butes, including the location and other attendant features of that object'. In that sense the studies we cite in our article do show the possibility of attending to some thing without consciously experiencing that very thing or location.

Take the two experiments that Mole cites. When combining forward and backward masking, the digit can be rendered totally invisible [3], with an associated $d' = 0$, the toughest measure of non-discriminability. Yet subjects still have to pay attention to the spatiotemporal location of this masked digit to obtain the priming effect. In other words, non-conscious priming requires attention, even though subjects do not experience any features that can be used for the discrimination of the prime digit. They do not even experience a blurry 'something' at the location of the invisible mask but see the previous and following masks.

Or consider intraocular masking that is at the heart of continuous flash suppression [4]. This technique is used in Ref. [5] to demonstrate that completely invisible nude male or female images still attract attention. Yet in a two alternative forced choice task, subjects cannot discriminate the location of the nude from that of the scrambled nude. Subjects are simply not conscious of any attributes associated with the nude picture – not its location, its color, its content, the gender of the nude or anything else – because otherwise they could tap into this information to obtain a $d' > 0$. That is, attention is directed at a thing without the subject consciously experiencing any of its attributes. What they do see instead is a series of flashing, colored rectangles.

Mole's argument concerning the blindspot is specious. Not having any representation for something is very different from having a suppressed representation [3–5]. Cloaking visual stimuli is a powerful experimental strategy; in combination with functional magnetic resonance imaging (fMRI) it can be used to infer that attentional modulation of an invisible object is happening somewhere in the visual processing hierarchy, far away from the retina [6,7].

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Letters

Music, language and cognition: unresolved issues

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Recent research has examined links between exposure to music and cognitive abilities [1–7]. Although the effects of listening to music (e.g. the so-called 'Mozart effect') stem from the listener's emotional state, byproducts of formal training in music on language and other aspects of cognition are poorly understood [1]. Nonetheless, speculation abounds about the nature of the observed associations [2–6]. Here, we highlight five issues that remain unresolved.

One issue concerns related but not identical concepts: musical aptitude, music lessons and musicianship. Aptitude refers to 'raw' (untutored) abilities, obviously music lessons involve learning, whereas musicianship is likely to be a consequence of aptitude and training combined with other factors. Duration of music lessons predicts cognitive abilities – including language – among children in primary school (aged 6–11) and university undergraduates who do not necessarily self-identify as musicians [1]. Such effects are not due to confounding variables such as family income or parents' education [1]. By contrast, comparisons of musicians and non-musicians yield null or inconsistent results [7]. Similarly problematic is the failure to account for musical training when studying aptitude [3,4], because musical training improves performance on tests of musical aptitude. In other words, the observed associations could be either genetic or the consequence of music lessons.

A second, related issue involves inferences of causation [2–5], which are unfounded in correlational studies. Although isolated experimental evidence indicates that music lessons have cognitive transfer effects [1], additional studies with random assignment and appropriate control conditions are essential for setting the record straight.

A third issue concerns the nature and specificity of associations between musical experience and cognition. Discussion of 'special links' with language [3–5] is misleading when associations between musical training and cognitive abilities are much more general, extending to working memory and mathematical and spatial abilities

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[1]. A fourth, related issue involves modularity for both music and language. A wealth of evidence indicates that music and language have distinct cortical representations and that either domain can be impaired selectively [8]. Although observed associations between music and language could be considered to provide evidence that refutes the modular position, such associations could also be the product of domain-general attentional [2] or corticofugal [5] influences.

This brings us to the fifth and final issue: general associations between music and cognitive abilities, which appear to stem from music lessons [1], imply that music lessons enhance general intelligence (*g*), which is known to be relatively stable across a wide variety of circumstances. What other mechanisms could explain the broad set of associations that have been reported in the literature [1]? A likely candidate is the set of mechanisms known collectively as executive function [2]. Historically, scholars have emphasized the distinction between executive function and IQ, yet executive function is correlated with many of the subtests administered in IQ tests. More importantly, unlike *g*, executive function can be improved readily by training. Indeed, taking music lessons could be one learning experience that improves executive function and, consequently, test-taking abilities in a variety of cognitive domains. At present, however, there is little or no empirical evidence to support this hypothesis.

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Book Review

Universal human thinking

The Stuff of Thought: Language as a Window into Human Nature by Steven Pinker, Viking/Allen Lane Press, 2007. £25.00/US$29.95 (hbk) (490 pp.) ISBN 978-0-670-06327-7

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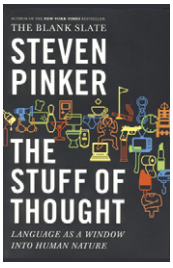

Two perennial questions in philosophy and (more recently) cognitive science are: 'What is the relationship between language and thought?' and 'What are the universal features of human nature, especially of the human mind?' Although many philosophers and social scientists have argued for the Whorfian view that language is prior to thought, such an account is almost universally rejected in current cognitive science – and rightly so, because humans share a rich set of conceptual structures and inferential systems with their animal cousins. By contrast, the question of a universal human nature is much more controversial. Although there is still no consensus on the outcome of the debate between nativists and empiricists, what is true is that the terms of the debate have shifted decisively towards the nativist end of the spectrum in recent years [1]; and this is, of course, a movement to which Steven Pinker's previous work has contributed significantly. No one now believes that the human mind is, to any considerable extent, like a blank slate.

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In his new book, Pinker ostensibly uses language as a window into our universal human nature (much of which is shared with other animals, no doubt). Taking for granted that thought is prior to language, he looks at the ways in which language (especially verbs) are learned. He examines the conceptual structures that are manifested in the ways in which we talk about space, time and causality. He discusses the metaphors that permeate our everyday talk. He studies the ways in which languages change over time, focusing especially on patterns and trends in the naming of children. He looks at the ways in which language (and especially a smallish set of 'taboo' swear words) can tap deep into our emotional psyche. In addition, he examines the curious (but extremely common) phenomenon of indirect speech, in which people do not say directly what they mean (as in the clichéd, 'Do you want to come up to see my etchings?'). In each instance, Pinker argues convincingly that a close study of the forms and uses of language can reveal a great deal about human nature. The result is a wide-ranging, thoughtful, judicious and witty book, which is almost everywhere illuminating.

It is worth noting, however, that the metaphor of language as a 'window' into the mind is somewhat