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Authors

Carroll, John M, Jr
Hennessey, John S

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Author(s): John M. Carroll, Jr. and John S. Hennessey

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Coordination Reduction and the English Comparative/Superlative:
A Psycholinguistic Perspective¹

John M. Carroll, Jr.

John S. Hennessey
Columbia University

Introduction

It is the concern of linguistics to develop general and revealing theories of language. The linguist seeks first to provide a theoretical structure capable of treating relevant data (eg, acceptability intuitions, occurrence in given contexts, etc.) and second to select the most highly valued adequate descriptive theory (for discussion see Chomsky, 1957, 1965; and many other sources). As part of the latter goal the linguist may concern himself with the possible role of linguistic grammars in a general psychological theory of mind (cf, Chomsky, 1968).

If the linguist makes this commitment, it is incumbent on him to 'integrate' his theories of language with other relevant psychological theories (eg, theories of perception, memory, social organization, etc.). For example, a general principle of perception need not be stated in grammar even if it can be shown to be the efficient cause of some fact about language behavior. This would be imparsimonious for and even deleterious to the development of a general theory of mind.

One independent line of argument for integrated approaches to the study of language is that very frequently we find that parcelling out the description of language phenomena leads to the discovery of generalizations which may have been obscured otherwise. In this paper we will specifically show that English graded adjective conjoined structures can be handled exceptionlessly within the universal syntactic schemata of coordination reduction proposed by Harries (1973). We will further argue that some of the data which have previously been considered problematic in the analysis of these structures (and which thereby obscured the simplest grammatical treatment) are accountable in accord with maximally general principles of speech production and perception and of conversation.

On the Grammar of Conjoined Graded Adjectives

The basic facts concerning graded adjectives, that is comparatives and superlatives, are well known. In English there are two types of grade markings, periphrastic (as in ld, f) and inflectional (as in la,c). There are strong constraints on the form of the

la. biggest	c. handsomest	*e. beautifullest
*b. most big	d. most handsome	f. most beautiful

grade marker which an adjective may take. These are largely governed by the phonological shape of the adjective itself (Jespersen, 1933). It is also known that there is an interaction between the form of the grade marker and the operation or non-operation of certain syntactic rules, specifically Coordination Reduction and Reduplication.

Zwicky (1969) noticed that coordinate reduced graded adjective structures occur only with a periphrastic grade marker. Thus, 2a, but not 2b. He also noted that reduplication is possible only

- 2a. That one is nice, but I want something more plain and simple.
- b.*That one is nice, but I want something plain and simpler.

where the same form of the adjective grade appears throughout the reduplicate string. Thus 3a and b, but not c. Zwicky discusses

- 3a. The children got more and more and more noisy.
- b. The children got noisier and noisier and noisier.
- c.*The children got noisier and noisier and more noisy.

these facts as a case of apparently phonological constraints on the operation of syntactic rules. Specifically, the data would seem to require the ordering of a phonologically conditioned rule of Adjective Inflection prior to the syntactic rules of Coordination Reduction and Reduplication.

In order to avoid such a solution, Zwicky proposes that each of the potential inputs to Adjective Inflection, which he describes as a minor rule, is marked as such in the lexicon by a rule feature (placed on the final morpheme of the adjective). Coordination Reduction is also constrained by this feature, failing to operate if its input string includes an adjective marked for the rule. The constraint on Reduplication is accounted for in that the rule feature is copied along with the adjective it marks. Adjective Inflection can thus be ordered after the syntax and the desired separation between syntax and phonology can be maintained.

This analysis presents several difficulties. It is not clear that the solution is satisfactory theoretically, since it requires that a syntactic rule be permitted to be made sensitive to the occurrence of a lexical rule feature whose referant is ordered later in the grammar (in fact, in another component of the grammar). This would commit us to a theory of grammar which admits global constraints. Further, the analysis, even if accepted in principle, proves unworkable in fact. Consider the sentences of 4.

