

- 58. See §I.B.2 above.
- 59. Gibson, 1979 p.256.
- 60. See, e.g., Gibson, 1966 pp.31, 45.
- 61. Gibson, 1970 p.426.
- 62. Gibson, 1970 p.426.
- 63. Neisser, 1967 p.140.
- 64. Neisser, 1976a p.24.

Notes to §II.D.3.

1. 1976a. The book is well summarized by Neisser [1978a].

2. In 'traditional' visual theories (including modern computational ones) "features" generally refers to two-dimensional features of the retinal (or TV) image [see, e.g., Frisby, 1979]. Gibsonian invariants, by contrast, may be three or even four-dimensional. Nevertheless, they are features, but features of the things in the world themselves rather than of a two-dimensional projection of it.

3. 1982.

4. However, I do not think that the reconciliation can be complete unless both sides revise their attitude to mental representation. 'Computer vision' researchers would have to give up the view that 'encodings' are the fundamental form of mental representation, and thus also that the purpose of perception is to produce an internal description. The Gibsonians would have to very much relax their blanket 'metatheoretical' hostility to 'internal', mental processes.

5. See Gibson, 1970 p.426.

6. Minsky, 1975.

7. 1976a pp.57-9.

8. Although Neisser [1976a pp.76-7n11] complains that compared to schemata, 'frames' are "essentially static" and passive, "places to put information rather than plans for obtaining more of it." As we are about to see, Neisser uses his concept of schema as the basis of his theory of imagery. It is worth noting that Minsky [1975 pp.212/228/267-71] also presents "frames" as providing the basis for a theory of imagery. He also compares them to

Kuhnian paradigms [Minsky, 1975 pp.260-262]! Another AI worker who suggests that imagery is associated with the "top down" aspects of perception is Waltz [1979] (but he seems to think that Kosslyn's theory fits this description).

9. See §I.A.1. The "selective interference" effects discussed in §I.C.2 presumably operate at the level of the exploratory behaviour itself, rather than within the schema.

10. C.f. Anscombe, 1974.

11. 1983.

12. Neisser, 1976a p.130-1.

13. Neisser, 1976a pp.132-3.

14. 1976a p.145.

15. E.g. Posner, Boies, Eichelman, & Taylor, 1969.

16. 1910.

17. 1971b.

18. 1976a pp.150-151.

19. 1974.

20. Peterson & Graham, 1974.

21. 1986b.

22. Finke, 1986b experiment 3.

23. Neisser, 1976a p.145. (My emphasis.)

24. 1978; 1979; Morris & Hampson, 1983 pp.138-9. Apart from these, discussions of Neisser's imagery theory are not very abundant. The brief critical discussions by Kosslyn [1980 pp.133-4] and Pinker & Kosslyn [1983 pp.49-50] do not seem to me to display a very good grasp of Neisser's proposals, and Kaufmann [1986 pp.186-8] merely repeats and endorses some of the criticisms of Hampson & Morris [1978]. The remarks of Kolers & Smythe [1979 pp.167-8] are too brief to be of much use. Sheehan [1978] and Klinger [1981] essentially endorse Neisser's theory, but they do little to further our understanding of it.

25. Hampson & Morris, 1979; Hampson, 1979. Whether they still hold a similar position in their later book [Morris & Hampson, 1983] is not entirely clear to me. I am not sure whether the view they put forward there [Morris & Hampson, 1983pp.143-8] is intended to replace their earlier account or to be a restatement of it in rather more general terms.

26. 1949. Neisser [1978b p.171] admits the similarities of his and Ryle's views, but denies any influence.

27. 1971 chap.2.

28. Neisser, 1978b p.171.

29. §II.D.1.

30. Hampson & Morris, 1979 p.13.

31. 1979.

32. Note that the term "surface image" comes from Kosslyn.

33. 1978; 1979.

34. Neisser, 1976a.

35. Neisser, 1978b pp.169-70.

36. Neisser, 1976a p.54.

37. Gibson, 1970 p.426. C.f. Gibson, 1979 p.256.

38. C.f. Ryle's [1949 chap.8 §§5-6] notion of imagining as bound up with abstaining from action. (See §II.D.1 above.)

39. See §II.D.2.

40. §II.B.2.

41. Inasmuch as such processes, and, indeed, any imagery processes, are under voluntary control, I would suggest that such control is probably mediated through the verbal system. It is probably possible, also, to bring the verbal system under the control of imagery (as when we try to name or describe our image, to ourselves or to others). Where directed thinking goes beyond the purely verbal and rule governed (and Johnson-Laird [1983] argues persuasively that in practice even syllogistic reasoning involves 'mental models'), I would suggest that this involves an alternating of control between the verbal and the imaginal (schema based) representational systems. If such a suggestion is viable it would mean that we could account for cognitive processes entirely in terms of the two types of representation of which we are consciously aware, and which form the basis of Paivio's [1971, 1986] 'Dual Coding' model of cognition. This is not only more parsimonious than theories which also postulate inherently unconscious mental representations, it avoids most of the conceptual difficulties associated with them. It would mean, of course, that infralinguistic animals and infants are not capable of voluntary control of their imagery, or of any

real directed thought, but then, this may very well be the case.

Notes to §II.D.6.

1. Paivio, 1971, 1986.
2. E.g. Paivio, 1977 p.51.
3. See Paivio, 1986 chap.2.
4. §I.C.2.
5. See §I.C.5 above.
6. Neisser, 1976a p.147.
7. Kosslyn, 1976a. But this work originally appeared as experiment 6 of his doctoral thesis [Kosslyn, 1974].
8. Kosslyn, 1974 p.78; 1976a p.249. In fact, examination of his graphs shows that the second group, the ones not given time to form an image actually tended to be somewhat faster in finding the feature than the ones who were supposed to already have formed it.
9. Kosslyn, 1976a p.294; 1974 pp.78-9, 100-101.
10. I made an attempt to replicate this result, with the assistance of Mr. G. Smith, whilst I was attached to the psychology department at the University of California, Davis. Unfortunately I have lost contact with Mr. Smith, who had retained the experimental results for analysis. I hope to be able to repeat the experiment, with a somewhat improved technique, fairly soon.
11. 1978 p.82.
12. Morris & Hampson, 1983 p.139.
13. Yabus, 1967.
14. See, e.g. Kosslyn, Pinker, Smith & Shwartz, 1979b p.573.
15. Neisser, 1976a pp.148-9.
16. See Gibson, 1979 pp.121-6.
17. 1981, 1984a.
18. Neisser, 1978b p.173.
19. See Pylyshyn [1979a], Yuille & Steiger [1982]