

geous for the human mind to be a "mathematically messy" organ.

**Chomsky and the analytic philosophers.** Though the analytic philosophers share the predilection of the social scientists for "shallow" theories of mind, they are divided from Chomsky also in two further respects.

With the rise of specialization there came the demand to spell out what the special domain of philosophy is. We need not go through the many proposals that have been made. Quine (1960) has rejected the distinction between analytic, conceptual, and empirical truths; he has also maintained that philosophy and science form a continuum. The latter deals more with issues closer to the observational level, while the former deals with matters more removed from observation – but the distinction, according to Quine, is one of degree. Chomsky rejects, on the one hand, Quine's views on analyticity largely on the ground that rule-structures must play important and distinct roles in explaining cognitive competences. On the other hand, he agrees with Quine on the philosophy-science continuum. Hence, he holds a position different from that of all the main current schools.

In examining the structure of human cognitive competences, Chomsky is concerned mainly with aspects of human understanding. Modern philosophers have been preoccupied with analyses of what it means to know a proposition to be true, and with the analysis of the notion of viable empirical evidence. They leave questions about understanding to the psychologist. Given Chomsky's philosophy-science continuum view, one can see why he regards this as unsatisfactory. He insists – rightly, it seems to me – that there are important conceptual problems regarding notions like "understanding," "learning," "growth," "development," and so forth, and that the tools of modern epistemology are not adequate for dealing with these.

**Conclusion.** In these brief remarks I have tried to show how deep the differences are that separate Chomsky from the main trends in current social science and analytic philosophy. I have also tried to show that the opposition to his views rests, by and large, on unarticulated assumptions that are very deeply rooted in our culture. One can only hope that a better understanding of Chomsky's position, and the nature of the opposition, will lead to a shifting of the level of dialogue, to a more rational and better articulated plane.

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### There are many modular theories of mind

Almost any sane psychological theory will account for behavior by reference to internal mental structure. But to say this is to rule out only the most naive *tabula rasa* empiricism or the most clumsy stimulus-response behaviorism. In particular, it does not commit psychology to a framework of discrete modular systems of concepts, whose interaction produces behavior. Chomsky presents an argument that our internal mental structure is indeed modular and that the mind has organs in much the way that the body has; he in fact presents some conjectures about what the modules may be. The argument consists essentially of a restatement of his reasons for thinking that language is based on such an autonomous conceptual system, and an imaginative extrapolation to the more general situation.

There is no doubt, as I see it, that there may be such modules; the idea is not incoherent. And there is now, after twenty years of campaigning by Chomsky and his followers, a presumption in favor of the idea that in language we have such a module. What Chomsky is now trying to do is to develop these insights into a general account of human capacity, of at least enough specificity to advise us what to look for when approaching nonlinguistic skills.

Human capacity breaks down into language, the system of concepts, sociality, musicality, and so on, apparently. But these modules are not at all basic; linguistic competence surely breaks down into phonetic competence, syntactic competence, semantic competence, at least. These things can clearly vary independently, though just as clearly they can only function normally in combination. This is typically the case, as we are discovering in cognitive psychology;

spatial ability, for example, almost certainly consists of a number of distinct capacities, which might even occur in different degrees in different populations (Jahoda 1979; Serpell 1979). Any recognizable piece of behavior, or any skill as described common-sensically, will result from the interaction of a number of more primary skills. It is now unlikely, to the point of incredibility, that there should be, for example, primitive arithmetic or musical skills. If there are absolutely primary skills, their number must be very large and their characterization very theoretical. (A little reflection on the systematic but paradoxical disruptions of capacity produced by brain lesions will lead one in the same direction; Wilkes 1980.) And if this is so, then the skills that underlie distinct capacities may overlap. It seems likely that some syntactic competence is put to use in arithmetic and musical skill; there is some neurological evidence for this in the case of music.

What could one learn about the workings of the liver by studying the workings of the heart? Very little. What could one learn about the interaction of the respiratory and circulatory systems by studying the interaction of the nervous and digestive systems? The problem is that, to the extent that we think that the most profitable analysis of something is in terms of autonomous modules, we must think that what we learn from one module is unlikely to transfer in any easy way to another. In what ways are nonlinguistic capacities likely to require a treatment different from those involved in language? Some basic features of the Chomskian analysis of language have much less force when applied elsewhere. The underlying regularities may not be rules; they may not even be manipulations of representations. They are even less likely to involve the possession of implicit innate concepts. One prepsychological reason for doubt on this score is the fact that nonlinguistic skills typically come in degrees; there is not usually something that one simply does or does not have.