- 4a. That's the most red and juicy apple I've ever eaten.
- b. That's the most red and succulent apple I've ever eaten.
- c. Harry is the most polite and attentive student in class.
- d. Harry is the most thoughtful and attentive student in class.

Of these, Zwicky's rules would generate only 4d. This is because "red", "juicy" and "polite" would all be marked to undergo Adjective Inflection. Yet 4b is at least marginally acceptable, and 4c is quite definitely acceptable.

In the case of Reduplication, the rules fail to properly constrain precisely those cases which motivated the analysis. If the adjective in question requires either one or the other form of the grade marker, these would be derived uniformly in any case. Those adjectives which may take either form of the grade marker

(eg. "noisy" in 3, "polite" in 4c) would have to be marked in the lexicon [\pm Adjective Inflection] or some such. Thus, after Reduplication operates there would still remain the possibility of wrongly deriving a mixed string, as in 3c.

It seems to us that a major source of these difficulties resides in Zwicky's initial assumptions. He works from the viewpoint that Adjective Inflection bleeds Coordination Reduction. There is some evidence that this is not the case. Zwicky claims that adjectives which undergo Adjective Inflection do not appear in coordinate reduced structures. But consider again the sentences of 4. Both 4b and 4c contain adjectives which are lexically marked to undergo Adjective Inflection, either optionally or obligatorily. Yet these sentences are acceptable.

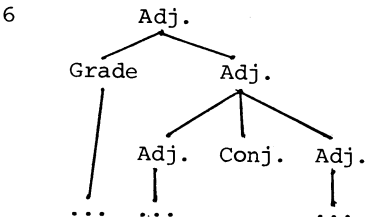
Zwicky claims that his treatment of the relation between Coordination Reduction and Adjective Inflection is consonant with a general principle that Coordination Reduction does not apply to proper parts of words. While this principle appears to be a valid generalization for graded adjectives, it is not true in the seemingly parallel case of genitives, where coordinate reduced structures occur with both periphrastic and inflectional markers, as in 5.

5a. The coat-of-arms of the king and queen is on the gate at Buckingham Palace.

b. Bill and John's boat was sunk in a storm last week.

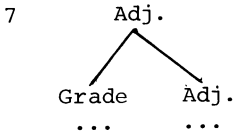
While this evidence is by no means definitive, it is at least suggestive that the direction of the rule conditioning is not necessarily the one Zwicky assumes. In our analysis Coordination Reduction constrains Adjective Inflection.

If such an analysis is allowed, the grammatical description becomes quite simple. Coordination Reduction is ordered before Adjective Inflection. Following Harries (1973) the universal syntactic schema of Coordination Reduction is a two step process of 'deletion' and 'regrouping'. Deletion operates by removing all but the leftmost of the identical constituents of the conjuncts of a coordinate structure. In each reduced conjunct regrouping Chomsky-adjoins the lowest node that exhaustively dominates all lexical nodes to the corresponding node in the unreduced conjunct. In the cases under discussion this would yield structures of the type shown in 6. Adjective Inflection is constrained to operate only



on inputs where the grade marker and the adjective are both dominated by a single node, structures of the type shown in 7. Where Coordina-

tion Reduction has already applied Adjective Inflection is blocked,



because potential inputs no longer meet the structural description of the rule.

This analysis is desirable in that it orders Adjective Inflection after the syntax without appeal to global constraints. Further, it allows a major syntactical rule, that is, Coordination Reduction, to operate exceptionlessly, avoiding ad hoc constraints. However, it is not without apparent problems. While it allows the generation of 4c and 4d, it will also generate the other sentences of 4, affording us no basis for distinguishing among sentences which obviously differ in acceptability. We are also apparently left without an account of the observed constraint on Reduplication. However, at this point the analysis is incomplete.

