ILLUSIONS. DIFFERENT TYPES OF ERROR IN PERCEPTION

ELENA PASQUINELLI

ABSTRACT

An analysis of different types of illusory phenomena shows the usefulness of considering illusions as errors of different sorts. The current approach to illusions describes them as departures from reality, at least in the sense they present discrepancies from simple measurements with rulers, photometers, clocks and so on. Intersensory conflicts, paradoxes and the effects of ambiguous or impossible figures show some analogies with classic optical illusions, but they cannot be considered as violations of the adequacy of perception to external reality. In their case the error is immediately detected by the perceptual system, since they are experienced as bizarre or even impossible perceptions. What they seem to have in common is the presence of discrepant elements that give rise to contradictions, so to violations of the coherence of perception. I then propose to modify the notion of perceptual error in order to include violations to coherence, and not only violations to adequacy. Some phenomena related to intersensory conflicts suggest that coherence is a critical concern for the perceptual system. I suggest that incoherent percepts could be considered as impossible because of the nature of perception as an embodied activity. In fact an embodied perceptual system cannot assume more than one point of view at a time. Embodiment of the perceptual activity and the positive value of coherence in perception could then be strongly related conditions.

1. INTRODUCTION

"Perceptual illusions" is an umbrella-term which is used to refer to many different phenomena. In the tradition of the indirect perception theory illusions are perceptual *errors*, characterized by a systematic character. True perception, as opposite to illusory perception, is in this case related to a notion of truth as adequacy. But there are phenomena classified between illusions for which it is difficult to identify the characteristic discrepancy between perception and reality. It is the case of some visual paradoxes, ambiguous figures and perceptual conflicts. I think it is possible to maintain the concept of error and to include these phenomena in the family of illusions. In fact, truth can be considered not only as a question of adequacy, but, for instance, as a matter of coherence. I will sustain that perceptual conflicts and paradoxes can be put in relation to illusions in that they violate coherence, which is a form of truth different from adequacy.

I will start by analyzing the possibility of being aware of illusion. There are in fact illusions we can be unaware of and illusions of which we are necessarily aware of. In the first case, the "diagnosis" that there is an illusion can be assessed only by a second person, the observer or experimenter who knows, for example, the real length of the lines of a Müller-Lyer figure. The subject of the experience should have good reasons for measuring the lines in a Müller-Lyer figure with a ruler and then to notice that there is a discrepancy between his perception and a more precise form of evaluation of the length. Classic illusions, such as geometric illusion, include this essential element: the subject may be aware of being victim of such an illusion, but he is not necessarily so. We are normally surprised when we discover that our perceptual experience was wrong, that what we see doesn't correspond to the measured extension or shape of the figure as it was traced. There exist other illusory phenomena and perceptual experiences that imply an immediate awareness that "something is going wrong" in actual perception. In these cases the system doesn't need to measure the objective reality to state the inadequacy of perception, since the actual experience directly looks (or sounds, or feels) impossible or at least bizarre. All the conditions for detecting a perceptual error must then be available for the subject. This is not the case when the perceptual error is conceived as an inadequacy with the non-perceived reality. We then need a different concept of error if we are to consider such phenomena as illusions and illusions as perceptual errors. Proprioception provides an interesting example of the relationships between illusions and awareness that something impossible is occurring. The vibration of muscle's tendons can in fact result in errors in postural sense and in illusions of movement that can exceed the anatomical limits of flexion and extension. With the agonist muscles of the vibrated

tendons slowly stretched against its contraction by the experimenter, the subjects report positions of the limb that are incompatible with the anatomical limits of the joints. Some subjects then report "strange" sensations in the arm, as if the arm was "in two places at once", it was curving, or as if "the arm is being broken" and "it cannot be where it feels" (Craske, 1977, Goodwin, McCloskey, Matthews, 1972).

