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### What is still living and what has died of the Gestalt approach to the analysis of perception

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The title of my paper is "What is still living and what has died of the Gestalt approach to the analysis of perception". One must add something to this title: if other speakers were here in my place some would say that all is dead, others would state that nothing has died, many would declare that it is respectively dead and alive, something quite different from what I want to say. The fact is that the death is rather recent and that before the heritage can be fairly divided out there will be numerous cases brought to court with notaries submitting their documents, the heirs their claims. I intend to divide my paper into three parts:

- 1) a very brief historical flash-back on the Gestalt Theory, because, today in the nineteen nineties, it may not be known to all;
- 2) a brief list of the salient points, some of the fundamental notions that act as the basis of this theory; and,
- 3) a final balance in keeping with the title of this paper.

The movement is considered as having originated with a study carried out by von Ahrenfels, the findings of which were published in Graz in 1890. This study regarded the perception of melodies, and in present-day terms might be considered the first study concerning "melodic contours". This learned thesis, availing of many, many words and complicated theories, explained that a melody remained perfectly recognisable even after all its notes had been altered, providing that the relationships between them remained intact, thus suggesting that the object of perception is not the sensorial fact but systems of relationships existing between sensorial facts. However, very few Gestaltists attributed paternity to von Ahrenfels's research. It should be pointed out that the Gestalt movement began at a moment of great cultural upheaval, after Windt, after William James, after American structuralism, therefore, after a great quantity of research had already been carried out. The period was that immediately preceding the First World War. The founder of the movement, Wertheimer, a native of Prague, a Jew, who like Kafka had studied music, physics and philosophy, was, at the time, unknown. One day he introduced himself to two young professors at Frankfurst, Kohler and Koffka, and showed them certain strange phenomena he had obtained by means of a strange toy, a stroboscope, capable of producing various types of apparent cinematographer movements (a succession of static images which were perceived as a sequence of continuous movements). He had varied exposition times, the forms of the objects and light intensity and thereby discovered many things. The two professors were impressed and proclaimed his findings a miracle and elected Wertheimer as their cultural "leader". This is why Wertheimer, although in his lifetime he published only about twenty articles (a further ten as well as a booklet of notes and essays were published posthumously by his son), became the emblem of the Gestalt theory. Koffka and Kohler, although they wrote copious tomes on the question and carried out thousands of hours of research all over Europe and America, very honestly always indicated Wertheimer as their master.

In 1929 Kohler attempted an exposition of the theory; in 1935 Koffka actually wrote a manual about the theory of form ("Principles of Gestalt Psychology"). Meanwhile hundreds of scholars were working assiduously producing new and unknown visual phenomena and publishing their findings in the *Psychologische Forschung* a magazine which acted, so to say, as the disorderly deposit for all Gestalt findings. Some of the contributors were genial scholars. Of these let me mention Rausch (Frankfurt University), who attempted and achieved an extremely complex and

in part successful mathematical generalisation of the Gestalt theories; Nichotte (Louvain), who while being neither a Gestaltist nor a sympathizer of the Gestalt theory, discovered the phenomenon of causality in perception and studied the question systematically; Metzger who, risking being considered a friend of Nazism (which he was not, I knew him quite well) remained in Germany, instead of escaping to the USA like Wertheimer, Koffka and Kohler, in order to keep the magazine alive, continue his experiments and publish a gigantic treatise on the theory of sight ("*Gesetze des Sehens*").

That this research movement is not extinct, although dead, is shown by the fact that the latest edition of the volume just mentioned above dates from 1974, and that, here in Italy, Gaetano Kanizse published an imposing number of findings under the title "*Grammatica del Vedere*" in 1980 and that a few weeks ago another 350-page book entitled "*Vedere e Pensare*" was published containing findings from further experimental research. The death of Gestalt, if it has occurred, has led to the birth of Cognitivism or rather of a number of Cognitivisms which have substituted parts of the Gestalt theories or refuted them. The progress made by neuro-physiology has also contributed to this pattern of things. We shall see later on what remains of the original theory.

