

4 RELATIONSHIPS BETWEEN IMAGERY AND PERCEPTION

A thesis defended by many supporters of mental imagery, as we have touched on in previous paragraph (pr. 2.1.2 and 2.2) (Kosslyn and Swartz, 1977; Kosslyn, Brunn, Cave and Wallach, 1984; Kosslyn et al., 2006), is that imagery is an activity closely related to visual perception. There are functional and structural similarities between perception and imagery suggesting that the two faculties share resources and cognitive processes. This would explain why the experience elaborating something in visual imagery is similar to seeing something which is outside on mind. We have to consider experiments showing a close similarity between imagery and perception are controversial, since the same finding can sometimes be explained by two opposing viewpoints.

4.1 Imagery and perception

It is a controversial question whether, despite the surface resemblances, imagery is a sui generis phenomenon, conceptually quite distinct from true perceptual experience, or whether imagery and perception differ only in level rather than in kind.

Some scholars, such as Hume (1740), hold that percepts (impressions in his terminology) and images (ideas) do not differ in kind, but only in their causal history and their degree of “vivacity” or vividness. This view has frequently been criticized, (recently, for example by McGinn 2004; Savage, 1975; Warnock, 1976). An alternative view, explicitly defended by some scholars (Jastrow, 1899; Savage, 1975; Thomas, 1997), is that imagery lies at one end of a spectrum starting from veridical, highly stimulus-driven and stimulus-constrained perception, to “pure” imagery (where the content of the experience is generated entirely by the subject and is quite independent of any current stimulus input). Several varieties of imaginative perceptual experiences may be taken to fill in the continuum between these extremes:

mistaken or illusive perceptions (imagining, for instance, that the bush seen indistinctly in the darkness is a bear) and various types of non-deceptive seeing as or seeing in (such as imagining a cloud to have the shape of a camel, weasel or whale). Other scholars, however - such as Reid (1764), Sartre (1936), Wittgenstein (1967), and McGinn (2004) - argued that there is a sharp conceptual and phenomenological distinction to be drawn between imagery and perception. Our imagination is argued, unlike our perception, is under the control of our will (and experienced as such). Provided I know what an elephant looks like, I can choose to imagine one wherever and whenever I want, but I cannot choose to see an elephant unless it is actually present. By contrast, if an elephant is present in front of my open eyes, I cannot help but see it, whether I will or no. Furthermore, it is claimed that (in sharp contrast to perception) we can derive no new information about the world from imagery: no image can contain anything except what the imager put there, which must already have been in his or her mind (Sartre, 1940; Wittgenstein, 1967). This negative view of the epistemological value of imagery is rejected by Kosslyn (1980, 1983), even if there is a genuine and important insight underlying what Sartre and Wittgenstein say. The information we can derive from imagery is of a different sort, and is derived in a different way, than what we get from perception.

According to Mckellar (1954), mental imagery, even though constructed with sensorial source material, would be subordinate to different perceptual processes. The mind, in fact, could process the items offered by senses independently from their origin. In the case of creativity, for example, the mind would join and connect perceptual elements giving them new forms and restructuring them in order to produce new results. Mac Kellar distinguishes two types of thinking: the A-thinking (autistic thinking) R-thinking (realistic thinking). The first one is characterized by lack of adequacy to reality and lack of logical constraints (oniric, hallucinatory images etc) whereas the second is characterized by the constant referring to reality evidence and compliance with physical laws.

4.2 Characteristics of equivalence

Several studies (Bagnara et al., 1988; Denis, 1991; Farah, 1988; Finke, 1980/1989; Massironi & Korea, 1995; Kosslyn, 1980,1983 1987) investigated the relationships between imagination and vision. Convincing results were obtained by means of tests on perceptual illusions (Berbaum, Sup Chung, 1981; Wallance, 1984; Cerf – Beare, 1993; Giusberti, Korea, 1995) Gestaltist laws (Kosslyn, 1983, 1990; Tye, 1991; Roskos-Ewoldsen, 1993) and ambiguous figures (Peterson et al., 1992; Kaufmann and Helstrup, 1993).

Data emerging from these studies supported a strong correlation between results in visual perception tasks and those obtained in mental imagery and such a concordance led to postulate their intimate relationship. Finke's (1980) work in represents the theoretical starting point about the presumed "equivalence" between imagery and perception. Finke's claim starts from some information relating to visual perception: that the processing of information coming from the environment takes place at different levels of the visual system. Works like those of Hubel and Wiesel (1977) of Marr (1978) and Posner (1978) demonstrated this. Moreover, knowledge relative to objects in the physical world participates only in the higher elaboration levels of visual information processing, while at more peripheral levels of visual system the information is processed only by basal mechanisms of vision itself, totally independent from knowledge or from subject's expectations. Imaginative function involves the activation of different processing levels comparing to the visual system; this would mean equivalence between visual and imaginative systems only for some stages, without influence of conceptualizations, knowledge and expectations. The question is therefore to identify the relationships between the two functions, within two distinct levels of information processing: one higher and central, one more intermediate and peripheral.

