A PHENOMENOLOGICAL FRAMEWORK FOR NEUROSCIENCE?

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The Phenomenological Constraint

To answer the question whether Neuroscience will dictate a new vision of man and society, I think we we should consider the possibility that it will be allowed to. I maintain that the Neurosciences will do this if their research and findings fit a phenomenological description of our actual experience of things, others, meanings and values. That is the immediate or actual phenomenal experience studied as such by the Gestalt psychology tradition.

What would this phenomenological constraint consist of exactly? I think this constraint will force us to reject the tenet according to which we are only aware of our inner representations, caused by an external or internal physical or physiological world, by which we gain the illusion of perceiving the inner and the outer world. In order to build an adequate phenomenology, we could do well to refer to the analyses of the Gestalt psychology tradition, assuming that neurobiological research should cover phenomenological, and not only behavioural data, for a neurobiological theory to exhibit the same manifoldness that phenomenal experience does.

Particularly, the Gestalt psychology analyses and core concepts about the structure and organisation of phenomena could be used for contributing to the modelling of the brain networks properties and dynamics, which realise the functions needed to account for phenomenal features or relations, and for suggesting a *field model* of the integration networks and their interactions at the different levels of the functional brain architecture.

I think phenomenological and Gestalt-like constraints might allow us to assess the experience problem that the cognitive sciences are faced with. As examples I choose JACKENDOFF (1987) *Intermediate Level Theory* (ILT) and PRINZ (2000) *Attended Intermediate Representations Theory* (AIRT). Gestalt psychology analyses will allow us to notice that both theories do not account in a reliable way for the actual experience of the world we ordinarily have, for the phenomenological data are not satisfactorily outlined. Furthermore, I shall hint at some psychological and neurobiological findings, according to which their arguments are at least disputable.

The Phenomenological Mind Problem: What's the Experience Like for a Computational System?

The Cognitive Sciences are supposed to solve the Mind/Body problem: the Mind is what the Brain looks like if seen from a functionalist point of view. But this solution would generate a new question: taken for granted that some computations define the more abstract level which describes what happens at the lowest neurophysiological level, how does the brain come to have *that* single experience of something?

This is what JACKENDOFF dubbed the Computational *vs.* Phenomenological Mind problem.

According to him, the computational and the phenomenological Mind are two different levels of descriptions of the physical body, but nonetheless they are not identical: computations do not exhibit the same properties as does experience. Strikingly, JACKENDOFF refers to three problems, in which the difference between these two descriptions comes to the fore, whose discussion can already be found in the Gestalt-Literature. They are the problems of externalization, shape and qualia (KÖHLER 1939, 1971). Let us consider these briefly. The externalisation problem states that some computations could have properties to mark the objects' positions in the sensory field, but they cannot account for one's experience of things in the world nor computations in the mind. The qualia problem is due to the fact that, although some computations could provide the mind with the right distinctions to represent one content of experience as different from one another, they possess no qualia property. The shape problem states that some computations could be endowed with some geometric properties coding for some shape features of objects, but nevertheless cannot account for experiencing *that* shape.

According to JACKENDOFF, we're allowed to solve only the weak forms of these problems, for we cannot possibly understand experience in terms of computations as we can in the case of the classical Mind/Body problem. So he assumes that the weak form of the phenomenological problem is outlined best, assuming that the following relations hold:

(*a*) for every content of experience there must occur some computations of a certain kind;

(*b*) not every computation produces a content of experience whatsoever;

(*c*) any content of experience depends on a structure and not on a process: only the former provide the representational distinctions for having this or that experience;

(*d*) the phenomenological mind has got no causal efficacy, and it's not a process of analysing lower level information or processing.

Given the arguments of the causal inefficacy and the functional asymmetry between the computational and the phenomenological Mind JACKENDOFF maintains that the experience depends upon a relation of causing/projecting/supporting running always from the computational to the phenomenological Mind and never backwards. So, JACKENDOFF stresses that the world is not the source rather the product of the computational work: it looks like the way it does due to some specified representations of the adequate structural level allowing it to appear parsed as we interpret it given our psychophysical constitution.

To fill the gap between these two levels of Mind, JACKENDOFF's theory specifies which computational structure causes this projection, and which kind of processing selects the computational features projected into phenomenal properties.

