COGNITION IN DYSCHIRIA: EDOARDO BISIACH’S THEORY ON MISCONCEPTION OF SPACE AND CONSCIOUSNESS

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Abstract

In this paper an overview of Bisiach’s theory on mental representations and consciousness is presented. It firstly shows how neuropsychological observations on space disorders have lead Bisiach to consider iconic representations (as opposed to symbolic representations) as truly ‘cognitive’, insofar as they are necessary for a good functioning of linguistic processes.

Also Bisiach’s approach to the scientific study of consciousness, conceived both as the private aspect of phenomenal experience and as a monitoring processes, is discussed.
A brief introduction

To write about Edoardo Bisiach for this special issue of Cortex is a great pleasure, but also a great responsibility. Bisiach’s contributions to psychology, neuroscience and to philosophy of mind are vast and important and I hope that the kind of survey I have chosen to carry out regarding some of the most challenging aspects of his work won’t be reductive of his thought.

I will not review Bisiach’s experimental papers; they are very well known and they inspired most of the research on spatial disorders in the last twenty years. Instead I have chosen to remember some of the most theoretical contributions of his production that, although being milestone for people who try to fill the gap between neuropsychological findings and mind models, may be less familiar to scientists not directly involved in this topic. In fact, I do not mean to carry out a systematic and exhaustive review, but simply to recollect the most significant aspects of Bisiach’s theoretical papers.

An important aspect of Bisiach’s approach is that he designed experiments not only with the aim of acquiring knowledge on, and formulating detailed descriptions of, a particular kind of neurological deficit (i.e. unilateral neglect or dyschiria, as he proposed to call the complex ensemble of neglect disorders, see also Bisiach and Berti, 1987), but also used neuropsychological data related to misconception of one side of space for advancing original hypotheses about the format of cognitive representations and the structure of conscious processes.

Neglect as a cognitive disorder

As regards the format of cognitive representation, Bisiach’s arguments, based on the observation of neglect patients’ behaviour, caused an important change in perspective in relation to what kind of
representations must be considered ‘cognitive’. He pointed out that in psychological and neurological literature the involvement of higher mental functions was seldom considered when neglect and related phenomena were observed and described (e.g. Bisiach, 1993). The status of ‘cognitive’ disorders was usually ascribed to language (i.e. symbolic) disorders only. This prejudice was certainly due to the analogical, sensory-like distribution of neglect symptoms in the extrapersonal space. However, the results of many Bisiach and coworkers’ experiments, starting from the very famous observation that left hemineglect patients omit left side details, not only when processing on-line information but also when describing a familiar landscape from memory (Bisiach and Luzzatti, 1978; Bisiach, Luzzatti and Perani, 1979; Bisiach, Brouchon, et al., 1994), have shown that the topological relationship between the damaged brain and the disturbed part of environment also held when neglect manifest itself in mental representation originating from within the nervous system. Therefore, the disturbance is not confined to low level perceptual systems but involves an imaginal system of coding. On this basis, Bisiach criticised the attempts to dismantle the notion of iconic mental images as non-cognitive (e.g. Bisiach, 1992: Bisiach and Berti, 1990). Moreover, he noted that damage to that system of representation interacts with high level operations, causing abnormalities even in language and thought processes. Indeed, language function can be primarily affected by damages to the imaginal system as in the case of neglect dyslexia (where patients omit to read the left part of a word) or in the case of errors in spelling words (where the mental representation of the word is affected) suggesting ‘an implicit dependence of language on a visuo-spatial analogue’ (Bisiach, 1988a). This dependence of symbolic functions upon analogic representation is even more dramatic when one considers the productive aspects of unilateral misrepresentation observed in neglect patients. This may range from completion phenomena in the linguistic domain, where patients can read ‘train’ as ‘brain’ or ‘right’ as ‘bright’, to complex somatoparaphrenic comments, as those observed in anosognosia for hemiplegia. In this latter disturbance right brain damaged patients, when asked about their motor problems, produce personal
reports that have striking non-veridical components. They may simply claim that their plegic arm can still move or they may produce fantastic confabulations about their arms and legs. As noted by Bisiach (1988a), what is really astonishing is that outside the pathological enclave cognitive-linguistic processes remain unaltered, but totally unable to correct the production of pathological thoughts. According to Bisiach’s interpretation (1988a), cognitive-linguistic processes, misfed by damaged non-verbal representations, do not function properly\(^1\). Therefore, Bisiach’s ‘provocative’ proposal was that not only analogical (non-symbolic) representation are \textit{cognitive}. They are also \textit{necessary} for a good functioning of symbolic processes that, as showed by the observations on neglect patients, do not qualify as autonomous representational system. On the contrary, the disorder that underlies neglect symptoms, not confined to the operations of an analogical device subserving earlier stages in accessing and processing spatial information and pointing to the concomitant failure of logical operations performed on the database incorporating the representation of space, definitely qualifies neglect as a truly cognitive disorder (see Bisiach, Berti, Vallar, 1985).

