

Rob DeSalle - Our Senses: Gateways to Consciousness (2017; Yale University Press)

Book review by Charles Spence, Head of the Crossmodal

Research Laboratory, Oxford University

ABSTRACT: Charles Spence reviews Rob DeSalle's (2017) new book *Our Senses: Gateways to Consciousness*, a popular science look at the neuroscience behind the senses set in an evolutionary context.

KEYWORDS: SENSES; EVOLUTION; GENETICS; MULTISENSORY PERCEPTION; POPULAR SCIENCE.

This book, released in association with an exhibition curated by the author, Rob DeSalle is one of a number of popular science volumes that have been published recently seeking to capitalize on the growing public interest in the senses. This offering is certainly broad in scope, attempting to bridge the gap between unicellular organisms at the start of the book (in what the author calls 'The brainless majority') and the creative feats of human consciousness at the other end. DeSalle takes a comparative look at the sensory capacities of different species, even discussing whether it is meaningful to suggest that plants 'sense' their environments. The lay reader's interest will likely be captured by the frequent inclusion of surprising facts and statistics, such as the loudest pop concert ever measured (130 dB by The Who, apparently, though falling short of the 142.2 dB recorded from the fans at the Arrowhead Stadium in Kansas City, USA). DeSalle goes on to explore the impact that exposure to such loud noise (over both the short and long term) may have on a person's ability to hear – the answer, as you might expect, is not good!

He also poses the question of how it is that professional ice-skaters, like figure skater Natalia Kannounikiova, manage to retain their balance while/after spinning at more than 300 RPM on the ice. Much is made of individuals with unusual conditions/abilities – think Phineas Gage, patient H.M., split-brain patient J.W., and other patients with Capgras syndrome (who believe that those who are close to them are actually imposters). For instance, DeSalle reports on the intriguing case of an older woman, Joy Milne, whose husband died of Parkinson's disease. She can apparently discriminate t-shirts that have been worn by individuals with Parkinson's disease from those worn by others who do not have the illness. According to Joy, the former have something of a musky smell. Such findings are certainly consistent with recent suggestions that the sense of smell, for many years, may have been underrated in humans (e.g., McGann, 2017).

The book covers each of the major senses, though, the author sometimes suggests that there are six of them (including balance), while at other times hedges for an Aristotelian five instead. Whatever the correct answer to the question of how many (‘major’ and ‘minor’) senses we have,¹ DeSalle touches on interesting aspects of all the major senses. Some, though, would undoubtedly wish to question DeSalle’s (2017, p. vii) assertion concerning the senses that “*Pain, or nociception, is one of the more obvious after balance that needs to be added to the big five.*” (see Auvray, Myin, & Spence, 2010; McGlone & Spence, 2010). For those of us fighting against the visual dominance that is a feature of so much of the research in the psychological sciences and cognitive neuroscience, it is refreshing to see the main chapter on sight (Chapter 9: The Eyes Have It), relegated to appear after those chapters dedicated to the senses of taste, smell, balance, hearing, and touch. This is certainly not what one typically finds in the more traditional volumes on the science of the senses (e.g., Barlow & Mollon, 1982).

For me, though, DeSalle is at his best when discussing the evolution of the senses in different species, hopping from sea to land, and explaining how the same solutions, such as electroreception and the ability to detect sweetness, have evolved independently several times. When detailing the unusual and exotic sensory worlds inhabited by other species, the star-nosed mole getting plenty of coverage, though Howard Hughes’ excellent *Sensory Exotica* (Hughes, 1999) is still, I would be tempted to suggest, the go-to book for those interested in the range of unusual sensing solutions that have been developed by other species.

DeSalle also does a good job of championing the lower, senses, especially the chemical senses. Picking-up, for instance, on the latest evidence suggesting that we are actually much more discriminating when it comes to smell, than to taste, touch, hearing, or even vision. Indeed, it has recently been claimed that we humans, even with our rather limited olfactory capacities, can discriminate somewhere in the order of a trillion odours (see Bushdid, Magnasco, Vosshall, & Keller, 2014). None of the other senses come close in terms of their discriminative abilities.

In truth, there is little in this engaging ‘romp through the senses’ on human multisensory perception that is likely to be startlingly new to the avid reader of *Multisensory Research*. Nevertheless, I would argue that there are enough facts and comparative figures to maintain the interest of even the most well-read multisensory researcher. The science underlying multisensory perception appear briefly in several chapters. In Chapter 13: Team of rivals meets the Kluge, for instance, DeSalle focuses on the now-classic classic double-flash illusion (Shams, Kamitani, & Shimojo, 2000). He briefly summarizes the currently-popular Bayesian account of such multisensory integration phenomenon. Meanwhile, DeSalle chooses to focus on Adams, Kerrigan, and Graf’s (2016) recent study of crossmodal interactions in the perception of glossiness/stickiness as an example of visuotactile integration. These researchers demonstrate that visually-perceived glossiness can affect the

¹ And who, after all, can definitively answer that question (e.g., see Durie, 2005)? Indeed, Laurence Harris, is quoted as saying: “*No sense does anything independently and listing 33 of them may be counterproductive.*”

perceived haptic/tactile slippiness of a virtual surface. Similarly, increasing the apparent slipperiness of a surface resulted in an increase in perceived glossiness (i.e., as shinier).

