

# VOCABULARY MATTERS

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## 1 Higher Goals

What someone *didn't* say can be revealing. Consider the following familiar passage.

Although even descriptive adequacy on a large scale is by no means easy to approach, it is crucial for the productive development of linguistic theory that much higher goals than this be pursued. To facilitate the clear formulation of deeper questions, it is useful to consider the abstract problem of constructing an “acquisition model” for language, that is, a theory of language learning or grammar construction. (pp. 24-25)<sup>1</sup>

As possible contrasts, imagine that Chomsky had instead written (1) or (2).

- (1) It's hard to formulate descriptively adequate grammars. But sometimes, it helps to ask how children could acquire the languages they do acquire.
- (2) Approximating descriptive adequacy is already hard. But in linguistics, the real goal is to explain how children acquire the languages they do acquire.

Alternative (1) would have suggested that the linguist's job is to describe languages, but that as with many difficult tasks—e.g., achieving wisdom—indirect methods can be useful. And as discussed below, Chomsky's conception of descriptive adequacy was already quite demanding. Yet he urged linguists to strive for more.

Alternative (2) would have implied that we should aim for a theory of certain biopsychological *processes* that are innately constrained but also input-sensitive. From this perspective, a descriptively adequate grammar for a human language characterizes some state of “knowledge” that any normal child could acquire (given suitable experience), and the linguist's task is to say how children actually acquire such states given their experience. Some of Chomsky's remarks are compatible with this construal of his project. But his claims about the

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<sup>1</sup> Page references are to Chomsky (1965) unless otherwise noted. Thanks to Tim Hunter for comments on a previous draft, and to Norbert Hornstein for conversations (over years, and usually over lunch) that made this paper possible.

competence/performance distinction (pp. 9-10), and the general character of his work, suggest skepticism about the prospects for theories of spatiotemporally located *uses of* the human language faculty. Episodes of language acquisition are special, in being early uses that constrain later uses of this faculty; but such episodes are still products of many interacting factors.

Indeed, the process of acquiring a language would seem to be *more* complex than the process of evaluating (3) and (4) for acceptability.

(3) sincerity may frighten the boy

(4) the boy may frighten sincerity

If judging that (4) is less acceptable than (3) involves many disparate factors, this interaction effect may be theoretically intractable (but still useful as data). The process of acquiring a language whose sentences include (3), and perhaps (4), may be far more complicated.<sup>2</sup> In any case, Chomsky speaks of the “abstract problem”—not the *real task*—of constructing a theory of “language learning or grammar construction.” He says that it is “useful to consider” this problem in order to help formulate “deeper questions,” not that such reflection will lead to a good theory of language learning. But even if language acquisition is an intractable phenomenon, focusing on the abstract problem can be useful. This is because thinking about acquisition highlights the importance, for children and linguists, of the *vocabulary* used to formulate grammars.

However, children are *not* little scientists trying to provide theories of languages, given the data and capacities available to adults. Acquisition is better described as selecting a language, from a certain range of options, by using ordinary experience to order the options—or perhaps better still as constructing one or more grammars by using experience to navigate a menu of options. But whatever the details, children presumably encode potential languages in some way that lets experience guide selection as it does. In which case, children are like linguists in an important respect: they employ a vocabulary that supports certain nondemonstrative inferences from “data points” to generalizations that cover unboundedly many cases.

On this overtly mentalistic view, each child can encode any human language, and the coding scheme supports “projections” (cp. Goodman 1954, described below) from parochial courses of human experience to particular languages. In this sense, there is a privileged way of representing the languages that children acquire: the child’s way, which linguists can try to capture. Absent this external standard of correctness for theories of natural languages, which are not governed by explicit stipulations, one might—and Quine (1960) did—worry that any description of such a language is as good (and as bad) as any other, at least within a range of descriptions that meet some minimal conditions of observational adequacy. And while Quine himself assumed a form of behaviorism that Chomsky (1957, 1959) had already criticized, even a 1960s cognitivist might have worried that linguistics was a subject with no objective subject matter.

