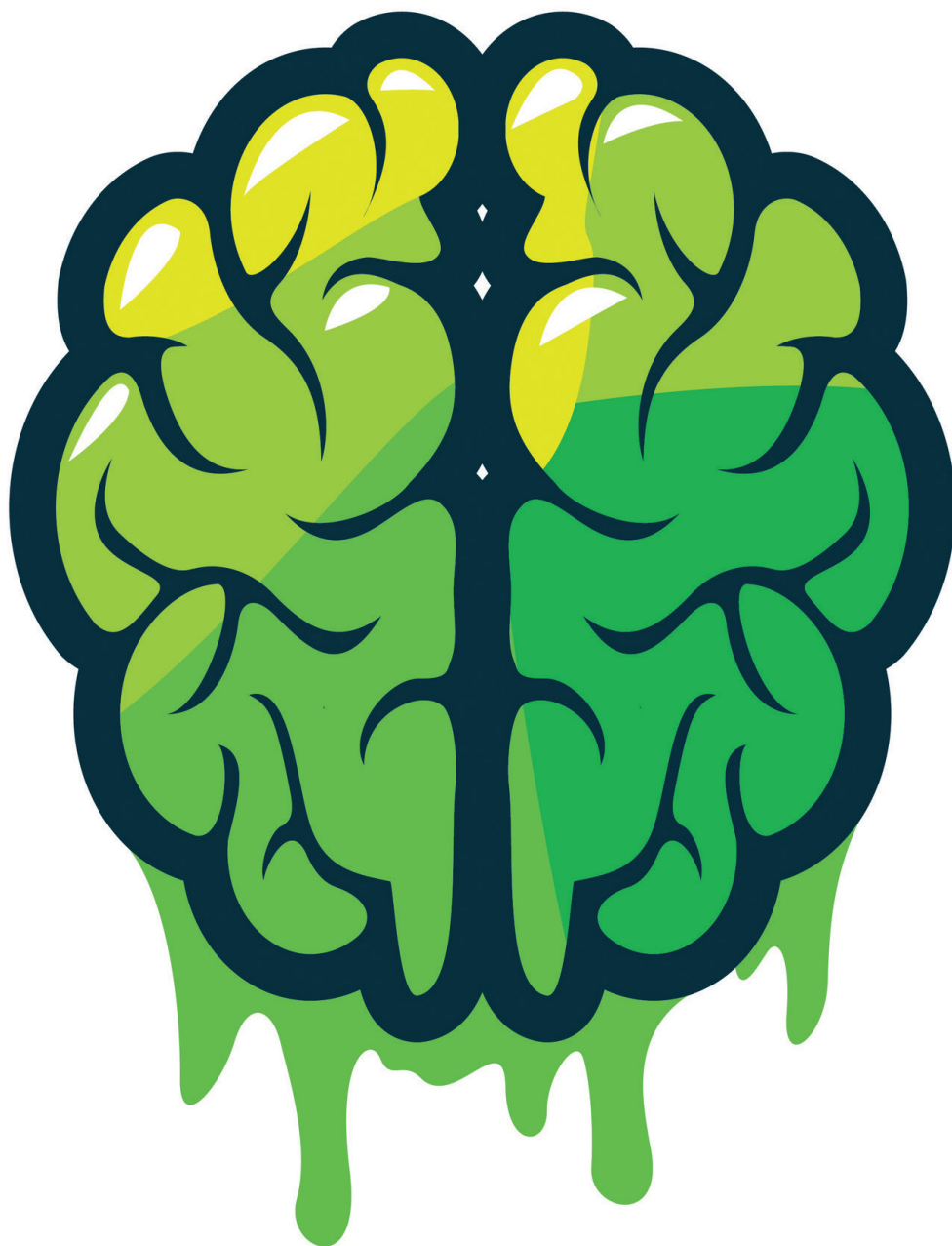


BEWARE NEUROMYTHS



The dictionary defines neuromyths as “commonly-held false beliefs about neuroscience”, and **Iain Robertson** believes they need debunking

