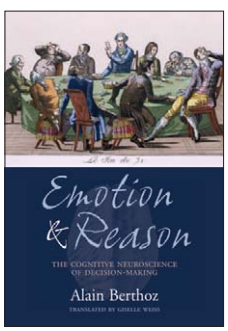
Books

Choosing is feeling—the cognitive neuroscience of decision making



Emotion and Reason: The Cognitive Neuroscience of Decision Making
Alain Berthoz
Translated from French into English by Giselle Weiss
Oxford University Press, 2006
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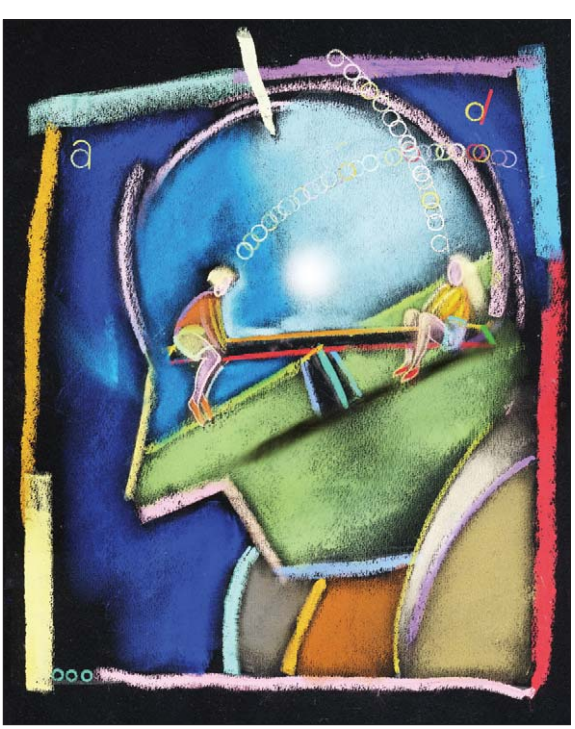
If you know exactly what you are going to do, why do it?
Picasso

Why do we often know exactly what we should do, but end up doing something completely different? For example, how many times were you supposed to study an important article, but read the latest thrilling crime novel instead? How often did you miss a lecture when you were a student because you were too lazy to get out of bed? In other words, how many times did you make an unreasonable decision? In his book *Emotion and Reason: The Cognitive Neuroscience of Decision Making*, Alain Berthoz aims to answer these questions and to shed light on the neural underpinnings of the highly familiar, yet so puzzling, phenomenon of making decisions. In 295 pages, he gives a comprehensive and entertaining overview of the neuroscience of choice behaviour. The focus of the later chapters is preluded by the first section of the book, entitled 'Is decision making rational or irrational?'. In this section, Berthoz gives a brief account of the current controversy of whether decision making is just about computing gains, losses, and probabilities, or whether it is more than that. Decision making is of course more than that as emotional, social, and other factors frequently bias a person's judgment to deviate from the path of rationality, hence the book's title.

In these first chapters, it becomes evident that Berthoz isn't interested in creating yet another theory of high-level executive response selection. On the contrary, the main theme that pervades every single chapter of the book is the view that decision making is a fundamental property of the entire nervous system that is present at nearly every stage of information processing. Decision making in the sense of selecting one behaviour from a limited repertoire of alternatives begins with the earliest relays of sensation and perception, where, for example, centre-surround antagonisms in the retina already select and limit the items to be further processed in the visual system: the brain "perceives what it wishes to". Berthoz argues that similar selection and limitation processes can also be found in, for instance, simple reflexes as well as in more complex fight and flight mechanisms, sensory-motor loops, complex perceptual skills, and, of course, preference-based choices and logical reasoning. In other words, all parts of the brain select and make decisions, the only difference is their remit. Consequently, a considerable fraction of the book is devoted to the discussion of low-level perceptual and motor functions that, only at first blush, seem unrelated to its main topic.

Consistent with his stance that decision making is everywhere in the brain, Berthoz's main message, conveyed throughout the book, is the idea that complex response selection is the product of the interplay of virtually all parts of the nervous system. Accordingly, he criticises the traditional hierarchical view of choice behaviour, according to which decision making is the job of a high-level supervisory central executive that collects and weighs sensory information about the world, and then selects, initiates, and monitors the responses to be effected by the motor system. Although Berthoz doesn't deny the existence of a neural hierarchy, he claims that decisions result from a heterarchically organised dynamic equilibrium of competing excitatory and inhibitory processes and winner-takes-all principles. Berthoz borrows this idea from recent studies on perceptual decision making and extends it to a more comprehensive theory of choice behaviour. For example, in the same way as different neurons in prefrontal and parietal cortex compete over the direction of a gaze shift, there may be a competition on a cognitive level between neural networks representing the rational key to a problem with networks representing emotional heuristics. The winner of this competition inhibits the loser and dominates the decision, thus shifting decision makers



Andrzej Dudzinski/Science Photo Library

between emotion and reason, fear and strength of mind, impatience and self-control, etc.

