Optic Aphasia: A Process of Interaction Between Vision and Language

Marie-France Beauvois

Email alerting service	Receive free email alerts when new articles cite this article - sign up in the box at the top right-hand corner of the article or click **here**

Optic aphasia: a process of interaction between vision and language

BY MARIE-FRANCE BEAUVOIS

Groupe de Recherches de Neuropsychologie INSERM U. 84,
La Salpêtrière, 47 Boulevard de l'Hôpital, 75634 Paris Cedex, 13, France

A neurological syndrome, called in the literature either optic aphasia or visual anomia, is defined in principle as the inability to name visually presented objects, together with the preservation of both the ability to identify them by sight correctly and to name them when they are presented in another sensory modality. This syndrome was first described by Freund in 1889, but since then its existence has been continually questioned. When it is accepted, the most common interpretation of it is in terms of an anatomical visuo-verbal disconnection. However, the precise level of the psychological process impaired remains unspecified. The purpose of this paper is threefold. First, evidence is reported showing that a verbal impairment specific to visually presented objects can be observed, as well as analogous syndromes (e.g. tactile aphasia). Secondly, a particular kind of visuo-verbal impairment is defined and called optic aphasia, to distinguish it from other possible cases of visuo-verbal impairments. This syndrome is defined by the specification of the level of the particular psychological process supposed to be impaired, i.e. a disturbance between visual semantics and verbal semantics, both of which operate normally. Thirdly, three hypotheses concerning the operation of the semantic system in normal subjects are derived from the evidence coming from this syndrome.

1. INTRODUCTION

In theory, the term optic aphasia is used to describe the performance of a brain-damaged patient who can name objects when they are presented to him or her tactually or auditorily, but cannot name them correctly when they are presented visually, whereas at the same time (s)he will identify them by sight correctly, as revealed for instance by the fact that (s)he can mime them correctly. This peculiar label was proposed about a century ago by Carl Freund (1889) to account for the performance of a patient who, very roughly, fitted this pattern of results. However, since then, the existence of such a syndrome which would be different both from visual agnosia and more general kinds of aphasia has been continually questioned. Freund's own case was not very convincing. First, the patient suffered from severe anomia even in spontaneous speech. Secondly, it is not clear whether visual identification was really achieved since Freund reported that the patient tried to express by gestures what he could not say, but quite often failed. In addition, at a theoretical level, Freund did not clearly distinguish disorders of visual recognition from visuo-verbal impairments. He was therefore later led to include under optic aphasia cases which would now be considered as cases of visual agnosia, on which he was criticized by Sigmund Freud (1891) 2 years later. At the beginning of the century several authors (e.g. Wolff 1904; Kleist 1934), while reviewing a number of cases reported as examples of optic aphasia, doubted that such a syndrome existed, distinct from both visual agnosia and a more general kind of aphasia. Nowadays, it is noticeable that with some exceptions (see, for example, Hécaen & Albert 1978; Heilman & Valenstein 1979), studies on visual agnosia or on aphasia as well as recent textbooks of neuropsychology either ignore it (Frederiks 1969; Bender

3-2

& Feldman 1972; Lezak 1976; Walsh 1978; Gazzaniga 1979; Dimond 1980; Kolb & Whishaw 1980) or quote it only in a footnote (Lecours & Lhermitte 1979), whereas others appear to reject it (e.g. Goodglass *et al.* 1968). However, cases of naming impairments, more marked when stimuli are presented visually than when they are presented auditorily or tactually, have been reported recently (see, for example, Spreen *et al.* 1966; Goodglass *et al.* 1968; Boudouresques *et al.* 1972; Lhermitte & Beauvois 1973; Assal & Regli 1980; Poeck 1982), as well as complementary cases of naming impairments more marked in the tactile modality (Geschwind 1965; Beauvois *et al.* 1978) or the auditory modality (Denes & Semenza 1975). As far as the visual modality is concerned they have been labelled indifferently optic aphasia or visual anomia.

There are probably two reasons why, despite this empirical evidence, the syndrome is often ignored. First, the findings reported may not seem very convincing. Two kinds of studies are available: single case studies on the one hand, in which quantitative data are most often lacking or insufficient; group studies on the other hand, concerned with the possible existence of a modality-specific disturbance of naming rather than with the possible existence of a modality-specific disturbance of naming rather than with the reason for such a disturbance. Secondly, there is some imprecision concerning the specific level of the psychological process impaired in this syndrome, as revealed by the fact that some authors (e.g. Kok 1964; Goodglass *et al.* 1968) seem to consider it as a minimal form of agnosia, others (e.g. Spreen *et al.* 1966) have looked for it in cases of amnesic aphasia, whereas the concept of an anatomical visuo-verbal disconnection first proposed by Freund (1889), discussed for other disturbances by Dejérine (1892) and definitively emphasized by Geschwind (1965), became the most common interpretation of this syndrome. In this last conception optic aphasia would be in fact a modality-specific kind of anomia, equivalent to what is observed in split-brain patients when objects are presented to their left visual hemifield. The existence of different accounts for this syndrome is not very surprising. Visual anomia is conceptually a neurological syndrome, i.e. it is defined by a simple pattern of results. From a psychological point of view, one should expect that it may be produced by the impairment of different processes since the relations between vision and language are probably very complex. In other words, the neurological syndrome could correspond to several different psychological syndromes (for the concepts of 'neurological' and 'psychological' syndrome see Shallice (1979), Beauvois *et al.* (1980) and Beauvois & Saillant (1982)).

