

attributed to the different levels in the hierarchy of processing, communication between areas as can be determined by measuring disruptions in synchrony between brain areas, at various spatial and temporal scales.

I strongly recommend this book to everyone working on the auditory system and related disorders and, in particular, to researchers interested in neural synchrony, including auditory neuroscientists, audiologists, speech-language pathologists, neurologists, and clinical psychologists in the field. To researchers with a background in cognitive neuroscience like me, the book with a focus on electrophysiology in animals should be of interest, as it allows gaining an understanding of the origin of signals we interpret using neuroimaging methods (i.e., M/EEG) in humans.

References

- Eggermont, J. J. (1999). The magnitude and phase of temporal modulation transfer functions in cat auditory cortex. *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience*, 19, 2780–2788.
- Engel, A. K., König, P., Kreiter, A. K., & Singer, W. (1991). Interhemispheric synchronization of oscillatory neuronal responses in cat visual cortex. *Science (New York, N.Y.)*, 252, 1177–1179.
- Gray, C. M., & Singer, W. (1989). Stimulus-specific neuronal oscillations in orientation columns of cat visual cortex. *Proceedings of the National Academy of Sciences of the United States of America*, 86, 1698–1702.
- Uhlhaas, P. J., & Singer, W. (2006). Neural synchrony in brain disorders: Relevance for cognitive dysfunctions and pathophysiology. *Neuron*, 52, 155–168. doi:10.1016/j.neuron.2006.09.020
- Zeng, F.-G., Kong, Y.-Y., Michalewski, H. J., & Starr, A. (2005). Perceptual consequences of disrupted auditory nerve activity. *Journal of Neurophysiology*, 93, 3050–3063. doi:10.1152/jn.00985.2004

Kalderon, M. E. *Form without matter: Empedocles and Aristotle on Color Perception*. Oxford UK: Oxford University Press, 2015; 240 pages hardback, £45.00, ISBN: 9780198717904

Reviewed by: Jan Koenderink, Laboratory of Experimental Psychology, University of Leuven (K.U. Leuven), Tiensestraat 102 - box 3711, Leuven B-3000 Belgium, koenderinkjan@gmail.com

In the words of the author “this is an essay in the philosophy of perception written in the medium of historiography.” So it is. Thus, for most readers of *Perception*—which I take to be mainly experimental psychologists occupied with phenomena experienced in their laboratories—the book is one for “bedside reading,” rather than of factual interest. For me, it made excellent subsidiary reading, and it might even have influenced my mindset in conceiving of novel empirical work. That is because mainstream science, predominantly by way of the peer review system, strives to “freeze” theoretical concepts and to impose a deadly uniformity on empirical paradigms. It often feels like a straitjacket to me and works against the creative development of scientific concepts. Then, reading literature that derives from outside the mainstream, or, in the case of this book, from *before* the mainstream, may come as a cool breeze on a hot day. Outside of the mainstream, one has no option but to *think*.

The writer of the book professes to defend “an anti-modern conception of color perception in that color perception is not merely a mental reaction, a conscious modification of the perceiving subject, but the presentation of mind-independent qualities of spatiotemporal particulars located at a distance from the perceiving subject.” I’m sympathetic with that, although I would state this in quite different ways myself. I like it

because I regret the takeover of phenomenology by cognitive science and analytic philosophy that occurred in the course of the 20th century. Perceptual awareness as a way by which organisms create their world makes much more solid sense to me. It has biological, rather than psychological or philosophical roots, and I feel that these are rather more substantial. The reader may have completely opposite notions, of course. But the point I am making here is that these notions are most likely also different from those of Kalderon. This renders the reading of the book an interesting exercise, because both you—the reader of the book—and Kalderon—the author of the book—necessarily will “read” Empedocles and Aristotle in parallel ways. This is then the major attraction of the book, not primarily to learn about the ancient authors, not about the ideas of the present author, but to be taken on a journey through premodern ways to grasp actuality and to interpret them in terms of your own mindset, most likely changing that during the course of the foray. Read in this way, you will be certain to profit from the book.

As might be expected, there is much in the book that is primarily addressed to philosophers. Many readers of *Perception* are likely to miss such points in various ways. It is like courtroom discussions in which the actual topic is often missed by naive people like myself. However, this is not necessarily a problem. The ancient authors were seriously trying to make sense of reality as they experienced it, and Kalderon generously let them have their say, without constantly “correcting them” by means of our own superior understanding and without trying to classify their thoughts in terms of modern philosophical notions.

