Strict Interfaces and three kinds of Multiple Grammar

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Modern linguistic theory introduces the question of how interfaces are to be mechanically represented. It is argued that there are strict innate interfaces where semantics, pragmatics, and syntax must coincide. The Strong Minimalist Thesis (Chomsky 2005) is a prime example. We argue that so-called 3rd Factors, which are part of these interfaces, must be present in core aspects of grammar. It follows language variation cannot and should not, as suggested by Richards (2008), be abstracted out of core grammar as entirely due to 3rd Factor or Externalization processes. Several instances where variation is compatible, because it can be represented, are introduced.

Keywords: language acquisition, syntax, interfaces, Multiple Grammars, minimalist theory, strong minimalist thesis, language design, language variation, dialect, externalization

1. Introduction

In the age of interfaces the question of how we describe an inherently diverse grammar and multi-lingual capacities grows both acute and obscure. We take every speaker to be responsive to and carry Multiple Grammars in the spirit of this remark by Chomsky (1986: 17):

> … [take] a speech community of uniform speakers, each of whom speaks a mixture of Russian and French (say an idealized version of the 19th century Russian aristocracy). The language of such a community would not be 'pure' in the relevant sense, because it would not represent a single choice among the options permitted by UG, but rather would include 'contradictory' choices for some of the options.

The existence of 'contradictions' within language makes grammatical *variation* a core property of language. In that sense everyone is bilingual and every language contains Multiple Grammars (Roeper 1999). We will review this idea briefly before we articulate our approach to interfaces and UG. Much of our discussion of interfaces will rest on intuition and metaphors because the extension of grammar to interfaces is rather uncharted territory, and because it is important to refine our intuitive grasp of the idea of interfaces before we begin to be precise. Our illustration of Multiple Grammars will be more precise as we proceed. One of our goals is to underline the importance of dialect and language variation to the study of core grammar.

1.1 Multiple Grammars and the lexicon

The most obvious domain for Multiple Grammars is the lexicon. The different sources of our vocabulary, Anglo-Saxon, Latin, and Greek with their associated morphology already exhibit within English a set of multiple grammars. The fact that bilingual speakers, in the midst of one language, can insert a single word from the lexicon of a different language, shows that our automatic linguistic system has simultaneous access to Multiple Grammars (Roeper 1999; Yang 2003; Yang & Roeper to appear).

Where else do we have access to different grammar types? Here, in brief, are a few examples drawn from Roeper (1999):

1. English Pro-drop: We have a few words that allow pro-drop (*'looks like rain'*) but they are lexically limited.
2. English V2: we have some speaking verbs that undergo V2 (*'nothing' said Bill*) and the verb *be* and *have* (in British English) allow raising over Negation which fits the V2 format: *John is not here / *John don't be here* and (British) *Bill hasn't money, (American) Bill doesn't have money*.
3. Present Telic: there are forms of present telic that resemble German. For instance, the present generic has a telic property like German that is distinct from a compositional present with the progressive *-ing*. Note that we can say: *John is killing Bill but he should stop* but the Stage Direction *John kills Bill* cannot be followed with **but he should stop*, which mirrors the progressive use of present in German (**Er tötet ihn, aber er soll aufhören 'He kills Bill but he should stop'* (Roeper 1999).

We can argue that the two forms of present tense in English are drawn from two different grammar types. They are however compatible within a single grammar,

hence English has no difficulty carrying both.[1] That idea will form one central theme of this essay:

Hypothesis 1: Speakers carry some variations within a Single Representation.

This occurs if dialect features can be captured in a single hierarchical tree. We will embed this concept in the theory of Interfaces and Externalization and the implications for variation introduced by Berwick & Chomsky (to appear) and Richards (2008).

1.2 Variation types

Our goal here will be to make a few theoretical distinctions which I hope will provide a modern framework for research on variation in language. We argue for three types with different acquisition and historical consequences:

1. *Parametric* competition: continued presence of multiple grammars in a single language.
2. *Structural* compatibility: points where dialect variations cause no structural interference in a single language, and
3. *Productive* extension: where grammar variation is a result of adding recursive productivity.

It should be no wonder that 'variation' itself varies when cast into formal representations: each form of variation responds to the formal structure it engages. First we will take a closer look at the notion of interfaces.

2. Strict Interfaces

What is the relationship of variation to interfaces? Is there variation at the point of an interface? A first hypothesis, often sustainable, is precisely that there is not:

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1. The existence of code-switching is direct evidence of this capacity to represent more than one grammar in a single tree. See various works by Jeff MacSwan and in particular van Gelderen and MacSwan (2008). They make interesting suggestions about limitations on code-switching in discussing the puzzle of why code-switching between pronouns and verbs never occurs, but they may occur between noun and verb. In that instance, as we discuss below, the DP projection of the pronoun lacks the substructure to support Agreement, and hence the tree structures of the two grammars are not compatible.

Hypothesis 2: Interfaces themselves are immune to variation.

This is the first example of what we call *Strict Interfaces*. For instance, it may be that the phonology/syntax interface is innately fixed: when syntax delivers a string, the phonology pronounces it. Dialect variation might affect either side of the interface – either syntax or phonology – but not the mechanism of the interface itself.

