

Gavagai! or the Future History of the Animal Language Controversy by David Premack.
MIT Press, 1986

One would have to go back approximately 15 million years to find the common ancestor of humans and chimpanzees; and not much more than four or five times longer to find the common ancestor of the elephant and the shrew. There is room for dispute about the time scales, but they should surely mean that biologists are under no obligation to deny to the human species characteristics not present in other primates. Premack's book retains a certain degree of ambivalence on this issue, but in many ways it can be regarded as an Odyssey, describing his progress from earlier behaviourist battles (for whose purposes the chimpanzee served as a device with which they could infiltrate human specializations) to a biologically safer haven, in which the human species can be allowed as many unique cognitive talents or dispositions as may seem convenient to account for the data to hand.

In 1966 Premack published a detailed account of preparations he had well underway for training chimpanzees in an artificial language which had a phonemic structure based on Jacobson's distinctive features model and a rudimentary phrase structure grammar. He was seeking a language competent species other than man: the then expected limitations of the chimpanzee were taken into account by a joystick apparatus connected to sound generators, which allowed simultaneous selection of five auditory dimensions by its hand; and the proposal to attempt first a grammar with no self-embedding or recursion. Little more was heard of this attempt, but by 1970 considerable success was being claimed for an equally ingenious but much simpler system, in which the initial combinatorial stage had been abandoned, and large chunks of meaning were said to be associated with plastic tokens, or "words", which could be observed or manipulated by the animal without stretching its perceptual or motor abilities. A longer account of work using this system with a number of chimpanzees was published in 1976. The present book adds very little to the experimental results presented 10 years ago; material published subsequently is referred to only in passing — on the other hand there is a sprinkling of previously unpublished detail, used to strengthen a point here and there. It is, rather, Premack's reflections on the conclusions which should be drawn from his labours of the last two decades, stripped down to the absolute minimum of experimental description. To some extent it is a *mea culpa*, since there is a strong final conclusion that apes cannot be turned into children, whereas the implication of much of Premack's earlier work was that by degrees they could be, his graduate training having led him to suppose that differences between species, like the difference between language and other observables, might be resolved within a sufficiently enlightened behaviourism (Premack, 1976; xii). He now interprets the internal evidence on the cognitive capacities of trained chimpanzees, as Lenneberg interpreted the biological aspects of the development of speech in infants, as meaning, among other things, that human achievements are "attributable to hard-wiring" or just (and I shall follow him in the abbreviation) "hard-wired".

Not everyone means exactly the same thing by "hard-wiring", but it suggests usefully something whose lack cannot be compensated for by even the most inspired methods of training. Others might wish to identify the hard-wiring with the most intellectually demanding aspects of information-processes: Premack attempts a tripartite division between hard-wiring, learning and cognition. Learning is distinguished from hard-wiring not on the grounds of innateness (the mechanisms which enable learning must in some sense be hard-wired — even Hume said that experimental reasoning was a species of instinct), but on the grounds of being a general- rather than a special-purpose device. Musical, spatial and numerical competences may be innate specializations; for linguistic matters there is a pre-programmed distributional analysis which, when triggered after the child has learned a

database of word-meaning pairs, allows it to construct an adult grammar via house-keeping operations on the database. Premack endorses the Wexler-Culcover (1980) model, in which both the triggering and the processes of the analysis are to do with relations between phrase-markers and surface structures, but is less concerned with the precise properties of the grammatical model than with the more general proposition that human language is a two stage process, in which the second-stage is a specialized, innate, (hard-wired in human but not chimpanzee infants), grammar generating program.

