Philosophica 57 (1996, 1) pp. 91-106

SOME PSYCHOLOGICAL MECHANISMS OF CULTURE

Henry Plotkin

ABSTRACT

There is a consensus amongst biologists interested in culture that one possible point of conceptual entry into this enormous and complex phenomenon is to consider cultural change as analogous to biological evolution. In this paper this analogy is examined in the light of possible psychological mechanisms that allow humans to participate in culture. First, attention is payed to the general psychological mechanisms that make culture possible at all. The general stance that is adopted is that a viable theory of culture, including cultural change, can only be based upon adequate psychological theory; and that, at least until the advent of extrasomatic storage, human culture was strictly constrained by its psychological mechanisms. Knowing what these mechanisms are will help in reconstructing human history.

1. *Introduction*

There is a long history of interest in culture by psychologists, and a reciprocal interest in psychology by anthropologists whose specialism is culture. A significant example of the former is Freud (1913) as one instance of a number of books on cultural matters; prominent examples of the latter are Mead (1928) and Levi-Strauss (1966). Freud's approach, typical of one school of thought, was to consider cultural practices as the social group's way of dealing with conflict in the same manner as neurosis is a result of conflict within the component parts and needs of the individual mind. Cultural phenomena such as taboos relating to food or the dead, and totemism, were all analyzed within the same psychodynamic framework as he used for understanding the individual mind. In essence, the approach was to view culture as an organism, the links between psychology and culture being made in terms of general organiza-

tional principles in an attempt to explain why any one culture has the characteristics that it does within particular circumstances. More recent approaches are very different from the culture-as organism view. For example Rosch (1973), considered the possibility of universal cognitive features whose appearance is invariant across cultures. This is much closer to what is attempted in this paper, which is a brief consideration of (i) what might be the cognitive mechanisms that are essential for the existence of culture, and (ii) an examination of a particular approach ¢o culture by biologists which incorporates certain psychologically loaded conceptions. There is much overlap between these. The central premise of the paper is Kitcher's (1987) assertion that a successful theory of culture must be rooted in and consonant with good psychological theory.

2. *What is culture?*

Literally hundred ~ of definitions of culture have been offered over the last 150 years, and these can be classified in a large number of ways (see Kroeber and Kluckholm, 1952 Keesing, 1974). In the face of such excess the appropriate strategy is to settle on a definition that most suites one's own view. Given the focus of this paper, this would be a definition most amenable to the analysis of mechanism. Goodenough's (1957) "culture consists of whatever it is one has to know or believe in order to operate in a manner acceptable to its members" is just such a vehicle. The point to note is that such a definition does not center on the products of culture, be they artifacts or behavior. The emphasis is on knowledge, hence on the cognitive mechanisms that underpin the human capacity for acquiring and transmitting knowledge, and on acceptableness, and hence on the social forces that operate within human groups.

It should also be noted that culture is treated here as a species-specific attribute of humans. Although some other species, notably some primates, live in relatively complex groups and display a proto-cultural sharing of skills amongst some limited, usually small, numbers of the group, only humans display all the core characteristics of culture. These are identified by Tomasello et al (1993) as (i) cultural traditions are acquired by all normal members of a social group; (ii) cultural knowledge and skills are present within social groups with remarkably small degrees of variation; and (iii) "human cultural traditions often show an accumula-

tion of modifications over generations (i.e. the ratchet effect)." The species-specific nature of culture means that any analysis of mechanism must focus on human psychology, with little help to be gained from studies of the psychological abilities of other species.

