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Book review

Review of The World in Your Head, a Gestalt View of the Mechanism of Conscious Experience, S. Lehar; Mahwah, NJ: Lawrence Erlbaum, 2003

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The subtitle of the book – *A Gestalt view of the mechanism of conscious experience* – makes it clear that the notions of Steven Lehar are squarely situated in the tradition of Gestalt theory. Gestalt is a German term meaning 'form', 'outer shape' or 'a whole at the perceptual level'. Most people associate Gestalt theory with scholars who insist that our phenomenological experiences cannot be explained solely from the elementary perceptual stimuli that reach our senses. This characterization is, in itself, not wrong other than it is insufficient. The aim of Gestalt theory is to reveal the nature of consciousness and that is also the task that Lehar sets out to accomplish. His approach is reminiscent of the work of the well-known Gestalt theorist Wolfgang Köhler (1887–1967). Köhler (1924) developed a theory that related phenomenological experiences to electro-chemical processes in the brain. That is, first he analyzed conscious experience and then he tried to explain the characteristics of consciousness through chemo-physical processes in the brain. His theory was inspired by the field theory of the physical chemist and Nobel Prize winner Walter Nernst (1864–1941). Köhler's specific theories regarding brain processes are now outdated; much progress has been made in the brain sciences since he wrote down his thoughts. Lehar develops in his book a completely new theory, supported, of course, with the latest scientific findings.

Lehar starts with an analysis of the world as we know it directly and unmediated. Every theory of reality, including the most scientific ones must arise from this world. However, our phenomenological picture is not an undistorted image of reality. For instance, we know that the street in the summer is not wet, but we see it as such. Hence, the problem is how to arrive at the causes of phenomenological experiences when we have only first-hand knowledge of them and we know also that they might be illusory.

As all empirical scientists must do, Lehar observes individual phenomena and then attempts to identify characteristics that are true for all the members of the set. Hence, he identifies characteristics of phenomenological experience and draws

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logical conclusions from them. Lehar limits himself to the characteristics of conscious experience of visual space, and he identifies as important that visual space is a volumetric spatial void that contains colored surfaces and objects (see p. 36). Lehar then logically assumes that our conscious experience must reflect the representation in the brain since that grounds our experience. It follows that the representation in the brain is in the form of a volumetric block.

I will explain Lehar's model of the volumetric block in some detail using as example several dots that are so placed that they are perceived as forming a triangle. Thus, the stimulus array is a few dots, but we see a triangle. A perception such as this one is, as Lehar observes, "experienced immediately", "beyond the reach of cognitive analysis or invention" and "independent of an individual's past visual experience" (p. 46). And he concludes that perceptual elements – the individual dots – are subject to visual computational algorithms that are responsible for the emergence of the "holistic, or global first, aspect of perception" (p. 46) – the perception of a triangle. "There is no magic in emergence" (p. 49), Lehar continues, "the principle of emergence is seen in many physical systems" (ibid). However, before Lehar can formulate general computational principles of visual perception, he has to identify the computational function that the visual system has to carry out: "The basic function of visual perception can be described as the transformation from a two-dimensional retinal image, or a pair of images in the binocular case, to a solid three-dimensional percept" (p. 61).

Lehar proposes that this transformation can be modeled with the help of "a volumetric block or matrix of dynamic computational elements" (p. 64). I will give a much simplified account of Lehar's proposals regarding the workings of these elements, and I refer to the appendix of his book for a detailed, mathematical account. For simplicity's sake, we assume that each element has only two states, an opaque one and a transparent one. The transparent state is the default position of each element, but it can be rotated to the non-opaque state by a stimulus like a colored surface. The default position, then, is that of spatial void. The dots will directly place a few corresponding elements in their opaque state. This, however, would not account for our subjective experience of a triangle; that requires a transformation of intermediate elements. A line, as it were, must be drawn between the several dots; the elements that are situated between the directly stimulated elements must turn into their opaque states as well. The model assumes that neighboring states try to adjust each other into a similar arrangement. The directly stimulated elements would exercise an influence on their neighboring elements to turn also into the opaque state. However, this influence is counter balanced by the non-opaque elements in the three dimensional matrix who influence their neighbors to keep or to adopt the non-opaque state. The result of these internal forces is an opaque line between the directly stimulated elements.