The first-stage is primarily learning individual words — by the use of general-purpose learning mechanisms, but requiring what would appear to be more unacknowledged hard-wiring for the necessary comprehension of thematic relations of case. On page 43 Premack opts for the traditional principle of locating species differences within perception as opposed to learning: in simple species learning must operate directly on primitive sensory data, while in others learning may operate indirectly on the outputs from complex perceptual processes (e.g. the distributional analysis). On pages 54-5 he seems to have neglected this principle when saying that the first-stage of language acquisition is all general purpose, but thematic concepts must simply be granted to the child. It would seem to me more plausible to say that there must be hard-wiring appropriate to the thematic concepts (it would also be possible to argue for the inclusion of aid from general-process learning in the second-stage: this would abolish the learning-stage plus hard-wired-stage distinction but would not negate separate stages of vocabulary acquisition then grammar extraction.)

Premack's reluctance to do this may be connected with what he admits is an unconventional use of the term cognition : hard-wiring involves unconscious and unintentional computation; may be restricted to certain critical (early) periods of life; needs special triggering conditions; is independent of motivation; rarely fails; is confined to big tasks. Cognition differs from hard-wiring on all these counts. In the last 2 or 3 pages Premack also refers to consciousness, which he uses in the sense of conscious problem solving, and conscious attribution to others of beliefs one does not oneself share. Both cognition and consciousness, as well as social attribution and language, are among the many human psychological specializations not shared, in Premack's view, by apes. As such they clearly ought to depend on hard-wiring but they are nevertheless distinguished from it: It seems to me that all the 'ideas' of cognition must come from the hard-wiring, by a route that is presently mysterious (p.51).

Thus, a substantial part of the book is spent discussing characteristics of *Homo sapiens sapiens* which are absent in all other extant species, rather than in examining the latent capacities of our closest living relatives. It will surprise some of Premack's readers to learn that he now finds not only a discontinuity between human and non-human, but also the lack of any degree of language among nonhumans. (p.149). Even more surprising to me was the final sentence, which suggests that excessive concern with questions of linguistic capacity are a distraction from the business of understanding human psychology. The conclusion that the necessary hard-wiring for language is significantly absent in apes could be taken to reinforce the claims for the importance of the special linguistic factor . Premack's dissent appears to derive from the willingness of an erstwhile empiricist to be hung for a sheep - having conceded the linguistic factor he is willing to add any others that present themselves, metacognition (self-knowledge), aesthetics, pedagogy and general intelligence being explicitly on the list.

But he has not altogether abandoned the chimpanzee; indeed there are some tantalising allusions to experiments still in progress which may reveal enhancements in conceptual imagination produced by an educational process applied to these animals, despite their lack of

hard-wired eligibility for it. Throughout the book there are hints of chimpanzee successes, though Premack has withheld some of the evidence in their favour. There are a number of comparative psychologists who firmly believe that in the absence of the special linguistic factor, a chimpanzee has no more claim to any sort of privileged intellectual status than a pigeon, or indeed a goldfish (e.g. Macphail, 1985), but Premack is not among them, and offers the thought-experiment of a special linguistic factor added to the brain of a frog or a chicken. Even if this operation were to be performed on a chimpanzee, he suggests it might fail because of a lack of general intelligence; any very specialized syntactical addition requiring an upgraded inductive capacity in the sense that an enhanced graphics adaptor card for one's PC will require a certain minimum amount of random access memory. But Premack, like most psychologists who have devoted any length of time to working with monkeys and apes, believes that whatever human abilities they may lack, they display some lesser superiority over other mammals. In the course of disparaging demonstrations that dolphins may be trained up to a short finite-state grammar, which allows them to respond to novel instructional combinations of the kind 'Frisbee ball fetch' (carry the Frisbee to the ball), Premack allows primates (probably he means monkeys and apes, otherwise we include bushbabies and lemurs) some measure of semantic comprehension - which means a primitive case perception of agent, recipient and patient. All other mammals, and possibly all vertebrates, are assumed to be able to categorise objects, properties and actions, and at this early stage of the book the human primate is assumed to have merely upgraded semantics and a new set of syntactic categories.

