REVIEW ARTICLE

Chomsky's linguistics: The goals of the generative enterprise

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In order to provide a framework for evaluating the generative enterprise as discussed in *Chomsky's linguistics*, which spans almost four decades—what has been and what remains to be accomplished—this essay examines the evolution of the goals of Chomsky's research program into the nature, origin, and use of language. It compares the early goals, first formulated in the 1950s and revised less than a decade later in Chomsky 1965 and summarized in Chomsky & Lasnik 1977, with the reformulation under the minimalist program, focusing on the strong minimalist thesis, which motivates a search for principled explanation in terms of interface conditions and general principles of computational efficiency, the latter based on the operation Merge and a theory of phases. This evaluation develops some alternative proposals to the formulations in the volume under review.*

Keywords: generative enterprise, faculty of language, I-language, Merge, phases, Spell-out, Transfer, strong minimalist thesis, principled explanation, efficient computation, full interpretation, no tampering condition, inclusiveness

1. *Chomsky's linguistics* and chomsky's linguistics. *Chomsky's linguistics* spans almost four decades of work on generative grammar—eleven published papers, starting with 'Remarks on nominalization' (1970) and ending with 'On phases' (2008). The second and third papers, 'Filters and control' (1977) and 'A remark on contraction' (1978), are coauthored with Howard Lasnik, demonstrating in part that Noam Chomsky's work in linguistics 'reflects a collective effort', as he notes in the first paragraph of 'Minimalist inquiries: The framework' (2000a; the seventh paper), first published in a festschrift for Lasnik (Martin et al. 2000). This work has also been a cooperative effort (cf. the first footnote of 'Bare phrase structure' (1995a, the sixth paper in this collection)), as illustrated in the following quote from the first footnote to 'On binding' (1980, the fourth paper), which was published to support a great deal of work done by other researchers based on the first draft manuscript.

> This paper was written in January 1978 as a first draft, not intended for publication, and circulated to a few friends and colleagues for comment. I then used some of the material in it as a basis for lectures in a graduate course at MIT in the spring of 1978. As anticipated, a fair number of errors came to light in my own further work, class discussion, and discussion with others who had read the paper, and in a number of cases it was possible to introduce substantial improvements. I had intended to prepare the paper for publication by mid-1978, but other demands intervened and I was unable to do so. Meanwhile, others have referred to the paper in their own work, proposing alternatives, offering criticism, or developing the ideas further. The unavailability of the paper poses a certain problem for these researchers, since they are compelled to make reference to material that their readers will not have seen. In the interest of facilitating ongoing research and communication, I have agreed to allow the paper to be published in its preliminary form, though with natural reluctance. I have introduced only very minor corrections.

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The seven papers after 'On binding' focus on a MINIMALIST PROGRAM for research into linguistic theory that Chomsky first formulated in 'A minimalist program for linguistic theory' (the fifth paper), published in a 1993 festschrift for Sylvain Bromberger.[1] In addition, the volume includes two complementary forewords, one by Howard Lasnik in which he succinctly outlines the technical developments covered in these papers and provides some reminiscences about working with Chomsky on 'Filters', and a second by Chomsky that gives a more general overview of the generative enterprise, focusing on fundamental issues and problems in the broader context of the history of ideas—which has been a unique trademark of Chomsky's writings since the early 1960s.

This collection provides a broad, detailed, and deep representation of Chomsky's contribution to linguistics, a wealth of ideas in the sheer volume of published output. Over the past six and a half decades, beginning with his University of Pennsylvania senior thesis 'Morphophonemics of Modern Hebrew' (1951; a revised version was published by Garland in 1979) Chomsky, has:

(i) constructed a formal theory of grammar (leading to the discovery of abstract underlying linguistic structure) and explored its foundations;
(ii) developed a cognitive/epistemological interpretation of the theory, leading to an understanding of human language as a component of mind/brain with substantial innate content, hence central to cognitive psychology and human biology;
(iii) contributed a series of major proposals for the computational system of human language, including both grammatical operations and general con-

[1] Later reprinted with some modification (e.g. all X double bar category labels have been replaced by XP labels) as the third chapter of *The minimalist program* (1995b), which includes Chomsky 1991, Chomsky & Lasnik 1993, and a fourth chapter 'Categories and transformations', based on 'Bare phrase structure' (cf. the introduction to Chomsky 1995b)—none of which are reprinted in *Chomsky's linguistics*. Nor are 'Approaching UG from below' (2007) and of course Chomsky's more recent 'Problems of projection' (2013a) and 'Problems of projection: Extensions' (2015). In addition to the four minimalist program papers mentioned above, this volume includes 'Derivation by phase' (2001), 'Beyond explanatory adequacy' (2004), 'Three factors in language design' (2005), and 'On phases'. For ease of reading and length considerations, the following abbreviations are used to refer to papers throughout this review: 'Nominalization' ('Remarks on nominalization'), 'Filters' ('Filters and control'), 'Contraction' ('A remark on contraction), 'Minimalist program' ('A minimalist program for linguistic theory'), 'Bare' ('Bare phrase structure'), 'Derivation' ('Derivation by phase'), 'Beyond' ('Beyond explanatory adequacy'), 'Three factors' ('Three factors in language design'), and 'Approaching UG' ('Approaching UG from below').

A collection of Chomsky's work since *The minimalist program* (1995b) has been long overdue, so the editors of this volume have done a significant service to the field, especially in collecting six of the eight most recent papers and publishing them in the context of some important earlier work, starting with 'Nominalization'. Perhaps regrettably, the prepublication versions (i.e. those distributed by *MIT Working Papers in Linguistics* (MITWPL)) of five of the papers ('Minimalist program', 'Bare', 'Minimalist inquiries', 'Derivation', 'Beyond') are reprinted instead of the final published versions. Putting aside minor differences in formatting, the two versions of 'Bare', 'Minimalist inquiries', and 'Beyond' are essentially identical based on a comparison of examples and footnotes. However, the final published version of 'Beyond' contains two paragraphs that are missing from the version in this collection (see n. 16 below). In addition, the MIT Press version of 'Derivation' contains four substantive footnotes (3, 5, 7, and 34) not contained in the MITWPL version (with two paragraphs of additional text around footnote 7). Also, footnotes 3, 6, 44, and 46 are extended in their counterparts in the MIT Press version, footnote 15 of the MITWPL version has been deleted in the MIT Press version and the text in which it occurred has been modified, and furthermore the MIT Press version contains two paragraphs that are missing from this version. The only substantive difference I discovered between the 1992 MITWPL and 1993 MIT Press versions of 'Minimalist program' is that footnote 7 in the latter contains an additional first sentence: 'See Marantz 1984, Baker 1988, on what Baker calls "the Principle of PF Interpretation," which appears to be inconsistent with this assumption'. The references for all of the papers have been combined into a single updated list at the end of the volume.

straints on their operation and output (ongoing from the beginning), where the postulation of constraints has resulted in a significant reduction in and simplification of the formal grammatical machinery;

(iv) reevaluated the theory of grammar in terms of questions about language design, raising the possibility of empirical proposals about the language faculty as a biological entity with general properties of efficient computation that instantiate more abstract notions of simplicity and economy—

all of this central to this collection of papers, especially (iv), which began with the formulation of a minimalist program for linguistic theory in the early 1990s. For a more detailed commentary on Chomsky's contribution, see Freidin 2013.

The generative enterprise that Chomsky founded in the mid-1950s has from the outset expanded the empirical basis of syntactic research far beyond anything that preceded it. Compare, for example, the rich empirical phenomena covered in *The logical structure of linguistic theory* (1975a and henceforth *LSLT*; written in 1955–56 and published in 1975 along with an extensive introduction, which includes commentary on the relation between the published edition and the original manuscript) and also *Syntactic structures* (Chomsky 1957) with the scant material on syntax discussed in H. A. Gleason's 1955 textbook *Introduction to descriptive linguistics* (cf. in contrast Gleason's 1961 second edition (see Freidin 2013 for discussion)), and then consider the extension of this basis to a wide range of languages under the PRINCIPLES-AND-PARAMETERS framework of the late 1970s to the present. In particular, the early work identified the 'ubiquitous phenomenon of displacement' (Chomsky 2015:5), which provides crucial syntactic structure supporting semantic interpretation. Furthermore, this work led to the empirical discoveries of 'syntactic islands' (which impose locality restrictions on displacement) and 'reconstruction' effects (a recurring topic in each of these papers, starting with 'Minimalist program') involving the interpretation of anaphoric expressions as affected by displacement. And finally, the range of syntactic topics investigated in current linguistics journals as well as the variety of languages covered are both far beyond what was being published in the early 1950s or before.

2. GOALS OF THE GENERATIVE ENTERPRISE. Chomsky's foreword to this volume of collected papers begins with the observation that the generative enterprise of the past six-plus decades has been and continues to be an exploratory process, 'a work in progress still very much underway, with constant changes, improvements, surprises, and many more sure to come' (ix). It continues with an arresting statement: 'One enduring problem has been to try to formulate the very goals of the enterprise'. Chomsky notes that these goals, which 'have only gradually come into focus', still seem to him 'in many ways obscure'.

In an attempt to elucidate these comments, the following discussion considers the evolution of goals for this program of research into the nature, origin, and use of language, which will provide a framework for evaluating the generative enterprise as discussed in this volume, what has been and remains to be accomplished. Section 2.1 examines the earliest goals as first formulated in *LSLT* (involving the concepts of language, grammar, and structure), revised less than a decade later in Chomsky 1965 (henceforth *Aspects*), and summarized in 'Filters'. Section 2.2 considers the reformulation of goals under the minimalist program, the focus of the last seven papers in the volume—in particular, the various formulations of the STRONG MINIMALIST THESIS in these papers and the search for principled explanation based on interface conditions and general principles of computational efficiency. Phase theory, the most recent formulation of a theory of cyclic derivation addressing the issue of efficient computation, is examined in §3, specifically the PHASE IM-

PENETRABILITY CONDITION: its formulation, empirical relation to a SUBJACENCY condition (an earlier locality constraint), and its implementation in syntactic derivations—leading to an alternative proposal to the strictly derivational model explored in these papers. Section 4 turns to one of the most fundamental issues for any theory of syntax: the question of how the computational system interfaces with the lexicon. These papers propose that syntactic operations (specifically Set-Merge) do not access the lexicon directly, but instead apply to a lexical array selected from the lexicon at one or more stages of a derivation, and also to the syntactic objects so created. Section 4.1 examines critically an empirical argument for lexical arrays involving the derivation of existential sentences, which crucially intersects with agreement and Case relations (central empirical concerns, the former starting with 'Nominalization' and the latter with 'On binding'), and §4.2 examines and rejects a conceptual argument for lexical arrays based on a distinction between copies (created by movement operations) and 'repetitions'. Three further grammatical operations beyond Set-Merge that appear to be required are considered in §5: Agree (§5.1), Pair-Merge (§5.2), and labeling (§5.3), completing the discussion of the computational system for human language as delineated in these papers. Section 6 attempts an evaluation of the enterprise by considering the validity of the strong minimalist thesis, which proposes that human language is in some sense a perfect and/or optimal system.

2.1. *LSLT* TO 'FILTERS AND CONTROL'. The first chapter of Chomsky's *LSLT*, the first detailed exploration of generative syntax, identifies three interdependent goals: 'the construction of grammars of particular languages, the development of an abstract theory of linguistic structure', and the justification of grammars (§3). To the extent that grammars constitute descriptions of particular languages (i.e. of the linguistic phenomena manifested in these languages), the first goal is essentially descriptive. So too is the second goal in that the theory of linguistic structure is abstracted from the grammars constructed and is thus a description of grammars at a higher level of abstraction. Yet the abstract theory will also have an explanatory component if it addresses the question of why particular grammars (and the linguistic phenomena they describe) have the properties they do and not other properties (or in the worst case, any property at all). Beyond the criterion of an accurate rendition of the linguistic facts, the justification of grammars becomes a purely explanatory goal if it addresses the 'why' question previously mentioned. From the outset, one of Chomsky's primary concerns has been to go beyond mere description, no matter how accurate, and raise questions of explanation similar to those found in the natural sciences. This is one aspect of Chomsky's work that distinguishes it from the work of his structuralist predecessors (e.g. Zellig Harris). For further discussion see Freidin 1994a, 2012, 2013.

As noted in §3 of *LSLT*, a grammar will be justified if it can be demonstrated that it follows from a specific abstract theory of linguistic structure that is not ad hoc and yields 'a revealing and intuitively adequate' grammar for each particular language, where such grammars are selected via an evaluation procedure that constitutes part of the theory. A non-ad hoc theory is characterized in this passage as one that develops 'in a simple and internally motivated way'. Evaluating how well these goals are met is, obviously, open to considerable interpretation, given the descriptors attached to the terms 'grammar' and 'theory'.

These three goals are formulated in terms of 'three fundamental and closely related concepts: language, grammar and structure' (*LSLT*, p. 5; see also §56.1). The first summary chapter of *LSLT* defines 'a language to be a set (in general, infinite) of strings in a finite alphabet, each string being of finite length' (1975a:71). Later on (in §56.1 and §56.3) 'a language' is characterized informally as 'a set of utterances', which emphasizes the vocal aspect of language—that is, phonetic form. There is no definition of lan-

guage (i.e. as opposed to a language), a more difficult issue; see Chomsky's first Dewey Lecture titled 'What is language?' (2013b), a question, he suggests, that involves some degree of obscurity. A grammar of a language (e.g. of language L) is defined as 'a finite device which generates all and only the strings of L in a determinate way' (1975a:71). The 1975 introduction to *LSLT* adds a clarification that 'each such string is a sentence of L' (p. 5), which follows if the initial symbol of every derivation in phrase structure grammar is S for sentence—possibly the wrong assumption, especially given that phrasal constituents of sentences (e.g. VP, AP, PP, and NP/DP) might themselves be considered as utterances in a language. It is worth noting that these definitions of language and grammar are grounded in the notion of strings, focusing on linear structure, which in language is overt, and excluding hierarchical structure, which is entirely covert. The definitions of the fundamental concepts in *LSLT* privilege the overt linear property of phonetic form in contrast to what became the central focus of the enterprise: the hierarchical analysis of phrase structure and its justification via a general theory of syntactic structure. For example, the formulation of phrase structure in Ch. VII is given in terms of strings and sets of strings designated as P-markers (later called 'phrase-markers'), where P constitutes a linguistic level of phrase structure. Phrase structure rules (e.g. those proposed for English in Ch. VIII), which establish hierarchical constituent relations, produce sets of strings. Coincidentally, *LSLT* gives no standard phrase structure tree representation (or equivalent labeled bracket representation) for any English example, although the nine figures in Ch. VII, which involve abstract strings of lowercase English letters, are all represented as trees with labeled nodes. The representations of *the old man in the corner has been reading the newspaper*, example 32 in Ch. VIII, and *I know the man reading the book*, example 123, come closest to the standard representation of constituent structure—the former as layered labeled horizontal braces underneath the example and the latter as a box divided into labeled segments with the label *Sentence* at the bottom and proceeding upward to the individual lexical items.

Two years later (see Chomsky 1982:62), a manuscript that was to become the first chapter of *Aspects* made a distinction between the output of a grammar in terms of strings of syntactic atoms (formatives, including lexical items) and structural descriptions, which designate hierarchical constituent structure as well as the linear order of constituents and their component parts. Thus a grammar WEAKLY GENERATES a set of strings (still characterized as 'sentences')—the weak generative capacity of the grammar, and STRONGLY GENERATES a set of structural descriptions—its strong generative capacity. Given that the linear order of syntactic atoms is encoded in structural descriptions along with constituent structure, string representations provide no information that is not already represented in structural descriptions. Moreover, they leave out information crucial to interpretation (cf. expressions involving pure structural ambiguity, such as *a review of a book by two professors* and *students and professors from Princeton*). As Chomsky notes, 'the study of weak generative capacity is of rather marginal linguistic interest' (1965:60), and furthermore 'discussion of weak generative capacity marks only a very early and primitive stage of the study of generative grammar' (p. 61).

Instead of defining the concept of grammar in terms of weak generative capacity as *LSLT* does, *Aspects* characterizes a generative grammar of a language as 'a description of the ideal speaker-hearer's intrinsic competence' (1965:4),[2] the knowledge of lan-

[2] The ideal speaker-hearer, 'in a completely homogeneous speech-community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance' (1965:3). This is of course an idealization, but standard in scientific inquiry.

guage that underlies language use—more specifically, the linguistic structure captured in structural descriptions that supports the perception and production of human language. A grammar is thus a model of a speaker's knowledge of language, a component of the mind of the speaker, hence internal to the speaker and therefore hidden from any kind of direct observation. This formulation distinguishes between linguistic behavior ('the actual use of language in concrete situations', designated as PERFORMANCE) and the linguistic knowledge that underlies this behavior (designated as COMPETENCE), where 'linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior' (1965:4).

Aspects gives no definition of language and no explicit definition of grammar, though it is clear that a grammar is a device for generating structural descriptions for linguistic expressions in a speaker's language—a device consisting of a lexicon plus phrase structure rules and transformations, and additionally, general constraints on the application of grammatical operations that restrict the output of these operations (e.g. the syntactic cycle proposed in the third chapter). What we find in *Aspects* is a distinct shift in focus from the overt externalized forms of language (which includes the phonetic form of lexical items and their linear order) to the covert structure of language (hierarchical structure, labeling of constituents, and phonetically null syntactic elements) and the grammatical devices that account for it, thus a shift from languages to grammars—that is, from speakers' output to the mental structure that underlies that output. In Chomsky 1986:3 this conceptual shift is characterized more generally: 'Put in the simplest terms, … the shift in focus is from behavior and the products of behavior to states of the mind-brain that enter into behavior'.

In essence, this shift in focus concerns two distinct approaches to the study of language, as a system of knowledge and as the product of behavior. Chomsky 1986 characterizes these two approaches in terms of the technical concepts E-language and I-language, where E stands for 'externalized', which is glossed as 'in the sense that the construct is understood independently of the properties of the mind/brain' (p. 20),[3] and I stands for 'internalized', hence in the mind of the speaker and thus 'individual' as well. Under the internalist perspective, an I-language consists of a computational system, including generative procedures and constraints on their application and output, plus a lexicon—in other words, a grammar. The computational system plus a lexicon defines the language under analysis. Thus the terms 'grammar' and 'language' (as in 'a language') identify the same mental object. Under this perspective, the study of language becomes a core topic of human psychology and biology, raising questions about acquisition, genetic endowment, and evolution.

The discussion of goals in *Chomsky's linguistics*, occurring in eight of the eleven chapters, starts with §1 of 'Filters' (426/59),[4] which identifies three goals of the earliest

[3] See footnote 72 in 'Derivation', which notes that a concept like E-language is defined in a way intended to identify 'no coherent object or study'—that is, 'independently of the properties of the mind-brain' in the formulation above—and furthermore that utterances and linguistic behavior more generally are 'no more or less a concern' under the I-language perspective than they are under the E-language perspective. Obviously, an important goal for the study of language is to understand how knowledge of language is put to use in linguistic behavior, to the extent that this is possible given that the creative aspect of language use (see Chomsky 2009a) appears to be beyond our intellectual grasp (see Chomsky 1988, 1994 for discussion)—and perhaps more fundamentally, given that there is no formal account of how a system of knowledge is utilized to yield behavior, linguistic or otherwise.

