34. This would not have been his terminology, of course.

35. We have seen "idea" and "image" equated by Descartes. Locke did the same at the start of the first draft of his **Essay** [quoted by Mandelbaum, 1964 p.2], although he subsequently sticks to "idea". According to Urmson [1982 p.10] "idea" was synonymous with "picture" in 17th century England and France. It is often said [e.g. Pringle-Pattison, 1924 p.302n; Urmson, 1982 p.10] that Locke did not always equate ideas with images. This is because Berkeley [1734 Introduction] showed that "general ideas" cannot be pictorial images, and Locke, unlike his successor, firmly believed in general ideas and yet was not entirely insensible to the difficulties Berkeley was to raise [see Locke, 1700 Bk.IV chap.7 §9]). However, when we consider that even with an Empiricist theory of perception, the representation of general ideas by images is not absolutely beyond defence [see Price, 1953 chap.9], we may wonder if so reading Locke in the light of his successors is not somewhat ahistorical. Berkeley and Hume certainly do seem to fully equate "idea" and "image": Berkeley's argument **depends** on ideas being picturelike, and Hume defines ideas as images of "impressions" on page one of his **Treatise** [1739]. No doubt "idea" and "image" have subsequently drifted apart; this may help to explain why the theory of imagery can again be broached by the 20th century. But, together with the post-Lockean demarcation between science and philosophy this also means that contemporary discussion pays little heed to the epistemological problems that **phantasia** was originally conceived of to solve, or to the setbacks that project has encountered.

36. 1739 p.207.

Notes to §II.B.1.

1. The term "quasi-pictorial" is his own [e.g. Kosslyn, 1978a; 1980], and he is not averse to explicit talk of the "mind's eye" [e.g. 1978b].

2. E.g. Turing, 1950.

3. Like many others of similar views Kosslyn is wary of asserting that computers can actually be conscious, rather than just that they can potentially reproduce the functional structure of the mind. Consciousness is thus seen as an epiphenomenon of the functional processes, realised when they take place in neural tissue but perhaps not when they take place in copper and silicon [see Kosslyn, 1983 p.27]. However, we are here using "consciousness" in a functional sense (I believe it always should be so used) to mean that which is cognizant of the image. In this sense Kosslyn does believe in the

programability of consciousness.

4. Kosslyn & Shwartz, 1977, 1978; Kosslyn, 1980, 1983.

There are other contemporary, materialist versions of quasi-pictorial theory, but they do not seem to call for full separate criticism, as Kosslyn's account is both the most general and the most detailed. Trehub [1977] has produced a little known piece of speculative neuro-physiology intended to explain shape recognition. This involves a hypothetical two-dimensional array of "mosaic cells" whose pattern of activation is isomorphic to the pattern of edges in the retinal image. This array of "mosaic cells" is recognised by Pinker & Kosslyn [1983 pp.53-4] as formally equivalent to the "visual buffer" of their own, computational, theory. Just as they would, Trehub sees the array of "mosaic cells" as capable of being activated in relevant isomorphic patterns not only by the visual stimulus, but also by internal stimuli from another group of cells specialized for the purpose. Yet another group of cells, the "filter cells" fulfil the 'mind's eye' function by each one becoming adapted to fire more strongly when the mosaic cells are activated in a particular pattern. Formally Trehub's theory does not seem to differ significantly, in relevant respects, from the core aspects of Kosslyn's theory. It could quite well be considered as a suggestion as to how Kosslyn's general theory might actually be instantiated in the brain rather than on a computer (it would seem to have been quite independently however), and as such does not call for separate criticism. It is worth noting, however, that Pinker & Kosslyn [1983 pp.55-6] confess considerable doubts over the physiological plausibility of aspects of Trehub's speculations and over whether real world shape recognition is actually possible by the mechanisms he suggests.

There is another computer simulation, apart from that of Kosslyn & Shwartz [1977, 1978], which could be considered as a simulation of a quasi-pictorial theory of imagery. This is the work of Funt [1976; 1983], which Kosslyn & Shwartz [1977] claim as being similar in spirit to their own work. Like Trehub, Funt has a little more to say about the first stages of the processing constituting the 'mind's eye' than does Kosslyn, but rather less to say about image production and manipulation. Also like Trehub, however, Funt's work has received little attention, and consequently little criticism or defence. Thus it does not seem worthwhile giving it separate discussion when the much discussed work of Kosslyn [see Kosslyn, Pinker, Smith & Shwartz, 1979a,b, and the commentaries by other workers printed with these articles] is before us and when our criticisms are intended to apply to quasi-pictorial theories in general.

