In the study of naive biology, disagreement arises over whether higher-order principles evince strong or weak NATIVISM; that is, whether they reflect the innate modularity and DOMAIN-SPECIFICITY of folk biology (Inagaki and Hatano 1996), or are learned on the basis of cognitive principles inherent to other domains, such as NAIVE PHYSICS or FOLK PSYCHOLOGY (Carey 1995). One candidate for a domain-specific principle involves a particular sort of ESSENTIALISM, which carries an invariable presumption that the various members of each generic species share a unique underlying nature, or biological essence. Such an essence may be considered domain-specific insofar as it is an intrinsic (i.e., nonartifactual) teleological agent, which physically (i.e., nonintentionally) causes the biologically relevant parts and properties of a generic species to function and cohere "for the sake of" the generic species itself. Thus, American preschoolers consistently judge that thorns on a rose bush exist for the sake of there being more roses, whereas physically similar depictions of barbs on barbed wire or the protuberances of a jagged rock do not elicit indications of inherent purpose and design (Keil 1994). People everywere expect the disparate properties of a generic species to be integrated without having to know the precise causal chains linking universally recognized relationships of morpho-behavioral functioning, inheritance and reproduction, disease and death.

This essentialist concept shares features with the broader philosophical notion NATURAL KIND in regard to category-based induction. Thus, on learning that one cow is susceptible to "mad cow" disease, one might reasonably infer that all cows, but not all mammals or animals, are susceptible to the disease. This is presumably because disease is related to "deep" biological properties, and because *cow* is a generic species with a fairly uniform distribution of such properties. The taxonomic arrangement of generic species systematically extends this inductive power: it is more "natural" to infer a greater probability that all mammals share the disease than that all animals do. Taxonomic stability allows formulation of a general principle of biological induction: a property found in two organisms is most likely found in all organisms belonging to the lowest-ranked taxon containing the two. This powerful inferential principle also underlies systematics, the scientific classification of organic life (Warburton 1967). Still, relativists can point to cultural and historical influences on superordinate and subordinate taxa as suggesting that biologically relevant properties can be weighted differently for induction in different traditions.

See also CONCEPT; COLOR CLASSIFICATION; NAIVE SOCIOLOGY

—*Scott Atran*

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Folk Psychology

In recent years, folk psychology has become a topic of debate not just among philosophers, but among developmental psychologists and primatologists as well. Yet there are two different things that "folk psychology" has come to mean, and they are not always distinguished: (1) commonsense psychology that explains human behavior in terms of beliefs, desires, intentions, expectations, preferences, hopes, fears, and so on; (2) an interpretation of such everyday explanations as part of a folk theory, comprising a network of generalizations employing concepts like *belief, desire,* and so on. The second definition—suggested by Sellars (1963) and dubbed "theory-theory" by Morton (1980)— is a philosophical account of the first.

Folk psychology (1) concerns the conceptual framework of explanations of human behavior: If the explanatory framework of folk psychology (1) is correct, then "because Nan wants the baby to sleep," which employs the concept of wanting, may be a good (partial) explanation of Nan's turning the TV off. Folk psychology (2) concerns how folk-psychological-(1) explanations are to be interpreted: If folk psychology (2) is correct, then "because Nan wants the baby to sleep" is an hypothesis that Nan had an internal (brain) state of wanting the baby to sleep and that state caused Nan to turn the TV off.

Although the expression *folk psychology* came to prominence as a term for theory-theory, that is, folk psychology (2), it is now used more generally to refer to commonsense psychology, that is, folk psychology (1). This largely unnoticed broadening of the term has made for confusion in the literature. Folk psychology (in one or the other sense, or sometimes equivocally) has been the focus of two debates.

The first is the so-called use issue: What are people doing when they explain behavior in terms of beliefs, desires, and so on? Some philosophers (Goldman 1993; Gordon 1986) argue that folk psychology, in sense (1) is a matter of simulation. Putting it less precisely than either Goldman or Gordon would, to use commonsense psychology is to exercise a skill; to attribute a belief is to project oneself into the situation of the believer. The dominant view, however, is that users of concepts like believing, desiring, intending—folk psychology (1)—are deploying a theory—folk psychology (2). To attribute a belief is to make an hypothesis about the internal state of the putative believer. Some psychologists (e.g., Astington, Harris, and Olson 1988) as well as philosophers simply assume the theory-theory interpretation, and some, though not all, fail to distinguish between folk psychology (1) and folk psychology (2).

The second is the so-called status issue. To what extent is the commonsense belief/desire framework correct? The "status" issue has turned on this question: To what extent will science vindicate (in some relevant sense) commonsense psychology? The question of scientific vindication arises when commonsense psychology is understood as folk psychology (2). On one side are intentional realists like Fodor (1987) and Dretske (1987), who argue that science will vindicate the conceptual framework of commonsense psychology. On the other side are proponents of ELIMINATIVE MATERIALISM like Churchland (1981) and Stich (1983), who argue that as an empirical theory, commonsense psychology is susceptible to replacement by a better theory with radically different conceptual resources (but see Stich 1996 for a revised view). Just as other folk theories (e.g., FOLK BIOLOGY) have been overthrown by scientific theories, we should be prepared for the overthrow of folk psychology by a scientific theory—scientific psychology or neuroscience. Eliminative materialists make the empirical prediction that science very probably will not vindicate the framework of commonsense psychology.

