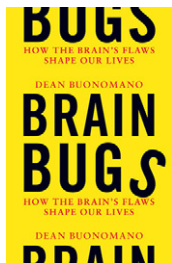# A brain bug's life

Brain Bugs: How the Brain's Flaws Shape Our Lives by Dean Buonomano, W.W. Norton & Company Ltd, 2011. US$25.95, hbk (310 pp.), ISBN-13: 978-0393076028

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Imagine you are attending a large scientific convention and you spot a smiling individual waving at a distance. While this person is quickly approaching, you are anxiously jogging through your memory and trying desperately to identify him. You recognize his face as familiar, but you can't place the name! Our brains are a wonderful piece of machinery that allows us to execute our goals through communication and action via a complicated and majestic network of neurons. Even so, at times it seems as if some of the simplest actions, such as recalling a familiar individual's name, can falter without warning. This is the fascinating topic explored in the thought-provoking and often amusing book *Brain Bugs: How the Brain's Flaws Shape Our Lives*, by Dean Buonomano.

The bugs in Buonomano's arguments are operationally defined as flaws and limitations in the processing ability of our brains that can have a detrimental effect on behavior. The term is akin to the use of the word 'bugs' when referring to computers and its glitches and breakdowns that can result in poor performance of the intended operation. The saving grace of a computer bug, however, is that it may be remedied with the next software update. The architecture of our brains does not quite permit such a quick fix, depending instead on evolution, and even then this process may not be updated to complete satisfaction.

The susceptibility of humans to the context in which information is perceived is argued to be one of the key reasons for the emergence of these brain bugs. As context-dependent individuals, humans often make decisions that are influenced by how the facts involved in the decision are presented (e.g. framing effect [1]) or the reference point they are given (referred to as anchoring [2]). A 99% fat-free yogurt may be preferred to a yogurt that labels itself as containing 1% fat, for instance, or an individual may make an unnecessary purchase merely because the price tag suggested a heavy discount from the original price. Some of the consequences of the so-called brain bugs are perhaps harmless, such as the previously listed examples or forgetting an individual's name. Buonomano argues, however, that such bugs can also cause misperceptions of external information that lead to substantial errors in decision-making affecting our personal well-being (e.g. susceptibility to how information is framed can lead us to make less than rational financial decisions [3]) or even

the lives of others, as is the case of false memories influencing eyewitness testimonies [4].

There are two particular features of Buonomano's writing style that keep the reader engaged with the contents and main premise of the book. First, the parallel between brain and computers as operational devices is clearly stated and interesting to ponder. Within this discussion, one can consider several features of a computer that would be useful in a human brain. The aforementioned memory glitch would benefit tremendously from a handy search button, for example; the existence of a delete button could eviscerate fearful memories detrimental to one's health. An interesting parallel in the book is the idea that, like an outdated computer operating system, genetic codes can at times promote some of these bugs given the pre-programmed information determining how we should feel or behave. An example is fear, which has been argued to automatically elicit conditioned responses to particular predetermined stimuli in the environment (e.g. a snake [5]), but can have unfortunate consequences for engaging with daily life if the fear overtakes one's ability to appropriately regulate emotional responses [6]. Unlike computers, however, our brains are generally able to adapt to different environments and contexts. It is clear that our memories cannot be deleted with a simple button. Nevertheless, recent research does suggest that particular representations, or fearful memories to be exact, are liable to be updated in the human brain under some contexts [7], such as during reconsolidation, a state where memories can be invoked, updated and strengthened [8] – a process akin to saving a reopened word document with updated information.

A second feature of interest in this book is Buonomano's ability to relate brain bugs and associated neural processes to real-life examples and applications. Back to our memory glitch case, you might imagine that a way to recollect the individual's name could be to scan him for identifiers that might serve to help your recall. You look at hair, facial features and observe the partially occluded name tag in which you can read the person's affiliation. By scanning your brain for knowledge about the individuals you know from this University that also match the person's features, you come up with a quick name but... interestingly, the person you remember does not attend these conferences – and you are left wondering why you came up with this name. The book presents similar and more compelling examples that highlight our dependence on the associative architecture of semantic knowledge that is important for organizing information into categories. Specific cues such as the ones provided by the name

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tag can serve to activate nodes within this network to facilitate the recollection of related concepts. Buonomano argues that many of these bugs in our brain's operational system – from coming up with an incorrect name because of your knowledge about their affiliation, to making a biased financial decision due to how the information was framed – arise from the strength of this associative network; specifically how activation of particular concepts can prime us with related concepts and influence our behaviors automatically, and at times unconsciously.

In our original example, the anxiety elicited by the nameless individual is diminished by the realization that he was waving to someone directly behind you. Yet another case of how our brains are amazing computational systems that can process a multitude of information, but still make simple mistakes such as misattributing a social signal. There is no mistaking this book, though. *Brain Bugs: How the Brain's Flaws Shape Our Lives* is an enjoyable and informative journey through the different cognitive and perceptual phenomena that modulate how we make everyday decisions.

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