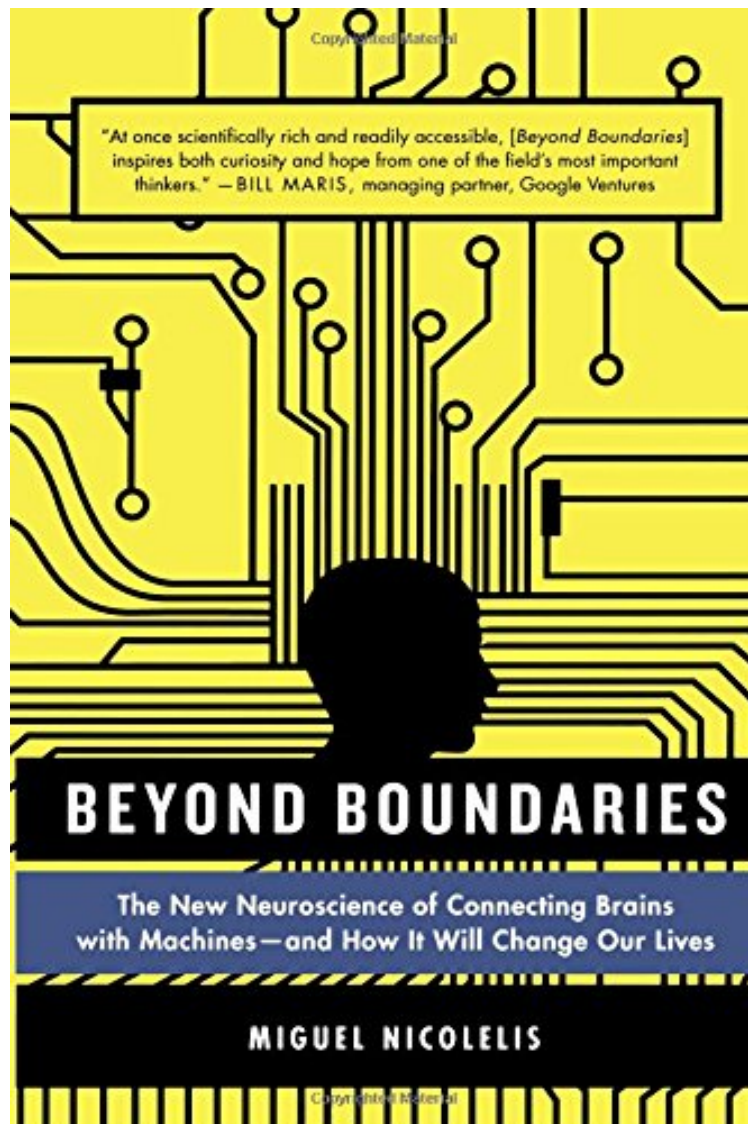


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Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines---and How It Will Change Our Lives

Miguel Nicolelis

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Miguel Nicolelis : Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines---and How It Will Change Our Lives before purchasing it in order to gage whether or not it would be worth my time, and all praised Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines---and How It Will Change Our Lives:

