

Notes to §II.D.4.

1. Gibson did not claim to have provided a finished theory. Even in his last major work, *The Ecological Approach to Visual Perception*, which was published shortly before his death in 1979 [Fox, 1980], he speaks of it as "not fully developed" [Gibson, 1979 p.xiii - c.f. p.311]. However, it does not seem to me that there is much fundamental difference between the theoretical approach of this work and that of his previous book, *The Senses Considered as Perceptual Systems* [1966]. I shall thus treat them as presenting the same, somewhat incomplete, theory. The theory as presented in his earlier *The Perception of the Visual World* [1950], although in itself a conscious and radical departure from traditional theories, seems to me to be definitely transcended by the later works.

2. Gibson, 1967. It should be noted that some philosophers, even those generally sympathetic to Gibson's theory, have not welcomed this trespassing on their turf [e.g. Hamlyn, 1977p.7].

3. Gregory, 1981 p.556. I say "admits" because Gregory is clearly unhappy with this conclusion, although he recognizes that the logic of his position forces it upon him.

4. E.g. Gibson, 1968; 1966 pp.2, 55-6.

5. Gibson argues that retinal images as such are not necessary for visual perception; insects can see, but their compound eyes do not form anything functionally equivalent to a retinal image [Gibson, 1979 pp.61-2].

6. Gibson, 1979 p.147. Emphases in the original.

7. For some examples see Ullman [1980] and the appended comments.

8. E.g. Marr, who claims to have learned from (and gone beyond) Gibson [Marr, 1982 pp.29-30], but who asserts in the opening lines of his book that vision is a matter of obtaining information from "images" (by which he means retinal images, or their TV camera equivalents) [Marr, 1982 p.3].

9. As we have already seen, Gregory [e.g. 1972, 1974a, 1981 p.373] is one of these. Perhaps the most thorough and careful 'demolition job' on Gibson is that by Fodor & Pylyshyn [1981].

10. See, e.g., Turvey, Shaw, Reed & Mace, 1981.

11. Examples of what I would consider as constructive criticisms of Gibson include the work of

Neisser [1976b, 1977], Hamlyn [1977] and Heil [1979, 1981b]. Vehement rejections of such critiques include those of Reed & Jones [1978, 1981, 1982], Heft [1980, 1982], and Wilcox & Katz [1981]. Heil's critique, being particularly clear and concise, seems to have borne the main brunt of this defensive reaction. Typically the apologists for Gibson react to any suggestion that Gibsonian theory is in any fundamental way incomplete with accusations that the critic has failed to get out of the old theoretical 'paradigm' [e.g. Heft, 1982], and that his views are tainted by "animal-environment dualism" [e.g. Heft, 1980 p.189], or even implicit Cartesian dualism [Wilcox & Katz, 1981 p.313]. The first accusation surely need not be very wounding; the second is simply false. (I have more sympathy with Johnson's [1980] reply to Hamlyn's critique of Gibson. However, the point of issue in this exchange, Gibson's denial of the significance of sensations [c.f. Yolton, 1968-9; Gibson, 1968-9], is quite different, and is perhaps only peripheral to the 'big' epistemological issues inherent in the other exchanges mentioned here.) Gibson himself seems to have been quite gratified by Neisser's [1976a] sympathetic but critical treatment of the theory [see Gibson, 1979 p.305].

12. 1983.

13. Bickhard & Richie, 1983. For a detailed treatment of the development of Gibson's thought, and its historical antecedents and context, see Lombardo [1973].

14. 1983.

15. This is how Bickhard & Richie [1983 pp.2f] define them, but it seems to me that things which represent by arbitrary stipulation should be included under this heading also.

16. Bickhard & Richie, 1983 p.4.

17. 1981 §2.

18. Bickhard & Richie, 1983 pp.61ff..

19. Bickhard & Richie, 1983 chap.3.

20. Gibson, 1950.

21. 1976. (See Bickhard & Richie [1983 p.78]).

22. 1979, 1983.