One of the most important aspects of culture is social construction (Searle, 1995 provides an excellent recent overview). A social construction is a highly complex belief system shared by all, or most, members of a group, which results in the creation of institutions and which guides and drives the behavior of the people in a group. Money is the obvious example. The Western notion of justice based on fairness is another. The latter is not an immutable fact inexorably caused by our biochemistry and present in all humans. Some cultures have quite different social constructions of justice based on revenge, social status or religious precepts. The social construction of justice in Western societies is what it is because members of our culture subscribe to the belief. It exists only because we think it so. Similarly with the construction of money. A one hundred Guilder or ten Dollar note has minuscule intrinsic worth. Their value resides in the agreed belief that they have value. Some biologists are skeptical about the existence of social constructions and suggest they are part of the mythology of the social sciences. This is a curious argument because it is manifestly the case that there is real causal force in social constructions. People live in the ways that they do, and die, because of them. Explaining culture *must* include an explanation of social construction, which exists in no other species.

We are not yet in a position, of course, to explain culture, which is a phenomenon of awesome complexity. But we are, I believe, moving to the stage where psychology can begin to offer a glimpse of the kinds of psychological mechanisms that cause culture. An outline of these is presented below.

3. *Essential Psychological mechanisms of culture*

There is an obvious case that can be made for virtually every psychological trait and mechanism of humans, from sensation and perception through memory and reasoning and on to skilled motor performance, as being essential to our ability to create and enter into culture. But perception, memory and attention are traits, amongst many others, that are

shared with other species, none of which have culture. Even though, say, attentional mechanisms are essential in the developing child for the process of enculturation, they are essential in a supporting role rather than as direct cause. A form of "substractive" reasoning, therefore, allows one to discard these aspects of human psychology shared with other species as either irrelevant to an explanation of culture, or of being only of secondary importance. If some set of traits, t_1-t_n, is shared with animals that do not have culture, then those traits cannot be essential for the existence of culture. What we are looking for is a combination of traits that are both human-specific and consonant with a definition of culture that emphasizes its cognitive-social dimensions of shared, acceptable knowledge within socially cohesive groups.

Consider again the matter of social constructions, which exist only because we *agree* to think that they exist. Agreement, it is suggested here, is of the essence. Whether readily entered into because of ritual interest, educated into, or coerced into, agreement is essential to shared knowledge. Knowledge can only be shared if there is agreement as to the where, what and how of that which is being shared. It cannot be denied that there are deep epistemological problems here that are grist to the mill of any philosopher. However, it also cannot be denied that people with normal colour vision agree that daffodils are yellow, even though there can be no certainty, indeed it is unlikely, that the sensation of yellowness is the same for all people. Indeed, even the colour blind will agree with those of normal vision on the colour of daffodils, their information on colour coming to them from more indirect sources. So while the philosopher may shudder at the complexities and uncertainties of what it means to agree on something as simple as the colour of a flower, it is a commonplace of everyday life that agreement exists. Mundane routines, like buying a loaf of bread, depend upon such agreement. That human culture exists at all is proof of the existence of agreement.

Agreement, then, is what must be explained, and in the following subsections three separate sets of psychological mechanisms are offered as the essential psychological ingredients of agreement.

4. *Theory of mind*

In a seminal paper, Premack and Woodruff (1978) posed the question

whether the chimpanzee has a theory of mind. By theory of mind, they meant "that the individual imputes mental states to himself md to others...a system of inference of this kind is properly viewed as a theory, first, because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms" (pp 515). Whether theory of mind, the attribution of mental states to self and others, occurs in chimpanzees, or any other species, remains a controversial issue (see Heyes, 1994 for a skeptical review). However, there is no question but that it occurs in all normal humans (Wimmer and Perner, 1983; Goldman, 1993; Gopnick, 1993; Leslie, 1994). There is accumulating evidence about the ontogenetic sequence as theory of mind develops in the human infant and child. Soon after birth infants show a marked sensitivity to the presence of eyes, and by 9 months there is good evidence of the existence of shared visual attention; by 12-14 months protodeclarative pointing (the use of an extended index finger and checking on the congruence between the pointing and the direction of gaze of an observer) has appeared; around 18-24 months the infant shows pretend play with others (hence showing appreciation that others can also have mental states), and begins to use the language of mental states (like wanting, thinking and knowing). Yet around 3 years of age the child thinks that what it knows is what all others know. Only at about 4 years old does the average human child enter the period of knowing not only that others have intentional mental states, but that they can be different from the mental states of itself, and indeed that such mental states might be false (see Leslie, 1987; Baron~Cohen, 1995 for reviews).

