Roughly speaking, in the context of golf, constraints are internal or external features that limit or set the boundaries within which the golfer must perform. Constraints coalesce to 'determine' what patterns of movement are produced, not by prescribing them, but by eliminating certain configurations (Kugler, Kelso & Turvey, 1980). According to the influential framework outlined by Newell (1986), constraints emanate from one of three sources—the performer, environment or task.

Performer constraints can be classified as those that are internal to the human movement system. This category of constraint can be further sub-divided into structural and functional constraints. Structural performer constraints tend to be physical constraints that remain relatively constant over time and include factors such as the golfer's height, mass, strength and flexibility.. Functional performer constraints, on the other hand, tend to vary quite considerably over time and can be either physiological or psychological. Major functional performer constraints include the specific intentions of the golfer geared by tactical needs, performance anxiety, confidence and any deficiencies in perceptual systems.

Environmental constraints can be classified as those constraints that are external to the human movement system. They tend to be non-specific constraints that pertain to the spatial and temporal layout of the surrounding world or the field of external forces that are continually acting on the human movement system. Examples of environmental constraints include ambient light and temperature, acoustic information, ubiquitous gravitational forces and the reaction forces exerted by *terra firma* and other contact surfaces.

Task constraints can be classified as those constraints that are specific to the task at hand and include task goals, the rules of the task, and any implements or tools (e.g., different golf clubs) used to perform the task. It is the constraints of the task that operate as an umbrella over all other constraints in influencing what patterns of movement are produced (Higgins, 1985; Clark, 1995). The main task constraints in golf include not only swinging the golf club so that the club head is travelling at the optimum speed at impact, but also ensuring that the point of impact occurs on or near the centre of percussion (or more commonly known as the 'sweetspot') so that energy transfer is optimised, and that the club head is correctly orientated to strike the golf ball in the intended direction (Hume, Keogh & Reid, 2005).

The relative impact of performer, environmental and task constraints is very much dependent on the activity being performed and the specific requirements of each performance situation. As striking a stationary golf ball can be classified as being a relatively 'closed' skill (i.e., there is spatial and temporal certainty), environmental constraints are only likely to have an impact on the golf swing in certain circumstances, such as when playing from an excessively sloping lie, when exposed to inclement weather conditions or when impeded by a tree or out-of-bounds stake. Performer and task constraints are, therefore, probably the most influential in shaping the golf swing under 'normal' playing conditions. Although some constraints are clearly more influential than others, an important aspect of the constraints-led approach is that these three major categories of constraints interact to shape performance at any one time (Newell, 1986; Newell, van Emmerik & McDonald, 1989).

Does the 'perfect' golf swing exist?

From a constraints-led perspective, it is clear that the 'perfect' golf swing cannot exist, and that the notion of a 'common optimal movement pattern', towards which each individual golfer must aspire, is a fallacy, because the confluence of constraints impinging on performance is patently *individual-specific* and *fluctuates continuously over time*. Therefore, not only will there be variations in patterns of movement between golfers, there will also be subtle variations within each golfer over repeated golf swings. These forms of variability would only be viewed in a negative light if one accepted the myth that every golfer can perform the golf swing in the same, identical manner. Variations at the population level have been viewed as the 'engine' of adaptive, evolutionary change over time and there are many good reasons why individual movement variations should be viewed in the same way. From this viewpoint, a more productive scientific

and pedagogical approach would be to understand the relatively unique patterns of movement of different golfers as a ‘window’ on to their adaptation to the unique constraints acting on them.

Differences in structural performer constraints are likely to account for much of the variation between golfers (Higgins, 1977) and anecdotal evidence certainly suggests this to be the case. For example, tall and slim golfers (e.g., Els, Faldo, Woods, etc.) tend to have more upright swings than short and stocky golfers (e.g., Parry, Woosnam, Trevino, etc.), and senior golfers tend to have much shorter, more rigid, swings than their junior, more supple, counterparts (see Videos 1-2). Furthermore, as the rules of golf do not specify how golfers should swing a golf club, differences in the interpretation of the task constraints are also likely to contribute to variations in technique between golfers. Many of the idiosyncrasies unique to individual golfers are, therefore, likely to be attributable to the combined influence of structural performer constraints and differences in the interpretation of task constraints.

(Video: Download: Windows Media ;) (Video: Download: Windows Media ;)

Jack Nicklaus as a 19 year old at the 1959 Walker Cup (Video 1) and Jack Nicklaus as a 65 year old at the 2005 British Open (Video 2), his final major championship. Note the changes in the speed and length of swing as the structural performer constraints (e.g., age, flexibility, strength, etc.) have changed.

