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1976

Analogy
or
Ungrammatical Sequences That are
Utterable and Comprehensible are the Origins
of New Grammars in Language Acquisition
and Linguistic Evolution

T. G. BEVER
J. M. CARROLL
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That's the first time anybody ever sang to me like that before.

GLORIA STUART TO DICK POWELL IN *GOLD DIGGERS OF 1935*

**1. INTRODUCTION AND
SUMMARY**

Recent linguistic discussion has focused on the power¹ of grammars needed to account for systematic variations in the acceptability of sequences. Constraints on derivations, as a formal means of describing variations in sequence acceptability,² have been considered. It has been proposed that 'acceptability' and 'grammaticality' are coextensive and therefore that formal derivational constraints belong within the arsenal of universal grammar. On this view, all systematic variations in acceptability judgments reflect properties of a single 'grammar.'

In contrast, it has often been argued that such constraints are due to interaction with linguistic knowledge outside the grammatical system.³ On this view,

1. By 'power' we shall intend throughout 'descriptive power' rather than 'generative power.' See note 5, Langendoen and Bever, Chap. 9; and Bever, 1975a, Section 5.

2. "Output filters" (Perlmutter, 1972), "derivational constraints" (Lakoff, 1969; Lakoff and Ross, 1972), and "transderivational constraints" (Lakoff, 1974; McCawley, 1974).

3. The system of "ethnic style" (Labov, 1968, 1970; Ervin-Tripp, 1973); the system of speech production (Yngve, 1960); the system of memory (Miller and Chomsky, 1963; Bever, 1970); the system of speech perception (Bever, 1970; Grosu, 1971, 1972; Kimball, 1974; Tannenhaus and Carroll, 1975; Bever, 1975); the system of conversational implicatures (Grice, 1975) or nonspecific 'knowledge of the world' (Katz, 1972).

Source: This article appears for the first time in this volume.

sequence acceptability is a function of the interaction of grammar and other systems of linguistic knowledge and skill (see Chomsky, 1965, 1975; Bever, 1970, 1971, 1975a and 1975b for discussions). The proponents of the former, 'inclusive', view hold that any separation of grammatical facts from linguistic but nongrammatical facts is arbitrary and intuitively unmotivated. The proponents of the latter, 'interactionist', view contend that if a constraint may be adequately treated by independently motivated systems outside the grammar, its inclusion in the grammar is unwarranted and obscures the descriptive and explanatory power of the grammar. If grammars include unnecessary formal power, grammatical universals will be less constrained and make claims about the child's mind that are less precise and less testable. (See discussions of this in other papers in this volume, especially the introduction, Bever, Katz and Bever, and Langendoen and Bever.)

In this paper we explore the implications of the interactionist view for the concept of 'creative analogy' in linguistics. Creative analogy is the term that describes the emergence of new sequences in actual speech that are intuitively acceptable but marked as 'ungrammatical' by the synchronic grammar. These cases usually appear to be closely related to a fully grammatical sequence, and hence are traditionally referred to as cases that are 'analogous' to existing grammatical forms. Recently this concept has been brought into discussions of generative grammar (Chomsky, 1970) and attacked because it appears to be an *ad hoc* concept (Hankamer, 1972). The basic problem is that nobody has set constraints on *possible* analogical neologisms that can extend existing structures. Bever and Langendoen (1971, and this volume), Bever (1974, 1975b), and Carroll (1974) proposed that new sentence forms can occur if they are analyzable by the systems of speech perception and production. Since these systems are partially independent from grammatical knowledge, they allow for the creation of new, non-grammatical forms. However, the strategies in these behavioral systems are themselves based on grammatical sequences, so they naturally constrain the neologisms to be 'similar' or 'analogous' to fully grammatical forms. This view merely articulates the common-sense intuition that sometimes speakers utter and understand nongrammatical forms because of the communicative value of those forms and because they are "close enough" to fully grammatical forms.

The considerations in the present paper motivate and clarify a distinction between ungrammatical neologisms that are *usable* (i.e., utterable and comprehensible but recognized as "errors") and those that are *usable and acceptable* (i.e., intuitively accepted as an idiomatic part of the language). To quote two ungrammatical examples we shall explore in detail, (1) was an actually uttered sequence, but is clearly unacceptable upon reflection; (2) was also uttered but remains an intuitively acceptable idiom even after reflection:

- (1) ? I really liked flying in an airplane that I understand how it works.
- (2) Harry will try and do it.

Sentence (2) is marked as ungrammatical because it would require special formal power to generate *and* only where it is acceptable as a complementizer. 'Acceptable' and 'usable' grammatical errors have the property that they are uttered and understood through systematic failures of the mechanisms of speech production and comprehension. On the basis of the cases we analyze in this paper, we suggest the following principle of creative analogy:

An ungrammatical speech error that remains unacceptable is one for which there is a usable and grammatical alternative. An ungrammatical speech error that becomes 'acceptable' is one for which there is no comprehensible and utterable alternative of equal (or lower) behavioral complexity that shares the same deep structure.

The intuitive basis for this distinction is clear: communicatively usable speech errors remain unacceptable so long as there are grammatical alternatives. If there are no equally usable alternatives, then the errors may become 'acceptable' even though they remain ungrammatical. The notion that a sequence can be ungrammatical but acceptable may appear jarring, if not wholly bizarre. However, it is clear that such cases are commonplace in the experience of the language-learning child—often the child appears to have mastered a new form as an idiom (i.e., *not* generated by its grammar) and only subsequently is the grammar extended to generate that form. On this model the child first incorporates a new form into his/her behavioral repertoire; then the grammar is restructured to generate it. Without such cases the child's grammar-learning process would depend entirely on negative feedback in response to its ungrammatical utterances. Acceptable sequences can motivate a change in the child's grammar only if the child can retain a category of cases that are 'acceptable' but not (yet) generated by its grammar (see Bever, 1975b).

The same principle holds for the interaction of adult grammar and language evolution. First, the notion of an acceptable but nongrammatically generated sequence is what is commonly referred to as an "idiom," and thus should not be a surprising concept for linguistic science. Second, if such cases did not exist then *there would be only one kind of extrinsic linguistic source for language change*. That is, if every 'acceptable' utterance were 'grammatical,' then the only possible kind of grammatical restructuring would be a reduction in the number of sentences that are 'grammatical' but 'unacceptable,' perhaps because of their behavioral complexity. Such cases are, by definition, usually not encountered, so it is unlikely that they are the only stimulus for grammatical change.

This discussion clarifies the source of extragrammatical neologisms that can force a restructuring of a grammar as the language evolves. Usable ungrammatical sequences that have usable grammatical alternatives drop in and out of usage without permanent consequence. Usable errors that lack easily usable alternatives can become encoded as extragrammatical "idiomatic" forms—it is these

forms that children attempt to integrate within their own grammar. Such integration is one source for diachronic changes in grammatical structure.

This paper is addressed primarily to the principles that govern the occurrence of ungrammatical but acceptable sequences in the language of adults. It is clear, however, that the same principle could apply to the ontogenesis of grammar in children. This principle may answer a major question about the claim that language learning proceeds by way of a series of temporary "grammars" (e.g., Chomsky, 1965; McNeill, 1969): what are the restrictions on a new "hypothetical" grammar a child generates at each stage in the course of language learning? On our view, the child generates a new grammar when a number of new constructions have accumulated that he can understand or utter, even though they may not yet be treated by the child as 'grammatical'. The systems of speech perception and production in the child constrain which sequences are "acceptable" at each stage. In this way, these systems constrain and guide the evolution of each temporary grammar in the course of language acquisition (see Bever, 1975b).

Thus, the explanation of analogy figures crucially in both the evolution and ontogenesis of grammatical structures. This is reflected in our proposal that the emergence of new analogical forms is not only constrained by systems of language use, it is also constrained by a principle true for language acquisition: namely, in analogy a primary constraint is to *maintain the structure of a form while extending its use to a new meaning*. That is, adult analogical neologisms are constrained in the same way as the young child's acquisition of language—"old forms take on new functions" (Slobin, 1971).

The main nongrammatical system studied to date has been speech perception. We shall review that research to illustrate the study of the interactions of grammar and other systems of linguistic skill. We then turn to a brief account of speech production and explore its interactions with grammar. We propose a formalization of the traditional notion of 'analogy' as a set of production constraints on possible neologisms and ungrammatical utterances that arise during the course of speaking freely. Finally, we discuss the implications of analogy for language acquisition and linguistic evolution.

