different from Kant's, in that while Kant claims that the same *a priori* synthetic categories he deduces can be shown transcendentally to be necessary for any being with an ectypal intellect (i.e., any being at all who gets his cognitive material from "outside" himself, and must synthesize it), Chomsky has no such argument for the universality and necessity of his "categories" or rules.

If we take Chomsky's clearest example, knowledge of language, it seems to be merely a contingent, biological fact, rather than a logical requirement, that this is the shape language must take! There is no reason given that shows that language could not appear in some other form. There is no reason to believe that there could not be creatures, even humans, with other innate structuring principles, perhaps also biologically developed as necessary or accidental results of selective evolutionary pressures. For that matter, one can imagine some new radiation in the atmosphere that would cause changes in the brain and would change one or more of the rules and our knowledge of the rules. Indeed, Chomsky gives no reason why all the citizens of the world could not get together and simply decide to change one of the rules, *by fiat*. All of this shows that while the rules may be innate and synthetic, they are not *a priori* in any traditional sense and thus do not shed light on the traditional philosophical problems associated with this concept.

Chomsky might respond by asserting that any change in the rules would result in something that would not be language. But this would seem to be quite implausible, especially if one could translate across the two differently rule-governed sign-systems. If it is suggested that it is *a priori* impossible to effect translation, Chomsky is left with his own version of a well-known difficulty: Even if we can prove in various ways that basic rules governing our knowledge of language are innate, this does not mean that they are cross-culturally similar in all existing cultures, let alone all possible cultures. It may be that while these sign-systems always require innate principles, different ones might have different principles, as remarked above. But if there were the case, it is difficult to see how we could know this, since *ex hypothesi* the two "languages," ours and theirs, are incommensurable. We could not understand other systems, except as filtered through our own. (There are, of course, those who suggest that different cultures *do* have different cognitive apparatuses. This is not *a priori* impossible. Like major physical and social differences, these could be biologically based. Would it then be possible for us to explain them in Chomskyan terms?) What we have just said of language applies *mutatis mutandis* to any other cognitive system allegedly based on innate principles: for example, to Chomsky's claim about our knowledge of objects.

I have argued, in essence, that any knowledge based on biologically determined rules, even though those rules are innate, will be contingent – empirically changeable, or refutable. This leads us to a further difficulty in Chomsky's argument. Let us suppose that our knowledge of mathematics or logic is determined, in part, by innate knowledge of rules. (Since these areas are clearly rule-governed, this seems more plausible than the idea that our knowledge of objects is so based.) These rules, as we have just seen, are subject to change on the basis of evolution, or as a result of radiation, chemicals, and so on. Would it then follow that what we now call our knowledge of mathematics and logic would change, or worse, be rendered false by empirically caused changes in the brain and correlatively in the innate rules? It is difficult to see how Chomsky can avoid this conclusion, yet it is also difficult to see how any distinction between *a priori* and *a posteriori* knowledge can be sustained if all cognition is based on biologically determined innate principles that are subject to change. If Chomsky is not disturbed by the prospect of destroying this distinction, once again the burden of proof is on him to give reasons as to why we should not mark such apparently major differences.

On the other hand, I grant that the sense in which the innate rules he postulates are empirical or *a posteriori*, or better, contingent, is an unusual one; since they are presuppositional for our current experience. Clearly, if Chomsky is right about the role of these rules in the knowledge of objects, for example, the sorts of changes I envisioned that could take place in the rules are not much like finding the proverbial white raven. If the rule changes were drastic enough (or perhaps if there were any changes at all), our entire way of experiencing the world would change – we would literally live in a world totally different in fundamental ways from the old one – and it is conceivable that the old world would no longer even be comprehensible to us. I believe that Chomsky would assert that our traditional distinction between *a priori* and *a posteriori* requires further refinement to do justice to such dramatic cases, although I am uncertain as to what form this reworking would take. As suggested above, he may in the final analysis wish to eliminate any hard and fast notion of *a priori* altogether, and have nothing stronger than a concept of what is currently presuppositional on the basis of our mental makeup. Again, this is *prima facie* implausible when applied to mathematics and logic.