5 of 5 people found the following review helpful. Neuroscience: You're doing it wrong! By Dylan Miguel Nicolelis is a Brazilian born, world-renowned neuroscientist working out of Duke University in North Carolina. He is seen as the public face of the recently begun and rapidly expanding field of Brain-Machine Interfaces, and has done much to bring widespread attention to not only that field, but to neuroscience in general. Part of why Nicolelis is seen as the representative of this field is because he brings academic research into a human context, making the ambitious claim that his research has led to a human-to-human brain interface, as well as giving a quadriplegic youth the ability to deliver the opening kick in the 2014 world cup held in Nicolelis own Brazil. This theme of bringing science, particularly neuroscience, into a more public and relevant context is one underlying his recent book, *Beyond Boundaries*. The author starts his historical narrative by describing the two camps of thought in neuroscience, which he terms localizationist and distributionist. Localizationists are interested in showing how the brains spatial organization is both largely pre-determined and that there is a strong connection between spatial organization and function of brain regions. They also aim to reduce this connection to the individual neuron, imparting emergent physiological capabilities to the single cell. Distributionists, on the other hand, are more interested in how the neuronal symphonies, his term for the aggregate of brain activity across multiple regions, each composed of neuronal with constantly plastic and changeable functions. Dr. Nicolelis is unabashedly in the distributionist camp and this loyalty, which often borders on ranting about the ideas he opposes, is apparent throughout the book. Dr. Nicolelis then spends much of the next several chapters going through a history of early and formative neuroscience research, invoking several of its well-known early researchers such as Cajal and Sherrington. Throughout this he shows how distributionist and localizationist thought battled for control over our understanding of the brain, and localizationist interpretations dominated for much of the time. In Nicolelis mind, however, the truth of the matter ultimately lies with a more holistic and systemic, rather than individual-cellular, view of the brain. The metaphor he uses is a symphony, like how a large group of instruments can indeed be described as many individual parts, the symphony cannot be simply reduced to them. The whole of the music a symphony creates is encoded as something greater than the sum of its parts; the same is true for the brain operations are greater than the sum of actions of individual neurons. For the second half of the book, Nicolelis goes through a nonlinear history of Brain-Machine Interfaces (BMIs), jumping back and forth in time to serve the point of both furthering distributionist ideas but also showing the ways research across disparate geographical locations and temporal periods has been connected to make something more than just the sum of several academic papers. Continuing the distributionist metaphor and theme of the book, he shows how modern BMI research is an emergent phenomenon that is greater than just the compilation of its history, that there are gains made through original thought and in the connections between seemingly unconnected research. Miguel Nicolelis book, while an extremely useful text for those academically interested in neuroscience and in Brain Machine Interfaces, shines most as a book made for those who lack exposure to science in general and neuroscience in particular. It does require some foundational knowledge of biology however, including the knowledge that the body is made up of units known as cells, and that the brain is made up of specialized cells known as neurons. While further knowledge of neurobiology would be helpful, like how neurons signal to each other using a combination of electrical and chemical signals, which is not absolutely necessary to get meaning from the book. Nicolelis weaves an autobiographical narrative throughout the text, frequently connecting ideas and research to his own life experiences. Often he explains complex scientific achievements alongside powerful and understandable human metaphors to his own life, like his experience with a conductor during medical school, an experience that served as his foundation for comparing the brain to a collection of musicians. He also explains his multiple intended and pursued career paths, including once dreaming of becoming a Brazilian soccer star, prior to becoming the renowned researcher he is now. With this connection of the text and its subjects to his own life, Dr. Nicolelis both the scientific process and the researchers who utilize the scientific method. He takes what, at first blush, seems an overwhelmingly complex topic, studying the brain and eventually having the brain and computers communicate with one another, and then makes himself and the topics of the book relatable and understandable to most any reader who has the type of interests to seek out a popular press book on science. If a reader seeks out this book, they likely already possess the requisite knowledge to understand it. Making the scientific process more human is only the start of it however-he then goes on to explain important aspects of science as an institution which arent often seen by the public, which the reader can now understand because of his aforementioned humanizing. Interwoven through much of his book are the conflicting ideals of localizationist and distributionist thought, a debate that has gone on for well over a century and continues to this day. This is a part of science not often understood even by those within it-that of competing and equally viable and proven ideas and narratives that, unfortunately, contradict one another. Science is often seen as uncovering facts and truth, but often there is a long period of competing facts and competing truths. For example, in the history of thought on the development of organisms, widespread acceptance of Darwins ideas is only a recent phenomenon, one preceded by intense and impassioned debates. Nicolelis gives us an insiders view on such a debate still raging within neuroscience-if he is right, then future neuroscientists will see what is now called distributionist thought as factually correct, but the meaning to most people will be his insight into the process of competing ideas within science. Miguel Nicolelis weaves three histories into his book-the history of neuroscience, and within that the history of Brain Machine Interfaces, and within even that, the history of Miguel

Nicolelis. The book relates all three to one another, and then makes Nicolelis someone we can all find a bit of ourselves in, allowing a more publicly accessible understanding of him, his work, and science in general. He draws us in with this attractive idea of connecting our brains to computers, but then shows us the impassioned history and modern practice of neuroscience. It is for these reasons—the book's popular appeal, accessibility, and educational value that I give it 5 stars. To anyone who is academically interested in Brain-Machine interfaces, mystified by the scientific process, or just wants to know the fascinating life story of this now famous Brazilian, I recommend this book to you!