2. GRAMMAR AND SPEECH PERCEPTION

2.1 Prima Facie Cases of Behavioral Complexity

Traditionally, investigators have appealed to perceptual complexity as an intuitive account for the unacceptability of sequences that are difficult to mark distinctively as ungrammatical (Miller and Chomsky, 1963). For example, sentences like (3) and (4) are judged unacceptable by most speakers although

they are clearly grammatical forms, as exemplified by the acceptability of (5) and (6), which have essentially the corresponding grammatical structures:

- (3) *The oyster the oyster the oyster split split split.
- (4) *The colonies' workers' forelegs' pincers' grip's duration hurt.
- (5) The reporter everyone I met trusted said Nixon would resign.
- (6) The big round splintering old wooden wheel rumbled on.

Such cases show that one can refer to behavioral complexity as the basis for sequence unacceptability: this relieves the grammar of the kind of descriptive power required to differentiate cases like (3) and (4) from (5) and (6), respectively. In these cases the unacceptability of fully grammatical sequences (3) and (4) is interpreted as due to their *perceptual* complexity.

There are many other behavioral sources of unacceptability. For example, observe in (7) the awkwardness of a compound verb phrase that does not maintain the logical or temporal ordering of the conjuncts in its surface form:

- (7) (a) ?John landed on his head and attempted to pole vault the Great Divide.
- (b) ?John will make breakfast and get up.

Even though identical sentoids are conjoined, sentence (7a) does not paraphrase (8a) but rather describes a different "John" who had an accident and *then* tried to perform a great feat:

- (8) (a) John attempted to pole vault the Great Divide and landed on his head.
- (b) John will get up and make breakfast.

To state the restriction on the surface order of conjuncts in the grammar would require sensitivity to a variety of wordly facts. That is, the formal grammar would have to include a specification of which activities can contingently or temporally precede others. On the other hand, the logical/temporal ordering restriction on coordinate structures seems a rather plausible principle of language behavior. Since the speaker utters and the listener hears conjoined forms in a linear sequence, it is reasonable to argue that these restrictions arise naturally out of what we do when we talk and listen. The independent motivation for such behavioral systems is not at issue: it is clearly plausible to claim that it is easier to build up contingent ideas in their temporal and causal order even if the sentences used are themselves simple conjuncts. The issue here is that to include such knowledge as part of the grammar would introduce considerable uncertainty as to the boundaries and content of grammar itself: almost any aspect of human knowledge can contribute to what is perceived as a temporal or causal relation. Thus, "grammar" would now include almost any aspect of human knowledge. Not only is this impossible to define, it places within "grammar" an aspect of the use of language which reflects general properties of cognition, and

which would require independent description outside of language (e.g., to account for our perceptions of visual cause and effect). Thus, it is reasonable to argue that the sequencing of ideas is an extragrammatical property.

Surface order can interact with worldly knowledge to determine the scope of determiners. Consider for example, sentence (9) and (10):

- (9) All cookies are not frosted.
(10) All bachelors are not married.

Even though the sentences are structurally identical, many speakers paraphrase them with different arrangements of the quantifiers as in (11) and (12) (see Labov, 1972a and b):

- (11) Not all cookies are frosted. (i.e., some are and some aren't)
(12) No bachelors are married.

The ambiguity of such constructions is exemplified by sentence (13) which may be interpreted as either (14) or (15):

- (13) All professors are not mean bastards.
(14) Professors are all (not mean bastards). (i.e., no professor is a mean bastard)
(15) Not (all professors are mean bastards). (i.e., some professors are not mean bastards)

The ambiguity of sentences like (13) can be interpreted as an ambiguity of quantifier scope. The problem then arises as to why (9) and (10) are behaviorally *unambiguous*, and why their interpretations have opposite scope relations between the quantifiers *not* and *all*. The solution to this problem rests on the interaction of such sentences with ordinary conventions of discourse, as systematized by Grice (1975). Notice first that (13) is ordinarily interpreted as (16) while (17) is its literal interpretation:

- (16) Some professors are not mean bastards while some are.
(17) Some professors are not mean bastards.

To explain this we refer to Grice's conversational maxim, "be relevant." Clearly, sentence (17) is of interest only if it is agreed that some professors *are* bastards.

A separate conversational maxim, "make sense," can now account for the structurally divergent interpretations of (9) and (10). Since (14) and (15) cannot be reliably distinguished by intonational stress contours or some other phonological property, the structurally opposite interpretation of cases (9) and (10) cannot be described with ordinary grammatical mechanisms. That is, the grammar would become considerably more complex if these phenomena are treated within it (see Jackendoff, 1972, and Lakoff, 1971, for discussions of the formal complexities that arise if such phenomena are treated within the grammar). However, reference to the Gricean conversational principles can

account for these cases, thus allowing the grammar to mark all of them as structurally ambiguous. Suppose (9) and (10) were ambiguous, their structurally possible interpretations are given (18)-(21):

- (18) No cookies are frosted.
(19) Some cookies aren't frosted while some are.
(20) No bachelors are married.
(21) Some bachelors aren't married and some are.

The reading in (18) is pragmatically ill-formed, since most speakers at least can conceive of a frosted cookie. The alternative in (21) is semantically ill-formed since bachelors are unmarried by definition. Accordingly, the unacceptable readings for (9) and (10) are effectively blocked by the conversational implicature "make sense." Thus, (9) and (10) are grammatically ambiguous like (13), although they are interpreted in structurally opposite ways because of conversational conventions. In this way we relieve the grammar of the descriptive burden of differentiating (9), (10), and (13), all of which are structurally identical. As above, we do so by referring to a system of knowledge that is independently motivated—in this case the system governing conversational interchanges.

2.2 Perceptual Strategies and Acceptability

The preceding cases exemplify some general ways that nongrammatical knowledge can restrict the acceptability and interpretations of grammatical sequences. To explain these cases we referred to general properties of extragrammatical systems of knowledge. The existence of a theory of speech perception makes explanation possible for more subtle phenomena. In recent years a good deal of research has been devoted to the development of a theory of speech perception (see Fodor, Bever, and Garrett, 1974; Bever (this vol.); Carroll and Bever (in press) for reviews). This research has isolated a set of perceptual segmentation strategies, operations that utilize information in surface constituents to assign directly their deep structure relations. Experimental evidence indicates that the words in a surface sequence are first assigned their possible lexical classification. Other experimental evidence supports the view that perceptual strategies are schemata that take the lexically labeled strings as input and mark them directly for deep structure relations without processing intermediate levels of representation.

A range of phenomena can be explained by reference to the perceptual strategies that assign modifier relations within phrases. For example, the perceptual strategy in (22) applies to English noun phrases as shown in (23):

- (22) (det) N_1 's $N_2 \rightarrow$ (NP (det) N_1 + possessive, N_2 (=head)) $_{NP}$
(23) (a) The newspaper's printing . . .
(b) The horse's gait . . .
(c) The bank's combination vault . . .

Such perceptual segmentation strategies can yield problematic parsings of constituent structure and therefore interact with judgments of acceptability. The strategy in (22) can lead to incorrect parsing in certain cases. Consider the operation of a Possessive Preposing rule of grammar (24):

(24) NP_1 of $NP_2 \Rightarrow NP_2 + \text{poss } NP_1$

This rule applies regularly, as in (25):

- (25) (a) The printing of the vendor \Rightarrow the vendor's printing.
(b) The gait of the owner \Rightarrow the owner's gait.
(c) The combination lock of the president \Rightarrow the president's combination lock.

However, if (24) applies to cases like (26), in which the possessive noun phrase itself has an embedded possessive,

- (26) (a) The printing of the vendor of the newspaper is unreadable.
(b) The gait of the owner of the horse is rapid.
(c) The combination lock of the president of the bank.

unacceptable sequences result as in (27) (cf. Wells, 1947; Carroll, 1975, and Langendoen, this volume, p. 183 ff.):

- (27) (a) *The vendor of the *newspaper's printing* is unreadable.
(b) *The owner of the *horse's steps* are too rapid.
(c) *The president of the *bank's combination lock* is efficient.