In sum, I consider Chomsky's analysis viewed as a program and theoretical basis for psychological research to be a salubrious counterforce to the atheoretical, haphazard dabblings that characterize much of behavioral psychology. I should like to see more discussion of the analogy between knowledge of language and knowledge of objects, as well as a sketch of what empirical research would be like in domains like knowledge of objects or knowledge of mathematics. I should further like to see Chomsky extend his program to animal psychology as well, since his arguments from poverty and diversity of stimuli and uniformity of result apply to the mental lives of animals as well as men. Indeed, *prima facie* at least, it appears that the evidence for innate principles in animals' minds is even stronger, since animal minds obviously develop uniformly within species despite vast environmental and experiential differences – there is here no cultural overlay to mask the similarities. The possibility for intra- and interspecies communication would be a natural target of study, for example [see *BBS* 1(4), 1978]. On the other hand, I do not think that the implications of Chomsky's analysis for traditional metaphysics and epistemology are quite as dramatic as they may appear to be at first blush.

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by **David M. Rosenthal**

Department of Philosophy, Graduate School and University Center, City University of New York, New York, N.Y. 10036

The modularity and maturation of cognitive capacities

The two central themes in Chomsky's discussion that I want to consider are his hypothesis that "the mind [is] modular in structure," and his inviting idea that we acquire much of our knowledge in a way more like ordinary biological growth and development than like learning, as learning has traditionally been conceived. In section I, Chomsky notes that the question of modularity is distinct from the issue of whether the mind has rich initial structures. But he also claims there that "there is a relation between the views, in part conceptual," for the assumption of modularity "leads to the natural conclusion that [the various] systems [of mind] are intrinsically determined." He does not, however, offer support for the converse connection and, indeed, notes that "[o]ne might hold that there is rich innate structure but little or no modularity."

It may not seem immediately clear, however, why Chomsky believes that, by itself, the hypothesis of modularity has any bearing at all on whether there are rich initial structures. Nor is it clear just how strong he takes the relationship between the two hypotheses to be. In some passages he seems to mean nothing more than that "opinions [about the hypotheses] cluster. Those who tend toward the assumption of modularity also tend to assume rich innate structure." It does seem clear that our mature mental capacities, and the mature structures we can assume underlie those capacities, reflect diverse families of principles. If one took modularity to consist in this relatively uncontroversial observation, and if that observation somehow made plausible the idea of rich initial structures, then perhaps innateness would inherit some of the uncontroversial and common-sense character of modularity. But the clustering of these two views, so understood, does not actually occur. Many would agree that our mental structures, when fully developed, reflect divergent principles without being at all inclined to endorse the idea of rich initial structures.

But at other points Chomsky writes as if modularity is a substantially

stronger thesis, which actually entails the assumption of rich initial structures. For example, at the outset of section III he claims that "[i]f the modular approach is incorrect," the study of interacting mental systems would "reveal . . . that these systems involve the same principles and develop in the same way from a common basis." And early in section II, having offered as an example of modularity the distinction between the computational and conceptual aspects of language, he goes on to urge that it might be possible "to distinguish these systems much as we distinguish the visual and circulatory system." This analogy between bodily organic systems and the modularity of mental structures is repeated often (e.g., eight paragraphs later and throughout the second half of section I), and it reinforces the impression that such modularity is a matter not only of the diversity of mature capacities but also of their genetically controlled development from diverse initial structures.

Perhaps this seems clearest in a passage that comes directly after Chomsky has distinguished modularity from rich initial structures in section I. For he writes that "we are . . . led to the conclusion that intrinsic structure is rich (by the argument from poverty of the stimulus) and diverse (by virtue of the apparent diversity in fundamental principles of capacities and mental structures attained)." Here as elsewhere, Chomsky evidently uses "intrinsic" in a way that implies innateness; for richness of "intrinsic structures" amounts to the richness of initial structures. But then it is these initial structures that, on the thesis of modularity, are said to be diverse; the "diversity in fundamental principles of capacities and mental structures attained" is offered as evidence for the diversity of rich initial structures. So it is not simply that "opinions [about modularity and rich initial structures] cluster"; modularity actually includes the assumption of rich initial structures.

