Perception, 2004, volume 33, pages 895 – 896

DOI:10.1068/p3308ed

Editorial

Perception beyond physics?

Perception is the universe in our heads. The universe of physical objects obeys physical laws, so physics provides guides for designing and interpreting experiments; though the most exciting experiments jump the guides, even to land outside acceptable science. Are experiments and concepts of perception guided by physics?

Physics sets restraints to what is accepted as possible for physical objects; but when restraints turn out to be wrong, the guide-book may have to be rewritten. This was so for Galileo's challenge to Aristotle's physics of motion, including, it is said, dropping different weights from the leaning tower of Pisa and finding, contrary to Aristotle's guide-book, that they fell at the same rate though the weights were different. Galileo and Newton rewrote the guide-book for the physics of motion, suggesting another physics, which successfully got men to the moon. But not all surprises rewrite accepted science. Indeed, this rarely happens. Marconi's radio signals sent across the Atlantic in 1901 seemed impossible for the physics of the time, as it was known that radio waves travel in straight lines and so could not possibly go around the Earth. Yet, as it turned out, this surprising success broke no laws. It prompted the English physicist Oliver Heaviside to the discovery of reflecting ionised layers in the atmosphere, which sent radio waves around the Earth while obeying known laws, so rescuing the guide-book. The story of the ether was of course very different: waves travelling impossibly in nothing!

Sometimes described as the most basic law of all, the Second Law of Thermodynamics puts the arrow of time into Newton's equations, and makes perpetual motion machines impossible. This is enshrined in Patent Law, inventions claiming perpetual motion being rejected, unread. So here there is a legal law based on a physical law. Perhaps Einstein was the only Patent Inspector (third class) who did not see the Second Law as magic. Over the centuries, many legal laws changed as physics took over from occult notions and practices, such as a law demanding that church fonts be covered and locked to prevent the practice of witches stealing holy water, supposed to have dangerous powers. This legal law was dropped when the powers of holy water were seen as restricted by laws of physics.

This takes us back to the theme of the last two *Perception* editorials ("Curious asymmetries" Parts 1 and 2: **33** 639 – 642; 765 – 768), which concluded that cognitive phenomena of perception can violate laws of physics. So, it seems that physics is not a reliable guide for cognitive theories. The particular evidence considered were some well-known phenomena of distortion illusions that appear to violate Curie's Principle that asymmetries cannot be generated systematically from symmetries. Most illusions, like Marconi's 1901 experiment, though surprising, do not violate the rule-book as their explanation is within accepted physics or physiology. Again, like Marconi's 1901 experiment, they may extend understanding by suggesting new processes, though within accepted science. Most science, surely, is noting surprises and using unexpected phenomena to see what is going on within accepted rules or laws. Physics is generally a useful, indeed essential, guide, even when it suggests looking for new paths when the way is not clear. Accepted science encourages new ideas, though it sets limits to how strange these can be. But cognitive concepts have generally been beyond acceptable science, as being outside physics. Hence the attraction of behaviourism, that dominated American psychology for more than a decade, as psychologists were anxious

to make their science respectable. There is conflict between the safety of following the respectable guide-book, and the danger of jumping into a conceptual universe which may never become respectable science.

Galileo's ideas were of this dangerous kind. The prevailing Aristotelian physics was useless for Galileo's experiments on motion as they were outside, or beyond, the physics of the time. His ideas returned to respectable physics-based science when the guide-book of accepted ideas was rewritten to encompass them. The present drama of the science of perception is that cognitive phenomena seem to be very important, and yet violate physics-based physiology. They demand concepts beyond the accepted guide-book to describe or explain them; which is dangerously like magic, or at any rate non-science.

At least, these concepts looked like magic before computers came on the scene. When physics-based machines started to rival and take over cognitive tasks from humans, and beat us at chess, both the machines and humans came to look different—touched with magic. We owe to computer science making the magic of cognition respectable, simply because computers are clearly physics-based and yet work effectively with symbols, whose rules and laws are not those of physics. Neither, of course, are the rules of grammar of human languages. Indeed, making cognitive concepts respectable owes almost as much to linguistics as to computer science.

What are we to make of our finding, if this is indeed so, that cognitive illusions can violate laws of physics, especially Curie's Principle? A prediction for AI is that computer software following similar perceptual rules should also be capable of violating physics, as by generating asymmetries from symmetries. Physics-based computers should be able to generate impossibilities of physics because they operate on rules which are not laws of physics, and may represent alternative universes, as the physiology-based brain does every minute of the day for perception—especially when perceptions depart from the physical world with cognitive illusions. This means that cognitive machines, our own brains and information technologies, are on their own; neither restricted nor guided by the physics of the universe. Artists have known this all along.

Richard L Gregory

ISSN 0301-0066 (print) ISSN 1468-4233 (electronic)

PERCEPTION
VOLUME 33 2004

www.perceptionweb.com