Thus all properties of syntax that cause changes in phonology are expressed on the syntax side. Nothing about the interface itself is open to variation if the syntactic instructions are complete. Social properties of the pragmatics might exert an independent impact on the phonology (leading to reduced or expanded vowels that express 'informality'). Again the critical feature could be expressed in syntax directly (reflecting a pragmatic or social distinction) and only interpreted by the phonology. We could build a social interface into phonology by a rule like: any element marked [+informal] => [+reduced]. We might build a pragmatic context variable in by saying: drop that phonological rule if we speak on the telephone or yell over a long distance.

In syntax, a deleted object, or a trace, is not pronounced, but that is not variation across the modular distinction between syntax and phonology, since it can be captured within UG purely on the syntax side by the device of an empty category. In general, we keep the interface between syntax and phonology strict and universal by a kind of cross-referencing across modules. In this case, we project an 'empty' category which leads to non-pronunciation. In general:

Hypothesis 3: Universal strict interfaces are represented by cross-reference on each side.

Therefore we must locate variation outside the interfaces which we can accomplish at the syntax/phonology interface by having an empty category in syntax.

2.1 Pragmatic Interfaces

How about the pragmatic/syntactic interface? Let us expand the question of how to represent object-deletion in UG. Some grammars allow more object deletion or Topic-deletion based on context than others. This effect could be coded into the syntax, or into the pragmatic disposition chosen, but would it affect the interface itself? Huang (1982) argues that there are 'hot' and 'cool' languages, where 'hot' languages allow context to motivate deletion. Asian languages are a prime example of where Context allows syntactic deletion. German allows more than English. We could write this as an interface property that is neither in the pragmatics (which we might want to keep universal), nor in the syntax, where it might

require new notation. It would then be a form of interface variation and not a case of a Strict Interface.

However, given indexicals (personal pronouns and demonstratives), it is clear that the lexicon already marks contextual orientation. Therefore it would be consistent to syntactically encode the hot/cool distinction which entails a collective awareness of Common Ground not unlike I/you differentiation. If so, the hot/cool distinction should be expressed on the syntax side of the interface in correspondence to a pragmatic dimension that might look like this (which we take to be Huang's proposal):

1. Pragmatic/Semantics: Establish Common Ground
2. Mark Syntax:
   a. express elements in the Common Ground with Deixis
   b. express elements in Common Ground with Deletion

Both (2a, b) would have a feature in the syntax that allowed its expression. The interface itself would be constant:

Hypothesis 4: Map Pragmatic representation onto a Syntactic Representation.

Therefore the variation would stay within the traditional modules. Each side of the interface will then be made to 'fit' the other. Could this be exactly the kind of biological bridge that occurs as a mutation? Questions of this kind are a natural domain for the emerging field of biolinguistics.

2.2 Animal Interfaces

Hauser (2008) suggested that animals and humans share most modules, but animals fail to have particular interfaces. He refers to cognitive capacities that do not map onto linguistic capacities. This raises the question of what an interface is such that it could be absent. At some level, every part of an organism is connected to every other.

What is an interface then? It is not an easy question, so we might begin from where we can imagine an interface best. An indicator of a direct interface is speed. When information can quickly, hence mechanically, move from one domain to another, an efficient translation mechanism must be present. A visual/verbal interface must exist which allows us to link words to objects in milliseconds. Animals are capable of linking words to visual objects, but it is not clear how quickly they can do it.

Animals have direct connections between muscles and complex intentions, quite obviously, because they undertake motivated actions (like attacking prey). They do not seem to have a direct connection, however, between complex intentions and words, nor can they formulate propositions. Thus vision may produce some intentional notion like 'get it' (say food) which motivates muscles, but may not directly connect to words for monkeys. Dogs certainly can connect words and commands. Humans lack interfaces or direct connections (which would be useful) to internal states, such that we cannot instantly represent our blood pressure in consciousness.

So can we begin to model, at an intuitive level, what interfaces look like? The sharpest metaphor for a strict interface is the notion of a key and a keyhole. The keyhole is made of air but it has the 'idea' of a key in it, in fact, the shape of a particular key. Many levels of grammar appear to have perfect and efficient interfaces. We will take some steps toward illustrating that idea in what follows.

2.3 Semantic Interface

How would a semantic/morphology interface operate? In order to have an affix like *-er* refer productively to Agent or *-ee* refer productively to Theme, we need both the morphological capacity to have an affix attach to a word and to capture a specific part of the verb's meaning, and we need an encapsulated concept like *Agent* that can participate in an isomorphic relation to the affix. The notion of Agent is implicit in action itself, but the diversity of actions makes the notion of Agent, as we shall see, an especially abstract notion. It is not automatically an isolatable mental unit. A dog which can carry out the instruction 'sit' might implicitly have the notion of Agent, but might not have it as an isolated mental unit. If true, the dog has that mental unit (Agent), but not the compositional morphology, then the dog will fail to learn or apply *-er* to 'sit' to form *sitter*. If the dog has the morphological capacity, but not the mental unit Agent, the mapping will fail again. Now a third possibility arises: suppose the dog has both mental capacities, but fails to have the *interface* between concepts and morphology, then the mapping will fail again.

Humans, we are suggesting, automatically look for mappings between certain encapsulated concepts and morphology. Animals may look for connections between *words* and *concepts*, but not between morphology, parts of words, and concepts. On the other hand, an animal might have direct connections between smells or sounds and concepts, like 'be afraid'. One might object that these are not really 'concepts' but 'instincts'. However I suspect that a really careful deconstruction of the notion of 'instinct' will produce concepts again.