The computational structures phenomenology must be related to are at the intermediate sensory level, such as the phonological, the $2^{1/2}$*D sketch* visual level, or the linear sequence of notes and chords in music perception. On the processing side, the theory assesses only the representations actively running in the STM (*vs.* those simply stored in the LTM) as fundamental for the projection of the phenomenal properties. Among these representations a subset is supposedly singled out by a memory selective function out, and kept in record with along with other eventually interactive subsets. Furthermore, JACKENDOFF hypothesises the thatintervention of a representation level mediating between the space understanding and the motor activity. It is supposed to be body-level representation projecting a special sort of phenomenal properties which mark different varieties of experience, bound to appear as characters of objects, such as meaningfulness, being consistent or congruent. JACKENDOFF adds a further element to this picture of the relationship between the computational and the phenomenological Mind: a specific computational structure with a translation processing unit. It is thought of as a conceptual structure (high level), which receives the representations projecting the phenomenal mind and translates them into a new intermediate level (phonological or visual) that makes them available for reflexive or access consciousness.

What about the visual experience in the ILT?

According to the ILT, the way things look as they do depends on the computational form of the appropriate intermediate level, that is Marr's $2^{1/2}$*D sketch* that supplies the representations corresponding to the phenomenal properties of what we consciously see. In fact, the $2^{1/2}$*D sketch* is thought of projecting the phenomenological experience because it is a sensory representation, whose being at an intermediate level allows it to provide explicitly with those information which, according to JACKENDOFF, correspond to the ordinary phenomenology of our visual world[1]. This sketch is thought of as mapping some features as pertaining *2D*

[1] JACKENDOFF uses the term «phenomenology» to mean our ordinary life experience of the inner (such in cases as our bodily sensations, emotions and affects or valuations) and the outer world. In this domain, it is a phenomenal property of the visual experience everything covered by a «what it is like to be»-property: what things look like from a particular point of view, given some specified psychophysical

surface patches visible from a current viewpoint but as distributed in a *3D* space, wherein the viewer itself is located. The information about the appearance of a surface to the viewer is specified according to texture, slant, tilt, distance values in all directions from the viewer's position. These types of information are thought to be integrated by the valuations of meaningfulness, congruity of phenomena provided by the above mentioned intermediate bodily representation structure.

I think that such an account for visual experience faces the following difficulties. First of all, the *$2^{1/2}$D sketch* does map converging outputs from lower levels to an explicit recover of depth and orientation of local surfaces. But it accounts only implicitly and locally for the shape of objects, which is one of their most important features for experiencing various other properties such as category, value, function. Secondly, the *$2^{1/2}$D sketch* is not organisationally differentiated: it does not make directly available the part/whole relations we ordinarily experience. I think these issues are problematic for the phenomenology the ILT assumes, which is too restricted if compared with the results of the Gestalt-like analyses.

Furthermore, making the *$2^{1/2}$D sketch* the level that projects experience, and at the same time equating experience and consciousness, could have some awkward consequences. For we are supposed not to be conscious of the back or of the overlapped parts of objects, we experience the difference among the hidden inner surfaces of an object, the back surfaces of an armchair, and the hidden tail of a cat behind an armchair. For we're supposed not to be conscious of the *3D* shape, every spherical object should seem being half-spherical to us and this would correspond to a satisfactory description of our ordinary experience we all should be inclined to accept. But I'm afraid this would be not the case. Finally, for we're supposed not to be conscious of the categorical identity, we would be constantly be guessing about the shapes of objects and their functions, not unlike those afflicted with visual agnosia.

The Need for a Neurobiological Level: the Attended Intermediate Representations Theory

I think that these consequences derive from an unsatisfactory phenomenological description, and from an overly abstract level which narrows the neurobiological level down to a mere implementation issue or to a subsidiary tool for a functional analysis. According to JACKENDOFF (1987), it is easier to compare the phenomenological Mind to the computational Mind than to the Brain. The human brain is thought of showing such a combinatorial complexity of its parts that it must be described as instantiating computational properties even at low scale levels. That being the case, the neuroscientific descriptions are thought of asbeing insufficient to account for the Mind, while the functional description seems to be the only one to explain the behaviour and the experience of an organism. Nevertheless the

constraints. A broadest sense of the term encompasses what we are really aware of *vs.* what we believe or we'd deliberately think of being aware of. Some consequences of this relationship among phenomenology, awareness and qualia properties will be briefly discussed farther on in this paper.

