

- Senna, H. 1952. *O problema da língua brasileira*. Entrevista com o Prof. Souza da Silveira. Rio de Janeiro: Ministério da Educação e Cultura, Serviço de Documentação.
- Tarallo, Fernando. 1983. "Relativization Strategies in Brazilian Portuguese". PhD dissertation, University of Pennsylvania.
- _____. 1985. "The filling of the gap: Pro-drop rules in Brazilian Portuguese". *Selected Papers from the XIIIth Linguistic Symposium on Romance Languages* ed. by Larry D. King & Catherine A. Maley, 354-75. Amsterdam & Philadelphia: John Benjamins.
- _____. (ed.). 1989. *Fotografias Sociolinguísticas*. Campinas: Pontes Editores.
- Tarallo, Fernando & Mary A. Kato. 1989. "Harmonia Trans-sistêmica: Variação intra- e inter-linguísticas". *Preedição* 5. 41pp.
- Weinreich, Uriel, William Labov & Marvin Herzog. 1968. "Empirical foundations for a theory of language change". *Directions for Historical Linguistics* ed. by Winfred P. Lehmann & Yakov Malkiel, 95-188. Austin: University of Texas Press.

Form and Function in Linguistic Variation

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One of the enduring problems in linguistic theory is the interaction between linguistic form and communicative function. Does function somehow determine form, because the requirements of communication impose certain limitations on linguistic structure, or is form essentially arbitrary, uninfluenced by functional or semantic considerations? In current linguistic theory, this issue has assumed the dimensions of a veritable continental divide. On one side are numerous proposals asserting a variety of functional explanations for the form of language: Martinet's 'functional view of language' (1962, 1975), the 'functional sentence perspective' of Kuno (1972), Halliday's 'systemic functional grammar' (1985), etc. On the other side is what can be called the 'formal' position, that formal structures and processes in grammar operate independently of the functional or communicative uses to which language is put. This position characterizes the Chomskyan mainstream of theoretical linguistics and other formal approaches to linguistic theory.

The same issue arises in studies of language variation and change. The main focus of the variationist literature has been whether linguistic variation and change is immediately constrained by functional considerations. In this vein are works such as Cedergren (1973), Guy (1980, 1981), Hochberg (1986), Lafford (1989) and Poplack (1979, 1980). Labov (1994:547-568) presents a survey of relevant materials. This research is now beginning to suggest answers to the general questions about form and function. Indeed, linguistic variables provide an ideal site for studying these problems; since they both occur and fail to occur in a variety of contexts, one can seek cases where the formal and functional positions make conflicting predictions, and put them to an empirical test.

In this paper I examine several results bearing on this issue. I argue that the evidence proves that the formal mechanisms of language production are NOT actively constrained by functional requirements. But the results also suggest a higher-level resolution to the problem: the functional utility of language is preserved in the long run through the interaction of variable production with normal processes of perception and acquisition.

1. The Functional Hypothesis: Theoretical considerations

It should be clear by now, after decades of debate, that extremist positions on this issue will not show the way forward. Since human communication is the *raison d'être* of language, it is simply not plausible that the form of language could long persist in a significantly dysfunctional state. Nevertheless, certain fundamental propositions about the nature of language suggest that some aspects of form are independent of function: Saussure's axiom of the arbitrariness of the linguistic sign states that the meaning of a word does not determine its phonological form, and the concept of 'autonomous' phonology and syntax suggests that each module of grammar is governed by internal formal constraints, apart from 'interface' effects. Therefore, we should no longer ask "Does function determine form?"; rather we must move on to questions like "What is the nature of the form/function relation?", and "How is functionality maintained despite formal autonomy?"

Pursuing empirical answers to such questions requires clear hypotheses about the mechanism by which function affects form. I will use as my point of departure the insightful discussion of these issues in Kiparsky (1982a). Kiparsky argues, from assorted diachronic evidence, that languages are functionally constrained NOT to obliterate surface evidence of essential morphological categories. He proposes a "distinctness condition" which operates as a "...blocking of rules in environments in which their free application would wipe out morphological distinctions on the surface" (1982a:89). Hence the phonology is PREVENTED from creating dysfunctional ambiguity, or stated positively, it is REQUIRED to preserve semantic distinctions.

Kiparsky also observes that certain morphological categories appear more resistant to obliteration than others. He cites TENSE and NUMBER as stronger categories, while CASE is usually weaker. Thus a rule might delete

case markers, while being inhibited from deleting a formally identical plural marker. Kiparsky proposes to account for this by a universal hierarchy of 'category strength' (p. 91), which turns out (p. 99) to depend on redundancy of information, in that weaker categories are more redundant. But gender behaves anomalously: Kiparsky finds empirical evidence suggesting it is a strong category (resistant to deletion), even though it seems to have a low functional load.