The purpose of this paper is twofold. First I shall give evidence that such a naming impairment specific to the visual modality can be observed (as well as other related syndromes), provided that one specifies clearly enough what visuo-verbal impairments can be. Secondly, I shall define a particular kind of visuo-verbal impairment, that I shall call optic aphasia, to distinguish it from other possible cases of visuo-verbal impairments, for which the general term of visual anomia will be used. The definition of this syndrome will not be given only in neurological terms, i.e. by describing a simple pattern of results and relating it to a hypothetical anatomical basis; it will be given also in psychological terms, i.e. by trying to identify the level of the particular process which is impaired.

2. The existence of modality-specific kinds of aphasia

(a) Description of a case of optic aphasia

Consider the case of optic aphasia, J. F., reported by Lhermitte & Beauvois (1973). With the exception of this very specific disturbance, his language was entirely normal. His verbal I.Q. was in accordance with his premorbid cultural level (he scored 96 on the verbal part of the W.A.I.S. and 106 on the French Synonym Test of Binois & Pichot (1958).) No disturbance could be detected in his spontaneous speech. Repetition of words and sentences, producing definitions of words, and making sentences from given words were all performed normally. A naming disturbance specific to visual presentation could be demonstrated: whereas the patient named virtually all objects from tactile presentation (111/120 correct responses) and from their sounds (24/25 correct responses) he made errors in naming objects from visual presentation (23/30 correct responses) and in naming pictures of objects (72/100 correct responses). Errors in naming objects presented visually were mainly semantic paraphasias (e.g. a bottle named as a glass; a comb named as a toothbrush), perseverations of the same word (e.g. a fork named as a comb after a comb had been presented and correctly named) or perseverations of a semantic feature of the word (e.g. scissors named as a child just after a baby had been presented and correctly named). A complementary disturbance was also observed, to a lesser extent, when the patient was asked to point to a picture upon spoken request. In this task, although he generally performed quite well, he made mistakes when the target object was not actually presented, even though he was repeatedly told that this was a possibility; under this condition he sometimes pointed to a picture of an object bearing a semantic relation to the name of the object given by the examiner. For instance when asked to point to a sausage (which was not actually presented) he pointed to a ham, and when asked to point to a pipe he pointed to a cigarette. This patient seemed therefore to suffer from a bidirectional visuo-verbal impairment.

It should be stressed that it is very unlikely that such a disturbance was due to a 'visual' impairment. First, in an experiment of naming in which the patient was shown a picture of an object for 2 s only, every time he misnamed a picture he was asked immediately afterwards to draw from memory the object that he had just seen. Whereas he produced 31 misnamings out of 100 stimuli, he managed to draw perfectly from memory 22 of these 31 objects, including quite significant details. (For one object he drew exactly what he had said, i.e. a bird instead of a mouse; five drawings included details belonging to both the stimulus and the misnaming (see below); three drawings were not precise enough.)

This clearly shows that misnaming in this patient was not due to the fact that he could not perceive the objects. But did he recognize them? At a simple clinical level it is noticeable that he did not complain of having any visual problem, and indeed in this respect he behaved normally in everyday life. In addition, certain data seem to confirm that he really recognized the objects that he could not name. Quite often in a test, although he misnamed an object, he correctly mimed its use. For instance when shown a boot, he correctly mimed a man pulling on his boot and said 'this is a kind of balaclava'; also when shown a comb he correctly pretended to use a comb and said it was 'a toothbrush'. This seems to show that he really identified the objects that he could not name, or in other words that their visual meaning was accessed. Another fact supports the view that visual semantics operated normally in this patient. He produced marvellous spontaneous drawings involving complex scenes. How could this have been possible if the meaning of what he had just drawn was not clear to him? How could he

have been able to add relevant data once he had started to draw without producing semantic errors in drawing if he had a disturbance at the level of visual semantics?

There is, however, one aspect of his performance that seems to present difficulties for this interpretation. In an experiment in which the patient was presented with a picture of an object for 2 s only, but in which the time allowed to respond was not limited, longer verbalizations could be observed. They consisted of a peculiar mingling of semantic errors, perseverations and descriptions of morphological features of the object. For instance, presented with an aquarium the patient said 'a bird-cage, unless it is a pot for flowers, a container, a tank, the four aspects...the walls made of glass or wood... it could be an aquarium if it is made of glass'. On the basis of these descriptions of morphological features, it was argued, even by Lhermitte and I, that the patient suffered in addition from a minimal form of agnosia. He would not have been able to process object categorization as normal subjects do, and would have tried to compensate for it in analysing visually later on the morphological features of the objects from his intact visual memory. I no longer agree with this analysis. The patient was obviously not aware of his disturbance. However, he kept *speaking* on and on until he reached the correct word (the production of which he was not always aware.) I now think that what the patient was doing was not to try to categorize the object visually from his intact visual memory, or to compensate for defective visual categorization by taking into account the visual features of the object, but rather to provide himself with some additional *auditory verbal* information. This interpretation would account for the fact that the patient also produced semantic paraphasias while describing visual features of the objects. For instance he said that the aquarium could be 'made of wood' whereas he obviously perceived the transparency of the glass walls. Such an analysis allows us to account for the whole pattern of results of this patient in terms of a visuo-verbal impairment, without assuming an additional visual impairment.