These remarks are an exercise in the separation of possibilities. Mental structure does not entail modularity; modularity does not entail the presence of rules and representations. The fact that language is both the best candidate for modularity and the best candidate for a representational mental framework does not tell us much about the nature of other skills. Chomsky gives rigorous arguments for describing language in terms of rules and representations, and heuristic arguments for modularity. But the two conclusions do not combine in the way he wants; if anything, modularity tells against the promise of language as a paradigm of human skill. I do not think that Chomsky has given us what we need in order to imagine a physiology of mind – a study of the interaction of essentially different mental components. To say this is neither to suggest that such a thing may not be found nor to deny the wish that someone find it.

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### Language: levels of characterisation

The issue I would like to address is the separateness of what Chomsky terms "abstract characterisation" on the one hand and "physical mechanisms" on the other hand. The distinction is introduced early in the article, when Chomsky is establishing that his use of terms like *mind* and *mental representation* "...need in no sense imply the existence of entities removed from the physical world." It is a sad commentary on the quality of the current debate that this qualification has to be made, since such a position is entirely natural for a cognitive psychologist. The essence of the information-processing approach is to describe cognitive function without regard to the substrate. To discuss the "existence" of such functions would be as strange as talking about the *existence* of a particular program in a computer. It is simply not an issue. What is important is the way in which the functions described in a psychological model are implemented in the brain. But note that without knowing what the psychological functions are, we cannot ask how they are implemented.

Chomsky talks about our knowledge of language being represented "in structures that we can hope to characterise abstractly, and in principle quite concretely, in terms of physical mechanisms." It is not quite clear, from this, what form we should expect the latter to take,

since shortly after, Chomsky continues "In the same way, a theory of human vision may be formulated in concrete terms, referring, say, to specific cells in the visual cortex and their properties."

There seem to be three possibilities here. The first is an account of human vision where the basic units are physiological. In such an account the stress would be on the responsiveness of single cells, their interconnections and projections, and perhaps their structure. The second possibility would talk about the implementation of the psychological formation in neural terms. This would include phrases such as "Function F is located in area A" or "It would be possible for function F to be realised in neural terms in the following way. . . ." The third possibility would be the reverse of the preceding one. That is, it would take a neural unit and describe its role in psychological terms. A typical statement in such an account would be "Area A is involved in functions F, G, and H." The extent to which these three possibilities overlap, with respect to what counts as data, seems to depend critically on the extent to which the psychological functions are localised. It seems possible that some simple visual functions might be localised, but it appears to be unlikely that any useful localisation of language function exists (Zangwill 1978). For language function, then, the accounts are likely to be distinct. In any case, a proper psychological theory is insulated from such considerations, since its justification will be, in Chomsky's words, "by success in providing insight and explanation."

One might note here that the use of behavioural data from brain-damaged patients does not of itself constitute a bridging of the gap between the levels. Thus I am aware of no work in which knowledge of the location of a lesion has played a role in the evolution of a psychological theory. For example, Bradley et al. (1979) compare data from normals and agrammatic patients and conclude that there is a separate lexicon for function words. They also postulate that this lexicon is in the left hemisphere. However, none of their strictly psychological arguments would be affected if it in fact turned out to be in the right foot.

It should be clear that the separation of levels I am discussing is neutral with respect to Chomsky's claim that linguistics is a part of psychology. If we are to accept this, then it should follow that psychologists should be able to provide evidence to decide among linguistic theories. It would be interesting to discover what such evidence might look like. Previous attempts seem not to have been too successful, and one recent move to support the claims of a particular grammar (Bresnan 1978) seems to me to have mistaken a computational device (A.T.N.'s) for a psychological model [see Arbib and Caplan: *BBS* 2(4) 1979]. Of course, if linguistics is actually more abstract than psychology, and is better to be considered at a different level, then neither can produce evidence crucial for the other, any more than physiology can decide between psychological models or vice versa. The proper questions would then be of the form "which psychological functions are responsible for linguistic function L?" We will discover, of course, that not only will linguists disagree as to the nature of the relationship between linguistics and psychology, but also, the kind of theory they produce will differ. The mode of interaction of psychology and linguistics, then, would depend crucially upon the level of abstractness of the particular linguistic theory being considered.