\textbf{Consciousness as an object of scientific inquire}

After the first publications on representational neglect and the initial studies on anosognosia for hemiplegia, both of which induce reflections and raise questions about patients’ awareness, Bisiach and Marcel organised a meeting in Como (Italy, 1985) with the intention to discuss and confront, amongst scientists coming from different disciplines, many issues related to the problems of referring to consciousness as a proper topic of study and to that of its explanatory use. A book arose out of the meeting: ‘Consciousness in contemporary science’ (Marcel and Bisiach, 1988), where various authors made explicit their different theoretical positions regarding the concept of consciousness. In the
introductory chapter, Marcel and Bisiach (1988) debated about the term ‘consciousness’, arguing that sometime it is used “in a functionalist way, so that it is equivalent to concept such as attention, short-term memory, representation, control, or what people can assert verbally” (pg. 3), whereas in other cases it is used to refer to “phenomenological concepts, such as subjective experience, qualia, the content of awareness, intentionality, or personal unity” (pg. 3). Marcel and Bisiach underlined that when the concept of consciousness is used to denote phenomenal experience then many authors argue against the possibility that consciousness can be studied within the frame of scientific research due to its private and subjective quality. In that book, while Marcel’s position was exemplified by the affirmation “…If we did not have phenomenal experience we would not have a concept of consciousness at all” (Marcel, 1988), Bisiach’s view (Bisiach, 1988b) was that consciousness cannot be studied as first-person phenomenal experience but that it can only be considered within the frame of functionalist models as a monitoring process. Bisiach considered phenomenal experience “inaccessible to the external observer (pg. 102)” and therefore not conforming to “the scientific requirement of public observability (pg. 103)”. The position, here, was very neat and definite and, in a certain sense, strange if one considers that, as a clinical neurologist, Bisiach had everyday experience of the most fantastic and intriguing subjective reports related, for instance, to the denial of illness or to the productive misrepresentation of somatoparaphrenic patients (see, for instance, Bisiach Meregalli and Berti, 1990). The outright dismissal of patients’ reports as part of a phenomenal experience that is impenetrable to public observation is very hard and even unreasonable (as Bisiach himself stated later, 1999), for someone who is involved in neuropsychological research. Indeed, in 1992, Bisiach wrote “Suspicion about consciousness as an object of scientific inquiry is rooted in the cultural prejudice due to which we regard physics as the paradigm of science par excellence” (Bisiach, 1992, pg. 113). And added “This prejudice may lead us to legislate away subjective experience from the scientific domain – a solution with which I have formerly sympathised”. Thus, in this paper, a change in perspective
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appeared and Bisiach argued that although each of us has a personal ‘point of view’ and, therefore, the bat has its own ‘experience’ (Nagel, 1974) and we have our ‘own’, these are not good reasons for eliminating experience from the scientific domain. Instead, he claimed that people who do not repudiate their own consciousness may legitimately develop a specific scientific interest in it. Bisiach’s change of perspective was so radical in this chapter with respect to the 1988b paper that the term consciousness was used as synonymous of phenomenal experience. Of course, there can be methodological problems in studying phenomenal experience, but the author affirmed that it does not matter if to recognise consciousness as a proper object of scientific inquiry implies the extension of the paradigm of science beyond that of traditional physics. The study of the mind is considered, in this view, as most problematic, but possible, and it is our conception of science that would need to be adjusted and developed.