Therefore a syndrome does exist that is clearly distinct from aphasia and from agnosia and which can be conceived of as an impairment between high-level visual and verbal processes.

(*b*) *An equivalent syndrome for tactile modality*

A case that can be considered as the equivalent of optic aphasia for the tactile modality was reported by Beauvois *et al.* (1978). The syndrome was called bilateral tactile aphasia. It appeared when the patient was asked to perform a linguistic task (e.g. naming) based upon an object tactually presented to him. The syndrome can be summarized as follows. First, in this non-aphasic patient it was clearly modality-specific: naming was virtually perfect when the stimulus was visual (96/100 correct responses) or auditory (sounds of objects: 77/80 correct responses) whereas when the stimulus was tactually presented one object in three was misnamed (135/200 correct responses). The errors were analogous to the previous case; they involved some omissions and perseverations, but most of all semantic paraphasias. It should be noticed that the disturbance was not restricted to a simple anomia: when asked not to name but to describe the object or to explain its use precisely, the patient's descriptions were full of dysphasic errors. For example, having a thimble in his hand he said, 'it's for seamstresses, they thread it inside the thimble. They put it on in order to write...or read'. Secondly, the syndrome was bi-directional: when asked to decide if an object put in his hand fitted the name of an object pronounced by the examiner at the same time, the patient accepted many false names, most of which bore a semantic relation to the objects tactually presented (e.g. he accepted 'clock' for a watch, 'glove' for a shoe). Thirdly, tactile identification seemed to be normal

since the patient could mime correctly the uses of objects presented tactually (79/80 correct responses).

These results were interpreted as indicating that tactile identification on the one hand, and language on the other, were operating normally, and that the impairment was located between the two, that is to say, that it was tacto-verbal and verbo-tactile.

In addition to the syndromes of optic and tactile aphasia we have described an equivalent syndrome for auditory modality (Beauvois *et al.* 1982).

3. The difficulties in the discovery of such syndromes

The reason that we were able to report such pure syndromes is probably because we were lucky enough to have come across the right patients. No doubt this was so with the patient suffering from optic aphasia with whom we carried out a clear clinical observation rather than an experimental investigation. For instance, miming was not quantitatively studied and therefore could not be statistically compared with naming. But progressively I realized that in order to study, say, visuo-verbal impairments it was not enough to take into account the kind of stimulus and the kind of response (one being visual, the other being verbal), as is done in standard studies of this kind. In the assessment of such syndromes, one has also to consider two other variables: first, the kind of intervening processes required to perform the task correctly may well be more complex than often assumed; secondly, the fact that the patient can choose to use a particular strategy has to be taken into account. I shall try to show concretely how these variables may be of extreme importance.

First, consider the intervening processes required to perform a so-called 'visual' or 'verbal' task. To do that let us take examples in the domain of colours. On the one hand consider a common clinical test generally supposed to be purely visual and often used to detect colour agnosia, for instance the task of Lhermitte *et al.* (1969) in which the subject is asked to choose the correctly coloured picture of an object from among several pictures. In this task two points at least make verbal mediation very likely. First, some 'correct' colours look so wrong that it is very unlikely that one can produce the correct response without thinking something like 'this is a frog, a frog is green, this is green, so this is the correctly coloured frog'. Second, some stimuli may directly activate verbal associations because of the existence of a very strong link between the name of the object and the name of the colour; for instance one has to point to a 'correctly coloured' tomato and there is a very common French phrase: 'red as a tomato'. Therefore verbal mediation can be either required or spontaneously used in so-called visual tests. On the other hand, consider a test generally used as a purely verbal task: if we ask the subject to say what colour a banana is; indeed, the stimulus is verbal and so is the response, but before giving the expected response, the subject has probably to imagine the coloured banana, because, in French at least, the word 'banana' and the word 'yellow' are never associated; also we never formally learn that a banana is yellow. So, between hearing the word and speaking the response the subject has probably to carry out a visual evocation of the coloured object. The verbal task has turned into a visuo-verbal one.

Secondly, consider the difficulty that arises from the strategy that the patient may use spontaneously. Suppose that a particular task can be achieved by either of two strategies and that the strategy that normal subjects tend to use depends on the context, on their way of thinking at a particular time, etc. It is likely that quite often the choice of strategy would not be

deliberate, but would instead be automatic and unconscious. Suppose also that the processing required by one of the two strategies is disturbed in a particular patient. It may well be that the patient will continue to try to use both strategies, as (s)he normally did before the stroke, because (s)he is unaware of the precise disturbance. This would therefore sometimes result in failure on a task that would have been performed normally if the appropriate strategy (i.e. the strategy appropriate to a particular disturbance) had been used. This indeed happened in our two cases of modality-specific kinds of aphasia. I mentioned that the optic aphasic patient, J.F., could usually draw from memory pictures of objects that he had failed to name. Occasionally, however, he began to draw the correct picture and then went on adding features pertaining to the wrong name he had produced. For instance his spoken response to the drawing of a tree was 'a leaf'; then when asked to draw from memory what he had just seen he produced a strange mixture of a leaf and a tree as it was actually represented on the picture (i.e. with five fruits). This clearly shows a mixture of two strategies: one required by the task (to draw only from visual memory) and one that is not required, which interferes with it and which produced unnecessary errors because of the dysfunction of naming of visually presented objects. Another example can be found in the case of bilateral tactile aphasia, R.G. When we first tried to demonstrate that tactile recognition was normal by asking the blindfolded patient to mime the use of the tactually presented objects we occasionally obtained semantic 'parapraxias'; for instance the patient used a toothbrush like a comb. We decided then that this might well be the consequence of an implicit verbalization. So, later, we inhibited verbalization by special instructions and by placing an adhesive plaster on the patient's mouth. Under these conditions the patient could mime perfectly the use of the objects that were tactually presented and semantic parapraxias no longer appeared.

