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The Truth on Fitness: **Does Focus of Attention Influence Performance Outcomes?**

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Does Focus of Attention Influence Performance Outcomes?

Spend enough time in a weight room, and you'll eventually hear a trainer ask their client, "can you feel your muscles contracting?" Sometimes the question takes the form of, "where do you feel it?" As if there is some doubt as to which muscles are actually working during a given exercise. In more deliberate approaches, some contemporary strength training modalities specifically direct the performer's attention to the activation of individual muscles.

The underlying assumption here is that purposeful attention to working muscles enhances contractility, force production, and in some instances, overall functional capacity. But is this true? Will a focus on muscle contraction, or for that matter, will any internal point of focus, actually result in improved outcomes? The answer to this question may seem intuitively obvious, but a body of work under the general title of the Constrained Action Hypothesis (more on this later) suggests that in reality, we've been directing our attention at the wrong target.

Marchant and colleagues (2009), for example, asked the question of whether one's focus of attention would have an effect on force production. It is noteworthy, that focus of attention refers to a point of concentration, and not to visual gaze.

Their subjects performed elbow flexion movements under three different conditions. In one, they were given an internal point of focus, whereby they were to concentrate on their biceps muscles. In the second, they were told to concentrate on the handle of the machine on which they were exercising, and in the last, they were given no point of concentration at all.

Their results indicated that when subjects concentrated on the handle (external focus) they were able to produce 6.5% greater elbow joint flexion torque than when they attended to an internal cue, or when the cue was absent.

These findings, by the way, are not limited to isolated muscle forces around individual joints. They have, in fact, been reproduced in studies involving multi-joint actions, such as jumping. Recently, Wulf et al (2010) measured jump height in eight subjects who were told to concentrate on either their fingers (internal) or the rungs of a Vertec vertical jump tester. In this dynamic functional task, jumps using an external attentional focus averaged 32.4 cm, while those associated with internal attention reached only 31.0 cm.

These differences could be attributed to variations in jumping technique, but Vanezis and Lees (2005) provide evidence suggesting something else. The authors evaluated 2 groups of soccer players, one which had high vertical jumps, and another with lower jumping scores. Motion analysis revealed that both groups had similar jumping techniques, but the high jumping group was able to generate greater peak power at the joints, which Vanezis and Lees attribute to improved coordination between the various muscle groups spanning those joints.

This conclusion is consistent with the findings of Wulf and Dufek (2009), who discovered not only greater jump heights in subjects with an external focus (rungs of a Vertec), but enhanced limb impulses and joint torques as well. What makes this study stand out, is that measures of external and internal focus were made upon the same subjects, performing the jumping task under both conditions. Thus, it is highly unlikely that technique, or even morphological variations, would have factored into the results. It's possible, therefore, that attending to an external point of concentration actually enhances coordination, leading to improved performance.

To address intramuscular coordination, one might examine the muscle activity that arises while performing various tasks under conditions of external and internal concentration. Several studies, in fact, have endeavored to do this, using electromyography (EMG) to assess muscle activation patterns.

Let's begin with Marchant and others (2009), whose study began this discussion. In their evaluation of biceps force, they also examined EMG amplitudes in the biceps during conditions of external and internal focus. One might guess that the condition which produced greater forces, the external attention condition, would also demonstrate greater EMG amplitudes. To the contrary, however, the authors reported lower EMG values during the external attention trials, in which force generation was higher.

These findings, quite frankly, are no aberration, as they have been consistently reported throughout the literature. Vance and others (2004), for instance, conducted a similar study in which subjects were instructed to perform biceps curls at 50% of their maximum capacity. The authors wanted to know if attentional focus would influence movement speed and muscle activation patterns. The results indicated higher joint velocities when subjects concentrated on an external point of focus, and significantly lower biceps (agonist) and triceps (antagonist) EMG activity.

Similar findings were reported by Wulf et al (2010), in their jumping study, suggesting that attentional focus affects muscle activity in isolated joint movements and dynamic multi-joint actions.

It's worth repeating; these studies reported larger joint torques, greater joint velocities, and increased jump heights when subjects adopted an external point of focus, all with reduced muscle activity. It seems,

therefore, that properly directed concentration results not in elevated muscle activity, but in a more efficient use of muscle activity. And thus, we have the concept of Constrained Action.

In any movement task, involving one or multiple joints, the nervous system must coordinate the total available movement capacity of the limbs (commonly referred to as degrees of freedom) with reflexive and voluntary muscle activity. That activity has to be carefully balanced, timed, and sequenced, because too much, too soon, or in wrong combinations, can result in inhibited force at the joints, with a net result of diminished capacity.