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<sup>2</sup> Compare *n*-body problems in physics, many weather patterns, or the production of appropriate novel expressions in communication. Even fifty years later, and allowing for parametric variation in grammatical principles, it seems “impossible to formulate an assumption about initial, innate structure rich enough to account for the fact that grammatical knowledge is attained on the basis of the evidence available to the learner...yet not so rich as to be inconsistent with the known diversity of language” (p. 58).

## 2 Descriptive Adequacy

In this context, Chomsky suggested a high initial standard of theoretical adequacy.

A linguistic theory must contain a definition of “grammar,” that is, a specification of the class of potential grammars. We may, correspondingly, say that a *linguistic theory is descriptively adequate* if it makes a descriptively adequate grammar available for each natural language. (p. 24)

A linguist can aim to be like a child whose (internalized) grammar employs a representational format that could be used to encode *any* language that the child could have acquired. I’ll return to the further desideratum of explanatory adequacy and its relation to the possibility of selecting languages given experience. But thinking about the subject matter of linguistics can lead one to emphasize the *acquirability* of the languages that linguists study and the importance of representational format, even if one remains agnostic about the prospects for theories of acquisition. Such agnosticism does not render the subject trivial. On the contrary, Chomsky’s notion of a descriptively adequate *grammar* is already interesting and remarkably demanding.

In particular, he didn’t say that a grammar is descriptively adequate if it specifies all and only the grammatical sentences of the relevant language as such.<sup>3</sup> A proposed grammar for the language is said to be descriptively adequate “to the extent that it correctly describes the intrinsic competence of the idealized native speaker;” where this relative notion, which allows for talk of a grammar being more or less adequate than another, is glossed mentalistically.

The structural descriptions assigned to sentences by the grammar, the distinctions that it makes between well-formed and deviant, and so on, must, for descriptive adequacy, correspond to the linguistic intuition of the native speaker (whether or not he may be immediately aware of this) in a substantial and significant class of crucial cases. (p. 24)

Here, the locution ‘and so on’ is not a casual addition that can be ignored. This passage follows a discussion of how structural descriptions are related to *interpretations*, as illustrated

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<sup>3</sup> One can get misled by the third paragraph of *Syntactic Structures* if one ignores the underlined phrase.

From now on, I will consider a *language* to be a set (finite or infinite) of sentences, each finite in length....The fundamental aim in the linguistic analysis of a language L is to separate the *grammatical* sequences which are the sentences of L from the *ungrammatical* sequences which are not sentences of L and to study the structure of the grammatical sequences. The grammar of L will thus be a device that generates all of the grammatic sequences of L and none of the ungrammatical ones. (Chomsky 1957, p. 13, my underlining)

But it helps to distinguish grammars from the aims of linguistic analysis, and to recall the first paragraph.

Syntax is the study of the principles and processes by which sentences are constructed in particular languages. Syntactic investigation of a given language has as its goal the construction of a grammar that can be viewed as a device of some sort for producing the sentences of the language under analysis. More generally, linguists must be concerned with the problem of determining the fundamental underlying properties of successful grammars. The ultimate outcome of these investigations should be a theory of linguistic structure in which the descriptive devices utilized in particular grammars are presented and studied abstractly, with no specific reference to particular languages. One function of this theory is to provide a general method for selecting a grammar for each language, given a corpus of sentences of this language. (Chomsky 1957, p. 11)

Chomsky’s talk of languages as sets, which he elsewhere eschews, was presumably to ease MIT undergraduates into the subject via his discussion of recursion.

with *ambiguous* strings like (5)

(5) I had a book stolen  
and the subtle semantic *contrast* between (6) and (7).

- (6) I persuaded John to leave
- (7) I expected John to leave

By way of highlighting this contrast, note that (8)

- (8) I persuaded John that he should leave

is acceptable and a reasonably good paraphrase of (6), while ‘I persuaded that John would leave’ is neither. Yet (9) is acceptable and a reasonably good paraphrase of (7),

- (9) I expected that John would leave

while ‘I expected John that he should leave’ is neither. Correlatively (10) is acceptable,

- (10) my expectation was that John would leave

but ‘my persuasion was that John would leave’ is not.