These two examples seem to indicate that the manipulation of the strategy used by the patient may also be a crucial variable in the identification of certain syndromes.

4. Optic aphasia for colours

I tried to take into account these methodological considerations in an experimental study that I carried out with Brigitte Saillant (Beauvois & Saillant 1982) on a patient, M.P., who appeared to have a severe form of colour agnosia, which then turned out to be an optic aphasia for colours. In this investigation we tried to establish whether the so-called colour agnosia in this patient was related to a visual disturbance, to a verbal one or to a visuo-verbal one, since these are the three main theoretical options considered in the literature to account for such a disturbance. In constructing a test that could be conceived of as visual, verbal or visuo-verbal, we therefore took account of three kinds of variable: (a) the kind of stimulus and the kind of response (visual or verbal); (b) the kind of intervening processes required to correctly perform the task; (c) the stragety used by the subject.

(a) Appearance of colour agnosia

M.P. had no intellectual deterioration and no expressive or receptive aphasia (her verbal I.Q. was 123). She had good visual acuity and performed normally on tests of colour discrimination such as Ishihara (1979) and Hardy–Rand–Rittler (1957) pseudo-isochromatic plates. However, her performance on the following clinical tests commonly used to detect so-called colour agnosia was extremely impaired: naming colours from visual confrontation (e.g. blue

was named 'beige', green was named 'pink', red was named 'white'); pointing to the correctly coloured object among several (Lhermitte *et al.* 1969); colouring drawings of objects; Goldstein–Scheerer (1941) colour-sorting test. M.P.'s clinical picture therefore perfectly fitted the clinical definition of colour agnosia (see, for example, Hécaen & Albert 1978). However, our experimental investigation allowed us to show that M.P. did not have any visual disturbance for colour at all.

(b) Experimental investigation

A number of general points need to be mentioned in connection with this investigation. (1) Results are available on numerous other tests and conform to the same interpretation. (2) All the results that I am going to discuss are statistically significant. (3) The differences observed between different kinds of tests cannot be assigned to a difference of test sensitivity; indeed a double dissociation was observed with the performance of an 'aphasic' patient on the one hand, and with those of an 'agnosic' patient on the other. (4) The experimental investigation was repeated in its entirety 5 years after the initial testing; the pattern of M.P.'s performance was virtually identical on the two occasions. (5) In the first experiment each category of test (verbal, visual and visuo-verbal) included both tests bearing on colour alone, and ones on colour as a specific attribute of objects. Similar results were obtained with both kinds of tests. Details of these points will be found in Beauvois & Saillant (1982).

(i) Verbal tests

A test was defined as verbal when the stimulus, the response and the intervening process required for the subject to perform the task were verbal. In addition, in all verbal tests a verbal strategy was strongly induced and a visual one strongly discouraged. There were two purely verbal tests. In the colour-name sorting test the patient was asked to answer questions such as 'which category does the word blush belong to: brown, red or yellow?' In another verbal test the patient was asked to produce a colour name from a verbal description, whereas the colour name did not correspond to the real colour of the object. For instance there is a kind of ham called (in French) 'Jambon de Paris' but also 'jambon blanc', i.e. white ham, which in reality is pale pink. We asked the subject, 'Give me another name for Jambon de Paris. Your answer must be a colour name.' Or we employed colour names linked to an abstract word, as in 'What colour name is generally associated with envy?' On these two verbal tests, M.P. performed at the ceiling (see figure 1). This clearly shows that she did not suffer from what is called 'aphasia for colour names' (Willbrand 1887; Kinsbourne & Warrington 1964).

(ii) Visual tests

A test was considered as visual when the stimulus, the response and the intervening process required for the subject to perform the task were visual. We also strongly induced a visual strategy: in order to discourage M.P. from using verbalizations we explained to her that it would be awkward to use language and stuck adhesive plaster on her mouth. There were two purely visual tests: first, a test of colour matching, where the patient was presented with two pieces of coloured wool and had to decide if they were or were not identical; secondly, a test in which the patient had to point out the correctly coloured picture of an object among five pictures of the same object. Contrary to similar tests commonly used in clinical neuropsychology, this test had been specially constructed so that it involved as much visual processing as possible and as little verbal searching as possible. For instance we used traffic signs of which people have

no verbal knowledge. On these two purely visual tests M.P. performed again almost at the ceiling (see figure 1). It is particularly striking that M.P. could have pointed out here all the correctly coloured objects correctly, whereas she made a lot of errors in a similar clinical test, pointing for instance to a red elephant, when the grey elephant had a somewhat unreal colour and she had not been told to avoid a verbal strategy. So M.P., who had appeared to be severely colour agnosic in clinical tests, turned out to have normal visual colour processing.