It would be possible to mark cases like (27) as ungrammatical by placing a restriction on the transformational rule (24), so that it would not apply to complex noun phrases of the form in (26). However, this restriction could not operate uniformly, as shown by the acceptability of the cases in (28):

- (28) (a) The vendor of the *newspaper's handwriting* was unreadable.
(b) The owner of the *horse's speech* is too rapid.
(c) The president of the *bank's daughter* is efficient.

which derive from the operation of rule (24) to sequences like those in (29):

- (29) (a) The handwriting of the vendor of the newspaper is unreadable.
(b) The speech of the owner of the horse is rapid.
(c) The daughter of the president of the bank is efficient.

Since the sequences in (29) are structurally (and almost lexically) identical to those in (26), there is no way of distinguishing them by reference to structural grammatical properties alone. What appears to be at issue is the perceptual *plausibility* of the N 's N sequence created by rule (24), as italicized in (27) and (28). In (28), such a sequence is not a plausible possessive noun phrase, while in (27) it is. Accordingly, rule (24) must be restricted to apply only when the

sequence it creates would not be a semantically plausible possessive noun phrase. This would account for the facts we have outlined thus far, but at the cost of an added constraint on potential derivations, an example of a so-called transderivational constraint. To restrict the operation of rule (24) to a sequence like N_1 of N_2 of N_3 , the possible plausibility of the potential sequence N_3 possesses N_1 must be checked; if the sequence is plausible then the derivation is blocked. The restriction is "transderivational" in that it must refer to a separate sentence derivation involving N_3 and N_1 . However, the complexity of the restriction goes beyond this. Consider the fact that the sentences in (30) are acceptable, even though the created N 's N sequences are possible possessive noun phrases:

- (30) (a) The vendor of the newspaper's printing revealed him to be fastidious.
(b) The owner of the horse's steps revealed his confidence as a former soldier.
(c) The president of the bank's combination lock frustrated his own attempts to steal the money.

The acceptability is apparently due to the implausibility of the *entire* sequence, N 's N VP, as a separate sentence. To accommodate this fact, the "transderivational" constraint on (24) would not be restricted to a single extraderivational sentence frame (such as N_3 possesses N_1) but must range over *whatever material follows* the ultimate surface structure noun phrase being treated by (24). It is not clear that such a formalism can be constructed within any grammar. Even if it can, it would merely catalogue the facts rather than explain their nature.

The theory of speech perception offers a different account of the cases we have been discussing and also a possible explanation for their relative acceptability. The acceptability of cases like those in (31), which combine the effects of (28) and (30), suggest strongly that it is possible to have the possessive ending -'s attached to a complex noun phrase by rule (24):

- (31) (a) The vendor of the newspaper's handwriting revealed him to be fastidious.
(b) The owner of the horse's speech was that of a former soldier.
(c) The president of the bank's daughter frustrated his attempts to steal the money.

However, the intuitively less complex versions of the same deep structure in (32) highlight the behavioral difficulty of such complex possessive noun phrases:

- (32) (a) The newspaper's vendor's handwriting . . .
(b) The horse's owner's speech . . .
(c) The bank's president's daughter . . .

What appears to be difficult in (31) is not the complexity of a possessive with a possessive embedding (as in (32)), but the competition between the tendency to attach the bound possessive morpheme to the immediately preceding noun and

the tendency to attach it to the more distantly preceding noun. That this is so is demonstrated by the cases in (27), in which the immediately adjacent lexical material supports this misparsing. Thus, the theoretical claim that perceptual strategies apply to local sequences predicts that the strategy represented in (22) will tend to misapply to (27), thus rendering cases like (27) relatively difficult to understand and therefore relatively unacceptable. We can now explain why the cases in (28) and (30) are relatively acceptable—they include properties that are incompatible with the *N's N* misparsing, thus reducing its force and increasing the overall acceptability of the sentences.

We conclude that the relative acceptability phenomena in (27), (28), (30), and (32) are due to the operation of the system of speech perception; on this view, all these constructions are structurally grammatical. This solution relieves the grammar of otherwise unneeded formal power and utilizes an independently motivated theory to do so. There are several advantages to this analysis. If transderivational constraints are excluded, then universal grammar makes more constrained claims about the child's mind. Of course, this might seem to be a trivial advantage, since we do agree that the kinds of facts represented in the transderivational solution exist, but we claim that they are part of the perceptual system, not the grammar. However, their inclusion in the perceptual system allows the possibility of explaining *why* the facts are the way they are. The transderivational solution can *describe* the facts, but it does not offer any hypothesis as to their dynamic nature.

The critical advantage of the perceptual explanation is that it predicts new kinds of cases that would not be predicted by the transderivational restriction on rule (24). Consider the cases in (33):

- (33) (a) ?*The owner of the horse's steps* were rapid.
(b) Because he was in a hurry to place a bet, *the owner of the horse's steps* were rapid.

The critical sequence italicized in (33b) is more acceptable than in (33a) because the context increases the plausibility that the speaker is referring to *the owner's . . . steps* not the *horse's steps*. Accordingly, many speakers attempt to improve the acceptability of sentences like (33a) by unstressing the next-to-the-last noun of the complex noun of the complex noun phrase (*horse*), placing a pause before the *-s* and adding extra stress to the initial and the final noun, as schematized in (34):

- (34) The owner of the horse(pause)-es steps
were rapid.

The perceptual explanation predicts that such modifications would reduce the likelihood of misparsing due to gobbling and increase the perceived relation between the first and third nouns, thus increasing acceptability. The transderivational account of restrictions on (24) can make no such prediction (although it could describe such facts *post hoc*). The perceptual explanation not only

offers a potential explanation for the original phenomena, but it also makes a wider variety of correct predictions.

We have gone through possessive noun phrase parsing in some detail, since it clarifies how the interactionist model of linguistic description deals with complex acceptability phenomena. The general principle is that if an acceptability phenomenon can be accounted for by reference to an independently motivated extragrammatical system and if the phenomenon would require adding formal mechanisms to universal grammar, then the property is classified as extragrammatical. Such cases highlight the theoretical position that grammaticality is a formal property that is variably mapped onto sequence acceptability. The cases reviewed above are ones in which this approach leads a number of sentences to be classified as grammatical but unacceptable. The interactionist form of explanation can also help us discover and explain an initially troublesome category of cases; namely, *sequences that are ungrammatical but acceptable*—that is, cases the grammar marks as ill-formed, but which are acceptable by virtue of their behavioral simplicity. Langendoen and Bever (in this volume) isolated such a case, as in (35) (for discussion of other such cases, see Bever, 1970; Carroll, 1974; and Carroll and Hennessey, 1975):

- (35) A not unhappy man entered the room.

They note the cases in (36) are not acceptable although they have the same formal properties as (35):

- (36) (a) *A not unearthy scream was heard by all.
(b) *Some not unusual clothes lay on the bed.
(c) *A not intrepid sailor stood at the bar.
(d) *The not impious regent favored the bishop.

In formal grammatical terms the acceptability of the sequence *det not un-adj N* is assessed by comparing it with *det adj N*; if the latter is acceptable with the same meaning for the adjective, so is the former. The cases in (36) do not meet this test as shown in (37):

- (37) (a) *An earthy scream was heard by all.
(b) *Some usual clothes lay on the bed.
(c) *A trepid sailor stood at the bar.
(d) *The pious regent favored the bishop.
(with "pious" pronounced 'piəs')

However, as shown in (38), (35) does meet this test.

- (38) A happy man entered the room.

Example (36d) is particularly significant since the only difference between the adjective stem *-pious* and the lexical adjective *pious* is in the phonetic form, but even this difference is apparently sufficient to render (36d) unacceptable. To treat the difference between (35) and (36) as a grammatical phenomenon would

require sensitivity to the *phonetic* output of a separate derivation; surely one of the most farreaching transderivational constraints possible.

Langendoen and Bever point out that the same facts could be accounted for by the motivated misapplication of a strategy that is needed independently for the analysis of phrases and lexical compounds like those in (39), in which an adjective is preceded by an intensive adverb.

- (39) (a) A not very happy person walked in.
(b) A not all-powerful diety is believed in by the islanders.

