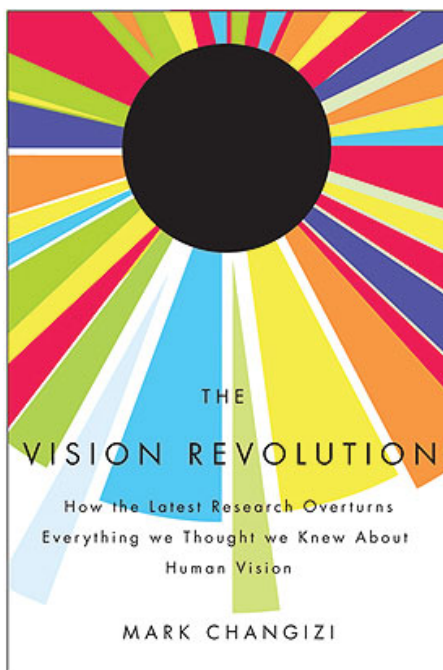


Book Review: The Vision Revolution – How the Latest Research Overturns Everything We Thought We Knew About Human Vision

Reviewed by Paul Harris, OD
Memphis, Tennessee



Mark Changizi
**The Vision Revolution – How
the Latest Research Overturns
Everything We Thought We Knew
About Human Vision.**

Benbella Books, Inc. 2009

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Many of the books we read add incrementally to our knowledge base while reinforcing great volumes of knowledge and data we already have on hand. Few books slap one up the side

of the head, in a good way, and demand the reader shift their orientation; to look at things in such a new way that one can never go back. This is just such a book.

[Mark Changizi](#) is an evolutionary neurobiologist, who you can tell from the depth of the text and the supporting data has spent thousands of hours dealing with tens of thousands of data points and seeing patterns that none had seen before. His background in physics and mathematics has given him the skills needed to handle this data. What has emerged is new thinking about why we see in color, why we see many illusions the way we do, why we have forward-facing eyes, why letters are shaped the way they are, why the brain is organized the way it is, and why animals have as many limbs and fingers as they do. He has a degree in physics and mathematics from the University of Virginia and a PhD in math from the University of Maryland. In 2007 he won the Sloan-Swartz Fellowship in Theoretical Neurobiology at Caltech. Later that same year he moved to Rensselaer Polytechnic Institute as an assistant professor in the Department of Cognitive Science and in 2010 became the director of Human Cognition at a new research institute called [2ai Labs](#).

The book has four major sections, and each introduces a new orientation and view of the visual process. The sections are: Color Telepathy, X-Ray Vision, Future Seeing, and Spirit-Reading.

Color Telepathy

In the section entitled Color Telepathy, he shares his insights on the purpose of color vision and how it developed in humans to what it is today. Some interesting twists emerged from insights as simple as, “why is it hard to pin down a description of ‘flesh-colored,’” and the question “why is there no ‘flesh-colored’ crayon in the 64-pack of Crayola Crayons?”¹

Changizi states, “We use color vision to see skin, so we can sense the emotions and states of our friends and enemies.”^{P. 3} The amount of oxygen in our blood changes the “color” of our skin in ways that can be read and which relates to our moods and emotions. Since this ability is present in many primates, he makes the point that “We have been seeing in color for tens of millions of years, well before we had cultural artifacts to add colors to. Therefore, whatever color vision is for, it is not primarily meant to see colors found in culture. Rather, we use colors in culture because they tap into what we have evolved to see.”

He discusses color across cultures and how universal our classifications of color are across those cultures. “All languages distinguish at most eleven different colors: white, gray, black, blue, green, yellow, orange, red, brown, pink and purple.”^{P. 13} From this as ground he states, “The experience of seeing skin color is not quite the same as the experience of seeing other colors.” Why would this be a good thing? He states that so much of what humans do is to categorize and to stereotype. If we had a simple name for flesh tone or for skin color then we would jump to that level of perception, rendering the ability to notice subtlety null and void.

One final prescient quote from this section is relevant: “...our perceptual view of the world is much less objective than we typically realize.”^{P. 47} He clearly states the WHY of the color vision in incontrovertible form and at the same time lays the foundation of much of Thomas Kuhn’s work on the lack of absolute truths or facts in science because so much of our view of the world is not objective but is subjective to serve the greater purposes of the species and propagation of life.