(iii) *Visuo-verbal tests*

As far as these were concerned three possibilities were investigated.

In the first experiment the visuo-verbal process was produced, as is usually done in studies on colour agnosia or anomia, by means of a simple difference between the type of stimulus and
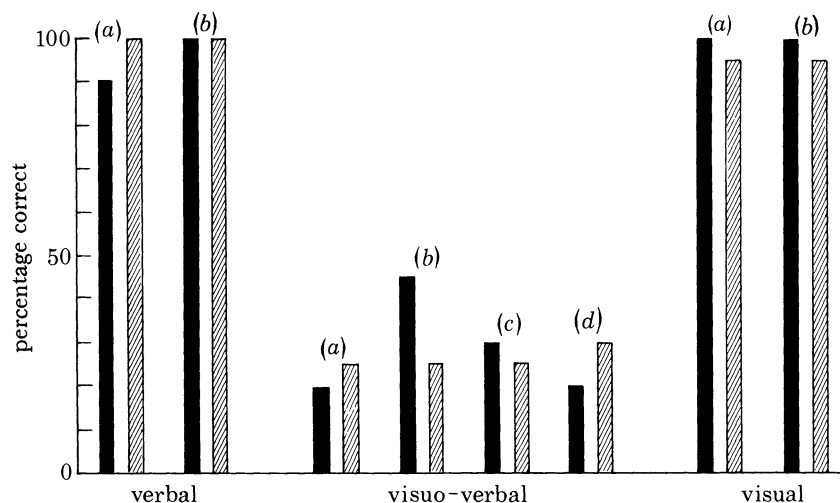

FIGURE 1. M.P.'s percentages of correct responses. Each test included 20 stimuli, and was carried out in 1976 (solid columns), then in 1981 (hatched columns). Verbal tests are: (a) colour-name sorting test; (b) producing a colour name from verbal description, without having the possibility of relying on visual imagery. Visuo-verbal tests are: (a) colour naming on visual confrontation; (b) producing the colour name of an object that is represented without colour; (c) colour pointing upon spoken instruction; (d) pointing to the colour of an object upon spoken instruction. Visual tests are: (a) colour matching; (b) pointing to the correctly coloured object.

the type of response, one being visual, the other being verbal. There were four such visuo-verbal tests, two involving colour alone (a test of colour naming and a test of pointing to a colour upon spoken request) and two tests involving colour as a specific attribute of objects (in the first the subject had to point out the colour of an object upon spoken request, for instance 'Show me what colour a cherry is', and in the second the subject had to give the colour name of an object that was drawn without colour). In all visuo-verbal tests M.P.'s performance was drastically impaired (see figure 1). Whereas her performance on visual tests was virtually 100 % correct, on visuo-verbal tests this dropped to a mean of 29 %. Thus whereas she could point to the correctly coloured traffic sign she was incapable of pointing out upon spoken request a red token or the colour of a cherry. In addition, her errors were extremely serious, for instance she pointed to bright blue when asked to point to 'pale green', to green instead of bright yellow, to navy blue instead of 'pink' and to brown instead of 'bright blue'. She

pointed to dark blue when asked to point to 'the colour of a tangerine', to blue for 'the colour of snow' and to yellow for 'the colour of redcurrant jelly'. Given the drawing of an object represented without colour, she said that a carrot was 'green', a fire engine 'beige' and a strawberry 'orange'. As far as the processing of colour is concerned, from this first experiment M.P. therefore had a severe visuo-verbal impairment, without any visual or verbal impairment at all.

In a second experiment we wondered if it would be possible to obtain similar results when the type of stimulus and the type of response were the same but when a visuo-verbal process was produced because the intervening process required to perform the task belonged to a different type. To check this point we constrasted the verbal test used in the first experiment, in which the patient had to give a colour name according to a verbal definition without being able to use visual imagery (e.g. 'give me another name for Jambon de Paris'), with a quite similar test in which the patient had to produce a verbal response to a verbal answer, but which seemed to require visual imagery (e.g. 'Tell me what colour a gherkin is'); M.P.'s performance dropped from 20/20 to 8/20 in this last condition. We also contrasted the first visual test in which the patient had to point to the correctly coloured traffic sign with a quite similar test in which the object was presented having an incorrect colour of the same name, and where the name of the object could provide the subject with the name of the colour because of the existence of a verbal association (e.g. green beans, orange). Again, M.P.'s performance dropped from 20/20 to 13/20 on this last condition. Therefore whatever intervening process was required (visual or verbal), the determining variable affecting M.P.'s performance was whether it belonged to another type from that of both the stimulus and the response.