It is worth noting explicitly that for Chomsky, a sentence is a string, as opposed to a structured expression. A sentence can have more than one structural description, and thereby have more than one meaning, as (5) illustrates.<sup>4</sup> Given the ubiquity of such structural ambiguity, it is interesting that each of the famous sentences (11) and (12)

- (11) John is easy to please
- (12) John is eager to please

has *only* one meaning; see Chomsky (1964, p.66). While (11) has the meaning indicated with (11a) as opposed to (11b), (12) has the meaning indicated with (12b) as opposed to (12a).

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<sup>4</sup> When we “speak of a grammar as generating a sentence with a certain structural description, we mean simply that the grammar assigns this structural description to the sentence” (p. 9); where a structural description “incorporates all information relevant to a single interpretation of a particular sentence” (p. 16). Chomsky (1964) stresses this.

The generative grammar of a language should, ideally, contain a central *syntactic component* and two *interpretive components*, a *phonological component* and a *semantic component*. The syntactic component generates strings of minimal syntactically functioning elements (following Bolinger, 1948, let us call them *formatives*) and specifies the categories, functions and structural interrelations of the formatives and systems of formatives. The phonological component converts a string of formatives of specified syntactic structure into a phonetic representation. The semantic component, correspondingly, assigns a semantic interpretation to an abstract structure generated by the syntactic component. Thus each of the two interpretive components maps a syntactically generated structure onto a "concrete" interpretation, in one case phonetic, and in the other, semantic. *The grammar as a whole can thus be regarded, ultimately, as a device for pairing phonetically represented signals with semantic interpretations*, this pairing being mediated through a system of abstract structures generated by the syntactic component. *Thus the syntactic component must provide for each sentence (actually, for each interpretation of each sentence) a semantically interpretable deep structure and a phonetically interpretable surface structure*, and, in the event that these are distinct, a statement of the relation between these two structures. (Chomsky 1964, p. 52, my emphasis)

- (11a) It is easy for us to please John  
 (11b) #It is easy for John to please us  
 (12a) #John is eager for us to please him  
 (12b) John is eager that he please us

So a descriptively adequate grammar for English must not only include all six strings among the sentences of English, it must assign structural descriptions which indicate that ‘John’ is the direct *object* of ‘please’ in (11) and the logical *subject* of the embedded verb in (12), without also assigning structural descriptions that indicate the unavailable interpretations. Yet such a grammar must still assign two structural descriptions to the ambiguous string (13),

- (13) John is ready to please

and three structural descriptions to (14), which has the three indicated interpretations.

- (14) Mary saw the boy walking towards the railway station  
 (14a) Mary saw the boy while walking towards the railway station  
 (14b) Mary saw the boy who was walking towards the railway station  
 (14c) Mary saw the boy walk towards the railway station

Sentence (14a) implies that Mary walked towards the station. But (14b) and (14c) do not; they imply that boy walked. Though unlike (14c), (14b) can be used to describe a situation in which Mary saw the *boy* without seeing him *walk*; see Chomsky (1964, p.73).<sup>5</sup> Interestingly, (15)

- (15) this is the railway station (that) Mary saw the boy walking towards

can only have the interpretation corresponding to (14c)—with the implication that the station is such that Mary saw the boy walk towards it—even though the relative clause in (15) seems relevantly like the ambiguous (14). By contrast, (16) is as ambiguous as (14).

- (16) this is the railway station such that Mary saw the boy walking towards it

Yet (17) paraphrases (15), and the interrogative (18) is unambiguous in the way that (15) is.

- (17) this is the railway station such that Mary saw the boy walk towards it  
 (18) what did Mary see the boy walking towards

As Chomsky notes, (18) can be used to ask which thing is such that Mary saw the boy walk towards it; but (18) cannot be used to ask which thing is such that Mary saw the boy who was walking towards it, or such that Mary saw the boy while walking towards it. This suggests a common *constraint* on the interpretation of relative clauses and questions.