4.2.1 The McCollough Effect

A well-known effect in visual perception is that of persistent images (afterimages): sometimes, watching for long time a very intense stimulus, a percept continues to persist for a few seconds even if we close our eyes. In some cases, especially if the

stimulus is characterised by very intense colours, the permanent effect is a coloured image complementary to that of the stimulus. Considering, for example, the McCollough (1965) effect: if you look for several minutes to horizontal black and red bars alternately to vertical black and green bars (the complementary colour), it happens that when fixing later black bars on a white background, horizontal bars appear on a slightly green background, while vertical bars are perceived on a slightly red background. The after-effect keeps the directionality of the bars, but transforms the colour in its complementary. Information concerning colour is processed in a different stage than orientation data, and so at a lower, peripheral level of visual system. If imagery and perception functions are functionally equivalent, it should be possible, under certain conditions, to use the image as a substitute of perception and then, for example, obtain after effects even in an imaginative situation.

Finke and Schimdt (1977) created for these purpose two experimental conditions: in one the participants had to imagine alternately green and red colours while they were shown vertical and horizontal achromatic bars. In the other, instead, they had to imagine vertical or horizontal bars, while they were shown red or green fields of view. All subjects participated in both conditions, simulating the typical adaptation procedure which precedes the McCollough effect. A forced choice procedure was used, because of this kind of effect is weaker than usual after effects: subjects were presented stimuli containing vertical and horizontal achromatic bars and asked them to choose, among them, those that seemed more intensely coloured with one of the colours presented previously. At the end of the experiment they were also questioned about the type of strategy used to provide the answer¹. Results showed that McCollough effect occurred almost exclusively in the "imagine the colours" condition. An effect due to the use of complementary colour in the adjustment phase highlighted.

¹ This procedure led to a data analysis was conducted on about half of subjects, because remaining ones, thinking it was a memory task, had tried to connect the colour (red/green) to orientation (vertical/horizontal).

The first doubt about these experiments is methodological: the use of forced choice and elimination of more than half of the subjects due to induced responses do not give confidence on the reliability of data. Moreover, it is legitimate to assume that there is some kind of difference between the image obtained in the "real" McCollough effect and that obtained in Finke and Schmidt's (1977) work. Elements of difference are detected in Kaufman, May and Kunen's (1981) work. They claimed that only the object's features you are perceptually aware can be imagined. This seriously calls into question the hypothesis that imaginative function involves the activation of receptor mechanisms belonging to the visual system. Also Rhodes and O'Leary's (1985) contribute to raise doubts about this hypothesis. Subjects had to imagine, for several minutes, gridlines consisting of horizontal and vertical bars. Subsequently real weakly gridlines were presented to them: the difference of orientation between perceived and imagined bars do not influence at all detecting threshold that does not undergo any change, therefore if there is interference there is no equivalence.

4.2.2 Interference between perception and imagery

Important information comes from the use of the selective interference paradigm. Perky's (1910) experimental participants look at some projected objects in front of them, so extremely weak, and simultaneously it was required to mentally visualize them: the effect is some kind of confusion between image and real picture in the sense that one is mistaken with the other. Similar results were found by Segal (1972), who showed how some features of the weak projected figures are incorporated in mental image. The interference phenomena were studied in particular by Brooks, whose work (1967, 1968 and 1970) concerned the interference between imagery and perception in spatial visualization tasks. In a first experiment subjects had to remind the position, inside a squared matrix, of certain letters. Descriptions could be heard or read. In the control condition subjects had to listen or read meaningless descriptions, that is syntactically similar to the previous one, but containing, in place of adverbs or adjectives of location, words without spatial reference. It was shown that while in the experimental situation reading descriptions interfered with the

memory of letter position, in control condition listening had a higher interfering effect. This means that the visuo-perceptive task of reading disturbs the spatial visualization more than a not visual task like listening. A similar result was obtained in 1970, showing interference between a reading task and a mental rotation task. A last question remains: first of all is interference selective? Is it involved exclusively in the spatial aspects of imagery or even in figural aspects? Moreover does also the inverse phenomenon occur? Does imagery interfere with perception?