In a third experiment, the visuo-verbal process was produced by manipulating the suggested strategy; to do that, we used tests in which the stimulus and the response were both verbal or both visual and which could be performed successfully either by relying on intervening processing belonging to the same category, or by relying on intervening processing belonging to the other category. Two different conditions were contrasted: one in which the subject was instructed to use a strategy based on the intervening process of the same category, another in which she was instructed to use a strategy belonging to the other category. Consider an example from a so-called verbal test. One can respond 'snow is white' either because one imagines it, or because one thinks of the verbal phrase 'white as snow'. M.P. was given the test according to two different instructions. One instruction suggested a verbal search. For snow it was 'You have learnt what colour snow is, it is often said. What do people say when they are asked what colour snow is?' The other instruction suggested the use of visual imagery. For snow it was 'It is winter. Imagine a beautiful snowy landscape; there are mountains and you can see skiers going down the slopes. Can you imagine it? Can you see it? Well, now tell me what colour snow is.' M.P.'s performance dropped on this last condition from 19/20 to 13/20. A similar manipulation of the strategy was carried out in a so-called visual test. Here M.P.'s performance dropped when she was instructed to use a verbal strategy from 20/20 to 12/20. Therefore, whatever the suggested strategy was (visual or verbal) the determining variable was whether it belonged to another type from that of both the stimulus and the response.

5. Conclusion

(a) The syndrome of optic aphasia

The investigations reported here seem to converge on the same two points: (1) modality-specific kinds of anomia do exist, clearly different from disorders of identification (agnosias) and from more general disorders of language (aphasias); (2) it is possible to describe a specific kind of such syndromes, which I will call modality-specific aphasias to distinguish them from other theoretically possible kinds of modality-specific anomias. In what follows for purpose of simplification I shall focus on the syndrome of optic aphasia, but analogous principles apply for tactile aphasia and auditory aphasia.

From a neurological or a descriptive point of view, the syndrome can be summarized as follows. First, it is specfiic to the visual modality. Secondly, there is a 'visuo-verbal' impairment that is bidirectional: both naming from visual confrontation and pointing to an object upon spoken request are impaired. Thirdly, the impairment corresponds to a kind of aphasia rather than to a simple anomia in which only the name of the object is unavailable. The patient does not fail to produce names, (s)he produces incorrect names, most of which bear a semantic relation to the target name. In addition, when not trying to name the object but to describe it or to explain its use, his/her description can sound like a kind of jargonaphasia. Finally, the patient is not aware of the impairment.

From a psychological point of view, optic aphasia will be defined as follows: (a) verbal processes are normal, including speech output as well as verbal semantic processing; (b) visual processes are normal up to the highest level, including visual categorization, visual imagery and something that I shall call visual semantics; (c) there is a bidirectional impairment of very central visuo-verbal processes, which may be located between visual semantics and verbal semantics. However, the existence of a visuo-verbal impairment cannot account for the entirety of the syndrome, without any further assumptions: most of these patients are incapable of spontaneously performing correctly certain tasks that are apparently purely visual or purely verbal. They have to be taught to inhibit any visuo-verbal interaction. It should be stressed how difficult and lengthy it is to inhibit such an interaction, as it seems to be automatic and the patient is not aware of the existence of the disturbance itself.

On the basis of correct visual identification, on the one hand, and the patient's lack of awareness of the disturbance, on the other hand, it seems that alternative interpretations can be rejected. First, optic aphasia is clearly distinct from other reported syndromes, i.e. from (a) an impairment of visual categorization, as observed in apperceptive agnosia; (b) a general loss of semantic knowledge, as observed in associative agnosia (Warrington 1975); (c) a disturbance between the semantic system and speech output, as could exist in some patients suffering from anomia. Secondly, other accounts that have been suggested (if not investigated) can be rejected as well, for instance: (a) an impairment at the level of visual categorization or between visual categorization and the visual semantic system, as suggested by Morton (1980); (b) a disruption of a hypothetical non-semantic route for naming, as suggested by Ratcliff & Newcombe (1982). In optic aphasia the disturbance is much more central. It should be located between the processes impaired in associative agnosia and those impaired in semantic aphasia, i.e. inside the semantic system, between visual semantics and verbal semantics.

(Note that the extension of this hypothesis to M.P.'s reading impairment allowed us to find a way to rehabilitate her complete alexia (Beauvois & Derouesné 1982), whereas a previous

attempt during 16 months with usual methods of rehabilitation for agnosic alexia had completely failed.)

(b) *Implications of this syndrome for normal psychology*

The existence of this syndrome allows us to make three hypotheses about the functioning of psychological processes in normal subjects. First, it supports the idea that visual semantics is probably distinct from verbal semantics, as assumed for instance in Paivio's (1972) theory. This seems to be so even in a highly specific domain such as the processing of colour, for which our findings support the view that colour semantics have two distinct components, one visual and one verbal. In my view, the apparently conflicting results obtained in normal subjects (Seymour 1979; Paivio & te Linde 1980), which seem to show that colour is mainly represented in the verbal semantic system, are probably due to an experimental artefact (i.e. in these experiments the underlying processes were not sufficiently taken into account, nor was the strategy used by the subjects manipulated). At a more general level the existence of modality-specific kinds of aphasia supports theories of the semantic system that presuppose the existence of several distinct semantic processes. Other results supporting such theories have been reported both in neuropsychology (see for example, Warrington & Shallice 1979) and in cognitive psychology (see, for example, Potter & Faulconer 1975; Hodgkin 1979).

