

special historical significance for this study.

54. See Bower & Winzenz, 1970. Much of this large volume of work is reviewed by Paivio [1971] and by Richardson [1980].

55. Segal, 1971a.

56. Paivio, 1971.

Notes to SI.C.2.

1. 1970.

2. Nappe & Wollen [1973] and Hauck, Walsh & Kroll [1976], for example, found that using bizarre images did not improve memory performance any more than using more ordinary images (in the second experiment this was true even after five days), and the bizarre images suffered the disadvantage of taking longer to form than the others. However, Neisser [1976 p.140] suggests that this may be merely the result of the fact that, for the naïve subjects normally used, the nature of the task and the experimental setting itself may make things seem bizarre enough to be memorable, even when the images themselves are quite ordinary. It might be different for habitual users of image mnemonics. A few workers [e.g. Andreoff & Yarmey, 1976; Merry & Graham, 1978; Webber & Marshall, 1978] have found positive effects of bizarreness in some circumstances. As far as I know the issue is still in dispute, although the consensus seems to be against bizarreness being of real importance. Richardson [1980 pp.72-3] and Morris & Hampson [1983 pp.249-50] provide brief reviews of the matter.

3. 1967.

4. In "recognition memory" experiments the subject is first exposed to a number of items (words, pictures, sentences or whatever) and later has the task of picking out items seen before from amongst "distractors", items of a similar type but not previously presented.

5. 1971.

6. Paivio, Yuille & Madigan, 1968.

7. Paivio, 1971 p.79f. The exceptions were words like "ghost" and "anger" (both high imagery yet low concreteness), and "antitoxin" and "armadillo" (concrete but hard to image).

8. Paivio, 1971 p.202. This pattern of findings is not, in fact, restricted to 'free recall' experiments but is found also in 'recognition memory', 'paired associate learning' etc..

9. See e.g. Aiken, 1971.

10. For a full account of Dual Coding Theory see Paivio [1971], and for more recent elaborations see Paivio & Begg [1981]. Although I shall argue in favour of the theory in general terms I do not necessarily subscribe to all aspects of Paivio's more detailed expositions of it.

11. Paivio himself specifically associates the verbal code with sequential and 'logical' thought, and the image code with richness of content, flexibility and "synchronic" thinking [e.g. Paivio, 1975c]. He also associates the two codes with the much touted functional differences between the two cerebral hemispheres [Paivio, 1971 pp.113f; Paivio & Begg, 1981 chap.15; Paivio, 1983 pp.322-323].

12. See e.g. Newton, 1982.

13. Flanagan, 1984 p.188. Flanagan does not in fact refer to Paivio (or anyone else), or to "Dual Coding Theory" whilst setting up his straw-man of "six-code" theory. However, I cannot doubt that he had Paivio's theory in mind here (or perhaps some descendant of it, such as Anderson's [1983] "tri-code" theory).

14. 1977 p.243. Kintsch does refer us to Paivio and acknowledges that he has made a convincing case for independent imagery and verbal systems.

15. See §I.A.1 above.

16. Paivio, 1971 p.12.

17. See *De Anima* 420b; *De Interpretatione* 16a.

18. See e.g. Paivio, 1971 chap.3; Paivio & Begg, 1981 pp.114ff.

19. 1734 Introduction §§ 10,13. Berkeley himself, of course, is not trying to argue against images ("ideas") as the fundamental mental contents. He unquestioningly assumes they are. Rather he wishes to argue that since, as he thinks to have shown, images cannot of themselves represent external perceptible objects then external, perceptually knowable objects do not exist. Later philosophers have generally run the argument in reverse: since external, perceptually knowable objects certainly do exist images cannot be the fundamental, representational mental contents. It is this construal of the argument which Moritz Schlick [1974 p.18 (original German 1925)] rashly called "one of the permanent possessions of philosophy."

20. Especially the opening pages of the *Blue Book* [Wittgenstein, 1960].

21. See e.g. Furlong, 1953; Brown, 1958; Harrison,

1962-3; Fodor, 1975 pp.178ff; Putnam, 1975 chap.1; List, 1981 - this list could be extended indefinitely. The last significant dissenting voice was probably Price [1953].

22. 1980, 1986.

23. This may not do full justice to Kaufmann's position. He claims to draw his views about meaning from Wittgenstein, but it is not clear to me that referential meaning can be entirely accounted for in terms of "use", as they would have it. It is precisely for this reason, it seems to me, that (late) Wittgensteinian views have so often led to relativism, or been recruited by relativists [e.g. Winch, 1958; Douglas, 1973; Rorty, 1980; Bloor, 1983].

24. 1972.

25. 1972.

26. 1975 p.191.

27. Flanagan's [1984 p.188f] account of "six-code" theory also takes it that the code underlying natural language would be "abstract, propositional and quasi-linguistic". Again, this would not be Paivio's view.

28. See especially Kosslyn, Holyoak & Huffmann, 1976.

29. See Kosslyn, 1980 p.116.

30. Kosslyn, 1983 pp.72-3,207-8.

31. Brooks, 1967.

32. In fact Brooks [1967] used the same description of the number grid in this condition, but he replaced the words "right", "left", "up" and "down" with "quick", "slow", "good" and "bad" respectively. This, of course, produces a nonsense description, but one which is otherwise as similar as possible to that used in the visualization condition.

33. Brooks, 1967.

34. Brooks, 1968. The present account of these experiments is inevitably somewhat simplified, and omits a number of further related experiments also reported in Brooks' paper (and which, of course, make his case even stronger).