One can invent languages that generate (14-18) in a way that imposes *laxer* constraints. In some of these “English<sup>+</sup> languages,” both (15) and (18) are ambiguous for competent speakers.

<sup>5</sup> For discussion of perceptual idioms and the relevance of event variables, see Higginbotham (1983). The constraint on extraction from the relative clause ‘who was walking towards it’ is independently interesting; see Ross (1967).

In others, (15) is ambiguous, but (18) has only its English meaning—or vice versa. One can also invent languages that impose *stricter* constraints and assign exactly one meaning to each string, including (14). There are also “alt-English languages” in which (15) and (18) unambiguously have the meaning corresponding to (14a) or (14b). Analogous considerations apply to (5-13).

The general point is that for any given language, a descriptively adequate grammar assigns exactly  $n$  structural descriptions to a string of words—or more precisely, to a string of *formatives* (p.16)—that can be understood in exactly  $n$  ways, and the grammar assigns typologically distinct descriptions to strings that are understood in typologically distinct ways.<sup>6</sup> These are huge demands that go far beyond the mere requirement of specifying the grammatical sentences, which are just sequences of formatives to which structural descriptions can be assigned.

Indeed, it’s hard to see how the sequences of formatives that happen to be grammatical in (i.e., generated by) English could form an interesting class. Endlessly many of these sequences will be ambiguous; and endlessly many will be like some *ungrammatical* string in not having a structural description of a certain sort. *Prima facie*, (19) is grammatical while (20) is not,

- (19) was the hiker who lost killed in the fire?  
 (20) \*was the hiker who lost died in the fire?

but only because ‘killed’ can be used in the passive; (19a) is grammatical while (20a) is not.

- (19a) the hiker who lost was killed in the fire?  
 (20a) \*the hiker who lost was died in the fire?

The interesting constraint illustrated with (20) is that ‘was’ *cannot* be understood as associated with ‘lost’, embedded in the relative clause, even though (21) is a fine question; see Ross (1967).

- (21) the hiker who was lost died in the fire?

The same constraint applies to (19), whose meaning is very different from that of (22),

- (22) the hiker who was lost killed in the fire?

which asks whether the lost hiker killed someone.

The grammaticality of (19) is much less interesting than the fact that (19) cannot have the meaning of (22), just as (20) cannot have the meaning of (21). Having *no* structural description is just a special case of having  $n$  (but not  $n+1$ ) structural descriptions; and for these purposes, the difference between zero and one is not theoretically important.<sup>7</sup> The interesting facts concern grammaticality/acceptability *on a reading*, not the grammaticality/acceptability of strings *simpliciter*. Given an invented language, like a first-order predicate calculus that can be defined as a set of unambiguous well-formed formulae, the notion of a legitimate sequence of symbols

<sup>6</sup> See Berwick et. al. (2011) for discussion in the context of recent responses to corresponding “poverty of stimulus” arguments. A descriptively adequate grammar will also assign structural descriptions to many strings that “deviate from well-formedness in certain respects” (p. 3). For example, ‘The child seems sleeping’ is a degraded way of saying that the child seems to be sleeping, *not* that the child seems sleepy; see Higginbotham (1983).

<sup>7</sup> But as a *sound*, (22) does have a structural description corresponding to (22a), with ‘died’ understood as ‘dyed’. And (22/22a) has this structural description, somewhat degradedly (see note 6), even with ‘died’ understood in terms of death; cp. ‘the hiker was disappeared’. Unsurprisingly, strings of uninterpreted formatives are uninteresting.

may be a good proxy for the notion of a structured expression whose meaning somehow reflects the way in which the structure was generated. But the languages that human children naturally acquire are not remotely analogous in this respect.

Chomsky's notion of descriptive adequacy reflects these points. To be sure, given any language L, one can talk about the languages that generate the same sentences as L. But if the notion of sentence is not theoretically interesting, then languages that generate the same sentences are not similar (or equivalent) in a theoretically interesting way. We can "say that a grammar *weakly generates* a set of sentences and that it *strongly generates* a set of structural descriptions (recall that each structural description uniquely specifies a sentence, but not necessarily conversely)." But the point is not that linguists should try to specify grammars that weakly generate the sentences of English or any other language. On the contrary, as Chomsky notes, the "study of weak generative capacity is of rather marginal linguistic interest" (p. 60).