Kiparsky's approach to these issues is, of course, diachronic. Can the distinctness condition (DC) be generalized to the synchronic arena? I will take the now-common, 'post-Saussurean' position that synchrony and diachrony are integrated via variation: variation is the synchronic reflex of change, and change is one diachronic outcome of variation. Hence the functional blocking of change expressed by the DC should arise through an equivalent functional limitation on linguistic variability. Of course in diachrony, there are other processes affecting change which have no synchronic counterpart. Kiparsky considers several such factors, such as language acquisition and intergenerational restructuring. But the DC is a constraint on the operation of the grammar; any such constraint should be synchronically evident in variation, if it produces change across time. Hence the DC can fairly be used to make predictions about functional constraints on variation.

Thus applied to variation, the DC permits several kinds of predictions. First, it could be interpreted categorically, to absolutely block the application of variable processes to functional categories. But this interpretation is empirically falsified on a massive scale; all the processes considered below sometimes eliminate surface distinctions. So the appropriate prediction of the DC regarding probabilistic linguistic behavior is that variable rules will apply less often in contexts where they would eliminate a surface distinction.

Second, the DC makes different predictions depending on how we treat redundancy. Must surface distinctions be maintained everywhere they occur, or just somewhere? The point of the DC is to avoid surface ambiguity, by preventing whole morphemic units from being eliminated during derivation. But deleting a redundant morpheme creates at most a local ambiguity, which is resolvable in the broader context. This situation arises systematically in languages with agreement phenomena. Thus, if all words in an NP are marked for number, a rule that deletes the marker from one of them might make that word 'ambiguous', but not the phrase as a whole, as long as markers survived on other words.

Distinctness therefore has two possible interpretations. 'Somewhere' distinctness only requires that SOME indication of a category be maintained; thus rules are only blocked from wiping out unique, unrecoverable markers. But 'everywhere' distinctness requires that ALL markers of a distinction be protected, even when redundant. By analogy with the terminology applied to a similar issue in underspecification theory, I will refer to these approaches as 'contrastive distinctness' for the 'somewhere' version of the condition, and 'radical distinctness' for the 'everywhere' version.

Two of the cases considered by Kiparsky are relevant to this question. Mecklenburg German allows a variable /-e/ deletion rule to apply to the dative singular ending, and also to the homophonous plural affix just in those words where deletion does not create surface equivalence between singular and plural. Thus deletion applies to *dem Tor[e]* (dat sg) and *gast:gest[e]* "guest(s)" (which has stem vowel umlaut in the plural), but not to *sper:spere* "javelin(s)". This evidence favors contrastive distinctness: 'strong' markers can be deleted, but only when redundant. Similarly, in Sanskrit, a causative affix -ay- is deleted in gerunds just when the causative is differentiated from the plain gerund by some other property: thus *vibhajya* (ger.) ~ *vibhájya* (caus. ger.) undergoes deletion because the causative has root vowel lengthening, but *vikramya* (ger.) ~ *vikramayya* (caus. ger.) retains -ay-, because the root is unaltered in the causative. Hence an -ay- deletion rule applies to redundant markers, but is functionally blocked just where it would create surface ambiguity.

This apparently invariant evidence favors contrastive distinctness. The two versions of the DC also make different predictions for the variable processes considered below. Consequently, this conclusion can also be empirically tested against quantitative evidence.

A third issue is whether the distinctness condition is pre-emptive or compensatory. The DC requires that important semantic distinctions continue to be expressed despite the effects of sound change. This requirement can be fulfilled in two theoretically distinct ways.¹ One is envisioned in the quoted passage from Kiparsky: to create functional exceptions to the sound changes, to block them from applying where they would "wipe out morphological distinctions". An obvious concern about this approach is that it contradicts the Neogrammarian principle of regularity of sound change, which claims that all instances of a targeted sound undergo a change, regardless of the morphemes they occur in. But contrasts can be preserved without denying Neogram-

marian regularity if the sound changes go ahead without regard to morphological distinctions, but then some other area of the grammar compensates, resolving ambiguities arising from the sound change. Such 'functional compensation' is attested historically; thus, in English and western Romance in the last millenium, sound changes have wiped out case markers, but other developments (e.g., fixation of word order) have taken over the functions previously filled by case marking. Similarly, Hochberg (1986) finds that Puerto Rican Spanish has lost second singular markers on verbs by a final -s deletion rule, but this is compensated for by increased use of subject pronouns. (And see also Steiner's paper in this volume.)