Neurosciences are not useless according to JACKENDOFF: they are a subsidiary tool for the abstract description, providing constraints for an adequate theory of the Mind, even outside the realm of AI, given some critical differences between a computing machine and the brain. But I think that it is probably more useful to adopt a neuropsychological approach whose aim is to correlate the phenomenal level of experience with the neurological level, and to provide a good description of the structure and constraints of experience (*Gestaltpsychology*).

Before sketching the form of what a gestaltist solution might be, I'll consider a neuro-functional theory, which refers explicitly to the ILT and backs it up with some crucial neuropsychological issues, proposed by PRINZ (2000) and dubbed *Attended Intermediate Representations Theory*. In fact, I think the ILT even from a strictly computationalist point of view demands neurobiological integration, as already noted by CRICK & KOCH (2000)[2].

The framework of the AIRT is a bottom-up, multistage processing model following Marr's partition, enhanced by an attentional feedback loop. In this theory, the low level is associated with V1, wherein retinotopically arranged cells selectively respond to wavelenghts, edges, movement; the intermediate level is associated with the extrastriate cortex (V2, MT), explicitly encoding surfaces features; the high level is associated with IT, whose cells are more indifferent to size, orientation, position and able to give an object-centred representation.

To AIRT, the visual consciousness should be located in the extra-striate cortex, because V1 seems to lack colour constancy or illusory contours encoding, whilst the IT-representations are more consistent with our phenomenology. On the other hand, it is possible to have phenomenology without high-level representations, such as in case of subjects who accurately draw an object without being able to identify it (*associative agnosia*). But since in cases of masked priming, visual stimuli can be recognised without entering into awareness, whilst intermediate-levelrepresentations can become conscious even without high-level interpretation, as when scanning is needed in case of interpretation failures, AIRT makes attention the sufficient condition for phenomenal experience. Neurobiological results, which attest that attention has the potential to increase neuronal activity in both low- and intermediate-level visual areas leads AIRT to hold that attentional enhancement or scanning is the very feedback that marks the intermediate level states corresponding to the high level interpretation for the right phenomenal grouping to appear.

We can label AIRT as a kind of a threshold theory, which locates the phenomenology at an intermediate level of the brain processing, and makes attention the sufficient feedback effect from higher level interpretations, needed for things to appear as they do. From a neurobiological point of view, attention related processes have different neural correlates for vigilance, selection among distracters,

[2] If JACKENDOFF is less concerned with the problem of how some brain activity correlates with experience, it is true that since computations are implemented in the brain, we'll come to ask for which processes in the brain are responsible for which computations projecting the phenomenal properties. I think that such a discussion can help in making clear the point as to the model assumed by JACKENDOFF.

object-based or spatial focusing in parietal and pre-/frontal cortex. All of these brain processes are thought of exploiting high-level processing for experience or awareness to take place. Therefore, AIRT predicts that the most plausible neural condition for entering awareness is a special connectivity, which privileges intermediate-level information and allows it to be broadcasted to areas related to action planning and verbal reporting.

I think conclusions drawn by AIRT are at least disputable under some respects.

First of all, feedforward and multistage processing model seems to be insufficient for recovering all the brain processes and activity patterns related to the organisational aspect of phenomenology. LAMME & ROELFSEMA (2000) point to the fact that feedforward detection of features is only one kind of neural activation, which involves all the receptive fields tuning properties all along the cortical hierarchy. In fact, even when provided with attentional feedback from the higher levels, this feedforward stream can not account for the recurrent interactions via horizontal, long range connections within or beyond the classical receptive fields, which are supposed to be fundamental for the contextual modulations needed for the phenomenal organisation to occur (KAPADIA & WESTHEIMER & GILBERT 1999 and 2000; SPILLMANN & WERNER 1996). The recurrent integrations providing the modulation of the neural response seem to exist even between areas at different levels and distances from one another, involving patterns of activity with different activation latencies. Hence, the modelling of the brain processes by a mere feedforward and multistage filtering and output-converging models seems not to correspond to the overall organisation of the visual system. In fact, it is reasonable to think that the activation of neurons patterns and their interaction are bound to the type of inter-area connections among neurons at different hierarchical levels, and to the different speeds at which processing occurs despite of their strictly feedforward relations.