Once a child has developed to the point of being able to attribute independent mental states to others, then it can begin to infer that on some occasions the attributed mental states of others are similar to those of its own. This assumed capacity for making a judgement about the degree of similarity of mental states, about the extent of agreement between the intentional mental states of self and others as well as just between others, is in fact quite close to one of the theories of theory of mind, which argues that the child has to do a lot of hard conceptual work - making inferences and constructing theories about the minds of others and testing their consequences and then revising their theory - before a mature theory of mind emerges (Gopnik, 1993).

Theory of mind, then, provides the platform or "stage" in the mind

on which understanding of agreement is forged and then played, and which then makes social constructions possible. It is, however, only a stage or arena. Agreement needs more than a complex inference-making mechanism by which the mental states of self and others can be judged as being in some matching state. Driving the mechanism must be information.

5. *Extragenetic transmission of information*

There is a general debate amongst cognitive psychologists as to whether cognition is built upon general mechanisms of information-processing or whether it is a product of a modular mind, each module sensitive to domain-specific problems and operating according to module-specific mechanisms (see Karmiloff-Smith, 1992 for a recent review of both positions). Even if the latter is correct and, in the most general sense, information for a theory of mind module must be coming in part from genes for the initial differentiation of it and all other modules, that argument can be side-stepped here. This is because it does not address the main problem, which is that given the existence of a theory of mind mechanism, whatever its provenance, the sources of information which feed into theory of mind and allow judgements of mental states being in agreement must be identified. One of the principal characteristics of culture, on which there are no dissenting voices, is the existence of extragenetic transmission of information. There are two distinctive possible kinds. The one is non-linguistic and the other is linguistic.

Non-linguistic information of interest to cultural theorists is most generally referred to as social learning, and embraces a variety of forms such as imitation, social facilitation and local enhancement (see Heyes and Galef, 1996 for a recent survey). Of these, imitation is most often cited as important for culture (Boyd and Richerson, 1985 for example). The ability to perform an act after seeing it done by another occurs early in humans (Meltzoff and Moore, 1977; 1983), and there is no reason to believe that it requires linguistic support. Somehow, and the mechanisms are not understood, information streaming in from one modality, usually vision, is transformed into an action, the sensory consequences of which, kinaesthetic and proprioceptive, are matched to the "inferred" input of the individual who is being imitated. Although it can be judged doubtful that

human culture, ever since the evolution of language, is built in a significant way on such non-linguistic extragenetic mechanisms of information transmission, it is possible that the child's early experience of matching own to others psychological states is significantly boosted through imitation. Since language most likely evolved over thousands or tens of thousands of years, it is also likely that the evolution of culture in humans was accomplished by a close interplay of such nonlinguistic mechanisms with emerging language ability.

Language itself, of course, is widely recognized as an essential ingredient of culture. Quite apart from the massive quantities of information that can be transmitted via language, another role that it might play is in the formation of the understanding of shared mental states, i.e. of agreement between individuals. Many things happen during the acquisition of language, but one in particular may be crucial in this respect. This is the learning of words as having reference, as referring to specific objects in the world outside of the individual and those with whom they are communicating. When a child learns through a quite lengthy process that the word cat refers to a specific thing, it learns that others refer to that same object by the same word. Reference, like imitation, may be a stepping stone along the way to a wider understanding of agreed mental states whereby, eventually, entirely abstract notions, like justice, can be agreed upon. "Money, property, marriage, government and universities all exist by forms of human agreement that essentially involve the capacity to symbolize" (Searle, 1995, pp 228). The capacity to share meaning surely fuels the capacity to infer intentional mental states like knowing and believing that builds in each person the secure base for entering into culture as shared knowledge.