A Psycholinguistic Perspective

To this point we have argued that the data for conjoined comparative and superlative structures is more complex than as originally countenanced by Zwicky. However, we have also proposed that these structures be generated exceptionlessly according to the universal schema of coordination reduction. This has led us to an apparent difficulty in that we predict the grammaticality of structures like 8b, which are in fact not fully acceptable for all speakers, and conversely that we fail to generate forms like 8d which we

- 8a.*This moon is the most big and most bright I've ever seen.
 b.?This moon is the most big and bright I've ever seen.
 c. This moon is the biggest and brightest I've ever seen.
 d.*This moon is the big and brightest I've ever seen.

have observed in actual speech. We believe the difficulty to be only apparent. We propose to deal with these cases by appeal to the perceptual principle of 'gobbling' and the speech production principle of 'analogy'. Since these principles have already been independently motivated in papers by Langendoen and Bever (1973), Carroll (1974, 1975) and Bever, Carroll and Hurtig (1975), this approach allows us to simultaneously pursue generalizations both in our account of the grammatical structure of conjoined comparative and superlative forms and in our description of the structure of linguistic performance theory.

The principle of gobbling defined in 9 predicts the reduced acceptability of 8b. The periphrastic superlative in examples like

- 9 Modifying elements tend to be parsed as co-constituent with most adjacent potential constituent heads.

this is gobbled up by the most adjacent potential head, namely the first adjective of the conjoined structure. Of course, this sort of gobbling can obtain in forms like 10b as well. However, in 10b the parsed constituent 'more beautiful' is still perfectly accept-

- 10a? She is more beautiful and more graceful than I remembered.
- b She is more beautiful and graceful than I remembered.
- c* She is beautifuller and gracefuller than I remembered.
- d* She is beautiful and gracefuller than I remembered.

able whereas in 8b the resultant form 'most big' is not. In order for sentences like 8b and 10b to make sense, the grade marker must semantically distribute over all members of the conjunction it syntactically dominates. This assumption of 'distributivity' plus the general principle of gobbling will distinguish 8b and 10b vis-a-vis acceptability judgments. Gobbling renders 8b unacceptable but does not so mark 10b because 'more beautiful' is a possible constituent whereas 'most big' is not. Distributivity then saves 10b with respect to acceptability by providing the proper semantic reading in spite of perceptual gobbling. Distributivity provides a semantically sensible interpretation for 8b as well but does not mitigate its unacceptability (ie, since 'most big' is out whereas 'more beautiful' is in).

There are several independent facts which support the foregoing proposal. For example, consider the 'absolute' superlative paradigm in 11. These forms recruit the superlative morphology

- 11a? A most big and most bright silver platter fell on Mort.
- b A most big and bright silver platter fell on Mort.
- c* A biggest and brightest silver platter fell on Mort.
- d* A big and brightest silver platter fell on Mort.

but to different semantic ends. All inflectional forms are unacceptable (contrast 11c with 8c) whereas all periphrastic forms are acceptable (contrast 11a with 8a). Gobbling is predicted in 11b just as it is in 8b and 10b. However, as noted above, 10b is acceptable in that "more beautiful" is acceptable and 8b is questionable in that 'most big' is unacceptable. The sequence 'most big' is, however, acceptable in the absolute superlative whereas it is not in the ordinary superlative. The gobbling analysis, therefore can explain the acceptability contrast between 8b and 11b.

Returning now to ordinary comparative/superlatives we would like to explore a consequence of our hypothesized principle of 'distributivity'. Since the periphrastic marker in forms like 8b and 10b must distribute in order for them to make sense, we might expect a potential weak derived gobbling effect involving the grade marker and the second member of the adjective conjunction. This tentative principle does find support in contrasts like 12 versus 8b. Since the second adjective in 12 may only take the

- 12 This moon is the most big and brilliant I've ever seen.

periphrastic grade marker, any gobbling which may obtain in forms like 8b between the grade marker and the second conjunct will not obtain in 12, hence 12 should be more acceptable. We refer to this principle as 'distributive gobbling'. We turn now to conjoined genitives in order to demonstrate the generality of the preceding analysis of conjoined grade adjectives.

