Chapter 17

Seeing for Knowing: The Thomas Effect and Computational Science

Jordi Vallverdú
Universitat Autònoma de Barcelona, Spain

ABSTRACT

From recent debates about the paper of scientific instruments and human vision, we can conclude that we don't see through our instruments, but we see with them. All our observations, perceptions and scientific data are biologically, socially, and cognitively mediated. So, there is not 'pure vision', nor 'pure objective data'. At a certain level, we can say that we have an extended epistemology, which embraces human and instrumental entities. We can make better science because we can deal better with scientific data. But at the same time, the point is not that be 'see' better, but that we only can see because we design those cognitive interfaces. Computational simulations are the middleware of our mindware, acting ad mediators between our instruments, brains, the worlds and our minds. We are contemporary Thomas, who believe what we can see.

"Except I shall see in his hands the print of the nails, and put my finger into the print of the nails, and my hand into his side, I will not believe", The New Testament, St John, 20: 24.

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INTRODUCTION

I propose you a simple activity: try to think whatever you want and imagine that situation, calculation or feeling for several seconds, I'll wait. Surely, you've used several images to think and imagine it, and I remember you that a letter is an image. And I propose you a second mental exercise: are you able to think any *concept* without images? Even the word's letters you use are strongly associated to visual aspects (typography, size, design…). We think with images, and all our language is full of visual words to mean 'known': 'clear demonstration', 'illuminating proof', 'I see' (meaning "I understand you'), etc.

Only blind born people develop their relationship with the world from touch sense. In March 2nd 1692, the Irish William Molyneux wrote a letter to John Locke in which he finished his comments with this text:

"I will conclude my tedious lines with a jocose problem, that, upon discourse with several, concerning your book and notions, I have proposed to divers very ingenious men, and could hardly ever meet with one, that, at first dash, would give me the answer to it which I think true, till by hearing my reasons they were convinced. It is this: "Suppose a man born blind, and now adult, and taught by his touch to distinguish between a cube and a sphere (suppose) of ivory, nighly of the same bigness, so as to tell when he felt one and t'other, which is the cube, which the sphere. Suppose then the cube and sphere placed on a table, and the blind man to be made to see; query, 'Whether by his sight, before he touched them, he could now distinguish and tell, which is the globe, which the cube?' I answer, not: for though he has obtained the experience of how a globe, and how a cube affects his touch; yet he has not yet attained the experience, that what affects his touch so or so, must affect his sight so or so; or that a protuberant angle in the cube, that pressed his hand unequally, shall appear to his eye as it does in the cube."[1]

Their following letters were centered on this topic, later denominated *Molyneux's problem*. Although they were discussing the limits and nature of empiricist's philosophy, the problem of relationships between vision-knowledge reached an own status. Later, Étienne Bonnot, Abbé de Condillac, with his *Treatise on Sensations* of 1754, tried to answer to the Molyneux's question, by asking his readers to consider an originally inanimate and insentient human being (a "statue" of a human being) and to consider what this being could come to know were it to acquire each of the senses in isolation from the others, or each in combination with just one or two others. In proposing this question Condillac was asking a more radical version of the question Molyneux had posed to Locke: would a person born blind to perceive spatial features well enough upon first sight to be able to identify cubes and spheres without touching them? But this is not a paper on the history of empiricist philosophers and their arguments and counterarguments about epistemology's senses. But, yes, we discuss about epistemology and about how our senses, basically the sight, define the instruments we use to reach knowledge.

What do we know about vision? Approximately 60% of the human brain's sensory input comes from vision (Humphreys, 2004). Therefore, there is a strong relationship between vision and cognition (Latour, 1986). Images and animations are valuable tools in both producing and learning scientific topics, because they help users with important conceptual relationships (Brodie, 1992). To think is to establish visual relationships in our minds. Even for non classical reasoning ways, like those of mathematician S. Ramanujan, A. Kekulé (and his dream about benzene atomics structure) or J. von Neumann, they told us that they 'see' the result. But at the same ime, we see things that we don't percept directly, like invisible motion (Moutoussis & Zeki, 2006). Vision is a very, very complex process. Just an example: wehen Stanford scientists tried to create a robot with artificial vision, Shakey, it revealed the difficulty of the whole project. In fact, shakey was something else: it was the first robot to combine problem solving, movement and perception.

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