

biology constrains the "space of possible languages" that are naturally available to humans. Moreover, experience can have an impact without "shaping" the ideas that humans naturally employ. If children do not learn languages by generalizing from experience, and a child's history of linguistic stimulation simply drives the child down one of the biologically available linguistic paths, then perhaps the same is true of the acquisition of mental capacities more generally. A nativist perspective is reinforced in so far as mental capacities emerge in young children throughout the species, in settings where experience dramatically underdetermines the knowledge that children attain. As with language, perhaps experience plays the role of triggering innate mental resources in the formation of (at least many of) the ideas that humans naturally employ – ideas that can develop only in a limited number of ways. If so, while experience influences the particular course of idea-formation in any given individual, this is *not* (as empiricists suggest) because individuals seek and find regularities in their experience. Rather, regularities are imposed on experience in accordance with mental structures already in place.

We think this is Chomsky's view, and also the view he finds in certain historical figures who participated in debates about innate ideas. Chomsky's contribution to the traditional debate lies in (i) his articulation and defense of a detailed nativist program in linguistics, showing *how* experience plays only a restricted role in a broadly rationalist account of the acquisition of linguistic knowledge, and (ii) the framework this program suggests, given its empirical success, for the more general study of human cognition. Linguistics – where this includes not just the study of expressions and their properties, but also related work in psycholinguistics – provides a case study of how to investigate *which aspects of* human thought are due largely to human nature. Earlier chapters have addressed (i). We'll try to give the flavor of (ii) by discussing some historically important examples, and then by reviewing some recent discoveries, inspired by the Chomskyan approach to human psychology, about the properties of linguistic expressions that have a direct bearing on logical reasoning.

Experience, mind, the gap

As the previous chapter indicated, Chomsky is part of a rationalist tradition according to which human knowledge is rooted in the cognitive resources used when humans conceptualize their experience. Experience can, and often does, "trigger" the use of these resources. So humans deprived of normal experience may not develop in the usual way, and they may be unable to apply their cognitive resources in the usual knowledge-producing ways. But rationalists maintain that in at least many domains, the knowledge we do achieve goes far beyond our experience in ways that reflect the contours of our cognitive

8 Innate ideas

Paul Pietroski and Stephen Crain

Here's one way this chapter could go. After defining the terms "innate" and "idea," we say whether Chomsky thinks any ideas are innate – and if so, which ones. Unfortunately, we don't have any theoretically interesting definitions to offer; and, so far as we know, Chomsky has never said that any ideas are innate. Since saying that would make for a *very* short chapter, we propose to do something else. Our aim is to locate Chomsky, as he locates himself, in a rationalist tradition where talk of innate ideas has often been used to express the following view: the general character of human thought is due largely to human nature.

One can endorse this view without saying that humans have specific concepts, like TURNIP or CARBURETOR, independent of experience. Correlatively, it is important to remember that while Chomsky is a nativist about language, he does not think that specific languages are innate. Whether a child ends up speaking Japanese or English, or both, clearly depends on the child's experience. The nativist claim is that all natural languages share core features that reflect the biology of *homo sapiens*. Knowing a language, like having a heart, is a reflection of our biological endowment. Just as humans have internal organs with characteristic traits, they speak languages with characteristic traits. According to Chomsky, linguistic variation is severely constrained by the mental systems that make human language possible. But this is compatible with some linguistic variation across (and within) communities, since the traits of individuals are always products of nature *and* nurture. Diet and exercise affect one's heart, within a limited range of possibilities. Similarly, experience affects the course of a child's linguistic development, within certain parameters.¹

Thus one can be a nativist about language without saying that humans come into the world equipped with particular languages, like cars come off the assembly line equipped with wheels. Similarly, one can be a nativist about ideas without saying that humans come into the world equipped with particular ideas. Encounters with the world clearly have an impact on the ideas that humans acquire. Nevertheless, biology may well impose substantial constraints on the "space of possible ideas" that are naturally available to humans, much as

apparatus. From this perspective, the knowledge achieved is not the result of “generalizing” from experience: the *character* of human knowledge owes more to our shared human nature than to our shared human experiences. Knowledge of language is a paradigm example of a domain in which such “poverty-of-stimulus” considerations strongly favor a rationalist approach, see the previous chapter.