1.1 Formalizing distinctness

Functionalist hypotheses present a clear challenge to several widely-held assumptions about the organization and operation of mental grammars. Most theories of grammar assume a modular architecture in which the various components (syntax, phonology, lexicon) are relatively autonomous and subject only or mainly to endogenous conditions (e.g., phonological rules are constrained by phonological conditions). There are many good reasons to favor such a position (cf. Zwicky 1984 for an extended discussion). But if the DC is an active constraint on the operation of grammatical rules (rather than a post-hoc fix-up principle), it will have to override this separation of levels. In phonology, it will block phonological operations on segments identified not by their phonological properties, but by their significance at some higher level. Similarly, if syntax is subject to functional constraints, semantic distinctiveness will have to be the overriding condition.

This violation of modular autonomy is less problematic for radical distinctness. If all markers of a 'strong' category must be preserved, it is a simple matter to operationalize this as a phonological constraint. For example, rules deleting segments can be blocked from applying when the target is surrounded by morpheme boundaries (*#C#). This states the condition in local terms within the phonology, avoiding reference to the meaning of the item. But if the DC only protects unique indicators of a distinction, it is hard to formalize in any way that is compatible with a modular grammar. Given the highly redundant nature of language, it may require fairly complex calculations to determine which markers are unique. For example, in a language with extensive agreement, a category value like [plural] might be indicated within

an NP by multiple plural markers, and/or by a quantifier or numeral; it could be indicated outside the phrase by a number marker on an agreeing verb. It could be inferrable from discourse, if the NP's referent had previously been established as plural. So deciding if a given marker was unique would require searching these other locations for redundant information. Such searches would clearly involve several modules of grammar. If the discourse has to be searched, then constraining the phonology from deleting a unique marker could potentially involve the entire grammar. Hence, if functional needs are shown to constrain production in the way that the DC (or at least its contrastive version) suggests, the way linguists think about grammar will need major revision.

In the next sections, I discuss the findings of several empirical studies that bear on these matters. As I have noted, Kiparsky finds the strongest functional effects in connection with tense and number categories. I consider three variable processes that affect tense or number markers. In English, a variable process deleting clustered final coronal stops affects the regular past suffix *-ed*, which is ordinarily realized as just a final coronal stop. If stop deletion applies freely to such past tense forms, they become equivalent to the unmarked present tense.

In Brazilian Portuguese a parallel problem arises with the variable deletion of final sibilants. This can potentially affect the nominal plural marker, generally expressed by a sibilant suffix. Again, free application of deletion to nominal plurals could cause the loss of the number distinction. Finally, Portuguese also has a variable process denasalizing unstressed final vowels. This also threatens a number distinction, as the most common verbal plural marker in the third person is nasality of the final vowel.

In each of these cases a phonological process affects some segments or features that constitute morphological markers, and others that do not. The operation of the process threatens the distinctness of the morphological units. Therefore, in each case the DC (in the probabilistic interpretation given above) predicts that the processes should apply less often to the phonological units that are functioning as markers. Quantitative study of these variables therefore provides us straightforward empirical tests of the predictions of the DC, and hence of the functional approach. But at the same time, I will also consider alternative, formal explanations of the facts. Such approaches, if empirically confirmed, will avoid the theoretical complications raised by the functional hypothesis.

2. English Coronal Stop Deletion

The English case involves a variable phonological process deleting final coronal stops from coda clusters. Numerous studies of this process have shown that it operates variably in all varieties of English, and is everywhere conditioned by the morphological status of the targeted stop. Many English words that are eligible for the rule are monomorphemic or underived words such as *mist*, *pact*, *bold*; in such cases the final stop is part of the root. But in another class of eligible words, the final stop is a reflex of the past tense suffix *-ed*: e.g., *missed*, *packed*, *bowled*. In such words the final stops bear a functional load: deleting them creates surface homophony with the present tense, and obliterates a tense distinction. Hence the DC predicts that past tense /t,d/ should resist deletion, showing a lower rate of deletion than comparable monomorphemic words: e.g., *missed* < *mist*.

This prediction is confirmed in all studies of coronal stop deletion that I know of (e.g., Labov et al. 1968; Wolfram 1969; Guy 1980, 1991; Neu 1980; Nesbitt 1984). Relevant results from Guy (1991) are given in Table 1. Regular past tense forms are by far the most resistant to deletion, deleting at less than half the rate of monomorphemic words. A multivariate analysis by Varbrul confirms the frequency results, and shows that the effect is statistically highly significant. Thus final /t,d/s representing the supposedly vital tense marker are very likely to be retained on the surface, while functionally unimportant /t,d/s in words like *west* are deleted fairly freely. Hence the DC seems to be neatly confirmed.