If a proposed grammar doesn't even generate the sentences that L generates, the grammar is clearly inadequate as a theory of L. In this sense, one can perhaps *show* that certain proposals are false without noting the meanings that strings can(not) have. But this epistemic point is no basis for assigning theoretical importance to the weak generative capacity of a grammar/language. Any feature of a system can turn out to be evidentially relevant for certain purposes.

### 3 Deeper Questions

To repeat, providing a descriptively adequate grammar for English would be a significant achievement. Providing a descriptively adequate linguistic theory, which "makes a descriptively adequate grammar available for each natural language (p. 24)," would be a major success. Yet Chomsky says that even strong generative capacity is "not necessarily of any particular theoretical interest." For at least in principle, grammars can employ different basic vocabularies yet generate the same structural descriptions. Putting this point another way, descriptive adequacy (at least to a significant degree) is a necessary but not sufficient condition for what we really want: a theory that perspicuously represents how humans encode grammars.

When a child acquires English, she does not merely acquire a grammar that agrees with others with regard to the structural descriptions assigned to strings of English words; she does not merely internalize a grammar that strongly generates a certain set. A child's grammar is formulated in terms of a certain *vocabulary* that makes it possible to construct a certain range of grammars. So linguists who want a descriptively adequate *theory* presumably need to aim for the "higher goal" of characterizing the vocabulary that children use to formulate grammars.

On the assumption that this is also the vocabulary in terms of which children evaluate grammars, for purposes of selection, there is little point to aiming for mere descriptive adequacy. And indeed, Chomsky characterizes explanatory adequacy in terms of grammar selection.

To the extent that a linguistic theory succeeds in selecting a descriptively adequate grammar on the basis of primary linguistic data, we can say that it meets the condition of *explanatory adequacy*. . . . The problem of constructing an explanatorily adequate theory is "essentially the problem of constructing a theory of language acquisition, *an account of the specific innate abilities that make this achievement possible*". (25-26, my emphasis)

But there is no assumption here about the feasibility of providing theories of how acquisition

unfolds. The added requirement is that descriptively adequate grammars be formulated in a way that makes it possible to choose one, given suitably characterized data.

This is, in effect, an “interface” requirement: the vocabulary in terms of which grammars are formulated must be “connectable” with the vocabulary in terms of which “primary linguistic data” is characterized; cp. Lightfoot (1993). In terms of the initial quote,

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the “deeper questions” concern the vocabularies of theorists and children, and the need for a *metric* in terms of which grammars are *evaluable*. And while Chomsky formulates explanatory adequacy as a condition on theories that is logically stronger than the demand of descriptive adequacy, there is an important sense in which the same rationale underlies “both” conditions.

The weaker demand would, by itself, be arbitrary; cp. Quine (1960). Why require that a descriptively adequate grammar for any one natural language be formulated in a vocabulary that permits construction of a descriptively adequate grammar for *any* such language, if not because the “higher goal” is to represent the various languages *of this sort* in terms of a metric that reflects their underlying commonality in a way that makes it comprehensible how the variation could be correlated with variation in individual experience? Chomsky puts the point compactly by saying that a descriptively adequate theory may “leave unexpressed major features that are defining properties of natural language and that distinguish natural languages from arbitrary symbolic systems” (p. 36). By “adding” the requirement of explanatory adequacy, motivated by reflection on the abstract problem presented by language acquisition, Chomsky connected the more obviously empirical challenges of providing descriptively adequate grammars for particular languages to the more obviously theoretical questions concerning human cognition that had long animated debates between rationalists and empiricists; see Hornstein (2005a, 2005b).