Consider 13. Our argument concerning gobbling predicts a per-

- 13a The King of England and the King of France's mother told them to wield power.
- b The mother of the King of France and the King of England told them to wield power.
- c Jack and Bill's mother told them to wield power.
- d The mother of Jack and Bill told them to wield power.

ceptual misparsing in which the scope of the genitive inflection in 13a and 13c is erroneously taken to be only the right-most NP. Similarly, we predict a tendency for the periphrastic genitive in 13b and 13d to be interpreted as only attached to the left-most NP of the conjunct pair.² Of course, when gobbling does not prevail, the entire coordinate structure becomes the genitive head. In general, periphrastic genitives are more acceptable with 'heavier' NPs and inflectional genitives are more acceptable with smaller NPs. On these grounds, the gobbling interpretation should be more likely to obtain in 13c than in 13d. We find that this agrees with our judgments. Now contrast 13b with 13d. Since 'the King of France' is heavier than 'Jack' we would predict that the gobbling interpretation is also more likely in 13b than it is in 13d. We also find this to accord with our judgments. This fact also gives us a way to explore the validity of distributive gobbling with conjoined genitive forms.

Our proposal concerning distributive gobbling would predict that in so far as genitive gobbling obtains and extra-sentential context demands that the distributive semantic reading be made, then forms like 14a and b will be more acceptable than forms like

- 14a The mother of Jack and The King of France told them to wield power.
- b The mother of Jack and the Student Council President told them to wield power.

13d. The periphrastic genitive disfavors short NP heads like 'Jack'. Hence gobbling would be predicted in any of the forms, 14a, 14b or 13d, and this will result in some degree of unacceptability. If a distributive gobbling effect can be detected, it would presumably manifest an even greater unacceptability for forms like 13d. In 14a and 14b the second NP better comports with the periphrastic genitive. An analogous line of thinking would predict 15a to be more acceptable than 15b when perceptual gobbling obtains but the distributive reading is required. While

15a Bill and the Student Council President's mother told them to wash up.

b The football team captain and the Student Council President's mother told them to wash up.

we find that our distributive gobbling predictions are borne out, the acceptability judgments required are so subtle that we regard this confirmation as tentative.³

We have argued that 8b can be viewed as fully grammatical but reduced in acceptability in virtue of perceptual gobbling. We shall now propose that 8d may be viewed as ungrammatical but to some extent acceptable or utterable in virtue of 'analogy'. Analogy as defined in 16 can provide the speaker with acceptable

16 A 'grammatical' sequence X may be analogically replaced by (ie. derived into) an 'acceptable' sequence Y when, through the agency of some linguistically relevant but extra-grammatical system, X becomes marked as 'unacceptable'.
Condition: The replacement sequence which is selected by analogy will be (1) structurally most related to, and
(2) semantically most similar to the original sequence X.

or utterable alternative forms for grammatical but potentially difficult strings. The sorts of difficulties that can motivate analogical replacements range from anticipated perceptual problems for the hearer, like ambiguity (cf. Carroll, 1974, 1975) to articulatory and clause-planning problems for the speaker (cf. Bever, Carroll and Hurtig, 1975).

In the present case, the grammar generates forms like 8b although these forms are found to present some measure of perceptual difficulty due to gobbling (cf. Bever et al, 1975, for discussion of similar cases). The speaker's tacit knowledge of this difficulty puts him in a position to choose an alternative output form in accordance with the analogy principle. One alternative which seems to satisfy both conditions of the principle is that of blocking coordination reduction altogether, yielding a form like 8c. However, given that an analogical alternative to 8b is at issue, another possibility suggests itself. A form like 8d may satisfy condition 1 of the analogy principle better than 8c. The 'derivation' of 8d must violate the morphological spelling out rule which specifies that only periphrastic grade markers may obtain in coordinate reduced structures. However, since the syntactic derivation of 8d includes coordination reduction, which the derivation of 8c does not, the form 8d may therefore be structurally more similar to 8b than 8c is.