X-Ray Vision

Here Changizi makes a great case concerning the purpose of binocularity and front-facing eyes. He pulls the rug out from under the commonly held notion that having two front-facing eyes are for stereo vision; for that fine depth perception that occurs within arm’s reach. He makes the case that having two front-facing eyes is good for seeing through multilayered complex environments (think of looking through randomly placed bushes and trees that occur in nature) further out in space. This additional information endows the owner of that information with an advantage in both hunting and attacking prey and in evading an attacker.

Future Seeing

In the section entitled “Future Seeing,” Changizi makes the case that we evolved the ability to run various scenarios in our minds to foresee the future and are totally dependent on a life based on movement. He uses many optical and visual illusions as examples of how being able to play things forward in time before they happen helps humans avoid committing fatal mistakes. The types of ambiguity in the optical illusions lead to confusions only when seen statically. However, they actually aid the moving person by providing potentially different ways of organizing what is being seen, thereby facilitating alternate scenario generation.

He states, “Motion is crucial to the story of illusions. When we encounter visual images like this in real life, out in the world, we are in motion, and that what are misperceptions in the case of the static drawings would actually be accurate perceptions in real life. We make perceptual mistakes only when presented with stimuli that are unnatural.”^{P. 115}

He has a lengthy section about concepts of time that I found right on the mark. The need to rehearse and see the future, even if that future is only a few seconds forward in time, is essential. Without that we would always be reacting to things that are happening “out there.” “The uncompromising crispness of time has demanded that we evolve future-seeing

capabilities, for only seeing the future can we perceive the present rather than the past.” P. 120

This concise statement seems to say that consciousness is simply the emergent of this future-seeing system. “If an animal did not try to perceive the present, it would also never have *any* perceptions of the present, accurate or otherwise.” P. 126

Lastly from this section is a comment that helps clarify the difference between what is actually coming into our eye and hitting our retina as opposed to what we ultimately do with that potential information. “Why would we want to perceive what’s on our retina? The answer is that we don’t want to perceive what’s on our retina. What we want to perceive—in addition to physical and objective properties of objects—is where objects in the world are in relation to us. More specifically, we want to know what direction each of the parts of a scene are in.” P. 139 Many times I have thought about what it would be like to be in touch directly with the flow of data onto our retinas and how different that would be from the representation of reality that I experience as a conscious being.

Spirit-Reading

Ok, don’t run away yet, he doesn’t really mean “spirits” in the “woo-woo” kind of way. He is talking about leaving thoughts for one to read or interpret in the absence of the message sender: stated more clearly, the evolution of reading. “Even though we evolved to speak and listen, but not to read, there is a sense in which writing has allowed us to become much better listeners than speech ever did. Readers can easily interact with the writer, no matter how far removed the writer may be in space or time. Readers can pause the communication, skim ahead, rewind back to something not understood, and delve deeper into certain parts.” P. 168

Changizi’s mathematics comes in handy as he evolved a number of frequency and pattern recognition ideas about our environment to make the following observation. “The strokes in the letters you’re reading, and in line drawings more generally, are quite a bit like the ‘contours’ in the real world that occur

whenever one surface stops and another starts – the edge between two walls, or the edge of your table – in that they are things, but usually, with contours, there is no line or stroke at all, just a sudden change in the nature of the color or texture from one region to the next.” P. 171

He states, “We didn’t evolve to read, but culture has gone out of its way to create the illusion that we did.” P. 173 In reference to the emergence of writing systems he states that, “We know that children worldwide draw very similar shapes and follow a similar developmental schedule.” P. 180 These shapes become the fundamental building blocks of writing and also of visual perception. He makes an excellent point that we evolved to extract from our visual environment the seeing of objects, not parts of objects. “Our brains evolved to perceive objects, not object-parts, because objects are what stay connected over time and are crucial to parsing and making sense of the world. Our brains naturally look for objects and want to interpret outside stimuli as objects.” P. 180

Since the symbols we have evolved to be the fundamental elements of reading are not whole words but portions of words, letters, then letters should not look like whole objects. “If written words must be built out of multiple symbols, then to make words look object-like, symbols should look like object parts.” P. 184

Conclusion

I thoroughly enjoyed this book and encourage you to read it yourself so that the author has every possible chance of altering your thinking and understanding of the visual process.

For more information on Mark Changizi:



[Clicking this + icon will open a separate window where you can listen to Paul Harris’ presentation on “X-Ray Vision” from the OEP Mid Atlantic Congress in September 2010.](#)



[Clicking this + icon will open a separate window where you can view an interview with Mark Changizi from Dr. Kiki’s Science Hour on 20 May 2011.](#)



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