In my view, one towering achievement of *Aspects* is that it provided a remarkably clear and still unsurpassed conception of the subject matter of linguistics. It made sense of how the method using acceptability judgments could, as it clearly did, lead to rational revision of theories concerning objective natural phenomena. But far from calling on linguists to provide models of complicated spatiotemporally located *processes* of production, comprehension, or acquisition, Chomsky outlined a project of describing natural languages *in the right way*—i.e., as kids do.<sup>8</sup>

## 4 Gruesome Projections

In stressing the importance of vocabulary and its relation to projection beyond data, Chomsky was influenced by Goodman. So let me connect this discussion to Goodman’s (1954) puzzle.

Let  $t$  be some time in the future, and define the predicates ‘grue’ and ‘bleen’ so that for any

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<sup>8</sup> See Fodor (1975) for sustained reflection on this point in the context of other developments. But since linguistic theories are still not explanatorily adequate, it would be rash to conclude that children encode mentalese translations of textbook principles. Likewise, reasonable skepticism about what kids do mentally encode is not a reason for rejecting Chomsky’s conception of the subject matter of linguistics.

entity  $e$ :  $e$  is grue iff  $e$  is green and observed before  $t$ , or blue and not observed before  $t$ ;  $e$  is bleen iff  $e$  is blue and observed before  $t$ , or green and not observed before  $t$ . For any emerald that has already been observed, it is grue iff it is green. So given any observed emeralds that are uniformly positive instances of (23), they are also uniformly positive instances of (24).

- (23) all emeralds are green  
 (24) all emeralds are grue

But while (23) can be confirmed by a (suitably gathered) data set that includes many emeralds all of which are green—and hence grue—such a data set does not confirm (24). So it seems that vocabulary matters for purposes of confirmation.

One might have thought that a generalization of the form ‘all Es are G’ is confirmed by a data set that includes a large sample of Es, gathered in a fair way, if all of the sampled Es are G. Indeed, one might have thought that this sufficient condition for confirmation was nearly trivial, and that challenging it would amount to radical skepticism about “empirical induction.” But as Goodman showed, counterexamples abound, absent restrictions on the kinds of predicates that can be instances of ‘E’ and ‘G’. His own example involves time-indexing: before  $t$ , observing grue emeralds does not confirm (24), even if the same observations do confirm (23). But reference to times is inessential to the abstract problem that Goodman highlighted.

Let ‘G’ and ‘B’ be contrary predicates:  $\forall x[G(x) \supset \sim B(x)]$ ;  $\forall x[B(x) \supset \sim G(x)]$ . Given a third predicate ‘T’, we can define a pair of contrary predicates ‘G\*’ and ‘B\*’ as in (25) and (26).

- (25)  $\forall x\{G^*(x) \equiv [G(x) \& T(x)] \vee [B(x) \& \sim T(x)]\}$   
 (26)  $\forall x\{B^*(x) \equiv [B(x) \& T(x)] \vee [G(x) \& \sim T(x)]\}$

Alternatively, we can use ‘G\*’ and ‘B\*’ to define ‘G’ and ‘B’ as in (25a) and (26a).<sup>9</sup>

- (25a)  $\forall x\{G(x) \equiv [G^*(x) \& T(x)] \vee [B^*(x) \& \sim T(x)]\}$   
 (26a)  $\forall x\{B(x) \equiv [B^*(x) \& T(x)] \vee [G^*(x) \& \sim T(x)]\}$

Suppose the domain consists of things on earth, and ‘T’ applies to things that are north of the equator. Now imagine individuals in the northern hemisphere who endorse generalization (27),

- (27) all cows are vegetarians

having noted that every observed cow grazes and never eats meat. If (27) has lots of positive instances, and no negative instances, the “inductive leap” seems reasonable—whether or not you