0 of 0 people found the following review helpful. Sound science accompanied by enjoyable anecdotes

By CodinaThe author takes you on the remarkable account of 25+ years of research in neuroscience, from his medicine years at Sao Paulo University to Duke's Center for Neuroengineering. Dr. Nicolelis summarizes the conclusions of his remarkable experiments in ten "principles of ensemble neurophysiology", supporting his distributionist theory of the brain. The book has plenty of music and sports allegories that make a very entertaining reading. My only concern is that the technical language may be a little difficult to understand for the layman, but I applaud the author's effort not to dumb down the description of the experiments. In conclusion this work is a must-read for anyone whose work is related to neuroscience, and remains a highly recommendable book for the curious minds that do not mind delving a little bit in the technical aspect of neural engineering.

2 of 2 people found the following review helpful. Monkeys, tools, and boundaries

By M. LavinGreat read for this previous friend of a Capuchin monkey years ago in LaPaz, Bolivia. I can attest that monkeys eagerly interface with tools e.g., put on lipstick with or without a mirror; without any human intervention, selectively [apparently based on empirical experience] choose and to all appearances thoroughly enjoy pharmacologically active plants of the psychedelic variety, ride pet cats like horses, and guard patios better than any watch dog. It is not surprising to me that their cousins, the Rhesus, partner with others in neuroscience labs in the study of the use of robotic tools. My only objection is the title "'Beyond' Boundaries." If my understanding of what the author is saying is correct, then, once incorporated into my neural circuitry, a robot I am using to pick up tools in New York from my office in St. Louis is as much a part of me as my grabber is when I am picking up an object lying on the floor, or as much as a modern artificial limb is to an athlete who has lost his/her birth limb. It is all tool-using capacity, in which we have gone from

1. selecting, making or using tools nearby to...
2. using and making communication tools with nearby and distant uses to...
3. using and programming robots to use tools nearby to...
4. to using and programming robots to use tools from a distance...
5. directing the robotic use of tools nearby, not by any intermediary program, but only by means of neural networks in the brain to...
6. directing the robotic use of tools at a distance, not by an intermediary program, but only by means of neural networks in the brain...

I agree, it is a giant step forward, even an evolutionary step forward. But, I am not sure it is 'beyond' boundaries. To me, it is more like the very first time event of riding a bike, with..., "Look, Mom, no hands!" --In this book, Nicolelis shares with us his adventure of learning how to use our brains to use tools with no hands! Breathtaking, explosive, an evolutionary leap, but not beyond boundaries: If we can envision something, we can do it. Some, like Dr. Nicolelis, have enormous vision, the capacity to bring that vision to life, and recount it beautifully.

Imagine living in a world where people use their computers, drive their cars, and communicate with one another simply by thinking. In this stunning and inspiring work, Duke University neuroscientist Miguel Nicolelis shares his revolutionary insights into how the brain creates thought and the human sense of self and how this might be augmented by machines, so that the entire universe will be within our reach. *Beyond Boundaries* draws on Nicolelis's groundbreaking research with monkeys that he taught to control the movements of a robot located halfway around the globe by using brain signals alone. Nicolelis's work with primates has uncovered a new method for capturing brain function by recording rich neuronal symphonies rather than the activity of single neurons. His lab is now paving the way for a new treatment for Parkinson's, silk-thin exoskeletons to grant mobility to the paralyzed, and breathtaking leaps in space exploration, global communication, manufacturing, and more. *Beyond Boundaries* promises to reshape our concept of the technological future, to a world filled with promise and hope.