The issue of redundancy is unimportant for regular past tense verbs, because their *-ed* suffixes are unique tense markers. Their time reference can be indicated by temporal adverbs, or inferred from discourse, but the tense category (which is what Kiparsky addresses) is not redundantly marked in English. Therefore, the final stops in such words should be conserved whether distinctness is radical or contrastive. But redundancy is an issue for the

Table 1. *English coronal stop deletion by morphological class*

	(Guy 1991 corpus)		
	N	% Deleted	Factor weight
Monomorphemes (e.g., <i>mist</i> , <i>bold</i>)	658	38.1	.64
Irregular Past (e.g., <i>lost</i> , <i>told</i>)	56	33.9	.55
Regular Past (e.g., <i>missed</i> , <i>tolled</i>)	181	16.0	.32

irregular past forms with a final coronal stop, like *left*, *kept*, *told*. In these verbs, the final /t,d/ is a tense marker, but a redundant one, since tense is also marked by root vowel ablaut. Deleting them does not wipe out the surface morphological distinction, because *lef'*, *kep'*, *tol'* etc. are still distinct from the present tense. Therefore, radical distinctness would protect these segments, but contrastive distinctness would not.

Interestingly, the results in Table 1 show that this class has an intermediate deletion rate, less than monomorphemes, but more than the unique tense markers of the regular past. How can the DC account for this? Arguably, it suggests that the DC is scalar: the higher the functional load on a class of targets, the more resistance they exhibit to a process that would eliminate them. Hence the highly functional regular past resists deletion the most, while the moderately functional irregular past is moderately resistant. Under this interpretation, the functionalist hypothesis is sustained for the data on the irregular past.²

2.1 Formal alternatives

These results thus seem to support the functionalist position. But note that alternative accounts of the facts can be given in purely formal terms, without appealing to distinctness or functional load. The morphological classes distinguished by coronal stop deletion have to be given distinct representations at some level in any adequate theory of morphology. Hence, as long as the phonology can be constrained by these different representations, the empirical results can be derived by formal means. The details of the formalization depend on what morphological theory is used, but the predictions are identical to those of the DC.

For example, if morphological structure is represented with the boundary symbols of Chomsky & Halle (1968, SPE), the facts in Table 1 can be modelled as a simple boundary constraint on the deletion rule: it is inhibited by a boundary preceding the targeted segment. The final cluster in the past tense is ...C#C##, while the monomorphemes terminate with ...CC##, and the irregular class has a different boundary: ...C+C##. The boundaries have the effect of lowering the probability of deletion, but by different amounts; the + boundary has a weaker inhibitory effect than #. In this model, the morphological effect can be straightforwardly quantified as variable factor constraints on a variable rule analysis.

A second approach to formalizing this morphological effect is given in Guy (1991). Using the model of Lexical Phonology (Kiparsky 1982b), I account for the differences among the various morphological classes in Table 1 in terms of different derivational histories. The two past tense forms are derived at different levels of the lexicon, while the monomorphemes have a terminal cluster underlyingly, in their lexical entries. The coronal stop deletion rule is postulated to apply variably at each derivational level. Therefore, a terminal cluster that is derived late in the lexicon (like a regular past) has fewer exposures to the rule than a cluster derived earlier, or present underlyingly. Word classes that are targeted by the rule earlier in the derivation have higher cumulative rates of deletion. Since the three classes in Table 1 become candidates for deletion at different points in the derivation, their differences in deletion rates follow automatically.

In both of these models, the deletion rule is constrained by formal properties of the morphological classes (their structure or derivational history), not by their functional load. Each successfully predicts the contrast between the three classes in Table 1, and each lends itself to adequate quantitative modelling. So how can one choose between a functional model like the DC and formal models like the ones I have just outlined?

The answer to this question is that we must look for cases where the DC and the formal model make different predictions. The classes in Table 1 differ in both form and function simultaneously, so the results can be attributed to either form or function. To solve the problem, we must hold one of these constant: compare classes that have the same form but different functions, or those that fulfill the same function with different forms. In the first case, we would seek situations where two classes of words have identical morphological structures, but differing functional loads. It is not uncommon for languages to use one segment to mark several morphological categories (cf. English plural, genitive, and third singular -s). If one category is functional and strong and another redundant or weak, the DC would predict them to be treated differently, while the formal models would predict them to behave alike. In the second case, we would seek situations where the same function is performed by devices with different formal structure, such as differing plural markers or tense markers in the same language (cf. English strong and weak verbs). In this situation, a formal model permits the several form classes to behave differently, while the DC suggests that equal functional loads should lead to equal resistance to deletion.