If this strategy were to apply to sequences like that in (35), then they would be analyzed by that strategy and treated in the same way semantically, which in fact is how they are understood. However, the misapplication of the perceptual strategy can occur only insofar as the adjective stem is recognizable as a separate lexical item, leaving the initial *un-* to be temporarily treated as an intensifying adverb. Thus, the phenomena in (36) can be accounted for without reference to transderivational constraints and in a way that offers an explanation of the facts rather than merely enumerating them. Thus, there are several advantages to classifying the sequences in (35) as ungrammatical but acceptable.

We mentioned above that if we are to understand the life and evolution of grammar we must pay close attention to the constraints that govern the creation of new ungrammatical idioms. Unfortunately, Langendoen and Bever's account leaves open what the general constraints are on possible ungrammatical forms. They suggest that the traditional notion of 'analogy' can be given theoretical and empirical content if we restrict it to cases in which a particular extragrammatical system of speech behavior accounts for the acceptability of an ungrammatical sequence. In the case of perception such cases would characteristically be ones in which a particular strategy is misapplied (successfully) to a sequence. The study of such cases in perception, however, is difficult, since the very acceptability of the critical sequences makes it likely that they will at first be classified as 'grammatical' and then discovered to be 'ungrammatical' only after attempts to describe their 'grammaticality' within a grammar have failed. Accordingly, we now turn to cases from speech production, for in speaking, we characteristically produce a class of utterances we recognize to be ungrammatical. It may be that the different kind of data will allow for further insight into what the constraints are on ungrammatical but acceptable sequences.

3. SPEECH PRODUCTION

An experimentally motivated theory of speech production is hard to develop for one obvious reason—it is hard to do controlled experiments on speech production. Ideally, we should do studies that are the converse of those used to verify perceptual models. We should control what a speaker intends to say, and then see how it is said. We could then sketch out the behavioral properties of the

problem of how speakers map ideas onto surface sequences as they talk. Unfortunately (from the standpoint of this experimental line of research) one cannot control what subjects think as easily as one can control what they hear; in particular, one has almost no control over *when* subjects think a particular thought. Consequently, the study of speech production is based primarily on theoretical, observational, and anecdotal considerations.

Even such limited data constrain what the theory of speech production must be like (see Boomer, 1970; Valian, 1971; Fodor, Bever, and Garrett, 1974). Clearly, the problem for the speaker is to find a way of mapping ideas onto comprehensible utterances. At the same time, the speaker listens to his or her own utterances as they emerge and can modify ideas based on the utterances as they appear. That is, to some extent we think before we speak, but we also find out at a conscious level what we think by listening to what we say.

These two features of talking are reflected in two properties of speech production that have been studied relatively carefully. First, several observational and experimental studies suggest that the primary unit of speech planning is defined over the surface structure and probably is the surface structure 'clause' (Boomer, 1965, 1970; Valian, 1971). That is, in mapping ideas onto utterable sequences, the main goal is to formulate surface structure clauses that in themselves are coherent units. The second property is that as we talk we listen ahead to see if what we are going to say represents what we mean. Evidence for this comes primarily from the study of points at which false starts in free speech occur (Maclay and Osgood, 1959) and studies of spoonerisms (Fromkin, 1971; MacKay, 1970; Garrett and Shattuck, 1974). The existence of false starts suggests that we can listen ahead to how a particular construction is going to work out and decide that it is inadequate to our idea or to the conversational context, so we stop and start afresh. The existence of spoonerisms reveals that when we talk we have in mind parts of an utterance that are delayed by several words, although generally within the same surface structure clause.

A final property of the speech production system has been asserted, but there is still little direct evidence that proves it (Valian, 1971; Fodor, Bever, and Garrett, 1974; Schlesinger, 1969; and Bever, 1975b). That is the proposal that talking involves a set of speech production rules that map ideas onto standard phrases. It is unclear to what extent these production rules are literally the rules of grammar. They must differ in certain respects simply because they apply surface clause by surface clause, whereas many grammatical transformations apply to several clauses simultaneously. Furthermore, production rules are concerned only with creating linear order, while transformations can carry out other functions. Finally, all production rules apply during a single temporal scan of the surface structure and thus are not ordered; this insures that many transformations cannot be production rules.

Thus, just as in the case of the perceptual strategies, the speech production rules are not isomorphic to rules of grammar. What is of crucial importance for

the present paper is that the speech production system differs at least in part from the grammar. This allows for the possibility that speakers can utter sentences that in fact are ungrammatical but that are systematically predicted by the speech production system. Indeed, it is the partial mismatch between the speech production system and the grammar that is a dynamic source for potential neologisms.

3.1 Lexical Errors

This model of speech production can explain the occurrence of a variety of ungrammatical-but-utterable sequences. Characteristically, ungrammatical utterances are used as the solution to a bind that the speaker has created by what has been uttered up to that point. For example, in (40) the speaker presumably starts out with *both* because of the expectation that only two noun phrases will be conjoined, and during the later sequence utters a third noun phrase:

- (40) ?Both the senators, the congressmen and their assistants refused to appear.

The resulting utterance is clearly 'ungrammatical' in the sense that, if asked, speakers agree that it ought to be unacceptable by virtue of the fact that *both* requires exactly two conjoined noun phrases. Furthermore, there is a version of (40) which means the same and is grammatical, namely (41):

- (41) The senators, the congressmen and their assistants all refused to appear.

Sentence (42) has properties similar to (40) in that it is directly recognized as unacceptable, but is often uttered in preference to the grammatical (43a-c) because it avoids committing the speaker to the assumption that *everyone* is of one sex only, as in (43a and 43b); (42) also avoids the relative cumbersomeness of (43c):⁴

- (42) ?Everyone forgot their coat.
 (43) (a) Everyone forgot his coat.
 (b) Everyone forgot her coat.
 (c) Everyone forgot his or her coat.

4. In many similar cases the speaker is forced to select one of several ungrammatical forms. In such cases the third person singular seems to be the most favored, perhaps because it is the most unmarked. Consider (i-vi) (pointed out by G. K. Pullum).

- (i) Either you or I am crazy.
 (ii) Either you or I are crazy.
 (iii) Either you or I is crazy.
 (iv) Either you are going crazy or I am going crazy.
 (v) It is I who am crazy.
 (vi) It is I who is crazy.

Examples (i-iii) are all ungrammatical reductions of (iv). However (iii) seems to be the form most preferable. Similarly, (vi) is preferred over (v).

3.2 Syntactic Errors, Clause

Relations

Sentences (40) and (42) are examples of intuitively ungrammatical utterances in which the structural difficulty occurs within one clause from the misuse of a single word. The view that speech production is planned clause-by-clause suggests that errors involving entire constructions occur across clauses but not within clauses. This follows from the fact that the misapplication of a syntactic process within a clause would be noticed by the speaker, and blocked; while across clauses the speaker might lose track of the exact syntactic form from one clause to the next. Consider (44) as an example of the misapplication of the pronominalization rule to the presumed underlying form in (45):

- (44) ?Iroquoianists are strange because they want it to be a world language.
 (45) Iroquoianists are strange because they want Iroquois to be a world language.

It is a misapplication because noun phrase identity does not occur in (45) (i.e., "Iroquoianists" ≠ "Iroquois"). Lakoff and Ross (1972) suggest that examples like (44) are acceptable because of a 'grammatical' principle that pronominalization can occur simply on the basis of semantically and phonologically *similar* commanding phrases. However, this description is difficult to state within the grammar since the notion of what counts as 'similar' differs from context to context (and from pronunciation to pronunciation). That is, the concept of 'similarity' is in part a function of language use, and thus would ordinarily be viewed as part of linguistic performance. On this view the appearance of "Iroquois" in (45) is interpreted by the speaker as a repetition of the phonologically and semantically similar element in "Iroquoianists" that has just been uttered (or planned); the separation of it into a preceding clause makes it difficult to check. Hence, the pronominalization misapplies acceptably as in (44). It cannot misapply in a case like (46) from (47) because the second occurrence of the phonological sequence "Iroquois" is within the same clause (i.e., within the same unit of speech production planning); thus the speaker is not confused by the apparent similarity because the words are syntactically differentiated within the clause:

- (46) *Because Iroquoianists want it to be a world language they're strange.
 (47) Because Iroquoianists want Iroquois to be a world language they're strange.