We can carry the example further: If the Agentive affix *-er* is like a keyhole into which we fit the complex notion of Agency, it will show biases as well that must be satisfied. The manner of Agency in: *singer, winner, lover* are each quite different (*singer* is intentional, *winner* is not intentional (you can intentionally compete but not intentionally win), and *lover* can require reciprocal intentionality). Nevertheless, an abstract cognitive unit, only roughly like the word Agent, is present so that we can attach it to this set of words. Seemingly similar actions disallow *-er* (**seemer*, **wanter*, **appearer*) because they fail to fit this cognitive class – these verbs describe *states* and not actions. Humans, apparently, do not conceptually allow one concept to cover those involved in either states or actions at our language/morphology interface. Real world obscurity – which is ample – allows us to go both ways: *he is a grandstander*, but those in back are (unwillingly as a rule) *standees,* but not *standers*.

Nonetheless we may have arrived at a useful contrast: While UG has a Strict Interface between Concepts and Morphology at the abstract level, it is not Strict at the substantive level, because languages allow morphology that has quite subtle differential relations to Agency. Another example can buttress the point: English has an Affix *-ant*, as in *participant*, which is weaker than Agency and may productively involve [–Agent] as in *defendant, deodorant, coagulant* (numerous chemical terms). The realworld subtlety comes across in cases like the contrast between *server* and *servant*, where the web-server has more originating power than a *servant*.[2] The child presumably has to identify some degree of 'lack of agency' whenever *-ant* appears.

Thus, perhaps like animals, we have certain neurologically fixed and efficient interfaces and lack others. Strange biases which allow for language variation do not yet have a characterization in this system. In linguistics we have the notion of *parameters* that are UG-fixed representations of alternatives, but exploration of parametric variation has shown few sharp distinctions that can be set with exposure to a single construction. So the notion of variation needs more differentiation. From the perspective we are developing, we can ask the question in terms of our metaphor: Where does an organism have an interface that works like a key/keyhole relation and where does it not? We turn now to an examination of variation in terms that Chomsky (2005) has introduced.

2. See Finer & Roeper (1989) for further discussion of affixation and concepts.

3. Innate endowment and Efficient Computation

Chomsky (2005) has proposed that three distinct dimensions characterize the language capacity: (1) Innate endownment, (2) Experience, (3) 3rd Source Factors. (1) is the traditional notion of UG; (2) is what children are exposed to; and (3) involves the mechanisms of Externalization that are compatible with linearization, memory, and the kinds of information organization that achieves efficient computation. The last category captures interfaces with other dimensions of cognitive capacity and may, in principle, be the source of design features, for instance, that enable efficient computation in other information-rich domains like vision.

Here great caution is called for. If vision operates efficiently in 3-dimensions, with the rapidity of innate structure, then those 'common' principles must be independently represented, separately 'wired' in the brain. An important analogy comes from stereoscopy. Both eyes and ears use stereoscopy to resolve information from two sources (two eyes and two ears). But they do not proceed from a single stereoscopy center. One does not lose the ability to see if one loses hearing or vice-versa. Therefore the principle is biologically written into the interfaces that are at work on quite different kinds of information (sound and light) and they are good examples of module-specific strict interfaces. Thus while Chomsky's three factors are conceptually distinct, the system they refer to will be, as I understand it, embedded in what is in effect a single mechanism. Our goal will be to specify where 3rd factor effects are written into the mechanism in a module-specific way.

The common image of innate information derives from fundamentals of Minimalism: principles of hierarchical phrase structure, movement, and domination. But there is no reason why, in a tight theory of interfaces, strong innate restrictions should not cross modular bounds, or put differently, determine the interfaces between modules, hence again *Strict Interfaces*.

If Efficient Computation is a goal, then an efficient connection between syntax, semantics, and pragmatics, and phonology would be an obvious advantage. In other words, Strict Interfaces automatically enhance efficient computation. Those interfaces may themselves reflect compatibility with 3rd Source factors like memory. These reflections lead to this broad hypothesis:

> Hypothesis 5: Innate interfaces are directly constrained by 3rd Source factors.

Chomsky (2005, 2008) has advanced the Strong Minimalist Thesis, namely that syntactic, semantic, and phonological information are all resolved at the Phase Edge. We can take Phase to be a paradigm example of a Strict Interface. Could

there be more substantive examples of Strict Interfaces? We will examine the *imperative* as a potential example of a Substantive Interface. First we approach the question from the other side: how to think about non-interfaces.