23. See Marr, 1982 p.3.

24. See, e.g., Gibson, 1958 p.192., 1979 p.134.

25. See Gibson, 1979 chap.8.

26. Gibson, 1979 p.127. (Emphases in original.) As

Gibson [1979 pp.138-40] tells us, the notion of the immediately perceptible "affordance" owes much to the Gestalt psychologists, especially Koffka [c.f. Koffka, 1935 p.7], who was for several years Gibson's senior colleague at Smith College. For more on Koffka's influence on Gibson see Gibson [1971], E.J. Gibson [1979 pp.238f.] and Lombardo [1973].

27. Gibson, 1979 p.140.

28. Gibson, 1979 p.134.

29. Gibson's teacher was the early "neobehaviorist" E.B. Holt [MacLeod, 1974], and Gibson lists Holt, together with Kurt Koffka, L.T. Troland and E.G. Boring, as one of the major influences behind his theory [Gibson, 1966 p.viii]. (A later version of this list [Gibson, 1979 p.xiii] drops Boring and adds William James and E.C. Tolman - another neobehaviorist and student of Holt [Schultz, 1981 p.240].) Lombardo [1973 p.161] is inclined to minimise the influence of Holt on Gibson's mature theory (stressing that of Koffka and especially Troland), but this may be a mistake. MacLeod, Gibson's colleague in his later days at Cornell, remarks that when he first came under Holt's influence "Gibson swallowed neobehaviorism, hook, line, and sinker (the sinker is still there, deeply embedded". Of course, I am not saying that Gibson, in his mature work, is a Behaviorist, but there are real affinities. In the light of Gibson's claims to vindicate a realist metaphysics it may also be of relevance that Holt first made his name in 1912 as a member of the 'New Realist' group of philosophers [Passmore, 1966 pp.261-4]

30. I do not mean to imply that postulating mental representations would enable us to resolve the classic problems of free will and determinism, but representations do, I think, allow us to escape from direct stimulus control.

31. Turvey, Shaw, Reed & Mace, 1981 pp.226-7.

32. Turvey, Shaw, Reed & Mace, 1981 pp.228-9.

33. Neisser, 1977.

34. Gibson, 1966 p.31.

35. Gibson, 1966 p.32.

36. Gibson, 1966 p.39, 1977 pp.55-6.

37. See, e.g., Frisby, 1979.

38. Gibson, 1967.

39. Neisser, 1967 p.139.

40. The term derives from Koffka [1935].

41. Gibson, 1979 p.164.
42. Gibson, 1979 pp.121f.
43. At least, I think he intends it to include such things. See Gibson [1979 pp.259-60].
44. Gibson, 1979 p.236.
45. Gibson, 1979 p.311.
46. Neisser, 1977 p.24.
47. Neisser, 1977 p.24. I am not sure that Gibson is committed to simple invariants for everything, but he probably should be if he does not want to make his theory vacuous (see Fodor & Pylyshyn [1981]; Fodor [1980b p.107]).
48. Fodor & Pylyshyn, 1981 §8. I think that Fodor & Pylyshyn do misconstrue Gibson's theory in important ways, and thus the arguments they give at this point would require re-framing. Nevertheless, I think the point survives.
49. Gibson, 1974.
50. Gibson, 1974 p.41.
51. C.f. Shepard, 1966; Meudell, 1971.
52. Possibly the experiment of Neisser & Kerr [1973], although it is explicitly presented as being about images, was done in the light of these Gibsonian ideas (they were all at Cornell at the time). This may explain the very different attitudes taken to the subjects' introspective reports during this experiment by Neisser & Kerr [1973; Kerr & Neisser, 1983] and by Keenan & Moore [1979; Keenan, 1983], who seem to hold a much more 'pictorial' and static conception of imagery. When we consider the known power of experimenter effects in imagery experiments [Intons-Peterson, 1983] these theoretical differences may also, perhaps, account for the directly conflicting results obtained by these two pairs of workers. Maybe the conflict tells us more about the confusions of both pairs of experimenters than it tells us about imagery.
53. Gibson, 1970.
54. Gibson, 1979 pp.255-8.
55. Note the parallel between this and the 'definition' of the real given by Polanyi [1964 p.10] which I quoted in my introduction.
56. 1949.
57. Gibson, 1970 p.426.

- 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.5.

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