The behavioral notion of 'similarity' can also explain the acceptability facts in (48a-c) (see McCawley, 1970):

- (48) (a) ?I think I'd like the Mediterranean climate even though I've never been there.

(b) I speak $\left\{ \begin{array}{l} \text{Irish} \\ \text{English} \\ *Dutch \\ *Hebrew \end{array} \right\}$ even though I've never been there.

(c) Many a German has learned $\left\{ \begin{array}{l} \text{Italian} \\ *Sanskrit \\ \text{Dutch} \\ *Tagalog \end{array} \right\}$ and vice versa.

Thus the view proposed by Lakoff and Ross (1972) is not only grammatically cumbersome, but it also fails to predict and explain already related facts.

The speech production model offers straightforward accounts of other frequent utterances that are intuitively ungrammatical. For example (49a) is presumably a rendition of (49b), which occurs because the speaker failed to insert *each* into the main clause (see Dougherty, 1970, 1971):

- (49) (a) *Harry and Bill didn't realize that each other was at the meeting.
(b) Harry and Bill each didn't realize that the other was at the meeting.

On the interactionist model of speech production *each other* is generated in the deep structure corresponding to the second surface clause; presumably the failure to move *each* into its proper position in the first clause results in part from the fact that the first clause is superficially well-formed without *each*; further, the speaker has uttered the first clause by the time he or she realizes that the second clause is ungrammatical. It is ungrammatical due to the fact that *each other* and *one another* can appear as a surface object (as in 50a, b) but not as surface subject (as in 50c):

- (50) (a) Harry and Bill hit $\left\{ \begin{array}{l} \text{one another} \\ \text{each other} \end{array} \right\}$.
(b) Harry and Bill were hit by $\left\{ \begin{array}{l} \text{one another} \\ \text{each other} \end{array} \right\}$.
(c) $\left\{ \begin{array}{l} *One\ another \\ *Each\ other \end{array} \right\}$ was hit by Harry and Bill.

A similar case that exemplifies the independence of surface clauses in speech production is given in (51) and (52):

- (51) ?I really enjoyed flying in an airplane that I understand how it works.
(52) ?So we won't have keys lying around that we don't know where they are . . .

Sentence (51) arises from the utterance in (53); in (53) the speaker felt it was awkward to stop at that point since the dimension on which the airplane was

'understood' was not clear; (51) arises because there is no correct way of expanding (53) to represent the intended idea, as in (55). Similarly, having reached the point in (54) the speaker could find no natural way to expand it to contain the content of (56), and therefore utters (52).

- (53) I really enjoyed flying in an airplane that I understand . . .
(54) So we won't have keys lying around that we don't know . . .
(55) I really enjoyed flying in an airplane the workings of which I understand.
(56) So we won't have keys lying around the whereabouts of which we don't know . . .

On this view the second clauses in (51) and (52) are utterable because of their full acceptability as independent clauses. The principle that speech production proceeds clause-by-clause explains why the speakers were willing to utter the sequences, in each case, the only difficulty arose from the incorrect syntax governing the relation *between* the two clauses, but leaving the intended meaning intact. (See Langendoen, 1970, for some discussion of such cases.)

3.3 Syntactic Errors, Repeated Items

In each of the preceding examples the utterance is clearly unacceptable upon reflection, although obviously utterable. We have argued that each critical ungrammatical utterance can be interpreted as due to a predicted potential failure of the speech production system. To treat each utterance as 'grammatical' (but 'unacceptable' due to processes outside the grammar) would weaken the power and interest of grammars unnecessarily, since there is an independently motivated system that explains the occurrence. Furthermore, it is characteristic of these examples that there are closely related alternatives that are fully grammatical.

In other ungrammatical but acceptable examples there seem to be no ready alternatives. It is characteristic of these cases that the ungrammatical forms are more readily accepted than those that have alternatives. Such cases are more subtle in that they are not clearly unacceptable even upon reflection; nevertheless, accounting for their acceptability within the grammar would still involve increasing its formal power. Consider example (57a), which represents (57b):

- (57) (a) That Herbie was chewing his tongue amused them is normal.
(b) ?That that Herbie was chewing his tongue amused them is normal.

Since (57a) is not obviously unacceptable, it is prudent first to examine the consequences of generating it as the grammatical version of (57b). A solution to the description of (57a) within the grammar would be to state a rule that obligatorily deletes the second *that* in any sequence of two. This, however, would be incorrect since (58) is entirely acceptable but it would be blocked by such a rule:

(58) That that person is here surprised Harry.

In (58) deletion does not apply to the phonologically repeated form since the two *thats* have different grammatical functions in the sequence. An alternate solution within the grammar would be to state a rule that requires both phonological equivalence and identity of syntactic function in order for deletion to apply. However, this rule also will incorrectly derive many cases, as the unacceptable (60) from (59) and (62) from (61) show:

- (59) ?Who who I like will be at the party tonight?
 (60) *Who I like will be at the party tonight?
 (61) ?If if Sally is back interests you then we can find out.
 (62) ??If Sally is back interests you then we can find out.

The acceptable versions of (59) and (61) are (63) and (64):

(63) Who $\left\{ \begin{array}{l} \text{whom} \\ \text{that} \end{array} \right\}$ I like will be at the party tonight?

(64) If whether Sally is back interests you then we can find out.

These cases demonstrate a principle that a word cannot be immediately repeated if it has the same grammatical function in each instance, but *must* be replaced *if there is an available substitute*, as in (63) and (64).

The repetition of a phonological form with identical structural function involving different parts of the underlying structure can cause difficulties both for speech perception and production. The reason is that free speech involves a certain amount of spurious repetition as speakers search for the right words, especially of clause-initial function words like *that*, *who*, *if* as in (65) (see Fodor, Bever, and Garrett (1974) and Maclay and Osgood, 1959):

- (65) (a) If . . . if . . . if Sally is back I'll call her.
 (b) I didn't know that . . . that Marty likes hot dogs so much.
 (c) I wonder who . . . who will be the one that has to tell him.

This makes it heuristically valuable to have a "repetition-collapse" that treats a sequence of words with the same phonological and structural role as a spurious repetition of the same word. Such a behavioral heuristic accounts for a number of variations in acceptability—for example, the unacceptability of (66a). The relative acceptability of (66b) is accounted for by the fact that the two instances of *over* have different grammatical properties:

- (66) (a) ?I rolled the film clip of Lassie's rolling over over
 (b) I looked the film clip of Lassie's rolling over over

In this regard, contrast (67a) (from Chomsky, 1953) with (67b) and (67c).

- (67) (a) Whom will they name him after after his first birthday?

- (b) *After after Oscar leaves Suzie kisses me then I'll really know for sure.
 (c) *John said he would come after after the picnic clean-up work is finished.

The unacceptability of repetitions may involve units internal to words as well. Bever (1970) discusses the unacceptability of forms like (68) (also see Ross, 1972):

(68) They were considering discussing producing toys.

A similar restriction on repeated forms occurs in Spanish clitics. Perlmutter (1972) noted that forms like (69a) are realized as (69c):

- (69) (a) *pero a los conscriptos se les los da
 (b) *pero a los conscriptos se se los da
 (c) pero a los conscriptos se los da ("but to the draftees one gives them")

Perlmutter argues that such facts can only be described by a set of "output constraints," which mark sequences like (69a) as ungrammatical. It is possible to recast Perlmutter's formally complex solution in the terms of the behavioral restriction on repeated forms. The ungrammatical *les los* of (69a) becomes *se los* as in (69b), since *se los* is a possible sequence. But now there is the sequence *se se* which is unacceptable: that is replaced by ϕ *se* since no other alternative is available. This results in the surface form (69c).

We can now understand the case in (57a) in which a repeated *that* is deleted. Alternative substitution items do not exist in this case as they do for (59) and (61). For this reason the null string is substituted. There are alternative similar strings, such as (70):

- (70) That the fact that Herbie was chewing his tongue amused them is natural.

A substitution like this, however, does not even maintain the basic grammatical relations of the original form. In (70) *the fact* is the grammatical subject (modified by the complement clause *that Herbie was chewing his tongue*) of the verb phrase *amused them*, while in (57a) and (56b) *that Herbie was chewing his tongue* is the subject (cf Kiparsky and Kiparsky, 1970). Furthermore, even if *the fact that* in (70) were analyzed as having the same structure as *that* in (70), it repeats the initial *that* and can reasonably be interpreted as a spurious repetition, as in (71):

- (71) That . . . the fact that Harry left upset many.