6. *Social force*

Two experiments are of relevance here. In a classic series of studies, Sherif (1936) exploited an optical illusion called the autokinetic effect. When someone fixates on a stationary point of light in a darkened room, after a time they will report that the light moves, and they can give an estimate of the amount of movement. Tested separately, people report a range of distances through which the light seems to move. Tested in a group and sharing their experiences, the judgement of all participants

quickly settles on some shared standard or norm. Sherif argued that the formation of a common norm is a fundamental feature of social life across a wide range of judgements and beliefs. Subsequently, Jacobs and Campbell (1961) exploited this finding by initially putting together a social group made up entirely of planted subjects who were instructed to exaggerate greatly the apparent amount of movement of the light. Only one person in the group was a genuinely naive subject, and that person's judgement was markedly skewed in the direction of that of the planted subjects. Then, one by one, the phoney subjects were removed and replaced by genuine subjects during a series of repeated trials of exposure to a stationary point of light. Eventually the group was made up entirely of naive subjects, yet for some four or five "generations" after the removal of all the planted subjects, the "cultural tradition" of overstating the amount of perceived movement was maintained. The astonishing feature of the experiment is that the belief concerned an illusion - the light never moved, though the genuine subjects did not know this.

Powerful social forces of this kind have been variously called conformity, obedience and group cohesiveness by social psychologists. They are likely evolved psychological traits in a species the near entirety of whose evolution over several million years occurred with one constant feature - lite was lived in small social groups, the coordinated activity of which was probably significant to the survival of the individuals making up the group. These social forces may directly contribute, as Sherif originally argued, to agreement; indirectly they may constitute a kind of contextual cement in which shared beliefs and judgements, including social constructions, are set.

There is no certainty as to how theory of mind, extragenetic transmission of information and social force combine as psychological mechanisms to give rise to culture; and it is certainly possible that there are other components of human psychology that are significant causal mechanisms of culture. What is offered above is illustrative of the kind of analysis that contemporary psychology offers in contrast to the approach by analogy used by Freud.

7. *Cultural change and the concept of the meme*

The use of analogy also figures large in a very different application of

psychological mechanisms to the understanding of culture. Not long after Kroeber (1953) called for the incorporation of the understanding of culture into some appropriate biological theory as an important goal for a science of culture, Murdock (1956) suggested that cultural change could be understood in terms of selection theory. That is, in terms of the operation of the same processes that drive biological evolution, but embodied in mechanisms that are at least to some extent, if not entirely, separated from the genetic and phenotypic mechanisms of biological evolution. This is a theme repeated subsequently in a series of highly influential papers (Campbell, 1965; Cloak, 1975; Durham, 1976) and books (Dawkins, 1976; Pulliam and Dunford, 1980; Cavalli-Sforza and Feldman, 1981; Lumsden and Wilson, 1981; Boyd and Richerson, 1985). Attempts to identify the cultural analogues of genes and gene pools in the form of memes (Dawkins, 1976) or culturgens (Lumsden and Wilson, 1981) and meme pools (Dunn, 1970; Ryle, 1973; Durham, 1976) were necessary accompaniments to this work (see also Hull, 1982). The importance of these attempts is simple to understand: without identifiable units that can be counted and measured in various ways, we do not have a science of culture.

Recent general reviews (Plotkin, 1994; Cziko, 1995) provide more detailed accounts of selection theory. The blare bones of its application to cultural change is that cultural forms, entities or units, what Dawkins called memes, occur in variant forms. One reason for the variation is the occurrence of changes in memes, equivalent to genetic mutations, that are not directly caused by any selection processes; another is that changes are wrought on memes as they interact with one another. Selection results in memes being differentially propagated by copying and transmission systems which move the units about in space and may conserve them over time. The differential survival of memes resulting from such selection and transmission processes leads to changes in frequencies of memes in a cultural pool over time; the culture shows descent with modification. In other words, cultural change occurs because of cultural evolution.