The same left-ward semantic distributivity operating in strings like 13c permits the analogical replacement of 8d to also satisfy condition 2 on the analogy principle. In so far as distributivity obtains forms like 8d are acceptable but ungrammatical (cf. Langendoen and Bever, 1973, for discussion of this category). However, on our judgments this distributivity applies only imperfectly. In practice, forms like 8d are likely to violate

condition 2 and resultingly are not particularly good analogical forms. They are clearly not as acceptable as the 'not un-' form discussed by Langendon and Bever (1973) and the 'good and' form discussed by Carroll (1974, 1975). These two forms are exemplified in 17 below.

- 17 a. A not unhappy man entered the room.
b. The waiters here aren't good, but they're good and greedy.

Despite the gobbling problem, we find that forms like 8b are more commonly used in our dialects.

In considering analogical replacements it is important, however, to distinguish between 'utterability' and 'acceptability'. While the latter datum represents a more selective criterion for well-formedness in the language, the former also provides insight into the dynamic structure of language. Bever et al (1975) contrast 'utterable' analogical forms like 18 with fully 'acceptable' analogies like 19. (See Bever et al, (1975) for a discussion of

- 18 a. I really enjoyed flying in an airplane that I understood how it worked.
b. Both John, Harry and Mike stopped over yesterday for some cold meatballs.
c. Sheila and the guard wanted each other to meet in Miami.
- 19 a. Lewis wanted to try and scale the mission wall.
b. Everyone forgot their coat.
c. That Herbie is boring disturbs Aunt Alice has been a joke in our family for years.

this distinction in linguistic performance theory.) Forms like 8d seem to be analogical forms which are merely utterable and usually not fully acceptable. One reason for this might be that the left-ward semantic distributivity which must necessarily obtain in order for the form to meet condition 2 does not in practice reliably obtain. Another reason may be that various preferable forms do exist such as 8b and 8c (this view is also considered by Bever et al).

We have observed other utterable but unacceptable grade forms such as 20.

- 20 The Post Office in La Jolla is clearly the most
.'''(pause)'''.big.

The effective instigator of cases like this seems to be speech production planning error. The grade marker is realized prematurely in its most general form, the periphrastic. However, the adjective (when it comes, usually after a pause) doesn't fit. Perhaps forms like 8d and 20 should be viewed as complementary speech production processes. In 20 through a planning error the speech production system codifies the grade marking when it should

have waited for the adjective stem (in order to affix an inflectional marker). While in 8d the grade marking is not codified soon enough and must be analogically adjoined to the final conjunct.

The foregoing analysis constitutes a very strong claim in terms of the coding trade-off between wholistic linguistic representations and the linear sequence of sounds by which they are realized. Since there is presently no relevant data with which to evaluate the claim, we must simply reserve judgment.

Finally, we return to Zwicky's observation concerning strings like 3. Grammatically we appear to be forced to generate structures like 3c or else to write a context sensitive morphological spelling out rule which blocks them very late in the grammar. Here again we believe the difficulty to be only apparent. A more general principle appears to be at work. We propose that forms like 3c are grammatical but unacceptable because they violate a general conversational principle (cf. Grice, 1968 for a discussion of conversational rules) governing the relevant formal symmetries of conjoined structures (cf. Kuno (1974) Schachter (1974); Bever et al, 1975). We claim, then, that 3c is unacceptable on the same grounds that 21 and 22 are. By treating 3c in this way

- *21 a That girl is like a child but sphinxlike
b That child is childlike but like a sphinx.
- *22 a Mary like cooking and to clean
b Mary likes to cook and cleaning

we make a generalization which would be obscured if the facts were dealt with by Zwicky's rule feature solution or context-sensitive spelling out.