However, are we suggesting that there are no similarities of note between golfers? The answer is categorically: no. Although there is likely to be a moderate amount of variability among the swings of different golfers, the topological characteristics (the global geometrical properties, based on relative limb motions, that define shape and form) are likely to be preserved between golfers (Newell, 1985). At the highest levels of performance anthropometric characteristics do not vary as greatly as in some other sports such as basketball, for example, where players’ roles can be defined by their structural constraints. The fact that all golfers need to be able to drive, chip and putt, places a limit on the tolerance to individual variability in golf. This need for consistency between golfers does not imply that a ‘common optimal movement pattern’ exists—it would be tantamount to saying that most people look the same because they have two eyes, a nose, and a mouth. One may argue that there is a ‘common coordination pattern’ (Bennett, 2003) However, owing to the wide range of golfers of varying abilities that share the same set of relative limb motions, this concept is clearly far too abstract to be of any practical use.

Changes in functional performer constraints and task constraints, combined with the inherent noisiness of the human movement system, are likely to account for much of the variation within a golfer over repeated golf swings. The unique requirements of the task faced by the golfer during each shot, changes in the physiological and psychological state of the golfer, or a combination of the two, are likely to have a major influence on the golf swing. For example, the swing used to strike a golf ball with a driver on the practice range is clearly different to the swing used to strike an iron shot over water to win a major national or international tournament in front of a huge global audience. In addition to the variability within a golfer over repeated golf swings, there is also likely to be some variability within a golf swing as the golfer attempts to satisfy specific task constraints that become increasingly influential during the course of the swing. For example, during the backswing and early downswing the main task constraint is the generation of club head speed, but as impact becomes increasingly imminent, accuracy of the strike between the centre of percussion and the golf ball, and the orientation of the club head in relation to the intended target, become the dominant task constraints.

Implications for golf instructors and their students

From our preceding analysis, it should be clear that, like all other motor skills, the golf swing is not stereotyped or invariant, but rather it is an emergent property of the confluence of constraints impinging on the golfer. We suggest that, rather than evaluating the proficiency of a golfer's swing in terms of its proximity to a perceived 'perfect' golf swing or 'common optimal movement pattern', it should be assessed in relation to the specific constraints impinging on performance. Although the exact nature of these interacting constraints cannot be known in advance—they can only be predicted—the main overarching constraints that shape and guide performance should be more or less identifiable (e.g., height, mass, strength and flexibility). Golf instructors need to understand that each golfer is unique with their own individual differences and mannerisms that may or may not be detrimental to performance. Constraints vary among individuals and practitioners need to adopt an approach that allows each performer to satisfy the range of constraints acting on them in their own, unique way. Any variability should, therefore, be considered as a potential resource and not necessarily a hindrance to performance. Only a careful analysis of individual differences in relation to the agreed performance aims and goals of the instructor and golfer will tell whether a specific movement solution (e.g., a golf swing) should be developed or coached out over time.

Concluding remarks

In this article, we have argued that the existence of one 'perfect' golf swing is a fallacy. Instead of implementing a 'one size fits all' approach, we suggest that golf instructors should embrace differences in technique within and between individual golfers. It is important to note that we are not suggesting that all variability is good, but rather that not all variability is bad. An appreciation and understanding of the constraints on an individual's performance are required before attempting to coach out any variability. Finally, we suggest that, rather than serving any functional purpose, the 'perfect' golf swing concept, based on any averaging process, is merely a social construct, which is based on the subjective judgement of aesthetics. It serves very little purpose in the teaching and coaching of the golf swing, and should, therefore, be used sparingly in a pedagogical context. From the constraints-led approach, performance 'perfection' should not be viewed in 'absolutist' terms, but rather should be viewed as a multi-faceted relative concept signalling that individual performers have optimally adapted to the range of constraints (including anxiety, fatigue, ageing, media scrutiny, weather conditions, etc) impinging on them at any one moment.

- Owing to the variability in technique within and between golfers, the 'perfect' golf does not exist.
- Instead of employing the 'one size fits all' approach, golf instructors should accept and even embrace a certain bandwidth of movement variability.
- Far from being dysfunctional, this variability may be a reflection of the golfer attempting to satisfy the unique confluence of constraints impinging on performance in the best possible way.
- Golf instructors need to establish which constraints are the most influential constraints in shaping the golf swing, together with the long- and short-term aims of that golfer, before deciding on whether to encourage or coach out 'unconventional' movement solutions or idiosyncrasies.

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