The question of scientific vindication, however, does not by itself decide the "status" issue. To see this, consider an argument for eliminative materialism (EM):

a. Folk psychology will not be vindicated by a physicalistic theory (scientific psychology or neuroscience).
b. Folk psychology is correct if and only if it is vindicated (in some relevant sense) by a physicalistic theory.

So,

c. Folk psychology is incorrect.

Premise (b), which plays an essential role in the argument, has largely been neglected (but see Baker 1995; Horgan and Graham 1991). If premise (b) refers to folk psychology (2), then premise (b) is plausible; but then the conclusion would establish only that commonsense psychology *interpreted as a theory* is incorrect. However, if premise (b) refers to folk psychology (1), then premise (b) is very probably false. If folk psychology is not a putative scientific theory in the first place, then there is no reason to think that a physicalistic theory will reveal it to be incorrect. (Similarly, if cooking, say, is not a scientific theory in the first place, then we need not fear that chemistry will reveal that you cannot really bake a cake.) So, the most that (EM) could show would be that if theory-theory is the correct philosophical account of folk psychology (1), then folk psychology is a false theory. (EM) would not establish the incorrectness of commonsense psychology on other philosophical accounts (as, say, understood in terms of Aristotle's account of the practical syllogism).

Other positions on the "status" issue include these: commonsense psychology—folk psychology (1)—will be partly confirmed and partly disconfirmed by scientific psychology (von Eckardt 1994, 1997); commonsense psychology is so robust that we should affirm its physical basis regardless of the course of scientific psychology (Heil 1992); commonsense psychology is causal, and hence, though attributions of attitudes are interpretive and normative, explanations of behavior in terms of attitudes are backed by strict laws (Davidson 1980); commonsense psychology is useless as science, but remains useful in everyday life (Dennett 1987; Wilkes 1991). Still others (Baker 1995; Horgan and Graham 1991) take the legitimacy of commonsense psychology to be borne out in everyday cognitive practice—regardless of the outcome of scientific psychology or neuroscience.

See also AUTISM; FUNCTIONALISM; INTENTIONALITY; LANGUAGE OF THOUGHT; PHYSICALISM; PROPOSITIONAL ATTITUDES; SIMULATION VS THEORY-THEORY; THEORY OF MIND

—Lynne Baker

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Formal Grammars

A grammar is a definition of a set of linguistic structures, where the linguistic structures could be sequences of words (sentences), or "sound-meaning" pairs (that is, pairs <*s*,*m*> where *s* is a representation of phonetic properties and *m* is a representation of semantic properties), or pairs <*t*,*p*> where *t* is a tree and *p* is a probability of occurrence in a discourse. A *formal grammar,* then, is a grammar that is completely clear and unambiguous. Obviously, this account of what qualifies as "formal" is neither formal nor rigorous, but in practice there is little dispute.

It might seem that formalization would always be desirable in linguistic theory, but there is little point in spelling out the details of informal hypotheses when their weaknesses can readily be ascertained and addressed without working out the details. In fact, there is considerable variation in the degree to which empirical proposals about human grammars are formalized, and there are disputes in the literature about how much formalization is appropriate at this stage of linguistic theory (Pullum 1989; Chomsky 1990).

Given this controversy, and given the preliminary and changing nature of linguistic theories, formal studies of grammar have been most significant when they have focused not on the details of any particular grammar, but rather on the fundamental properties of various *kinds* of grammars. Taking this abstract, metagrammatical approach, formal studies have identified a number of basic properties of grammars that raise new questions about human languages.

One basic division among the various ways of defining sets of linguistic structures classifies them as *generative* or *constraint-based.* A GENERATIVE GRAMMAR defines a set of structures by providing some basic elements and applying rules to derive new elements. Again, there are two basic ways of doing this. The first approach, common in "formal language theory" involves beginning with a "category" like "sentence," applying rules that define what parts the sentence has, what parts those parts have, and so on until the sentence has been specified all the way down to the level of words. This style of language definition has proven to be very useful, and many fundamental results have been established (Harrison 1978; Rozenberg and Salomaa 1997).

A second "bottom-up" approach, more common in CATEGORIAL GRAMMAR and some related traditions, involves starting with some lexical items ("generators") and then applying rules to assemble them into more complex structures. This style of language definition comes from LOGIC and algebra, where certain sets are similarly defined by "closing" a set of basic elements with respect to some generating relations. In these formal grammars, the structures of the defined language are analogous to the theorems of formal logic in that they are derived from some specified basic elements by rigorously specified rules. A natural step from this idea is to treat a grammar explicitly as a logic (Lambek 1958; Moortgat 1997).

Unlike the generative methods, which define a language by applying rules to a set of initial elements of some kind, a *constraint grammar* specifies a set by saying what properties the elements of that set must have. In this sort of definition, the structures in the language are not like the (generated, enumerable) theorems of a logic, but more like the sentences that could possibly be true (the "satisfiable" sentences of a logic). This approach to grammar is particularly prominent in linguistic traditions like HEAD-DRIVEN PHRASE STRUCTURE GRAMMAR (Pollard and Sag 1994). However, most linguistic theories use both generative and constraint-based specifications of structure.

Recently, linguists have also shown interest in a special variety of constraint grammar that is sometimes called