

# The Science of Combat

## PART ONE: Instruction psychology

So, what if we told you that the instruction you get — or give, if you're a sensei, sifu or coach — makes an instant and measurable difference to the power of your strikes? If you don't believe it, then take it from the scientific minds at work in the Australian Institute of Sports Combat Centre and the University of Nevada, USA. In the first of this series looking at groundbreaking AIS research into martial arts and combat sports, PhD scholar, kickboxer and strength and conditioning coach Israel Halperin joins the University of Nevada's Professor Gabriele Wulf in revealing a simple trick to better technique.

STORY BY ISRAEL HALPERIN & GABRIELE WULF



Aussie team member Jack Marton at the World Taekwondo Grand Prix 2015

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Whether you're a new student learning basic techniques, or an elite athlete preparing for a title bout, the instructions or feedback coaches provide can substantially affect your learning and performance. The role instructions play in directing a fighter's focus of attention (or 'attentional focus', as we say) has been the subject of intense investigation in recent years and is of practical relevance to coaches in all martial arts and combat sports.

Defined simply, attentional focus refers to what we get trainees to concentrate on during training and/or competitions. In this line of research, it is common to distinguish between an internal and external focus. Directing one's attention inward, towards a body part or even muscle group, leads to an internal focus. For example, you might say to a student, "Focus on extending your elbow when delivering the punch", or "Focus on your quadriceps muscles during the roundhouse kick". In contrast, directing one's attention externally — that is, to the effects of the movement on the environment — promotes an external focus, for example: "Focus on hitting the pad when delivering the punch" or "Push off the ground during the roundhouse kick". While the two instructions may seem similar, one of them has repeatedly been shown to be superior to the other. Care to guess which one before moving on to the next paragraph?

You might find this fact surprising, but almost two decades worth of

research has clearly demonstrated that an external focus is superior to an internal one. This effect was established with activities requiring balance, accuracy, force and power, as well as cardiovascular and muscular endurance, all of which are important in martial arts. Furthermore, the superiority of external focus instructions is not limited to a particular type of person — it was demonstrated for males and females, young and old, untrained and elite athletes.

Here are a few examples to illustrate the differences: Focusing on the movement of the wrist during a basketball shot (internal) impairs accuracy compared with focusing on the basket/hoop (external); balance performance measured by the degree of sway while standing still on a balance platform is enhanced when focusing on the platform (external) compared with focusing on the feet (internal); directing participants' attention to an external target (external) improves performance in vertical and standing long-jumps compared with focusing on extending the legs (internal); trained athletes can shot-put further when asked to focus on throwing the shot far (external) compared to extending their arms rapidly (internal)...and the list goes on and on.

### ATTENTIONAL FOCUS AND STRIKING

At the Australian Institute of Sport we recently investigated the effects of attentional focus feedback on punching

performance among competitive boxers and kickboxers, including world-title holders. The athletes were asked to punch a punching integrator (a device measuring peak impact forces and punching velocities) under two conditions: External focus ("Focus on punching the pad as fast and as forcefully as you possibly can") and internal focus ("Focus on moving your arm as fast and as forcefully as you possibly can"). Irrespective of the athletes' skill level, external focus instructions led athletes to punch four per cent faster and with five per cent more force compared to internal focus instructions. We repeated the study with national-level taekwondo athletes who were asked to deliver roundhouse kicks to the punching integrator under similar instructional conditions, and observed similar effects. Considering the high skill level of the participants in these studies, the observed improvement was significant.

### TALKING THE TALK

About 15 years ago, one of us (GW) proposed the 'constrained action' hypothesis to account for the superior effects of an external over an internal focus. According to this hypothesis, which has been supported by many studies since then, an internal focus constrains our motor-neural system by leading to conscious control of movements that disrupts the automatic and fluid nature of the action. In contrast, an external focus promotes a more automatic response in line

"Another advantage of an external focus is reduced muscular fatigue due to the greater movement efficiency."

with the desired outcome. So, when an athlete concentrates on their movement's intended effect, rather than on the body movements themselves, the motor system produces a more effective and efficient coordination pattern within muscles (i.e. recruitment of motor unit) and between muscles (i.e. a reduction of co-contractions). A complex movement such as a punch, which involves the integration of many muscles and body parts, will be executed with greater accuracy and force.