35. Brooks, 1968 pp.364-5.

36. Brooks, 1968 pp.364-5.

37. See chapter I.A. above.

38. 1975.

39. Also reported in Baddeley, Grant, Wright & Thompson, 1975.

40. Atwood, 1971. Atwood's results, in unpublished form, were known to Paivio and cited in his major book **Imagery and Verbal Processes** [Paivio, 1971].

41. Atwood, 1971.

42. Atwood, 1971.

43. For details of these see Janssen [1976b p.37].

44. Baddeley, Grant, Wright & Thompson [1975]. This paper also cites unpublished work by Quinn in this connection. Other mentions of unpublished 'failures' to produce results similar to Atwood's occur in Paivio [1971 p.374] (work by Brooks), and in Anderson & Bower [1973 p.459] (the work by Brooks and some by Bower, Munoz & Arnold). On the other hand, Bower [1972 pp.61-2] briefly mentions some unpublished work of his own which seems to corroborate Atwood's findings.

45. Janssen, 1976a,b.

46. Janssen, 1976a p.2. Emphasis in original.

47. Byrne, 1974.

48. See e.g. Noton, 1970; Noton & Stark, 1971a,b; Stark & Ellis, 1981.

49. Janssen, 1976a pp.22-3.

50. It is worth noting, in this context, that all the non-primate mammals (and many non-mammals) get by perfectly adequately with little or no colour vision [Humphrey, 1983 p.146], and the common enough fact of colour blindness in man causes so little behavioural deficit that it seems to have gone entirely unremarked before 1777 [Walls, 1956].

51. Phillips & Christie, 1977.

52. 1980 pp.58-9.

53. 1983 pp.167-70.

54. 1973.

55. Galton, 1883 pp.114ff.

56. Oswald, 1960. Number forms are also discussed by Paivio [1971 pp.482-3], and see also Horowitz [1983 p.25].

57. 1981.

58. Also of relevance here is the work of Denis [1982]. He found that vivid imagers (as measured by the VVIQ questionnaire of Marks [1972, 1973, 1983a]) read highly imagable passages of prose more slowly than did weak imagers. The vivid imagers also remembered the passage better. However, the two groups of subjects did not differ in speed or retention when reading prose with a low potential for imagery. Also, when they were specifically instructed to form images whilst reading the "high imagery" text the performance of the "low imagers" became much more like that of the vivid imagers, in both speed and retention.

59. 1973.

60. 1970.

61. Paivio, 1975b.

62. Such conflict effects are well known in psychology, the best known of them, to which Paivio here makes allusion, being the "Stroop Effect" [Stroop, 1935]. This involves words written in different coloured inks, with the subjects having to report on the colours of the inks. This is normally quite easy. However, when the words are actually colour names, and they name colours different from those of the inks in which they are written, then considerable conflict (and thus slowing of response) arises.

63. 1978.

64. See Richardson, 1980 pp.47-8.

65. Richardson, 1980 pp.46-54. Perversely, he excludes size comparisons from this general conclusion. However, this would seem to be because he implicitly holds to a 'pictorial' conception of imagery, which both Paivio [see e.g. Paivio, 1977 p.51] and myself would reject.

66. 1978.

67. See Paivio, 1983.

68. McKellar, 1957.

69. See especially Paivio, 1975c.

70. Much of it will be dealt with in later sections, in somewhat different contexts.

71. Paivio, 1983.

72. After this section was written it came to my attention that Paivio had just published a new book defending and restating 'Dual Coding' theory [Paivio,

1986]. No doubt if I had seen it earlier this section would have taken a slightly different form. However, judging from the brief examination which I have been able to make of this work it does not alter the theory in any respects relevant to our argument (after all, from our point of view it is the broad outline and not the details of Paivio's theory which are important, and which I wish to defend). It is worth noting that whereas his earlier book [Paivio, 1971] was largely concerned with defending the theory from the formerly standard (but now outdated) view that all memory is encoded in our natural language, the new book is mainly concerned with defending it from critics who adhere to the 'propositional' [see chap.II.C below] theories which have since become very influential. I shall be giving my own reasons for rejecting 'propositional' theories, but Paivio's replies to these critics can surely only strengthen the case for 'dual coding'. It is also notable that Paivio shows little sympathy for the imagery theory of Kosslyn [1980], which argues strongly for the significance of imagery but within the context of an essentially 'propositionalist' framework [Paivio, 1976 pp.45,51]. In this my sympathies are again with Paivio.

Notes to §.I.C.3.

1. Hacking, 1983 pp.22-24.

2./To speak of "theoretical entities" in this context seems to be the usual practice in philosophy of science. However, looking at the list we have just given it is clear that the explanatory constructs of science may just as well be substances or even abstract objects. What they all seem to have in common is that they are put forward as candidates for existence. Even confirmed instrumentalists must act as if the postulated entities, substances, etc. really exist whilst they are using the theory. "Theoretical existents" would perhaps be a better term, but there seems to be no pressing need to depart from the standard usage here, so I will refrain.

3. Hacking, 1983 p.23 - emphasis in original.

4. 1966 pp.10-11 (original French 1940).

5. 1967 §621f.

6. Sartre, 1966 pp.10-11 (original French 1940). Wittgenstein seems to be making the identical point, in a rather more gnomic form, in *Zettel* §§ 621 & 627 [Wittgenstein, 1967].

7. 1981 p.209.

8. Taylor, 1981 pp.209-210.