

Response to Jaeggi *et al.*: Exploring training methods

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We welcome the interesting contribution of Jaeggi, Berman and Jonides [1] to our discussion of methods to alter attention. As we stated explicitly in our article [2], our goal is to facilitate discussion in this novel field.

The distinction between ‘rest’ and ‘exercise’ that Jaeggi *et al.* [1] propose is interesting, and certainly, restoration of attention is an important goal and might be a good way of conceptualizing the effects of exposure to nature. We continue to believe in the importance of employing the distinction between attention training (AT) and attention state training (AST) methods because we believe that AST methods are not merely a means of restoration, but a group of methods that improve the efficiency of attention. State changes are a common and important process for improving behavior and performance in animals and humans [3,4]. Integrative body-mind training (IBMT) qualifies as a state change rather than merely restoration because it is effective after rest and after stressful tasks. However, unlike AT, AST involves more than specific strengthening of a particular brain network, instead, it integrates and coordinates body and mind to improve attention and self-regulation. This seems to involve a state of increased central and autonomic nervous system interaction which would be very different from what is expected from AT methods.

It would be useful, as the authors suggest, to have an empirical method to determine how training should be classified. Using the argument developed by Sternberg [5], two tasks that share a common mechanism would produce a statistical interaction; if there was no common mechanism (e.g. they were independent statistically), they would show additivity. For example, if methods such as exposure to nature and meditation, when applied together, produced a statistical interaction, one might argue that they have a common mechanism and should be put into the same category. If the two are additive, the argument would be that they should be classified separately. For instance, Jaeggi *et al.* [1] argue that meditation might interact with both nature exposure and AT tasks, whereas we think that IBMT would not interact with AT. This approach to determining how training could be classified would involve the additive factors method commonly applied in cognitive studies to examining common mechanisms. Additive factors have proven

to be a useful method, but this approach does have limitations, particularly with complex processes such as those involved in training [6].

A different but compatible method would be to use brain imaging to show which training methods involve similar brain networks. As suggested previously, and in our paper [2], we think that IBMT is a kind of state training and because it involves mental and bodily processes, it might activate both the central and peripheral nervous system. This is quite different from what has been found with training methods such as the use of working memory tasks [7].

It is also important to note, as Jaeggi *et al.* [1] have, that there are other methods that might influence cognition. For example, both aerobic exercise [8] and music education [9] have been shown to alter cognitive processes. However, the goal of our article [2] was to deal with methods designed specifically to train attention. It might well be that all of these methods also target attention, but it is equally possible that they involve other cognitive processes. As conclusive evidence regarding the processes targeted by these methods is still lacking, we chose not to discuss them in our contribution.

References

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doi:10.1016/j.tics.2009.02.001 Available online xxxxxx