3.1 Interfaces and interactions

In Roeper (2010) the claim was made – which is important, but in a sense quite obvious – that an *interface* is distinct from an *interaction*. An interaction covers the entire ecology of the body, which we hardly understand. Why is it hard for a child to walk and talk at the same time, and often for adults as well? There is a complex interaction – a competition for computational space or energy – which must feed from the same source. At the same time, on the whole, there is tremendous evidence of modularity: we can undertake many activities simultaneously: breath, dance, sing, and worry about how late it is. How such modular and non-modular interactions work we do not know. This observation begs a question about the primary property of modules: modules have independent primitives and principles of organization.[3]

Thus the thematic module has thematic roles, but those roles are directly mapped onto, in fact mapped by, other systems such as Merge which honors the thematic subcategorization properties of verbs. If these are biologically specified links, then they are interfaces. It should therefore be comparable to the heart and the lung: the connecting channel is just as innate as the organs, as the heart and lungs themselves. Another example is: eye-hand coordination is just as innate as eyes and hands, even though it can undergo fine-tuning with experience. The connection between syntactically defined words, like verbs and their subcategorizations, conceptual definitions, and image-recognition ('there's a dog') are all innately defined interfaces, although they carry 'learned' information much like the lungs carry oxygen obtained from outside the body. All of these are Strict Interfaces which we take to involve dedicated biological design. Were the connections not mediated by an interface then, for instance, we could not co-ordinate our hands through our eyes. In fact the interface between touch and vision is very minimal and largely uni-directional. If you see objects first, you may be able to identify them by touch alone, but if you touch a set of objects first (mitten, sock, shirt) they are very hard to identify then by vision.

3. Thanks to Tanja Kupisch for clarification of some of these questions.

3.2 Strict Interfaces and Classical Innateness

Because the interface itself is invariant and genetically specified, it is simply an extension of classic concepts of innateness. This observation is important because it might seem to some that the idea that grammar interfaces with other dimensions of cognition simplifies the acquisition problem, or even eliminates innateness (as some, like Tomasello 2005 have argued).

The exact opposite relation to innateness follows from Strict Interfaces. Previous models of grammar built on the autonomy of syntax dealt with a smaller range of potential combinations. If we include semantic and pragmatic interfaces the potential information explosion increases, hence the set of possible grammars explodes, as it has been classically argued (Chomsky 1965).

However, if strict innate interfaces exist, they restrict the set of possible grammars via other dimensions. The restrictions lead to both narrower and broader properties for UG. The available combinatorix of recursive Merge and Labels, as current theoretical work defines them (Chomsky 2005) (see below), certainly expands UG beyond what fixed Phrase Structure Rules imply. And other dimensions expand the set of possible grammars by, as we noted above, allowing interface features for the Common Ground[4] to be generated by the set of primitives linked to empty categories. The Strict Interface now restricts the syntax because not all interpretations are possible in the semantic component. For instance, a syntactic system might be able to generate recursive articles (*the the the hat*) as easily as it generates recursive adjectives (*a big, blue, fat house*), but the recursive articles are not interpretable. Therefore the acquisition device can reject multiple articles because they fail to succeed at the interface, not because syntax fails to generate them.

The argument therefore must be that the innate component would not be successful if it did not exhibit a perhaps evolutionarily developed compatibility with 3rd factor features *inside* the innate endowment. In a word, in order to guarantee a system that works in milliseconds, the innate component must have well-defined, to be metaphorical, well-greased intermodular connections. Thus, like the key in the keyhole of the larger mind, the key must exactly fit the demands of the mechanism which allows a lever to turn and the door to open. It

4. Common Ground is a syntactic/pragmatic term whose ultimate representation is open, but the use of definite articles certainly presupposes that both Hearer and Speaker know what specific object the Noun refers to. If this is part of the function of definite articles it is not surprising that it would not allow a recursive interpretation, a Common Ground inside the Common Ground. Therefore, recursive articles are excluded at the Interface not within the grammar as they would be in traditional PSR rules.

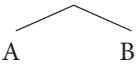
may not be obvious to the casual observer that the general shape and magnitude of the key entails constraints borne from the physics of the lock, but in fact keys of the wrong shape might not allow the inner mechanism to turn via the leverage of the external fingers. The relation of the key to the keyhole – like thematic roles and morphology – is the Strict Interface. The impact of physics on the size of the key and the turning mechanism is a 3rd Factor phenomenon. It is a non-strict interface or an Interaction, where the principle is honored but not written into the physics of the lock in the way that stereoscopy is written into the biology of seeing and hearing. This I take to be a rough characterization of differentiation among 3rd Factors, although the exact nature of 3rd Factors is of course part of the scientific agenda. This intuitive approach raises philosophical questions about well-defined concepts, but I hope the intuition is clear.[5]

3.3 Projections from Merge

At an abstract level, it is obvious that humans do not begin with the assumption that language might refer only to its musical properties, as bird dialects apparently do, or use those musical properties in a fixed mating ritual, as could be the case. Instead we all assume a human syntax/semantics mapping following the idea that we use language to communicate ideas that entail precise reference to the world around us:

Hypothesis 6: Language has an efficient interface with reference.[6]

(1) Project structure => Map Structure to semantics and context
Merge, Label, Project Meaning
B => map to something



5. There are significant philosophical and definitional questions here. For instance the notion of *gravity* might seem to be wholly external, applying indiscriminately to all objects. And yet aspects of musculature might not be explainable without reference to the demands of gravity, hence seem to be 'written in' to the definition of muscles. On the other hand, the module-specific requirements of seeing and hearing mean that stereoscopy – and having two eyes and two ears – entail a strict and biologically specified interface.

6. This means simply we interpret words as linked to context immediately. Of course, reference is one of the most bedeviled scientific concepts, but we can still observe that we seek sharp and quick interpretations of most referential words.