Secondly, the existence of the syndrome supports the view that although the visual and verbal semantic systems are modularly distinct, there is a strong interaction between them. Although such an interaction has been reported in brain-damaged patients (see, for example, Marin & Saffran 1975; Dahmen *et al.* 1981) there is no reason to consider it as the result of an anatomical pathological interference, since it has also been observed in normal subjects. For instance, Carmichael *et al.* (1932) presented their subjects with ambiguous figures at the same time as a verbal label that was different for two experimental groups. The same picture was labelled as 'curtains in a window' for one group and as 'diamond in a rectangle' for the other group. The subjects were asked to make immediate reproductions of the pictures, and it turned out that many of the reproductions were obviously influenced by the verbal label. This clearly shows that verbal label can affect a performance that could have been carried out only from visual memory. It therefore seems likely that in normal humans language may interfere with other cognitive processes, even if this is not required at all to perform the task.

Thirdly, the bidirectional visuo-verbal interaction process would be automatic and not present in awareness. This important point may account for several difficulties in the discovery of optic aphasia. The first is that optic aphasia is very difficult to distinguish from associative agnosia, if one does not try very hard to inhibit this process in tasks designed to test visual identification (e.g. miming). Therefore this makes it very likely that certain reported cases of visual agnosia were in fact cases of optic aphasia in which the investigators failed to obtain evidence of correct identification. The second problem is that optic aphasia is also very difficult to distinguish from more general kinds of aphasia. For instance, it is exceptional to observe an optic aphasic patient who obtains 100 % correct responses in naming when objects are presented tactually. It is very likely that quite often tactile presentation of an object arouses its visual evocation, so that if a patient suffers from optic aphasia he would also tend to produce naming errors in such a task if he is not taught to avoid visual imagery. The patient may produce errors in spontaneous speech too, depending on the strategy he uses (visuo-verbal or purely verbal).

If these three hypotheses have some degree of reality, this may allow us in further studies to

relate neuropsychological investigations more precisely to experimental and theoretical studies of cognitive psychology, but also (why not?), if we are careful, attentive and open enough, to psychoanalytical data and theory too. After all, this syndrome raises two points that were put forward by Freud (1900) in his *Interpretation of dreams*: (*a*) the existence of a close connection between visual imagery and verbal processes (a dream that involves visual imagery is normally provoked by verbal associations, and conversely the visual imagery of a dream is normally reported in words); (*b*) the fact that this connection is, in general, not accessible to awareness. The topic of awareness, as well as that of the possible existence of several semantic systems is at the moment the subject of much debate in cognitive psychology; however, to my knowledge their possible interaction has not been investigated. In neuropsychology, with two exceptions (Patterson 1978; Beauvois & Saillant 1982) even awareness itself has not been experimentally investigated. It seems likely that to develop such a new direction of research would involve not only a new theoretical view but also an attempt to work out the appropriate methodology.

References

Assal, G. & Regli, F. 1980 Syndrome de disconnexion visuo-verbale et visuo-gestuelle. *Revue neurol.* **136**, 365–376.

Beauvois, M. F., Bastard, V. & Saillant, B. 1982 Auditory modality specific kind of aphasia. (In preparation.)

Beauvois, M. F., Derouesné, J. & Saillant, B. 1980 Syndromes neuropsychologiques et psychologie cognitive. Trois exemples: aphasie tactile, alexie phonologique et agraphie lexicale. *Cah. Psychol.* **23**, 211–245.

Beauvois, M. F. & Derouesné, J. 1982 Recherche en psychologie cognitive et rééducation: quels rapports? In *Rééduquer le cerveau* (ed. X. Seron). Bruxelles : Pierre Mardaga. (In the press.)

Beauvois, M. F. & Saillant, B. 1982 Optic aphasia for colours and colour agnosia: a distinction between visual and visuo-verbal impairments in the processing of colours. (In preparation.)

Beauvois, M. F., Saillant, B., Meininger, V. & Lhermitte, F. 1978 Bilateral tactile aphasia: a tacto-verbal dysfunction. *Brain* **101**, 381–401.

Bender, M. B. & Feldman, M. 1972 The so-called 'visual agnosias'. *Brain* **95**, 173–186.

Binois, R. & Pichot, P. 1958 *Test de vocabulaire*. Paris: Éditions du Centre de Psychologie Appliquée.

Boudouresques, J., Poncet, M., Sebahoun, M. & Alicherif, A. 1972 Deux cas d'alexie sans agraphie avec troubles de la dénomination des couleurs et des images. *Revue Oto-Neuro-Ophtal.* **44**, 297–304.

Carmichael, L., Hogan, H. P. & Walter, A. A. 1932 An experimental study of the effect of language on the reproduction of visually perceived form. *J. exp. Psychol.* **15**, 73–86.

Dahmen, W., Hartje, W., Willmen, K. & Wenigen, D. 1981 To what extent are the cognitive performances of Wernicke's aphasics disturbed by their own vocalizations. Presented at the European Conference of the International Neuropsychological Society, Bergen. Norway.

Dejérine, J. 1892 Contribution à l'étude anatomo-pathologique et cliniques des différentes variétés de cécité verbale. *C.r.Séanc. Soc. Biol.* **4**, 61–90.

Denes, G. & Semenza, C. 1975 Auditory modality-specific anomia: evidence from a case of pure word deafness. *Cortex* **11**, 401–411.

Dimond, S. J. 1980 *Neuropsychology. A textbook of systems and psychological functions of the human brain.* London: Butterworth

Frederiks, J. A. M. 1969 The agnosias. Disorders of perceptual recognition. In *Handbook of clinical neurology* (ed. P. J. Vinken & G. W. Bruyn), vol. 4, pp. 13–47. Amsterdam: North-Holland.