Neuroscience is everywhere. As more research is being done into the patterns and processes of the brain, we are seeing more articles, blogs and suggestions about how this research can be transferred in all sorts of contexts – including learning and development. It seems that every week we are presented with a new piece of fMRI (functional magnetic resonance imaging)¹ research that offers us another pretty picture of the brain. These pictures (and the associated data) are then used to explain all sorts of psychological (and other) phenomena, often with exaggerated claims. Such research has the potential to shape our views on all sorts of things, with even some US legal scholars suggesting that neuroimaging technology could be used in both jury selection and as a better-quality replacement for the existing polygraph lie detector.²

Much of the research is at best poorly understood – and at worst wildly misinterpreted. This can lead to the creation of “neuromyths” – scientific-sounding explanations that do not reflect the reality of understanding in the field. According to Lia Commissar, a project manager at the Wellcome Trust, “[neuromyths] seem to persist because they are easy to understand, fit everyday observation, are heavily promoted or are easy to implement. However, unfortunately they often have little or no evidence supporting the impact they will have on learning”.

Our own industry is far from immune to this – so where does the truth lie? We will explore below some of the key issues that neuroscience research faces, and the implication for learning and development.

The incredible (and popular) appeal of neuroscientific explanations

Researchers have noted that psychological explanations seem to generate more public interest (and appear much more credible) when they are accompanied by scientific information – and in particular neuroscientific information. Perhaps oddly (since they are clearly concerned with similar questions), the public seems much less interested in run of the mill cognitive

psychology. It is worth looking, therefore, at what impact including neuroscientific information has on our understanding of psychology.

Weisberg et al³ looked into *why* people find cognitive neuroscience particularly alluring – and in particular why neuroscientific explanations are found to be so persuasive. Most articles and information in the popular press tends to focus on neuroscience’s ability to explain behaviour – something that we as development professionals have been looking to do for years. Understanding why neuroscience seems to have such a significant impact on why people find explanations so persuasive and convincing could help us to i) structure our own programmes and interventions accordingly and ii) be aware of any potential challenges from delegates who may have read the “next big thing” in the science



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section of the Sunday paper.

The Weisberg experiments looked at whether the addition of spurious neuroscientific information changed people’s judgments of explanations for psychological effects that otherwise did not differ in content or logic. The studies employed a 2x2 design – explanation type (good vs bad) and neuroscience (with vs without). This provided a baseline measurement of participants’ abilities to distinguish good vs bad explanations as well as any influence on this ability by the additional presence of neuroscientific information. Study subjects were given a one-paragraph description of a well explored psychological effect together with an explanation for that effect which they were asked to rate based on how effective they considered the explanation to be.

The results of the experiments were clear. Good (scientifically

accurate) explanations were rated much more positively than bad explanations (which were generally circular restatements of the problem). Likewise, explanations with neuroscientific information were rated as much more satisfactory than those without. Combining these effects means that adding pointless neuroscience made people rate bad explanations as good. In the words of the study, “adding irrelevant neuroscience information thus somehow impairs people’s baseline ability to make judgments about explanations”.

It gets worse with pictures

McCabe and Castel⁴ further explored a similar problem when they studied the effect of including brain images in articles describing neuroscience. In particular, they were looking to see whether simply adding a picture of the brain would increase readers’ perceptions of the credibility of neuroscience data.

Subjects were given identical explanations of fictional brain studies summarising cognitive neuroscience research that included no image, a bar graph depicting the results, or a brain image and asked to rate the explanations for the quality of their scientific reasoning. Those explanations that included a brain image were rated as significantly more persuasive than either other condition – even though both the bar graph and the research without imagery presented identical information. This effect was replicated with other visual representations of the data (a complex topographical map) and with a real-world article taken from a major publication. In other words, including a picture of the brain makes any explanation sound more persuasive!

McCabe and Castel’s data supports the idea that “there is, indeed, something special about the brain images with respect to influencing judgments of scientific credibility”. Combined with the Weisberg study, researchers believe that these sorts of explanations appeal to our reductionist approach to understanding the mind as an extension of the brain – it’s easier to believe that “this specific bit of the brain does this particular thing” than to understand the complex and →

ambiguous reality of interconnected and distributed processes.

We also need to be aware that even when the pictures of the brain that accompany these articles are relevant they may not be helpful. Recent research by Eklund, Nichols and Knutsson⁵ has suggested that much of the fMRI research in the past has been plagued by significant amounts of “false positive” readings by the software – in other words, the areas of the brain that are shown as being active may not actually be active after all!