In the second place, it seems more and more apparent that attention is not a sufficient condition for phenomenology to appear the way it does, even though it can play a crucial role given some circumstances. LAMME (2003) holds that there are theoretic reasons as well as psychological ones to believe. On the one side, there are properties of stimuli that might never reach consciousness even when attended, whilst there are non-attentional selection mechanisms affecting phenomenology, such as in case of perceptual rivalry under voluntary control. On the other, there are psychological evidences that Gestalt grouping effects are early automatic processes, and are not overridden by task-dependent attentional allocation (BAYLIS & DRIVER 1992; FOX 1998; PETERSON & GIBSON 1994; ZIPSER & LAMME & SCHILLER). DAVIS & DRIVER (1994) reported that the time required to find subjective contours targets does not increase as the number of location to be searched does, suggesting that subjective contours are generated in parallel across the visual field, and that focal attention is unnecessary. Furthermore, amodal contour completion seems to occur sufficiently early and observers can not ignore them even when doing so would improve their performance in the task assigned to them (HE & NAKAYAMA 1994).

From a strictly neurobiological point of view, one could say that attention is a platitude term for various different kinds of neural processing, which let a neural pattern be processed faster and deeper than others. These processing can be thought of depending upon the states the involved nervous network happens to be in and the salience and phenomenal properties, whether shared or not, of stimuli (LAMME 2003). This last point is consistent with the psychological observations that attention spreads across entities defined by grouping factors, even when task performance would be improved by focusing attention on the target, and that early activated memories affect shape assignment only if the spatial relations of the parts of known objects are not altered, rearranged or scrambled (GIBSON & PETERSON 1994).

If these arguments prove to be right, there is room left to distinguish not only between attention and visual awareness, but also between phenomenology and various forms of awareness, which should not be considered as an all-or-none property counted as a necessary feature of experience. This topic could be addressed from the results of PETERSON & de GELDER & RAPCSAK & GERHARDSTEIN & BACHOUD-LÉVI (2000), who suggest that figure/ground processing occur even in agnosic patients whose neurological impairments prevent them from recognizing objects but not from performing a other basic visual tasks such as contour integration.

A Gestalt-like Model for Phenomenology and Neuroscience: KÖHLERs Dynamical Theory

If the previous arguments prove to be right, maybe we can go a bit farther and assess the real need of a model to fit the Neurosciences with the phenomenology, securing the same manifoldness to the interpretation of both neurobiological and experience data. I propose that it could be a model enriched by Gestalt-like features, and that this model could be provided by KÖHLERs theory, thanks to its well defined criteria for physical Gestalts to obtain, which could be applied to the brain activity patterns. The possibility of a physical realisation of the Gestalt-like behaviour, so strongly defended by KÖHLER, allows us to think of a Gestalt model as useful for explaining the contextual effects and interactions of neurons in the complex functional brain architecture as well as for rightly outlining the phenomenological data.

To be sure, the theory proposed by KÖHLER can not be accepted without great number of modifications and integrations. Nonetheless, I maintain that it could provide a model of promise for what a solution of the experience problem might look like. I will limit myself to expound the core concepts, which to me are still profitable to refer to, and to explain why its principles are still attractive.

First of all, KÖHLERs phenomenology is rich enough. From a gestaltist point of view, the phenomenological data are the most directly ascertainable, because the data of actual experience are immediate and reproducible. EHRENSTEIN & SPILLMANN & SARRIS (2003) mark this point very clearly and propose that the very phenomenal data could work as a guideline for the study of correlated brain mechanisms. This means that the phenomenology cannot be narrowed to qualia properties or restricted to subjective features of the phenomenal properties depending upon the viewer. Furthermore, KÖHLERs dynamical theory meets the so-called Lashley's principle: the means by which experience is organised are not directly experienced. KÖHLER (1940) states that the viewer has no direct experience of the phenomenal laws, whose only structural correlates must be specified in neurobiological terms. I think that this point is really important in that it does not trivialize the function that phenomenological analyses can bear for the neuroscientific research. Furthermore, this feature of the theory provides the research with another strong constraint. In fact, it helps to define in a more satisfactory way what a «what's it like to be»-property could be. It is not restricted to an unaccessible phenomenal realm of each single subject, and at the same time it prevents also from localising the phenomenology somewhere in the brain architecture.