Similar points could be made about the model of Hampson & Morris [1979], which seems to me to amount to yet another version of quasi-pictorial theory, and for which neither a computer implementation nor a putative neural instantiation is provided. However, since it is developed

in the course of a critique of the 'perceptual activity' theory of Neisser [1976], with which it still retains strong affinities, we will find reason to discuss it in chapter II.D.

5. 1974.

6. Kosslyn, 1983 p.206.

7. 1981; c.f. Kosslyn, 1981 p.49.

8. 1637.

9. Like Descartes, Kosslyn rather wants to have things both ways here. In a recent talk [Kosslyn, 1985] he suggested that the neural site of the "surface image" might be at the primary visual cortex, which, according to the well known work of Hubel & Wiesel [e.g. 1979], has a pattern of activation during vision roughly isomorphic to the optical image on the retina. Clearly, however, Kosslyn is not committed by his general theory to locating the image here, or to its having such a spatial layout anywhere. It is worth pointing this out to make clear that these physiological facts have no direct bearing on the truth or falsity of pictorial type theories.

10. 1977, 1978.

11. The limitation to monochrome is presumably merely a convenient and for most purposes irrelevant simplification to make programing easier. I do not doubt that Kosslyn would hold that in the brain colour information is also specified, and there would seem to be no problems in principle with extending the model this way. Kosslyn's school does seem wedded, however, to the two-dimensionality of the image, presumably as a reflection of the two-dimensional image on the retina. His close associate (his student, I suspect) Steven Pinker has investigated the depth properties of images and found effects very similar to those found by Kosslyn, Shepard, and others in two-dimensions (i.e. linear scanning and rotation times). Despite this Pinker still maintains that a two-dimensional "surface display" must be postulated [Pinker, 1980; Pinker & Finke, 1980; Pinker & Kosslyn, 1978].

12. C.f. Fodor, 1975 p.189; Anderson, 1978 p.252; Wright, 1983 p.67.

13. Kosslyn, 1981 p.51.

14. 1664.

15. Kosslyn, 1980 p.268.

16. This conception of consciousness as the 'highest' or most 'central' stage of processing is very common, although it is seldom examined in detail by

psychologists who seem to hold it (but see Carr [1979]). It has been defended from charges of regressive homuncularism by Attneave [1961]. Morris & Hampson [1983] apply the conception more explicitly and self-consciously to a quasi-pictorial theory of imagery than does Kosslyn.

17. Shiffrin, 1973.

18. See Descartes, 1628 Rule XII.

19. 1979 p.9; c.f. Fodor, 1981a p.1.

20. 1982.

21. 1980 p.464.

22. That is, the so called "analog-propositional" dispute between 'quasi-pictorial' and 'descriptional' theorists during the 1970's. [My note.]

23. Kosslyn, Pinker, Smith & Shwartz, 1979b.

24. 1976. Neisser intends this diagram somewhat satirically. But despite the rather blatant placing of "consciousness" in the final box, I doubt if information processing theorists could find much to seriously object to in it. Similar, if more specific, diagrams, occur throughout the literature. For another generalized version, which shows "consciousness" here too (also meant a little humorously, but less critically), see Haber [1974].

25. Kosslyn, 1981 p.51.

26. See e.g. Kosslyn, 1981 pp.51-2.

27. 1977.

28. Many are much disputed 'findings, we should note.

29. E.g. Kosslyn & Shwartz, 1977; Kosslyn, Pinker, Smith & Shwartz, 1979a; Kosslyn, 1980, 1983.

30. Kosslyn & Shwartz, 1977 p.276.

31. Kosslyn, 1985; Kosslyn, Holtzman, Farah & Gazzaniga, 1985; Farah, 1984.

Notes to §II.B.2.

1. See part I above. Also Engell, 1981; Warnock, 1976; Strawson, 1970.

2. Ryle, 1949 p.235.