Although our cognitive systems surely reflect our experience in some manner, a careful specification of the properties of these systems on the one hand, and of the experience that somehow led to their formation on the other, shows that the two are separated by a considerable gap, in fact, a chasm The problem, then, is to determine the innate endowment that serves to bridge the gap between experience and knowledge attained. . . . The study of language is particularly interesting in this regard. (Chomsky 1986)

As this quote makes clear, Chomsky sees his “rationalist linguistics” as one branch of a broader – and for the most part, yet to be developed – rationalist psychology; see especially Chomsky (1966, 2002a). A similar program was envisioned by various seventeenth- and eighteenth-century theorists whom Chomsky regularly cites as initiators of the (very much unfinished) cognitive revolution: Descartes, the Port-Royal logicians, Ralph Cudworth, and Herbert of Cherbury. These thinkers maintained that a great deal of human knowledge springs (under the pressure of normal experience) from cognitive resources that humans have *independent of and prior to* experience. In their terminology, human beings have *innate ideas*.

Having introduced this traditional terminology, some caveats are in order. The claim is not (and was not) that humans are born with certain ideas – say, the idea of a triangle, or the idea of a verb phrase – and then just wait for the chance to apply them. Whether humans are *born* with ideas is not important on a rationalist account. The relevant cognitive resources may develop according to a maturational timetable, or they may be triggered by experiences that occur later in life.² Moreover, a rationalist need not describe any pre-triggered cognitive resource as, say, an innate idea of a *triangle*. Perhaps a person can be properly said to have an idea of *X* only if the person has had triggering experiences that are “appropriate to” the formation of that idea. If so, then nothing within us prior to experience can be properly described as an idea of *X*, no matter what we substitute for “*X*.” Rationalists can agree to limit use of the word “idea” in this way. For this is fully compatible with the hypothesis that humans come to have the idea of a triangle (or a verb phrase), across a range of environmental situations, mainly because human cognition has contours that make us apt to acquire such ideas. Indeed, a rationalist need not describe any pre-triggered cognitive resource as an *idea*. Perhaps every idea is an idea of something, and

so a thinker has an idea only if it is an idea of *X*, for some particular instance of “*X*.” On this view, all ideas are intentional; they have a specific *content*. A rationalist could adopt this view while granting that mental entities come to have specific contents only under the pressure of experience.³

The traditional terminology is thus misleading. Innate ideas need not be inborn; experience is relevant; and whatever is innate need not be an idea, much less an idea of anything in particular. We suspect this is why Chomsky aligns himself with Descartes and other rationalists, but *without* using the phrase “innate ideas” to describe his own views. For Chomsky, the important issues do not concern what counts as an idea. The important issues concern (the size of) the “gap” between experience and knowledge, and how to best characterize the cognitive resources that fill the gap – thereby making it invisible in ordinary life.

In hindsight, it seems clear that many empiricists have rejected rationalist proposals at least in part because of misunderstandings about the crucial features of those proposals. To the best of our knowledge, no empiricist has successfully rebutted the relevant poverty-of-stimulus arguments for a broadly rationalist psychology.⁴ One can sympathize with the desire (discussed in the previous chapter) for an account of how humans occasionally come to have veridical and justifiable beliefs about the mind-independent world. But one must guard against letting this desire drive one’s psychological theorizing. According to Descartes and Chomsky, questions about how minds are related to the world are hard questions to be faced honestly in light of (i) our best theories of human psychology and (ii) our best theories of the mind-independent world. If our best theories of human psychology turn out to be rationalist theories, then so be it, even if this makes it *really* hard to see how we ever manage to come to have true justified beliefs about the mind-independent world. One can’t argue for an empiricist psychology by noting that *if* human knowledge were mainly a product of generalizing from our shared experiences, then it would be easier to account for empirical knowledge.⁵

Why it’s called “Plato’s Problem”

It might help at this point to focus the discussion on a historically important example, already mentioned, that reveals how far human knowledge can extend beyond experience.

If a triangle is a three-sided figure with perfectly straight lines, then no one has ever seen a triangle, at least not in the ordinary sense that we can and do see rocks, people, and chalk marks. Nor has anyone ever heard, touched, smelled, or tasted a triangle. Nonetheless, humans have the idea of a triangle; and one can know a great many things about triangles. For example, the ancient

Greeks – who also had the idea of a *square*, a *right triangle*, the *area* of a figure, and the *sum* of two areas – knew that the square built on the hypotenuse of a right triangle with equal sides must be equal to the sum of the areas of the (equal) squares built on the shorter sides of the triangle. These ideas correspond to abstract geometric objects that are related as depicted below:

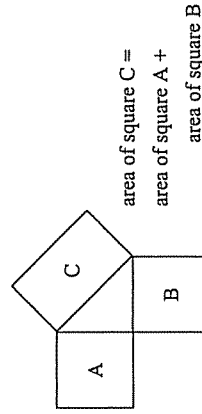


DIAGRAM 1

For present purposes, the crucial point about “correspondence” is not that the abstract entities *exist*, but that geometric ideas are not spurious. Since the Pythagorean Proposition is provably correct, it somehow “agrees with” reality. (By contrast, endlessly many similar propositions disagree with reality. Consider the false claim that the square of the hypotenuse equals *twice* the sum of the other squares.)