Another advantage of an external focus is reduced muscular fatigue due to the greater movement efficiency. Studies related to weightlifting, for example, have shown that athletes can perform more repetitions with the same weight when they concentrate on the weight as opposed to their arms or legs. In combat sports, similar effects would be expected — that is, a fighter would be able to maintain the force of their punches longer. Moreover, thanks to the fighter's actions being more automatic, they will have more attentional capacity to spare, which can be directed to the ever-changing environment associated with a bout, or the tactical and strategic aspects of the fight.

**WHERE ARE COACHES AT?** Our collective experience suggests that coaches in all disciplines tend to over-utilise internal focus instructions,



Israel Halperin gives some advice to ISKA world champ Josh Tonna in the ring



ACTION	INTERNAL INSTRUCTION	EXTERNAL INSTRUCTION
PUNCHES	Move your hands quickly	Punch the target quickly
FIGHTING STANCE AND MOVEMENT	Lift your hands up Keep your elbows tucked in Move your feet	Lift your gloves up Touch your shirt Move around the ring
KICKS	Turn your hips when you kick	Turn towards the wall when you kick
TAKEDOWNS	Use your legs to drive the opponent up	Push off the ground to drive the opponent up
TAKEDOWN DEFENCE (SPRAWLING)	Kick your legs back Use your hands to push the opponent down	Kick the wall behind you Push the opponent down towards the ground

and to under-utilise external ones. This also applies to coaches in martial arts and combat sports. In the spirit of science, we recently undertook a study to put our beliefs to the test. During the 2015 national boxing championship, we recorded, transcribed and analysed the verbal feedback provided by boxing coaches during the one-minute break between the rounds of each bout. We observed two interesting findings. The first, as hypothesised, was that coaches under-utilised external focus and over-utilised internal focus instructions. The second finding was that coaches provided roughly eight per cent more internal instructions in their losing bouts compared to their winning bouts. This last point suggests a relationship between greater usage of internal focus instructions and the match outcomes. We emphasise that

it is not possible to identify cause and effect from this study; however, the correlation between the type of attentional focus induced by the coaches' feedback and the competition outcome is interesting.

**WHAT TO DO NOW**

The upshot is this: even when differences in the wording of the feedback provided by coaches may seem insignificant, research has clearly shown that the choice of words can have a big impact on motor performance. Combat-related performance will be no exception to this rule, so we therefore recommend that martial art coaches carefully choose the type of instructions they use with their trainees, and attempt to promote an external over an internal focus of attention (see the table above for some recommendations and suggestions).