Does this syntactic representation involve 3rd Source mechanisms? If B = Noun Phrase, then it has at least reference to the cognitive world in which NP can be represented. If A = the, then pragmatic reference to Common Ground is present as well. In Roeper (1978) I observed that hierarchies are found throughout cognition and labels may reflect cognitive notions, but that the *point of combination*, the exact interface, was unique to language. Hornstein (2009) similarly argues that Concatenation is a general ability, but that when it combines with Labels, a species-unique basis for language was established. Chomsky (2005) argued that the syntactic Labels are not universal but subject to Labelling Algorithms which are a further part of innate grammar. The important point is that the connection between structure and labels is part of the innate architecture, even if they are related to broader principles of mind.[7]

Thus we assume the idea that human utterances are *meaningful* is immediate to the child and it reflects a Strict interface whose ingredients in turn reflect 3rd Source Factors found outside of grammar as well. Thus the simple notion of *meaningfulness* is a strong and important notion of a Strict interface between syntax, semantics, and pragmatics.

3.4 Helen Keller and External Systems

It could be otherwise. Helen Keller, a blind and deaf child who learned to speak, did not learn grammar spontaneously and immediately because she did not associate Touch with Reference until, by repetition, she finally began to connect a linguistic system with tactile experience. She had to cross a modular boundary that had no innate interface with a communicative system. Such a connection between touch and the language component is not immediate but apparently possible. It may be limited as well. Helen Keller eventually was able to read, but it seems unlikely if she had only touch that she would ever learn to communicate spontaneously, as a child does from just hearing spoken language.

Let us imagine her situation as a blind child. She was certainly guided with say *a hand on the shoulder* to a table to eat. Would she now define 'hand on shoulder' as *food*, as *breakfast*, as *move where I want*? This is the kind of tactile information that she must have had. It seems not to have led to the definition of any particular objects. Instead, the connection had to be created by deliberate instruction by another person using fingers in the palm of her hand.

7. Richards (2008) makes a similar observation in fn. 4.

Children do not need to be taught that a word can refer to a thing. Moreover, work by Weissenborn & Höhle (2003) has shown that virtually pre-linguistic infants respond to the presence of complementizers in the sound stream, suggesting that they are looking for Functional categories as well. Thus the touch/language interface does not seem to be a strict inborn interface.

Visual gestures, used among the deaf, appear to arise naturally by simple exposure and could be derived from an innate referential use of pointing that appears shortly after the one-word stage (as reported by Goldin-Meadow & Alibali to appear).

4. Strict Interfaces: A substantive example

Our discussion has been abstract and in some respects quite unresolved about how to define Strict Interfaces. Could a Strict Interface be substantive, where specific features of different modules are innately linked, and cross-modular? Consider a demonstration example that may have some plausibility. Take the concept of *imperative*. While it may vary somewhat in languages, it involves:

a. a Force Feature in the CP,
b. 2nd person deletion,
c. lexical selection of a verb or other major category,
d. Focal intonation.

Suppose ingredients and the interface from all of these domains were in fact stipulated in the grammar such that parsing efficiency and acquisition efficiency are guaranteed. That is, the child could hear *Come!* and recognize the combination of Emphatic stress + verb + absent *you* as an imperative which instantiated its position in a Force Phrase inside of the CP in one stroke. Logically the same result could occur as a pure inference on a loud noise from a parent. Or the result could have stages: (1) child identifies verb, (2) then focal stress, (3) then context invites action, then (4) Force Phrase is instantiated, then (5) project and delete *you*. Or could it happen all at once via a pre-existing complex interface that just needed to be triggered? It is difficult to imagine that a language would have imperatives that can only be generated by a complex interaction of factors each subject to parametric variation.[8]

8. A surprising comparison is reference to the notion 'present' in English. With the decline of Tense morphology, we now construct a reference to the present by forming *is running* rather than *runs* which requires several morphemes and movement operations.

There is no evidence that a real acquisition path occurs for imperatives. So we can venture the strong claim that these cross-modular links are present and immediately invoked with minimal experience and therefore lead us to expect them to exist across otherwise divergent language families. This is far from obviously true, but it does make a concrete claim about how a strict innate interface might work. Again, if the set of options for imperative are fairly limited cross-linguistically, it could work even if imperatives do not share all properties cross-linguistically, for instance if some languages do not have focal intonation. This is then a prototype for what a tight theory of Strict Interfaces should deliver.

With a programmatic interface theory of invariance in hand, we turn now to the challenge of where variation arises and how it can produce Multiple Grammars.

4.1 Parameters and Externalization

What about language variation? Where does language variation now fit in? Berwick & Chomsky (to appear) argue:

> Parametrization and diversity, then, would be mostly – possibly entirely – restricted to externalization. That is pretty much what we seem to find: a computational system efficiently generating expressions interpretable at the semantic/pragmatic interface, with diversity resulting from complex and highly varied modes of externalization, which, furthermore, are readily susceptible to historical change. (Berwick & Chomsky to appear: 15)

Richards (2008: 135) makes this comment about the status of variation in this light:

> Not only does variation lack a locus, but it would also now seem to lack a rationale given the uniformity of Factor I (see Section 1.1) and the invariance of Factor III (that is, third factor constraints cannot be parametrized. … This would appear to lead to a rather startling conclusion from the perspective of traditional principles and parameters theory: the range of variation across the world's languages can no longer be taken to be part of the universal, genetic specification. … Variation, and the forms it takes, is no longer determined by UG. How, then, are we to explain and accommodate language variation in a system based on third-factor explanation (i.e. minimalism)? If variation cannot be ascribed to UG, then where are we to locate it? (Richards 2008: 135)