These gene-culture co-evolutionary theories (for reviews see Laland, 1993; Laland, Kumm and Feldman, 1995), one form of which are dual inheritance theories (Boyd and Richerson, 1985), are concerned with the relationships between cultural and biological evolution, even if the emphasis generally has been on culture. The evolutionary analogy should not be taken to imply that variation is blind. Campbell and Cziko have

adopted this stance, but it is simply not necessary to do so. It can be questioned whether any evolutionary change occurs by the way of blind processes, and that would apply as much to conceptual and cultural change as to biological evolution as conventionally understood. This is because mutation and variation is alway structurally constrained, the constraints arising from past selection histories.

For the purposes of this paper, the concern of which is purely one of possible psychological mechanisms of culture and cultural change, the linkage with genes is ignored. Co-evolutionary theories have implicated a range of psychological mechanisms as constituting cultural selection devices and transmission processes involved in cultural evolution. In part the suggestions are governed, as they are in this paper, by the theorists' views as to what is the most tractable approach to the problem of culture. Thus Boyd and Richerson (1985), for example, specifically reject Goodenough's definition based on knowledge and belief and instead define culture explicitly in terms of behavior and imitation. Whatever one's theoretical predilections, a complete theory of culture couched in these terms will have to identify the psychological mechanisms that are the basis of memes (the variants), selection processes (including the vehicles or interactors on which selection acts), and transmission processes. Each one of these warrants an extensive analysis on its own. Space constraints lead to a brief concentration here on identifying the meme.

Dawkins (1976) own "unit of imitation", which is how he defined the meme, is exemplified by "tunes, ideas, catch-phrases, ways of making pots or of building arches" (pp 206), which is not a homogeneous grouping of entities. But the idea behind his formulation is a powerful one. Dawkins is important in developing the concept of the replicator as central to any evolutionary process. A replicator is any entity which can make copies of itself, the archetypal replicator being the gene. Memes too must be capable of making copies of themselves, and so perhaps tunes, ideas and ways of making pots are indeed memes because all can make copies of themselves by some process of imitation. Take as a more likely example of a "unit of imitation" the actions necessary for the construction of a stone tool. The behavior of a skilled stone tool-maker can be observed by another person and then copied, replicated, by the observer.

There are problems, though, in formulating the replicating unit of cultural evolution in this way. For one thing, many social scientists object to culture being analyzed in terms of actions and artifacts (Ingold, 1986

for example), even if some of the action involves speech or song. For another, it could be argued that behavior, which is what is being imitated, is not the replicator but the vehicle or interactor upon which selection acts, analogous to the phenotype's role in biological evolution (Hull, 1982; Boyd and Richerson, 1985; Heyes and Plotkin, 1989). The replicator is properly identified as the neural networks and psychological mechanisms, in other words, the memories of the actions being imitated. This immediately runs into the difficulty of there being no understanding at all of the neurological basis of imitation, and no clear understanding or agreement on what psychological mechanisms are involved beyond the necessary informational transformations described earlier (see section on extragenetic transmission of information). It is extremely unlikely that the neural network states of the observer, after having successfully acquired the skill of how to fashion a stone tool, are copies, replicates, of the neural network states of the teacher. On the other hand, it is likely that once a functional understanding of imitation is gained by psychologists, that the psychological mechanisms involved in producing a copied complex sequence of skilled actions will be the same in observer and teacher. But right now, we just do not know what these are.

