Short of the goal

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Have you ever noticed that basketball players tend to miss their shots short, hitting the front of the rim more often than the back of it? Or that baseball players tend to ground-out on low pitches and fly-out on high pitches? Well, there just might be an explanation for it.

Recent research (Oliveira, Elliott and Goodman 2005) suggests that humans have an intrinsic tendency to minimise energy while performing motor actions, even when this is detrimental to performance. In other words, despite the fact that the objective of an athlete might be maximum precision, this athlete might be influenced by a tendency to miss generated by an inherent property of their bodies.

**Undershoot versus overshoot**

In simple laboratory tasks such as pointing to a pre-determined location, researchers have observed that humans have a tendency to undershoot targets more often than overshoot them. Anecdotal evidence from sports skills also points to an undershoot bias.

An interesting example was illustrated on a television show as part of the *Frontiers series* from Scientific American (www.pbs.org/sal/previous/watchonline405.htm). In the show, entitled *Better Baseball*, John Garver, a retired high school teacher, argues that baseball players, when hitting high and low pitches, present an undershoot bias that is similar to that observed in laboratory tasks. Players tend to hit the bottom of the ball in high pitches and the top of the ball in low pitches. In fact, Garver shows that by instructing university baseball players to 'miss' the ball, they would start hitting the ball dead-centred, something they had difficulty doing when properly aiming for it.

Basketball might be another example of the presence of an undershoot bias; the idea that the majority of missed shots are short of the basket, hitting the front of the rim rather than the back of the rim or the backboard is widely accepted. (Coaches from other sports can probably think of examples of skills that present a similar form of an undershoot bias.)

Based on this evidence, research (Oliveira, Elliott and Goodman 2005) was conducted to investigate whether the undershoot bias seen in laboratory settings and described anecdotally in sports precision skills might be a more generalisable phenomenon that could be happening right in front of our eyes in many real-life skills. It was hypothesised that this undershoot bias was an expression of an underlying tendency to minimise energy while performing motor actions.

**Tendency to minimise energy**

In simple terms, the hypothesis was that we might be subconsciously monitoring all of our actions in a way that we would be performing them using the bare minimum (and sometimes a little bit less than the minimum) amount of energy needed to fulfill the objective of the task. Travelling a lesser distance (undershooting) implies less energy expenditure and thus we hypothesised that the undershoot bias was the result of a more general energy minimisation bias. The research results supported this notion and it was found that people tend to undershoot when undershooting is more energy efficient and overshoot when overshooting is more energy efficient.

In summary, it appears that when we are trying to achieve maximum performance, not only are we fighting against external factors such as the opponents, but we are also fighting against ourselves and the tendency to err while minimising energy.

**Implications for coaches**

You might then be wondering what the implications of these findings are to your everyday training sessions. It is still early to draw any major conclusions, and more work is needed in order to establish how much these processes really influence our performance of motor skills. However, there are numerous strategies that could be used to account for these intrinsic tendencies. Some suggestions are that:

- Coaches should first try to identify any undershoot (or energy minimisation) biases present in the skills practised. This could be done by observation, or by consulting with other coaches to improve confidence that this is a real issue in your sport.
- Coaches then develop strategies that will lead athletes to account for the intrinsic biases. This could be done, for example, by creating a system in which missing short is penalised in some manner.
- Coaches should be mindful, however, that athletes do not become overly conscious of their tendencies to err short, because this may lead to the classical 'choking effect', present when athletes think too much about the skill they are about to perform and about the possibility of failure.
- Coaches should create a balance between letting athletes become aware of their intrinsic movement tendencies and using strategies that lead them to avoid being biased without having to actively think about it. For instance, instead of focusing on the error by telling your basketball players they are missing their free throws short all the time, you might want to consider just providing them with solutions such as shooting with a higher arc or putting more leg power into the shot.

In summary, coaches should pay more attention to the tendencies to minimise energy and develop training strategies to account for these intrinsic biases. You might not need to go as far as John Garver suggested. Instead, you could generate your own strategy to teach athletes to improve their performance in precision skills, but as amusing as it may sound, it may be the case that sometimes in order to hit, you have to aim to miss.

**Reference**


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