[4] All page references to papers in this volume are given in the format 'A/B', where B designates the pages from *Chomsky's linguistics* and A designates the pages from the original published version (with the exception of 'Minimalist program', where references are to the version published in Chomsky 1995b). Page numbers for Chomsky 1991 and Chomsky & Lasnik 1993 also refer to the versions published in Chomsky 1995b.

work on generative grammar: (i) to develop transformational analysis to capture 'linguistic processes that escaped any natural formulation within the theory of phrase structure' (as formulated solely in terms of phrase structure grammars), (ii) to demonstrate that the combination of transformational rules with phrase structure rules (i.e. transformational grammar) 'laid the basis for a more adequate account of the meaning of linguistic expressions', that is, beyond the capacity of phrase structure grammar alone, and (iii) to demonstrate that a theory of transformational grammar 'could provide explanations for some of the formal properties of natural language'. It goes on to note that the first two goals involve 'descriptive adequacy' (a technical term first introduced in *Aspects*) that relates to description as opposed to explanation. Specifically, a grammar is descriptively adequate 'to the extent that it correctly describes the intrinsic competence of the idealized native speaker', so that descriptive adequacy is characterized as a correspondence between the formal analysis assigned by the grammar (e.g. the structural descriptions of linguistic expressions, distinctions between deviant and nondeviant expressions) and 'the linguistic intuition of the native speaker' (1965:24)—or perhaps more precisely, the linguistic knowledge of the native speaker. Some of this knowledge (e.g. a deviant/nondeviant distinction) may be accessible to consciousness, though most of it is not (e.g. the structural descriptions of linguistic expressions, which involve crucial and substantial covert properties like (labeled) hierarchical structure, nontrivial chains, and syntactic elements lacking phonetic features). Furthermore, the deviant/nondeviant distinction carries no structural information in that it does not identify the source of the deviance, such as a structural description that violates some general grammatical constraint, or possibly a string of lexical items that could not be generated. It is worth noting that the linguistic processes that are the target of the first goal are invariably on a par with structural descriptions—inaccessible to introspection, and while the meanings of linguistic expressions appear to be part of our conscious knowledge, a choice between phrase structure grammar and transformational grammar accounts of meaning, for example, may not be something that can be easily decided by consulting the linguistic intuitions of speakers. Clearly, the determination of descriptive adequacy is a more complicated issue than its apparent correspondence to a notion of description might imply.

The third goal of providing explanations for formal properties of natural language is related in this section to the notion of 'explanatory adequacy' (another technical term first introduced in *Aspects*): '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*' (1965:25). Taking primary linguistic data as the linguistic evidence a child encounters in the task of language acquisition, determining explanatory adequacy 'is essentially the problem of constructing a theory of language acquisition, an account of the specific innate abilities that make this achievement possible' (1965:27). But here again exactly how explanatory adequacy is determined raises difficult questions of analysis, including crucially and not insignificantly determining the descriptive adequacy of grammars. For example, the characterization of 'primary linguistic data' presumably involves more than just a set of continuous sound waves of the speech a child encounters and plausibly would have to include discrete and covert linguistic structure. In practice, the approach to explanatory adequacy has focused on what does not occur in primary language data—specifically, deviant linguistic expressions along with the information that they are in fact deviant in the language. Knowledge of deviance in linguistic expressions thus poses a poverty-of-the-stimulus problem (see Berwick et al. 2011 for a recent discussion), which is resolved by postulating innate linguistic structure in the form of general constraints on grammars—

specifically, on the application of grammatical processes or on the representations these processes create. In this way explanatory adequacy focuses on the initial state of the language faculty, that is, the genetic endowment for human language, hence universal across the species, designated as UNIVERSAL GRAMMAR (UG). UG in conjunction with linguistic input from experience yields a grammar of a language, characterized as a steady state of the language faculty, the focus of descriptive adequacy. As stated succinctly in 'Bare' (51/323):

> To attain descriptive adequacy for a particular language L, the theory of L (its grammar) must characterize the state attained by the language faculty. To attain explanatory adequacy, a theory of language must characterize the initial state of the language faculty and show how it maps experience to the state attained.

Both goals can be pursued independently, and as 'On phases' also notes, the search for explanatory adequacy 'contributes to the other goal and even to discovery of the nature of the task, by clarifying the true nature of the object of inquiry (I-language) and of descriptive adequacy' (134/611–12).

The development of transformational analysis, the first goal mentioned in §1 of 'Filters', played a major part in the formulation of an abstract theory of linguistic structure, the second goal identified in *LSLT*. Demonstrating that a theory of transformational grammar leads to 'a more adequate account of the meaning of linguistic expressions' (the second goal mentioned in §1 of 'Filters') has no analogue in *LSLT* because the syntax/semantics interface did not become a major focus of research until almost a decade later. Demonstrating that a theory of transformational grammar provides explanations for formal properties of natural languages, the third goal mentioned in §1, engages both the descriptive and explanatory sides of the justification of grammars (the third goal of *LSLT*) to the extent that formal properties are predicated on specific analyses of linguistic phenomena. The formulation in §1 of the goals of the earliest work in generative grammar significantly shifts the emphasis from grammars of languages to theories of grammar. In this regard it is significant that the first *LSLT* goal of constructing grammars of languages is not mentioned at all.

Even the earliest work in generative grammar that focused on the construction of grammars did not produce a complete grammar for any particular language, a daunting task given the complexity of the earliest grammars in terms of the formulation of rules and their interactions. Oddly enough, at the present state of knowledge it is easy to formulate the computational part of a grammar of a particular language given that grammatical 'rules' are reducible to a small number of elementary operations constrained by general principles of minimal computation (see below for details). This does not mean, however, that it would be easy to construct a complete grammar for any particular language (e.g. English, Chinese, Tagalog). The real difficulty in formulating a grammar would be in specifying what is in the lexicon and how it is organized as well as how the elementary operations that turn lexical items into a linguistic expression are constrained.

Although the goals discussed in 'Filters' involve both description and explanation, Chomsky and Lasnik are explicit that the focus of linguistic theory is the latter. They designate as 'the basic goals of linguistic theory: to provide explanations rather than descriptions and to account for the attainment of grammatical competence' (428/61), the second conjunct naming a specific explanatory goal of linguistic theory. As noted in 'Filters', the problem for linguistic theory is to restrict the descriptive options available 'without sacrificing descriptive adequacy' (430/64). Otherwise, an overly permissive descriptive framework renders the goal of explanation inaccessible, as noted in 'On binding' (1/190). But if achieving descriptive adequacy requires extending the grammatical machinery available and so expanding the class of possible grammars, then the

pursuit of descriptive adequacy blocks the pursuit of explanatory adequacy, creating a tension between the two goals ('Filters', 427/60); '[t]his tension defined the research program of early generative grammar' ('Bare', 53/324).

The earliest steps to reduce this tension focused on the phrase structure rule component of grammars. The very first involved separating the lexicon from phrase structure rules (see *Aspects* for the original proposal and Freidin 2012 for commentary). As a result, phrase structure grammar could be restricted to context-free rules, excluding more complicated context-sensitive rules by formulating context-sensitive properties of lexical items as contextual features specified in lexical entries and constraining lexical insertion so that the contextual features of lexical items matched the syntactic contexts into which they were inserted. The next major step was the formulation of the X-bar theory of phrase structure in 'Nominalization', which proposed that general properties of phrase structure could be understood in terms of general schemata that capture the endocentric character of phrases. The two schemata proposed (one for the head/complement relation and the other introducing the 'specifier') are given in rewrite rule format, but are not, strictly speaking, phrase structure rules, because they are formulated with variables instead of syntactic categories, requiring some extra kind of interpretation. X-bar theory is more a theory of phrase structure than a theory of phrase structure grammar. It placed substantial constraints on the formulation of phrase structure, without any obvious degradation in descriptive adequacy.

In the late 1970s a resolution of the tension between the twin pursuits of descriptive and explanatory adequacy was achieved with the formulation of the principles-and-parameters framework, which remains the current framework for 'minimalist inquiries' (see Chomsky 1981a,b, Chomsky & Lasnik 1993, Freidin 1994b, 2006, and for commentary from a historical perspective see Freidin 2012, Lasnik & Lohndal 2013). In essence, the complex rule system that had seemed necessary for the formulation of grammars was replaced by a simple rule system made possible by positing general constraints on the application and output of rules. These constraints constituted principles of grammar, part of an innate UG rather than grammars of particular languages. It turned out that these principles had relatively simple formulations as well as a certain conceptual naturalness in the way they incorporated general relations found crosslinguistically—involving Case, anaphors and their antecedents, predicates and their arguments, and the boundedness of movement.[5] These principles made it possible to reduce the format of transformational rules to simply and minimally the elementary operations they involved, limited to a single elementary operation per grammatical rule, which followed from the prohibition against compounding elementary operations in the formulation of transformations ('Contraction', footnote 1; 'On binding', 4/193). As a result, the language-specific and construction-specific transformations in previous work were reduced to a single operation (Move α) that made no reference to language-specific elements or construction types, a radical departure from traditional grammar and the formulations of generative grammars that had been developed previously.[6] The Move-α

[5] Putting aside the complications that arose under the attempt to formulate these constraints in terms of a common structural relation designated as *government*, an attempt that was explicitly abandoned in 'Minimalist program'. As 'Bare' notes, the move toward simpler rule systems could have resulted in a more complicated version of UG ('it could turn out that an "uglier" and richer version of UG reduces permissible variety') because the simplification of rule systems does not entail a simple and natural formulation of UG (5/324–25). With hindsight, one might consider the formulations of UG principles in terms of government (mostly absent from this volume) as an example of an 'uglier', more complicated version of UG.

[6] A case in point is the formulation of a passive transformation in *Syntactic structures* (Chomsky 1957), which involves two movements and two insertions of lexical material (the passive auxiliary *be* and the pas-

analysis constituted a drastic reduction of the transformational component and thus of the class of possible grammars.

The formulation of constraints within the principles-and-parameters framework also had a profound effect on the theory of phrase structure. It became clear almost immediately that phrase structure rules stipulated properties (often in a language-particular way) that followed from general principles. The redundancy was resolved by eliminating phrase structure rules altogether (Chomsky 1981b:136, Stowell 1981, Chomsky 1986:83; see Freidin 2012 for some discussion), another significant reduction in the class of possible grammars constituting a substantial step toward explanatory adequacy.

2.2. THE MINIMALIST PROGRAM: LANGUAGE DESIGN, THE STRONG MINIMALIST THESIS, AND PRINCIPLED EXPLANATION. In contrast to the goals of the early work in generative grammar, the formulation of goals for a minimalist program is strikingly even more abstract and tenuous, stated as a question, as in 'Derivation' (1/473)—referring to alternatives being pursued under the general rubric of the minimalist program.

(1) The shared goal is to formulate in a clear and useful way—and to the extent possible to answer—a fundamental question of the study of language, which until recently could hardly be considered seriously and may still be premature: to what extent is the human faculty of language FL an optimal solution to minimal design specifications, conditions that must be satisfied for language to be usable at all?

The question focuses on a new topic: 'language design', which is first mentioned in 'Filters' in a somewhat different context (434/71 and 465/119). It is formulated more generally and perhaps opaquely in 'Minimalist inquiries' as 'how well is FL designed?' (92/398). The minimalist question in 1 is complex, involving several abstract concepts: FL and (minimal) design specifications (not to mention 'an optimal solution' to them), as well as language. To a large extent, the history of generative grammar involves an ongoing attempt to define the noncount noun *language* and its relationship to the count noun *language* (see Chomsky 2013b on the difficulties for defining the former). Also contributing to the complexity of the minimalist question is the fact that the answer will be a matter of degree rather than a simple yes or no. The clarity and coherence of the question depends crucially on the clarity and coherence of the concepts it engages.

'Bare' identifies FL broadly as 'a component of the human mind/brain dedicated to language … interacting with other systems', characterizing this as a 'factual' assumption (55/327). In 'Minimalist program', FL is described (again broadly) as 'an array of capacities that enter into the use and understanding of language' provided by the human brain—capacities that 'seem to be in good part specialized for that function and a common human endowment over a very wide range of circumstances and conditions' (167/257). 'On binding' refers to FL as 'the biological endowment that specifies the general structure of the language faculty' (2/190). Chomsky 1986:xxvi designates FL as a biological endowment, 'the innate component of the mind/brain that yields knowledge of language when presented with linguistic experience, that converts experience to a system of knowledge'. More specifically, FL 'is a system of discrete infinity' ('Three factors', 11/595), that is, based on a primitive structure-building operation that constructs new objects from objects already constructed, a recursive operation in that it can freely reapply to its own output, producing 'hierarchically organized objects' ('On phases',

sive *by*). For a detailed discussion of the history of the passive transformation as an example of this reduction, see Freidin 1994a.

137/617)—a description of the operation Merge, first formulated in 'Bare' (see below for details). 'Minimalist inquiries' states that 'FL generates expressions Exp = <PF, LF>' (95/403) and thus includes the computational system for human language (C_{HL} in 'Bare' and elsewhere) that produces linguistic expressions. For a detailed discussion of what operations might be required for C_{HL}, see §§3–5 below.

In order to generate linguistic expressions with phonetic and semantic properties, C_{HL} must be able to access objects that contain these features. Standardly, C_{HL} operates on items from a lexicon (see §4 for details). 'Derivation' (10/485) suggests that from a universal set of features F available in FL, each particular language L assembles a subset of features (F_L) as lexical items of a lexicon Lex (see also 'Minimalist inquiries', 100–101/411–12).[7] In the simplest circumstance, each lexical item (henceforth LI) contains a single collection of all of the relevant features: phonological, semantic, and formal. 'Derivation' comments that the latter two intersect and are disjoint from the first, suggesting that phonological features might have a different status from the other two kinds and prefiguring the claim in 'On phases' that 'mapping to the SM interface is an ancillary process' (136/615).

Given this perspective, FL contains at least all of the features found in the lexicons of particular languages, in addition to C_{HL}. Whether this is correct remains to be determined, especially considering the question of how these features relate to the performance systems that make use of them. In the case of phonological features, in some sense these are going to be restricted to features that the vocal apparatus can produce and the auditory apparatus can distinguish. At the conceptual-intentional (C-I) interface, the issue becomes much more opaque and obscure.

From the biolinguistic perspective, FL is taken to be 'an organ of the body' that interacts with other subcomponents of the human organism ('On phases', 133/609). It exists in the mind/brain in a genetically determined initial state (S_0)—that is, before exposure to any particular language—and in a mature (final or steady) state after exposure to linguistic experience (primary linguistic data, PLD). S_0, as part of FL, 'appears to be a species property, close to uniform across a broad range', that largely determines the possible mature states that FL can manifest ('Beyond', 104/535). A 'strong uniformity thesis for language acquisition' specifies 'that each attainable [mature] state of FL is a further specification of S_0 with parameters valued', where all parameters are initially set (in S_0) with unmarked values ('Beyond', 104/535–36). Under 'the standard idealized model of language acquisition', S_0 constitutes a function that maps PLD to a language—that is, to an I-language (i.e. a grammar) ('Minimalist program', 169/260).

An I-language (or grammar), which represents a system of knowledge in the mind of a speaker, is embedded in systems of performance: 'That is, use of language involves knowledge of language' ('Filters', 434/71). The empirical question that arises immediately is: 'to what extent are the performance systems part of FL, that is, language-dedicated, specifically adapted for language?' ('Minimalist inquiries', 90/395). The

[7] Given the definition of I-language above as a computational system plus a lexicon, this formulation seems problematic if we construe 'assembles' as an actual process (as claimed in 'Minimalist inquiries') rather than a description of the state of an object. A particular I-language presupposes the existence of a particular lexicon. A more plausible scenario might be that the semantic features of lexical items are essentially predetermined so that acquisition of the lexicon is primarily a matter of assigning phonetic labels to concepts (Saussurean arbitrariness, as this is dubbed in 'Minimalist program') and fixing morphosyntactic structure, where phonology and morphology are largely determined by overt evidence. See Chomsky's critique of a referential theory of the lexicon (Chomsky 1992, 2009b, 2013c,d), which shows that the semantic properties of lexical items are far from straightforward even in the apparently deceptively simple case of nouns.

footnote to this passage notes that the question concerns the systems but not necessarily their component parts, which need not be 'specific to language'. 'Minimalist inquiries' enunciates 'a standard working assumption' that these systems are 'external to FL' (90/395). If so, then FL can be narrowly defined as the capacities that construct a system of linguistic knowledge in the mind of the speaker, crucially S_0, designated as UG because, being genetically determined, it must be universal across the species.

So far, all of this is still within the domain of what came before the formulation of a minimalist program. The advent of Chomsky's minimalist program inaugurates a rather radical shift in focus. While it was always recognized that FL intersected with other systems of the mind/brain, the effects these systems might have on the structure and function of FL had not been seriously considered. Research on a minimalist program not only focuses attention on this intersection, but also hypothesizes that these effects might to a significant degree determine the structure and function of FL. This leads to the formulation of the fundamental question for the study of language quoted above in 1, which is a new question in the history of the field.[8]

THE STRONG MINIMALIST THESIS. In response to this question there is a minimalist thesis that manifests in various formulations in these papers and others. The first formulation, specifically designated as 'the strongest minimalist thesis' (SMT), is given in 'Minimalist inquiries' as 2 (96/404).

(2) Language is an optimal solution to legibility conditions.

A few pages earlier, this thesis (referred to as a 'substantive thesis') is formulated in terms of 'language design', which 'may really be optimal in some respects, approaching a "perfect" solution to minimal design specifications' (93/400). Thus, legibility conditions (to be discussed in more detail below) belong to the more inclusive category of minimal design specifications. They are imposed by other systems of the mind/brain that 'have to be able to access expressions generated by states of FL ((I-)languages), to "read" them and use them as "instructions" for thought and action' ('Minimalist inquiries', 94/401).

In subsequent papers, the SMT is similarly, but not identically, formulated.

(3) a. language is an optimal solution to minimal design specifications (i.e. 'legibility conditions') ('Derivation', 1/473)
b. 'FL is "perfectly designed" ' ('Approaching UG', Chomsky 2007:4)
c. 'language is a perfect solution to interface conditions' ('Approaching UG', pp. 4–5, and repeated in Chomsky 2013a)
d. 'language is an optimal solution to interface conditions that FL must satisfy; that is, language is an optimal way to link sound and meaning, where these notions are given a technical sense in terms of the interface systems that enter into the use and interpretation of expressions generated by an I-language' ('On phases', 135/613)

Regarding the formulation in 3a, legibility conditions are the only design specifications mentioned. Furthermore, 3a is postulated as an answer to the fundamental question posed in 1, which is about FL, thus raising a question of interpretation between the terms 'language' and 'FL', as do the two formulations (3b–c) that occur in 'Approach-

[8] Many aspects of the minimalist program are rooted in previous work in linguistic theory (e.g. the effort to reduce mechanisms to the bare minimum and to eliminate redundancies in the theoretical apparatus generally, what Martin and Uriagereka (2000) have called 'methodological minimalism', which is virtually standard practice in the physical sciences). For a discussion of the historical roots of the 'minimalist program', see Freidin & Lasnik 2011.

ing UG' (see below for further discussion). Formulation 3b is almost identical to 3c, if 'perfectly designed' means 'a perfect solution to interface conditions'. Although 3a is called 'the strongest minimalist thesis', the formulation in 3c, which replaces 'optimal' with 'perfect', is in fact stronger, given that a perfect solution would invariably be optimal but the converse is not necessarily true. The formulation in 3d returns to 'optimal solution' and is referred to as 'the strong minimalist thesis'. Importantly, it appears to distinguish *language* from *FL*.

'Approaching UG' proposes that, in entertaining the SMT, 'the first task would then be to formulate SMT coherently' (2007:4), which acknowledges the fact that the formulations of the SMT are open to considerable interpretation, immediately raising the question 'What is language?' (see §2.1 above). One clue comes from the very first formulation of the SMT, not so designated, which is given as a basic assumption in the initial discussion of a minimalist program.