The *epistemological dualism* and the *isomorphism hypothesis* make up the core concepts of the theory. I think the *epistemological dualism* outlines the framework wherein to suggest what a solution of the experience problem might look like. Its basic assumption is that it is misleading to refer to phenomenal and physical properties as one and the same, in such a way that the phenomenal properties should be located inside the brain, which possess only biochemical and electromagnetic properties. If this were the case, the phenomenological world should be thought of asbeing a part of a particular neurophysiological system, whose processes are ascribed to it. The substitution of the physical level of the brain with the computational level leads to the same «compulsion to project»[3]. Rather, a satisfactory theory should specify the relations among phenomenal, computational and physical properties. The epistemological dualism assumption allows us to face the problem of the external localisation, the shape and the qualia properties. In fact, the theory should specify which relations and organisational phenomenal features are to be considered as fundamental and how they are mapped onto the neurobiological system. As already known, the isomorphism hypothesis is devoted to this task. WESTHEIMER (1999) already noticed that the isomorphism hypothesis could serve to explain why psychophysics experiments show a potentiation effect among elements marked by a phenomenal preference, whose presentation facilitate responses in the visual cortex of awake monkeys.

Within this framework, we are allowed to expect that the sides of the isomorphism relation should share the same manifoldness: neurobiology and phenomenology must functionally correspond to each other, and this correspondence could be expected to be mirrored by a computational model. ZUCKER (2001), BEN SHAHAR & HUGGINS & IZO & ZUCKER (2003) provide a meaningful example of what a computational model which holds in due

3 In KÖHLERs own words used to stigmatize one of the way followed to solve the mind/body problem as to the shape- and externalisation problems.

consideration the organisational relations of the phenomenal world and the contextual modulation of the neurons could be like[4].

Strikingly, KÖHLERs dynamical theory allows us to sketch the form a possible answer to the value/meaning question, posed as a condition for Neuroscience to affect our vision of man, might have. Values and even complex meaning the phenomena support for a subject cannot be reduced to a subjective projection, although it depends upon the activity of the brain. According to KÖHLER, as phenomena show contextual dependencies so do the phenomenological self and objects. This relation is not a subjective one, in the sense of arbitrariness, because it obtains in specific contexts due to the structural properties of phenomena and is also founded and mapped onto neurobiological processes. I am aware of the fact that it is only a sketch of a possible answer and that much work must be done in order to well specify this last claim. However, I believe that this remarkable point could pave the way for the research of a satisfactory answer.

An example of recent research about the neurobiological functional correlates of intersubjectivity, and purposes of actions and values understanding is one proposed by GALLESE (2003), even though GALLESE & GOLDMAN (1998), METZINGER & GALLESE (2003) show that this interpretation of the so-called mirror neurons is framed within the simulation theory of mind reading and formulated in the mental models jargon. Instead a dynamical theory should be inclined to correlate structures on the two sides of the neurobiological and psychophysical relation and to specify the conditions of the overall activity patterns related to phenomenal structures and specific organisational features which supports values and meaning.

So, if we assume that designing an isomorphism correlation between phenomenology and neurobiology is a profitable move, we can say that the phenomenological Mind is not the projection of distinctive computational features of the state an organism happens to be in, whilst the values of experience depend upon what a particular brain would do under certain conditions given some structural constraints.

Arguments for Future Research

I proposed that KÖHLERs theory, thanks to its well-defined criteria for physical Gestalts to obtain, could be applied to brain activity patterns, securing the same manifoldness to the interpretation of both neurobiological and experience data. However, I think the isomorphism relation mapping needs a new specification and the theory has to be further integrated in light of modern neuroscientific findings

4 The computational abstraction presented in these papers is defined at a macroscopic level wherein the processing problems which are natural for the visual cortex are specified. This way, it is supposed to fit some physiologically functional constraints, as regards the cortical connections accounting for the fundamental property of objects of seeming as coeherent wholes. The very notion of a field facilitation beyond a mere associative local field or a co-linear functionality, for non co-aligned facilitations to obtain, is designed by the Authors to strenghten the good continuation factor.

and current needs. Therefore I expound briefly the distinctive features of KÖHLERs theory, and then I sketch the arguments that appear to confirm some of its principles and suggest the lines along which the theory could be improved.