I’ll just give a few examples of cases that launched me on various trains of thought. One is the Empedoclean principle: “to be perceptible is to be palpable to the sense—in order for something to be the object of perception it must be in contact with the relevant sense organ.” This is obvious enough in the case of touch, but how can one possibly square that with the fact that vision is a “distance sense?” You will find an interesting part of the book dealing with this. It set me thinking on how such ideas can still be traced in present day psychology. There are numerous occasions! Think of the “mainstream” interpretation of Euclid’s *Optics* (ca. 300 BCE). Essentially, any modern author makes it a point (yawn) to accuse Euclid of getting his physics wrong (“extramission theory”). But that is wildly beside the point because Euclid is not talking about physics at all; it is a “visual information theory.” Information is about meaningful structure and *meaning* is necessarily *imposed* (Vico’s, 1725 *Verum Factum*). Thus “visual rays” are indeed “feeling out.” Psychologists and philosophers alike generally don’t understand physics at all (sorry about that). In physics, *there simply is not ANY direction* in which “luminous objects” go (read the Wheeler–Feynman time-symmetric theory of 1945). There are various theories and in some there is no direction at all, but these theories are equally valid because they predict exactly the same phenomena. Of course, for the ancient authors, there was no distinction between physics and experimental psychology. Primitive? In my view (but I’m only a physicist), they had it right. Then it got me thinking about Fritz Heider’s *Ding und Medium* of 1925 (see also Heider, 1930). That is nothing but the Empedoclean principle in modern garment! It was no doubt a major seed for James Gibson’s (1950) *The Perception of the Visual World*. Isn’t that what you want from “bedside reading?” You reread papers that somehow sunk into the depth of your mind, and you endow them with novel meaning inspired by the reading of ancient authors. I experience that as invigorating.

Apart from “vision at a distance,” an important topic of the book is “transparency.” There we go again—it should open up a world of incompletely digested concepts and literature for you. Perhaps refreshingly, the ancient authors do not repeat the mainstream blurbs. They simply had no such option. Indeed, you will need considerable mental acrobatics to come to some kind of grasp of what the ancient authors were talking about.

For them, there were no walls between physics, phenomenology, psychology, and philosophy, as there indeed shouldn't be today. Here, we run into such ill understood trivialities as that "electromagnetic radiation in the visual range" is strictly invisible. Experimental psychologists and philosophers often misunderstand the physics of radiation as being about "light." They tend to believe light propagates in a certain direction, which is a categorical mistake (light is a mental object) and believe that physicists know photons or Maxwell's waves to move in certain directions, which is factually untrue. Einstein apparently thought nothing wrong with the Wheeler–Feynman theory (see Imaeda & Imaeda, 1982), but psychologists and philosophers know better. The ancients had much to say on the topic and it is instructive to follow their reasoning and ponder on the problem of whether we do any better. Aristotle states that light "moving" is contrary to both reason and the observed facts. Anyone engaged in vision should follow his arguments and think the matter over.

The parts that deal with "transparency" are especially interesting. Personally, I have always been intrigued by transparency because it deals with cases in which I sometimes become immediately aware of luminous volume, whereas normally I have only a discursive grasp of light and space because it is not in my optical presentations. I tend to be merely aware of reliefs and relations between visual objects, but I never see something palpable "between" visual objects that might be called "space." Judging from the literature this may well be an idiosyncratic agnosia. This has immediate implications for color. For instance, it has bearings on whether "white" is a surface property, a material bulk property, a spectral composition, a variety of mental paint, or what have you. This can immediately be expanded to the realm of chromatic colors too. Remember that Goethe considered the genesis of chromaticness to be found in the properties of diaphaneous media. "Transparency" can be seen as central an issue as any. It is almost incredible how many notions on the origin of "color" have been proposed over written history. Each of these beliefs can be followed up and diversified into almost endless volleys of questions. Few people worry about such questions today. Most believe that science has provided answers long ago and that you always can ask a physicist if you really want to know. I am a physicist, but I know more questions than answers. Of course, questions are much more interesting than answers anyway! For such reasons this book is a must read. The ancients had thoughts on all these topics, some truly amazing and striking. Kalderon surely makes the most of it.