> (4) 'The linguistic expressions are the optimal realizations of the interface conditions, where "optimality" is determined by the economy conditions of UG.' ('Minimalist program', 170/262)

The focus of this formulation is on linguistic expressions as structured objects given as a pair of structural descriptions (SDs) '(π, λ) drawn from the interface levels (PF, LF), respectively' (170/262), rather than on the biological endowment itself—that is, FL (or more precisely, a mature state of FL, an I-language), which generates (π, λ). It is assumed that the initial state of FL contains 'invariant principles with options restricted to functional elements and general properties of the lexicon', the options constituting parameters of crosslinguistic variation. A selection of options S determines a language (i.e. an I-language), which 'in turn, determines an infinite set of linguistic expressions (SDs)' ('Minimalist program', 170/262). Note that this formulation makes no direct reference to physical manifestations of language (e.g. as speech or sentences (spoken or written)). The pair (π, λ) provides a complete description of a language. Thus 'language' references the output of FL; linguistic expressions are instances of language—close to the common understanding of the term, which involves the overt manifestation of language in speech and writing, but also different in that the technical definition involves covert structure. The common understanding of the term apparently does not cover what goes on inside our heads, specifically at the C-I interface, even though we talk about 'language and thought' as if both conjuncts are equally well understood. Nonetheless, it should follow that if the output of FL constitutes an optimal realization of interface conditions, then FL itself must be at least optimally designed to satisfy these conditions, both the mature states of FL and its initial state S_0. Moreover, a plausible interpretation of the abstract noun *language* would include at least FL, and perhaps nothing more.

This initial formulation of the SMT in 4 crucially depends on the interpretation of the ambiguous compound noun *interface conditions*. Aside from applying at the interface between FL and intersecting systems of the mind/brain, there is a question of where these conditions are located: internally to FL—hence in UG, or internally to the intersecting cognitive systems—hence external to UG, or conceivably with some conditions internal and some external to FL. 'Minimalist program' refers to 'the (external) interface conditions' that 'the PF and LF outputs must satisfy' (189/287), the only such reference in the volume. In 'Minimalist inquiries' and 'Derivation', interface conditions are also referred to as 'legibility conditions', indicating the conditions other cognitive systems that interface with FL impose on its outputs. The footnote on the first reference in 'Minimalist inquiries' relates the term to 'bare output conditions' in chapter 4 of

'Minimalist program', where 'output' indicates interface levels and 'bare' distinguishes these conditions from 'filters, ranked constraints, and other devices that are part of the computational system itself' (footnote 16), thus external to FL.

Yet given the importance of interface conditions for the minimalist enterprise, this volume and the minimalist papers not included (including the most recent; see n. 1) contain only the sketchiest, most general formulation of what they might be. 'Minimalist inquiries' identifies legibility as a species of 'least effort' conditions 'which seek to eliminate anything unnecessary', specifically, 'superfluous elements in representations' (99/409). This formulation expresses 'the intuitive content of the notion of Full Interpretation (FI), which holds that an element can appear in a representation only if it is properly "licensed" ' (Chomsky 1991:437), first formulated in Chomsky 1986 as an economy condition on representations. However, the passage cited in 'Minimalist inquiries' identifies two subcategories, one involving legibility conditions and the other 'convergence ("full interpretation")', where 'convergence is determined by independent inspection of the interface levels' ('Minimalist program', 171/263)—which seems to separate the two rather than simply interpret FI as a legibility condition at the interfaces (as suggested in Freidin 1997:575). Whether there is a clear distinction to be made is not obvious.

According to 'Minimalist program' (171/263), 'a derivation D *converges* if it yields a legitimate SD and *crashes* if it does not', the SDs being π at the PF interface and λ at the LF interface. Further on, 'a derivation forming λ converges at LF if λ satisfies FI, and otherwise crashes' and 'the representation λ satisfies FI at LF if it consists entirely of legitimate objects' (194/293). Six pages later, LF legitimate objects are 'tentatively' identified as heads, arguments, modifiers, and operator-variable constructions. Presumably these are the legible elements of λ, so we are still left without a clear distinction between legitimate and legible objects, and thus no clear way to distinguish legibility imposed by external interface conditions from the legitimacy of objects required by convergence.

The discussion in 'Minimalist inquiries' seems to equate convergence and legibility; thus, 'a computation of an expression Exp *converges at an interface level IL* if Exp is legible at IL, consisting solely of elements that provide instructions to the external systems at IL and arranged so that these systems can make use of them; otherwise, it crashes at IL' (95/402). Nonetheless, we are warned in the next paragraph that 'the phrase "converge at an interface" should not mislead: convergence is an internal property of an expression, detectable by inspection'.[9] The footnote to this warning contains the following statement: 'Convergence is defined in terms of properties of the external systems; the concept is clear insofar as these properties are clear' (footnote 19), which seems to undermine the previous claim. Furthermore, the properties of the external systems on which the concept of convergence depends are so far anything but clear. As 'Minimalist inquiries' goes on to note, 'the external systems are not well understood', and perhaps more importantly, 'progress in understanding them goes hand in hand with progress in discovering the language systems that interact with them' (98/407) (see also the quote below from 'On phases' on the interactive nature of the research task). As far as this goes, it still leaves open the possibility that a distinction between convergence and legibility is unnecessary.

[9] 'Derivation' states that 'for convergence, uninterpretable features must be deleted in the course of the computation of LF' (4–5/478). If the only property of convergent derivations is the absence of uninterpretable features, then convergence will be detectible by inspection. But even so, this still does not distinguish between convergence and legibility at the interface.

Another factor that complicates the analysis of convergence is that 'a convergent expression may be complete gibberish or unusable by performance systems for various reasons' and further that 'performance systems typically assign interpretation to non-convergent expressions' ('Minimalist inquiries', footnote 18). The footnote begins with a warning that 'interpretability is not to be confused with intelligibility'.[10] Given this situation, it seems unlikely that convergence is going to correspond neatly with speaker acceptability (one form of speaker judgments that have been used as evidence for linguistic analyses). Footnote 7 of 'Minimalist program' (194/294) explicitly dismisses as pointless the temptation to equate 'the class of expressions of the language L for which there is a convergent derivation as "the well-formed (grammatical) expressions of L" ', noting that 'the concepts "well-formed" and "grammatical" remain without characterization or known empirical justification'—in part because 'linguistic expressions may be "deviant" along all sorts of incommensurable dimensions'; and, discounting informal exposition, these concepts 'played virtually no role in early generative grammar' or after. In this regard it is worth noting that 'Minimalist inquiries' proposes replacing 'the obscure notion of "linguistic evidence" by the meaningful notion: satisfaction of interface conditions', where the former notion is normally taken to refer to 'informant judgments about sound and meaning and their relations'. The proposal results in 'a substantive (but extraordinarily strong) empirical hypothesis, namely, the thesis (2) [= 2 above—*RF*]: an optimal solution to legibility conditions satisfies all other empirical tests as well' (97/406), including 'acquisition, processing, neurology, language change, and so on' (96/404). But if this extension of the SMT turns out to be correct, then it would appear that the internal notion of convergence can be eliminated, unless convergence can be shown to be a necessary part of the optimal solution to interface conditions.

As for interface conditions, 'Minimalist program' postulates that 'all conditions are interface conditions' as a minimalist assumption (194/293).[11] Exactly how all previously formulated UG conditions (e.g. in Chomsky 1981b) can be replaced with interface conditions is not discussed. Moreover, the discussion of interface conditions in the following three chapters adds no details. However, 'Beyond' formulates 'an "interface condition" IC: the information in expressions generated by L must be accessible to other systems, including the sensorimotor (S-M) and conceptual-intentional (C-I) systems that enter into thought and action', identified as a necessary condition on language design 'if language is to be usable at all' (106/538). Clearly, accessibility entails legibility, but whether it involves more is not discussed. Furthermore, 'Beyond' defines convergence in terms of legibility: a derivation 'D converges if PHON and SEM each satisfy IC; otherwise it crashes at one or the other interface', where PHON and SEM are, respectively, the representations that interface with the S-M and C-I systems (106/540). Apparently, at this point there is no longer any basis for distinguishing convergence and legibility. In this regard it is worth noting that the technical theory-internal notion of convergence is not mentioned in the subsequent papers.

[10] Although no examples are cited, one might consider the famous sentence *Colorless green ideas sleep furiously* and multiple center embedding (e.g. *The boy the girl the dog bit cursed fled*) as candidates.

[11] The Case filter is cited as an example, where it is described as 'the condition that all morphological features must be checked somewhere, for convergence' (197/297), extending the usual formulation, which is limited to Case features. Exactly how this would work where the Case filter is formulated as an interface condition external to UG is not discussed in this volume or in any of Chomsky's other papers. However, if Case features are inherently uninterpretable at one interface (or both), then they would constitute superfluous elements in representations and therefore violate legibility conditions on general grounds—details to be determined. See §3 for some relevant discussion.

According to 'Beyond', the IC 'imposes [linear] order at PHON and duality of semantic interpretation at SEM, with no interaction between Φ-PHON and Σ-SEM', where duality refers to argument structure versus everything else (e.g. scopal and discourse-related properties) (110/547–48). It 'requires that all features be interpretable' (113/553), determines the application of displacement (116/562), and should provide a basis for a natural characterization of phases (124/575). Furthermore, because internal levels not forced by interface conditions do not seem to exist, multicycle formats can be replaced by a single-cycle syntax ('Three factors', 11/594). Thus a great deal depends on the notion of interface conditions, however they are formulated.

In addition, the IC analysis in 'Beyond' leads to another distinct and 'extremely strong' formulation of the SMT (106/539) in terms of the initial conditions on language acquisition, which involve the initial state of FL (S_0) and what are designated as 'general properties of organic systems, in this case computational systems incorporating, it is reasonable to expect, principles of efficient computation' (105/536). 'Beyond' identifies the IC as 'the principled part of S_0' and contrasts it with 'unexplained elements of S_0'—though no examples of the latter are cited, think of the original formulations of island constraints, filters involving Case and other elements, and perhaps also binding theory conditions. The new version of the SMT hypothesizes that there are no unexplained elements of S_0 ('too much to expect'), in which case S_0 can be given a principled explanation in terms of the IC and general properties, going beyond explanatory adequacy. Nonetheless, verifying this version of the SMT is by no means simple: 'Evidently, there are no a priori instructions about how to proceed on this path. The questions are empirical at every point, including the kinds of computational efficiency that FL selects' (106/539).

It is worth noting that this formulation of the SMT postulates the IC as a part of S_0, where in previous papers interface conditions are taken to be external to FL. What the IC replaces (e.g. stipulated UG conditions) thus becomes the principled part of S_0. However, if the IC is external to FL, then it is actually no longer part of S_0. Alternatively, the IC as imposed by interfacing cognitive systems could be internal to FL, as suggested in 'On phases' (see the next paragraph), contrary to what has been assumed in the previous chapters. It is a subtle distinction, and at this level of abstraction it is difficult to see what might distinguish these alternatives empirically or even conceptually, especially given how little is known about the interfacing cognitive systems (see the quote from 'Minimalist inquiries' (98/407) above). The discussion of this formulation in 'Beyond' also says nothing about the basic grammatical operations of FL (Merge and Agree; see §5.1), as well as Transfer (Spell-out; see §3) under phase theory along with Linearize and Delete as 'phonological' operations; see further discussion below. If these operations are motivated by the IC and principles of efficient computation that constitute general properties of organic systems, then presumably they will also be categorized as belonging to the principled part of S_0. The project of validating this new version of the SMT depends on understanding the remaining UG conditions (and operations, if any) as reflexes of the IC or general computational principles.

Principled explanation. The technical term 'principled explanation' is defined in 'Beyond' as follows, where L is a generative procedure, hence an I-language (106/538; see also 'Three factors', 10/592):

> Insofar as properties of L can be accounted for in terms of IC and general properties of computational efficiency and the like, they have a principled explanation: we will have validated the Galilean intuition of perfection of nature in this domain.

As such, principled explanation constitutes another goal of the generative enterprise: 'to determine what aspects of the structure and use of language are specific to the language

faculty, hence lacking principled explanation at this level' ('Beyond', 106/538–39). In 'Three factors' this goal is designated as a 'basic question from the biological point of view' (2/578), and principled explanation a 'fundamental biological issue' (8/589) that addresses 'a deeper level of explanation, beyond explanatory adequacy' ('On phases', 134/611). 'Three factors' explains that if language acquisition 'is a matter of parameter setting and is therefore divorced entirely from the remaining format for grammar: the principles of UG' (i.e. as postulated in the principles-and-parameters framework), it becomes possible 'that the UG might be reduced to a much simpler form, and that the basic properties of the computational systems of language might have a principled explanation instead of being stipulated in terms of a highly restrictive language-specific format for grammars' (8/590).

Given the considerable level of abstraction of the 'basic computational ingredients' within the principles-and-parameters framework, including 'locality, minimal search, basic recursion, etc.', 'it becomes quite reasonable to seek principled explanation in terms that may apply well beyond language, as well as related properties in other systems', in other words, in terms of 'language-independent principles of structural architecture and computational efficiency' (9/590). Whether these principles are unique to humans is a separate empirical issue, thus an open question. The unprincipled part of UG, in contrast, might presumably be unique to humans. The bottom line is that in some way language is unique to humans, who acquire an I-language, whereas other species do not. The pursuit of principled explanation requires us to reexamine wherein the uniqueness of language resides, with no obvious answers in sight. Principles not specific to FL, including the general properties of computational efficiency mentioned in the quote above, are designated as the third factor of language design, the other two factors being experience and genetic endowment ('Three factors', 6/585). This third factor also includes as one subtype 'principles of data analysis that might be used in language acquisition and other domains' and as another 'principles of structural architecture and developmental constraints that enter into canalization, organic form, and action over a wide range, including principles of efficient computation' ('Three factors', 6/586). However, principled explanation also includes 'conditions coded in UG that are imposed by organism-internal systems with which FL interacts', so not restricted to third-factor conditions ('On phases', 134/611).

Given the possibility of principled explanation, it is no longer necessary to assume 'that the means of generating structured expressions are highly articulated and specific to language' ('Three factors', 9/591), in marked contrast to what has been pretty much the standard view for the latter half of the twentieth century. Instead, by attempting 'to sharpen the question of what constitutes a principled explanation for properties of language', we can address 'one of the most fundamental questions of the biology of language: to what extent does language approximate an optimal solution to conditions that it must satisfy to be usable at all, given extralinguistic structural architecture?'—that is, a reformulation of the SMT as a question ('Three factors', 10–11/591). There is a direct connection between principled explanation and the SMT, namely, 'any postulation of descriptive technology that cannot be given a principled explanation' constitutes a departure from the SMT ('On phases', 135/613). 'On phases' suggests that our understanding of the nature of FL, including the question of how it evolved, depends on the degree to which principled explanation is achievable.

A further issue involving principled explanation concerns the apparently asymmetrical role of the two interfaces. 'On phases' conjectures that 'conditions imposed by the C-I interface enter into principled explanation in a crucial way, while mapping to the SM interface is an ancillary process', presumably because of the existence of 'phonological

systems that violate otherwise valid principles of computational efficiency, while doing the best they can to satisfy the problem they face: to map to the SM interface syntactic objects generated by computations that are "well designed" to satisfy C-I conditions' (136/615).[12] 'On phases' suggests there is empirical evidence to support this, but cites none. This asymmetry—which leads to an inversion of Aristotle's dictum: 'language is not sound with meaning, but rather meaning with sound (or some other externalization), a very different concept, reflecting a different traditional idea: that language is primarily an instrument of thought—"audible thinking," "the spoken instrumentality of thought," as William Dwight Whitney expressed the traditional conception'—raises the possibility of the radical and far-reaching thesis that linear order is 'a peripheral part of language, related solely to externalization at the SM interface', where it is necessary (Chomsky 2013a:36). Note that this thesis is prefigured in the discussion of PF in 'Minimalist inquiries', where the phonological component is said to reflect 'special properties of the sensorimotor systems, which are in a certain sense "extraneous" to language, relating to externalization by systems with nonlinguistic properties and capable of much variation while FL remains fixed, as in sign languages' (118/438). One important consequence of the thesis is that communication cannot be the primary function of language (see Chomsky 2013b:655).

Designating the linearization of linguistic representations as ancillary or even extraneous to language may be in a certain way jumping to conclusions. While it makes sense that the sensorimotor systems would impose linear order on linguistic expressions, it also seems unlikely that these systems would care what specific linguistic order is imposed. This leaves at least two possibilities: one, that the linear order found in languages is just an accident of history and therefore any ordering is possible (which seems implausible); or two, that the linear-order patterns found in languages reflect something fundamental about FL (in which case the pattern of linearization in languages is neither extraneous nor ancillary—though it may be both for the C-I interface as hypothesized).

On the one hand, as with interface conditions, the importance of principled explanation must be weighed against the fact that the conditions that enter into it:

> are only partially understood: we have to learn about the conditions that set the problem in the course of trying to solve it. The research task is interactive: to clarify the nature of the interfaces and optimal computational principles through investigation of how language satisfies the conditions they impose optimally. ('On phases', 135–36/614)

This research task is characterized as a familiar feature of empirical inquiry into the sensorimotor interface ('On phases', 136/614) and of rational inquiry more generally ('Three factors', 10/592).

On the other hand, we might learn something by looking more carefully at the formulation of both the interface conditions and the principles of computational efficiency that have been proposed to see what they contribute toward the goal of a principled explanation for FL.

THE FORMULATION OF INTERFACE CONDITIONS. Starting with interface conditions, the only somewhat explicit formulation occurs in 'Beyond', where the IC postulates

[12] Although no details are given in this or other papers, we might consider phonological rules that change features or add phonetic segments (epenthesis), as well as rules that affect prosody (intonation and stress), as likely candidates. The question then is: what 'otherwise valid principles of computational efficiency' do these processes violate? Presumably, they would violate inclusiveness and a prohibition against 'tampering' with structure that has been generated in a derivation, depending of course on precise formulations of these conditions as principles of computational efficiency (see §2.2).

that information in linguistic expressions must be accessible to interfacing cognitive systems. At a minimum, accessibility must entail legibility, and thus the IC operates as a legibility condition at the two interfaces. While this is a plausible characterization of interface conditions, it will ultimately depend on an explicit characterization of what constitutes legibility and how it functions.

Consider the following examples from Chomsky 1991 (1995b:152), which are cited as violations of FI.

(5) a. who John saw Bill
b. who did John see Bill

Suppose that whatever the representations C_{HL} assigns to 5a,b, both are legible and interpretable at the S-M interface—not obviously correct. Then the problem with 5a,b resides at the C-I interface, where by hypothesis there is no linear order and also no phonetic features. And if 'Derivation' is correct that subject-verb inversion is a PF operation (and by extension also the insertion of periphrastic *do*) and therefore does not affect LF representation, then there is only a single representation for both 5a,b.

There are two apparent problems with 5: *see* takes only two arguments and the examples involve three (*John*, *Bill*, and *who*), given that the interrogative pronoun is interpreted as an independent argument; alternatively (or simultaneously), the interrogative is interpreted as a quasi-quantifier (operator) that binds no variable in the representation for 5. The latter is not obvious, however, given that we are dealing with a deviant example, which could have all kinds of crazy (or perhaps not so crazy) derivations: for example, *who* could form a nontrivial chain with a covert copy in the predicate VP just as easily as it could constitute a trivial chain in violation of some general constraint against vacuous quantification. Furthermore, for deviant examples, questions of constituency proliferate: is *who* in 5 a constituent of CP (e.g. 'in Spec-CP') or just TP?; if *who* constitutes a nontrivial chain, where is its covert copy merged? The answer to the second question will determine whether it is *Bill* or *who* that is not assigned an argument function (θ-role) and therefore constitutes a free (or vacuous) argument in violation of a principle of FUNCTIONAL RELATEDNESS (Freidin 1978), one part of the θ-CRITERION (Chomsky 1981b). Under any possible derivation for 5, at least this principle will be violated as long as a predicate cannot assign a single argument function to more than one argument. That is, a principle of unique assignment holds for argument functions of a predicate (cf. Freidin 1975, footnote 20).

The question now is how this analysis translates as a violation of the IC. Specifically with respect to 5, how is the information in these linguistic expressions inaccessible (or illegible) to interfacing cognitive systems? The answer unfortunately is not obvious because of the high level of abstraction at which the IC is formulated. As these examples were cited as violations of FI, another approach to the question might be to consider how 5 violates FI, and then raise the question of a possible relation between FI and the IC, as suggested above.