Now let us take a brief look at the basic ideas. Some are concepts, others notions. The psychology of the Gestalt school is one of the least known, even by those who think they know and understand the Gestalt theory well. The Gestalt theory never stated that the whole is greater than the sum of the parts; it never said that all depends on all, on the contrary, there is a chapter in one of Kohler's books (difficult to read because in part based on physical-mathematical concepts) which demonstrates beyond all doubt that if all depended upon all this would only lead to chaos; certain things may depend upon certain others and not upon totality, not upon "Genshait" metaphysics. This is typical of the way in which the theory is mortally caricaturised. The reason why these concepts are not simple is due to the fact that the first generation of Gestaltists were well versed in classical physics and all the physiology of their time. That is why it is difficult to catch them out as it were. One concept, or rather notion, is that of the distal stimulus; a second notion is that of the proximal stimulus; a third one is that of the peripheral stimulus, to remain in the field of vision alone which is the subject of this meeting. Then there is the notion of silent organisation and the concept of manifest organisation or of phenomenal field.

The famous concept of isomorphism is solved in a series of conceptual guidelines as far as what we might call Gestalt phenomenal analysis is concerned; we have the concept of pregnancy, the law of the minimum, references to the electric-magnetic field etc. Now I shall continue my discussion in a rather unscientific manner, because, at times, to avail of one's imagination, to use an almost visual kind of imagination, allows us to grasp the substance of things better.

What is meant by the "distal stimulus" the Gestaltists speak of? The distal stimulus is the object of physics in space and of time in physics. Imagine a metal cube suspended in an empty room; this is a possible distal stimulus for the sight. To describe the distal stimulus means to describe the material objects that populate our experiences by means of equipment that elementary physics allows us to apply to those objects. The cube will have a weight, a form, a size. its faces will be square. its sides can be measured. The distal stimulus is a list of properties regarding objects in the space-time of physics defined in terms of physical measurements. It is not within perception because perception is the last link in a chain of things that start from an object.

What is a proximal stimulus? In our case it is the projection onto the back of the eye of the properties of the cube represented or re-presentable by means of the waves which, amid all the infinite waves that are dispersed in a thousand directions, are reflected by it and manage to pass through our pupil and, having been duly inverted, reach the back of the eye. However the proximal stimulus is not what occurs within the sensitive tissues of the eye, but what we obtain by cutting this "optical flow" orthogonal an instant before it arrives at the retina. It is the projectional description of the distal stimulus in a certain point in space.

"Peripheral stimulation", on the other hand, is the sum of the processes that take place within the retina when this "optical flow" reaches it. Here the Gestaltists introduce the first erroneous

idea; seeing that from a histological point of view (at the time when they were carrying out their work) very little importance was attributed to the transversal connections within the retina while great importance was given to the single photo-sensitive units, thus leading to the coining of the expression "retinal mosaic". The "optical flow" which reaches the eye from afar, from the physical object observed, from the distal stimulus, is split up into many, many tiny tesserae corresponding to the photo-sensitive histological units, incapable of doing anything else except - according to their physiology - transmitting beyond the retina, by means of an electrical code, the properties of the luminous rays by which they were struck. If we go further into the question, to where present-day psycho-physiology is capable of revealing much, we discover a huge gap in the Gestalt theory which defines the sum of these supposed processes occurring beyond the retina "silent organisation", that is cerebral events of which we are totally unaware. The Gestaltists imagined, without having any operational proof whatsoever to support this idea, that certain processes take place in the brain capable of preparing for the transformation of the sensorial mosaic, that is, in this case, of the retinal mosaic into what we effectively see, that is into perception. Although they had rather vague ideas about the physical nature of this silent organisation, the Gestaltists entertained unshakeable dogmas regarding its fundamental properties.