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### Cross purposes

With a little semantic revision ("instinctive behavioral patterns" instead of "mind" for instance), Chomsky's brief discussion of learning of grammar (p. 13) might have come from Staddon and Simmelhag's (1971) behavioristic discussion of "learning" and evolution. But the parallelism is illusory. Prior to this discussion, one encounters Chomsky's response to those critics who have claimed that his grammar "has no psychological reality." Chomsky says that he never meant to distinguish "psychological reality" from what constitutes good linguistics in the first place. A behaviorist would also deny the distinction. A grammar, to a behaviorist, is a theory of behavior. But for the behaviorist the grammar is the theory of the linguist. For Chomsky, the

grammar is not only the theory of the linguist, it is also represented, as an organ, called a "mental organ" but real, like the heart, lungs, liver, eyes, held captive *inside* the speaker. This assumption (the physiological justification of which is claimed to be far in the future) is what behaviorists are likely to find unacceptable. Chomsky seems to feel that the facts call for an extreme degree of nativism with regard to language, and that nativism, in turn, requires the concept that the language faculty is a "mental organ." A psychologist, even a nativist, even a cognitivist (let alone a behaviorist) would begin with different assumptions.

At first I suspected that "mental organ" was meant to be a collective name for the areas of the brain known to be necessary for the control of speaking and understanding speech. But Chomsky seems to feel that these areas contain something beyond what (little) we know about them. The language "organ," as Chomsky describes it, seems intended to embody inside the organism, in concrete form, whatever is important in language, structurally *and* functionally. Why is it necessary to (so to speak) hold a behavioral function hostage in the human body? Where does this get us? Do we need to fear that this imprisoned function (in the case of language) will escape and lodge itself in a dolphin or a chimp or even, God forbid, a pigeon? Our bodies themselves are organized in a symmetric way and presumably have evolved that way. Do we then have to have an "organ of symmetry" inside us to explain the way our bodies are? [See Corballis & Morgan: *BBS* 1(2) 1978.]

If not, then it cannot be the *innateness* of language that prompts the postulation of an organ for it; nor can it be the fact that language has a complex organization. These things language shares (or might well share) with walking, bicycle riding, genuflecting, and many other functions. To understand better what Chomsky is driving at, I tried to imagine some behavior that people might agree has a large innate component where (unlike the various manifestations of language) there is clearly little variation among cultures. Perhaps, *walking* will do as an example. (There are those who would argue that the common nature of walking is due to common shaping of the environment and common reinforcement for locomotion, but let us ignore such arguments and agree that walking is a largely innate behavior.) There could be constructed a grammar of walking, perhaps not as complicated as grammars of speaking but complicated enough. Certainly each instance of walking is different in some respects from all others; elements can be replaced by other elements; limps, skips, hops, struts, and other variations have their own regularities yet fit within a general pattern. A given environmental demand (say a low wall) brings forth unique solutions that yet fit within the "grammar." A mime might construct syntactically correct walking without semantic content (without getting anywhere) corresponding to similar constructions (jabberwocky) of language. Although, to my knowledge, there are no written grammars of walking, there is no reason I can think of why the job, in principle, cannot be done. In addition, in the brain there are structures that, if damaged, will impair walking.

Granting all this, the facts still do not compel the postulation of a physiological "module" that contains somehow all that is or can be important about walking. Perhaps the reason Chomsky proposes such an all-inclusive organ for speech is what he calls "the impoverished environment." This phrase is repeated several times but remains unexplained. Impoverished with respect to what? In what way is the stimulus poor? And how is such an "impoverished" stimulus supposed to "fine-tune" behavior (Chomsky refers to all behavioral shaping such as that which causes differences between Persian and English as "fine-tuning")? The stimulus in question is other people talking and acting. Except perhaps in the case of a poet or linguistic stylist, our linguistic environment seems at least as complicated as our linguistic behavior. Certainly all children (and adults probably) hear or see more sentences than they speak. If by "poverty" is meant merely the fact that I speak certain *particular* sentences that I have not heard, then that is also true generally in my behavior. I might whistle nondissonant melodies that I have not heard, or build a house different from any I've seen, or put on my pants in the morning in a new way, or (to cite a social action like language) relate to a friend in a unique way; all of these conform to the rules governing these behaviors, but not to any