Freud, S. 1891 *Zur Auffasung der Aphasien. Eine kritische Studie.* Leipzig: Deuticke.

Freud, S. 1900 *Die Traumdeutung.* Leipzig and Vienna: Deuticke.

Freund, D. C. 1889 Ueber optische Aphasie und Seelenblindheit. *Arch. Psychiat. NervKrankh.* **20**, 276–297, 371–416.

Gazzaniga, M. S. 1979 *Handbook of behavioral neurobiology*, vol. 2. (*Neuropsychology*). New York: Plenum.

Geschwind, N. 1965 Disconnexion syndromes in animals and man. *Brain.* **88**, 585–644.

Goldstein, K. & Sheerer, M. 1941 Abstract and concrete behaviour. An experimental study with special tests. *Psychol. Monogr.* **53**, 1–151.

Goodglass, H., Barton, M. I. & Kaplan, E. F. 1968 Sensory modality and object-naming in aphasia. *J. Speech Hear. Res.* **11**, 488–496.

Hardy, L. H., Rand, G. & Rittler, C. 1957 *HRR pseudoisochromatic plates.* New York: American Optical Company.

Hécaen, H. & Albert, M. L. 1978 *Human neuropsychology.* New York: John Wiley.

Heilman, K. M. & Valenstein, E. 1979 *Clinical neuropsychology.* Oxford University Press.

Hodgkin, D. 1979 Representation of sensory information in semantic memory. Presented at the Experimental Psychological Society, Oxford.

Ishihara, S. 1979 *Tests for colour-blindness.* Tokyo: Kanehara Shuppan Co.

Kinsbourne, M. & Warrington, E. K. 1964 Observations on colour agnosia. *J. Neurol. Neurosurg. Psychiat.* **27**, 296–299.

Kleist, K. 1934 Kriegsverletzungen des Gehirns in ihrer Bedeutung fur die Hirnlokalisation und Hirnpathologie. In *Handbuch der arztlichen Erfahrungen im Weltkriege* 1914–1918 (ed. O. von Schjerning), vol. 4, pp. 1343–1349. Leipzig: Barth.

Kok, E. P. 1964 Modifications of speed of perception of pictures of objects in optic aphasia. *Cortex* **1**, 328–343.

Kolb, B. & Whishaw, I. Q. 1980 *Fundamentals of human neuropsychology.* San Francisco: Freeman.

Lecours, A. R. & Lhermitte, F. 1979 *L'aphasie.* Paris: Flammarion.

Lezak, M. D. 1976 *Neuropsychological assessment.* New York: Oxford University Press.

Lhermitte, F. & Beauvois, M. F. 1973 A visual-speech disconnexion syndrome. Report of a case with optic-Aphasia, Agnosic Alexia and Colour Agnosia. *Brain* **96**, 695–714.

Lhermitte, F., Chain, F., Aron, D., Leblanc, M. & Souty, O. 1969 Les troubles de la vision des couleurs dans les lésions postérieures du cerveau. *Revue neurol.* **121**, 5–29.

Marin, O. S. M. & Saffran, E. M. 1975 Agnosic behavior in anomia: a case of pathological verbal dominance. *Cortex* **11**, 83–89.

Morton, J. 1980 Recognition and naming. Presented at the European Conference of the International Neuropsychological Society, Chianciano, Italy.

Paivio, A. 1972 *Imagery and verbal processes.* New York: Holt, Rinehart & Winston.

Paivio, A. & te Linde, J. 1980 Symbolic comparisons of objects on color attributes. *J. exp. Psychol.: hum. Percept. Perform.* **6**, 652–661.

Patterson, K. 1978 Phonemic dyslexia: errors of meaning and the meaning of errors. *Q. Jl exp. Psychol.* **30**, 587–601.

Poeck, K. 1982 Neuropsychological demonstration of posterior interhemispheric disconnexion in a case of 'Optic Aphasia'. (In preparation.)

Potter, M. C. & Faulconer, B. A. 1975 Time to understand pictures and words. *Nature, Lond.* **253**, 437–438.

Ratcliff, G. & Newcombe, F. 1982 Object recognition: some deductions from the clinical evidence. In *Normality and pathology in cognitive functions* (ed. A. Ellis), pp. 147–171. London: Academic Press.

Seymour, P. H. K. 1979 Retrieval of object colour. Presented at the Experimental Psychological Society, Oxford.

Shallice, T. 1979 Case study approach in neuropsychological research. *J. clin. Neuropsychol.* **1**, 183–211.

Spreen, O., Benton, A. L. & Van Allen, M. W. 1966 Dissociation of visual and tactile naming in amnesic aphasia. *Neurology, Minneap.* **16**, 807–814.

Walsh, K. W. 1978 *Neuropsychology. A clinical approach.* Edinburgh: Churchill Livingstone.

Warrington, E. K. 1975 The selective impairment of semantic memory. *Q. Jl exp. Psychol.* **27**, 635–657.

Warrington, E. K. & Shallice, T. 1979 Semantic access dyslexia. *Brain.* **102**, 43–63.

Willbrand, H. 1887 *Die Seelenblindheit als Herderscheinung.* Wiesbaden: Bergmann.

Wolff, G. 1904 *Klinische und kritische Beiträge zur Lehre von den Sprachstörungen.* Leipzig: Veit.