Here we must pause to remember that Kohler, among other things, was very well versed in physics and had received acknowledgement from Max Planck, who had also expressed his enthusiasm for the Gestalt theory. One of the first essays which Kohler wrote on what was later to be called the theory of fields was a book on physics entitled "Physical Forms in static and almost static states". Here he examined electrostatic phenomena, the self-distribution of electric charges upon semiconductors, the flow of liquids through increasingly complex pipe systems, the fundamental properties of the membranes that permit osmosis. By means of the study of all these topics he began, quite indirectly, formulating ideas concerning the workings of the brain; not because he practised neuroanatomy, but because, due to the way the stimulus mosaics transformed themselves into veritable perception, the only solution appeared to be that of availing of the Gestalt properties of physics, especially of electric and electric-magnetic fields. After this "silent organisation", dominated by these electric-magnetic fields, by osmotic processes and other things, Kohler studied yet another level within the framework of physics: that is "evident organisation", visible organisation. Between these two levels of organisation, the concept of "isomorphism" can be placed. According to Kohler, the properties which we study when analysing our perceptions in highly simplified situations, are the properties of the underlying physical process, enclosed in the brain, in the cranium, which correspond biunivocally to the phenomena of sight or hearing. Thus, if you, when studying a visual phenomenon, notice that it changes as three conditions change, then there will be a physical process in the head which will vary according to three important conditions; there may be an electrical process, a chemical one, an osmotic one; which, we do not know, however, the rule that expresses the functional connections of the object being examined is the rule governing what happens in the brain at that moment. Therefore, it is opportune to go beyond the brain, take the objects of perception as they are in everyday experience, in the unsophisticated experience of psychophysical laboratories, in the experience of which the poet, the painter, and certainly (in that period) the cinematographical technician, speak: it is clear that cinema has played an important role as stimulant in the creation of these ideas.

First of all it is important to discover the general properties of the objects of everyday perception. It will not have escaped the notice of those who have read recent literature on the psychology of perception that all this sounds like a premise to Gibson, to the ecological view. But Gibson is the very opposite of the Gestaltists. He was the pupil and assistant of Kurt Koffka, one of the three great Gestaltists of the first generation; from Koffka he learnt above all that we need not study the sensations obtained in the laboratory to see where the threshold of a red dot on a black ground lies; we must study the objects of experience in their complexity. Gibson gives the same indication when setting forth his ecological view, which is not subjective but realistic and he gives a definition of stimulus which differs completely from that of the Gestaltists. Among other things, Gibson denies the existence of processes of any kind,

while the Gestaltists filled their theories with conscious and unconscious physical and physiological processes of all kinds. One concept that the Gestaltists introduced into numerous fields was that of "pregnancy" or "good form". Many people associate the Gestalt theory with the theory of "good form". This too is a commonplace and ought to be appropriately redefined. The original idea simply stated that when the stimuli observed are of a rather high level of complexity and contain within them, at elementary level, the elements necessary to the grasp a regular structure, it is more probable that the eye perceives this structure than the other structures which might, in theory, be drawn from the same object. The range of this concept has been over-emphasised, although it does work within certain limits.

Other perceptive processes may be interpreted in terms of maximum/minimum, of minimization or maximisation, as in Wertheimer's famous laws concerning nearness, resemblance, continuity of direction, closure, concepts that are taught in the very first pages of psychology books. Something far more important must be pointed out, that is, that the Gestaltists underlined the fact that perceptual events, besides having tendencies, besides pregnancy, besides obeying the law of the minimum etc., are always the vehicles of "tertiary" qualities, that is they always convey meaning. There is a sentence attributed to Wertheimer, which he never wrote, but which his friends always quoted and which recites, "black is lugubrious even before being black". Most of the Gestaltists who knew Wertheimer and Koffka and later made various cultural choices (for example Arnheim) greatly exploited this trend which permits one to study, at a very basic level, the purely aesthetic properties of perceivable structures. A sound or a face may be aggressive, a melody like a dish may be sweet, a thing may provoke fear or attraction. This is not true only of extremely complex objects like human faces or dance, but even, as Kandinsky has shown us, of very elementary signs, for example, a dot within a rectangle or a comma placed at the edge of a picture. These are, roughly speaking, the most important elements of the theory and we can once more sum them up as follows:

distal stimulus, proximal stimulus, peripheral stimulation, silent organisation, evident organisation, isomorphism between silent organisation and the immediate datum of experience, experience maximised or minimised in relation to its own elementary constituents, and meaning.