Rationalists are struck by several features of cases like these. First, in order to entertain the Pythagorean Proposition, one needs to have the relevant ideas. If you met a creature who didn’t have the idea of a three-sided figure composed of straight lines, you couldn’t tell him *what* the Greeks knew, much less how they came to know it. In one sense, this is a perfectly general point. If you met someone who didn’t have any conception of cows, you couldn’t tell him that cows are brown. But at least you could show him some cows (distinguishing them from rocks, horses, bulls, etc.); whereas you can’t show anyone a triangle.⁶ So one question is how humans can even entertain thoughts concerning triangles. How do we come to have the relevant ideas?

A recurrent empiricist suggestion is that thinkers somehow *abstract* ideas from a series of sensory experiences, by representing similarities (and ignoring dissimilarities) across those experiences. Whatever the virtues of this proposal as it applies to acquiring the idea of a cow, it is unclear how the suggestion applies to triangles. How does one abstract the idea of a perfectly straight line from encounters with perceptible objects whose edges are never perfectly straight? Not only are geometric lines not *common* features of experience, they are never manifested in experience at all. A possible reply is that thinkers somehow abstract the *ideal* of a straight line by observing various nearly straight lines that diverge from the ideal in statistically random ways; in effect, one

“averages” across a range of perceptible cases. But this raises the question of why humans focus on some averages and not others. Why does our idea of a line abstract away from thickness altogether, as opposed to representing some ideal or average thickness? More generally, why do human thinkers naturally form ideas that correspond to *certain* (averageable) dimensions of perceived entities, but not others?

Shifting back to language for a moment, this is the point of Chomskyan examples like (1–4).

- (1) John ate an apple.
- (2) John ate.
- (3) John is too clever to catch a fish.
- (4) John is too clever to catch.

Assuming that most speakers of English hear sentences like (1–2) before hearing sentences like (3–4), why *don’t* they generalize as follows: since (2) means that John ate something or other, (4) means that John is too clever to catch something or other? Of course, speakers don’t interpret (4) on analogy with (2). They know that (4) means, roughly, that John is too clever for relevant parties to catch *John*. One can say that speakers interpret (4) on analogy with some other experienced paradigm(s). But this just pushes the question back. Why do speakers analogize along some dimensions but not others? The facts suggest that the explanation will take a rationalist form: the cognitive apparatus brought to experience has a certain *character* in virtue of which human beings are disposed to project from experience to certain characteristic states of linguistic knowledge.

An empiricist account, based on abstraction of ideas from sensory experience, also requires that each thinker who acquires a certain idea has *enough* experience to abstract that idea. Encounters with one or two triangular figures are presumably not a sufficient basis for acquiring an idea that has been “shaped” by experience.⁷ Moreover, theorists cannot rest content with the claim that someone *could* abstract the idea of a triangle (or a verb phrase) given *suitable* experience. One has to explain why so *many* thinkers abstract the same idea across the range of *actual* experiential situations. If thinkers of varying intelligence regularly form certain ideas, even when their experience is limited, that is a fact to be explained. So as rationalists have always stressed, if humans can acquire certain knowledge quickly and in the absence of much experience, such knowledge would seem to be a reflection of the cognitive resources humans bring to experience. Plato thus describes his famous thought experiment in which an uneducated servant comes to know the Pythagorean Proposition with *very* little experience (given some prompting by Socrates).⁸

Summarizing the key steps, the servant comes to "see" that doubling the sides of a square quadruples the area, as suggested by the diagram below:



DIAGRAM 2

He also agrees that a square can have any area. (It is striking that this is so obvious. How would you *teach* it to someone not initially disposed to agree?) So for example, a square can have an area twice that of the square we started with; and doubling the sides of a square with area 2 yields a square with area 8.

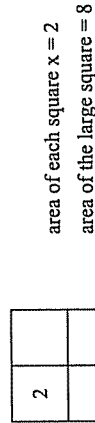


DIAGRAM 3

Socrates then leads the servant to a crucial (but intuitively obvious) lemma: bisecting a square yields two right triangles with equal areas; and so any square, including our square of area 8, can be divided into four right triangles with equal areas.