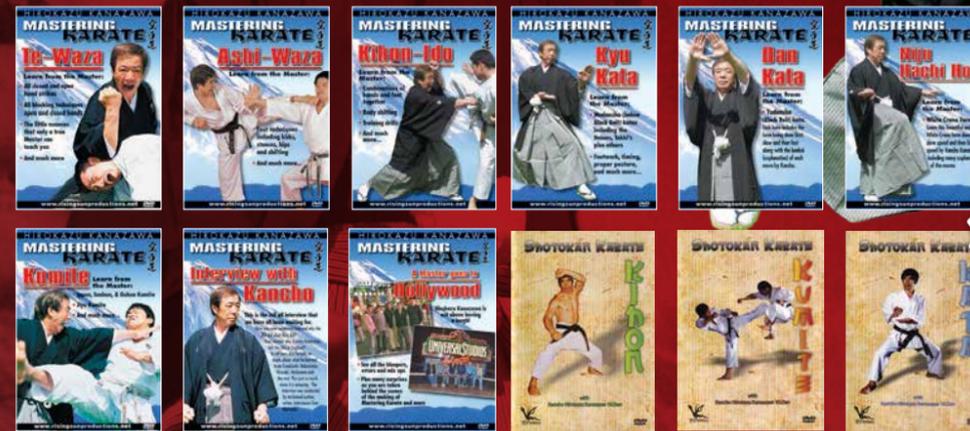
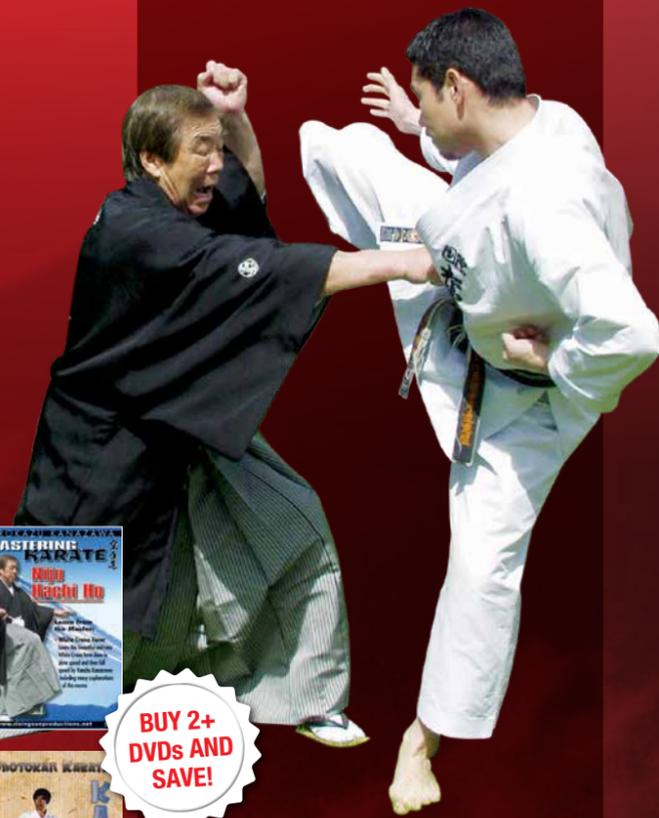
Former combat-sports athlete Israel Halperin is a kickboxing and strength and conditioning coach, and a PhD scholar with Edith-Cowan University in conjunction with the Australian Institute of Sport (AIS). Halperin works at the AIS Combat Centre testing and monitoring athletes, conducting research and providing overall support for the four Olympic combat sports of judo, boxing, wrestling and taekwondo.

Gabriele Wulf is a Professor in the Department of Kinesiology and Nutrition Sciences at University of Nevada, Las Vegas, USA. Dr Wulf studies factors that influence motor skill performance and learning, such as athletes' focus of attention and motivational variables. Her research has resulted in 175 journal articles and book chapters, as well as two books. ■

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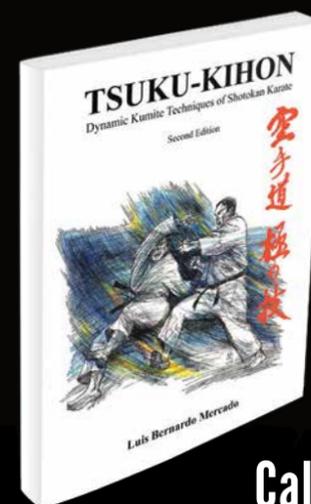


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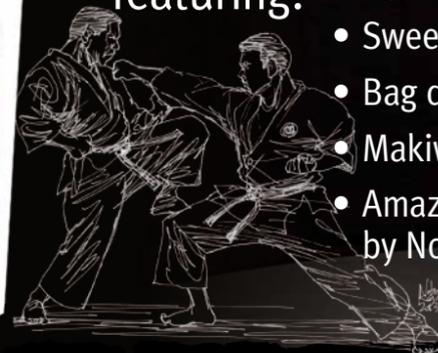
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