<sup>9</sup> Think of the domain as divided into six regions: (the union of) regions 1, 3, and 5 correspond to (the extension of) ‘T’; regions 2, 4, and 6 correspond to ‘ $\sim T$ ’. Let regions 1 and 2 correspond to ‘G’, while 3 and 4 correspond to ‘B’. Regions 5 and 6 correspond to ‘ $\sim G \& \sim B$ ’. Then 1 and 4 correspond to ‘G\*’, while 2 and 3 correspond to ‘B\*’. The extension of ‘G\*’ can be described as a union of intersections:  $(\{1, 2\} \cap \{1, 3, 5\}) \cup (\{3, 4\} \cap \{2, 4, 6\})$ ; i.e.,  $\{1, 4\}$ . But likewise for ‘G’:  $(\{1, 4\} \cap \{1, 3, 5\}) \cup (\{2, 3\} \cap \{2, 4, 6\})$ ; i.e.,  $\{1, 2\}$ . Similar remarks apply to ‘B\*’ and ‘B’. In the context of language acquisition, and the difficulty of learning constraints without “negative data,” it is also worth noting that ‘grue<sup>+</sup>’ and ‘blue<sup>+</sup>’ can be defined so that each of these predicates applies to entity  $e$  iff  $e$  is blue or  $e$  is both green and examined before  $t$ . Then all green emeralds examined to date are both grue<sup>+</sup> and blue<sup>+</sup>. Or put another way, the extension of ‘grue<sup>+</sup>/blue<sup>+</sup>’ is a superset of the extension of ‘blue’.

know about hemispheres. Since ‘vegetarian’ and ‘carnivore’ are contraries, (27) implies (28).

(28) no cows are carnivores

But if ‘vegetarians\*’ and ‘carnivores\*’ are defined as in (25) and (26), then generalization (27\*)

(27\*) all cows are vegetarians\*

is unwarranted, despite being like (27) in having each observed cow as a positive instance. For unlike (27), (27\*) implies that all cows in the southern hemisphere are carnivores, and hence that (28) is *false* if there are any cows in the southern hemisphere.

With regard to ‘grue’, one can’t avoid “cherry picking” the data until time *t*. With regard to ‘vegetarian\*’, one can’t avoid cherry picking north of the equator. But the vocabulary-relative character of confirmation remains, even bracketing spatiotemporally-indexed predicates. Even if we observe cows from both hemispheres—and thanks to time travel, even cows observed on the day that the last cows died—there will still be many predicates that all the observed cows satisfy. Let ‘T’ mark the division between things that moo in a certain way, and things that don’t. Suppose that all the observed cows happen to moo in this way, which is typical but not exceptionless for cows. A radical skeptic might insist that (27) is unwarranted, given the “biased sample” and the possibility that atypical mooers eat meat. But one can have laxer standards for confirmation without saying that (27\*) is equally well-confirmed; where now, vegetarians\* are vegetarians that moo in a certain way *or* carnivores that don’t moo in that way.

Goodman’s “riddle” of induction is to say what distinguishes generalizations that are confirmed by their positive instances—and the “projectible” predicates used to formulate such generalizations—from their gruesome counterparts. So “good” generalizations, which might well occur to us naturally, are often contrasted with “bad” generalizations that we would never think of without help. But one can also view Goodmanian examples as illustrating another point: one person’s reasonable inductive inference is another person’s leap of faith.

Given three Scrabble tiles in a bag, how often would you need to draw a ‘G’ (and put it back) before concluding that each of the tiles was a ‘G’? Reasonable people can differ. But after seeing a ‘G’ drawn ten times, who would conclude that the tiles spell ‘GOD’? The answer is obvious: someone who thinks that the bag must contain an ‘O’ and a ‘D’, even if sampling provides no evidence of this. And such a person could reach the same conclusion after seeing a ‘G’ drawn *once*. From the perspective of someone whose only background assumption is that the bag contains three Scrabble tiles, inferring ‘GOD’ will seem crazy, not merely rash. For someone who knows that the bag contains an ‘O’ and a ‘D’, drawing again after seeing a ‘G’ is pointless; you might as well check to see if the cow down the street is eating blue emeralds.

Of course, background assumptions can be wrong, and reasonable people are not unduly stubborn. But Chomsky saw that kids just project languages as they do, without regard for how reasonable their projections are from a scientific perspective. That is, kids project gruesomely. Who would conclude, on the basis of listening to adult speech, that (13), (14), and (16) are ambiguous, but that (11), (12), (15), and (18) are not?