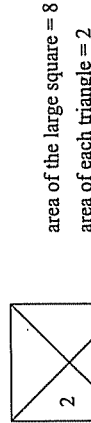


DIAGRAM 4

If we now extend the figure, by adding a right triangle to create a square of area 4, we have an illustration of the Pythagorean Proposition: the square of area 8 is the square of the hypotenuse of a right triangle (with area 2), each of whose sides has a square with area 4:

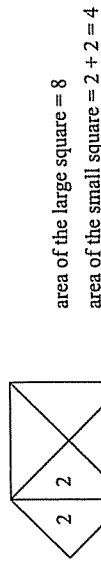


DIAGRAM 5

And as Meno recognizes, the same result can be achieved (in the same way) for any right triangle with equal sides.⁹

Faced with the fact that humans can manifest rather esoteric knowledge so quickly, Plato conjectured that humans "recollect" knowledge acquired in some past (immaterial) life in which ideal objects could be apprehended directly. But this is no explanation, absent an account of how immaterial beings apprehend triangles (and then store this knowledge in a form accessible to material beings). So one may as well – and Chomsky does – treat Plato's talk of recollection as a placeholder for unknown cognitive resources from which the knowledge springs. This makes it clear that Plato's "experiment" raises more questions than it answers: what is the best theoretical characterization of the relevant cognitive resources; how do they give rise to the knowledge in question; and in virtue of what do human beings have these resources? But this is hardly an embarrassment. Figuring out which questions to ask is a crucial starting point for inquiry.¹⁰

It is also striking that the Pythagorean Proposition, like many mathematical claims, is *provable* from compelling principles that are intuitively more basic. One cannot prove that cows give birth to cows, or that heat rises. One discovers, in large part by making repeated observations, that these generalizations are correct. But not only are measurements of perceptible figures unnecessary for geometric knowledge, they are irrelevant. One can't come to know the Pythagorean Proposition, in the way that geometers knew it, by generalizing from thousands of carefully drawn and measured triangular figures. A diligent student might note that the more carefully she draws and measures, the closer she approaches the ideal. But this is not a proof of the theorem. And provable propositions seem to have a distinctive character that is related to the felt *necessity* of such propositions.¹¹

If thinkers recognize certain propositions as noncontingent, this suggests that judgments concerning such propositions go beyond experience of the mind-independent world. A related observation (Chomsky 1986) is that the same kind of felt necessity attaches to claims like (5–8).

- (5) If Mary persuaded John to go to college, John intended to go to college.
- (6) If John boiled the soup, the soup boiled.
- (7) If John thinks that Bill likes himself, John thinks that Bill likes Bill.
- (8) If John is too clever to catch, John is too clever for relevant parties to catch John.

And speakers of English know that (9) and (10) are not even *possible* sentences of English.

- (9) Bill thinks that Mary likes each other.
 (10) Who did Mary wonder that saw Bill?

These facts about speakers' capacities to tell that certain strings of words are (not) legitimate English expressions, or that certain English sentences are sure to be true come what may, call for explanation. They invite the hypothesis that humans (unconsciously) deploy various linguistic ideas that spring from underlying cognitive resources, with the result that (5–8) are perceived as analytic while (9–10) are perceived as illicit.

Cartesian ideas

Knowing a language, however, requires experience in a way that knowledge of geometry does not. Again, knowing Japanese differs from knowing English, even if the underlying mental states have much in common. Correlatively, knowing a language requires at least some experience with its vocabulary and certain aspects of its syntax. For example, one has to learn that direct objects typically follow verbs in English, while they typically precede verbs in Japanese; and that Japanese has overt case marking, as in Latin, while English does not. Thus, while Chomsky regularly speaks of Plato's Problem, he does not push the analogy to mathematical knowledge too hard. As his favorite seventeenth-century rationalists argued, symptoms of innate cognitive resources are not limited to our judgments about abstract objects.

In a famous example, Descartes asks what underlies his various judgments concerning a piece of melting wax. The perceptible qualities of the wax – its visual appearance, smell, and so on – change over time. Indeed, Descartes claims, no perceptible feature of the wax remains constant throughout all possible changes in the wax.¹² Descartes concludes that he conceives of the wax as something *with* (changeable) perceptible qualities, even though the wax does not seem to *be* any bundle of perceptible qualities. The wax seems to be something that *underlies* its perceptible qualities. Perhaps this intuitive view is wrong; though for present purposes, the metaphysics doesn't matter. Focus on the question of how we come to have the idea of an extended substance: something that occupies space and is a potential bearer of various perceptible qualities at various times. What *in experience* could provide the basis for the idea that the things we see – like lumps of wax – are things over and above bundles of sensible qualities?¹³ Cartesians, seeing no prospects for a plausible answer to this question, conclude that even the ideas humans employ when thinking about concrete perceptible objects are ideas that transcend perceptual experience.