The discussion of FI in Chomsky 1991 characterizes it as a UG condition (1995b: 153) whose 'intuitive content' involves a prohibition against 'superfluous symbols in representations'. More specifically, FI 'holds that an element can appear in a representation only if it is properly "licensed" ', where 'licensing under FI is expressed in terms of conditions relating syntax, broadly construed, to other systems of the mind/brain' (p. 151). In its initial formulation in Chomsky 1986, FI is characterized as 'a property of natural language' (p. 99) and 'an overriding principle' (p. 102) that 'requires that every element of PF and LF, taken to be the interface of syntax (in the broad sense) with systems

of language use, must receive an appropriate interpretation' (p. 98)—a formulation that raises the difficult question of the connection between the system of knowledge of language and systems of language use; see also n. 3 above. 'Minimalist program' designates FI as the sole economy principle for representations, where 'every symbol must receive an "external" interpretation by language-independent rules', adding that 'there is no need for the Projection Principle or θ-Criterion at LF' (200/301). In the case of the θ-criterion, however, this seems doubtful if the notion of 'superfluous element' is to be given a precise formulation. See the discussion of the example in 5 above. 'Minimalist program' interprets a violation of FI as a failure to 'provide appropriate instructions to performance systems', citing examples for PF representations π, though presumably this generalizes to the other interface (194/293).[13]

Again, the high level of abstraction used in the formulation of FI makes it difficult to see precisely how it applies to 5. Presumably, a linguistic expression that contains an argument to which no argument function is assigned, an extraneous argument (e.g. *who*), contains a superfluous element that is not 'properly "licensed" ' or appropriately interpreted—though how this is determined in the absence of some specific principle like functional relatedness remains obscure unless we postulate some corresponding principle as part of the interfacing cognitive systems. The requirement for 'an "external" interpretation by language-independent rules' is equally opaque. In fact, it seems plausible that *who* in these examples is capable of receiving some 'external' interpretation by language-independent rules as an interrogative pronoun. As such, it would be legible and presumably accessible. If so, then we might want to consider another construal of 'full interpretation' where elements in representations must be fully interpreted—for example, in the case of arguments, that they are assigned an argument function by a predicate in the expression in which they occur. Under this construal, superfluous elements in a linguistic expression are those that fail to be FULLY INTERPRETED at the interfaces (a gloss on 'appropriate interpretation' in the initial formulation of FI in Chomsky 1986). FI remains the sole economy principle for representations. If it can apply externally to FL, then it is a plausible replacement for the IC. If not, then there is the question of whether the IC in its current formulation rules out anything that will not be also prohibited by FI. If full interpretability is required by the cognitive systems that interface with FL, then even if FI falls within FL, it could still be a principled part of S_0. Alternatively, if FI is a principle of efficient computation, then as a third-factor constraint it would presumably not constitute part of FL.

PRINCIPLES OF EFFICIENT COMPUTATION. The first mention of efficient computation occurs in 'Derivation' in conjunction with the possibility that 'the design of FL reduces computational complexity' (15/493). Principles of efficient computation are a subcategory of general properties of organic systems (along with principles of data processing (see Yang 2002) and structural architecture; see also 'Three factors', 9/590) and are on par with what determines how proteins fold, not genetically determined—hence external to FL ('Beyond', 105–6/538–39): 'One natural property of efficient computation, with a claim to extralinguistic generality, is that operations forming complex expres-

[13] 'Minimalist program' cites vowels that are marked both +high and +low and consonants that are stressed, both examples of phonetic segments that cannot exist and presumably could not exist in the lexicon or be created by standard phonological processes. The other example concerns 'a morphological element that "survives" to PF, lacking any interpretation at the interface', which is a possibility in derivations but crucially assumes that the S-M interface will recognize morphological features as uninterpretable instead of just ignoring them. See further discussion of this point below.

sions should consist of no more than a rearrangement of the objects to which they apply, not modifying them internally by deletion or insertion of new elements' ('Three factors', 11/594). This is essentially a description of the operation Merge, first proposed in 'Bare' (62/337), where merger of two syntactic objects (SOs) X and Y yields minimally a set {X, Y}; see below for a more detailed discussion. Chomsky 2013a:37 suggests that 'for computational systems like language' the principles of computational efficiency involved 'may well be reducible to laws of nature'.

In 'On phases', principles of efficient computation are spelled out as the no-tampering condition and the 'inclusiveness principle' (elsewhere 'condition', henceforth IP)—the latter to eliminate a significant amount of descriptive technology that had been widely utilized for several decades (see next paragraph for examples), and the former to radically constrain the application and output of the sole structure-building operation Merge.

The IP, first introduced in 'Bare' but not named as such there, proposes that 'any structure Σ formed by the computation—hence π and λ—is constituted of elements already present in the lexical elements selected for N; no new objects are added in the course of computation' (59/333). Chapter 4 of Chomsky 1995b names the IP as 'a condition of inclusiveness', characterizing it as 'another natural condition … that outputs consist of nothing beyond properties of items of the lexicon (lexical features)—in other words, that the interface levels consist of nothing more than arrangements of lexical features' (p. 225). As a result, the IP prohibits the use of indices in syntactic representations under the plausible assumption that indices do not exist in the lexicon. It also eliminates the notion of 'trace' as an 'empty category' that is coindexed ultimately with a nonempty c-commanding antecedent, yielding instead the copy theory of 'movement' (see below for discussion). It also follows from the IP that syntactic category labels projected from a lexical head are not distinguished via special diacritics (e.g. via bar levels, the technical device from the initial formulation of X-bar theory in 'Nominalization', or via superscripts that identify an instance of category X as a maximal or minimal projection (e.g. X^{max} or XP versus X^{min} or X^0), or as an intermediate projection that is neither maximal nor minimal (e.g. X′); such designations are relational, not intrinsic properties of categories and therefore not part of syntactic representation, as proposed in Muysken 1982 ('Bare', 61/336). Furthermore, 'categories are elementary constructions from properties of lexical items', and as a consequence, a single lexical item can be simultaneously a head (X^0) and a maximal phrasal projection (XP) (Chomsky 1995b:249).

The IP distinguishes the computation of LF (NARROW SYNTAX, henceforth NS) from the computation of PF, where the phonological component adds new elements (prosodic structure and narrow phonetics) in violation of the IP, which is therefore assumed not to hold for this part of a derivation ('Minimalist inquiries', 117/437–38). In this way it supports the view that the properties of language at the S-M interface are fundamentally different from those involving the C-I interface. However, 'Beyond' suggests that the semantic component 'on usual assumptions', which maps LF to a (full) semantic representation (designated as 'meaning' in Chomsky 1975b:Ch. 3, ex. 37), also violates the IP (107/541 and footnote 12).

The ' "no-tampering" condition of efficient computation' (henceforth NTC; 'Three factors', 11/594) receives an explicit formulation in 'On phases' as 'Merge of X and Y leaves the two SOs unchanged' (138/619; see also 'Approaching UG', 2007:8), though the concept is first mentioned almost a decade earlier in 'Minimalist inquiries', where it is suggested that 'operations do not tamper with the basic relations involving the label

that projects'—in particular, sisterhood and c-command (136/467).[14] The term SO covers lexical items as well as objects constructed from them. 'Beyond' elucidates the notion in terms of the elements of the lexicon in a lexical array, treating these as 'atoms' for the derivation that undergo 'no internal tampering in NS'—from which it presumably follows that 'there is no feature movement and hence no "modified lexical items" with features attached to them' (contrary to 'Minimalist inquiries' and previous work, as a footnote points out) (108/543–44). Under the NTC, Merge of X and Y yields minimally an unordered set {X, Y}, and merger must be to the edge of SOs ('On phases', 138/619), the latter entailment yielding the 'extension condition' ('Three factors', 12/597), which imposes strict cyclicity on derivations (cf. 'Minimalist program' (190/288) for the initial proposal of this condition). Given the restriction of merger to the edge, Merge of X and Y involves minimal (if not zero) search to determine how they combine (cf. 'Beyond', 109/545). Furthermore, the NTC 'entails the so-called copy theory of movement, which leaves unmodified the objects to which it applies, forming an extended object' ('Three factors', 13/597); see below for further discussion. All of this has the effect of minimizing computational load ('Three factors', 12/597).

Note that the restrictions imposed by the IP also minimize computational load. Moreover, the effects of the IP overlap with those of the NTC, where the latter is the broader principle. Turning copies into traces (i.e. empty categories) violates the NTC, as does adding indices to SOs that have been constructed (including single lexical items). Adding a label to an SO constructed by Merge should not violate the NTC, and therefore labels with bar levels (as in early X-bar theory) or labels unrelated to any feature contained in the SO they label (e.g. exocentric labeling such as S for a clause) cannot be ruled out by the NTC—unless adding features to SOs that are not contained in the SO itself constitutes a change that violates the NTC. Alternatively, if third-factor principles of minimal computation require that outputs are strongly restricted by inputs, then bar levels and other diacritics that do not exist in the lexicon could not be produced by any labeling algorithm (cf. 'On phases', 145/631) that satisfies the SMT. (For more on labeling see §5.3.)

The NTC is quintessentially a structure-preserving constraint, where structure preservation is plausibly a fundamental property of efficient computation. Once a structure is computed, it remains unchanged for the remainder of the computation. This enforces the bottom-up derivation of phrase structure and simultaneously guarantees the cyclicity of the application of operations, thus linking the notions of structure preservation and cyclicity as proposed in Emonds 1970, where the notion of structure preservation is first discussed. Emonds identifies cyclic transformations as those whose outputs can be filtered by the phrase structure rules of a base component as formulated in *Aspects*. Thus a transformation is structure-preserving only if 'the new position of X is a position in which a phrase structure rule, motivated independently of the transformation in question, can generate category X' (Emonds 1972:22). The filtering function of phrase structure rules is a natural extension of the discussion of the filtering function of transformations in *Aspects*. It is in effect a characterization of the nondistinctness condition on the elementary operation of substitution proposed in *Aspects*—see also Chomsky & Lansik 1993, where structure preservation is linked to 'a UG principle of *recoverability of deletion*, which requires that no information be lost by the operation' (1995b:44). However,

[14] 'Approaching UG' suggests that the NTC may only apply to Merge, leaving open a possibility that the SOs merged could be altered by further operations, which seems unnecessary, especially because it undercuts, for no apparent reason, the generality implied by the discussion in 'Minimalist inquiries' cited above—that is, that operations in NS conform to the NTC. See §5.1 for further discussion.

given a prohibition against the compounding of elementary transformational operations in the formulation of grammatical transformations (proposed in the first footnote of 'Contraction'; see also 'On binding', 4/193)—specifically, the elementary operations of substitution and adjunction cannot be compounded with deletion—the structure-preserving character of operations other than deletion cannot be linked to a principle of recoverability of deletion as proposed. As a result of noncompounding, movement operations (now perhaps reduced to (Internal) Merge) 'leave behind' copies (formerly 'traces', so-called empty categories that now are excluded by the NTC/IP). Thus, structure preservation results in part directly from the noncompounding constraint—precisely, the separation of deletion from structure-building operations. In addition, the NTC ensures that the internal structure of constituents once constructed cannot be later altered by other structure-building operations. Given that deletion operations change SOs, the noncompounding prohibition with respect to deletion also follows from the NTC. The sum effect is to minimize computational possibilities.

The necessity of deletion operations in ellipsis (and possibly also for chain reduction, but see discussion below) shows that the NTC, which does not govern the derivation of PF, is operative only for the derivation of narrow syntax, which interfaces with C-I systems.

3. Derivation by phase. Another aspect of minimizing computation concerns the size of domains in which operations apply. In generative grammar this aspect falls under the rubric of *locality* and has been a focus of investigation for over half a century, starting with the A-over-A principle of Chomsky 1964, continuing with Ross's island constraints (1967, 1984) and later Rizzi's relativized minimality (1990), up to the present phase impenetrability condition (PIC, first formulated in 'Minimalist inquiries' and discussed in 'Derivation', 'Beyond', and 'On phases'). In what follows we will consider first the formulation of the PIC, then its empirical bite, and finally its implementation in C_{HL}.

The PIC is initially formulated as 6 ('Minimalist inquiries', ex. 21).

(6) In phase α with head H, the domain of H is not accessible to operations outside α, only H and its edge are accessible to such operations.

A phase constitutes an SO that is 'the closest counterpart to a proposition', of which there are two candidates, a verb phrase in which all θ-roles of the verb are assigned or a full clause that includes tense and force—thus *v*P (under the assumption that a subject θ-role is assigned to Spec-*v*) and CP are designated as phases subject to the PIC ('Minimalist inquiries', 106/420). The domain of a phase head is the SO that is merged first with the phase head, so VP for *v* and TP for C—the obligatory complements for these heads. The 'edge' of a phase consists of the syntactic residue outside of the phase head and its complement—that is, outside [v VP] or [C TP], which involves 'either specifiers (specs) or elements adjoined to HP' ('Derivation', 13/489).

The PIC as formulated in 6 blocks a movement operation from targeting a constituent of VP and merging it outside of the *v*P that immediately contains it (and similarly with constituents of TP merged outside of the CP that immediately contains that TP). Instead, any movement out of the complement of a phasal head (*v* or C) requires a nontrivial chain with a copy at the edge of every intervening phase (cf. 'Minimalist inquiries', 108/423). Thus, a single-clause question like 7a requires a three-member chain for the interrogative pronoun, with an intermediate copy at Spec-*v*, as illustrated in 7b.

(7) a. What have you read?
b. $[_C$ what $[_C$ Q $[_T$ you $[_T$ have $[_v$ what $[_v$ you $[_v$ *v* $[_V$ read what]]]]]]]]
c. *$[_C$ what $[_C$ Q $[_T$ you $[_T$ have $[_v$ you $[_v$ *v* $[_V$ read what]]]]]]]

The derivation in 7c without the intermediate copy in Spec-*v*P is blocked by the PIC because once the *v*P phase is completed (with the merger of T *have*), the VP complement of *v* is inaccessible to movement operations. Thus the PIC induces a stronger form of successive cyclicity on A′-movement—that is, involving Spec-*v* as well as Spec-C. 'Minimalist inquiries' (ex. 17) postulates what might be considered 'a still stronger cyclicity condition' on phases that renders 'the phase head "inert" after the phase is completed, triggering no further operations', and refers to the PIC as 'strengthening further the notion of cyclic derivation', commenting on the formulation in 6: 'The cycle is so strict that operations cannot "look into" a phase α below its head H' ('Minimalist inquiries', 108/423). Note, however, that the inertness of a phasal head on the completion of that phase does not follow from the PIC and must be stipulated as an additional condition.

'Derivation' reiterates essentially the 'Minimalist inquiries' formulation of the PIC (see 7) and then adds a clarification. The formulation in 6 does not specify any limit on the accessibility of the head of a phase and its edge to operations outside of the phase itself. 'Derivation' responds to this by stating that a phase head and its edge are 'accessible only up to the next strong phase, under PIC' (13/489). The distinction between strong and weak phases is introduced in 'Derivation' (12/488). C and *v** are identified as the strong phasal heads, as opposed to the light verb *v* that marks unaccusatives and passives. Summarizing what little is said about the strong/weak phase distinction in 'Derivation', 'Beyond', and 'On phases', strong phases are targets for movement and are therefore subject to Spell-out (discussed below), in contrast to weak phases: '*v** is the functional head associated with full argument structure, transitive and experiencer constructions' ('On phases', 143/627). 'On phases' simply designates *v**P as a phase and does not mention *v*P.

The clarification for the formulation of the PIC in 6 concerns the schema 8 ('Derivation', ex. 8), where H and Z are phasal heads, YP is the domain of H, and α is its edge.

(8) $[_{ZP}\ Z \ldots [_{HP}\ \alpha\ [H\ YP]]]$

Given 8, H must be accessible to Z in the case of head movement, and α must be accessible to IM for creating a specifier of ZP. Therefore, accessibility is up to BUT NOT BEYOND the next strong phase. 'Derivation' (ex. 9) then proposes a reformulation of the PIC in terms of the next higher phase boundary, given in 9 (cf. also 'Beyond', ex. 6).

(9) The domain of H is not accessible to operations at ZP; only H and its edge are accessible to such operations.

Under this formulation, the domain of H is accessible beyond the phasal boundary HP—for example, to a nonphasal head that occurs between Z and HP. T would be an actual candidate, occurring between *v* and C. However, as soon as Z is introduced in the derivation it creates a 'ZP' that triggers the PIC as formulated in 9. The formulation in 9 is therefore a less restrictive locality constraint than the one in 6; the choice between the two is consequently an empirical issue. 'On phases' dispenses with the 'next higher phase' condition (footnote 24) on the grounds that 'for narrow syntax, probe into an earlier phase will almost always be blocked by intervention effects' (143/626). What accounts for intervention effects is not specified, nor is a revised formulation of the PIC given. Rather, it is assumed that the literature on the PIC (including 'Minimalist inquiries' and 'Beyond') 'is more or less on target' modulo this modification (143/626). This seems to privilege the more restrictive formulation of the PIC in 6. (For further discussion see M. Richards 2011, and for a survey of work on phase theory see Citko 2014.)

Turning to empirical issues, 'Minimalist inquiries' claims that the PIC 'yields a strong form of Subjacency', commenting that for A-movement this 'should follow from the theories of Case/agreement and locality' (108/423)—which suggests, it should be noted,

that some other locality condition is needed in addition to the PIC. The footnote to the comment remarks that 'a far more comprehensive review and analysis than is undertaken' in the remainder of 'Minimalist inquiries' is needed to both clarify and verify this conclusion and others 'in full generality' (footnote 47). The footnote applies to the subjacency claim as well.

Under the PIC, the complements of the phasal heads *v* and CP (i.e. VP and TP, respectively) would constitute the bounding domains for a subjacency condition, which prohibits a single movement operation from extracting a syntactic object out of more than one of these domains. To see how this works, consider the derivation of a standard WH-island violation (10) of the sort cited in Chomsky 1973 as empirical motivation for a strict cycle condition and reanalyzed in Freidin 1978 as a violation of subjacency interpreted as a condition on representations.

(10) *Who has John said what borrowed?

Under the analysis of 10 where the overt copy of *what* occurs in Spec-CP of the clausal complement and therefore *who* has had to move from Spec-TP of the clausal complement directly to either the matrix clause Spec-*v* (or the root Spec-CP) over both the complement TP boundary and the matrix VP boundary, the derivation violates the reformulated subjacency condition by moving *who* across two bounding nodes (TP and VP) under a single operation. Given the PIC, *who* would not be accessible for movement out of the complement Spec-TP at the matrix *v*P phase. Yet with more intermediate 'landing sites' available under the phasal analysis, there are more derivational possibilities to calculate and rule out. For example, if *what* in 10 is analyzed as occurring in the clausal complement Spec-*v*, then there would be a derivation of 10 that does not violate the PIC. Consider this derivation in stages, starting with 11, where *what* is merged as the complement object of *borrowed*, and *who* as the subject of the verb is merged as the specifier of *v*.

(11) [$_v$ who [$_v$ *v* [$_V$ borrowed what]]]

At the next step in the derivation *what* merges with 11, yielding the *v*P 12, a necessary step under the PIC to account for the derivation of interrogatives like *What has Mary borrowed?*, where *Mary* enters the derivation in the position of *who* in 12 and is later merged as the specifier of T *has*.

(12) [$_v$ what [$_v$ who [$_v$ *v* [$_V$ borrowed what]]]]

The *v*P in 11 then merges with T *has*, creating a TP, and then the subject *who* merges as Spec-TP, creating 13.

