The Intelligent Design controversy: lessons from psychology and education

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The current debate over whether to teach Intelligent Design creationism in American public schools provides the rare opportunity to watch the interaction between scientific knowledge and intuitive beliefs play out in courts rather than cortex. Although it is tempting to think the controversy stems only from ignorance about evolution, a closer look reinforces what decades of research in cognitive and social psychology have already taught us: that the relationship between understanding a claim and believing a claim is far from simple. Research in education and psychology confirms that a majority of college students fail to understand evolutionary theory, but also finds no support for a relationship between understanding evolutionary theory and accepting it as true [1,2]. We believe the intuitive appeal of Intelligent Design owes as much to misconceptions about science and morality as it does to misconceptions about evolution. To support this position we present a brief tour of misconceptions: evolutionary, scientific and moral.

Numerous studies have shown that students hold highly systematic misconceptions about evolution [3]. These misconceptions conform to internally consistent alternative theories of evolution (akin to Lamark's) and are remarkably impervious to instruction [2,3]. In particular, most people construe evolution as the simultaneous adaptation of individuals rather than the collective adaptation of a population. On this view, populations evolve because the environment increases the probability that organisms will bear offspring with adaptive traits rather than increasing the probability that organisms with adaptive traits will bear offspring [2]. This misconception could result from a poor understanding of random processes coupled with a tendency to overgeneralize properties of artifact design to evolution [4,5]. Alternatively, biological 'essentialism,' the commonsense assumption that the outward appearance of a species is determined by some kind of a hidden cause or 'essence,' could predispose individuals to construe evolution as the transformation of each species member's essence rather than the selective propagation of individual traits [6,7].

Because people fail to understand the mechanisms of evolution, they also fail to appreciate how empirical evidence bears on evolutionary claims. For example, most college students fail to understand that the presence of an adaptation implies past differential reproduction, or that the absence of within-species variation precludes the operation of natural selection in that species [8]. If a theory is *scientific* by virtue of its ability to generate testable hypotheses, then those who fail to understand how evolutionary claims can be tested might not appreciate why evolutionary theory has a stronger claim to scientific legitimacy than Intelligent Design, which purports to provide a scientific alternative to evolution.

Misunderstanding the content and scientific status of evolutionary theory might seem sufficient to account for the general public's ambivalence, but a surprising finding reveals that this cannot be the whole story. As alluded to previously, understanding the rudiments of natural selection is not correlated with accepting natural selection as a mechanism of evolution [1,2]. Perhaps people are reluctant to accept natural selection because they believe it has undesirable implications. Brem, Ranney and Schnidel [1] found that the overwhelming majority of their participants believed evolution to have negative social consequences, such as justifying racism and selfishness, and negative philosophical consequences, such as denying free will and a purpose to life. These views presumably stem from mistaken beliefs about biology (e.g. that race is a biologically meaningful category or that ultimate explanations reveal proximate intentions) coupled with the naturalistic fallacy (i.e. the belief that one can derive how we ought to behave from a description of how the world actually is). But their findings reinforce the lesson that understanding a claim and believing a claim are at best fair-weather friends; in fact, knowing more about evolution often strengthened students' perceptions that evolution has negative consequences.

So what leads some people to accept evolutionary theory and others to reject it? Brem *et al.* [1] found that students who accepted evolution were exposed to anti-evolution messages as often as creationists, but to pro-evolution messages more often than creationists. They were also more likely than creationists to believe that evolution has no social or moral consequences, positive or negative. Existing data do not provide a definite answer, but they do suggest that beliefs about evolution cannot be regarded in isolation. A proper understanding of evolutionary theory and its consequences requires more than a few lessons in biology. It also requires lessons from philosophy of science about what constitutes a scientific theory and an empirical test, and lessons from moral philosophy about the difference between empirical claims

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and moral claims. Perhaps this is what ought to be taught alongside evolution in America's public schools.