Descartes applied similar considerations to the idea of a thinking thing; and while one can object to both his metaphysical and psychological conclusions, it is easy to see why Chomsky is impressed with the style of argument. Descartes tried to figure out, on the basis of the kinds of judgments we make about thinkers (including ourselves), what human beings naturally assume about thinkers/persons independent of experience. The goal is to characterize the cognitive resources that humans bring to their experience of persons; so Descartes tried, as best he could given the theoretical tools available, to isolate our idea of a person and factor out the contribution of experience. Similarly, Chomsky uses the linguistic judgments of speakers as data for claims about what children assume about language, prior to experience.

For various reasons, moral knowledge was also an important topic in the seventeenth and eighteenth centuries. So much of the discussion about innate ideas concerned the kinds of moral judgments humans are apt to form. Ralph Cudworth and Herbert of Cherbury, mentioned above, held (roughly) that human nature makes a certain range of moral ideas naturally available to anyone who grows up in a normal human environment. And once a thinker starts to form judgments involving these ideas, particular judgments – say, “killing people is wrong” – will be especially compelling. While early formulations of this view were often incautious, and open to easy criticism by empiricists, Chomsky endorses the underlying picture.¹⁴ Human minds develop in accordance with human nature, projecting ideas in response to initial experience; and then humans use those ideas, as best they can, to represent a world that has whatever character *it* has. In certain domains, like geometry and language and morals, these ideas manifest themselves as a special kind of knowledge whose source is “from within.”

One might think there is a crucial difference between the “linguistic ideas” that seem to spring from human nature and ideas of perceptible objects. For the latter are at least “directed” towards the language-independent world, even if human judgments fail to represent that world accurately. And one might think that ideas of external objects – ideas that are (or at least are intended to be) *about* things independent of those ideas – cannot be innately constrained in the way that the idea of a verb phrase is constrained. But stated this baldly, the objection just restates the denial of rationalism. On Chomsky's own view, there are no linguistic expressions independent of language users; nothing “outside us” is relevant to whether or not our natural linguistic judgments are right or wrong. Correspondingly, an ordinary speaker's idea of a verb phrase is not about some aspect of the external world to which the speaker is attuned. On the other hand, an ordinary person's idea of (say) wax is about – or at least is sometimes used to think about – some aspect of the mind-independent world. But the fact that we think about things outside us hardly shows that our ideas owe their character to

those external things. And the fact that we occasionally “tune in” to features of the mind-independent world, in ways that let us form *reliable* judgments, hardly shows that our ideas are not predominantly shaped by the cognitive systems that gave rise to them.

From this perspective, we are *fortunate* if we can use our natural ideas to form thoughts that truly reflect mind-independent reality. So one should not assume that humans have a natural capacity to form reliable judgments about every aspect of the environment that attracts their attention. Thus, rationalists typically stress that the very capacities that make knowledge possible also impose constraints on what one can know by deploying those capacities. For example, the language faculty imposes constraints on which languages humans can naturally acquire. This leaves open the possibility of “decoding” a non-human language – i.e. a language that does not conform to the principles of universal grammar – by using cognitive systems other than the language faculty; but we could not understand such a language in the way we can understand human languages. Similarly, when acting as scientists, humans *may* be able to construct ideas that lie outside the space of ideas naturally available to them; although Chomsky (1975, 1980, 2002b) suggests, in good rationalist fashion, that whatever cognitive systems underlie our capacity for doing science will also be governed by their own internal principles (see also McGinn 1994a).

That said, Chomsky also thinks that by pursuing the kind of scientific research that linguists pursue, we can begin to understand aspects of how human beings represent and reason about the world. So we conclude this chapter with a brief discussion of two phenomena that seem to straddle syntax and semantics and logic. For such phenomena may provide suggestions about how to (slowly) push beyond the study of linguistic forms, and into the study of why linguistic expressions have the meanings they do (as opposed to other logically coherent but “non-human” meanings), while remaining focused on how human ideas are constrained by our biological endowment.