Richards proceeds to identify variation with processes of externalization that apply at the phonological level. We depart from his view by arguing that some forms of variation consist in representing mutually *compatible* dialects in a single syntactic tree (see below). In effect this argues that some meanings, as well, are representable in a direct syntactic manner in one dialect which otherwise require lexical or elaborate circumlocations in another. Therefore if they can be assimilated to a common syntactic tree, then the 'language' can have properties that really adhere to two different grammars. Therefore core properties of UG must be invoked to describe grammatical variation. An illustration is the two particle positions in English which we discuss below.

The upshot is that not all variation should be viewed as *phonological* aspects of Externalization. While aspects of the syntactic tree could also be reflexions of *externalization* parsing processes, if our reasoning is right, then the *externalization* features will be so closely and mechanically connected to UG features that the UG features themselves will be defineable as *externalization-compatible*.

4.2 Competition Model

Yang (2003) has articulated a Competition Model for acquisition that assumes that several grammars are simultaneously represented (as argued in Roeper 1999 and Kroch & Taylor 1997). The classic example is pro-drop where both obligatory subject and optional subject are maintained until some combination of agreement, *there*-insertion, and pragmatic factors are used to mark obligatory subject as required in English and outweigh the optional subject option. Other languages without an obligatory subject are then pro-drop where the subject is optional and sensitive to discourse phenomena.

The other option may continue to be present, but linked to a limited set of lexical items which carry a diacritic for the other parameter. This system applies to parameters and involves mutually exclusive choices. A sentence cannot both have a subject and not have it. I have argued that when *recursion* is present, complete productivity arises and lexical options are blocked. For instance, in English a recursive possessive blocks the German option where possessives are limited to one and a lexical restriction to humans exists. No such restriction can exist if it is syntactically recursive. Where that is not the case, two grammars can co-exist within a single language, preserving an important notion of variation within the notion of a single language.

Another dimension of variation arises when different grammars are compatible, for instance, when both can be represented in a single syntactic tree. The first question to ask concerns variation where we posit two grammars to reflect the fact that a speaker must be sensitive to social register or geography. Here again, in effect, a diacritic within essentially a single grammar is the locus of variation. It can help us see both where bilingualism is easy to maintain and where language change can occur easily. We illustrate with African American English.

4.3 Compatibility Model

Green (2002) has demonstrated that in African-American English (AAE) aspectual habitual *be* occupies an independent node in a tree hierarchy. Green and Roeper (2007) argue that habitual *be*, while a signature feature of AAE, can fit into the same syntactic tree as Mainstream American English (MAE) and therefore a speaker can easily move from one dialect to the other or allow one dialect to influence the other. Unlike for aspect, a single tree cannot capture both VO and OV grammars without using a transformation to get from one to the other.

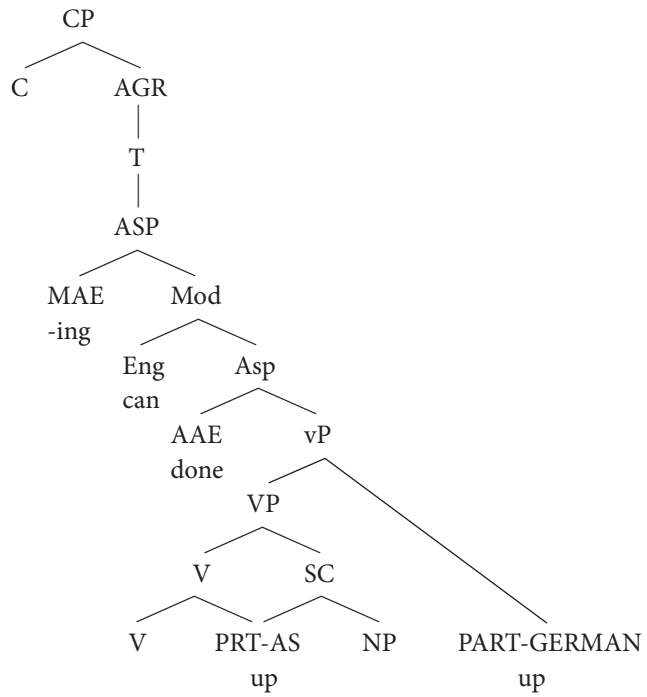
Now habitual *be* is both easily recognizeable and easily representable if a special node is involved that captures Aspect in AAE but it is compatible with the remaining Mainstream American English because it is a pure addition to the syntactic tree and nothing in MAE is disturbed. In the following sentence *done* stativizes the verb (Terry 2004; Green to appear):

(2) you *done thrown* the ball (ain't you)

Predictably, a stative tag like *aint you* can occur (*you done thrown the ball, aint you*). It is captured in this tree, where we also mark the presence of other language types (AS = Anglo-Saxon, Ger = German). Similarly we argue that the two positions for particles in English represent both the German origin (final particle) and the English innovation (particle raises with the verb) (see Green & Roeper 2007). And there are two ways to express indirect objects (double object = Anglo-Saxon, and PP = Latinate). If we were to insert them simultaneously, showing their tree-compatibility, we would have:

(3)	*Will*	you	can	have	*done*	thrown	*me*	*up*	the ball	*up*	*to*	*me*
	Ger			AAE		AS	AS		Ger	Latinate		

(4)



The particle positions (Anglo-Saxon and German) are both part of Mainstream American English, while the stativizer *done* is a part of AAE and may be lexically marked to carry that information, while syntactically it occupies a compatible further node. It constitutes a kind of non-parametric variation within syntax which carries semantic effects, and therefore departs from the view that all variation that is not phonological has no impact upon interpretation.