(13) [$_T$ who [$_T$ has [$_v$ what [$_v$ who [$_v$ *v* [$_V$ borrowed what]]]]]]

At this point there are two derivational possibilities: 13 merges with a covert C, or (less likely) it merges with V *said*. Because this is a derivation for a deviant structure, neither is necessarily untenable, all other things being equal. The movement from Spec-TP to Spec-CP is independently motivated by examples like *Mary wonders who has borrowed the books* on standard assumptions, so we can at this point pass over the alternative. The remainder of the derivation for 10 under the PIC would require *who* to merge as the Spec of the matrix *v* and then finally as Spec-CP of the main clause. Standard chain reduction eliminates the unpronounced copies and, along with head movement from T to C, yields 10 at PF. Thus the PIC prohibits some derivations of WH-island violations in English, but not all of them, in contrast to the representational analysis of subjacency in Freidin 1978.[15]

[15] The labeling theory developed in Chomsky 2013a would prohibit 13 if *v*, unlike C, shares no feature with *what* (e.g. +Q), as suggested by Noam Chomsky (p.c.)—but only if unlabeled SOs violate FI at the C-I inter-

The problem for the phase-theoretic analysis of 10 is that there is an additional intermediate landing site for *what* at Spec-*v*P. Apparently this position is not one where an overt WH-phrase can occur (but see comment about 'crazy' derivations for deviant expressions regarding the analysis of 5 above). Still, whatever accounts for this will be separate from and so in addition to the PIC, and furthermore, whatever the condition is, it would probably not be formulated in terms of locality.

One question that arises for the formulation and application of the PIC is how accessibility is actually implemented in the computational system. The PIC says in effect that a certain portion of a derivation at a certain point becomes inert (or opaque or simply irrelevant) to current operations. One might conclude that if so, then that portion of syntactic structure does not need to be present. And then it might be natural to look for a mechanism that would reduce the syntactic structure to which operations apply at various stages of the derivation, thereby reducing 'the computational burden' (cf. 'Derivation', 12–13/489). Such a mechanism is proposed in 'Beyond' as Transfer, an operation applying 'to narrow syntactic derivation D-NS' that 'hands D-NS over to Φ and Σ', where Φ is the phonological component that maps D-NS to the SM interface and Σ is the semantic component that maps D-NS to the C-I interface (107/541). Φ is identified in 'Filters' as the component containing deletion, filters, phonology, and stylistic rules, whereas the component that apparently corresponds to Σ contains interpretive rules listed as 'Construal, Quantifier interpretation, etc.' (431/67). The outputs of these components constitute the interface representations. Transfer is a generalization of the operation Spell-out to the mapping to the C-I interface.

The first proposal for Spell-out, in 'Minimalist program', is somewhat unspecific—that is, as an operation that 'switches to the PF component' (189/286). The computation of NS continues after Spell-out but with 'no further access to the lexicon' (189/287), a reason being cited that a mismatch between PF and LF would result. 'Minimalist program' assumes that Spell-out applies at a single point in a derivation, which may differ across languages (191/290). A more precise characterization of what Spell-out does to an SO is given in 'Bare', where Spell-out is an operation in a derivation that 'strips away' from the linguistic structure formed 'those elements relevant only to π' (π = PF), with the remaining structure being mapped to LF (59/333). 'Minimalist inquiries' identifies the elements that Spell-out strips away as 'the true phonological features', noting that Spell-out enables the derivation to converge at LF and that introducing lexical items after Spell-out will cause the derivation to crash at LF (118–19/439), presumably because true phonological features are not legible at the C-I interface (see discussion of legibility above, and also below). Note that the SO to which Spell-out applies has no linear order (by hypothesis) and that linearization will depend to a significant extent on hierarchical structure (cf. the LINEAR CORRESPONDENCE AXIOM; Kayne 1994), so that the object produced by the application of Spell-out ought to be a syntactic object with hierarchical structure to which linear order is later assigned.

The next step toward the Transfer analysis involves the reformulation of Spell-out as a cyclic operation. This is proposed in the final pages of 'Minimalist inquiries', in part to resolve a technical problem concerning the deletion of features: 'There is a single cycle: all operations are cyclic' (131/461). As a result, operations with phonetic effects are interspersed with those without phonetic effects. The phonological cycle proceeds

face, which would require an extension of the theory of uninterpretable features that has yet to be formulated. But then the deviance of 13 would involve neither locality nor cyclicity.

in parallel with the single NS cycle ('Derivation', 5/missing[16])—that is, without a separate LF component ('Minimalist inquiries', 131/461). 'Minimalist inquiries' designates this approach to be 'apparently the simplest and most principled one' (131/460). Given the formulation in 'Beyond', however, it is not clear why Σ is not functioning as the 'LF component'. Depending on how cyclic Transfer interacts with interface systems, there may be no LF representation, or PF representation for that matter. That is, if syntactic parts of the whole expression under analysis are mapped individually to the interfaces, then the derivation will not produce a composite representation internal to FL that corresponds to what have traditionally been called LF and PF. See below for further discussion.

The cyclic domains for Spell-out (and Transfer more generally) are taken to be strong phases ('Derivation', 19/499). However, there seems to be a question about what gets spelled out and when this happens. 'Derivation' notes that, given the PIC, a phasal head and its edge belong in effect to the next higher strong phase (e.g. H and α in 12 are computed as part of the ZP phase) 'for the purposes of Spell-Out' (13/490). But the next paragraph seems to contradict this analysis with the claim that 'the picture improves further if interpretation/evaluation takes place uniformly at the next higher phase, with Spell-Out just a special case', followed by the postulation of 14 as a principle, where Ph_1 designates a strong phase and Ph_2 designates the next higher strong phase that contains it.

(14) Ph_1 is interpreted/evaluated at Ph_2.

This formulation is endorsed again in a discussion of object shift toward the end of 'Derivation': 'This is in accord with the principle (10) [= 14 above—*RF*] that all evaluation/interpretation takes place at the next higher strong phase, including Spell-Out' (36/524). At the next higher phase, any displacement of the head or edge of the lower phase has occurred, so it seems plausible that at that point, the entire lower phase could spell-out. 'Beyond' notes that phases 'must be able to spell-out in full'; otherwise, 'root clauses would never be spelled out' (108/542). If this is the case, then the effects of the PIC as formulated in 6 will not follow from the derivational process itself because the domain of the lower phasal head (α in 8) will not be transferred prior to the transfer of the lower phasal head and its edge. This renders the domain α accessible beyond its phase, as discussed above for the formulation of the PIC in 13, an analysis that is repeated in 'Beyond' but prefaced with the phrase 'however PIC is formulated exactly' (108/543)—which suggests some uncertainty about the formulations previously proposed (depending on how much weight we give to *exactly*). One plausible conclusion is that the way Spell-out/Transfer operates is not sufficient to render the intended locality effects of the PIC—in which case, the PIC would function as an independent locality condition needed to supplement the effects of Spell-out/Transfer of phases.

One possible independent motivation for a Spell-out operation comes from the sole condition on the economy of representations, FI. If phonetic features are uninterpretable and hence superfluous to the C-I interface and, in addition, semantic features are uninterpretable to the S-M interface, then their derivational separation at Spell-out is required to satisfy FI for the two interface representations. However, this is not mentioned in the initial discussions of FI (Chomsky 1986, 1991), nor is it explicitly stated in 'Minimalist program' where Spell-out is first proposed or in any subsequent paper. At best, there is

[16] Two paragraphs of the final published version are missing from the version in this volume. They would have occurred between the first and second full paragraphs on p. 478.

the comment in 'Minimalist inquiries' about the problem of lexical insertion after Spell-out (118–19/439) quoted above, which appears to be based on this analysis. Furthermore, this analysis entails an assumption that is not obviously correct and also plausibly a bit strange—namely, that interface systems can recognize AS UNINTERPRETABLE features to which they can assign no interpretation, what can be called the recognition problem. Alternatively, it could be that C-I interface systems will ignore phonetic features just as S-M interface systems will ignore semantic features, simply because these features are unrecognizable and therefore essentially invisible. See below for more on the analysis of what are designated uninterpretable features at the interfaces.

Another potentially problematic issue for the operation of Transfer concerns what the operation actually does to an SO. If the transfer of phasal material—whatever its size—involves actually detaching an SO from a larger SO, then there is a question about how these parcels of syntactic structure are reassembled to form the linguistic expression whose derivation is being computed; call it the reassembly problem. Presumably the SOs that are mapped to the interfaces by the phonological and semantic components have to be reassembled BEFORE the SOs that constitute the full linguistic expression are passed to the interface systems; otherwise, it would be left to the interface systems to reassemble the syntactic pieces into a single SO, raising a new set of problems (first and foremost: how do interface systems recognize which SOs belong to the same derivation?). These problems are surely illusory, the result of interpreting metaphorical terms like 'transfer' and 'hand over' literally. But if so, then what does the operation Transfer actually do to the SO to which it applies? And how does it contribute to minimizing computation beyond the contribution of the NTC, FI, and especially the PIC, which on its own minimizes the domain of computations?

Both the problem and the questions begin to evaporate if locality is a structural property that is not built into the derivational process under an operation like cyclic Transfer. A full solution would require a reanalysis of how a derivation intersects with the two interfaces. Needless to say, a derivation must split into two parts at some point or points simply to account for the fact that a linguistic expression must be linearized at the S-M interface, whereas it will not and need not be at the C-I interface. Note that corresponding sentences in languages with different word orders (e.g. English and Japanese) have virtually identical hierarchical structures, which supports the standard assumption that linguistic representations at the C-I interface are uniform across languages. Linearization would therefore have to occur after the derivational split, presumably as the first operation of the phonological component. Furthermore, it would seem that however the splitting is done, it would not decompose syntactic objects that have been constructed in the course of the derivation, which might follow from a stricter interpretation of the NTC.

4. THE INTERFACE BETWEEN C_{HL} AND THE LEXICON: LEXICAL ARRAYS. Another potentially problematic issue concerns how the computational system accesses the lexicon to form linguistic expressions. From 'Bare' on, there has been only one operation that constructs SOs out of lexical items, Merge. In its most recent formulation, 'On phases' defines Merge as 'an operation that takes *n* syntactic objects (SOs) already formed, and constructs from them a new SO' (137/617), where lexical items as well as the objects constructed from them constitute SOs. Merge of two SOs X and Y yields an unordered set {X, Y}, 'the simplest possibility worth considering' ('On phases', 138/619).[17] The question then is how Merge, specifically Set-Merge, accesses the lexicon.

[17] This characterization also occurs in 'Bare', where Merge is first proposed. But 'Bare' assumes that the SO created must also contain a label, assigning this function to Merge as well and thus apparently rejecting

Starting with 'Bare', the assumption has been that C_{HL} maps 'some array of lexical choices' to interface representations (π, λ). This lexical array (henceforth LA) 'must at least indicate what the lexical choices are and how many times each is selected by C_{HL} in forming (π, λ)' (58/332). To account for this latter property, 'Bare' proposes that the LA is an object consisting of not just the lexical items, but also a numerical index on each indicating how many times any particular lexical item is selected by the operation that constructs the LA, now called a numeration. In 'Bare' a numeration—and thus an LA—is motivated as a 'reference set' for comparing competing convergent derivations in terms of economy of derivation. As a result, these considerations 'tend to have a "global" character, inducing high-order computational complexity' ('Minimalist program', 201/303)—in particular, in terms of the economy principle Procrastinate, first formulated in 'Minimalist program' (198/299) and eventually set aside as 'not even formulable if the overt/covert distinction collapses' because 'purely "covert" Agree is just part of the single narrow-syntactic cycle' ('Derivation', 15/493).

A numeration not only violates inclusiveness (IP)—a 'narrow departure' according to 'Minimalist inquiries' (114/432) and designated simply as a violation, without qualification, in 'Derivation' (11/489)—but it also requires that C_{HL} contains a device that can count. Exactly how the numerical index is constructed for items that are selected from the lexicon more than once is not specified. But given lexical items in an LA that have been selected from the lexicon multiple times and therefore have numerical indices greater than 1, each time an item in the LA is accessed by Set-Merge, the numerical index is reduced by 1. 'Minimalist inquiries' (114/432) suggests that the LA could dispense with numerical indexing if the requirement is dropped that an item is removed from the array when accessed during the computation of an expression, and that this would require 'a modification of interpretive procedures at the LF interface' and 'a new notion of chain'. 'Derivation' suggests that an LA would be a numeration only in the event that one or more lexical items 'are selected more than once' (11/487; see also 'Beyond', 107/540); however, this suggests that a lexical item in an LA would not have a numerical index if it were selected only once from the lexicon, which would complicate the procedure for emptying the LA by requiring, in addition to reducing the numerical index to zero, an additional subroutine for lexical items lacking such indices. The concept of numeration is based on a fundamental assumption that C_{HL} tracks the number of times each lexical item is inserted into a particular derivation. See below for some critical discussion.

The motivation for an LA—that is, for a one-time selection of LIs from the lexicon for each derivation—that is cited in these papers tends to be quite general. 'Minimalist inquiries' claims that an LA 'simplifies computation' (100/411) because restricting access to the lexicon reduces 'operative complexity' (101/411). 'Derivation' talks about 'a reduction of computational burden', which in this case is 'vast' because the lexicon, 'which virtually exhausts' the language, 'need no longer be accessed in the derivation once LA

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the simplest formulation. 'Minimalist inquiries' restates the minimal formulation but also says that more information about the SO formed is needed, identified as its label (133/463). This passage contains a footnote, crediting the discussion in Collins 1997, which adopts the simplest formulation and posits a separate operation (later dropped in Collins 2002) called Head, which determines the label of the SO formed by Merge. 'Minimalist inquiries' goes on to consider whether labels are predictable, concluding two pages later that 'in all cases, then, the label is redundant' and therefore presumably not part of the operation Merge. 'Derivation' suggests that 'in the best case' labels for SOs are 'determined by general algorithm' (3/475), segregating the labeling function, which leaves the simplest formulation of Merge. 'On phases' proposes specific labeling algorithms; see 28 below.

is selected' (11/487). 'Beyond' refers to 'memory requirements' that 'are restricted (massively in the case of LA)' (107/540), a seemingly obscure reference given that C_{HL} is presumably not a model for language processing, which would involve memory. 'Minimalist inquiries' characterizes these considerations as 'conceptual arguments', which 'can be given either way, but they carry little weight', noting: 'The questions are empirical. Investigating them, we can hope to discover whether (and if so how) what might reasonably be considered complexity/economy considerations enter into language design' (101/412). (See also 'Derivation' (11/487) for a similar comment.)

As noted in 'Derivation' (11–12/487), ' "Minimalist inquiries" proposes another reduction of computational burden' where the derivation of linguistic expressions proceeds by phase, 'each phase determined by a subarray LA_i of LA, placed in "active memory" '. Nonetheless, derivation by phase increases the operational complexity of the derivation by adding another process by which subarrays are periodically extracted from the initial LA as the derivation proceeds. Moreover, the reduction argument remains a conceptual argument, now for subarrays. So the question is whether there are empirical arguments for lexical arrays of any kind.

So far, only two arguments have been proposed as support for the necessity of arrays, one for subarrays concerning the derivation of existential sentences, hence empirical, and the other theory-internal, involving the necessity to distinguish chains from repetitions of the same lexical items (see 'Derivation', 11/487). The ultimate issue is the identification of chains. 'Minimalist inquiries' says that chains can be identified given numerations, while 'On phases' and 'Approaching UG' utilize phases.

4.1. THE DERIVATION OF EXISTENTIAL CONSTRUCTIONS. The discussion of the empirical argument for subarrays begins in 'Minimalist inquiries', where it is noted that 'a problem throughout the whole account is why raising is EVER possible, if Agree and Merge preempt Move' (106/419). The underlying assumptions are that (i) there is a displacement operation Move consisting of the combined operations Merge and Agree (see below for discussion), which is therefore more complicated than any of its components, and (ii) a simpler operation preempts the application of a more complicated operation. 'Minimalist inquiries' (ex. 6) formulates a θ-theoretic principle 15 as part of the answer to the question.

(15) Pure Merge in θ-position is required of (and restricted to) arguments.

Thus, in the case of non-θ-positions, pure Merge is restricted to nonarguments—that is, expletives. But these positions are also the ones to which movement of an argument is possible, and therefore there remains an inherent competition of Move versus Merge-expletive when a derivation involves an expletive. The preference for Merge-expletive over Move is not absolute, however, illustrated by 16a (= ex. 7a in 'Minimalist inquiries'), where *proofs* has been moved in the embedded clause α before the expletive *there* is merged in the matrix Spec-TP, as 'Minimalist inquiries' points out.

(16) a. there is a possibility [$_\alpha$ that proofs will be discovered]
b. [$_\alpha$ that there will be proofs discovered] is a possibility
c. [$_\alpha$ that proofs will be discovered] is a possibility
d. there is a possibility [$_\alpha$ that there will be proofs discovered]
e. it is a possibility [$_\alpha$ that there will be proofs discovered]
f. it is a possibility [$_\alpha$ that proofs will be discovered]

Furthermore, given the LA for 16a, there is another possible derivation where the expletive is in fact merged in α and then Move applies to α, displacing α to the matrix Spec-TP. Nonetheless, both derivations are possible, and therefore 16b, which conforms to the Merge-over-Move preference, does not block the derivation of 16a. In ad-

dition, the following related derivations are also possible: movement both in α and of α to Spec-TP in 16c; merger of expletive *there* in both α and the matrix Spec-TP in 16d; merger of both expletive *there* in α and expletive *it* in the matrix Spec-TP in 16e; and movement in α and merger of expletive *it* in the matrix Spec-TP in 16f.

'Minimalist inquiries' eliminates 16a as a counterexample to the Merge-over-Move preference by proposing that it applies not to the LA as a whole, but to subarrays constructed from the LA in the course of a derivation, where each subarray constitutes a phase containing one occurrence of *v* or C (see discussion above). Thus the subarray for α in 16a will not contain an expletive, and therefore displacement of *proofs* is the only possibility for the derivation (in contrast to the derivations of 16b, d, and f, where *there* is contained in the subarray for α). Derivation by subarray eliminates any need for backtracking or look-ahead—that is, for comparison of alternative derivations ('Minimalist inquiries', 138/470). However, the derivations by subarray for 16a–f only show that if an expletive occurs in a subarray, it blocks movement to the position in which it will be merged. But this results simply because Move would block Merge-expletive, leaving the expletive *there* unused in the subarray, which would be a more basic violation of derivational principles. The question now is whether there is any independent empirical evidence for postulating a Merge-over-Move preference.

'Minimalist inquiries' (104/417) invokes the Merge-over-Move preference to account for the deviance of 17a (= ex. 12a).

(17) a. *there is likely [$_{\alpha}$ a new proof to be discovered]
b. there is likely [$_{\alpha}$ to be a new proof discovered]
c. a new proof is likely [$_{\alpha}$ to be discovered]

This analysis assumes that in 17a α is not a phase, hence not a subarray in the derivation; if it were, then expletive *there* would not be available in that subarray to compete with the displacement of *a new proof*. Furthermore, it must be assumed that in the derivation of 17a, there is only one phase, the entire LA (see below for further discussion)—thus no intermediate *v**P or CP boundary between the expletive and the complement VP. Given that the complement VP is passive, the *v*P in which it is a complement does not constitute a strong phase and is therefore not subject to Spell-out/Transfer. 'Minimalist inquiries' postulates that the infinitival T *to* has an EXTENDED PROJECTION PRINCIPLE (EPP) feature, which requires that some constituent occupy its Spec-TP position—with EPP basically a stipulation, but perhaps a necessary one (see, for example, the analysis of Russian accusative unaccusative constructions in Lavine & Freidin 2002). In the case of 17b–c, what occurs in Spec of infinitival TP is covert—presumably a copy of *there* (17b; = 'Minimalist inquiries', ex. 10a) and a copy of *a new proof* in 17c. Alternatively (as suggested in 'Derivation', 9/484), infinitival T has no EPP-feature, in which case Spec of infinitival TP in 17a–c is unmotivated. In 17b–c a covert Spec-TP for the infinitival is not required by either Case or θ-theoretic considerations, or by locality under the PIC. Therefore, under this analysis it does not exist in these examples—in which case *there* in 17b occurs solely in the matrix Spec-TP via pure Merge and *a new proof* is moved directly from the infinitival VP. What prohibits 17a remains to be explained—possibly that nothing motivates the application of Move or Merge to fill this position, which does not involve a preference for Merge over Move.[18] Another complicating factor is that α in 17a can occur in exceptional Case-marking contexts, as in 18a (= 'Minimalist inquiries', ex. 10c) and 18b.