The lesson to be learned, though, is that understanding what cultural replicators are will only come through understanding the psychological mechanisms which give rise to the behavior. They should not be identified with the behavior itself, and cannot be identified with the exact underlying neural network states. The loose linkage between neural network states and psychological mechanisms makes one wonder whether any form of strict eliminativism can ever be a viable scientific programme. This means the emphasis must, for the moment, be placed on psychological mechanism not precise network states. However, this should not be taken to mean that there is room for folk psychological concepts. Psychological concepts of memory and higher-order structures bear little relationship to folk theory. This is Kithcher's (1987) point. We need good psychologial theory, at least to begin with. Theory pitched either at the neuronal or folk levels are each as inadeqaute as the other.

Imitation serves to warn of the difficulties of identifying memes, even when the notion of culture is hopelessly oversimplified to the transmission of simple, if skilled, acts. Culture, however, is not a matter of collective twitches. If we concentrate on the Goodenough definition of culture, then replicators are going to have to be sought amongst the

psychological mechanisms that support beliefs and ideas, which must be some form of complex memory or higher-order knowledge structure; the transmission will be primarily linguistic; and the vehicles or interactors will be, at a minimum, the behaviors generated by beliefs and ideas, and possibly the performance (behavior) of social institutions such as courts of justice or government bodies, which are manifestations of social constructions. There is fearsome complexity that must be dealt with here.

Psychology takes us a little way in this complexity. Just as it is unlikely that a powerful theory of so complex a thing as culture will be built on simple imitated actions, so it is equally unlikely that a competent theory can be built on simple memory. For example, being told that a certain school has a good reputation for teaching science to girls is a non-complex, easily copied and transmitted piece of information. The name of the school, its location and its reputation are what is meant here by simple memories. Such memories, however, are the small change of culture. It is higher-order knowledge structures, variously referred to as schemas (Bartlett, 1932), frames (Minsky, 1975), scripts (Shank and Abelson, 1977), memory organization packets and thematic organization points (Shank, 1982) that are serious candidates as memes in cultural evolution. A higher-order knowledge structure of a school is some generic description of schools as places where children go for some part of each day and are taught by adults about language, maths, history and so on, and where they are exposed to large numbers of peers and learn how to live cooperatively with others. Every child growing up in our culture acquires the higher-order knowledge structure for schools, as well as structures relating to shops, games, sports, authority and many others. The transmission of such higher-order knowledge structures is the central feature of enculturation. Of course, every culture is characterized by different higher-order knowledge structures. The San people of the Kalahari do not acquire restaurant schemas and the English have no scripts relating to ancestral Spirits. These structures are culturally transmitted at rates close to that of genetic transmission, that is, once in a normal life-time. They are deep-level replicators that form the core structures from which are derived their more dynamic, surface-level replicators - the simple memories that inform us that this is a good school and that is a restaurant to be avoided - which are actively transformed and transmitted throughout our lives.

It is possible that there exists in all humans and every culture certain

even deeper-level cognitive structures that form the fundamental architecture of cultural knowledge. These would be universal, innate, genetically determined and evolved structures of mind concerned with, for example, sharing resources, defending the social group, or reacting to strangers. From such a limited number of primitive, culturally-universal meme structures might be built the deep-level, core, culture-specific memes of higher-order knowledge structures that characterize each culture; and clustered around these deep-level memes will be clouds of very large numbers of surface memes. There is as yet no evidence that such an architecture of memes actually exists. But it is congruent with current models of memory in terms of levels of processing; and it presents a complexity of explanatory structure that begins to do justice to the complexity of its subject matter.