Green and Roeper (2007) argue that most dialect variation occurs at the Feature level, while the Labelling algorithm that defines Nodes is a different source of variation. While some features found in dialects may be 'contradictory' to those of the Mainstream language, it is evident that Nodes can exhibit greater interlanguage compatibility.

Richards (2008) adopts a similar perspective,[9] but with the additional claim that syntactic variation will be semantically empty: "A maximally empty UG thus

9. "At the end of the previous section, we suggested a second source: the underspecification of UG, leaving options open. The prediction for narrow syntax, the domain of the SMT, is that such indeterminacies should give rise to free variation, with competing options existing side by side in a single grammar. This is because the consistent resolution of this optionality in favour of one or other option in the syntax would require the existence of a special, FL-specific device (a parameter), enlarging the content of UG."

leads us to expect 'true' (semantically vacuous) syntactic optionality to emerge in the satisfaction of certain featural requirements" (Richards 2008: 154). This would indeed hold true of the two particle positions in English and German.

We argue, on the whole, that syntactic variation is not necessarily semantically empty, given the notion that a single representation can contain additional nodes that carry special semantic force, but correspond to the traditional notion of variation.[10]

4.4 Structural Extension: Another form of Multiple Grammars (MG)

Every form of recursion shows difficulty and a sequential acquisition. Roeper & Snyder (2005) argued therefore that children must be exposed to recursive structures in order to acquire them. This view does not explain why they would not be immediate if the grammar generates them. If the grammar generates an Adjective Phrase in front of an NP, and the AP is inherently recursive, then the child should show no difficulty in generating them too. If the grammar generates a complement S (in traditional terms) inside of a VP, then it should be impossible to prevent it from being recursive, using traditional formalism for rewrite rules:

(5) S => NP VP
VP => V (S)

The consequence is that when a child generates:

(6) John thinks that Bill runs

he can also generate:

(7) John thinks that Bill thinks … that Fred thinks …

and the recursion is unstoppable. However extensive evidence, detailed in Roeper (2009) and references therein, show that children avoid recursion, and there has been a substantial controversy about whether other grammars do so as well.

If we assume that a form of Generalized Transformations (GT, developed extensively within TAG grammars) is at work, then we have a rationale for arguing that an extra step is involved in structurally extending a given form to include

10. This could be seen as terminological. Richards would probably categorize this variation as non-syntactic and a part of the PF 'externalization' process, which then, in effect, creates a second syntax in phonology. Variation within one tree that allows both core syntactic representations and meaning-bearing syntactic variation seems to us valuable.

a recursive form.[11] This would then provide a basis on which a core property of grammars, Generalized Transformations, would also be a source of grammar variation. Under GT sentences are separately generated (as *kernal* sentences in the GT approach of *Syntactic Structures*) and then inserted by an independent operation into a single representation:

(8) [S1 John thinks NP]
[S2 that Bill came]
S2 *substitutes* for NP

Only when children hear examples of recursive sentences do they extend their grammar by invoking Generalized Transformations. Where it does not occur, variation is present and a different grammar exists. More needs to be said to differentiate types of GT so that we can isolate exactly where it constitutes a separate acquisition step. Looking at real examples is a good place to begin (although we will not pursue these ideas in full formal depth).

Possessives are recursive in English but not in German. It is arguable that when a possessive marker appears on a complex phrase, it also triggers recursion because another DP is now automatically generable inside the first. Thus:

(9) the man that I like's hat => the man's friend's hat

The example in (9) shows that SPEC-DP allows a possessive marker under D, then a full DP in the Spec position which in turn allows another Poss, and recursion occurs.

We will not discuss the details, but the complex phrase *the man that I like* involves the same kind of Generalized Transformations found in sentences. Therefore it is natural to utilize the GT framework to capture the step the child takes to construct recursive elements.

4.5 Counter-argument

We have discussed typical examples of grammar variation and claimed that they are so deeply involved in properties of UG that to exclude them would distort our image of grammar. A reply might be that, of course, these phenomena engage UG but that they are all describable as minor externalization choices. Thus the Head parameter, which divides VO from OV languages, is just a low level externalization choice. This itself, however, is a rhetorical choice. The argument remains that variation can be seen in the core representations and mechanical

11. Thanks to R. Bhatt for this suggestion.

devices of grammar, including hierarchy and recursion. If they engage such core devices, they belong to the sources of insight into the nature of grammar.

4.6 Conclusions and consequences

We conclude that there are attractive ways to view core grammar and its interfaces with 3rd Factor phenomena which preserve the view that the core properties of grammar are engaged in language variation.