The empirical data on language training is thus used to support the theory that chimpanzees possess exceptional semantic capacities of some kind, rather than the claim that they possess any approximation to human linguistic competence. One of the peculiarities of the field of chimpanzee education is that no trainer, to my knowledge, has ever supported a theoretical claim by a positive reference to data obtained by others. Premack confines himself therefore to data obtained in his own laboratories by the method of associating easily recognisable plastic tokens with discrete objects, properties, agents and actions. Using this technique, it is possible to make a reasonably plausible case that chimpanzees can describe their own recent behaviour (putting up tokens for 'Elizabeth cut apple' immediately after having done so) and, less enthusiastically, that of their trainer (going through similar limited routines of cutting and washing apples, and so on).

One chimpanzee, Sarah (who must now be in her middle twenties) has appeared to be very much more adept than others both at tasks using the tokens and others without them, but I am prepared to accept Premack's assurances that the data even from this single subject is reliable, since he has been assiduous in running control conditions. Some of these allow Premack to suggest that Quine (1960) was too pessimistic about the technical possibilities of interrogating a subject whose language is initially incomprehensible (Gavagai ! having been Quine's incomprehensible word). Chimpanzees are perhaps too simple a case, since it is neither difficult nor surprising to discover that a large part of their inner semantic world is devoted to rich representations of fruit. Representations which amount at the very least to associations between shape and colour can be tested by showing the animals a red patch and offering alternatives of an apple and a banana both painted white. (Premack's chimpanzees live in a slightly idealized world in which apples are absolutely always red, and bananas always yellow). Another band of associations (at least) is required for the animals to succeed on this test when shown a red patch and the words for apple and banana (a blue triangle and a pink square). However an association between an arbitrary signal and a reasonably interesting denotated event can be put down to Pavlovian conditioning (though not therefore ignored, if a large collection of object and signal identifications is involved). One type of empirical

elaboration is to perform similar tests on children (using white painted Santa Claus and Kermit-the-frog dolls as alternatives) — 3.5-yr olds failed, and 4.5-yr olds succeeded at their version of the task, but were not confused, as were chimpanzees, if the real objects were painted in distracting colours instead of the neutral white. Premack deduces from this that the ape's representations are deficient; but might have appealed to the well known Stroop phenomenon, in which human adults suffer a degree of confusion if asked to identify the word 'red' when it is painted in green.

A different kind of elaboration is to map tokens onto properties and relationships instead of object categories. The predicates 'colour of', 'shape of' and even 'name of' seemed to present very little difficulty. The word 'brown' (all colour names were monochrome) was taught to Sarah nonostensively by the instruction 'brown colour of chocolate' (3 plastic tokens) and tested by the instruction 'take brown' from a set of four coloured objects. This could all be interpreted in terms of hierarchies of associations, and it is not clear that dolphins, or other large-brained mammals, would be incapable of something similar: but it is not therefore an achievement irrelevant to human cognition. Sarah's failures, as stressed here by Premack, are in fact in the area of social agency. She was unable to sort videotapes into intentional and unintentional acts (as are 3.5 year olds, until told to look for on purpose) and refused to cooperate if corrected on a test in which she was supposed to place colour markers on the screen to indicate the agents, instruments and objects in videotapes of standard activities (apples being cut, washed etc. by human trainers). But if allowed to persist with her own categories, she was well above chance in distinguishing human agents from human idle observers, though differing considerably from the human experimenter in her classification of the objects and instruments of actions (p.129 — again 3-yr olds tend not to do any better at similar tasks without helpful explanations).

This does not exhaust the experimental evidence Premack summarises here, but exemplifies the empirical background to the various arguments he is concerned to deploy. The book is clearly intended for those more interested in the arguments than in the data, and indeed it will be valuable to any who wish to consider the nature of non-human cognitive abilities, either from the point of view of disputes about language or for the purposes of less restricted issues in comparative cognition. But although it may be the best available book on its topic, it is not the best conceivable. A minor frustration is the lack of the adult form of distributional analysis known as an index. Although the book is not long (about 50,000 words) it covers a good deal of ground, and as the method of progress through topics is elegant rather than systematic, it is hard to recover partially remembered assertions.