The foregoing quotation also calls attention to a striking pattern of inference that recurs in Chomsky's discussion – namely, the passage from "diversity in fundamental principles of capacities and mental structures attained" to some corresponding diversity in initial and innate mental structures. It is possible, of course, that fundamental principles of our mature mental structures could illuminate features of the initial structures from which mature structures develop. And perhaps with language this is the case. For one might take the presence of highly abstract but strong constraints, to which the otherwise divergent grammars of all human languages seem to conform, as being evidence of common features in the relevant initial structures. And Chomsky is surely right that, insofar as we currently understand these constraints, "[i]t would be surprising indeed if we were to find that the principles governing these phenomena are operative in other cognitive systems."

But the inference from the principles governing mature mental capacities and structures to those governing initial mental structures is far less credible in the case of the other "mental faculties" that Chomsky touches on, such as "knowledge of . . . music, of mathematics, of the behavior of objects, of social structure, of human characteristics, and so on." In the case of music, there is a great diversity of musical systems, which might seem to echo the diversity of human languages. But here the common features in these diverse systems appear to derive from well-understood apects of the mechanisms underlying the production of sound, rather than from anything innate in the organism. And the presence of features common to otherwise significantly diverse systems is wholly absent in the case of mathematics, though according to Chomsky "it seems reasonable to suppose that [the number] faculty is an intrinsic component of the human mind."

Chomsky's brief treatment of the "number faculty" merits special attention. For he claims that "[t]he capacity to deal with the number system . . . is surely unlearned in its essentials." If Chomsky has in mind, here, either the "second-order sense of 'capacity' " that he isolates at the outset or the sense of "capacity" as a mental faculty, his claim that our capacity to deal with the number system is unlearned will be trivial and uninformative; for it is a matter of meaning that, in these senses, capacities are unlearned. So Chomsky must have in mind the more interesting but surprising claim that our mature capacity to deal with the number system, though in many respects the product of training, is, "in its essentials," innate. Without some idea of what the "essentials" of this capacity are, however, even this claim would lack significant import. But Chomsky tells us that "[t]he very essence of the number system is the concept of adding one, indefinitely," presumably inviting us to infer from the "very essence of the number system" to an understanding of what the "capacity to deal with the number system . . . [is] in its essentials." Chomsky is of course right that "the concept of adding one, indefinitely" is sufficient to distinguish our number system from the rudimentary numerical abilities of other terrestrial species. But it is far from clear that understanding the essence of our number system can, by itself, help us to understand our capacity to deal with that system.

Chomsky would presumably agree that the essence of our number system, for example, cannot by itself reveal details of specific mechanisms that underlie the relevant capacity and mental structure. But he would insist that the essence of our number system does serve to characterize that structure at the appropriate level of abstraction. As he puts it at the outset of section III, his discussion "proceeds as an inquiry at a certain level of abstraction into the nature of certain mechanisms . . ., now largely unknown. The level of abstraction is appropriate insofar as it enables fundamental properties of [cognitive] systems to be isolated, analyzed, and explained; and insofar as results obtained at this level provide a guide for the study of mechanisms." An accurate and revealing description of a subject matter with which mature humans can deal is, of course, useful and perhaps ultimately necessary for a satisfactory study of the human capacity to deal with that subject matter. But that is because such a description defines the problem under investigation. Such a description does not, as Chomsky makes it appear, constitute the beginning of an actual theory about the nature of the target capacity, even "at a certain level of abstraction."