One of the possible methodological problems is how to test the subjective aspect of consciousness. Bisiach suggests the following move: we can make use of the introspective reports of other people ascribing phenomenal experience to them by analogy with the phenomenal experience of the observer. In Bisiach words: “granting phenomenal experience to other people is the only possibility we are given to learn indirectly about consciousness when we study the consequence of brain lesions (unless we were ourselves suffering from dysfunction such as blindsight or unilateral neglect)”, Bisiach 1992, p. 115). Introspective reports are in this view data “i.e. legitimate candidates for explanations in their own right or as independent variables in psychological or neuropsychological research” (Bisiach, 1999).

Although in 1999 Bisiach again distinguished between ‘consciousness’ as a term that captures the ‘unitary selfhood of phenomenal experience’ on one hand, and ‘consciousness’ as a term used to designate “the coherent, actual or possible, monitoring of any mental content throughout the whole spectrum of available behaviour open to public observation” (Bisiach, 1999) the distinction operated
between phenomenal experience as a private domain and consciousness as a monitoring processing, did not, however, lead the author to dismiss phenomenal experience from the field of scientifically legitimate research. Keeping in mind that there cannot be a science of those aspects of private feeling that tell us what it is like to be some other subject or of those aspects that are manipulated in thought experiments, such as those on qualia inversion, we may, however, take advantage of the subjective component of different neuropsychological syndromes for studying many aspects of conscious processes.

In conclusion, we can study the manifold aspects of consciousness both by acquiring data through experimental research and by obtaining information (and even inspiration, Bisiach, 1999) through subjects’ personal reports.

From neglect to the structure of conscious processes

The theoretical position outlined above influenced Bisiach’s experimental research.

When consciousness is considered as a monitoring process then many questions can be posed such as: the kind of information processing needed to achieve a conscious representation of an event, the ways in which that information processing is implemented in the brain, or the interaction between conscious and (apparently) non-conscious processes (Bisiach, 1999). Also the problem of the structure of conscious processes and the timing of consciousness can be addressed (see below). On the other hand to accept first-person reports as informative, if not demonstrative, of those aspect of consciousness that constitute the subject’s private experience may shed light on the organisation of the processing that underlie that experience.

First of all, starting from the observation on the characteristics of neglect symptomatology
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Bisiach affirmed that consciousness must have a spatial structure because it can be shown that it is assembled from different neuronal activities distributed in different brain centres. These centres work more or less in parallel and follow “a complex interactive schedule by which . . . the content of consciousness is continually restructured” (Bisiach, 1992). When Bisiach refers to consciousness as a process distributed in neural space he does not only refer to the fact that there is a horizontal separation amongst various sensory modalities (e.g. Gentilini, Barbieri et al., 1989; Vallar, Rusconi et al., 1991; Beschin, Cazzani et al., 1996), or amongst discrete spatial representations (e.g. Halligan and Marshall, 1991; Cowey, Small and Ellis, 1994), mapping different sectors of the perceptual world, but also to the vertical organisation of conscious experience along the input-output axis of the sensory pre-motor integration, shown by many neuropsychological findings. This latter dependence of consciousness on such an interaction is demonstrated, for instance, by the effect that the modality of response has on awareness of stimuli in neglect patients. There are many examples in the neglect literature of such an influence on the emergence of neglect (for a review see Bisiach and Berti, 1995). One situation in which the kind of response requested by the task modulates the emergence of consciousness has been described by Bisiach and coworkers (Bisiach, Vallar and Geminiani, 1989). They showed that, when the measure of awareness is the detection of contralesional stimuli, detection appears to be more impaired with manual choice-reaction time responses than with verbal responses. Other examples of the dependence of perceptual awareness on response modality is given by many results in experiments where detection of contralesional and ipsilesional stimuli is influenced by pre-motor factor, such as directional hypochinisia (see for instance Bisiach, Geminiani et al., 1990; Bisiach, Berti and Vallar, 1985). In these cases when a manual act is requested towards the sector of space affected by neglect, the perception of the stimuli located in that space seems to be more impaired than when the manual response to the same stimuli is requested in the ipsilesional space. Examples of the role of response mechanisms in gating access to consciousness are now very numerous and they cannot
be reviewed here. The point made by Bisiach (1992; Bisiach and Berti, 1995) was that whatever is the correct explanation within the frame of neglect syndrome for this kind of reduced rate of detection of neglected stimuli with a particular kind of response modality, these data show that conscious experience of the external world is the result of the different information processing systems related to the whole situation in which the stimuli are perceived, confirming that the mechanisms by which conscious experience is achieved are widely distributed in neural space and are divided into several processors.