KÖHLERs core concept is that phenomenology is endowed with a spatial order, wherein what belongs together must be perceived together: this order is exemplified by topological relations as well as by gradients and context articulation. KÖHLER assumes that the phenomenal space and physiological field must share structural properties, whose vector field analysis is thought of as accounting for functional proximity and distance among pairings of events occurring in both the two domains, whose relation is of an isomorphism of some sort. Furthermore, for the neurophysiological domain, the theory specifies that the explication level is suited to the currents originating in the tissue fields by the electric potentials. These currents are thought of as explanatory units rather than corresponding to single neuron spikes because: (*1*) they are not all-or-none events, but instead show a graduate unfolding; (*2*) they are not of brief duration and show steady-state behavior; and (*3*) they do not follow fixed conduction lines, along the nervous pathways but, rather, propagate freely in a continuum field.

I think we can reasonably question the topological nature of the isomorphism relation, but at the same time we can accept the proposal of a vector field analysis. It could prove to be a strong modelling tool for results that the Neuroscience research is still putting to the fore: the growing complexity of the receptive field at various levels and the modulatory effects that appear to go beyond the hypercolumnar connections. And this could be a way to satisfy the request for a more detailed specification of the field metaphor rightly addressed by TSE (2004)[5].

As to the topological definition of the relevant relations between the phenomenal and the neurophysiological fields, we can no longer accept the terms in which it was formulated by KÖHLER. It is not only a matter of noticing that the Neurosciences' research ruled out the possibility of currents spreading across the overall cortex and retaining the topological invariances of the phenomenal objects. In fact, it is more crucial to realise that the topological constraint given by KÖHLER does not take into account the eventual function of anatomical connectivity. Although one can not reduce the conditions of patterns of neuronal activity to the spatial properties of different tissue patches in the brain, it is otherwise certain that being in different anatomical layers is to possess different points of origin and termination in the overall connection. This could in fact match the functionality of hierarchical, horizontal and recurrent processing.

To be sure, LAMME & ROELFSEMA 2000 notice that an analysis of the latency of visual responses in the cortical areas yields somewhat different results than those obtained if taking into account the responses expected only on anatomical grounds. But, it remains still true that it is no more possible to ignore the anatomical constraints, and I think there is actually no compelling evidence even to narrow them down to mere boundary conditions.

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5 I wish to thank Dr Gerhard STEMBERGER for giving me the chance of reading this paper in advance.

Instead, there is a growing body of work that concerns the relationship between anatomical and functional connectivity, which can be investigated at different scales, ranging from local circuitries to the organisation of streams or to parallel connections. I think that a structural analysis at the adequate level of this kind of connectivity could be useful to clarify another core distinction in KÖHLERs dynamical theory: the one between micro- and macro-level effects. To do that, it is possible to make reference to different models such as: the synchronization of the spike discharges among different neuronal populations; the assumption of a massive sparse and reciprocal interconnectedness with re-entrant reciprocal routes; the study of long range, modulatory connections.

Nonetheless, I believe that a vector field theory could serve as a strong modelling theory. It seems to me useful for comparing the contextual effects of the grouping Gestalt laws and the context or modulatory effects within or beyond the classical receptive fields. On the one hand, SPILLMANN & EHRENSTEIN (1996) and EHRENSTEIN (2001) stressed respectively the possibility of seeing the receptive field itself as «micro-Gestalt», of comparing the psychophysical field data to the integration provided by the hierarchy of different receptive fields, according to the principles that apply to single cells activity[6]. On the other hand, the increasingly apparent inadequacies of the Neuron Doctrine and the stress on the non classical receptive field properties appear to be consistent with the overall dynamical principles that KÖHLERs theory was in search of. Finally, as to the structural comparison between the phenomenal organisation and the modulatory effects, there are evidences that neurons do not act as independent filters. In fact, the single neuron response can change dynamically as latencies become longer and show contextual effects, which request the assumption of neuronal interactions for distances far beyond the Hubel & Wiesel hypercolumns. Furthermore recent research has shown *local* contextual effects also for detection or discrimination of targets; contour detection among a set of distractors (LI & GILBERT 2002); texture segmentation (HARRISON & KEEBLE 2002); detection of a low contrast Gabor target flanked by Gabor elements (POPPLE & POLAT & BONNEH 2001). So, one can assume that the modulatory effects are correlated to the binding properties of the parts of the stimuli involved and that the contextual neuronal effects are always part of grouping processes which aim at perceiving *coherent* phenomenal objects. One can formulate the hypothesis that some features affect the contextual modulation only if they are a meaningful part of a parsing process of the overall structure of what is going to appear, *while the neural interaction seems to be critically dependent upon the size of the contextual field*.