[18] The deviance of 17a is actually a complicated issue, depending on a precise analysis of the structure of existential constructions and how they are generated. This concerns where the expletive *there* is first merged

(18) a. I expected [$_{\alpha}$ a new proof to be discovered]
b. I expected [$_{\alpha}$ there to be a new proof discovered]

Therefore, neither movement to nor Merge of expletive in that position can be prohibited in general.

The attempt to explain the deviance of 17a in terms of a preference for Merge over Move crucially depends on the distinction between the two operations. This becomes impossible under the analysis in 'Beyond' where the displacement function of Move is subsumed under Merge WITHOUT ALTERING THE FORMULATION OF THAT OPERATION IN ANY WAY. The formulation there is worth quoting in full ('Beyond', 110/544) (a footnote at the end of this quote is omitted):

> NS is based on the free operation Merge. SMT entails that Merge of α, β is unconstrained, therefore either *external* or *internal*. Under external Merge, α and β are separate objects; under internal Merge, one is part of the other, and Merge yields the property of 'displacement,' which is ubiquitous in language and must be captured in some manner in any theory. It is hard to think of a simpler approach than allowing internal Merge (a grammatical transformation), an operation that is freely available. Accordingly, displacement is not an 'imperfection' of language; its absence would be an imperfection.

'On phases' provides the following clarification. There are two conditions in which the single operation Merge applies: (i) X and Y are separate (external Merge; EM), and (ii) Y is contained in X (internal Merge; IM). Both applications yield a set, and 'IM yields two copies of Y in {X, Y}, one external to X, one within X' ('On phases', 140/621). As 'On phases' notes, IM follows automatically from the simplest formulation of Merge; restricting Merge to EM only would require a stipulation and sufficient empirical evidence to support it. However, given that IM renders displacement, thereby replacing the more complex operation Move, the empirical evidence overwhelmingly supports IM. Given this simplest formulation of Merge (i.e. without unexplained constraints), the empirical argument for subarrays based on linguistic expressions containing expletive elements, as discussed above, simply collapses.

4.2. DISTINGUISHING COPIES FROM REPETITIONS. The second argument for using arrays in derivations concerns the identification of (nontrivial) chains, consisting of multiple copies of a single syntactic object, which thereby seems to call for a distinction between copies created by the application of IM and what are called 'repetitions'. According to 'Approaching UG', 'there must be a procedure to distinguish copies from independent repetitions; this is easily stated with a proper notion of cyclicity in terms of phases' (2007:10), presumably based on an assumption that is stated clearly in Chomsky 2013a:40: 'Clearly it is necessary to distinguish copies from repetitions' (see also 'On phases', 145/632). Chomsky 2012:3 claims that 'one goal of *Phase Theory* is to provide the mechanisms to distinguish copies from repetitions, as straightforwardly as possible'. The empirical issue concerns the distinction between the analyses of 19a,b given in 20.

(19) a. John named John
b. John was named

(20) a. [$_{T}$ John T [$_{v*}$ John v* [$_{V}$ named John]]]
b. [$_{T}$ John T-was [$_{v}$ v [$_{V}$ named John]]]

in a derivation, where it may be moved and under what circumstances, what features it carries (e.g. Case and ϕ-features, or some subset—valued or unvalued (and if unvalued, then how valued)). See Deal 2009 and Sobin 2014 for some recent proposals and some critical discussion of previous analyses in the extensive literature on this subject. See below for some discussion of feature valuation in the analysis of these constructions.

The two elements *John* in 20b are copies, created by the application of IM to *John* in VP. In contrast, in 20a the two elements *John* in *v** are independent 'repetitions', while the two elements *John* in Spec-TP and Spec-*v**P are copies created by the application of IM to *John* in Spec-*v**P. Serious problems would arise if copies were misinterpreted as independent repetitions or vice versa. 'On phases' proposes that these distinctions are straightforward 'if within a phase each selection of an LI from the lexicon is a distinct item, so that all relevant identical items are copies' (145/632); this is contradicted by 19a, however, analyzed as 20a, where the two *John*s in the *v**P phase are not copies. 'Approaching UG' states a solution in terms of copy formation, that given phases 'all copies are formed by IM at the phase level, hence identifiable for Transfer' (2007:16), which clarifies an earlier statement in 'Bare' suggesting 'that there are no "copies" other than those formed by movement' (footnote 13). Chomsky 2013a:40 claims that 'the intuitive basis for the distinction is clear … : it reduces to independent extraction from the lexicon'.

Whether the repetition/copy distinction is actually a real problem depends on the interpretation of the terms 'repetition' and 'copy'. In *Chomsky's linguistics*, the term 'repetition' occurs once in 'Derivation' without explication. 'Approaching UG' treats *repetition* as a hypernym of *copy* when it says 'all and only repetitions formed by IM within a phase are copies' (2007:10), echoing the quotes from 'Approaching UG' and 'Bare' in the preceding paragraph. This usage seems to suggest that the concept of repetition is somehow more basic than the concept of copy. However, this is not at all obvious. In terms of C_{HL} there is no operation that creates repetitions, in marked contrast to copies. Furthermore, the notion itself is not useful for characterizing derivations. For example, in the sentence *The student read the journal article in the cafe at the train station*, there is no reason for the derivation to track the number of times *the* is merged. In the case of multiword phrases that are repeated in a single linguistic expression, not only would the derivation have to track the number of times each lexical item in the phrase was selected from the lexicon, but also the derivational histories of the phrases to determine identity. Consider, for example, the complexity involved in determining whether and how in the sentence *A review of a book by two professors was mentioned in a review of a book by two professors* the two phrases *a review of a book by two professors* constitute repetitions.

In contrast to a notion of repetition, the concept of copy is central to linguistic theory, given that the NTC entails the copy theory of movement ('Three factors', 13/597; cf. also 'On phases' (140/621) and discussion above). The copy theory is in actuality the null hypothesis, not a controversial innovation ('Beyond', 111/548–49; see also 'Minimalist inquiries' (114/432) and 'On phases' (140/621)) and is furthermore 'the simplest version of transformational grammar, making use only of Merge', which neither compounds with a deletion operation (prohibited by a general constraint against compounding elementary operations, discussed above) nor creates coindexed empty categories (traces) that would constitute a 'serious violation' of the IP ('Minimalist inquiries', 114/432).

The term 'copy' taken literally implies a multiplication of entities, one that results from a process. However, the idea that copies are created by a separate process is clearly rejected in 'On phases': 'It has sometimes been supposed that a new "copy" is created, then inserted in the position of the moved element—all unnecessary—and an alternative has been proposed in terms of "remerge," which is simply a notation for the copy theory as originally formulated in the most elementary terms' (footnote 17). Nonetheless, the idea that movement results in multiple copies in syntactic representa-

tions occurs in the first discussion of copy theory in *Chomsky's linguistics*, where 'the trace left behind is a copy of the moved element, deleted by a principle of the PF component in the case of overt movement' ('Minimalist program', 202/305). This is then compared to deletion in ellipsis constructions, which are derived 'by an operation of the PF component deleting copies' (203/306)—but note the use of the term 'copies' now applies to syntactic objects that are created by EM and thus obliterates a distinction between copies and repetitions. 'Minimalist program' suggests that 'the trace deletion operation may well be an obligatory variant of a more general operation applying in the PF component' (203/306). This is implicitly rejected in footnote 13 of 'Bare' (quoted above) where—to repeat—'there are no "copies" other than those formed by movement'. This leaves open the question of whether copies that result from the application of IM constitute multiple entities.

The discussion of copies above with regard to the analysis of 19 appears to assume the multiple entity analysis, as does the discussion of chains in 'Bare', where Move is characterized as an operation that 'forms the chain (α, *t*); α c-commands *t*, which is a copy of α' (65/341). The definition of chain is modified in 'Minimalist inquiries': 'a chain can be defined as a sequence of identical α's—more accurately, a sequence of *occurrences* of a single α' (114/433). An occurrence of α is taken to be either 'the full context of α' in a constructed syntactic object K or more simply a sister of α (as also proposed earlier in chapter 4 of Chomsky 1995b:251–52). As 'Minimalist inquiries' notes, this allows a simplification of the concept of chain 'from sequences to sets, relying on the fact that a "higher" occurrence of α properly contains lower ones'—in which case occurrences will always be in a subset relation (115/433). In support of the definition of chains in terms of occurrences, 'Minimalist inquiries' cites a problem that arises if chains are defined as sequences or sets of copies. When DP raises to Spec-TP to check Case and delete the uninterpretable Case feature, DP and its trace will be identical, 'so the feature must also delete in the trace'. However, it is not clear what mechanism 'guarantees that the feature is deleted throughout the chain'. This problem, which arises for the multiple entity interpretation of 'copy', does not occur if chains are defined in terms of occurrences: 'the feature is deleted in the single element α, unproblematically' (116/435). This formulation of chain is compatible with the analysis in which nontrivial chains involve a single syntactic object α that has multiple contexts rather than multiple identical syntactic objects in multiple contexts. If correct, then IM in no way creates multiple copies of a syntactic object to which it applies, and thus there is simply no issue of distinguishing copies from repetitions. Furthermore, there is no issue regarding the deletion of copies (chain reduction) at PF; when a syntactic object is linearized at PF, it occurs in one place in the same way that syntactic objects created by EM do. Thus there is no PF operation for deleting copies or traces that is somehow related to the PF operation involved in the derivation of ellipsis constructions.

If this analysis of IM is on the right track, then the question of whether derivations of linguistic expressions need to involve LAs and/or subarrays does not necessarily have a positive answer. Given that a copy/repetition distinction can no longer be formulated, there would appear to be no motivation for using the computational power of numerations to track how many times each lexical item is 'selected by C_{HL} in forming (π, λ)' ('Bare', 58/332; see full quote above). One plausible solution to eliminating the complexity that numerations bring to syntactic computation is that the LA contains multiple tokens of the same lexical item without indices of any kind. There seems to be no reason to assume that when Merge applies to a lexical item in the LA, the information that there are other tokens of the same lexical item in the LA is relevant to the computation—that

is, that this is something that a derivation tracks. Another solution is to have C_{HL} access the lexicon directly. 'Minimalist inquiries' argues against this on the grounds of 'operative complexity', employing as a metaphor an automobile that must incorporate a petroleum processing plant: 'If the derivation accesses the lexicon at every point, it must carry along this huge beast, rather like cars that constantly have to replenish their fuel supply' (100–101/411). However, the lexicon and C_{HL} are in fact physically linked in the brain, unlike cars and oil refineries (and/or gas stations) in the world. C_{HL} must obviously access the lexicon in some way, an unquestionable empirical necessity and certainly a prime candidate for what is referred to in the minimalist chapters as a 'virtual conceptual necessity' (see Al-Mutairi 2014 for commentary on this term). Direct access between C_{HL} and the lexicon would be the apparent null hypothesis, with Merge being the computational device that accesses it; nonetheless, exactly how C_{HL} accesses the lexicon remains a fundamental question for linguistic theory.

5. Beyond set-merge.

5.1. Agree. In addition to Set-Merge (with its dual function of EM and IM), C_{HL} also contains an operation Agree, which is first described as establishing 'a relation (agreement, Case checking) between an LI α and a feature F in some restricted search space (its *domain*)' ('Minimalist inquiries', 101/412), and later on as 'the erasure of uninterpretable features of probe and goal' (122/445), which implies that Agree is a deletion operation. Agree is referred to as an operation also in 'Derivation' (4/477, 40/530) and 'On phases' (141/623), whereas in 'Beyond' (113/555, 115/558, 116/560) and 'Three factors' (17/604) it is only referred to as a relation. 'Derivation' is the only paper in which Agree is referred to as both an operation and a relation (see 3/476). Furthermore, 'Derivation' introduces another relation Match (5/478), which becomes Match/Agree (8–9/482–83). According to 'Beyond', 'the simplest version of Agree would be based on the free relation Match', first defined as identity (115/558) and then corrected to nondistinctness (116/560; see also 'Derivation', 5/see footnote 28), given the analysis of uninterpretable features as those without values, a property of certain lexical items: 'The natural principle is that the uninterpretable features, and only these, enter the derivation without values, and are distinguished from interpretable features by virtue of this property' ('Derivation', 5/see footnote 28).[19] Thus, features without values are inherently uninterpretable, but assumed to be nondistinct from their valued counterparts. The values of unvalued features 'are determined by Agree' ('Derivation', 5/see footnote 28). According to 'Derivation', at the point at which unvalued features are valued, they 'must be deleted from the narrow syntax (or they will be indistinguishable from interpretable features at LF) but left available for the phonology (since they may have phonetic effects)' ('Derivation', 5/see footnote 28; see also 'Beyond', 113/553, 116/560).

Under this analysis, Agree would seem to perform two functions: valuation of unvalued features under the relation nondistinct Match and then deletion of these valued features before Transfer to the semantic component Σ (but crucially no deletion before Transfer to the phonological component Φ, where such features (e.g. Case and agree-

[19] 'Minimalist inquiries' identifies 'uninterpretable features of two types', agreement features involving number, person, and gender (ϕ-features), and a 'selectional feature' EPP that 'seeks an XP to merge with the category it heads' (122/444). Given the valuation criterion for uninterpretable features cited above, it is unclear how EPP constitutes such a feature. For further discussion, see 'Three factors' and 'On phases', where the EPP feature that was initially formulated specifically for Spec-TP (see 'Bare', 66/343) generalizes to other categories as an 'edge feature'.

ment) affect phonetic representation),[20] which requires two distinct Transfer operations that will not apply at the same derivational point unless the deletion occurs after Transfer to Σ, introducing a deletion operation into NS that is otherwise unmotivated. The question is why valued previously unvalued features must not occur at the C-I interface. According to 'On phases', the answer is that 'since these features have no semantic interpretation, they must be deleted before they reach the semantic interface for the derivation to converge' (154/647). However, the valued versions of previously unvalued features are 'indistinguishable' from—and in fact identical to—their interpretable counterparts; otherwise, valued and unvalued feature pairs could not have been nondistinct in the first place. But if the valued features in the lexicon have a semantic interpretation, then so must the valued previously unvalued features. That is, it is the lack of a value that constitutes the uninterpretability of a feature, not the feature itself. If this is the case, then the unvalued features should themselves be interpretable at the C-I interface, just not fully interpretable and therefore in violation of FI. Thus there is no issue of the C-I interface having to recognize as 'uninterpretable' features that it could not interpret at all. In addition to resolving technical problems with uninterpretable features (cf. Epstein & Seely 2002a, 2006), this analysis has two desirable consequences: NS will remain deletion-free, and Agree is limited to a single elementary operation of feature valuation.

Under this adjustment to the analysis of Agree, the operation involves only the valuation of unvalued features for probe and goal, not their erasure as stated in 'Minimalist inquiries'. As an illustration, consider the derivation of existential constructions, which are an empirical focus in 'Minimalist inquiries' and 'Derivation', using 21a with the analysis 21b, where the labeled braces indicate sets—that is, without linear order.

(21) a. There were several bankers secretly indicted.
b. $\{_T$ there $\{_T$ T-BE $\{_v$ v $\{_V$ secretly $\{_V$ indicted {several bankers}}}}}}

The expletive *there* has an unvalued person feature ('Derivation', 16/494). T has unvalued ϕ-features for person and number. The noun *bankers* has valued ϕ-features—that is, third person, plural, but an unvalued Case feature. Exactly how the derivation proceeds will be determined by several conditions on probe/goal relations postulated in 'Minimalist inquiries' and 'Derivation'. A probe, which by definition has unvalued features, is seeking a goal with nondistinct valued features. However, there is an activity condition on a potential goal that it too has unvalued features: 'uninterpretable features render the goal *active*, able to implement an operation' ('Minimalist inquiries', 123/446); therefore, both a probe and its goal 'must be *active*: once their features are checked and deleted, these elements can no longer enter into the Agree relation' ('Beyond', 115/558). Furthermore, there is a locality condition on probe/goal relations 'to minimize search' ('Beyond', 115/558) that is spelled out as 'closest c-command' ('Minimalist inquiries', 122/445).

In 21 the valued ϕ-features of *bankers* will value the unvalued ϕ-features of T. And if Case is a reflex of agreement (see 'Derivation', 16/494, 496), then the ϕ-features of T will value the Case feature of *bankers* as nominative. 'Minimalist inquiries' (122/444) proposes that structural Case is a reflex of UNINTERPRETABLE ϕ-features, so that the ϕ-features of the noun itself (e.g. *bankers* in 21) cannot value its structural Case feature, a subtle analysis with a peculiar requirement. Note that the ϕ-features themselves will

[20] 'Beyond' states that the interface condition IC 'requires all features to be interpretable', noting 'it is clear that there are uninterpretable features that must somehow be eliminated before the NS derivation is transferred to Σ' (113/553). The two versions of the second part of this quote do not agree. In the published version (Chomsky 2004), Σ is replaced with Φ, which seems to be a mistake.

not determine what structural Case is valued. If the features are associated with T, then nominative Case results, and with *v*, accusative Case as in exceptional case-marking (ECM) contexts (e.g. *They expected there to be several bankers indicted*). Furthermore, this proposal seems to run into a timing problem with respect to the activity condition. If the uninterpretable features of T value Case on the nominal, then the nominal becomes inactive and cannot value the unvalued ϕ-features of T. This would also leave unvalued the person feature of *there*, with no active goal available for valuation. One alternative is to value the unvalued person feature of the expletive first with its associate N as goal (not proposed in 'Minimalist inquiries', 'Derivation', or 'Beyond', the papers that deal with existential constructions), and then value the ϕ-features of T and the structural Case feature of *bankers* simultaneously. A second alternative is to value all of the unvalued features simultaneously.

The linear order in 21a must somehow derive from the set representation in 21b after Spell-out. One basic principle of linearization must be that members of a set are adjacent in linear structure. Thus {V, O} translates to the linear order [V O] or [O V]. In the case of {Adv {V, O}}, there are four possible linearizations, none of which match the order in 21a. To derive the linear order in 21a, an extra step will be necessary, one that positions *several bankers* outside of VP, presumably at the edge of *v*P—where linearization could yield 21a. In 'Derivation', this step is formulated as an English-specific obligatory phonological rule of 'thematization/extraction' (Th/Ex) that moves a direct object of an unaccusative or passive predicate to the edge of *v*P (20/501). The same effect can be achieved by IM, yielding 22, where the displaced *several bankers* is linearized to the left of the adverb.

(22) [$_{T}$ there [$_{T}$ T-BE [$_{v}$ [several bankers] v [$_{V}$ secretly [$_{V}$ indicted [several bankers]]]]]]

However, this raises a question about a potential difference between the syntactic structure of 21a and its nonexpletive counterpart *several bankers were secretly indicted* at the C-I interface. 'Derivation' gives an argument for the phonological rule formulation on empirical grounds that Th/Ex and WH-movement cannot both apply to the same constituent.

The next question is how this analysis extends to more complicated structures—that is, those with embedded clauses like 23.

(23) There are likely to be several bankers secretly indicted.

Again, *several bankers* has raised out of VP and linearized to the left of the adverb, as in 21a. Nonetheless, *bankers* remains in the embedded infinitival clause. The expletive *there* is pronounced as Spec-TP for the finite T. 'Derivation' considers two possible derivations for *there*: (i) it is merged as the matrix Spec-TP, or (ii) it is merged as the clausal complement Spec-TP of infinitival *to*, which does not have a complete set of ϕ-features, and then raises to matrix Spec-TP, which does. In the movement analysis, the activity condition guarantees that the expletive's unvalued person feature is not valued; otherwise it could not serve as a goal and raise to matrix Spec-TP to satisfy the EPP feature of finite T in the matrix clause. In the nonmovement analysis, which is considered as an alternative in 'Derivation' (9/484), the feature-valuation analysis of *there* is essentially identical to the one given for 21a, with one difference: the distance between the expletive and its associate N is greater, as is the distance between the associate N and the finite T whose ϕ-features it values. Nonetheless, no phase boundaries intervene between *bankers* and *there*/T_{finite} that would trigger Spell-out and the PIC; otherwise, the associate DP *several bankers* would be spelled out before its Case feature

is valued, causing a crash at one or both of the interfaces. And the same must be true for the following examples.[21]

(24) a. There are believed to be likely to have been several bankers indicted for fraud.
b. There are believed to have been reported to be several bankers indicted for fraud.
c. There are believed to have been reported to be likely to be several bankers indicted for fraud.