Whatever eventually prove to be the appropriate units of cultural evolution, one thing is clear. The replicators and vehicles can only be sought amongst psychological mechanisms and the behaviors that they generate. No matter how complicated and presently illunderstood these mechanisms might be in terms of intentional mental states, social forces, language and semantics, simple memories and higher-order knowledge structures, memes and whatever supports and services them reside within the minds of the individuals making up culture. Whatever the characteristics of these mechanisms are, it is these that constrain culture, set its limits and determine its general nature. Until the invention of extrasomatic storage in the form of written scripts, human cultural practices were limited by the characteristics of human memory, which is a fallible and uncertain thing. These memories were, and still are, largely embedded in rituals and narratives in order better to preserve information, rather than in artifacts like tools. The advent of extrasomatic storage occurred only about six thousand years ago. It is only in the last one to two hundred years that there has been wider access to such stored information, which even now at the end of the 20th century is not available to everyone. Six thousand years is a mere drop in evolutionary time and there could not have been significant evolutionary changes wrought in just a few thousand years. Strip away the rather flimsy trappings of 20-th century mass-media and the massive concentrations of populations, and whatever human culture is now in terms of causal mechanisms, it is what it has always been for hundreds of thousands of years. A science of culture, in other words, based upon psychological mechanisms as they

exist now, should allow us to extrapolate back in time and understand something of the culture of humans in unrecorded time. Combining such understanding with archaeological and anthropological evidence should allow a more complete picture to emerge of human history.

University College London

REFERENCES

Bartlett F.C. (1932), *Remembering*. Cambridge: Cambridge University Press.

Boyd R. and Richerson P.J. (1985), *Culture and the Evolutionary Process*. Chicago: Chicago University Press.

Campbell D.T. (1965), Variation and selective retention in sociocultural evolution. In H.R.Barringer, G.I.Blanksten and R.W.Mach (eds) *Social Change in Developing Areas: a Reinterpretation of Evolutionary Theory*. Cambridge Mass.: Shenkman. pp 19-49.

Cavalli-Sforza L.L. and Feldman M.W. (1981), *Cultural Transmission and Evolution: a Quantitative Approach*. Princeton: Princeton University Press.

Cloak F.T. (1975), Is a cultural ethology possible? *Human Ecology* **3**, pp. 161-182.

Cziko G. (1995), *Without Miracles: Universal Selection Theory and the Second Darwinian Revolution*. Cambridge Mass.: MIT Press.

Dawkins R. (1976), *The Selfish Gene*. Oxford: Oxford University Press.

Dunn F.L. (1970), Cultural evolution in the late Pleistocene and Holocene of Southeast Asia. *American Anthropologist* **72**, pp. 1041-1()54.

Durham W.H. (1976), The adapted significance of cultural behavior. *Human Ecology* **4**, pp. 89-121.

Freud S. (1913), *Totem and Taboo*. New York: Norton.

Goldman A.I. (1993), The psychology of folk psychology. *The Behavioural and Brain Sciences* **16**, pp. 15-28.

Goodenough W.H. (1957), Cultural anthropology and linguistics. In P.Garin (ed) Report of the 7th Roundtable meeting on Linguistics and Language Study, Georgetown University Monograph Series on *Language and Linguistics* **9**, pp. 167-173.

Gopnik A. (1993), How we know our minds: the illusion of first-person knowledge of intentionality. *The Behavioural and Brain Sciences* **16**, pp. 1-14.

Heyes C.M. (1994), Social cognition in primates. In N.J.Mackintosh (ed) *Animal Learning and Cognition*. London: Academic Press. pp 281-305.

Heyes C.M. and Galef B.G. (1996), Social Learning in Animals: *the Roots of Culture*. San Diego: Academic Press, pp 281-305

Heyes C.M. and Plotkin H.C. (1989), Replicators and interactors in cultural evolution. In M.Ruse (ed) *What the Philosophy of Biology Is*. Dordrecht: Kluwer. pp 139-162.

Hull D.L. (1982), The naked meme. In H.C.Plotkin (ed) *Learning, Development and Culture: Essays in Evolutionary Epistemology*. Chichester: Wiley. pp 273-327.

Ingold T. (1986), *Evolution and Social Life*. Cambridge: Cambridge University Press.

Jacobs R.C. and Campbell D.T. (1961), The perpetuation of an arbitrary tradition through several generations of a laboratory microculture. *Journal of Abnormal and Social Psychology* **62**, pp. 649-658.