Contextual modulation can be thought of as an example of the neuronal correlates of phenomenal organisational features at the appropriate level, and future research will tell us more about the extent to which these connections are independent of low level features, so realising the same function as the currents in KÖHLERs theory. HERZOG & SCHMONSEES & FAHLE (2003) show examples

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6 I am very grateful to Dr. Walter EHRENSTEIN for drawing my attention to the relationship and difference among the Neuron Doctrine, the classical hierarchical receptive field theory and the features of a sort of a field theory as the one I am trying to hint at in this paper.

of such an independence of features such as stimuli frequency or orientation per se, even *within* the classical receptive fields.

In conclusion, I think that much is still to be expected from neuroscientific research concerning the experience of values and meaning. Maybe, it will be necessary to modify the explanation given by KÖHLER with regard to this problem. However, I maintain that his theory could provide a satisfactory framework, wherein to make phenomenological analyses and neuroscientific research consistent to one another.

I have sustained that the isomorphism relation mapping needs a new specification and the theory needs to be further integrated by light of modern Neuroscience findings and current needs. But I believe that the aforementioned benefits of KÖHLERs theory are not only promissory notes, but that they remain substantive claims, which can be tested and used to address controversial issues.

Summary

I attempt to sketch what a phenomenological constraint for Neuroscience would consist of. I maintain that an adequate phenomenology is a condition for the Neurosciences to account for our every-day experience of the world in its broadest sense. As a guideline, I assume the phenomenological description of our actual experience of things, others, meanings and values provided by the Gestalt psychology tradition. In order to prove its usefulness, I discuss the explanatory gap the Cognitive Sciences are faced with. I then propose some arguments drawn by KÖHLERs dynamical theory, to show what a solution to the explanatory gap problem might look like, and how the phenomenological and neurobiological correlation might be though of. I also suggest that this theory needs to be further integrated and somewhat modified in light of recent neurobiological findings, which in turn appear to sustain some of its claims. In fact, I propose the isomorphism hypothesis and the epistemological dualism as a framework for current research, while the studies about the contextual effects and interactive facilitation, at various ranges and levels of the brain functionality, will be used to try to specify a new functional meaning of the vector field analysis proposed by KÖHLER.

Zusammenfassung

In diesem Beitrag skizziere ich, was ich als Verpflichtung der Neurowissenschaften zur Phänomenologie bezeichnen möchte. Ich vertrete nämlich die Auffassung, dass die Neurowissenschaften ohne adäquate Phänomenologie nicht auskommen können, wenn sie für unsere Alltagserfahrung im weitesten Sinne relevant sein wollen. Ich gehe dabei von der phänomenologischen Beschreibung der uns gegebenen Erfahrung von Dingen, von anderen Menschen, von Bedeutungen und Werten in der Tradition der Gestaltpsychologie aus. Um die Fruchtbarkeit eines solchen Zugangs zu belegen, diskutiere ich zuerst die Erklärungslücke, mit der sich die Geisteswissenschaften konfrontiert sehen. Dazu führe ich einige aus KÖHLERs dynamischer Theorie abgeleitete Argumente an, um Möglichkeiten aufzuzeigen, wie diese Erklärungslücke geschlossen und wie die Beziehung zwischen Phänomenologie und Neurobiologie angemessen verstanden werden könnte. Daran schließe ich einige Vorschläge an, wie diese Theorie im Licht neuerer neurobiologischer Erkenntnisse, die diesen theoretischen Ansatz durchaus zu stützen scheinen, noch weiter integriert und teilweise modifiziert werden sollte. Insbesondere die Isomorphiethese und den erkenntnistheoretischen Dualismus schlage ich als Rahmen für weitere Forschungen vor. Studien über das kontextuelle und interaktive Geschehen mit Effekten unterschiedlicher Reichweite und auf verschiedenen Ebenen der funktionalen Hirntätigkeit können genutzt

werden, um eine neue funktionale Bedeutung der von KÖHLER vorgeschlagenen Vektor-Feld-Analyse herauszuarbeiten.

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