Beyond mere grammar

As we have emphasized, Chomsky contends that the cognitive apparatus human beings bring to language learning has a certain *character*, given which humans acquire certain characteristic states of linguistic knowledge that go well beyond their experience. To illustrate this point about the language faculty, Chomsky frequently notes that as soon as children are able to combine the words *brown* and *house* to form the expression *brown house*, the composed phrase has semantic properties beyond those attributable to the meanings of the individual words. In particular, children use *That is a brown house* to say that the *exterior* of the house in question is brown; and unless interiors are explicitly mentioned,

children will hear *That is a brown house* as a claim about the exterior of the house. (See chapter 10.)

The kind of innate knowledge that Chomsky envisions also includes knowledge of linguistic properties that have been investigated by researchers in the field of formal semantics. Chomsky views formal semantics as a theory about a component of the language faculty that determines certain features of structures generated by the computational system – i.e. the syntax. These structures include expressions of various categories. For example, the category of determiner covers a large class of (intuitively quantificational) expressions like *some*, *all*, *no*, *every*, *most*, *at least three*, *more than three*, *but less than ten*, and so forth.

There seem to be semantic universals that constrain the contribution of determiners to the meanings of expressions that contain them. One proposed universal property of determiner meanings, known as conservativity (Barwise & Cooper 1981; for introductory discussion, see Larson & Segal 1995; Chierchia & McConnell-Ginet 2000), is illustrated in (11).

- (11) If all cows are brown cows, then all cows are brown.

Speakers of English can know that (11) is sure to be correct, regardless of the situation. Moreover, (11) remains obviously correct if we replace *all* with other determiners like *some*, *no*, and so on. This suggests the following generalization:

- (12) If [(DET cows) (are brown cows)], then [(DET cows) (are brown)]

In (12), “DET” can be replaced by any natural language determiner to produce an obvious truth. Some examples include those in (13).

- (13) a. If most cows are brown cows, then most cows are brown.
b. If all but two cows are brown cows, then all but two cows are brown.
c. If more than three cows are brown cows, then more than three cows are brown.

This turns out to be an important fact. To see why, it will help to note that one can specify the meaning of a determiner using (something like) set-theoretic relations. One can think of determiners as names for relations that can hold between sets. For simplicity, let’s continue to focus on sentences of the form DET NP VP, where the determiner is followed by a noun (or noun phrase) like *cows* and a verb (or verb phrase) like *are brown cows*; the NP and VP are, respectively, the first and second arguments of the determiner. A sentence of the form DET NP VP is true if and only if the set associated with the first (NP) argument bears the relation named by DET to the set associated with the second (VP) argument. For example, the sentence *All cows are brown* is true if and

only if the set of cows is a subset of the set of brown things. So one can think of the determiner *all* as a label for the subset relation. Likewise, *All cows are brown cows* is true if and only if the set of cows is a subset of the set of brown cows. So (11) expresses the following set-theoretic truism: if the set of cows is a subset of the set of brown things, then the set of cows is a subset of the set of brown cows.

The sentence *Some cows are brown* is true if and only if the set of cows intersects with the set of brown things. So one can think of the determiner *some* as a label for the relation of intersection. Likewise, *Some cows are brown cows* is true if and only if the set of cows intersects with the set of brown cows; and if the set of cows intersects with the set of brown things, then trivially, the set of cows intersects with the set of brown cows. Similar remarks apply to all natural language determiners. The generalization indicated in (12) is quite robust. But natural languages also contain quantificational expressions that *would* be counterexamples to (12) if these words were determiners. For example, inserting the word *only* into (12) would yield (14), which is not a truism (as indicated by '#').

- (14) # If only cows are brown cows, then only cows are brown.

Suppose there is a brown horse in the conversational context. Then while (11) and (13) remain obviously correct, (14) is false. So to maintain the generalization in (12), one must say that *only* is not a determiner. But this is independently plausible, since *only* (which is arguably an adverb) can appear in a much wider range of syntactic positions than genuine determiners. Consider, for example, *He only likes brown cows* and *Bessie is the only brown cow*.