References

1 Brem, S.K., Ranney, M. and Schindel, J.E. (2003) The perceived consequences of evolution: college students perceive negative personal and social impact in evolutionary theory. *Sci. Educ.* 87, 181–206
2 Shtulman, A. (in press) Qualitative differences between naïve and scientific theories of evolution. *Cogn. Psychol.*
3 Cummins, C.L., Demastes, S.S. and Hafner, M.S. (1994) Evolution: biological education's under-researched unifying theme. *J. Res. Sci. Teaching* 31, 445–448
4 Evans, E.M. (2000) Beyond scopes: why creationism is here to stay. In *Imagining the Impossible: Magical, Scientific and Religious Thinking in Children* (Rosengren, K. *et al.*, eds), pp. 305–331, Cambridge University Press
5 Kelemen, D. (2004) Are children 'intuitive theists'? Reasoning about purpose and design in nature. *Psychol. Sci.* 15, 295–301
6 Medin, D. and Atran, S. (2004) The native mind: biological categorization and reasoning in development and across cultures. *Psychol. Rev.* 111, 960–983
7 Mayr, E. (1982) *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*, Harvard University Press
8 Lombrozo, T. (2005) Why adaptationist explanations are so seductive. In *Proc. 27th Annu. Conf. Cogn. Sci. Soc.*, p. 2516, Erlbaum

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Book Review

Coloured thoughts on perception

Seeing, Doing, and Knowing: A Philosophical Theory of Sense Perception by Mohan Matthen. Oxford University Press, 2005. £40.00/$74.00 (xxii+362 pages) ISBN 0 19 926850 9

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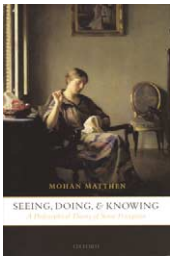

This book advertises itself as belonging to 'the new philosophy of vision' (pp. 1–3) – philosophy motivated not by the problem of scepticism (i.e. how can we justify our belief that we have perceptual knowledge of the external world?), but by scientific knowledge of how we use perception to guide action and find out about things in the world.

According to the old philosophy, perception comprises both non-cognitive 'raw sensations' and cognitive judgements that attribute sensory qualities to objects. Drawing from visual science, Matthen argues that this view is mistaken: instead, sensory experience reflects the results of sensory classification and categorization, and as such is already cognitive. Sensory systems sort objects into sensory classes, and create ordered relations of similarity and dissimilarity among distal stimuli. These ideas (the 'Sensory Classification Thesis' and the 'Sensory Ordering Thesis') form the subject matter of Parts I and II.

The idea that sensory systems classify stimuli is familiar, but Matthen develops it in fresh ways. Sensory appearances are the result, not the basis, of the classificatory activity of sensory systems. Colour vision does not categorize ripe tomatoes as red and unripe tomatoes as green because the former look red and the latter look green. Rather, ripe tomatoes look red and unripe tomatoes look green because our colour vision assigns them to the sensory classes 'red' and 'green'. Vision does not categorize objects according to their colour appearance, but objects appear coloured because vision categorizes them according to its own colour classification scheme. More generally, appearance follows sensory classification and is the record of such classification; it is not the basis or ground for sensory classification (Matthen's 'Posteriority of Appearance Thesis').

Although sensory classes like 'red' and 'green' do not correspond to physical classes, they are not arbitrary. They are 'action-relative', grounded on how the perceiver, given its biological make-up, is disposed to respond to various physical properties of the environment (e.g. light wavelengths and surface reflectances). A sensory classification scheme is right or wrong depending on whether it promotes or disrupts the perceiver's species-typical activity. Matthen calls this proposal the 'Thesis of Pluralistic Realism'.

Part III develops pluralistic realism for colour. Here, Matthen builds on my own writings that use comparative colour vision to chart an 'ecological' middle course between subjectivism and objectivism [1,2]. Subjectivists hold that colour is an attribute of visual sensations (or cannot be specified without reference to colour sensations), objectivists that it is an observer-independent, physical property (e.g. surface reflectance). Matthen maintains that colour sensory classes are specifiable in the language of physics, although they do not correspond to quantities in the laws of physics. Unlike traditional realists (or objectivists), however, he holds that colour is not an intrinsic property of objects; it is a response-relative or action-relative property that results from the sorting activity of sensory systems. Furthermore, different animals have different sensory colour classes, and hence experience things as having different colours. For example, the pigeon and the honeybee can discriminate wavelengths in the ultraviolet region, and pigeon colour vision is tetrachromatic (four appropriately chosen lights are needed to match the hue of any test light), whereas normal human colour vision is trichromatic (only three lights are needed). Thus, different

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