Berthoz's book is written in a pleasant and enjoyable way. He continually uses examples from every day life to illustrate his points and encourages the reader to conduct small self-experiments to experience the phenomena described. The countless references to the fine arts, poets, philosophers, and romanticists make this book bracingly different from the dry and clinical style of writing that is common to many other scientific works. Berthoz's numerous allusions to French cuisine, lip-smacking food, and good wine create an atmosphere of savoir-vivre that makes the book an almost gastronomic pleasure to read. It culminates in an "intellectual trou normand" in its middle section, where Berthoz takes a break from the previous topics, and, with loose analogy to decision making, elaborates on the properties and architecture of water fountains to refresh and relax the mind and prepare it for the upcoming chapters, much like the culinary trou normand in a long meal renews the desire of the tongue to appreciate the dishes to come.

However, what makes this book different may also be its weak point. Owing to the large range of covered topics, Berthoz risks giving a mere overview of the different fields in the neurosciences today, and the relevance of the different subjects for decision making is not always evident. Although the main title of the book, the introduction, and the space devoted to emotions would suggest differently, many fields in the neurosciences that deal with the role of emotions in decision making—eg, neuroeconomics—are largely omitted or only briefly acknowledged. Consequently, the precise role of emotions in decision making remains somewhat elusive. Berthoz is clearly interested in the bigger picture at the occasional expense of explanatory meticulousness, and one is left wishing that some depictions of theories and experiments were slightly more exhaustive and punctual. As a result, some of the models and findings may not be readily comprehensible to the lay reader without a priori knowledge of the topic.

However, owing to the abundance of inspiring thoughts and propositions and the ardent writing style, I can highly recommend the book to any interested reader. Berthoz's call for more fervour in choice theory and scientific writing returns passion into science and should be a paragon not only for decision theorists, but also for every researcher in general.

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Tracking white matter

More than 40 years have elapsed since Norman Geschwind wrote his landmark paper *Disconnexion Syndromes in Animals and Man*, but surprisingly little is known of the cerebral connections that figure so prominently in his work. Contemporary neuroanatomy texts give only brief accounts of white matter tracts, while neocortical structure and function receive detailed attention. Indeed, the anatomy of myelinated systems in the brain remains relatively neglected and, with the exception of the corpus callosum, clinicians have little appreciation of the role that individual tracts play in brain organisation and clinical syndromes. *Fiber Pathways of the Brain* provides a welcome remedy to this predicament, focusing on the nearly one-half of the cerebrum occupied by white matter.

The authors of this impressive work present the results of 12 years of meticulous neuroanatomical research on the rhesus monkey brain. Using radioisotope track tracing they illustrate a wide range of fibre systems with the intent of stimulating study of those in the human brain that are likely to be similar. Beginning with a thorough survey of white-matter pathways in the history of neuroscience, the book proceeds to describe methods of study in the monkey, the fibre bundles by cortical region of origin, the connectional topography of individual tracts, and a summary of the fibre systems; a final section takes up functional considerations that will most interest the clinical neurologist.

Fiber Pathways of the Brain is beautifully produced to display in exquisite detail the origin, trajectory, and destination of white-matter tracts. Enormous care has been taken to establish the precise location of these systems. While acknowledging the contributions of prior investigations, most notably those of Dejerine in 1895, the authors devote much effort to clarifying unresolved issues with modern techniques. The rhesus monkey is assumed to have much in common with human beings and thus add important information to human neuroanatomy, but the authors appropriately point out that the study of human white-matter systems mostly lies ahead. Reassuringly, references to several studies of human tractography with diffusion tensor imaging suggest that white-matter organisation in the two species is in fact quite similar.

In summary, this book offers a splendid addition to our knowledge of brain anatomy. With exceptional scholarship that lays a solid foundation for the investigation of the role of white matter in brain-behaviour relationships, the authors have presented a tour de force of neuroanatomy that those interested in brain connectivity will find most valuable.

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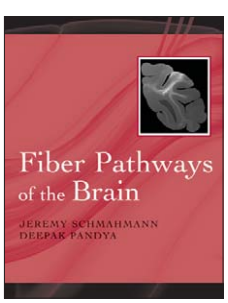

Fiber Pathways of the Brain
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