The availability of words like *only* in natural languages shows that logic alone does not explain the generalization about the conservativity of determiner meanings. Rather, it seems that natural language is intolerant of determiner meanings that would violate (12), though it tolerates such meanings for other kinds of linguistic expressions. So even if actual instances of (12) report logical truths, logic alone does not exclude the possibility of quantificational expressions that would be counterexamples to (12). The relevant generalization evidently holds because of some fact about speakers of human languages, whose mental grammars are subject to a substantive constraint that prohibits certain determiner meanings; see Pietroski (2005) for a proposal.¹⁵

If this constraint turns out to be a linguistic universal, then it is a likely candidate for innate specification. For what evidence (that children are sensitive to) would allow speakers to *infer* that other speakers use only conservative determiners? The nativist proposal would be that the conservativity of determiner meanings is a reflection of features shared by all natural languages in virtue of human biology. These "core" features of natural languages constitute what Chomsky calls "Universal Grammar" – the initial state of the language learner. A

consequence of Universal Grammar is that sentential structures are interpreted in certain ways. If this is correct, then theorists can try to characterize the notion of "natural" consequence that is a by-product of how the human language faculty is organized (see Ludlow 2002). And it seems that the "interpretive" component of Universal Grammar does indeed impose constraints on the meanings of so-called logical words. A child exposed to a particular spoken language has to figure out which sounds in that language are associated with which possible meanings for quantificational expressions like *all*, *some*, and *no*. But the nativist expects a child to know how such words contribute to the truth conditions of sentences (in any natural language) as soon as these words have entered the child's lexicon. For example, the nativist will expect the child to manifest knowledge that all determiner meanings are conservative, as soon as it is possible to test for such knowledge.¹⁶ (We return to words for propositional operators – *and*, *or*, and *not* – presently.)

Other semantic properties of determiners are also viable candidates for innate specification. Although all determiners are conservative, they can be further partitioned into semantic classes that correspond to certain entailment relations among sentences. Consider the impeccable inferences in (15):

- (15) NP: If no cow ate a vegetable, then no brown cow ate a vegetable.
VP: If no cow ate a vegetable, then no cow ate a green vegetable.

Given the determiner *no*, one can replace a general term like *cow* with a more specific expression like *brown cow* in the first (NP) argument. One can also replace a general term like *vegetable* with a more specific expression like *green vegetable* in the second (VP) argument. To capture this fact, semanticists say that *no* is "downward entailing" in both of its arguments. This is related to the fact that negation generally licenses inferences from claims about sets of things to claims about subsets. For example, if John did not buy a car, it follows that he did not buy a red car; whereas if John bought a car, it does not follow that he bought a red car.

But not all determiners have this feature, as indicated in (16–17):

- (16) NP: If every cow ate a vegetable,
then every brown cow ate a vegetable.
#VP: If every cow ate a vegetable,
then every cow ate a green vegetable.
(17) #NP: If some cow ate a vegetable,
then some brown cow ate a vegetable.
#VP: If some cow ate a vegetable,
then some cow ate a green vegetable.

The universal quantifier *every* is downward-entailing on its first argument, but not on its second argument. The existential quantifier *some* is not downward entailing on either of its arguments.

The semantic property of downward entailment has important linguistic consequences. For it is connected to several seemingly unrelated linguistic phenomena, including the licensing of so-called negative polarity items (such as *any*, *ever*, and *at all*) and restrictions on the interpretation of *or*. The sentences in (18–20) illustrate that the negative polarity item *any* is licensed by downward-entailing argument positions. For example, *every* is downward entailing on its first (NP) but not its second (VP) argument. And as shown in (19), *any* can appear in the complex NP *cow that ate any vegetable*; but if *any* appears in the complex VP *ate any vegetable*, it sounds odd (given the determiner *every*), as indicated by the asterisk. By contrast, *no* is downward entailing in both of its arguments, and *any* can appear in either argument; while *some* is downward entailing in neither of its arguments, and *any* cannot appear in either argument.

(18) NP: No cow that ate any vegetable became ill.

VP: No cow ate any vegetable.

(19) NP: Every cow that ate any vegetable became ill.

VP: *Every cow ate any vegetable.

(20) NP: *Some cow that ate any vegetable became ill.

VP: *Some cow ate any vegetable.

Similar remarks apply to the complex NP *cow that ever ate vegetables* and the complex VP *ever ate vegetables*. The generalization seems to be that negative polarity items are licensed in downward-entailing environments.

Another striking fact is that if a determiner is downward entailing on one of its arguments, the disjunction operator has a “conjunctive” implication in that argument position. This is illustrated in (21), where *or* has a conjunctive implication when it appears in the first argument of *every*, but not when it appears in the second argument.

(21) NP: If every cow that ate broccoli or asparagus became ill, then

(i) every cow that ate broccoli became ill and

(ii) every cow that ate asparagus became ill.

#VP: If every cow ate broccoli or asparagus, then
every cow ate broccoli and
every cow ate asparagus.