Each of these examples with expletive *there* has a counterpart where the associate DP *several bankers* is moved to the matrix Spec-TP of T_{finite}.

(25) a. Several bankers were indicted for fraud.
b. Several bankers are likely to be indicted for fraud.
c. Several bankers were reported to be likely to be indicted for fraud.
d. Several bankers are believed to have been reported to be likely to be indicted for fraud.

Unless the infinitival Ts have an EPP feature, for which there does not seem to be any motivation other than keeping the domains in which IM applies small, then IM displaces the DP *several bankers* directly from the VP headed by *indicted*, in which case there would not be an intervening phase boundary to activate the PIC and trigger Spell-out. This is required in the case of 22–23 because the Case feature of the associate DP can only be valued by the ϕ-features of finite T. If so, then the size of phases can be arbitrarily large, clearly not what is intended in these papers.

As formulated here and also in 'Minimalist inquiries' and 'Derivation', the Agree-based analysis of Case for the associate DP in expletive constructions separates Case valuation and displacement. What motivates movement in 25 is solely the EPP feature on finite T. The claim that 'uninterpretable features are the mechanism for displacement, perhaps even an optimal mechanism' ('Beyond', 116/562) will not hold if 'uninterpretable' is synonymous with 'unvalued', unless there is some way of interpreting an EPP feature as unvalued, which does not seem evident (see n. 19 above). One solution would be to reinstate a classical Case filter analysis, where the expletive bears unvalued structural Case (see Deal 2009 and Sobin 2014)—not out of the question if structural Case is abstract and need not strictly correlate with overt morphological Case. If the expletive occurs in a position where its Case feature cannot be valued (e.g. Spec-TP of infinitival T), then its Case feature will be unvalued in violation of FI. But this does not account for the deviance of 17a. Given the analysis of 21, the finite T in 17a would value the Case feature of the expletive associate, which is closer to finite T than in 17b where there is no problem. Example 17a appears to demonstrate that the infinitival T in this structural configuration does not have an EPP feature, but unless there is a principled reason for this, it remains a stipulation, a description of a fact. A classical Case filter analysis of 17a might claim that the associate DP does not occur in a Case-marked position, thereby violating the filter; but this is undermined by the fact that the associate that has not moved (e.g. 17b) does not violate the Case filter. According to 'Derivation', 'Case assignment is divorced from movement and reflects standard properties of the

[21] Example 24c appears to be more degraded than 24a–b, possibly because of the complexity of a triple embedding. Nonetheless, if the grammatical mechanisms allow 23, then they should by themselves allow all of the examples in 24—unless there is some general constraint on the mechanisms that prevents the generation of some or all.

probes, indicating that it is a reflex of Agree holding of (probe, goal); the EPP-raising complex is a separate matter' (17/496–97). If so, then a classical Case filter analysis, in which Case assignment and movement are linked, cannot explain the deviance of 17a. See Epstein et al. 2014 for an account of 17a based on the labeling theory of Chomsky 2013a.

INHERITANCE. The separation of Case assignment from movement is dropped in the analysis of 'On phases'. There it is assumed that C has two probes, 'the edge feature EF that is automatically available for an LI' and an 'Agree-feature' (i.e. ϕ-features), where the former 'attracts the wh-phrase to the edge of C', while the latter 'attracts the DP, but only as far as T, with which it agrees' (148/636; cf. also 'Minimalist inquiries', footnote 50, which attempts to generalize the notion of 'EPP-feature' for a head 'by virtue of its inherent properties (e.g. Case/agreement properties of *v*, the Q-feature of interrogative C)', a device that 'is introduced to extend the general theory of movement beyond A-movement, but should raise warning flags'). The mechanism for this is called *inheritance*: 'T inherits its Agree feature from C, and then derivatively serves as a probe at the phase level CP' (148/637). Thus the so-called EPP feature of T is in actuality an Agree feature, in which case, movement and Case are once again connected phenomena. One potentially serious drawback of the proposal is that it requires an anticyclic operation (inheritance) and the anticyclic operation of IM in the case of movement to Spec-TP ('tucking-in' of N. Richards 2001), both of which violate the NTC (the former 'a narrow violation', which might still satisfy the SMT (144/628–29)). 'On phases' proposes that 'on optimal assumptions, transmission of the Agree feature should be a property of phase-heads in general, not just of C' and therefore *v** should be able to transmit an Agree-feature to V, motivating displacement to Spec-V in ECM configurations and triggering V to *v** movement as well (148/637).

The inheritance analysis is based on a few fundamental assumptions, first and perhaps foremost that 'transmission of the Agree feature should be a property of phase-heads in general'. Although this is claimed to follow 'on optimal assumptions', these are not stated in 'On phases'. What is stated as an assumption is that 'only phase heads trigger operations' (144/629), a conceptual assumption (cf. the discussion of conceptual arguments above) and one that is immediately challenged by 'inheritance' phenomena (including displacement to Spec-TP). 'On phases' also assumes that 'for T, ϕ-features and Tense appear to be derivative, not inherent: basic tense and also tense-like properties (e.g. irrealis) are determined by C (in which they are inherent: "John left" is past tense whether or not it is embedded) or by the selecting V (also inherent) or perhaps even broader context'; it also assumes that T lacks these features in the lexicon and, furthermore, that 'T manifests the basic tense features if and only if it is selected by C (default agreement aside)' (143/627). This set of assumptions is, however, more suggestive than convincing and is based on an analysis of the selection relation that may not be necessary (or optimal) under derivation by Merge. Instead of the standard view of selection as top-down (from a head to the head of its complement), it is possible to define the relation bottom-up where the properties of the head of an SO determine the properties of a head with which the SO can merge. Thus T selects C and V selects *v**/*v*—in which case, T could have tense features and unvalued ϕ-features.

'On phases' offers the following empirical evidence for the inheritance analysis involving subject island effects. The examples in 26 are adaptations of the original examples (exs. 5–7), giving only the WH-interrogative versions without the preposition pied-piped; the cleft examples are not given here.

(26) a. Which car did they find the driver/picture of?
b. *Which car did the driver/picture of cause a scandal?
c. Which car was the driver/picture of awarded a prize?

(Variants 26a and 26c, where *of which car* is raised to Spec-CP, seem somewhat less acceptable, but variant 26b is equally deviant.) 'On phases' suggests that because 26c patterns like 26a and not 26b, which it structurally resembles (the surface subjects occupy the same overt position), the island effect is determined by the covert positions of the WH-phrase, where the WH-phrase in 26c, like the one in 26a, is first merged with V and moved from that position. In the passive construction (26c) the matrix CP is the only phase, and hence C is the only phasal head with features that drive the two operations: movement of the WH-phrase to Spec-CP and movement of the DP containing the WH-phrase to Spec-TP, applying in parallel according to 'On phases'. If movement to Spec-TP occurs first, then the distinction between 26b and 26c would be lost, presumably assuming that WH-movement in both derivations would occur from Spec-TP. Note that this analysis assumes that WH-movement in 26b occurs when the DP containing the WH-phrase is in Spec-TP. However, this does not follow from the inheritance analysis. In the derivation of 26b, the subject DP containing the WH-phrase is merged as Spec-*v** (the VP-internal subject hypothesis; see the discussion of 7 above). By hypothesis, T has no features to drive movement to its Spec position, so movement can only be driven by C. Therefore when C is merged, it can transmit its ϕ-features to T and attract the WH-phrase in Spec-*v**P to Spec CP while T simultaneously attracts the DP in Spec-*v**P to Spec-TP. This is exactly what happens to the DP containing the WH-phrase in the derivation of 26c. So it seems that the inheritance analysis of C/T provides no basis for the explanation of the examples in 26.

The island-based argument for inheritance also seems weak empirically because different lexical choices affect judgments (see also the comment in footnote 39 of 'On phases'). Thus consider 27, where *celebrity* replaces *car* and *an unauthorized biography* replaces *the driver*/*picture*.

(27) a. Which celebrity did they find an unauthorized biography of?
b. Which celebrity did an unauthorized biography of cause a scandal?
c. Which celebrity was an unauthorized biography of awarded a prize?

Examples 27b and 27c seem on a par, and perhaps slightly less acceptable than 27a. Unless the lexical choices involve structural differences, which seems unlikely in this case, the deviance of 26b is not obviously a structural problem concerning 'syntactic islands'. And if inheritance does not distinguish the derivations of 26a–c (or 27a–c) as detailed above, there is no empirical motivation for tolerating violations of the NTC (via feature transmission and tucking-in). What remains is the conceptual assumption that 'only phase heads trigger operations', which under the circumstances may not outweigh the NTC, plausibly a general (and hence third-factor) principle of efficient computation.

To the extent that the NTC, the IP (if not subsumed by the former), and FI contribute significantly to the computational efficiency of a system of minimal elementary operations that are also empirically indispensable, there is good reason to regard the SMT as a viable thesis, in spite of the current lack of precise formulations for interface conditions. The system of operations developed in these papers consists of Merge and Agree, along with some version of Transfer that bifurcates a derivation so that the 'phonological' operations of linearization and deletion can map the derivation to the S-M interface, all of them empirically indispensable.

5.2. PAIR-MERGE. In spite of the clarity and simplicity of a theory of phrase structure based on Merge, however, there remain empirical and theoretical issues that are as yet far from having anything that approaches a definitive account. On the empirical side, there is the phrase structure analysis of adjuncts, which in the mid-1990s elicited the comment 'we still have no good phrase structure theory for such simple matters as attributive adjectives, relative clauses, and adjuncts of many different types' (Chomsky 1995b, Ch. 4:228; see also 'Beyond', 117/563). 'Minimalist inquiries' and 'Beyond' attempt to provide a theory of adjuncts by complicating the analysis of Merge, proposing two distinct operations of Set-Merge versus Pair-Merge. On the theoretical side, the labeling of syntactic objects has continued to be a central focus for the theory of syntax, starting with 'Minimalist inquiries' and Collins 2002, and continuing most recently with Chomsky 2013a, 2015. Under the initial formulation in 'Bare' (63/339), Merge performs two functions: forming a new SO out of other SOs and labeling the newly created SO: 'The operation Merge, then, is asymmetric, projecting one of the objects to which it applies, its head becoming the label of the complex formed'. In the later papers, the labeling function (projection) constitutes a separate operation, raising questions about what constitutes a label and how labels are determined.

In 'Minimalist inquiries', 'pure Merge' (i.e. not Move, which compounds Merge plus Agree, under the analysis of that paper) covers 'two cases: Set-Merge and Pair-Merge' (133/463). Set-Merge forms an unordered set {α, β}, where α merges with β and vice versa, so that either α or β might project. In contrast, Pair-Merge forms an ordered pair <α, β>, where α adjoins to β, but not vice versa. Thus Set-Merge is a symmetric operation, whereas Pair-Merge is an inherently asymmetric operation: 'if α is adjoined to β, the construction behaves as if α isn't there apart from semantic interpretation, which is not that of standard X-bar theoretic constructions' ('Beyond', 117/563). With the former, merger of α and β 'is to satisfy (selectional) requirements of one (the *selector*), but not both' ('Minimalist inquiries', 133/463)—an asymmetry that concerns labeling rather than the operation itself. The selector for Set-Merge is 'typically unique' (134/464) and renders the operation obligatory. In contrast, Pair-Merge involves no selector and is therefore optional. Furthermore, 'an adjunction construction is plainly not the projection of a head: for NP-adjuncts, for example, the constituent structure appears to be something like [NP, XP]' ('Beyond', 117/563). If P designates the maximal projection of N and X, then the labeling of adjunction constructions cannot involve category features and therefore remains uncertain. The claim in 'Beyond' appears to deny a head-adjunct relation, which seems problematic given that adjuncts function as modifiers of heads (e.g. adverbials for verbs and relative clauses, APs, PPs for nouns).

'Beyond' (118/564) attempts to motivate adjunction (hence Pair-Merge) as 'a device to yield predicate composition at SEM', an enrichment of expressive power not provided by Set-Merge (which yields the duality of interpretation that comes from argument structure), including 'θ-roles, the "cartographic" hierarchies, and similar properties', in contrast with 'discourse-related properties such as old information and specificity, along with scopal effects' ('On phases', 140/622). Technically, however, the analysis of adjunction outlined in 'Beyond' (117–18/563–64) gets complicated, starting with the suggestion that 'given the basic properties of adjunction, we might intuitively think of α as attached to β on a separate plane, with β retaining all its properties on the "primary plane," the simple structure'. As empirical motivation, 'Beyond' cites the binding theory phenomenon (e.g. ex. 11), where an R-expression in a relative clause modifying a displaced nominal escapes condition C effects by presumably not reconstructing into argu-

ment positions along with the nominal it modifies (see Freidin 1986)—for example, 28 (i.e. ex. 11 in 'Beyond').

(28) $[_{wh}$ which $[_{\alpha}$ $[_{NP}$ picture $[_{\beta}$ of Bill]] $[_{ADJ}$ that John liked]]] did he buy t_{wh}

Under the copy theory, if the trace of the WH-phrase includes the relative clause, reconstruction follows as a consequence, and therefore, given condition C, the pronoun *he* could only be interpreted as disjoint in reference with the R-expression *John*—which is not the case with the possible interpretations of the pronoun in 28. Given that *he* can be interpreted as *John*, the WH-trace should not include the relative clause, in which case the relative clause would have to be (pair-)merged with the WH-phrase *which picture of Bill* after displacement of this WH-phrase to Spec-CP, what is called 'late insertion' (as proposed in Lebeaux 1988)—this in violation of the NTC, unless the two-planes analysis is more than just a metaphorical description in lieu of a formal analysis that has yet to be discovered. It remains to be determined whether adjunction phenomena under this analysis conform to the SMT or constitute a significant departure from it.

5.3. LABELING. SOs represented simply as sets or pairs do not suffice for interpretation at the interfaces, which require more information: 'thus verbal and nominal elements are interpreted differently at LF and behave differently in the phonological component' ('Bare', 62/337) (e.g. the verb *permit* and the noun *permit* and the phrasal constructs they participate in). 'Three factors' notes that 'labels, or some counterpart, are the minimum of what is required, on the very weak assumption that at least some information about a syntactic object is needed for further computation, both for search within it and for its external role' and characterizes this as, optimally, information to 'be captured entirely in a single designated element, which should furthermore be identifiable with minimal search: its label, the element taken to be "projected" in X-bar-theoretic systems' (14/599–600)—'the best case' ('On phases', 141/623). If the label of an SO identifies its head, then other constituents merged with it must be interpreted in some subsidiary relation as complement or specifier/adjunct/modifier. Moreover, according to 'Minimalist inquiries', 'computation is driven by a probe/selector of a label, which projects' (135/465), a statement that is reiterated in a simpler formulation in 'Beyond': 'operations are "driven" by labels' (109/545)—underscoring the importance of labels for C_{HL}.

Given the importance of labels, it is somewhat surprising that the papers that discuss them tend to leave open precisely what they are. The very first discussion of labels states that a label 'identifies the relevant properties' of an SO and must be constructed from the two constituents α and β of the SO, where the label is either one or the other, which projects and is the head of the SO ('Bare', 62/337). The relevant properties are those 'relevant to further computation (perhaps the categorial information D, N [in reference to the analysis of *the book—RF*]; Case; etc.)' (63/339). It is worth noting that this formulation is the beginning of a rejection of the standard analysis of phrase structure grammar, which assumes only syntactic category labels. First, the relevance of categorial features is downgraded to 'perhaps', with Case added as a possible label, and then there is the intriguing 'etc.' (consider for example the use of the label *wh* in 27). The only other paper to mention syntactic categories as labels is 'Minimalist inquiries', where they are initially equated and then equated with lexical items: 'no matter how complex the object constructed, its label is an LI' (133/463).

While it is obvious that lexical items must be the source of features that are relevant to further computation, the only analysis where lexical items actually serve as labels occurs in ex. 3b of 'Bare', where *the* labels the SO consisting of *the* and *book*. Moreover,

under this analysis all features of a lexical item are apparently relevant, which contradicts the more cautious suggestion in the parenthetical statement quoted above. Thus, equating labels with LIs may be a bit of an overstatement if taken literally and seems in context to represent a casting around for a characterization of the notion of label.

Ever since 'Nominalization', published a quarter of a century before 'Bare', it has been recognized that the distinction between categories and features is artificial and can be eliminated if we 'regard all symbols of the grammar as sets of features' ('Nominalization', 208/42), thereby equating categories and features (e.g. N = +N, etc.).[22] Although it follows without additional stipulation that categories would then be features projected from lexical items, nowhere in 'Nominalization' is the noun *projection* or the verb *project* mentioned, and, perhaps surprisingly, nowhere in Chomsky's writings is the term *phrasal projection* used. The concept of projection is implicit in the X-bar analysis developed in 'Nominalization', but the term *projection* only first occurs in 'Minimalist program' (172/264), roughly sixteen years after the verbal term *project* is used in 'Filters' to characterize the relation between 'major categories (NP, VP, etc.)' and the basic lexical features (±N, ±V) from which they are 'projected' (430–31/66). Note too that 'Filters' also contains the first published reference (in Chomsky's writings) to the feature analysis of syntactic categories defined by multiple features, an analysis that also occurs in Chomsky's 1974 Amherst lectures (unpublished), whereas 'Nominalization' at first rejects a feature analysis of categories (199/17–18) and then finishes the paragraph with 'it is quite possible that the categories noun, verb, adjective are the reflection of a deeper feature structure', concluding that 'for the moment, however, this is hardly clear enough even to be a speculation' (199/28), which, however, does not prevent a second reference to the possibility several pages later (210/46).

Although the question of which lexical features constitute the labels of syntactic objects that drive computation remains largely unanswered, it is assumed in the later discussions of labels, starting with 'Minimalist inquiries', that they are predictable ('Minimalist inquiries', 134/464), in the best case 'determined by a general algorithm' ('Derivation', 3/475), possibly 'by a general rule' based on the assumption 'that {α, β} is identified either by α or by β (its label); a label, then, is always a head' ('Beyond', 109/544) or 'by a natural algorithm' ('Three factors', 14/600), called 'a simple algorithm' in 'On phases', for which 29a–b are given as 'two obvious proposals' (145/630).

(29) a. In {H, α}, H an LI, H is the label.
b. If α is internally merged to β, forming {α, β}, then the label of β is the label of {α, β}.

'On phases' designates these algorithms as 'principles', claiming that they 'suffice for virtually every case', but also noting a complication that arises when they interact. These algorithms identify the head of an SO, but they do not specify what features of the head actually constitute the label. In general, it seems an unstated assumption that the syntactic category features of a head constitute the label of the SO. 'Minimalist inquiries' concludes its discussion of labels with the claim that 'both label determination and operations are "first-order Markovian," requiring no information about earlier stages of derivation' (135/465). However, what is called 'label determination' is in actuality only head determination, which may only be a first step in determining the label

[22] The analysis in 'Nominalization' does not, however, opt for the most restrictive theory of category features because it allows for the possibility of phrasal category features like +NP (208/42), which are prohibited in principle by the IP.

of an SO. The situation becomes even more complicated if lexical items are roots without a category designation, as mentioned in 'Minimalist inquiries', 'Derivation', and also 'On phases', which refers to Marantz 1997. If labels are perhaps not always constructed of syntactic category features, as suggested in 'Bare' (see quote above), then determination of a head and its label becomes a more complicated issue. See for example Chomsky 2015, which proposes that the label of a finite clause is a pair of ϕ-features <ϕ, ϕ>. If correct, then labeling theory radically revises the analysis of phrase structure.

