

Steven Lehar

The world in your head

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by Prof. Hellmuth Metz-Göckel (Universität Dortmund)

(Translated from German by Steve Lehar)

This is an incredibly important book that deals with the peculiarities and puzzles of perception, and seeks to establish a rigorous theoretical framework for them. For this, the author addresses the foundations of Gestalt theory, as espoused particularly by WERTHEIMER and KÖHLER, and extends them rigorously, leading to a large number of novel observations and theoretical conclusions.

As the basis for the discussion he begins with the general observation that Gestalt theory is often identified exclusively with the Gestalt grouping laws, but it plays no great role in contemporary psychological research and discussion. He is of the opinion that this general ignorance of the significance of Gestalt theory beginning around the 1950's can be traced to the fact that at the time – as computer modeling was first beginning – there was no plausible computational mechanism to account for the global nature of perceptual experience and its particular properties that could be imagined. Two further reasons lie in developments that were diametrically opposed to Gestalt theoretical thinking. The first was a particular emphasis and consideration of the processes in the individual neuron. The other was the rise of the digital computer, through which those operational principles won the upper hand, in which every problem is broken down to a sequence of simple steps that are each computed and handled in isolation from the problem as a whole. The computational principles underlying biological computation are fundamentally different from those of digital computation. Only an analogical representation is capable of accounting for the phenomenon.

LEHAR's foundational assumption is that one must begin with the phenomenon, because the phenomenon represents observable reality, and any modeling must take its characteristics into account. Throughout the whole book is found a working hypothesis, that the phenomena of perceptual experience cannot exist without a corresponding physiological correlate.

The starting point of his ruminations are a series of peculiarities of perceptual experience, some of which are well known and are brought into sharper focus, although one or two of them are in fact novel observations. These peculiarities must be described, explained, and when possible, expressed in a rigorous model. In the course of the discussions Lehar shows time and again that contemporary neurophysiological theory is incapable of contributing much to this process. Even existing perceptual psychological theories of perception (like

those of MARR) such as information theoretical theories are shown to be not particularly fruitful.

The tally of peculiarities of perception stands out even in comparison to existing textbooks. Behind it lies the critical realist scission into 1. and 2. realities, that draws a distinction between the theoretical positions of 'direct' and 'indirect' realism, corresponding to the distinction between naïve realism and critical realism. Furthermore, he emphasizes the recognition that we have a pictorial replica of the world, including our own self, in our head. Particular emphasis is placed on the fact that our experience is spatial, although the retinal images are two-dimensional.

Throughout, the principle of 'emergence', introduced by the Gestalt theorists, plays a special role in his presentation. The English expression seems to me more pertinent than our [German] terminology, namely: the obvious non-arbitrary emergence or appearance of the phenomena, even without an instance to trigger it. (This foundational concept is maintained throughout, even when the text speaks only of 'construction') A further concept, for which there is also no unambiguous German expression, describes an important characteristic of perception, (that possibly has not been taken account of until now) that is the principle of 'reification' in the sense of completion, or filling-in of a complete perceptual whole, even under ambiguous and incomplete input. Further, the ambiguity of many perceptual phenomena, for example the reversals of the NECKER cube. Also, invariance of perceived forms, including the well known constancy phenomena, and also invariance to rotation, are indicated. He emphasizes repeatedly that invariance of recognition in general in combination with reification and abstraction occurs somewhat as follows: when a portion of a pattern is observed, perception fills in the missing parts by extrapolation of the basic pattern of the adjacent visible parts. Further evidence of this process is seen in amodal perception: the visible front face of an object leads to a perceptual completion of its hidden portions, in particular of the hidden rear face of the object.

One principle that the existing literature has not taken sufficiently into account, that poses a genuine challenge for explanatory theories and models, is the apparent free anchoring of the phenomenon in the nervous system. Every motion of the head leads to a shifting of the objects of perception – with respect to the neurophysiological substrate – and yet we experience reality as stable in a fixed location in the field of experience.

The many particular themes cannot be elaborated here; they are plausibly discussed throughout, and evidenced through definitive examples.

Here we can only go into certain particularly important points, and into the underlying central theory.

With respect to the question of how it comes to be that we experience a spatial world in perception, he proposes as plausible – also based on certain investigations – that the perceived world is based on a non-Euclidean geometry. What is meant by this will perhaps become clear if one imagines a person on a straight road: The sides of the road curve outward from the point where the person is standing, and they converge again into the distance by perspective, where they however somehow terminate. On the basis of this structural manifestation we experience the road as perfectly straight with parallel sides.

By individual phenomena it must be explained how three-dimensional perceptions arise despite the fact that the retinal stimuli are two-dimensional. Here he begins with the assumption that we must imagine processes in a kind of a bubble, and that the two-dimensional presentation engenders innumerable spatial interpretations in the form of a probability distribution, whereby then the most prägnant [simplest] and perhaps also most familiar constellation is realized. Every possible orientation of lines that extend out from an origin are spatially unfolded, and those variants that represent a contour of a body win the competition as the most plausible and prägnant interpretation.

Much greater problems await the attempt to integrate the many diverse inputs of perception at a higher level, and thereby permit top-down as well as bottom up processes to operate. Fundamentally LEHAR represents the position that we must begin simultaneously at higher and lower levels, that is the conduction of activation in nerves, against the predominant conception, involves bi-directional processes, which even his own theory entails (s.u.). Furthermore, that parallel distributed processes are involved. (Of course he finds the theories of the proponents of Parallel-Distributed-Processing theory unsuitable, i.e. he argues that that type of modeling is implausibly complex.)

The integration that then leads to the perceptual phenomenon of a spatial world is in his opinion best understood by the fact that a large quantity of information about the same object across different modalities (that are localized in various different locations in the brain) become fused to a single whole. A simple example occurs to this reviewer: in the perception of fruit, we are capable of integrating the information from various sensory channels.

The next theory presented is the 'harmonic resonance theory', that proposes that the representation of physical (and other) structures in perception can be best explained by the condition of 'standing waves' in a resonance system. (The theoretical construction and also the conceptualization are well known in physics.) The components can be distributed over the whole brain, where in electroencephalogram recordings they can be distinguished as individual resonators, in which individual frequencies of oscillation are merged into a global oscillation.

Standing waves offer exactly the adaptability and flexibility, to account for the global wholes, invariances, reification, etc. To take account. Even more comprehensive relationships are active in recognition or recall. Here, top down – and bottom up – resonances are active, probably bi-directional and alternating. In the case of an incomplete or ambiguous input, the nearest comparable pattern that is encoded in the harmonic representation is activated, and leads to reification, amodal completion, and naturally also to recognition.

The foundational concepts developed so far are then applied to a further series of phenomena, for example speech and cognition, motor control, and aesthetics. For these issues we refer you to the original.

The theory that LEHAR presents here is unusually stimulating, and can certainly be seen as the most important contemporary contribution to Gestalt theory and its further development. Much of it is – as the author concedes – speculative, but when one considers the facts, his considerations are characterized by a high plausibility and rigor. If one wishes to clear up the manifold phenomena, there remains only one possibility, as the presented

theory offers. It remains to be seen which and how much resonance the resonance theory will find in the scientific literature. It has certainly earned it.

Hellmuth Metz-Göckel (Universität Dortmund)