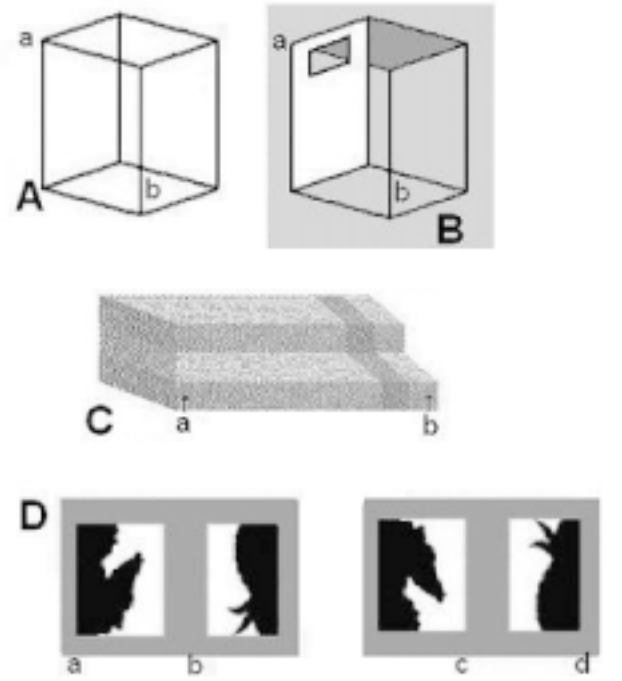

Figure 2 (Hochberg). Some shapes isomorphism must take. **A.** The reversible Necker cube. Sometimes offered as an example of how a minimum principle (or something like it, in Lehar's version) leads to perceiving an entire three-dimensional structure (Hochberg & McAlister 1953; Kopfermann 1930). **B.** The partly reversible Killer cube. When attended at (a), the present cube appears of definite and nonreversible three-dimensional structure; when attended at (b), it soon starts reversing, though the same Gestalt remains in view (though off attentional center). The reversals are attested by their perceptual consequences: When rotated clockwise around its vertical axis, the perceived motion is clockwise when (a) is attended; when (b) is attended and when it appears nearest the viewer, motion appears *counter*clockwise. Such perceptual consequences help validate one's otherwise unsupported phenomenology, as in the next figure (Hochberg, in press; Hochberg & Peterson 1987). **C.** Adelson's Impossible Staircase. With no discernible discontinuity, the right and left sides here are incompatible as three-dimensional structures; showing that they are actually seen that way. Note that the same print density appears of higher reflectance (lighter paint job) at (b) than at (a) – (after Adelson 2000, with permission); see text. **D.** Do configuration-based organizational factors first provide figure-ground segregation, which thereby offers a shape to be recognized? Not so you can tell: see text (see Peterson 1994; Peterson & Gibson 1993).

Figure 2D; cf. Peterson 1994; Peterson & Gibson 1993) have shown that meaningful (*denotative*) shapes preempt figural status when in their familiar orientations (Fig. 2Dc,d) but not when *the physically identical* configurations are inverted (Fig. 2Da,b), makes it hard even to imagine what an appropriate formulation of isomorphism would be like. A phenomenology centered on query-directed units of perceptual behavior, emulating the TOTE rubric offered by Miller et al. (1960), might be more effective (cf. Hochberg 1970; in press; O'Regan & Nöe 2001).

Does perception replicate the external world?

Donald D. Hoffman

Department of Cognitive Science, University of California at Irvine, Irvine, CA 92697. **ddhoff@uci.edu**
http://aris.ss.uci.edu/cogsci/personnel/hoffman/hoffman.html

Abstract: Vision scientists standardly assume that the goal of vision is to recover properties of the external world. Lehar's "miniature, virtual-reality replica of the external world inside our head" (target article, sect. 10) is an example of this assumption. I propose instead, on evolutionary grounds, that the goal of vision is simply to provide a useful user interface to the external world.

Lehar asserts that "The central message of Gestalt theory is that the primary function of perceptual processing is the generation of a miniature, virtual-reality replica of the external world inside our head, and that the world we see around us is not the real external world but is exactly that miniature internal replica" (target article, sect. 10, last para.). I wish to consider this assertion of indirect realism.