Segal and Fusella addressed these questions in a very famous work (1970). Participants had to imagine sounds or objects of various kinds. Simultaneously various geometric shapes or various tonalities of a sound were presented to them, in a detection of the signal task. Results showed that visual sensitivity decreases consistently when subjects were asked to imagine objects, but not when they had to imagine sounds; equally the acoustics sensitivity was strongly influenced by the task asking to imagine sounds, but not by the task asking to imagine objects. This leads to the conclusion that when using the imaginative function concurrently with the perceptual one, there is like an appropriation, by imagery, of some mechanisms of perceptual information processing. Imagery would therefore use not similar, but just the same processing involved in visual perception: so visual perception would suffer a sort of impoverishment due to the contemporary work of the imaginative function.

4.2.3 Facilitating effects between imagery and perception

Neisser (1981) claimed that images are derivatives of perceptual activity, and that in particular they are anticipating phases of that activity. This leads to the hypothesis that imagining an object, an event, a picture, could facilitate its detection or identification. In an experiment by Farah (1989) subjects had to mentally project some letters ("H" and "T") on a matrix of 5x5 squares. On the same matrix, in some tests, asterisk was displayed for a short time. The asterisk could fall both outside and inside of squares "occupied" by the letter image. The task was to decide whether the asterisk had appeared or not: the decision was more accurately when the stimulus was within the image. In another experiment subjects were shown the same matrix of squares where marked letters, that could be seen both as "T" or "H" appeared and

asked them to focus on one of the two. As in the previous experiment, an asterisk was then displayed, for a very short period of time: again, the concentration upon a letter facilitated signal detection inside of that letter, exactly as if you mentally projected an image. Therefore mental images change perceptive process characteristics in those areas of the visual field in which they are projected. In fact this improves, in that area, the stimulus detection ability: we have a facilitating effect of imagery on perception, which can result from priming of perceptual channel during the imagery task. From here the hypothesis that imagery, at least at this level of processing, can be defined as a kind of attentional state, an active process that makes the subject ready to receive information.

The review of the literature about the relationships between perception and imagery is not devoid of contradictions. On one hand some works showed the presence of facilitation effects, on the other hand it is instead detected an interfering action of imagery on perception. It is possible that this contradiction depends on several factors, such as the intensity of the stimulus, the type of perceptual judgement, the degree of correspondence between the imagined and perceived objects.

4.3 The stages of visual information processing and the relationships with imagery

The equivalence between perception and imagery appears to be questionable at the earliest levels of information processing. At this stage the primary, basic characteristics of the perceived object, such as color data are extracted, processed and elaborated. This would mean that the imaginative function doesn't participate in the early stages of perceptual information processing. The Marr's model (1982) asserts the existence of at least two levels of processing. The first stage works in an automatically, preattentive and simultaneously way, so involving the whole visual field, and processes in parallel: it is therefore independent from the will and extremely fast. The second stage, on the other hand, uses a certain amount of attention, follows a sequential mode and depends on the will.

Massironi (1998), while defending the functional peculiarities of imagery, maintains its independence from perception for architectural reasons, supported by experimental data. The substantial difference between imagery and perception is due to the nature of vision, which is a precategorical, preattentive activity which processes autonomously the visual input. The output of perceptual processes is only “middle-elaborated”, and is subsequently processed by refining processes, that operate substantially as filters, which forward a smaller and precise amount of information to cognitive central system. An interesting argument advanced by Massironi draws attention on a point of view often overlooked: perception not only works in cognitive central processes, but can serve also as direct interface between the world and the motor system. For example, in activities requiring a rapid response, subjects are able to produce performance of extraordinary effectiveness and precision without the mediation of central processes. This certainly depends not only to the nature of these processes but also on the richness of information, available at the level of primary visual processes. On the contrary, information conveying to higher levels is considerably filtered. Imagery processes stay in working memory and are based on filtered data, processed by lower visual components, and on data already available in LTM. The imagery activity is, as Massironi says, a form of thinking, a “visual thinking”. Thinking is something else from seeing, for at least two reasons: firstly, mental images are “blind” to physical stimulation; on the other hand they benefit from access to central data. The overall picture drawn by Massironi appears convincing enough with a residual doubt concerning his propensity to identify visualization with primary vision. The limitation of vision to the so-called primary visual processes appears an extreme hypothesis but this point is not so crucial to evaluate the value of Massironi's theoretical framework. His argument is that the processes, that essentially compose imagery, are central, while the vision processes of vision are peripheral and the first ones do not have access to informational resources of the second ones but only to their outputs. It may be that vision involves, for example, recognition, but its crucial part is formed by primary vision processes and so it may extend at most to include the extraction of shape.