Chomsky believes that such descriptions can "provide a guide for the study of [underlying] mechanisms, much as the study of chemical properties provides a guide for inquiry into atomic theory" (*ibid.*). Presumably the intended analogy is that, just as atomic processes must be able to give rise to chemical properties, so neural mechanisms must be able to generate and deal with the number system. This naturalism with respect to mental phenomena is thoroughly laudable. But the usefulness of chemical properties in studying atomic structures depends on our having some active grasp of atomic mechanisms. One could not have predicted how these mechanisms would turn out to be able to achieve their effects at the level of chemistry merely by knowing how those effects can be systematized, at their own distinctive level. Indeed, some fair success at the level of atomic theory seems to have been necessary before we could arrive at an accurate and revealing systematization of chemical phenomena. And in general, the ways of systematizing phenomena at higher levels of organization have often proved to be false guides to the nature of phenomena at underlying, lower levels of organization. Moreover, since the mechanisms that produce effects at higher levels of organization are largely unpredictable on the basis simply of a knowledge of those effects, the idea of higher and lower "levels of abstraction" seems straightforwardly inapplicable in this context. For it is not as though we could arrive at descriptions at higher levels of organization by way of some process of abstraction. And it is even less credible that we might arrive at acceptable descriptions of our mathematical or musical systems by abstracting from innate mental structures or from their underlying neural mechanisms. So, although more abstract descriptions often do illuminate concrete details, this process cannot be expected to help in the present context. It is these concerns, and not some antinaturalist attitude towards the mental, that are responsible for the worry that Chomsky's theories may well lack psychological reality.

The worry about psychological reality also arises in connection with the question of whether Chomsky's approach can capture, in a non-question-begging way, the distinction he appeals to in section III between having knowledge and having a skill. The example he offers of two missiles does not help here. For we know that the "cognizing" missile "incorporates an explicit theory" simply because it was so constructed. What we need is some clear idea of how to tell when a system of mechanisms incorporates rules and representations which does not simply reduce to the question of whether the system can be described as if it did. Chomsky supposes that in many cases "there is

a mentally-represented system of [a grammar-like] nature, which can be taken to be an object of knowledge." But he suggests no clear way of trying to decide whether what we have is merely a set of mechanisms that act as if they embody rules and representations, or a set of mechanisms that actually does.

Even when modularity is understood as a thesis about the divergent principles of initial as well as mature mental structures, modularity and the hypothesis of rich initial structures do not jointly imply Chomsky's striking speculation that "a central part of what we call 'learning' " is essentially a matter of biological growth and development. Nor is it obvious that the hypotheses of modularity and rich initial structures would, if true, even provide evidence for this bold thesis about learning. Even if our acquisition of knowledge depends in some way on initial mental structures that are both rich and diverse, such acquisition might nonetheless be more like a process of imitation and adaptation, for example, than like the maturation of a bodily organ. And slight differences in initial structures could lead to great diversity in mature structures whether the fundamental mechanisms involve interactions with the environment or internally-controlled processes. The idea that acquisition of knowledge is basically a matter of biological maturation does of course imply modularity and rich initial structures. But the converse does not hold; the idea of learning as growth is a further step in the analogy of our cognitive capacities with physiological systems. However, this view about the acquisition of knowledge does fit well with the idea that systematizing the objects of our knowledge is likely to shed light on the nature of the operative mental capacities and structures. For, if "a central part" of our knowledge develops in the manner of genetically-determined maturation, it is then reasonable to expect that the character of our ultimate objects of knowledge will be informative about initial mental structures. And if one were convinced that the ultimate objects of knowledge would be revealing in this way, the model of genetically-guided development would very probably seem appealing.

If "a central part" of our acquisition of knowledge is essentially a matter of biological maturation, the relevant genetic instruction will then determine to some degree what it is possible for us to know. Chomsky does not shrink from this consequence, writing at the close of section I that "the very same intrinsic factors that permit [cognitive] achievements also impose severe limits on the states that can be attained." Chomsky's frequent references to biological determinants of our perceptual cognitive capacities lend some support to this idea. For it is obvious that the range and character of our perceptual knowledge is a function of our organic perceptual apparatus.