“Gavagai!” is a personal and imaginative essay, even-handed rather than dogmatic, and there will no doubt be more to come from Premack. But at present I would say that his conclusions are still biologically unrealistic, since he still appears to discount the 15 million years — no gradual evolution from the cognition of an ape-like common ancestor to the mind of a tool-producing and only eventually civilised hunter-gatherer is entertained. Premack's own work on the natural reasoning of chimpanzees is notable by its absence. Without special training chimpanzees (and up to a point monkeys) have excellent comprehension of the fact that food items may be invisibly present in containers. If shown a single banana placed in a bucket, then shortly afterwards shown the same bucket outside, they run to retrieve the banana — other things being equal they assume object constancy. But if in similar circumstances the trainer stands by the bucket eating a banana, they show no interest in the bucket at all — unless they saw two bananas deposited in the first place. As Premack (1983) has previously pointed out this suggests an primitive grasp of a sort of spatial anaphora (or binding?) — the trainer is eating a definite rather than an indefinite article. Here, alternatively, he relays a personal communication from Chomsky (p.139) suggesting

that a simple mutation added recursion on to a system of conceptual relationships, and at a stroke produced something close to human language. Premack's years of experimentation, allied to Chomsky's suggestion, or the similar idea put forward by Shepard (1987) and others, might be expected to produce something more substantial than an appeal to multiple human specializations, of inexplicable origin. The suggestions have in common the implication that specifically syntactic capacities would have been less likely *de novo* than as modifications of computational facilities already present. One would have thought this should be congenial to all comparative psychologists, and it would fit well with some of Premack's views if human syntactic specializations were related (at some distance) to the social and spatial intelligences of apes. Evolution might be considered to have already provided a version of the thought-experiment of transplanting a linguistic module into the brains of frog and ape respectively. But a residual empiricism leaves Premack curiously antipathetic to any form of Darwinian evolution for cognitive capacities. He explicitly disavows anything Darwinian about the origins of human language, and challenges the reader to find any selective advantage in recursion and syntax. This is too easy — during several million years of competitive tool using, who would not wish to understand “This is the stone I killed the leopard with?”

Perhaps Premack's graduate seminar in philosophy, to which he has attributed his initial gravitation toward the chimp, did not include enough from the eighteenth century. The quickest retort to his scepticism about the evolutionary benefits of recursion is Riverol's — “inasmuch as syntax has evolved, we may assume that it could have done so”. And one might say that the cause of Premack's radical shift of position, from enlightened behaviourism to enlightened nativism, is that he was initially searching for language itself in the chimpanzee, when he should instead have been looking merely for clues as to the precondition of its possibility.

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References

- Macphail, E.M. (1985). Vertebrate intelligence: the null hypothesis. *Philosophical Transactions of the Royal Society, B*, 308, 37-51.
- Premack, D. (1970) A functional analysis of language. *Journal of the Experimental Analysis of Behaviour*, 14, 107-25
- Premack, D. (1976). *Intelligence in Ape and Man*. Lawrence Erlbaum Associates: Hillsdale, N.J..
- Premack, D. (1983). The codes of man and beasts. *Behavioural and Brain Sciences*, 6. 125-37.
- Premack, D. and Schwartz, A. (1966) Preparations for discussing behaviourism with a chimpanzee. In F.L. Smith and G.A. Miller (eds.), *The Genesis of Language*. MIT Press: Cambridge, Mass., 295-335
- Quine, W. V. (1960) *Word and Object*. MIT Press: Cambridge, Mass.
- Shepard, R.N. (1987) Evolution of a mesh between principles of the mind and regularities of the world. In J. Dupre (ed.), *The Latest on the Best: Essays on Evolution and Optimality*. MIT Press: Cambridge, Mass., 252-75
- Wexler, K. and Culicover, P. (1980) *Formal Principles of Language Acquisition*. MIT Press: Cambridge, Mass.