2. INTERSENSORY CONFLICTS AND PERCEPTUAL PARADOXES: THE PROBLEM OF COHERENCE

2.1 *Explicit perceptual conflicts*

There are other cases in which the actual perception can appear impossible to the subject. Let's suppose a subject looking at an illusory figure such as the spirals designed by Fraser, which are in fact concentric circles; if the figure was reproduced in a 3D form, the subject could discover by touch the "real" shape of the lines he is following by his hand and eyes (this if it doesn't exist, as in the case of many a geometric illusion, a haptic version of the same illusion). In this case he could be aware of the existence of a discrepancy between the information delivered by the two sensory modalities involved in the exploration. We can suppose he would also describe his situation as that of someone who is victim of an illusion, even if we cannot predict which one of the two sensations he would trust.

This experiment has not been done, but the situation has been interestingly explored by the literature dedicated to intersensory conflicts. We can define a perceptual conflict as the presence of two contradictory elements in one and the same perceptual

unit, so that as the production of an incoherent perceptual grouping. What happens when two discrepant intersensory perceptions coexist (that is: are combined in one and the same final percept, are ascribed to one and the same perceptual object)? As a first possibility, the subject can undergo an *explicit perceptual conflict*: the conflict is consciously accessed. In this case, the subject could report an object as feeling a certain way and looking another. This doesn't seem to be a common situation. Even if it is rare, this condition is very interesting because it shows that the perceptual system can immediately detect errors without recourse to the comparison between mental content and extra-mental reality. Something must be wrong, even if the subject, lacking knowledge to credit one of the two possibilities, cannot say where things went wrong. The subject knows that the percept must be wrong because an object cannot be ambiguously placed or determined. The errors so detected are classified as impossible percepts and are characterized by their incoherence. Are they illusions? If we conceive truth and error just in relationship to adequacy to the external reality, and illusions are errors of this sort only, then perceptual conflicts are not illusions. Nor they have nothing to do with. They state simply as a different kind of perceptual phenomena. But we have this analogy with proprioceptive illusions where the subject is immediately aware of the impossibility of his experience. And above all, the experience of conflict is described as necessarily erroneous: it immediately feels, or sounds, or looks wrong to the subject. If we enlarge the concept of error to the violation of coherence (and then we enlarge the concept of truth beyond adequacy with external reality to coherent percepts) we can consider perceptual conflicts in the family of illusions. On the other side: if we think we have good reasons to consider perceptual conflicts as related to the family of illusions,

then he should modify the concept of error in perception in order to comprehend a theory of truth as coherence.

2.2 *Paradoxes of impossible figures and other "special" objects*

In order to further develop the issue, I propose an analogy between the previous cases of "impossible perceptions" and other perceptual phenomena that are commonly classified between illusions (for instance by Gregory), such as the perception of impossible figures and impossible objects. Many of these figures and objects, such as the two-pronged trident [figure 1], use pictorial rules in order to create the impression of three dimensions, but then some of these rules are broken by other cues in the figures, so making the object impossible to construct. The illusion of an impossible figure is then provoked by the application of opposite rules: the two-pronged triangle is a possible drawing following the rules of construction of a 2D figure, but becomes an impossible object when the rules of 3D perception are applied. In other cases the same rules for 3D perspective can be used in a contradictory manner: the famous Escher's lithography *Belvedere* [Figure 2] exploits the double, conflictual interposition or occlusion of the pillars of the building in order to provoke the illusion that the building is twisted. What is feasible for a 2D drawing is impossible for the 3D world suggested.

As in the case of intersensory conflicts, we are faced to a form of error that the perceptual system is immediately able to detect: the figure looks impossible, even if the subject who sees it is not able to say where and why. As in ambiguous figures (which case we will analyze later) there is a problem of interpretation of the drawing as a 2D figure or as the 3D object it should represent. Thank to human ability to exploit the rules

of vision in producing graphic artifacts, two incompatible realities are simultaneously present in one and the same perceptual space.