On these grounds, then, (70) does not constitute an alternative to (57b) in the sense that (60) and (62) may replace (59) and (61), respectively. Zwicky (1969)

deals with related analogical simplifications that modify such sequences as (72a) to (72b):

- (72) (a) *The The Hague airport is very modern.
(b) The Hague airport is very modern.

Sequences of two possessive morphemes are often collapsed to one. Consider the form in (73a), which may be realized as in (73b):

- (73) (a) My mother's dog's foot slipped but your mother's dog's foot didn't.
(b) ?My mother's dog's foot slipped but your mother's's didn't.

Forms like (73b) are often actually rendered as in (74a) even though such replacement forms do not really mean the same thing. In particular, the *grammatical* source for (74a) would have to be a form like (74b):

- (74) (a) My mother's dog's foot slipped but your mother's didn't.
(b) My mother's dog's foot slipped but your mother's foot didn't.

Similarly, consider the embedding of (75b) in a form like (75a) as in (75c) (pointed out by Kuno). Forms like (75c) are usually realized as in (75d) with the extra 's 'analogically' deleted:

- (75) (a) a friend of Mary's
(b) this friend of Mary's
(c) a friend of (this friend of Mary's)'s
(d) a friend of this friend of Mary's

4. INTERACTION OF PERCEPTION AND PRODUCTION

A "minimax" principle governs the interactions between speech production and perception. The problem for the speaker is to map ideas onto a surface structure. The speaker attempts to minimize the surface structural complexity of the utterance while maximizing the information communicated to the listener. It is obviously in the speaker's interest to communicate effectively while not unnecessarily burdening himself in the process. Consider, as an example, self-embedded sentences like (3), (5), and (76a).

- (76) (a) The bear the mole the grasshopper jumped bit growled.
(b) The bear that the mole that the grasshopper jumped bit growled.

As Fodor and Garrett (1967) and others have observed, such difficult sequences are easier to perceive if the relative pronoun markers are not deleted (as in 76b).

This increases the complexity for the speaker since each *that* potentially signals the beginning of a new surface structure clause. However, it is just that property that facilitates comprehension. In this regard, Valian and Wales (1975) found that when speakers are asked to make a sentence "clearer" for the listener, they do so by altering the sentences so that the deep structure relations are more clearly marked in distinct surface structure clauses. For example, a sentence like (77a) might be clarified for the listener by a sentence like (77b):

- (77) (a) The destruction of the building upset everybody.
(b) The building was destroyed and that upset everybody.

Of course, the goal of the speaker is to take potential utterances like (77b) and utter them in a form like (77a), which has fewer surface structure clauses. Indeed, forms like (78a) are quite typically changed into forms like (78b):

- (78) (a) John runs faster than Bill runs.
(b) John runs faster than Bill.

Although (78a) is closer to its "deep structure" form, some of its structure is redundant (cf Fodor and Garrett, 1966, p. 150).

The main goal for the speaker is to maximize the information within each surface structure clause. For example, the convention that conjunctions must appear in the surface sequence in their logical order allows for the grammatical simplification of a variety of *originally* complex sentences (e.g., 79a to 79b; 79c to 79d):

- (79) (a) Harvey left and then Harvey ate a sandwich.
(b) Harvey left and ate a sandwich.
(c) Marge inherited a million and then supported the ASPCA with it.
(d) Marge inherited a million and supported the ASPCA.

This pressure can even lead to the utterance of unacceptable sequences, as exemplified by (80) (after Schmerling, 1973):

- (80) *(It) seems like (it is) a good idea (Do you) want Harvey to cut that out?

Although usable, cases like (80) are clearly unacceptable upon reflection.

4.1 Using *And* as a Complementizer

We turn now to a case of a usable sequence that is also fully acceptable. We shall argue that it is ungrammatical but acceptable because it simplifies surface structure complexity for the speaker, while remaining completely comprehensible for the listener.

Consider the sentences in (81b). They are a frequent version of the corresponding sentences in (81a).⁵

- (81) (a) John will try to jump over the fence.
 (b) John will try and jump over the fence.
 (a) The foreman will leave to accept the better job.
 (b) The foreman will leave and accept the better job.
 (a) Harry wants to go to see the King.
 (b) Harry wants to go and see the King.
 (a) They asked us both to come to eat with them.
 (b) They asked us both to come and eat with them.
 (a) Malcomb hopes to stop to rest at Inverness.
 (b) Malcomb hopes to stop and rest at Inverness.
 (a) I need Calvin to testify to save me from jail.
 (b) I need Calvin to testify and save me from jail.

It would appear that the sequences in (81a) could be treated as grammatical versions of those in (81b): *to* could be rewritten as *and*, as stated in the hypothetical transformation (82):

$$(82) (V_1 \text{ (to } V_2)) \Rightarrow V_1 \text{ and } V_2$$

However, there are a number of restrictions on (82). First, V_1 must be an infinitive in the surface structure, as shown by the unacceptability of (83a, b, c), in contrast with the acceptability of (83d, e):

- (83) (a) *John tried and jumped over the fence.
 (b) *John has tried and jumped over the fence.
 (c) *John is trying and jumping over the fence.

5. Notice that for the verbs *come* and *go* the forms in (i) and (ii) also obtain.

- (i) They asked us both to come eat with them.
 (ii) Harry wants to go see the King.

This is consistent with the minimax principle. *Come* and *go* are very frequently used in ' V_1 (to V_2)' constructions, hence not only is the ' V_1 and V_2 ' analogy available (see below in text), but also ' $V_1 V_2$ '. The latter sequence further simplifies the verb structure by rendering conjoined verbs as a compound verb. See Ross (1967) and Zwicky (1969) for further discussion of related examples. Ross pointed out that V_1 need not be adjacent to V_2 in surface structure in order for (79) to apply as in (iii):

- (iii) John wants to go to the store $\left\{ \begin{array}{l} \text{and} \\ \text{to} \end{array} \right\}$ buy some whiskey.

Ross also pointed out cases (iv) and (v), which appear to be related to the cases under discussion but are not examples of (81) since they are peculiar to *go* as V_1 :

- (iv) She went and solved a problem.
 (v) She went and stained her dress.

- (d) John didn't try and jump over the fence.
 (e) John did try and jump over the fence.

In (83d) the negative element requires Do-Support, which leaves the main verb in the infinitival form, thus allowing (82) to apply (unlike 83a). Accordingly rule (82) would have to be a late rule, applying after such rules as Do-Support which leave the main verb form as an infinitive. At first, this appears to be an elegant solution, since the statement of (82) is itself simple and can easily be treated as a late optional rule.

The problem is, however, that many verbs are structurally and semantically indistinguishable late in a derivation from those above, but do not allow (82) to apply when they are V_1 —as demonstrated in (84b), which cannot be derived from (84a):

- (84) (a) John will attempt to do it.
 (b) *John will attempt and do it.

Other examples like (84b) are given in (85):

- (85) (a) *Everyone will expect and greet you tonight.
 (b) *Harry didn't want and read that book.
 (c) *The queen will desire and meet the jester.
 (d) *He did seem and get more money.

The complement verbs which can act as V_1 in (82) share one characteristic—they can stand alone, without an object phrase, in other constructions like (86a) and in the imperative (87a):

- (86) (a) Harry really will try.
 (b) *Harry really will attempt.
 (87) (a) Try!
 (b) *Attempt!

(Note that the contrast between *attempt* and *try* is crucial since they have identical meaning.)

It is important that the reason a verb can occur in constructions like (86a) and (87a) without an object can differ. For example, *go*, *come*, . . . never take objects, while *try*, *leave* may do so. A further restriction is that " V_1 and V_2 " must be roughly paraphrasable as a " V_1 causes or facilitates V_2 ." For example (88a) cannot appear as (88b), presumably because the activity of "waiting" does not cause or facilitate the "eating" (in fact, it does the opposite):

- (88) (a) The devout Moslem will wait to eat until sunset.
 (b) The devout Moslem will wait and eat until sunset.

However, there are instances in which "waiting" does facilitate or cause a predicate as in (89a):

- (89) (a) To own your own car you're just going to have to wait to grow up.
(b) To own your own car you're just going to have to wait and grow up.

