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## Visual Models in Scientific Reasoning (Summary)

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Everyone knows that, in their daily work, many scientists often reason with various forms of visual representations such as diagrams, pictures, and even scale models. This practice is difficult to reconcile with the dominant account of scientific representations as primarily linguistic in form (words or equations), and scientific reasoning as the logical manipulation of such symbolic representations. A standard account has been that visual representations are of heuristic value only. They facilitate the construction and understanding of linguistic structures as well as reasoning with these structures, but the real content and the principles of reasoning are to be understood in terms of the linguistic structures.

This paper suggests an alternative account in which what have been regarded as statements of laws of nature are interpreted instead as general principles used in the construction of abstract models of varying degrees of specificity. The models thus constructed form a hierarchy

with the type of vertical and horizontal structure now regarded within cognitive psychology as typical of natural concepts of all sorts. Visual models can then be seen as particular instantiations of aspects of these abstract models. Their role in science is parallel to, not ancillary to, abstract models. These distinctions are illustrated with examples from classical mechanics and geophysics.

One important type of scientific reasoning concerns the fit between a particular model and some real physical systems. This reasoning is here construed as a scientific form of human judgment, a matter of decision rather than the manipulation of symbolic representations. So construed, such reasoning can be understood as using visual representations as part of the basis for particular judgments of fit between models and the world.