Suppose it is true. Then we do not see the real external world, nor do we hear, smell, taste, or in any other way perceive it. Instead, we perceive just the miniature virtual-reality (henceforth, mini VR) that we generate. Given this, what empirical grounds might we have for claiming that our mini VR replicates the external world? Perhaps we could compare objective measures of the external world against psychophysical measures of the mini VR. If mismatches are minor, we would have grounds for the replica claim. This process seems straightforward enough. The basic sciences measure the external world, and psychology the mini VR. So we simply compare data.

But this is too fast. It is not just psychologists who perceive only their mini VRs; all scientists, regardless of discipline, perceive only their mini VRs. So how do the basic scientists manage to measure the external world?

The trouble is that every time scientists try to measure the external world, whether they look through telescopes or microscopes, they see only their mini VRs. They extend their senses with countless technologies, but the technologies and their outputs are still confined to the mini VRs; for if they were not, then, according to indirect realism, the scientists could not perceive them. Hence, all scientists are confined to perceive only their mini VRs. If they wish to make assertions about the external world, even assertions that an external world exists, then these are necessarily, according to indirect realism, *theoretical* assertions. They are not direct measures. As Einstein notes, "physics treats directly only of sense experiences and of the 'understanding' of their connection. But even the concept of the 'real external world' of everyday thinking rests exclusively on sense impressions" (Einstein 1950, p. 17).

So indirect realism does not allow us incontrovertible empirical grounds to assert that our mini VRs replicate the external world. At best, it allows us to postulate an external world as a theoretical construct. Once we take the external world as a theoretical construct, then we have many options for the particular form of that construct. We can, as Lehar suggests, propose that our mini VRs are replicas of the external world. This is a particularly simple theory and, on the face of it, quite unlikely. Our best evidence suggests that mini VRs vary dramatically across species (Cronly-Dillon & Gregory 1991), and there are no evolutionary grounds to suppose that our species happens to be the lucky one that got it right. To assert otherwise would be anthropocentric recidivism.

Once we extend our gaze beyond the replica theory, many other possibilities arise. One class of possibilities is that there is little or no resemblance whatsoever between the external world and our mini VRs, but that instead our mini VRs are simply useful user interfaces to the external world, with no more need to resemble that world than a Windows interface needs to resemble the diodes, resistors, and software of a computer. Of course, we could not call a theory from this class an "indirect realist" theory because, by hypothesis, there is no realism. So indirect realism leads us to con-

sider dropping indirect realism in favor of a broader and more likely class of theories. Let us call these new theories "user-interface" theories. For what they entail is that our mini VRs, rather than being replicas of the external world, are simply useful user interfaces to that world. Different species employ different user interfaces for their different purposes. The human user interfaces are simply a small set of the total, of special interest to us for only parochial reasons.

The move from indirect realism to user interface can be disconcerting, for it denies an anthropocentrism very dear to us: the assumption that our perceptions are privileged among all species. And it opens a Pandora's box of theoretical possibilities for the nature of the external world and its relation to our mini VRs. It has been convenient to assume that because there are neurons and synapses inside the heads that appear in our mini VRs, therefore there must be corresponding real neurons in real heads in the external world. But convenience rarely coincides with truth. It looked for millennia as though the sun and stars circled the earth, but we now know better. Even space and time themselves are not immune from this process, for as Einstein pointed out: "Time and space are modes by which we think and not conditions in which we live" (quoted in Forsee 1963, p. 81).

Moving from indirect realism to user interface does nothing to impede progress in modeling of the mini VR itself along the Gestalt lines proposed by Lehar. Nor does it impede progress in modeling the neural networks of the perceptual systems in our mini VRs. All this modeling can continue as it has. We simply realize that we are not modeling a replica of the external world; we are instead modeling our species-specific user interface to an external world. And in consequence we are far more cautious in our knowledge claims about the external world.

The move from indirect realism to user interface gives us more elbowroom in dealing with the hard problem of consciousness. The hard problem arises when we assume that neurons as we perceive them in our mini VRs are replicas of real neurons in the external world, and we must therefore figure out how those real neurons could possibly give rise to conscious experience. But if we drop the replica assumption, we now have a broader range of theoretical possibilities for what, in the external world, might correspond to neurons in our mini VRs. In this case our only limits in solving the problem are not the straitjacket of the replica assumption, but our imaginations.