In this case, rule (82) *can* apply, producing (89b) as an acceptable version. These facts could be treated within some form of grammar, but would require sensitivity to a heterogeneous set of structural properties and would offer no explanation of the nature of the phenomenon. The grammar would simply list the properties governing the application of (82), as in (90):

- (90) (a) The last formative of V_1 must be infinitival.
(b) V_1 must be: (i) intransitive.
(ii) subject to object deletion.
(c) V_1 must cause or facilitate V_2 .

The condition in (90b) is 'global' in the sense that it makes reference to an earlier stage of derivation (i.e., lexical insertion). The condition in (90b, ii) is 'transderivational,' since it makes reference to the application of a rule of V-Object Deletion, which does not occur in the derivation of sentences like those in (81b). Condition (90c) requires sensitivity to the real-world contingencies governing which activities can cause or facilitate other predicates.

It remains for us to consider if there is an explanation for why the verbs and verb sequences that do undergo a change represented in (82) do so. The min-max principle seeks to minimize the (surface) structural complexity of utterances while maintaining comprehensibility. We have given examples showing that such a principle assigns a preferred status for the speaker to forms with reduced clause embeddedness. The sequences in (81b) compared with those in (81a) have this property. They represent an infinitival verb embedding a second infinitive with a pair of conjoined verbs. The behavioral preference for conjoined structures over embedded ones is supported by some research (e.g., Blumenthal, 1966). Accordingly, speakers would prefer to avoid uttering embedded constructions like those in (81a) if a grammatical alternative exists with conjoined rather than embedded verbs. In fact, such a construction does exist, as in (81b); that is, speakers have available a speech production rule which takes a linear sequence of superficially identical verb forms and conjoins them with *and*. Hence the conjoined verb sequence is a possible and utterable syntactic structure in the language. However, the grammatical derivation of conjoined structures as in (81b) involves a different meaning from (81a).

Nevertheless, the operation of the perceptual system guarantees that the intended meaning rendered in (81a) will be understood in (81b). This will occur because of the independently motivated perceptual strategies that normally apply to a sequence like " V_1 and V_2 ." As we observed above (see examples (7),

(8), and discussion), conjoined verbs are interpreted as coinciding with their temporal or logical order. This principle operates in sentences like (7) and (8) and exemplifies a natural constraint on speech behavior. The process in (82) also depends on this constraint. Thus, the listener in understanding sequences like those in (81) assumes that V_1 necessarily precedes V_2 logically or temporally. The grammatical relational information that V_1 takes V_2 as its complement can usually be recovered with this perceptual assumption. However, when this assumption is false, as in (88b), then the misapplication of the conjoined verb speech production schema is blocked. In this way, surface structural complexity is minimized by the speaker at no cost in comprehensibility for the listener.

At first this solution may appear merely to be a notational variant of the grammatical statements in (82) and (90). However, viewing the sequences in (81b) as produced by the misapplication of a speech production rule and the regular application of a perceptual strategy allows us to explain why the restrictions in (90) are the way they are. V_1 must end in an infinitive since V_2 is always infinitival in the source sequence " V_1 to V_2 ." If the *conjoined verb speech production rule* is to (mis)apply at all, V_1 must be superficially identical with V_2 ; i.e., V_1 must be an infinitival.

The restriction that V_1 must optionally be able to delete its object is also explicable if we interpret the sequence in (81b) as acceptable because of behavioral processes. If (82) were allowed to apply to the verbs in (84) and (85), which require an object phrase, the output would be homonymous with reduced compound structures like (91a), derived from (91b):

- (91) (a) John will attempt and do it.
(b) John will attempt it and John will do it.

In ordinary language usage, the compound interpretation of sentences like (91a) would be unavoidable since the verbs in (84) and (85) must have objects. Hence (82) is blocked in such cases, because the output would be *necessarily* homonymous with a fully grammatical sentence having a different meaning. This would leave no opportunity for the extended analogical meaning to obtain. In cases where V_1 does not require an object, the listener is not forced to interpret the sequence as a compound verb: so long as V_1 does cause or facilitate V_2 , then the general perceptual strategy will lead the listener to hear such sentences as potentially having the complement meaning. In this way, our account explains why V_1 must at least optionally have no object and why V_1 must facilitate V_2 .

In brief, the assumption that the sequences in (81b) are produced by behavioral processes relies on independently motivated structures, simplifies the grammar, and allows for a direct explanation of the restrictions on the phenomenon. It should be noted that we have demonstrated that the sequences in (81b) have the interpretation in (81a) only due to extragrammatical systems. That is, the sequences in (81b) are ungrammatical but acceptable on their complement interpretation.

4.2 The Interaction of Productive Analogy and Perceptual Gobbling

We have argued that ungrammatical utterances become acceptable if they have no grammatical alternative that is behaviorally usable. The interaction of usability constraints and grammaticality can become quite intricate. Consider example (92) (actually uttered in a conversation), which is interpretable as (93):

(92) The three of your's book will make you rich.

(93) The book which $\left\{ \begin{array}{l} \text{is by} \\ \text{belongs to} \end{array} \right\}$ the three of you will make you rich.

On our analysis (92) is an ungrammatical but acceptable version of the grammatical but perceptually confusing sentence in (94):

(94) The three of you's book will make you rich.

Example (94) is generated from (93) by the regular adjective phrase preposing transformation that forms standard prenominal possessive phrases. The perceptual difficulty of (94) is that the pronoun *you* gobbles the adjacent possessive morpheme. Since that morpheme is ordinarily a lexically absorbed suffix, it is particularly vulnerable to gobbling (see examples (22)–(34)). Now we must account for why the particular ungrammatical utterance in (92) is the one that replaces the perceptually complex grammatical sentence in (94). The production of (92) from (94) involves an interaction of productive analogy and further instances of perceptual gobbling. The first logical step is that *you's* in (94) becomes *your* as in (95):

(95) The three of your book will make you rich.

This morphemic process is the same that applies to any possessive pronoun (changing *he's* to *his*, *they's* to *their*, etc.). Sentence (95) is itself unacceptable because the possessive pronoun *your* is gobbled by the apparent head noun *book* of the derived noun phrase, leading to an incomprehensible perceptual analysis as sketched in (96):

(96) (The three of ((your book) (will make you rich))

To block this further gobbling and the resulting unacceptability, an alternate constituent is substituted. The principle of analogy requires that it be a constituent with similar syntactic and semantic properties. The constituent whose semantic content and morphological form are closest to that of the possessive pronoun *your*, and whose substitution would block gobbling, is the possessive pronoun *yours*. This analogical replacement yields sentence (97):

(97) The three of yours book will make you rich.

In fact, some speakers find that (97) is the acceptable way to express (94). For those speakers our account stops here. However, this form is unacceptable for

many speakers who prefer (92). This may be because a mandatory transformation reduces the possessive pronoun in the preposed position, as illustrated in (98):

(98) The book is yours \Rightarrow yours book \Rightarrow your book

The effect of this transformation precludes the occurrence of the possessive form *yours* in the prenominal position in sentence (97). Therefore, the alternative in (97) reduces to the unacceptable form in (95).

The unacceptability of (97) compels the speaker to resort to further analogical substitution. The next most likely alternative constituent that will block gobbling and whose occurrence in the prenominal position is not blocked by some mandatory transformation is the possessive pronoun *your's*. This form occurs in grammatical and acceptable sentences; e.g., (99b) (see also 73b above):

(99) (a) My guitar's strings are rusted but your guitar's strings are not.
(b) My guitar's strings are rusted but yours's are not.

This establishes the form *yours's* within the system of speech production and makes it available for substitution of the perceptually complex forms in (94) and (95). This example illustrates the dynamic relationship in sentential acceptability among the productive analogy, perceptual constraints, and the grammar.

5. "DERIVATIVE GENERATION" AND ANALOGY

All the examples above involve misusing a constituent syntactically while maintaining the meaning of the misused constituent. For example, in (40) *both* maintains its lexical meaning; similarly *their* in (42) and *and* in (81b) have meanings that are independently motivated in other uses.

