

Excerpt from "The varieties of Scientific Experience" - Carl Sagan, Penguin Books, 2006, all rights reserved, © Democritus Properties, LLC<sup>1</sup>.

An Italian astronomer, Giovanni Schiaparelli, looking through a newly completed telescope in Italy was glancing at Mars and suddenly saw the surface of the planet reveal intricate, fine, linear detail as being like the lines in a fine steel etching. Schiaparelli promptly called these lines 'canali' for 'channels' or 'grooves'. We can understand how it was translated into English as 'canals', a word with a clear imputation of design, intelligence, vast engineering works constructed for a reason. The idea of *canali* on Mars was taken up by American astronomer Percival Lowell. Lowell constructed a major observatory with funds of his own pocket near Flagstaff, Arizona, called, naturally, the Lowell Observatory, to study these markings.

Lowell was convinced that the planet was covered by a network of intersecting single and double straight lines; that these lines crossed over enormous distances and therefore could correspond only to engineering works on the most massively imaginable scale. Other observers also drew these canals.

Photographing them was more difficult. Atmospheric 'seeing' was unreliably due to the intrinsic turbulence and unsteadiness of the earth's atmosphere, which generally prevent you from seeing the canals. But every now and then the atmosphere steadies, the turbulent eddies of air are not in your line of sight to Mars, and just for a few moments you can see the planet as it truly is with this network of straight lines. And then another bit of atmospheric turbulence comes by and the planetary image becomes shimmery and the details are lost. Lowell reasoned that a photograph, which involves a time exposure that adds up the rare moments of good seeing with the much more plentiful moments of bad seeing, would not reveal the canals. But the human eye can remember those instants of excellent seeing and rejects the other moments, much more common, when the image is fading and blurring and distorting. And this is why, he argued, experienced observers skilled in drawing what they see at the telescope could obtain results that the photographic emulsion could not.

There were other astronomers who couldn't see the straight lines, but there was a range of explanations: They were not in the best sites for their telescopes. They were not experienced observers. They were not adequate draftsman. They were biased against the idea of canals on Mars. Lowell and Schiaparelli were by no means the only astronomers that could find the canals. Astronomers all over the world saw them, drew them, mapped them, and named them.

There was a point of view that said that the canals were not really on Mars, that they represented some sophisticated failure of the hand-eye-brain combination, that Lowell and his confreres were too carried away by the power of the idea. Lowell dismissed these objections and pointed to the remarkable similarity of the maps that he had drawn to those that other independent observers had drawn. Lowell argued that this convergence by quite separate observers, with no prior collusion, onto the same pattern of straight lines could only be due to something on Mars. Lowell deduced from these straight lines an ancient civilization on Mars more advanced than we, having to face a planetary drought of proportions unprecedented on Earth. And their solution was to construct a vast globe-girdling network of canals to carry liquid water from the melting polar caps to the thirsty inhabitants of the equatorial cities, What's more, Lowell thought, because the network crossed the entire planet, there was a world government on Mars, at least as engineering details went. And Lowell went so far as to identify the capital of Mars, a particular spot on the surface from which six or eight different canals seemed to emanate.

And yet, there are no canals on Mars. The whole thing is wrong. It's a mistake. It's a failure of the human hand-eye-brain combination. Lowell's idea provoked a passion; a

very understandable and human passion. The vision of more advanced beings with a world government struggling to keep them selves alive was such a wonderful idea that it trumped the scrupulousness of the investigative process.

If scientists can be fooled on the question of simple interpretation of straightforward data of the sort that they are routinely obtaining, when the stakes are high, when the emotional dispositions are working, what must be the situation when the evidence is much weaker, when the will to believe is much stronger, where the skeptical scientific tradition has hardly made a toehold – namely in the area of [fill in your area of interest].

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<sup>i</sup> This excerpt is provided for personal study only. All rights are with the original author and/or publisher. I would encourage you to buy this book – there's so much there that will start you thinking and/or wondering – Jan Didden