The greatest blow to the Gestalt theory has come from physiology of the brain which, not only has failed to prove any of the things the Gestaltists had foreseen, but has actually come up with completely different findings. Those who study the brain seriously, either from a functional point of view like the physiologists, or from an anatomical point of view, like my good friend Valentino Braitenberg, have simply not found the things prospected by the Gestaltists. They do not exist. It is as simple as that. Only once during a conference at Tubingen, a paper read by Grunewald of Tel Aviv, turned out to be an unconscious paper on Gestalt physiology. On that occasion, Grunewald carried out a curious experiment: he put the matrix of 15x15 micro-electrodes contemporaneously upon the striated area of a monkey without knowing the exact positions which the electrosensitive points would touch. To obtain directly and in real time a 15x15 matrix, however, he had used a terrible poison invented by himself capable of heightening the electrical activity of the brain. Grunewald covered the eyes of the poor monkeys he used for his experiments and connected the matrix of the micro-electrodes to a computer which transformed the electric signals from the brain into signs which appeared on the screen and I saw that when a luminous object passed in front of the eyes of the monkey, depending upon the direction and slant of the object in relation to the matrix we spectators saw a shadow that moved accordingly across the screen. This may be considered as the last echo of the cry emitted by Wolfgang Kohler when he, in an attempt to prove something similar, used electrical changes upon his own cerebral cortex (once even causing loss of sight for several days), as Professor Zuckerman of New York once told me.

The Gestalt theory can not be falsified in the sense Popper requested, because in the Gestaltist community it is impossible to say what kind of results are capable of obliging one to renounce the theory. The Gestaltists never say why they can not say because on account of the fact that

peripheral stimulation depends upon on proximal stimulation and that silent organization exists what one sees either corresponds to the stimulation or it does not. In the second hypothesis there are the "processes". But seeing that the processes are not known one can not say when silent organization is at work or when the eye sees according to classical psycho-physics. Therefore this approach, like Popper's molecular proposition: "either it will rain tomorrow or it will not", is always true, because it is an actual fact that tomorrow it will either rain or not rain. In the same way the optical illusions studied so much by the Gestaltists are cases where silent organisation is present. But in those cases where there are no illusions the eye sees according to simile; so the eye sees either "according to stimuli or not according to stimuli". This is another case of molecular proposition which is always true, pure tautology.

There is a second mortal point in the Gestalt theory which is common, however, to many of the cognitivists and to science of the brain, and that is: isomorphism is all right, but soon it becomes something of a "virtus dormitiva" after a while. Moliere in his "Hypocondriac" included an interesting scene, an examination at the Medical Faculty in Paris. There is a young man who wishes to become a doctor being questioned by the professor of pharmacology who asks him, "Why does poppy make one sleep?" He replies, "Quia in eo est virtus dormitiva" (Because it has the power to make one sleep). So the professors reply "Bene est" (Very good). The student goes on to show how good is really is adding, "Cuius est natura sensus assopire" (The nature of which makes one fall asleep). And so we have the so-called "model" and the "theory". Usually the brain scholar does more or less the same thing, and the Gestaltists in particular did so (and there is no excluding that others may do so too). The brain expert says, "Because when two lights alternate at a certain pace and at varying intensity I see movement, there must be a certain process at work, etc." If you ask him, "But why do I see that movement?", he will reply, "Because we have a mechanism in our brain that permits to do so". The man in the street may be dazzled and may believe that the brain expert has explained something. The truth is that he has explained nothing and the man in the street returns home duped. Men and animals perceive causal relationships because a process taking place in the cortex perceives causal relationships. But what conditions does this process obey? It obeys this speed, that time etc. as seen during our psychological experiments. A real case of "virtus dormitiva".

Then there is fashion too, to tell the truth. It is no longer in fashionable to speak in a certain manner, and very often it is fashionable to reformulate the same concepts using new words. This permanence of old concepts through which new words flow gives the sensation of change and so people are happy, and life proceeds. In psychology magazines today many old Gestaltist theories are wrapped in new words and sold for original ideas. But what is still living? I think that there are many things still alive which posterity may inherit and exploit to the full. I would like to begin with the following concept. How can a theory which has proven to be so vulnerable to criticism, some of which very decisive including my own, have produced so much research concerning new aspects in the field of perception? When I say "new" I mean in the sense of "discovery", that is things never noticed previously, but which turn out to be true when put to the test, even today. An unbelievable crop; there must be as many as 700 to 900 discoveries contained in the "Psychologische Forschung" regarding perception of color, of movement, of the third dimension, regarding the configuration of space, the sense of the passing of time, the fundamental relationships upon which many basic physical concepts are based: fall, causality, impact, etc. Any attempt on my part to give you an idea of all this would fail due to the immensity of the results obtained. Something is out of joint. So many products from such a faulty theory. There is the fact that the theory of form contains an implicit postulate which must be made explicit: we, in the world of sight, know little or nothing, not in the sense that we do not know what the brain does in order to transfer incoming data into the world of visual perception, which is in itself a great mystery, where little by little it gnaws at a new truth, but in the banal sense that we do not know what the visual world to be explained by means of the brain is like; let us put aside the "explanandum" of which neurophysiology, informatics etc. are the "explanans".