We can now apply the principle of analogy to explain a case of "derivative generation" raised by Chomsky (1970) and questioned by Hankamer (1972) and McCawley (1973). Chomsky points out that there are three kinds of deverbal noun phrases: the derived nominal (100a), the gerundive (100b), and the "mixed" forms (100c):

(100) (a) Harry's criticism of the book . . .
(b) Harry's criticizing the book . . .
(c) Harry's criticizing of the book . . .

Chomsky argues for the "lexicalist" position, that only the gerundive (100c) is derived from a deep-structure sentoid (e.g., "Harry criticized the book"). This would explain the fact that gerundive nominals can include verbal modifiers such as adverbials (101a), while derived nominals cannot (101b):

(101) (a) Harry's criticizing the book all evening long upset Bill.
(b) *Harry's criticism of the book all evening long upset Bill.

Further support for this analysis is given by the fact that gerundive nominals have a "factive" interpretation while derived nominals are treated as simple nouns. For example, (102) is unacceptable because (*was... quoted*) is a predicate that cannot take a factive subject:

(102) *That Harry criticized the book was widely quoted.

This is consistent with the unacceptability of (103b) on the view that (103b) is derived from a sentence like (102) (see Jackendoff, 1974, for numerous arguments supporting this analysis):

- (103) (a) Harry's criticism of the book was widely quoted.
(b) *Harry's criticizing of the book was widely quoted.

Chomsky notes that for some speakers the derived nominal can include a verbal modifier. For example (104) is acceptable even though it is consistent with the lexicalist position since the nominal has a subordinate modifier:

(104) Harry's criticism of the book before he read it was widely quoted.

Chomsky proposes that (104) be accounted for by "derivative generation" from (105):

(105) Harry's criticizing the book before he read it . . .

That is, Chomsky argues that (104) is acceptable by "analogy," but remains ungrammatical, thus saving the lexicalist analysis. Hankamer (1972) and McCawley (1973) have attacked this proposal on the grounds that it is unmotivated by any general theory of "derivative generation." We can give force to Chomsky's claim and meet the objections to it by application of the analogy principle we have been illustrating. Suppose that a speaker wished to express the two propositions in (106) in one surface clause:

- (106) (a) Harry criticized the book before he read it.
(b) Harry's criticism was widely quoted.

There is no grammatical utterance that will represent this combination; rather there are two ungrammatical choices, (107) and (108):

- (107) *Harry's criticizing the book before he read it was widely quoted.
(108) Harry's criticism of the book before he read it was widely quoted.

In (107), the regular meaning of the gerundive would have to be changed from a factive to a nonfactive. However, in (108) the normal meaning of the derived nominal is exactly the one intended. Thus the speaker uses (108) following the constraint that in analogy the meaning of individual phrases is preserved wherever possible.

This analysis motivates the particular form used to express (106) and thereby explains (104) as an analogical formation. In this way, "derivative generation" may be given explanatory force.

6. EPILOGUE—IMPLICATIONS FOR A DYNAMIC MODEL OF LANGUAGE CHANGE AND ACQUISITION

Bever and Langendoen (1971, this vol.) articulated a problem in the model of linguistic evolution proposed by Halle (1962). According to this model, languages evolve according to specific constraints on the rules, for example, simplifying rules (Halle) or increasing the functional coherence of sets of rules (Kiparsky, 1968). As new cases come into linguistic usage, the child restructures its grammar to handle the new cases more efficiently than the grammar of its parents. The problem posed by such a model concerns the generation of "new" cases that motivate grammatical restructuring. Bever and Langendoen interpreted this problem as a question of constraints on possible neologisms and proposed that "possible neologisms are limited by the systems of speech behavior."

On this view, linguistic evolution is interpreted as an interaction between systematically constrained neologisms and an ontogenetically shifting filter in the child: those neologisms that are appropriate to a particular state in the child "survived"; they are picked up by the child and incorporated within the predicted grammar of the language. In this sense the effect of linguistic neologisms is analogous to the role of biological mutations in species evolution: their form is somewhat constrained by existing synchronic structures and if they create a structure which is too much at variance with existing structures they "die out" and do not become part of the structural evolution.

The present paper has fleshed out part of the view that was left unexplored: the source of acceptable neologisms. In their formulation Bever and Langendoen simply stated that neologisms are *constrained* to be "usable." They left the *source* of neologisms unexplained, relying on the possibility that they occur randomly and spontaneously. In the present paper, we have argued that behavioral limitations of the mechanism of speech production actually limit possible neologisms. Furthermore, they can *force* certain neologisms to become idiomatically "acceptable," though ungrammatical. That is, linguistic evolution is not merely a passive process in which randomly occurring neologisms are filtered out by behavioral and grammatical constraints. Rather, the process is partially an *active* one in which the needs of the system of speech production give rise to new constructions the grammar must accommodate to. Accordingly, linguistic evolution occurs in part as the by-product of mutual adjustments and interactions among different linguistic systems.

The notion that neologisms arise in an active process resolves a parallel problem in the standard models of language acquisition (see Chomsky, 1965; McNeil,

1969; Braine, 1964; Bloom, 1970). According to these models, language is acquired by way of a series of grammatical stages. At each stage the child attempts to incorporate within its grammar new sentences that it has come in contact with and to exclude sentences generated by its previous grammar that turned out to be unacceptable. Previous considerations of this model have left open the question of how the child brings new sentences into its behavioral repertoire before changing its grammar to generate them. That is, the previous discussions have characterized the language acquisition process as a passive one in which the child continually attempts to "weed out" unacceptable sentences that are generated by its grammar at each stage.

This view implies that the child's earliest grammars are the least constrained and become successively more restrictive. However, there is no evidence that this is the case. Also, grammar acquisition would be completely haphazard, depending entirely on *which* sentences the child happened to try out and which sentences the linguistic community happened to respond to appropriately.

The considerations in this paper allow for a more constrained and dynamic view of language acquisition (cf Bever, 1975b). On this view, the child is acquiring a behavioral system of speech perception and production partially independent from each other. "Grammar" develops primarily because of its functional role in easing the double burden on the child's memory imposed by the fact that there are a number of different systems for language use, each of which overlaps with the others. The main focus of the overlap are the shared lexical and syntactic sequences. For example, if the systems of speech production and perception are independent, then the set of words and sentences the child can understand will be represented in a distinct way from those words and sentences that he can utter. As this multiplication of information increases, so will the burden of the child's memory. On this view, the development of the "grammar" represents an organization of linguistic knowledge in which lexical items are listed only once each, and no sentences are listed. The syntactic and semantic components of the grammar specify how the lexical items can be combined to produce actual sentences.

An example may clarify this model of language acquisition. Consider simple adjectival sentences ("Harry was tall") and "truncated passives" ("Harry was hurt"). Children utter and understand both kinds of sentences at a very young age (about three years). This is puzzling if one were to assume that the child has developed a full grammatical analyses of truncated passives, since truncated passives are linguistically complex (i.e., they are derived from full passives such as "Harry was hurt by someone"). However, if the child uses only a minimal grammatical analysis to classify lexical items into types, then truncated passive past participles can be treated as "adjectives" and simply understood with the same perceptual schemata that are used to understand adjectives. By age six the child starts to understand and use full passives. By this hypothesis, this now creates a duplication of linguistic information in the child's repertoire—namely,

the information that whatever can be the subject of the "adjectives" in truncated passives can also be the subject of full passives. Since truncated passive "adjectives" are homonymous with the past participle of the verbs they are related to, the grammatical solution to this replication of information is to derive truncated passives from full passives. This in turn would reclassify the "adjective" of truncated passives as a past participle. One would expect that the reorganization of truncated passives would make them more difficult for children to use at around age seven than they were at a younger age. In fact, there is evidence showing that this is the case. In a study of sentence retention, Slobin (1966) found that children at age eight have a relatively more difficult time with truncated passives than children at age six. This follows from the assumption that at age eight the child has ascribed a new grammatical analysis to truncated passives as derived from full passives.

This model of language acquisition is dynamic in that it depends on the interaction of different systems of linguistic knowledge and skill. At each stage, each of the systems attempts to represent the same set of sentences. However, one system (e.g., of speech production) may predict new cases that another system (e.g., of speech perception) does not allow. If the child tries these new cases out and finds them usable in the linguistic community, then this provides both internal and external pressure for all the systems of linguistic representation to accommodate to these cases. Thus, on this view, language acquisition not only depends on information from the linguistic community but on internal dynamics as well.

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