

*Comment*

## All We Need Is Brain (and Technology)

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*Received: 16 January 2014; in revised form: 3 March 2014 / Accepted: 4 March 2014 /*

*Published: 14 March 2014*

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**Abstract:** Here, I suggest we must invest our scientific resources in brain research. Scientists interested in human (and non-human) intelligence should frame their key questions regarding where to look and where to go around technical advances related to the fascinating, general purpose, highly dynamic device we call the ‘brain’.

**Keywords:** intelligence; brain; neuroscience

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I had a really good time reading the thoughtful articles written by E. B. Hunt, S. Jaeggi, and W. Johnson [1,2]. These are great pieces, touching relevant topics. However, I still endorse the reductionist perspective held in my previous contributions to this special issue [3].

Genes and environments are correlated (Johnson), but the relevant products are expressed in the structural and functional features of our brains. We do not use our brains; we are our brains [4]. I put my money on a posit very close to that chosen by Johnson (“I put my own money on understanding the development of what we measure as intelligence, and the role of gene-environment correlation within it, as the most promising way forward” [5]), but my posit is brain-shaped. The recent study by Burgaleta *et al.* [6] is a good example of what I’m meaning here. Their findings highlighted the dynamic nature of intelligence–brain relationships showing that developmental changes in intelligence do have a neuroanatomical substrate. Across a two years follow-up, participants showing intelligence gains preserved their cortical thickness on average. However, those showing large decreases in intelligence displayed significant reductions in cortical thickness. Therefore, remarkable intelligence changes within short developmental periods are associated with the dynamics of cortical thickness development.

Contrary to Hunt and Jaeggi, I don’t think that the definition of intelligence should be one of the Big Five (issues). Intelligence interacts with emotion and both factors interact with the social

environment. True. But, again, these three factors are uploaded and combined in our brains. I strongly agree with the Hunt and Jaeggi statement: “what is missing is information about how individual differences in brain structures and networks influence intelligence” [7]. Furthermore, finding straightforward answers to this missed knowledge might be the first step for improving our intelligence, a goal that I also consider to be highly relevant [8]. Scientists, not necessarily psychologists, are working hard pursuing this key goal. The Santarnecchi *et al.*'s (2013) study [9] is an interesting example. This research showed enhanced fluid performance induced by gamma-band stimulation over the left middle frontal gyrus. Stimulated participants shortened the time required to find the correct solution to the more complex problems included in the Raven Advanced Progressive Matrices Test (RAPM). We must not lose this plane of thought.

As underscored in my previous comments, the brain is a general purpose, highly dynamic, device. We should focus our scientific resources on the brain, asking how it produces intelligence. Technological devices still unavailable, but that would be derived from the BRAIN Initiative [10] and the Human Brain Project [11] will be of great help for that main purpose. In my view, these tech advances will contribute to overcome our current understandable reservations regarding the correct definition of intelligence and the best way for obtaining proper measures, among many other things.

In short, we must stop asking where to look and where to go, because the answers to these questions will deliver the (false) impression that we really don't know. It would be great to accept that we (as scientists interested in human intelligence) should refer most of our relevant questions to the brain. I strongly think it is time to voyage from the earth to the brain [12].

### Conflicts of Interest

The author declares no conflict of interest.

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