Moreover, there is independent motivation for such a claim. Kuno (1974) has noted the following examples:

- 23 a. John likes flying airplanes and murdering cossacks.
b.?John likes chopping firewood and flickering campfires.
- 24 a. The dinner is ready to eat and so is the salad.
b.?The dinner is ready to eat and so are the guests.
- 25. a. John expected Mary's departure and Jane's arrival.
b.?John expected Mary's departure and Jane would arrive.
- 26 a. John likes Mary and Bill.
b.?John likes Mary and singing songs.

Kuno observed that coordinate conjunction is most acceptable with conjuncts having parallel structures. He suggests further that when ambiguity is involved parallel structures are more acceptable under parallel interpretations as in 23.

Schachter (ms) has detailed this proposal in his discussion of the "Coordinate Constituent Constraint" (the CCC):

The constituents of a coordinate construction must belong to the same syntactic category and have the same semantic function.

In his consideration of this principle, he notes the following contrasts:

- 27 a. John ate quickly and greedily.
 b. ?John ate quickly and a grilled cheese sandwich.
- 28 a. It's odd that John is busy and that Helen is idle now.
 b. It's odd for John to be busy and for Helen to be idle now.
 c. ?It's odd that John is busy and for Helen to be idle now.
- 29 a. Bobby is the man who was defeated by Billie Jean and who beat Margaret.
 b. ?Bobby is the man defeated by Billie Jean and who beat Margaret.

Schachter suggests that the CCC is itself perceptually motivated. He accepts the speech perception model of Bever (1970), Grosu (1972) and others which rests on 'perceptual principles'. These principles provide segmentation and mapping hypotheses for input verbal material. Schachter appeals to Grosu's (1972) 'perceptual conflict' principle (which is related to Bever's (1970) 'double function' principle). This principle asserts "that complexity arises when two sets of cues assign contradictory values to a stimulus in terms of some parameter." (Grosu, 1972, p. 2) Such complexity can presumably render linguistic forms perceptually unacceptable. Schachter notes that the principle would therefore have the effect of disfavoring or blocking conflict forms in speech.

Schachter points out that coordinate conjunction implicitly assigns 'equal rank' to conjuncts. However, if the coordinately conjoined constituents differ either in syntactic category or semantic function, they are simultaneously being 'equated' and 'contrasted'. The result of this is perceptual conflict and ultimately speaker/hearer judgments of unacceptability.

Conclusion

The analysis we have given here is, of course, in no sense a decisive argument for integrated approaches to the study of language. Phenomena we would analyze by appeal to the functional interaction of theoretically separable verbal systems will always have corresponding analyses in 'all-inclusive' grammars. The explanation of this resides in the formal power of the grammars in question (cf, Peters and Ritchie, 1974). This issue might become empirical if grammars could be constrained in ways that would reduce their enormous expressive power. We have explored one such constraint here, namely that phonological rules are not ordered within the syntax in the transformational grammars of natural languages (cf, Zwicky and Pullum, forthcoming, for a more complete

discussion). The fact that we are led to this analysis by adopting an integrated model we take as a prima facie argument in favor of this approach to linguistic research.

In addition, we find the intuitive appeal of the integrated approach enormous. As it is obvious that the speaker of a language knows something complex and abstract, it is obvious that much that is not uniquely linguistic is involved in speaking and understanding sentences. Phenomena that are, e.g., fundamentally perceptual ought to be treated in a perceptual theory. We propose that linguistic grammars should describe not all that is relevant to language, but just that which is specific to it.

Footnotes

1

We would like to thank Thomas Bever, Lucia Kellar, Geoffrey Pullum, Rick Wojcik and especially Arnold Zwicky for helpful comments on this research. They should not, of course, be implicated in any blunders we made in spite of them.

2

One way to avoid this misparsing would be to repeat the genitive inflection as in i, ii, iii and iv. While these forms are per-

i The King of England's and King of France's mother...

ii The mother of the King of France and of the King of England....

iii Jack's and Bill's mother...

iv The mother of Bill and of Jack...

spicuous, they may be stylistically awkward. This observation also bears on the status of 10a and 11a above.

3

Note also that the support we can derive from an example like 15 is confounded by word length.

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