So what does this mean for us in the development world? Primarily, we need to beware of uncritically accepting the latest claims – particularly when they are accompanied by neuro-babble and/or colourful and persuasive pictures of parts of the brain “lighting up” when

being asked to perform particular tasks or study particular things.

I was recently passed a paper by a well-meaning colleague that fell into both of these traps – it was essentially a glossy repackaging of existing understanding of a basic development concept (the learning cycle) that had added neuroscientific language and a pretty picture of the brain. Compare the following:

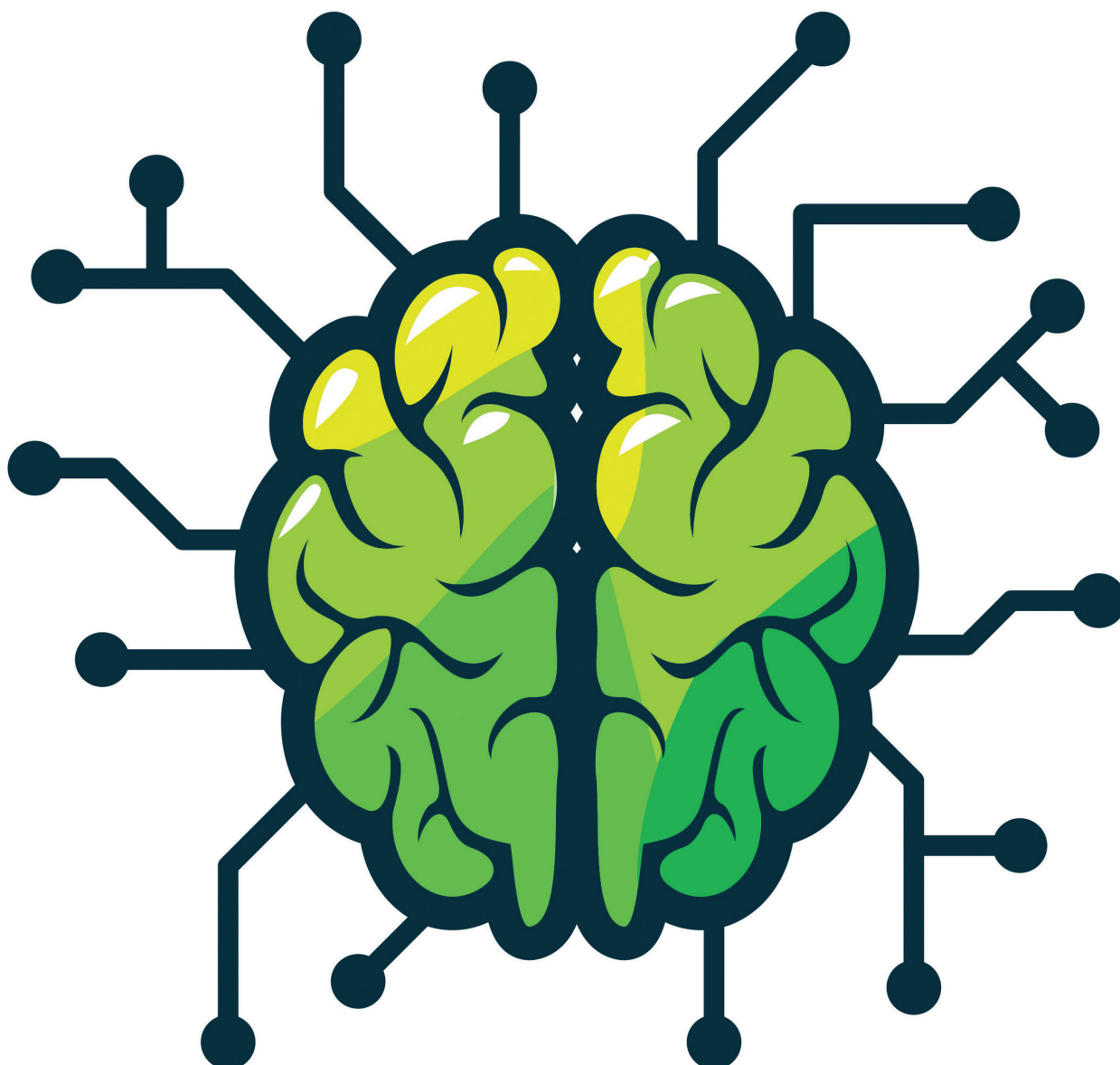
Gather sensory experiences through the sensory cortices, engage in reflective observation, drawing on the temporal lobe, create new concepts in the prefrontal cortex and actively test through our motor cortices. ⁶	Gather sensory experiences, engage in reflective observation, create new concepts and actively test.
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Removing the neuroscientific language from the quote on the left does not in any way alter the