I just gave a few examples, but you will find the book a rich mine—if you read in the manner I suggested here. If you read it as a historian of science or an analytic philosopher, you might be dissatisfied with its factual content. But anyway, I'd be happy to see analytic philosophers banished to the arid desert regions where they belong, and historians should stick to the heavily annotated literal translations that would hardly appeal to the readers of *Perception*.

My *bottom line* is evidently an (almost) unqualified recommendation.

References

- Euclid (ca. 300 BCE). *Optics*. Many translations available. For instance, see Harry Edwin Burton (1945). The Optics of Euclid. *Journal of the Optical Society of America*, 35, 361–372.
- Gibson, J. J. (1950). *The perception of the visual world*. Boston, MA: Houghton Mifflin.
- Goethe, J. W. v. (1810). Zur Farbenlehre [Theory of Colours]. 2 Bde. Tübingen: Cotta.
- Heider, F. (1925). Ding und Medium [Thing and Medium]. *Symposium*, 1, 109–157.
- Heider, F. (1930). Die Leistung des Wahrnehmungssystems [The function of the perceptual system]. *Zeitschrift für Psychologie*, 114, 371–394.

Imaeda, K., & Imaeda, Mari (1982). The Wheeler-Feynman absorber theory, the Einstein-Podolski-Rosen paradox, and stochastic electrodynamics. *Journal of Physics A: Mathematics and General*, 1, 1232–1259.

Vico, G. (1725). *Scienza Nuova [The New Science]*. Napoli: Felice Mofea.

Wheeler, J. A., & Feynman, R. P. (1945). Interaction with the absorber as the mechanism of radiation. *Reviews of Modern Physics*, 17, 157–161.

Claudia Roda (Ed.). *Human Attention in Digital Environments*. Cambridge, England: Cambridge University Press, March 2014; 360 pp.: ISBN 9781107670433, £25.99 Paperback.

Reviewed by: Christina Howard and Polly Pattinson, Nottingham Trent University, Nottingham, UK

For most of us, interacting with digital devices has now become a pervasive aspect of modern life, from using a range of software and technical devices in the workplace to the use of smartphones and social media outside of work and interacting with digital devices at the supermarket checkout, the train station, airport, and in our own cars with ever more sophisticated hardware and software. Furthermore, the use of highly specialist digital solutions is commonplace in many jobs, from the electronic learning rooms now used in most schools and universities to the technical displays used by experts in medical, military, and transport contexts. Clearly, the demands on the users of these systems are complex and can determine the successes and failures of our daily interactions with technology. Given that we are decreasingly limited by the availability of information in these digital environments, the nature of our interaction with these interfaces is now increasingly shaped by our own cognitive architecture. In *Human Attention in Digital Environments*, Claudia Roda brings together a collection of work seeking to understand how the human attentional system may limit and shape these interactions and also how digital systems can best be designed in order to support and align with the way that users interact with them. With the extremely rapid pace of change across society in the way that we interact with technology, this couldn't be more timely in terms of our well-being at leisure and in the workplace and for the effectiveness of many professions on which we rely. Furthermore, with the current emphasis on interdisciplinary research and research with real impact, it may be keenly read by academics looking for ideas for their own future research. Different chapters approach the area from the perspectives of traditional cognitive psychology, neuroscience, systems design, computational modelling, human computer interaction and education. Chapters are contributed by experts in their relevant fields which provides a good flavor of some example current areas of research. However, this does of course present the reader with a challenge since they are unlikely to be up to speed in the terminology, methods, and theories in all these areas. For example, from my background in visual cognition, I felt that I would need to go away and do further reading on systems design to fully get a feel for some of the content presented in Chapters 8 and 9 (Schmitz et al. and Stojanov & Kulakov). The flip side of this is that readers in their respective fields may well feel inspired to explore some further reading in subject areas new to them.

Several sections of the book also serve as a summary and literature review of research in human attention with a particular focus on the processing of visual information. The opening chapter by Roda is a general introduction for the reader on a diverse range of theories, phenomena, and subclassifications in the field of visual attention as well as a review of how these may operate in digital contexts. Further, several of the chapters (e.g., Chapter 5, Bowman et al.) start with a similar summary of those areas of visual attention research