ACKNOWLEDGMENT

This material is based upon work supported by the National Science Foundation under grant No. 0090833.

Psychological relativity

Donald Laming

Department of Experimental Psychology, University of Cambridge, Cambridge, CB2 3EB, United Kingdom. **drjl@cus.cam.ac.uk**

Abstract: "Psychological relativity" means that "an observation is a relationship between the observer and the event observed." It implies a profound distinction between "the internal first-person as opposed to the external third-person perspective." That distinction, followed through, turns Lehar's discourse inside-out. This commentary elaborates the notion of "psychological relativity," shows that whereas there is already a natural science of perceptual report, there cannot also be a science of perception per se, and draws out some implications for our understanding of phenomenal consciousness.

Lehar is lacking an essential idea. Physicists have it – "relativity" – but Lehar does not. Lehar mentions (sect. 1) "the internal first-person as opposed to the external third-person perspective" but fails to realise how that distinction impacts on his discourse. If the implications of that distinction are followed through, the entire body of problems addressed is turned inside-out. The overriding principle that Lehar is lacking is:

> an observation is a relationship between the observer and the event observed

and thereby depends on the observer as well as the event. So, two observers in motion relative to each other make different determinations of the velocity of a third object (Galilean relativity). Figure 2 sketches the set-up for Thouless's (1931a; 1931b) phenomenal regression to real size. The observer has a different view of the experiment to the experimenter.

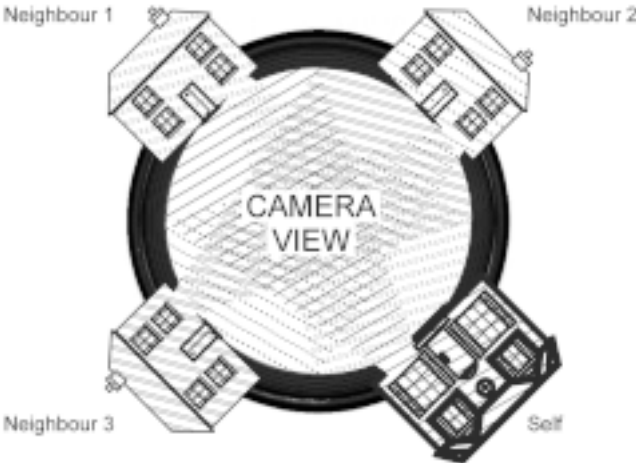

Figure 1 (Laming). The different views from four houses on a housing estate. (© 2004, Donald Laming. Reproduced with permission from D. Laming, *Understanding human motivation*, Blackwell.)

Figure 1 presents an analogy. Looking out from my window, I can see three other houses, separated from me by a road and a green sward. If there is a car in the road, my neighbour and I can readily agree that it is red. By agreeing on a suitable instrument for measurement, we can agree the colour of the car to whatever precision we desire. That arena outside our houses (*camera view*) is part of the public domain within which experiments can be conducted. But my neighbour and I cannot see into each other's houses. If I telephone my neighbour, I can only describe my interior furnishings by reference to what my neighbour will have seen elsewhere. The scope of experimental procedure can be extended to internal experience only by projecting that experience into the public domain. I might describe my curtains as scarlet, or carmine, or cerise – but my neighbour might think of a different colour referent to the one that I have in mind, and "seeing red" will then mean slightly different things to the two of us.

I can invite my neighbour into my house to see for himself but I cannot give him direct access to my visual experience. One might suppose that my internal visual experience could be measured, like the colour of the car in the road. But experimental psychologists have been trying to measure internal sensations for 150 years and have so far progressed nowhere (Laming 1997).

Some part of our visual experiences can be shared with others; the remainder is private. The Gestalt properties surveyed in sections 5 and 7 belong to that private part, which is why Gestalt psychology has not proceeded beyond verbal description. There is a boundary between experiences that can be shared and experiences that are essentially private. It is determined by what, within my field of view, my neighbour can also see (see Fig. 1). That is, the boundary is determined within my *neighbour's* field of view and is not to be found within my own visual experience. My own experience by itself contains no distinction between that which lies in camera view and that which is private. The junction is seamless. It is only too easy to confound subjective experience with objective observation; this is what Lehar has done.