information content or the usefulness of the summary – but does make it feel less new and less up-to-date. To the uncritical eye, however, it can look and feel like a breakthrough – or at very least a significant advancement – in understanding. When presented with similar information we should be careful to strip out the neuroscience (if we can) to see whether the underlying argument makes sense or adds to what we already know.

More mundane (but equally dangerous) neuromyths

While the colourful images of fMRI scans are perhaps the most obvious neuromyths that we need to be aware of, there are other areas of psychology of which development professionals need to keep abreast. From memory to motivation there are many fields



where an understanding of the actual state of the cognitive research can help us avoid falling into the trap of believing something that is at best inaccurate and at worst unhelpful. In my experience, the most common in our industry is an attachment to the idea of learning styles.

There are many approaches to learning styles – mostly derived from Gardner’s multiple intelligences hypothesis⁷ – of which the most common is the division of learners into visual, auditory and kinaesthetic. The contention is fairly intuitive and self-explanatory – someone identified as a visual learner will learn more



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(and more effectively) when presented with visual information; an auditory learner will derive more benefit from auditory information and so on.

The good thing about this view of learning styles is that it clearly lends itself well to simple – and hopefully persuasive – experimental design.

Do visual learners learn better when presented with information in visual form? Do auditory learners learn better with auditory information?

Pashler et al⁸ effectively went looking for information and/or experimental data to support the learning styles hypothesis. What they found was that there was virtually no good quality research to support the idea of learning styles or their impact on learning. In their words “that at present, there is no adequate evidence base to justify incorporating learning styles assessments into general educational practice”. From our point of view, therefore, it should be clear that designing development interventions to match participants’ alleged learning styles is a waste of

precious time and energy. Rather, we should accept that we are all visual, auditory and kinaesthetic learners.

If not learning styles, then what?

So, it appears that we can’t necessarily trust articles with neuroscientific language in them, we need to be wary of anything that shows a picture of the brain and the research into a very common developmental belief (learning styles) shows little or no support for it. Neuroscience so far has been very good at telling us what not to believe. What instead can it tell us about what to believe – and how can we use that to support our learners?

Cuevas⁹ has contrasted the research into learning styles with that into an alternative, mutually exclusive, learning model known as dual coding. Dual coding suggests there are two independent pathways for encoding information into long-term memory – one visual and one verbal. As we know, almost all adult learning includes some degree of language processing. Dual coding predicts all learners will learn more efficiently when some degree of visual stimulation is added to that inevitable verbal component.

There is evidence to support this theory¹⁰ – even if the exact mechanism by which dual coding might work is still the subject of debate. The good news for development professionals is that we don’t need to understand how dual coding works, we just need to understand that it works – and how we can best make use of it.

Most importantly, this means we need to limit the words on our slides and stop talking over slides that need words on them in order to avoid cognitive overload as we over-stress the verbal element of dual coding and under-use the visual.

Where does that leave us? Ultimately, with a reminder of what many of us were told when we started working in development. Visual aids are just that – visuals that aid learning and retention. More positively, Cuevas suggests that: “Rather than creating PowerPoints and Prezis with paragraphs and extensive written explanations, the presentations should only contain key words or phrases for overarching themes and predominantly feature visuals that relate

to the concepts being discussed verbally. These could include charts, graphs, pictures, drawings, videos and any other visual cues that support the concept.”

Dual coding seems to offer a promising focus for further research into how we learn and how we can continue to improve our own learning design and approaches. It offers a more inclusive view of learning, where we are all visual learners, as well as being auditory learners and (possibly) kinaesthetic learners. Balancing the amount of stress we put on our learners’ verbal and visual systems will lead to better learning outcomes all round. **TJ**

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