The separation of composition via Merge from projection via labeling algorithms simplifies the formulation of the former in a way that makes it clear how composition of SOs appears to conform to the SMT as discussed above, with a caveat about the uncertain status of a theory of adjunction. However, whether the identification of SOs (projection) under a labeling theory will also conform to the SMT remains to be established.

6. *Perfect* and/or *optimal*. One of the main problems with the SMT as a goal of the enterprise has been its formulation and interpretation, which crucially involve the interpretation of the adjectives *optimal* and *perfect*, whereby language (or linguistic expressions or FL) is a perfect and/or optimal solution to interface conditions.

Regarding the question of 'perfect', these papers utilize two approaches: one, to identify under what conditions language would be a 'perfect system' (this term used only once in 'Bare', 51/321), and the other 'to seek "imperfections" of language, properties that language should not have' under the SMT—as 'a research strategy'—to determine whether they are real properties of language that might be 'part of a "best way" (perhaps not unique) to meet design specifications', in which case they would not be imperfections ('Minimalist inquiries', ex. 29). The quotation marks around *imperfections* recur in 'Bare' and 'Derivation' as well, indicating that what the term covers is not obvious and thus subject to some significant interpretation.

Along the lines of the first approach, 'Minimalist inquiries' (96/404) proposes that one criterion for a perfect solution would be the situation in which 'FL satisfying legibility conditions in an optimal way satisfies all other empirical conditions too: acquisition, processing, neurology, language change, and so on' (quoted earlier in §2.2)—which shifts the burden to the interpretation of 'an optimal way', and nonetheless remains at present more speculative than substantive for obvious reasons. 'Derivation' (2/474) seems to suggest that a system satisfying only legibility conditions would be another requirement. 'Bare' proposes that 'in a perfect language, any structure Σ formed by the computation—hence π and λ—is constituted of elements already present in the lexical elements selected for N; no new objects are added in the course of computation (in particular, no indices, bar-levels in the sense of X′ theory, etc.)' (59/333)—that is, the inclusiveness principle, though not so designated in this paper. This top-down approach to the question is suggestive, but of an abstractness (excluding the inclusiveness requirement) that leaves the question unresolved.

Coming at the question from the perspective of 'imperfections' has the potential to yield more concrete results because it directly addresses C_{HL}. 'Minimalist inquiries' identifies the 'dislocation' property and uninterpretable features of lexical items as imperfections (119/439), to which 'Derivation' adds Agree (3/476). 'Minimalist inquiries' later suggests that the former two might reduce to one: the dislocation property, given that uninterpretable features are 'a device used to yield the dislocation property' (121/443)—but recall the analysis of expletive constructions discussed above where Agree apparently operates independently of dislocation. To this list can be added 'varieties of government' ('Minimalist inquiries', 117/437) and parametric variation ('De-

rivation', 2/474). For all intents and purposes, government was abandoned pretty much solely on the strength of the objections to it in 'Minimalist program'. (See Freidin 1997, especially footnote 3, for some discussion.) Parametric variation too can be dismissed if it is 'restricted to the lexicon, and insofar as syntactic computation is concerned, to a narrow category of morphological properties, primarily inflectional' ('Derivation', 2/475), a thesis credited to Hagit Borer and unspecified others (see Borer 1984)—given that 'one expects "imperfections" in the formal part of the lexicon' ('Bare', 54/326). In the end, the discussion of putative imperfections focuses on the displacement property and uninterpretable features, involving the operations Move and Agree. Both 'Minimalist inquiries' and 'Derivation' attempt to argue that displacement, Agree, and uninterpretable features are not actually 'imperfections' on the grounds that the latter two 'may be part of an optimal solution to minimal design specifications by virtue of their role in establishing the property of "displacement," which has (at least plausible) external motivation in terms of distinct kinds of semantic interpretation and perhaps processing' ('Derivation', 3/476).

Considering the displacement property to be an 'imperfection', as it turned out, is a 'mistake' ('Beyond', footnote 29), because the simplest formulation of Merge—the one that was assumed all along—yields displacement (noted in 'Beyond', 110/548, as quoted above, and also 'Three factors', 12/596–97, and 'On phases', 140/662). The source of the mistake was an incorrect analysis of the mechanism for implementing displacement. 'Minimalist inquiries' (101/413) assumes that mechanism to be a complex operation Move, compounding Merge (applied to features rather than phrases), Agree, and generalized pied-piping (necessary for the displacement of phrases), an analysis reiterated in 'Derivation' (10/485). This presumed difference in complexity between Merge and Move was then utilized in 'Minimalist inquiries' and 'Derivation' as a basis for a general principle under which simple operations were preferred to complex ones, the Merge-over-Move analysis for expletive constructions offered as empirical evidence. The analysis of Move is also linked to the notion of 'last resort', where Move is 'chosen when nothing else is possible' ('Minimalist inquiries', 102/413), which suggests that economy considerations might be the underlying motivation for the Move analysis. The demise of Move under the simplest interpretation of Merge undermines the immediate relevance of the general principle as well as its application to the analysis of expletive constructions.

If it turns out that the only apparent imperfections that have been suggested are not actual imperfections, it does not necessarily follow that FL is in fact perfect under some formulation of the SMT—that would depend ultimately on what criteria there are for defining 'perfect' in this context.

Turning then to the other crucial adjective in the formulation of the SMT, we return to the original formulation in 'Minimalist program': 'The linguistic expressions are the optimal realizations of the interface conditions, where "optimality" is determined by the economy conditions of UG' (171/262). 'Minimalist program' concludes with the statement that 'economy can be given a fairly narrow interpretation in terms of FI, length of derivation, length of links, Procrastinate, and Greed' (212/319). Interestingly, most of this list eventually falls out of consideration. Length of derivation as an economy measure requires comparison of derivations, which inevitably involves look-ahead and possibly back-tracking, introducing nonoptimal complexity into computations. Length of links, what is referred to as the MINIMAL LINK CONDITION in later papers (see 'Bare', 67/344) though not formally defined, suffers from the same problem if it involves comparing derivations. Procrastinate is defined in 'Minimalist program' as a principle according to which 'LF movement is "cheaper" than overt movement' (198/299). 'Min-

imalist inquiries' says that 'preference for Agree over Move yields much of the empirical basis for Procrastinate and has other consequences' (102), but thirty pages later concludes that 'the principle of Procrastinate is no longer formulable (at least as before), eliminating another case of look-ahead' and moreover 'the concept of strength, introduced to force violation of Procrastinate, appears to have no place' (132/461). 'Derivation' adds a clarification that the collapse of the overt/covert distinction is what makes Procrastinate unformulable: 'purely "covert" Agree is just part of the single narrow-syntactic cycle' (15/493). Greed is formulated in 'Minimalist program' as 'self serving Last Resort', a companion principle to Procrastinate (201/303). As presented in 'Minimalist program', 'the notion of Last Resort operation is in part formulable in terms of economy: a shorter derivation is preferred to a longer one, and if the derivation D converges without application of some operation, then that application is disallowed' (200/302). Last resort, and therefore Greed, like Procrastinate involves comparison of derivations, hence look-ahead. In 'Minimalist inquiries', Greed is reformulated as ENLIGHTENED SELF-INTEREST following Lasnik 1995, where 'movement is still motivated by morphological requirements, just as in Chomsky's theory, but the requirements need not be limited to those of the moved item; the target can be the beneficiary' (Lasnik 1995:620), to which is added 'the further requirement that the matched probe delete: we might call the principle Suicidal Greed' and the observation that Suicidal greed does not require look-ahead (127/452). Nonetheless, neither Suicidal greed nor 'Last resort' under any formulation is invoked in the following papers, indicating, it would seem, their lack of utility for the theory being developed.[23] Thus the set of economy conditions cited above reduces to the sole economy condition on representations, which itself could be interpreted as an external interface condition, therefore not part of UG—in which case there would be no independent measure for optimality as proposed in the original formulation of the SMT.

There is, however, another way to evaluate *optimal* if we consider the history of the generative enterprise, in particular the evolution of the grammatical operations that have been postulated for C_{HL} from its modern beginnings in the early 1950s to the present. Initially, phrase structure rules and transformations constituted the two indispensable mech-

[23] The history of the term 'last resort' illustrates the intricate nature of the concept. It first occurs (in quotes and without capitals) in Chomsky 1986 regarding a suggestion that the lack of Case on NP-traces might constitute an independent principle: 'Its intuitive content is that movement is a kind of "last resort" ' (p. 143). Chomsky 1986 proposes a condition (p. 170) on chains whereby the head of a maximal chain is in a Case-marked position, referred to as 'the "last resort" condition' (p. 180) and claimed to bar Case-marked trace, 'thus making movement a "last resort" ' (p. 189). Chomsky 1991 refers to 'the Last Resort condition on movement, which yields a partial explanation for the requirement that A-chains be headed by a Case position and terminate in a θ-position (the "Chain Condition"), has the corresponding effect of eliminating superfluous steps in derivations, thus minimizing their length' (1995b:130). However, in Chomsky & Lasnik 1993, the term 'last resort' is first cited in a more general context: 'The principle of economy of derivation requires that computational operations must be driven by some condition on representations, as a "last resort" to overcome a failure to meet such a condition' (1995b:28). In the next citation, the term has become a condition with capitals: 'The Last Resort condition on movement (see section 1.1) requires that movement is permitted only to satisfy some condition, in particular, to satisfy visibility (hence, FI)' (p. 46), a formulation that is reiterated in 'Minimalist program', which states that 'the basic economy-of-derivation assumption is that operations are driven by necessity: they are "last resort," applied if they must be, not otherwise' (199/301). Worth noting here is that although 'Minimalist program' interprets this as a preference for the shortest derivation (200/302), this conception of last resort as formulated in Chomsky & Lasnik 1993 necessarily does not involve comparing derivations. The last reference in these papers to 'last resort' occurs in 'Minimalist inquiries', where it is applied to Move, 'chosen when nothing else is possible' (102/413), an evaluation that once again requires comparison of derivations.

anisms for generating linguistic expressions. Formulations of both sorts of operations were complex and tended to be language-particular (see Freidin 2012, Lasnik & Lohndal 2013 for discussion). In contrast, the simple unconstrained formulation of Merge constitutes a massive reduction of grammatical apparatus (phrase structure rules and movement transformations) to a single elementary operation, conforming to the previously mentioned important prohibition that transformations (grammatical rules) cannot compound elementary operations ('Contraction', footnote 1; 'On binding', 4/193), which Move as formulated in 'Minimalist inquiries' and 'Derivation' violates. Merge also subsumes the function of a special rule of 'lexical insertion' (cf. the substitution operation utilized for this purpose in *Aspects*). With Merge, the formulation of grammatical mechanisms for C_{HL} approaches what might be considered 'optimally simple', a criterion that is at least easier to evaluate than other considerations of economy.

At this point we can at last address Chomsky's comment in the foreword to this volume about how the very goals of the enterprise may still seem 'in many ways obscure' (ix). If pursuing the SMT is taken to be the immediate goal of the current enterprise, then there are two obvious sources: interface conditions external to FL, and the interpretation of the adjectives *optimal* and *perfect* as applied to the interaction between these conditions and FL. Regarding the former Chomsky (2000b:26) comments:

> To the extent that the strong minimalist thesis holds, interface conditions assume renewed importance. They can no longer simply be taken for granted in some inexplicit way, as in most empirical work on language. Their precise nature becomes a primary object of investigation in linguistics, in the brain sciences, in fact from every point of view.

Unfortunately, the intervening fifteen years seem to have produced virtually nothing about the precise nature of these conditions, excepting the imposition of linear order at the S-M interface. And without explicit formulations, it is not really possible to evaluate precisely the interaction between these unknown conditions and FL, about which, thanks to the generative enterprise, a great deal is known. But we do have reasonably precise proposals concerning general properties for efficient computation in the form of FI and the NTC/IP, which contribute to principled explanation and thereby support the SMT. Assuming, plausibly, that these principles are not intrinsic properties of the interface systems, we might consider reformulating the SMT along the lines of 'C_{HL} is an optimal (perhaps even perfect) system satisfying third-factor properties of minimal computation', with the contribution of interface conditions left as a factor that could eventually be established. Most recently, Chomsky reformulates the SMT, referred to as a conjecture 'that UG reduces to the simplest computational principles, which operate in accord with conditions of computational efficiency' (Berwick & Chomsky 2016:94), without any reference to interface conditions.

Nonetheless, 'tenable or not, the SMT sets an appropriate standard for true explanation' ('Derivation', 2/474) for the generative enterprise, in much the same way that a unified field theory sets the standard in physics. And if language is 'an instrument of thought' (Chomsky 2013b:36; see discussion above), then pursuing the SMT ultimately involves understanding the relation between language and thought, which may well be a harder problem than the unified field theory because there is at present no way to observe individual thoughts or measure them in terms of their immediate effects, nor is there any way to enlist mathematics to aid in their investigation.

In spite of the very obvious problems that remain, the generative enterprise over the past sixty years, including especially the pursuit of the SMT for over a third of this time, has produced a deeper understanding of language, both in terms of what is now understood as well as what is not. The former category includes the ideas and analyses we

currently believe to be correct as well as those ideas and analyses that have been discarded as 'mistakes'. To get some perspective on the scope of this, a simple comparison of what constituted C_{HL} in the mid-1950s, especially complex phrase structure rules and transformations, with its current state of evolution under the SMT is especially revealing. The evolution toward the optimally simple computational devices whose operation is tightly constrained by what appear to be natural principles of efficient computation not specific to language is to be expected if something like the SMT is true.

This evolution produced several interesting mistakes along the way, including the analysis of displacement as an imperfection, as discussed above, the elimination of generalized transformations in favor of 'generalized phrase-markers' (*Aspects*, 1965:134), the theory of government, opting for trace theory instead of copy theory ('Three factors', 13/597), and possibly a binding theory that attempted to unify movement and construal. It is more than likely that the first two were encouraged by an unstated assumption that phrase structure rules are simpler and more basic than transformations, which were initially considered a necessary complication of grammars. The elimination of generalized transformations in the early 1960s is a clear case of a preference for phrase structure rules over transformations. It involved a reformulation of 'the recursive property of grammar' as 'a feature of the base component'—'in particular, of the rules that introduce the initial symbol S in designated positions in strings of category symbols' (*Aspects*, p. 137). This reformulation had beneficial effects, in particular the elimination of 'transformation markers' that tracked derivational histories and the introduction of the transformational cycle, which eliminated derivational possibilities for which there was no empirical evidence (see *Aspects*, Ch. 3, and Freidin 1999, 2017 for discussion). The device of generalized transformations reenters the discussion in 'Minimalist program' (189–90/286–87)—interestingly, prior to the formulation of Merge, and it is not mentioned in 'Bare' where Merge is first formulated. Moreover, the fact that Merge is a generalized transformation is only mentioned in 'On phases', which points out that 'reliance on iterable Merge as the sole computational operation of narrow syntax eliminates, as unformulable, the notions d- and s-structure, and three of the compositional operations of EST: those that form d-structure and map it to s-structure, and then on to LF' and states that Merge 'also revives, in far more elementary terms, the notion of generalized transformation of the earliest work in generative grammar in the 1950s' (139/621). The treatment of the displacement property is predicated on a distinction between the operations Merge and Move, the latter involving the former as well as other elementary operations (Agree and generalized pied-piping) and therefore more complicated. The Merge versus Move dichotomy is also a reflection of the historical dichotomy between phrase structure rules and transformations, where Merge can be identified as the replacement for phrase structure rules. The fact that there is only Merge (i.e. only transformations) reveals the unstated assumption to have things exactly backward. It might be claimed that this was a mistake of not taking Merge seriously, which was not corrected until 'Beyond'.

The theory of government too might be viewed as a development motivated by the difference between phrase structure rules and transformations. That is, the theory can be construed as an attempt to unify the theory of phrase structure under X-bar theory with the theory of transformations under trace theory (see Freidin 1994b for discussion). In contrast to theories of government, which were formulated in the early 1980s, Merge is obviously the minimal and optimal solution to this unification.

The mistaken choice of trace theory over copy theory cannot be explained as an effect of any assumption about phrase structure rules versus transformations. The written

record shows that the copy theory was not considered at all when trace theory was formulated in the early 1970s. If it had been understood then that the copy theory was 'the simplest version of transformational grammar' and 'the null hypothesis' ('Minimalist inquiries', 114/432, and elsewhere), there would have been at least some justification offered for choosing the more complicated trace theory. 'Minimalist inquiries' notes that *LSLT* adopted a complex movement operation (essentially Merge-Delete) 'on the assumption that T-markers are mapped to PF', and when movement was reformulated under the EXTENDED STANDARD THEORY, 'Delete was abandoned in favor of trace theory, trace being a new kind of element' (footnote 62)—an 'empty' category. According to 'On binding', 'movement of the category α is assumed to "leave behind" the category $[_{\alpha}\ e]$, in accordance with trace theory', an assumption that is claimed to be 'implicit in earlier versions of transformational grammar, and becomes explicit when compounding of elementary transformations is forbidden' (4/193). That the prohibition against compounding deletion with the movement operation might yield copies rather than traces was not considered when trace theory was developed. One plausible explanation for this might be the focus at the time on the possibility of unifying displacement and construal in terms of binding, where NP-traces were considered to be the empty category counterparts to lexical anaphors and the binding relation was expressed by the single device of coindexing and subject to the same general set of structural constraints (as developed in Chomsky 1976 and 'On binding', with a further attempt to unify this theory with a theory of government by recasting binding conditions in terms of government in Chomsky 1981b). In contrast, 'Minimalist program' formulates binding conditions without reference to traces—the discussion of these conditions does not include movement examples—and without resort to indexing (see also Chomsky & Lasnik 1993), thereby refuting the simplistic critique of 'canonical' binding theory that it can no longer be formulated because it is based on indexing (e.g. Reuland 2011:53). (However, see Hornstein 2000 for a more recent attempt to realize a unification of construal and displacement.)

Chomsky's characterization of this collection of papers in his foreword to *Chomsky's linguistics* (cited at the beginning of this review and repeated here) as 'drawn from a transitional chapter' in the generative enterprise of the past sixty years, a process that 'has been exploratory, a work in progress still very much underway, with constant changes, improvements, surprises, and many more sure to come' (ix), is quite an accurate assessment of the work collected here. The value of these papers lies more in the ideas they explore—literally 'leading ideas' that have fueled research on language for decades—and in the fundamental questions arising from their exploration than in any definitive answers they give or any definitive analyses they present. In fact, *definitive* is not an adjective that applies to these papers. And while the unification of phrase structure grammar and transformations under Merge is an absolutely major achievement, there is still much to be learned about virtually all of the topics discussed in these papers, including Merge itself as it applies to adjunction constructions like relative clauses. The analysis of relative clauses intersects with binding theory in that these constructs do not appear to 'reconstruct' to their covert positions under displacement (see the discussion of 28 above), which raises questions about where and how adjunction applies in a derivation and also the proper formulation of binding conditions including where in a derivation they apply. Displacement of course is subject to locality conditions, which in most formulations impose successive cyclic movement, phase theory being the most recent proposal. Phase theory raises questions about 'transfer'—and on the phonological side, linearization and other phonological processes like deletion (in

the derivation of ellipsis constructions, which also intersect with binding theory in a major way), and possibly head movement as analyzed in 'Derivation'. Head movement raises questions about labeling, which is a crucial ingredient in any theory of phrase structure, especially if the labeling is an operation that functions independently of Merge (Chomsky 2013a). One labeling question concerns the structure and content of the lexicon: do the major lexical items (nouns, verbs, adjectives) contain category features or are they just roots unspecified for category, as suggested in 'Nominalization' and raised again after thirty years in 'Minimalist inquiries', 'Derivation', 'On phases', and most recently Chomsky 2013a?

Clearly, there remains much to be puzzled about in the study of language, but fortunately the generative enterprise (which Noam Chomsky founded in the 1950s and to which he has been the foremost contributor of leading ideas ever since) has developed a powerful and robust framework in which all of this can be productively explored, these papers being prime examples.

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