(13) John is ready to please

(14) Mary saw the boy walking towards the railway station

(16) this is the railway station such that Mary saw the boy walking towards it

- (11) John is easy to please
- (12) John is eager to please
- (15) this is the railway station (that) Mary saw the boy walking towards
- (18) what did Mary see the boy walking towards?

If you're Chomsky, the answer is obvious: someone who comes to the task with a definition of "grammar"—i.e., a child who has "a specification of the class of potential grammars" (p. 24).

Linguists try to represent this specification by trying to provide an explanatorily adequate linguistic theory. But good scientists do not ignore the possibility of languages that violate the child's definition. On the contrary, by envisioning "inhuman" languages (e.g., the English<sup>+</sup> languages described in section two) and showing that children do not acquire them, linguists can provide scientific justifications for hypotheses about the vocabulary children employ. The child's vocabulary determines a limited "class of potential grammars" that can be evaluated given ordinary linguistic experience. The linguist's vocabulary permits description of a much larger class of languages, but also the use of evidence (unavailable to children) to evaluate the scientific hypothesis that children can only acquire the languages that respect certain constraints.

The child's projections are gruesome, from a scientific perspective, because the child's "hypothesis space" is constrained by the child's definition of grammar. This definition supports language acquisition, and in that sense is adequate for a *child's* purposes. But the vocabulary of an explanatorily adequate linguistic theory may not be well suited to modeling causal processes acquiring languages. For these *scientific* purposes, the child's definition may be inadequate.

We can imagine a mind that deploys the vocabulary of its best physical theory—and the corresponding simplicity metric used to evaluate candidate hypotheses in light of data—in the service of projecting from courses of linguistic experience onto procedures that pair signals of some sort with interpretations of some sort. The class of "languages" this mind can acquire is determined by the vocabulary and simplicity metric it uses to formulate and evaluate physical theories. Whatever the merits of such a thinker, it will not project from courses of experience to grammars in the way that a human child would; and there is nothing scientific about pretending otherwise. One of the great merits of *Aspects* was that it made this point vividly clear. In my view, this makes *Aspects* a significant if still under-appreciated contribution to philosophy. The contribution to linguistics is more obvious, though intimately related.

## References

- Berwick, Robert C., Paul Pietroski, Beracah Yankama, and Noam Chomsky. 2011. Poverty of the Stimulus Revisited. *Cognitive Science* 35: 1207-42.
- Chomsky, Noam. 1957. *Syntactic Structures*. The Hague: Mouton.
- Chomsky, Noam. 1959. Review of Skinner's *Verbal Behavior*. *Language* 35:26–58.
- Chomsky, Noam. 1964. *Current Issues in Linguistic Theory*. The Hague: Mouton.
- Chomsky, Noam. 1965. *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.
- Fodor, Jerry. 1975. *The Language of Thought*. New York: Crowell.
- Goodman, Nelson. 1954. *Fact, Fiction, and Forecast*. Cambridge, MA: Harvard University Press.

- Higginbotham, James. 1983. The Logical form of Perceptual Reports. *Journal of Philosophy* 80:100-27.
- Higginbotham, James. 1985. On semantics. *Linguistic Inquiry* 16:547-93.
- Hornstein, Norbert. 2005a. Introduction to *Rules and Representations*. New York: Columbia University Press.
- Hornstein, Norbert. 2005b. Empiricism and rationalism as research strategies. In J. McGilvray, ed., *The Cambridge Companion to Chomsky* (Cambridge: Cambridge University Press).
- Lightfoot, David. 1993. *How to Set Parameters*. Cambridge, MA: MIT Press.
- Piatelli-Palmarini, Massimo. 1980. *Language and Learning: The Debate between Jean Piaget and Noam Chomsky*. London: Routledge and Kegan Paul.
- Quine, Willard Van Orman. 1960. *Word and Object*. Cambridge, MA: MIT Press.
- Ross, John R. 1967. Constraints on variables in syntax. Doctoral dissertation, MIT. Published in 1986 as *Infinite syntax!* Norwood, NJ: Ablex.