2.3 *Solved intersensory conflicts*

Let's go back to intersensory conflicts. If the perceptual experiences are too discrepant for the system, and/or there are no good reasons to put them together in one only set, they are separated into two different final percepts. If not, the experiences can be suitably modified in order to give rise to a coherent final percept. We can name such situations *solved conflicts*. In the case of the perception of the extension of a square, Heller, Calcaterra, Green and Brown (1999) have shown that the discrepancy between tactile and visual information has the effect of producing a final percept which is mid-way between the visual measure and the haptic one. The final percepts which result from this activity of the perceptual system can be described as illusions, since the final, multisensory percept which is put together by the combinatory activity of the perceptual system diverges from the original unisensory building blocks that constitute it. The studies on intersensory conflict and related illusions seem then to suggest that the perceptual system has a propensity to preserve the coherence of perception whenever is possible, even if this induces errors about how things really are. When coherence is reestablished the product of perception can be an illusion, of which the subject is not necessarily aware. Illusions can then be considered as the result of an active attempt to maintain the coherence of the perceptual outcome (at least at the intersensory level), where being incoherent is a special way of being wrong. They are not only errors, but even active solutions.

2.3 *Paradoxes of ambiguous figures*

A last speaking case is that of ambiguous, multi-interpretable figures. As in the case of proprioceptive illusions of movement the subject immediately experiences that there is something strange in his perception. As in the case of explicit conflicts, the perceptual experience is in fact ambiguously double: the same figure can be interpreted in almost two ways. The two interpretations cannot be synchronic: the visual system seems to have no choice but to access one aspect at a time. As the perceptual system does with intersensory conflicts at a subpersonal level (solved intersensory conflicts), we have a special attitude through stimuli that can be "interpreted" at the same time as one and two different objects or properties: we separate their descriptions, saying that we see, now, the stimulus as one object, and, then, as another, and we call this act an "interpretation" and not a "direct perception" (this is in part the difference between "seeing" and "seeing as"). In this way we recognize that only one perceptual world can exist at a time for us and that ambiguity is not admitted in "normal" perception. It is reasonable to include such perceptual phenomena in the family of illusions in analogy with conflicts, for they consist in violations of the coherence of the world, even if the adequacy of each single interpretation is correct. This is much evident for those ambiguous figures that are also impossible figures. Impossible figures are figures that provoke a perceptual experience which is impossible in the normal perception of the objects and events of the world.

Art works such as famous M. C. Escher's lithographies *Another world* and *Relativity*, *Window* by Del Prete and many other works by Gonsalves (as, for example, *Puzzle, Treehouse, Railroad*) well represent the category of impossible and ambiguous

figures. Escher's lithographies exploit the perceptual ambiguity of impossible figures with multiple points of view. In *Relativity* [Figure 3], for example, the recreated universe is impossible because there are three different plans in which the figures are evolving. In *Another world* [Figure 4] we are faced to three coexisting perspectives on the same bird. Escher's *Relativity* and *Another world* then deal with the co-presence of two or more points of view in one and the same picture, over one and the same world: there are simultaneously represented universes that are perfectly coherent if separated, but which cannot coexist in a general coherent view (in some way as in the case of the duck-rabbit figure cited above). The three simultaneously presented worlds are connected to three simultaneous positions of the observer: three worlds in one shot, three positions of the observer in one perceptual experience. *Window* [Figure 5] by del Prete poses the same problem to perception: the picture looks bizarre not because the boy and the girl are looking to different directions, but because the window is represented as if a viewer (the painter who is reproducing a real life scene, for example) was looking at it form and from the right in the mean time, so that as if the observer was positioned into two different points of view at a time. This is clearly a perceptual impossibility. In all these cases to see an impossible world is to see the world from different points of view at the same time, which is in fact impossible in virtue of the very nature of the observer, who can assume only one position at a time. In all these cases, the subject is in fact immediately aware that there is something strange in his perception, that the experience is bizarre, in the sense that it is ambiguous or that he would describe it as impossible. Gonsalves's works seem to represent conceptual paradoxes more than perceptual impossibilities: a confusion between worlds and meta-worlds (the world of the house with garden and the meta-world

of the children making a puzzle of a house with garden [Figure 6]), between objects of the world and models of the same objects (the train and the model of the train [Figure 7]), between spatial relations (a house which is in the same time built upon a tree and next to the tree [Figure 8]). In all these cases some logical laws are violated. But it seems that the pictorial representation of the violation of logical laws is effective at a perceptual level, since when looking at these pictures we are immediately aware that there is something strange in them and that we will never see such scenes in our normal perception of the world.