Karmiloff-Smith A. (1992), *Beyond Modularity: a Developmental Perspective on Cognitive Science*. Cambridge Mass.: MIT Press.

Keesing R.M. (1974), Theories of culture. *Annual Review of Anthropology* **3**, pp. 73-97.

Kitcher P. (1987), Confessions of a curmudgeon. *The Behavioural and Brain Sciences* **10**, pp. 89-97.

Kroeber A.L. (1953), Concluding review. In S.Tax, L.C.Eisely, I.Rousse and C.F.Voegellin (eds) *An Appraisal of Anthropology Today*. Chicago: Chicago University Press. pp 357-376.

Kroeber A.L. and Kluckholm C. (1952), Culture: a critical review of the concepts and definitions. *Papers of the Peabody Museum of American Archaeology and Ethnology* **47**, pp. 1-22 ~ S.

Laland K.L. (1993), The mathematical modelling of human culture and its implications for psychology and the human sciences. *British Journal of Psychology* **84**, pp. 145-169.

Laland K.L., Kumm J. and Feldman M.W. (1995), Gene-culture coevolutionary theory: a test-case. *Current Anthropology* **36**, pp. 131 -156.

Leslie A.M. (1994), ToMM, ToBY, and agency: core architecture and domain-specificity. In L.A.Hirschfeld and S.A.Gelman (eds) *Mapping the Mind*. Cambridge: Cambridge University Press. pp 119-148.

Levi-Strauss C. (1966), *The Savage Mind*. Chicago: Chicago University Press.

Lumsden C. and Wilson E.O. (1981), *Genes, Mind and Culture*. Cambridge Mass.: Harvard University Press.

Mead M. (1928). *Coming of Age in Samoa*. New York: Mentor.

Meltzoff A.M. and Moore M.K. (1977), Imitation of facial and manual

gestures by human neonates. *Science* **198**, pp. 75-78.
Meltzoff A.M. and Moore M.K. (1983), Newborn infants imitate adult facial gestures. *Child Development* **54**, pp. 7()2-709.
Minsky M.L. (1975), A framework for representing knowledge. In P.H.Winston (ed) *The Psychology of Computer Vision*. New York: McGraw--Hill. pp 211-277.
Murdock G.P. (1956), How culture changes. In H.L.Shapiro (ed) Man, *Culture and Society*. Oxford: Oxford University Press. pp 247-260.
Plotkin H.C. (1994), *Darwin Machines*. Cambridge Mass.: Harvard University Press.
Premack D. and Woodruff G. (1978), Does the chimpanzee have a theory of mind? *The Behavioural and Brain Sciences* **1**, pp. 515-526.
Pulliam H.R. and Dunford C. (1980), Programmed to Learn: an Essay on the Evolution of Culture. New York, Columbia University Press.
Rosch E. (1973), Natural categolies. *Cognitive Psychology* **4**, pp. 328-350.
Ruyle E.E. (1973), Genctic and cultural pools: some suggestions for a unified theory of biocultural evolution. *Human Ecology* **1**, pp. 2()1-215.
Searle J.R. (1995), *The Construction of Social Reality*. London: Allen Lane.
Shank R.C. (1982), *Dynamic Memory*. New York: Cambridge University Press.
Shank R.C. and Abelson R. (1977), *Scripts, Plans, Goals and Understanding*. Hillsdale NJ: Erlbaum .
Sherif M. (1936), *The Pychology of Social Norms*. New York: Harper and Row.
Tomasello M., Kruger A.C. and Ratner H.H. (1993), Cultural learning. *The Behavioural and Brain Sciences* **16**, pp. 495-511.
Wimmer H. and Pemerl J. (1983), Beliefs about beliefs: representation and constraining function of wrong beliefs in young childrens' understanding of deception. *Cognition* **13**, pp. 103-128.