Here is an experiment to carry out when you are in a car at night on the motor-way. You are there on the road, driving and all is extremely banal. The light of the road-side reflectors come up to meet you as you travel forward. As you move along you read the road signs. You pay attention as they come close so as to read what is written on them, you notice that there is a bend, you stop at a station, you leave the motor way. What is there to be explained? You have perceived the road, the horizontal and vertical road indications. No, that is not true! Get up for a moment onto the bonnet of your car, with the front wheels spanning the line that divides the road into carriage-ways, observe this line and you will notice that it disappears under the car. You will discover that as it is about to disappear under the bonnet it suddenly lengthens. (This is called the "Dallenbach effect" and was made known by Dallenbach in the thirties in the USA.) Look at the reflectors that come up to meet you: very well, they come up to meet you. If you raise your eyes to look in the rear-view mirror you will see these the reflectors peripherally. They no longer come up to meet you, they simply pass by laterally, going out of sight to the left and to the right. Now look back at the road and you will see that once more they come up to meet you. Then go back to look at them peripherally and you will notice that once more they move away from each other. When you come to the exit, you will see the luminous blocks that lengthen and shorten. No such thing! The underside is always lighted while the upper side turns on and off so you will see something moving in and out. This is called "Polarized Gamma Movement" and was discovered by Kanizsa about twenty years ago. In actual fact everyone sees something emerging and then returning inwards. If you drive at a constant speed by day, the bill-boards will approach from afar, come closer, you say. This is the law of the "Prospective constants", because we have a mechanism in our brains so that by unconscious judgement, which does not exist, or by other miraculous things, we see the bill-boards come close. But look carefully at them when they are at a distance of about fifteen or ten meters; the board no longer approaches but explodes laterally, it opens up. All these things become clear if we know how to look when driving along the motorway. In the world of vision there are more things that we see in normal life.

Now one might think that a complete list of all these things has already been drawn up. No, it has not! What I say is that our knowledge covers only about 10% of the properties present in the world that surrounds us and that the remaining 90% has still to be discovered. If we do not seek we shall not find. These are the kind of facts that physiology will have to explain, and not a simplified world of sight that does not exist; this more complex world will have to be explained by informatics or by the different branches of the neurological sciences, because this is the real world of sight, not that impoverished and summarised one that we carry in our heads as our image of the visual reality.

Another important point, in my opinion, is that of the "perceptual couplings" or Bishop's functions, which are the basis of all experiments regarding sight. The fact that in immediate experiences within the field of perception one risks making this kind of discovery every second moment depends on the fact that one thing inevitably implies something else. This is "perceptual coupling". Imagine you have a red circle in a gray ground and that the circle has got clear contours. You will see a red of a certain degree of intensity. Now if you blur the contours of this circle somewhat then all the color of the circle, including that within the circle (although the luminous radiations coming from the stimulus have remained the very same) will become paler, whitish. If we change one perspective aspect of the world another is also modified. The modifications of the second is strictly implied in that of the first:  $X = f(y)$  but at times  $x = f(y, z, w, \dots)$ .

There is a story about a dying peasant who left his field to his children and told them that there was a treasure in it. So the children began to dig and dig and dig. They found nothing but the field became amazingly fertile. Many years later when they died they met their father in Heaven. The first thing they said to him was, "You said there was a treasure but we dug and dug without finding anything". The old ghost replied, "Yes you did, you turned a piece of land into fertile ground thanks to your having dug in depth".

This is the type of work that must be done in the direction indicated by Gestalt Psychology. It means changing its concepts, freeing it from physiological superstitions (above all avoiding the creation of new ones), purifying its logic, rendering it refutable; but preserving its method for the analysis of phenomena and perfecting it in all possible manners, so as to reduce that unknown 90% of which we spoke above, otherwise, with our present day physiological inventions and informatics, we risk presenting a world of perception that does not exist.