In accord with the previous examples, I suggest that it is not necessary for the perceptual system to assume coherence (the absence of ambiguity) as a characteristic of the world (to make a logical assumption or to learn it from experience), since this condition is inscribed into the nature of the perceptual system. The perceptual system in fact does not have "a view from no-where" but always develops its activity from a certain point of view. A static viewer looks at an object from the left or from the right of the object. For a human perceiver the world he sees is that of a train or that of a boy playing with a model of a train, because the human perceiver can participate to only one world at a time.

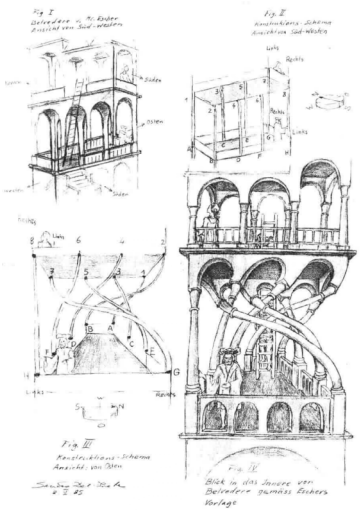
3. Conclusions

It seems useful to accept the general description of illusions as a particular type of perceptual errors, but the notion of error should be suitably modified in order to include a sort of "coherence theory of truth" adopted by the perceptual system. The coherence of the perceived reality seems in fact to represent a very important issue for the perceptual

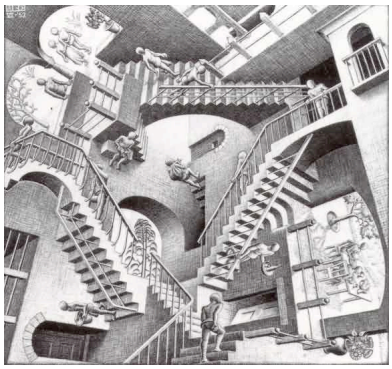
system, if it actively displays solutions to produce coherent complex percepts even from discrepant stimuli. Sure, coherence has a positive adaptive value, in that incoherent percepts have the effect of inhibiting the action of the subject: it is difficult to program an action in an ambiguous world with objects that are, for instance, in the same time little and big, to catch rabbits that are even ducks and so on.

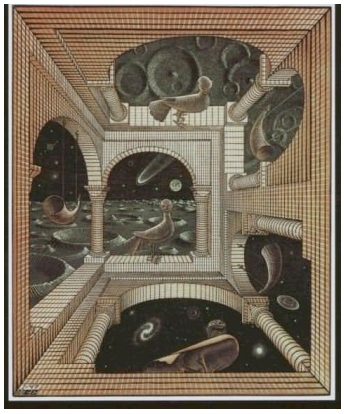
We can also look at the problem of coherence from another point of view. The presence of two simultaneous, discrepant worlds (the lack of coherence), in fact, can be described both as the presence of two discrepant stimuli and as the co-existence of multiple points of view of the observer on one and the same scene or object. The coherence of perception, and the description of incoherent percepts as impossible, could be a consequence of the nature of perception as an embodied activity. Embodiment means that perception cannot assume more than one point of view at a time, that it is impossible to see or touch the world from more than one position. An embodied perceptual system cannot set itself free from the necessity of being placed in a point of view on the world. That is why figures with multiple points of view constitute a problem for perception and strike it with their impossibility. Not the figure is impossible (in fact it exists), but to see an object of the real world in the way the figure suggests we could do. Embodiment of the perceptual activity and the positive value of coherence in perception could then be strongly related conditions.

[Figure 1. Del Prete's *Three candles*]



[Figure 2. Del Prete's Escher's Belvedere Explained]


[Figure 3. Escher's *Relativity*]


[Figure 4. Escher's *Another world*]


[Figure 5. Del prete's *Window*]


[Figure 6. Gonsalves's *Puzzle*]


[Figure 7. Gonsalves's *Railroad*]


[Figure 8. Gonsalves's *Treehouse*]