Another point put forward by Bisiach and coworkers is that of the relativity of the timing of consciousness (Bisiach, 1992; Bisiach and Berti, 1995). The distribution of preconscious processing in different brain processors gives rise to the possibility of rearrangement of what is being experienced by the subject. In an experiment carried out in right brain-damaged patients with neglect (Bisiach, Berti and Vallar, 1985), patients had to respond to 200-ms illuminations of red or green diodes. Diodes could be flashed either to right (good) or to the left (impaired) visual field and the patients had to press a lit response-key of the same colour of the flashing diode. There were four response keys: two on the left and to on the right side of the apparatus that lay in front of the patients. On each trial two of the response keys, one green and one red, simultaneously lighted, one for each side of the panel. The patients were instructed to keep central fixation while the diodes flashed. After their appearance the patient was free to move his eyes and press the response key corresponding to the colour of the flashing diode. The rate of correct responses to left side stimuli was in general very low in neglect patients and even more so when the response had to be given on the left side (i.e. when the response key lighted on the left side). In other words, awareness of left side stimuli was diminished when the response action was required on the neglected side (an instance of directional hypochinesia). Reaction to stimuli presented to the right side were almost always correct when the response was required on the right. However, when the response to right side stimuli was requested to the left, the number of errors
increased (i.e. patients either press the unlit key or the key of the wrong colour, both of which were on the right side of the panel) and sometimes patients did not gave any answer at all. In other words, the overt behaviour of the patients suggested a misperception of right side (good!) stimuli whenever the response was requested towards the left side (impaired) space. This behaviour was particularly evident in one patient, patient F.S., who, in such trials, explicitly denied the presence of any stimuli on the right. Right stimuli were instead responded to without error (and, therefore, phenomenically perceived) when the response had to be directed towards the right side of the panel. Considering that in this experiment the side of manual response was known only after stimulus presentation, it appear that in trials where right side stimuli were denied, gating of ‘normal’ sensory information out of consciousness (out of phenomenal experience) originated after the stage of colour identification. According to Bisiach (Bisiach, 1992; Bisiach and Berti 1995), this can be taken as evidence of diacronical mechanisms underlying consciousness that, through reentrant influence (Edelman, 1989), give rise to dissociations between awareness of stimuli when its sensory processes is part of an intact stimulus-response cycle and unawareness of the same stimuli when that cycle is interrupted at the level, for instance, of the access to response. In this sense, Bisiach proposed the idea of a continuous rearrangement of the content of consciousness.