Multisensory interactions such as these are, of course, increasingly coming to be seen as the norm, rather than the exception, as was once historically the case. Indeed, DeSalle's (2002, p. 202) suggestion that "*Combining information from multiple senses is not a uniquely human or even uniquely primate capability.*" Could be taken to hint at the author not being aware of just how widespread multisensory integration really is in nature. After all, in the words of Barry Stein and his colleagues: "...*there is no animal in which there is known to be a complete segregation of sensory processing*" (Stein, London, Wilkinson, & Price, 1996).

When discussing synaesthesia, the suggestion is erroneously made that it is a primarily cross-sensory phenomenon whereas, of course, the majority of cases are actually intramodal, e.g., with more than 60% of synaesthetes reporting coloured graphemes (see Day, 2005). Though DeSalle, who isn't a psychologist by training, should perhaps be forgiven, given that the same mistake has been made by a number of other well-known researchers in the field (e.g., see the opening lines of Ramachandran Hubbard, & Butcher, 2004, for one such egregious example). The coverage of synaesthesia is necessarily brief given the amount of material crammed into this book. For my tastes, DeSalle fails to draw a clear enough distinction between synaesthesia, crossmodal correspondences (see Spence, 2011, for a review), and multisensory flavour perception. I would also strongly disagree with DeSalle's suggestion that the study of synaesthesia has taught us a lot about multisensory perception (see Deroy & Spence, 2013a). DeSalle also falls for the erroneous, or at least not-yet-empirically-supported, neonatal synaesthesia hypothesis – the notion that we are all born synaesthetic,² and that neural pruning eliminates synaesthesia in the majority of us (see Deroy & Spence, 2013b, for a review).

At the same time, however, he does show that he has been keeping up to date with some of the debate currently raging in the synaesthesia literature. He quotes extensively from Hupé and Dojat's (2015) meta-analysis of published neuroimaging studies claiming that, contrary to the suggestions typically made by the authors' of the original research, there is currently no evidence to support the suggestion that the brains of synaesthetes are either functionally or structurally different from those of non-synaesthetes. Contrary to the situation a quarter of a century ago (see Baron-Cohen, Harrison, Goldstein, & Wyke, 1993; Cytowic, 1989), no one now doubts the reality of the phenomenon itself, but for those who agree with Hupé and Dojat's conclusions, there is clearly more research to be done before we have an acceptable cognitive neuroscience account of the neural correlates underlying synaesthesia.

The sometimes strange sensory worlds experienced by those suffering from brain damage or perhaps questionable surgical practices (in the unfortunate case of split brain patients) are also discussed at length (e.g., see Chapter 11: Modern life, strokes and the senses, and Chapter 12: Full/Half/Split brain). In truth, though, the interested reader will find more in this

² In DeSalle's (2017, p. 194) words: "... *most, if not all babies, are synesthetic just after birth.*"

book on the neuropsychology, physiology, and genetics of sensing than on the psychology. And, in places, I would argue that DeSalle oversimplifies matters beyond the truth of the matter, such as, for example, when suggesting that “*Hard liquor is a no-no for supertasters.*” Given that we all learn to like a number of the tastes/flavours that we were born disliking (Berridge, 2000; Steiner, Glaser, Hawilo, & Berridge, 2001), the enhanced bitterness associated with alcohol amongst supertasters is more likely to delay their uptake of alcoholic beverages rather than preventing it entirely (Duffy, Peterson, & Bartoshuk, 2004).

Given my own interest in taste (gustation), I was particularly taken by DeSalle’s claim that there are a small number of super-supertasters out there. Individuals who presumably have even more taste-buds squished onto their tongues than do regular supertasters.³ Though, a recent large-scale genetic test of almost 400 people conducted at the Denver Museum of Nature & Science (see Garneau, Nuessle, Sloan, Santorico, Coughlin, & Hayes, 2014) failed to find any evidence in support of the oft-encountered suggestion that taster status actually does correlate with the density of taste-buds on the tongue. The existence of such a group of individuals with mega-tasting abilities was news to me. However, a quick look at the back of *Our Senses* failed to reveal any references to support the claim as far as I could tell. Elsewhere, in this entertaining book, DeSalle tends to emphasize the research highlighting sex differences in (multi-)sensory perception much more than most academic researchers would tend to do. So, for example, he highlights in some detail reports of sex differences in the susceptibility to the crossed hands illusion (Cadieux, Barnett-Cowan, & Shore, 2010). Who knows, perhaps the author is playing to the popular science readership on this particular topic (Gray, 1992).

Finally, the academic researcher will likely find the writing style itself, while often engaging, irritating in places. Just take the following examples to see what I mean: “*Comb jellies, or ctenophores, are incredibly interesting animals. They look darn cool, ...*”; Or “*We can barely see our noses. Try it. With both eyes open, you can vaguely see some of your schnozzola.*” However, for those who can manage to see past the stylistic issues, I would argue that this book deserves a closer look by anyone with at least a passing interest in the senses of humans and other creatures. DeSalle has clearly done his homework and there is likely to be a little something for everyone in this latest addition to the growing shelf of books hoping to unravel the mysteries of the senses. This is certainly a good place to start for anyone interested in learning a little more about neural systems in an evolutionary context.

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³ According to Miller and Reedy (1990), there is a 16-fold variation in the density of taste buds between people.

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