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.

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Psychological relativity

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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.

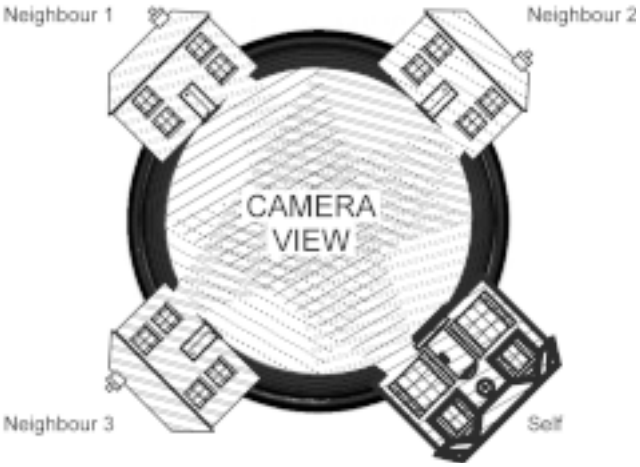

Figure 1 (Laming). The different views from four houses on a housing estate. (© 2004, Donald Laming. Reproduced with permission from D. Laming, *Understanding human motivation,* Blackwell.)

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.

It follows that there cannot be a natural science of perception. There is a science of perceptual report, a tradition that goes back to Fechner (1860/1966). But perceptual reports cannot be taken at their face value (here the Gestalt psychologists erred); rather, they must be evaluated by experiment. Lehar is aware of this (sect. 5.2), but asserts that perceptual experience is isomorphic to the neural substrate and thereby denies this distinction.

Lehar's stance is that "the world of conscious experience is accessible to scientific scrutiny after all, both internally through introspection and externally through neurophysiological recording" (sect. 2.3, para. 9). He envisages an isomorphism between perceptual experience as described by the observer and the observations of the natural scientist. Thouless's (1931a; 1931b) experiment on phenomenal regression to real size (Fig. 2) shows why such an isomorphism is not found in nature.

The observer's task is to select a disc set normal to the line of sight at distance *a* to match the *angular size* of the larger disc at distance *b*. Although people do choose a smaller disc from the alternatives at *a,* they systematically choose one too large to match (phenomenal regression to real size). Imagine that a neurophysiologist is making observations at the neural level of description relevant to understanding how and why this error of judgment occurs. If the observer's perceptions stand in the same relation to the neural substrate as the neurophysiological observations, then there has to be an internal "observer" looking at internal processes with the same objectivity as the neurophysiologist. The fact that Lehar has a mathematical model to replace the neurophysiological observations does not alter this requirement. This observer is represented by the "thinks bubble" in Figure 2. Philosophers will immediately identify this internal observer as Ryle's (1949) "ghost in the machine" (which is why the "thinks bubble" is decisively crossed out).

I next ask whether the hypothetical neurophysiologist can also observe the neural substrate of this "ghost." If so, the relationship of the ghost to the neural substrate is structurally different from that of the neurophysiologist; otherwise the "ghost" is pure mind-stuff. In fact, verbal descriptions of what is perceived are produced by the same system as that which does the perceiving, and the relationship of "observer" (if that term may still be used) to the neural substrate that is supposedly "observed" is essentially different from that of a third-party neurophysiologist. Several conclusions follow:

There need not be any useful isomorphism between neural process and perceptual experience.

Modelling perceptual experience is not an alternative to understanding the neural process.

There cannot be a natural science of perception, distinct from the study of perceptual report.

The idea of psychological relativity also impacts on consciousness (sect. 6). Because it is impossible to access any other person's subjective experience, it is not possible to observe any other person's consciousness. Even if the hypothetical neurophysiologist were to observe and record a substrate in the brain that subserved consciousness, there is no way in which the observations could be identified as such. However much one explores the brain, all that one finds is brain function. Phenomenal consciousness is simply the quality of subjective experience.

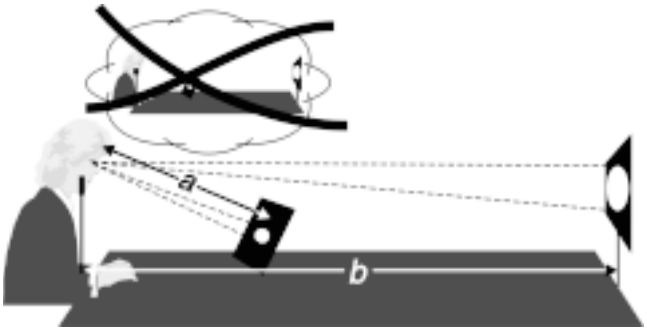

Figure 2 (Laming). Experimental set-up for the measurement of phenomenal regression to real size. (© 2004, Donald Laming. Adapted with permission from D. Laming, *Understanding human motivation,* Blackwell.)

Lehar's discourse has neglected some real empirical relations between perceptual report and experimental observation. I give two examples. Rubin (1921) drew attention to the "figure-ground" phenomenon, the assertion that the first stage in visual perception was the separation of a figure from its background. Elementary neurophysiological study has revealed that sensory neurons are differentially coupled to the physical input (Laming 1986), so that they are specifically sensitive to boundaries in the visual field while responding with only a noise discharge to uniform illumination. This appears to match the "figure-ground" phenomenon. Second, the Necker cube is ambiguous as a visual stimulus. The ambiguity is temporarily resolved by factors from within the perceiver (sect. 7.3). But there is no reason why those internal factors should be consistent, comparing one instance with another, so that the project of constructing a consistent geometry of subjective perceptual space is not achievable.

Double trouble for Gestalt Bubbles

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Abstract: The "Gestalt Bubble" model of Lehar is not supported by the evidence offered. The author invalidly concludes that spatial properties in experience entail an explicit volumetric spatial representation in the brain. The article also exaggerates the extent to which phenomenology reveals a completely three-dimensional scene in perception.

The real world is a place of many properties; so also is its presentation as a phenomenal world in the conscious brain. One way for a brain state to present in experience a worldly property *P* is to duplicate *P* itself. Like a painter striving for perfect mimesis, an embodied consciousness might use patches of red in the head to represent a red apple. Or, according to Lehar, a brain might use spatial properties to represent external spatial reality:

> 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)

Lehar's article makes the case for the internal replica, or "Gestalt Bubble," and then develops a model of how three-dimensional spatial modeling could occur in something like a neural medium. In this commentary, I suggest that the evidence in support of the Gestalt Bubble is in double trouble. It is both conceptually and phenomenologically flawed.

The coffee in the cup at my elbow is (to me) hot, brown, of a certain weight and size, and in a specific location. We cannot conclude, however, that the state of my brain that is my consciousness of the coffee replicates any of these properties itself. Yet this is an inference Lehar seems to make repeatedly in the target article. For example: "The fact that the world around us appears as a volumetric spatial structure is direct and concrete evidence for a spatial representation in the brain" (sect. 5.2).

This is a non sequitur, as can be seen by substituting "colored" for "spatial" in the passage. A slightly more elaborate argument is no less fallacious:

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