The conjunctive implication is present for both arguments of *no* and neither argument of *some*. For example, if no cow ate broccoli or asparagus, it follows that: no cow ate broccoli, and no cow ate asparagus. But if some cow ate broccoli

or asparagus, it does not follow that some cow ate broccoli; nor does it follow that some cow ate asparagus.

One can think of DeMorgan’s law for negation, stated in (22), as a special case of a general relation between disjunction and conjunction in downward entailing linguistic environments, as stated in (23).

(22) not(*A or B*) $\rightarrow$ not(*A*) and not(*B*)

(23) For any downward-entailing operator *O*: *O*(*A or B*) $\rightarrow$ *O*(*A*) and *O*(*B*)

The generalization in (23) extends to all downward-entailing expressions. But since *every* is downward entailing only in its first argument, the conjunctive implication of disjunction arises only in its first argument. Theorists can thus capture the fact that *every* falls between *no* and *some* with regard to the DeMorgan phenomenon.¹⁷

In thinking about such facts, it is important to distinguish logical truths – about the interrelations of logical notions like conjunction, (inclusive) disjunction, and negation – from facts about the (natural) meanings of linguistic expressions. The logical truth reported with (22) does not, by itself, tell us anything about the meanings of sentences involving the natural language expressions *not*, *and*, and *or*. In this regard, note that DeMorgan’s law would not be germane to sentences of the form *A or B* if the word *or* had an “exclusive” interpretation according to which *A or B* is false if *A* and *B* are both true. This suggests that certain expressions have the property of being downward entailing because speakers of human languages are subject to a substantive constraint involving downward entailment.

This constraint is relevant to at least all of the following: the basic (inclusive) meaning of disjunction words in natural languages, the licensing of negative polarity items, and prohibitions on the imposition of scalar implicatures. The constraint under consideration is another candidate for innate specification. If so, language learners are expected to approach the task of grammar formation equipped with this aspect of logical reasoning. Whatever “errors” of logical inference learners make, we do not expect them to violate DeMorgan’s laws, or to produce negative polarity items in the wrong linguistic environments. Recent experimental evidence from studies of child language lends credence to nativist hypotheses. As soon as children can be tested, around the age of three, they obey the licensing conditions on negative polarity items, they compute the conjunctive interpretation of disjunction in downward entailing linguistic environments, and they evince knowledge that determiner meanings are conservative (Chierchia et al. 2001).

This is the kind of inquiry suggested by Chomsky’s conception of innate ideas. One tries to learn about the character of human thought by looking for generalizations that are neither logical truths nor plausible candidates for

hypotheses that thinkers have empirically confirmed on the basis of data available to them. If young children, with different backgrounds, all respect a (non-logical) generalization G that trained linguists have only recently noticed, this suggests that G is a reflection of human nature. This is then a starting point for further inquiry into how (and why) human nature gives rise to such generalizations. Chomsky – following Plato, Descartes, and others – thus offers a methodology for how to formulate and occasionally answer substantive questions about human thought.

9 Mind, language, and the limits of inquiry

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This chapter explores a very general philosophical and methodological theme in Noam Chomsky's work – the scope and limit of scientific inquiry in the study of mind and language. It is a conspicuous fact about Chomsky that accompanying the vast and driving intellectual ambition of his program in what he conceives as the *science* of linguistics is a notable and explicit modesty about the extent to which he thinks he has given, indeed the extent to which one can give, scientific answers to fundamental questions. This modesty in terms of *breadth* of coverage is in a sense the other side of, and therefore indispensable to, the *depth* of what he has achieved in the area he has covered.

In his work, he seems to offer at least two different sorts of reasons for us to be made modest about ourselves as inquirers. First there is a modesty implicit in his guardedness about claiming for semantics what some other philosophers have claimed for it, and what he himself has claimed only for syntax understood in a broad sense viz., that there is in some interesting sense an explanatory theory to be offered which can be incorporated into the science of linguistics. Second, there are reasons for modesty having to do with the fact that either because of our conceptual limitations or because of faulty formulations of questions, we are in no position to give serious and detailed answers to them. The next two sections will take up each of these in turn.

Is referential semantics possible?

For Chomsky, scientific inquiry into language and into the human mind is possible if it can assume that what is being studied are the “*inner* mechanisms” which enter into the study of thought and expressions and behavior generally. As he says:

The approach is “mentalistic” but in what should be an uncontroversial sense. It is concerned with “mental aspects of the world” which stand alongside its mechanical, chemical, optical, and other aspects. It undertakes to study a real object in the natural world – the brain, its states, and functions – and thus to move the study of the mind [and language] towards eventual integration with biology and the natural sciences. (Chomsky 2000a: 6)