But Chomsky also holds that much of our nonperceptual knowledge is acquired by a process essentially like biological maturation, though often it remains unclear whether, in a particular passage, he is simply asserting modularity of initial structures or also affirming the idea of learning as growth. But he does suppose that "[i]t is entirely possible that significant components of [many] cognitive states are 'wired in,' " and his examples of this (e.g., at the end of section III) range well beyond perceptual knowledge. Chomsky's formulations of this idea tend always to involve phrases such as "significant components," "a central part," "in its essentials," "substantially in place," and the like; this results in some measure of obscurity about just what this idea involves. Presumably he would urge, as he does in a related context, that we are dealing with "a difficult empirical question, only partially clear, which can become more precise only in the course of finding some answers to it."

However the issues are sharpened, Chomsky's idea "that significant components of [many nonperceptual] cognitive states are 'wired in' " will require that what propositional knowledge we can have is, to some degree, a function of our biological endowment. And an apparent consequence of this view is that cognitive beings with suitably diverse biological endowments will diverge in what propositional knowledge they can have and, hence, would have to differ even in the range of propositions they could comprehend. If this were so, it would be possible for organisms to exist whose cognitive capacities were comparable to ours in richness and range, but with whom communication would be severely obstructed because of differences between them and us with respect to what propositional content can coherently enter into speech and thought. And it would perhaps also be possible for organisms to exist who could comprehend all our thoughts but think things literally unthinkable by us. This striking idea, though it appeals to biological rather than divine determinants, is reminiscent of Descartes' vexed view about the nature of the eternal truths, according to which it is a contingent fact about our minds that we "cannot conceive a mountain without a valley, or an aggregate of one and two which is not three" (Kenny, p. 236; see Frankfurt, especially section VI, for a highly illuminating discussion).

Many, however, would contest the very intelligibility of this difficult thesis, arguing that one respect in which propositional cognitive capacities differ from perceptual cognitive capacities is that, given time to define terms and explain theories, a certain threshold intelligence is all that is needed to comprehend any proposition whatever. Perhaps progress could be made in giving some measure of intelligibility to the idea that biological endowment can cause variation in what propositions are thinkable. But cognate views, such as the idea that different human languages might embody distinct conceptual schemes, or the idea that children may have something like distinct conceptual schemes at successive stages of cognitive development, have been notoriously unyielding in the face of efforts to confirm them, or even give them clear content. Much of the difficulty in giving content to such views results from the complex interactions that hold between meaning and belief, which Chomsky touches on midway through section II, though perhaps some nonarbitrary ways can be found to sort out these factors.

Whatever the case on these questions, it seems clear that, if essential aspects of our propositional knowledge have biological determinants in some nonvacuous respect, other cognitive beings could diverge from us in respect of what propositional content could enter their mental lives. The difficulty of making clear sense of that possibility, therefore, should make us cautious about whether clear sense can be given to Chomsky's idea of learning as growth. One might maintain, of course, that if such divergence were a genuine possibility, our difficulty in comprehending that possibility might simply be the result of biologically determined limits on our knowledge. But there is no reason to suppose that these limits would be responsible for this particular case of our being unable to comprehend something; for one would expect some things to be incomprehensible no matter what one's cognitive capacities, and such divergence might be a case of this sort. Such self-supporting defenses aside, therefore, the apparent incomprehensibility of this sort of divergence in the ability to entertain propositions gives us compelling reason to seek an alternative to any theory of the acquisition of knowledge that has this consequence.

by **Geoffrey Sampson**

Department of Linguistics, University of Lancaster, Lancaster LA1 4YT, England

Chomsky's evidence against Chomsky's theory

Contrary to Chomsky's claims, there *is* good reason to argue that "the brain is unique in the biological world," in that its complex products are determined hardly at all by fixed mechanisms but emerge as attempts to make sense of experience in ways unpredictable on the basis of initial state. Furthermore, it is Chomsky himself who has drawn attention to the evidence for this view in various of his works on language, even though he interprets his evidence in a very different way.

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