In the L2 literature, considerable discussion is devoted to the idea of Transfer from L1 to L2 or simultaneous bilingualism. I am not in a position to survey or evaluate these claims, but our discussion here should be relevant. If we pursue the concept from the perspective here, then we can make a claim: Transfer is only possible where syntactic compatibility is met.[12]

The notion of Compatible Multiple Grammars means that where Transfer appears we should imagine that the child or adult is attempting to Merge two compatible grammars and only a single representation is present. Thus the term Transfer is then a misnomer because in reality both grammars are present in a single representation, that is, where the apparent transfer involves an addition to an existing tree.[13]

We summarize a few possibilities:

1. Under compatibility, languages with and without articles can both be represented in a single tree. Many languages, like English, allow expressions both with and without articles. Therefore a deletion rule DP can be added or deleted without fundamental distortion of a tree. If a single representation is in use, it is then not surprising if a speaker is unsure when an article is called for.
2. Under parametric perspectives, the very subtle variations in parameters can be described under the Competition model if the parameters can be formulated as micro-parameters in Kayne's (2005) sense.
3. Under recursive variation, the pattern of Saxon genitives in the Germanic languages may be captured as involving a separate Generalized Transformation.

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12. See Roeper (2010) for more differentiation in the context of Bilingualism and SLI. See Roeper (1999) for a basic discussion of Universal Bilingualism.

13. Work by Green & Roeper (2007) and Adger & Smith (2005), among others, has utilized modern feature theory to represent dialect variation with considerable subtlety and variation. The composition of Feature bundles remains uncharted terrain. Presumably the same arguments we have made about Nodes will apply to their internal feature structure as well.

One can view (1) and (3) as perspectives which eliminate 'variation' as a theoretical entity by assimilating them to core grammar. However we would argue that the opposite choice of perspective is preferable: these dimensions of UG demonstrate that variation belongs to the core of grammar. The latter is closer to customary perspectives, hence less misleading, hence to be preferred.[14]

5. Critical Period Hypothesis

Another important perspective on the claim that Strict Interfaces are biologically stipulated in a species-specific manner comes from the Critical Period Hypothesis. The Critical Period Hypothesis is that, as with other biological phenomena, there is a critical temporal period where an ability must emerge. How is it relevant to our current questions? 3rd Factor phenomena are clearly aspects of mind that are engaged in a great deal of mental activity and therefore not subject to language-specific instantiation. If, however, 3rd Factor phenomena are innately specified aspects of what has been bundled in the grammar by biology, then the Critical Period hypothesis could be very pertinent. If not triggered at the appropriate age, though present elsewhere in the mind, such biological links may not have been fixed at the critical moment, and therefore language is permanently impaired.

Many involved in L2 research believe that UG continues to be available throughout life, even if unused dimensions are more difficult to reach by those learning a second language that engages a module not used in the first.

This does not, however, prove the Critical Period Hypothesis wrong. If UG is triggered – with the potential of many grammars – even those unused, then failure to trigger it at an early age will leave a person unable to learn special properties of grammar in any language. A hard look at the facts about Genie dictate supports this view.

If only cognitive abilities were involved, or if 3rd Factors elements accounted for all of grammar variation, and UG is intact, then Genie who began to learn language at 13 would be exactly like an L2 learner who begins a foreign language at that age.

Therefore if an L2 learner uses only cognitive capacities to enrich a very narrow UG, then it is not surprising that L2 is teachable. And then Genie should still have the capacity to learn a language with almost native ability, beginning at age 12.

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14. It is likely that some of the L2 and historical work of Meisel (1992, 1994), Lightfoot (1999), Kupisch (2008), Müller & Hulk (2001), Westergaard (2009), Bentzen et al. (2009), Sollid & Eide (2008) among many others may be open to analysis in terms of these hypotheses.

As Curtiss (1982) has argued, which is summarized in Vainikka & Young-Scholten (to appear), many of the properties of Functional Categories were not realized by Genie, in particular the absence of questions and inversion strongly suggests that the child was unable to project Functional Categories and movement rules. It follows that the fundamental argument that language is innate, including interfaces, and has a critical period is correct, but that:

> Hypothesis 7: The entire UG system – covering all possible grammars – must be instantiated in the acquisition of the first language in early years.

The UG system which has been instantiated then remains accessible in fundamental respects for L2 acquisition, piggybacking in complex ways on L1 as we have now outlined. This is strong support for the Strict Interfaces perspective.

6. Conclusions

We have provided a perspective, admittedly programmatic, on the meaning of interfaces and introduced the notion of Strict Interfaces as immune to variation. We have argued that the concept of greater, not lesser, innateness of grammar is entailed by this vision of interfaces, which claims that non-linguistic abilities are biologically bundled with UG in a way that requires species-specific innateness and may engage the critical period hypothesis.

We then explored Chomsky's 3-way division of grammar into UG, Experience, and 3rd Factors, arguing that this division does not, contrary to the suggestions of Richards, lead to a view of variation as 'outside' of grammar linked to rules of Externalization, but rather that many forms of variation are to be captured in several forms of compatible Multiple Grammars.

Much remains uncertain and, as yet, described in largely intuitive and metaphorical terms. Still we hope to have taken a few steps toward integrating aiming multilingualism and dialect studies at fundamental aspects of the architecture of language ability. Ultimately, this extension of Minimalism suggests that the origins of multilingualism and dialect variation will reflect, not surprisingly, diverse formal devices, both inside grammar and across interfaces.

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