An internal focus results in inefficient muscle activity, by increasing the activity in other muscles surrounding a joint. Say Vance and colleagues (2004), "an internal focus freezes the degrees of freedom, inhibiting movement execution. In fact, "focusing on one body part may even constrain the whole motor system," resulting in a constrained action. On the other hand, when the central nervous system is free to organize movements efficiently, without being overburdened by an internal attentional focus, movements become fluid, effective, and ultimately, automatic (Wulf and Dufek, 2009). Automaticity, as we'll see, has many benefits.

Skills of accuracy, for example, are enhanced under more automatic control, and constrained when there is too much internal attentional focus. Zachry et al (2005), for instance, engaged their subjects in a free throw shooting task, in which they were instructed to focus on the basket for one series of shots, and their wrist motion in another shooting series. True to form, accuracy was significantly better when subjects concentrated on the external object. The authors also examined EMG activity, and as previously demonstrated, the external focus was associated with lower biceps and triceps activation. When the system works more efficiently, performance improves.

Parenthetically, these findings, that improved performance is accompanied by reductions in EMG levels, bring to light a simple, but profound point when addressing muscle activation. That is, when it comes to muscle activity, more is not necessarily better; better is better.

Attentional focus also influences the performance of complex motor skills. One example involves a combination of balance and reaction time, as reported by Wulf, McNevin, and Shea (2001). In this study, subjects were required to balance on a stabilometer, keeping the moving platform horizontal over a 90 second test interval. In addition, the subjects were given a hand switch, which they were to depress as fast as possible once an auditory tone was heard. For an external focus, subjects were told to concentrate on markers placed on the balance platform. Internal concentration was achieved by focusing on their feet.

Once again, the findings were consistent with others of this genre. When subjects were given an external point of concentration their platform deviations were smaller, and their corrective responses more rapid,

suggesting a higher degree of efficiency, fluidity, and coordination. Furthermore, their reaction times to the auditory stimulus were significantly faster when they focused on the external markers, indicating that when the nervous system is unconstrained, it can manage multiple tasks more effectively.

The truth is, according to Hommel (2007), "all that is necessary to allow coordination processes to operate in an automatic mode would be to prevent learners from attending to their own body movements." In fact, the effects of an external focus are unrelated to the type of skill being executed, or to the performer's level of skill (Wulf and Dufek, 2009).

In conclusion, regardless of the activity in which someone is engaged, whether it's a simple strength training exercise, or a complex sports skill, a level of concentration is necessary in order to perform the task effectively. Shifting concentration to objects affected by the movement, will evidently, produce far better results than if concentrating on the movement itself, or the muscles responsible for creating the movement.

Potentially, the concepts advanced by these studies will give practitioners something more compelling on which to concentrate.

References

Hommel, B. (2007). Goals, attention, and the dynamics of skill acquisition: commentary on Wulf. *E-Journal Bewegung und Training.* 1: 25-26.

Marchant, D.C., Greig, M., and Scott, C. (2009). Attentional focusing instructions influence force production and muscular activity during isokinetic elbow flexions. *Journal of Strength and Conditioning Research.* 23(8): 2358-2366.

Vance, J., Wulf, G., Tollner, T., McNevin, N., and Mercer, J. (2004). EMG activity as a function of the performer's focus of attention. *Journal of Motor Behavior.* 36(4): 450-459.

Vanezis, A., and Lees, A. (2005). A biomechanical analysis of good and poor performers of the vertical jump. *Ergonomics.* 48(11-14): 1594-1603.

Wulf, G., and Dufek, J.S. (2009). Increased jump height with an external focus due to enhanced lower extremity joint kinetics. *Journal of Motor behavior.* 41(5): 401-409.

Wulf, G., Dufek, J.S., Lozano, L., and Pettigrew, C. (2010). Increased jump height and reduced EMG activity with external focus. *Human Movement Science.* 29: 440-448.

Wulf, G., McNevin, N., and Shea, C.H. (2001). The automaticity of complex motor skill learning as a function of attentional focus. *The Quarterly Journal of Experimental Psychology.* 54A (4): 1143-1154.

Zachry, T., Wulf, G., Mercer, J., and Bezodis, N. (2005). Increased movement accuracy and reduced EMG activity as the result of adopting an external focus of attention. *Brain Research Bulletin.* 67: 304-309.

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