The triangle that we see is, in this view, caused (1) by the external stimulation coming from the dots that activate corresponding internal elements, and (2) the internal stimulation from elements to their neighboring ones. The resulting pattern of stimulation is perceived as a visual scene. Perception, according to this model, is not the real world directly, but merely a replica of that world. Moreover, experience is identical to the activated pattern in the replica. "The world which appears to be external to our bodies is in fact an internal data structure in our physical brain" (p. 37). The transformation of the real world to the internal replica is helped by certain algorithms. These algorithms serve us well in most real life cases, but they are also responsible for the – illusory – percept of a triangle in place of some mere dots.

In Lehar's model, "objects are represented in the brain by constructing full spatial effigies of them that appear to us for all the world like the objects themselves" (p. 10). This model can easily explain hallucinations and dreams. These are perceptual constructs in the brain that are not caused or guided by external stimulation. Hallucinations and dreams use the same brain mechanisms as perception but they differ from perception in what triggers and guide the perceptual constructs during a hallucination or a dream.

Lehar then asks what the precise shape of the volumetric block must be in order to represent incoming stimuli as we see them. To that end he identifies some properties of subjective perceptual experiences that point to the nature of the representation. For instance, when we stand on a railroad track we *see* its two rails meet at the horizon even while we perceive them to be straight and parallel. Lehar argues that these properties of phenomenological experiences rule out the option that the volumetric block represents stimuli in a block-shaped, three-dimensional Euclidian space. If that would be the case, we should not see the rails meeting each other. Hence, Lehar concludes, the volumetric block would represent more like "museum dioramas…where objects in the foreground are represented in full depth, but the depth dimension gets increasingly compressed with distance from the viewer" (p. 75). In other words, the volumetric block is more bubble shaped than brick shaped.

Lehar's next step is to link his perceptual model with the brain's neuro-physiology. He proposes that the volumetric block is warped in the same manner as the cortex is. The obvious objection to this view is that the brain represents color, motion, sounds and so forth in different cortical areas. To this Lehar responds that the brain constructs several models of the stimulus; each model is specialized for depicting a certain property of the stimulus. All the models differ from each other in the property they represent and therefore in the exact pattern of activity in its volumetric space. These patterns, however, are superimposed on each other so that the several representations of the outside stimulus become fused into one. This would explain the unified nature of conscious experience.

Till now, visual perception has been explained exclusively in terms of a perceptual model. Lehar believes that "the properties of perception as observed phenomenally" (p. 149) show a remarkable similarity to "the phenomenon of harmonic resonance, or the representation of spatial structure expressed as patterns of standing waves in a resonating system" (ibid). In other words, Lehar claims to have identified how his model is actually implemented in the brain. Lehar believes that electric standing waves in the brain are the physical underpinning of static spatial perception. Thus, there is an electric vibration over brain tissue and the pattern of this vibration is experienced as our perceptual scene. This means that "the representational strategy used by the brain is an *analogical* one" (p. 10) and not a computational one.

Lehar's book, I think, is an outstanding contribution to our theoretical understanding. His analysis of the nature of perception and consciousness is disciplined, logical and articulated; it brings together contemporary scientific knowledge of physical phenomena like wave patterns and information processing with the gestalt theoretical discipline of analysis. It provides a challenging alternative for many of today's computational models. As all good theories, this one stimulates our thought processes and suggests a variety of new directions of investigation. In conclusion, this book is sure to stimulate a great deal of empirical investigations for decades to come.

Reference

Köhler, W. (1924). *Die physischen Gestalten in Ruhe und in Stationären Zustand (Physical Gestalten at Rest and in stationary State)*. Erlangen: Verlag der Philosophischen Akademie.