Other examples of dissociations of awareness that Bisiach studied in order to shed light on the composite spatio-temporal structure of consciousness can be observed in the somatic domain. Patients with right-hemisphere damage and contralateral hemiplegia may deny their motor disorder (anosognosia) claiming that nothing is the matter with their arms or legs. Once established that the disorder can be studied within the frame of cognitive science and that an explanation in term of psychodinamic reaction is unsatisfactory (see Bisiach and Geminiani, 1991; Berti, Ládavas et al., 1996), Bisiach underlined the fact that in clinical practise it is quite common to observe different anosognosic behaviours that suggest nonconscious representation of the actual pathological status of
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the patients. For instance, patients who deny their inability to move do not remonstrate for being bedridden and may show a total lack of intention to engage their affected limbs in everyday activities (other patients may present with the opposite behaviour: they may verbally acknowledge their disturbance but try to get out of the bed). In other cases when patients who resolutely deny their motor problems are asked to rate on a 10-point scale their ability to execute either bimanual or bipedal actions or monomanual actions with the left hand and leg they judge their ability to be reduced or severely impaired, giving very low points to such ability (Berti, Lâdavas et al., 1996, Berti, Lâdavas et al., 1998). While there are instances in which phenomenal experience of unconscious sensory information seems to be indistinguishable from the case where there is a complete absence of stimulus processing (as with nonconscious priming effect in neglect patients, e.g. Berti and Rizzolatti, 1992; Lâdavas, Paladini and Cubelli, 1993; McGlinchey-Berroth, Milberg, et al., 1993; Driver, and Vuilleumier, 2000), cases like the ones just described in anosognosic patients suggest the existence of different streams of consciousness, individually endowed with phenomenal experience, in relation to the same physical event (Bisiach and Berti, 1995). This conclusion make any “conjecture that consciousness is achieved in a certain focal point, a phrenologicl module reminiscent of the Cartesian pineal gland and endowed with the unique and exclusive function to get mental content alight (Bisiach, 1999, p.675)” implausible. Indeed “…psychological and, much more conclusively, neuropsychological research supports the contention that full consciousness in information processing term is indeed the result of a decomposable complex of devices monitoring mental content with no common terminal” (Bisiach, 1999, p.676). Therefore, consciousness is not the prerogative of a central executive component of the mind, hyerarchically superimposed on the other cognitive systems. The dissociation of consciousness found in neglect and related disorders suggest, instead, that a person’s mental states, at a given moment, are co-conscious and that, although individually endowed with phenomenal experience, they are kept separated from one another within the stream of consciousness (Bisiach and Berti, 1995). This
separatness allows a discrete brain lesion, that causes the breakdown of a single chain of brain events, to reveal the composite structure of conscious processes.

**Concluding remarks**

Bisiach’s interpretations of neuropsychological data on neglect and related disorder contributed to a deeper understanding of the format of cognitive representations whereas his informational approach to consciousness, focusing on ‘the coherent, actual or possible, monitoring of any mental content throughout the whole spectrum of available behaviour accessible to public observation’ (Bisiach, 1999), contributed in a determinant way to the clarification and enrichment of the concept of consciousness and to the scientific study of phenomenal experience itself.

I have not mentioned some recent papers related to the study of the extensional characteristics of the **representational medium** because they were, I think, beyond the scope of this article. However, it is worth remembering that some data recently collected in neglect patients by Bisiach and his coworkers (e.g. Bisiach, Ricci and Neppi-Modona, 1998; Bisiach, Neppi-Modona, Genero, 1999) suggest that brain damage to the spatial representational system produces a left-right anisometry of the representational medium such that the grain of the latter is relatively compressed towards the ipsilesional side and progressively expanded or relaxed towards the contralesional side. This anisometry seems to affect, in important respects, the disorder of spatial consciousness shown by neglect patients and in future research it will have to be taken into account in order to explain the structural aspects of consciousness itself.

Bisiach’s contributions to the study of mind are not limited to the ones I have cited. However, my desire was simply to remember the different fields of knowledge in which Edoardo Bisiach was
involved and also to pay a homage to someone who I consider my ‘maestro’. Maybe in this very moment he would prefer to receive the last rare hybrid of a plant of roses (I do not think it would be indiscreet if I say that gardening is at present one of his many interests and I would like to add that what characterised Bisiach’s approach to neurological cases, i. e. the intellectual curiosity, the desire of knowledge, and, of course, the scientific method, also characterise Bisiach’s approach to gardening) than to be reminded of his theoretical positions on representation and consciousness. But I am very happy to have had the occasion of going, once more, through his impressive papers. I am only worried of what he may think about the idiosyncratic and incomplete review I have done on his works. And even more so because I was one of his students and I had the unique opportunity of beginning my working experience collaborating in some of his research projects. I would like to conclude saying that being one of his students has been a great privilege for me. Maybe I did not deserve such a fortune but, from my personal point of view, that was a great phenomenal experience!
REFERENCES


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\[1\] A model of both negative and productive aspects of misconception of space has been proposed by Bisiach. To describe it in details goes beyond the aim of this article. For those who are interested in the modelling of spatial disorders see Bisiach, Meregalli and Berti, 1990 and Bisiach, 1995.