Educational neuro-nonsense, or: The Return of the Crockus

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Vicky Tuck, President of the British Girls' Schools Association (http://www.gsa.uk.com/), has some odd ideas about the brain.

Tuck has appeared on British radio and in (http://www.independent.co.uk/news/education/education-news/singlesex-schools-are-the-future-1023105.html)print (http://www.telegraph.co.uk/education/educationnews/3475963/Single-sex-schools-to-make-a-comeback-says-leading-headmistress-Vicky-Tuck.html) over the past few days arguing that there should be more single-sex schools (which are still quite common in Britain) because girls and boys learn in different ways and benefit from different teaching styles. Given her job, I suppose she ought to be doing that, and there are, I'm sure, some good arguments for single-sex schools.

So why has she resorted to talking nonsense about neuroscience? Listen if you will to an interview she gave on the BBC's morning Today Program (http://www.bbc.co.uk/iplayer/console/b00ffzws) (Her part runs from 51:50s to 55:10s). Or, here's a transcript of the neuroscience bit, with my emphasis:

> Interviewer: Do we know that girls and boys brains are wired differently?
> Tuck: We do, and I think we're learning more and more every day about the brain, and particularly in adolescents this wiring is very interesting, and it's quite clear that you need to teach girls and boys in a very different way for them to be successful.Interviewer: Well give us some examples, how should the way in which you teach them differ?Tuck: Well, take maths. If you look at the girls they sort of approach maths through the cerebral cortex, which means that to get them going you really need to sort of paint a picture, put it in context, relate it to the real world, while boys sort of approach maths through the hippocampus, therefore they're very happy and interested in the core properties of numbers and can sort of dive straight in. So if a girl's being taught in a male-focused way she will struggle, whereas in an all-girl's school their confidence in maths is very, very high.Interviewer: So you have no doubt that all girls should be taught separately from boys?Tuck: I think that ideally, girls fare better if they're in a single sex environment, and I think that boys also fare better in an all boy environment, I think for example in the study of literature, in English, again a different kind of approach is needed. Girls are very good at empathizing, attuning to things via the emotions, the cerebral cortex again, whereas the boys come at things... it's the amygdala is very strong in the boy, and he will you know find it hard to tune in in that way and needs a different approach.Interviewer: And yet we've had this trend towards co-education and we've also had more boys schools opening their doors to girls... [etc.]

This is, to put it kindly, confused. Speaking as a neuroscientist, I know of no evidence that girls and boys approach maths or literature using different areas of the brain, I'm not sure what evidence you could look for which would suggest that, and I'm not even sure what that statement means.

Girls and boys all have brains, and they all have the same parts in roughly the same places. When they're reading about maths, or reading a novel, or indeed when they're doing anything, all of these areas are working together at once. The

cerebral cortex (http://en.wikipedia.org/wiki/Cerebral_cortex), in particular, comprises most of the bulk of the brain, and almost literally does everything; it has dozens of sub-regions responsible for everything from seeing moving objects (http://en.wikipedia.org/wiki/Visual_cortex#V5) to feeling disgusted (http://en.wikipedia.org/wiki/Insular_cortex#Role_in_emotions_and_feelings_.28relationship_to_the_.22limbic_system.22.29) to moving your eyes (http://en.wikipedia.org/wiki/Frontal_eye_fields). I don't know which area is responsible for the the boyish "core properties of numbers" but for what it's worth, the area most often linked to counting and calculation is the angular gyrus (http://en.wikipedia.org/wiki/Dyscalculia#Potential_causes), part of... the supposedly girly cerebral cortex!

The gruff and manly hippocampus (http://en.wikipedia.org/wiki/Hippocampus), on the other hand, is best known for its role in memory. Damage here leaves people unable to form new memories, although they can still remember things that happened before the injury. It's not known whether these people also have problems with number theory.

When it comes to literature, things get even worse. She says - "Girls are very good at empathizing, attuning to things via the emotions" - which I guess is a pop-psych version of psychologist Simon Baron-Cohen's famous theory of gender differences (http://en.wikipedia.org/wiki/EQ_SQ_Theory): that girls are, on average, better at girly social and emotional stuff while boys are better at systematic, logical stuff. This is, er, controversial, but it's a theory that has at least some merit to it.

However, given that the amygdala is generally seen as a fluffy "emotion area" while the cerebral cortex, or at least parts of it, are associated with more "cold" analytic cognition, "The amygdala is very strong in boys" suggests that they should be more emotionally empathic. If Tuck's going to deal in simplistic pop-neuroanatomy, she should at least get it the right way round.

The likely source of Tuck's confusion, given what's said here (http://www.telegraph.co.uk/education/educationnews/3475963/Single-sex-schools-to-make-a-comeback-says-leading-headmistress-Vicky-Tuck.html) about Harvard research, is this study (http://www.brighamandwomens.org/ConnorsCenter/Research/Images/Articl

es/Normal%20sexual%20dimorphism.pdf) led by Dr. Jill Goldstein, who found differences in the size of brain areas between men and women. For example she found that men have, on average, larger amygdalas than women. Although they also have smaller hippocampi. Whatever, this study is fine science, although bear in mind that there could be a million reasons why men's and women's brains are different - it might have nothing to do with inborn differences. Stress, for example, makes your hippocampus shrink.

More importantly, there's no reason to think that "bigger is better", when it comes to parts of the brain. (I make no comment about other parts of the body.) That's phrenology (http://en.wikipedia.org/wiki/Phrenology), not science. Is a bigger mobile phone better than a smaller one? Bigger could be worse, if it means that the brain cells are less well organized. Likewise, if an area "lights up" more on an fMRI scan in boys than in girls, that sounds good, but in fact it might mean that the boys are having to think harder than the girls, because their brain is less efficient.

I'm a believer in the reality of biological sex differences myself - I just don't should try to find them with MRI scans. And Vicky Tuck seems like a clever person who's ended up talking nonsense unnecessarily. She could be making a good argument for single-sex schools based on some actual evidence about how kids learn and mature. Instead, she's shooting herself in the foot (or maybe in the brain's "foot center") with dodgy brain theories. Save yourself, Vicky - put the brain down and walk away.

Link Cognition and Culture (http://www.cognitionandculture.net/) who originally picked up on this.Link The hilarious story (http://www.mindhacks.com/blog/2007/09/girls_have_a_bigger_.html) of "The Crockus" (http://158.130.17.5/%7Emyl/languagelog/archives/004922.html), a made-up brain area which has also been invoked to justify teaching girls and boys differently. It's weird how bad neuroscience repeats itself.

[BPSDB (http://layscience.net/?q=node/245)]

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