For coronal stop deletion, English fortuitously provides another word class that allows the first kind of test (same form, different function). Regular past participles are marked by an *-ed* suffix that is formally identical to the regular past tense suffix: e.g., *talk#ed*, *have talk#ed*. But the participial ending ranks very low in functional load, little more than a grammatical grace note. It is also highly redundant; whatever function it serves is more than adequately indicated by the auxiliary verb that obligatorily co-occurs with it. It conveys no vital semantic information, and no ambiguity is created when it is deleted: *I've already walk' my dog* is still unambiguously interpretable as a participial construction.

Consequently, the DC should not protect participial *-ed*, and coronal stop deletion should not treat participles like past tenses. This is true for both versions of distinctness. Contrastive distinctness won't protect these forms because they are redundant, and even radical distinctness will not block deletion here because 'participle' is not one of the strong categories that resist erosion. Therefore, the DC predicts that regular past participles will undergo deletion at a rate higher than regular past tenses; in fact, the participle deletion rate should approximate the rate found for monomorphemes or for irregular pasts.

The formal models, however, predict that the same segment in the same morphological context will experience the same rate of operation of a rule. As we have noted, the regular participles are formally identical to the corresponding past tense forms: both are demarcated by the same # boundary in the SPE model, and both are derived at the same point in the lexicon (level 2) in the LP model. Hence the participles should undergo deletion at a rate equal to the structurally identical regular past tenses, if form alone governs deletion rates.

An empirical test of these predictions can be conducted on a subset of my 1980 corpus which made a coding distinction between past participle and past tense forms. These data, for five adult native speakers of English from several dialect regions, are given in Table 2. They show that past participles undergo deletion at the same low rate as past tense forms (17.6% for past participles, 19.1% for regular past tense), as predicted by the formal models. There is no statistically significant difference between the two categories ($p > .45$ by a chi-square test performed on varbrul log likelihoods). This result is also true for each individual in the corpus, as indicated in Table 3; the participles and past tense forms are not significantly different even at the .25 level for any of the five speakers.

Table 2. *Coronal stop deletion in 4 morphological classes*

	(Guy 1980 corpus)		Factor weight
	N	% Deleted	
Monomorphemes	739	38.6	.64
Irregular Past	74	35.1	.60
Regular Past (e.g., <i>talked</i>)	157	19.1	.41
Past Participles (e.g., <i>have talked</i>)	74	17.6	.35

Table 3. *Coronal stop deletion in regular past tense and past participles for 5 individuals*

Speaker	(Guy 1980 corpus)				Significance $p >$
	Past tense forms % deleted	N	Past participle forms % deleted	N	
BJ	8%	13	13%	15	.25
EQ	17%	46	15%	13	.75
JR	21%	33	40%	10	.50
MCo	19%	21	33%	3	.90
WW	23%	44	12%	33	.25

These results have been independently confirmed in Nesbitt's (1984) study of coronal stop deletion in Australian English. With data from sociolinguistic interviews with 21 native speakers of Sydney English, he found deletion rates of 12% for past tense and 10% for past participles, which values are not significantly different ($p > .50$) for the Ns obtained (263 and 147, respectively). Monomorphemic words, however, were deleted at a significantly higher rate: 32% (N=1992).

Therefore, for English coronal stop deletion, it is morphological form that conditions rule application, not functional distinctness. Where the predictions of the DC work, they are also explained by the formal models, and where the DC conflicts with formal accounts, the empirical results follow form, not function. Of course, this is only one variable in one language. Before drawing general conclusions, let us consider the Portuguese evidence.

3. -S Deletion in Portuguese

Another well-studied variable process with functional implications is the deletion of final sibilants in Brazilian Portuguese. The social distribution of

this process is almost as wide as English coronal stop deletion — most Brazilians delete at least some of the time — but it is particularly characteristic of the popular variety of Brazilian Portuguese (PBP) spoken by a majority of Brazilians. The morphological category that it threatens is number, another of Kiparsky's strong categories. This variable also involves interesting problems of agreement, redundancy and rule interaction that do not arise in the English case.³

The segments targeted by this process include all the sibilant fricatives of Portuguese, [s,z,ʃ,ʒ]. Although in syllable onsets these four are phonemically distinct, in codas they are not, and can be treated as the realizations of a single unit, whose phonetic details depend on phonetic context and regional dialect. Hence I refer to this unit by the symbol -S: a coronal fricative archiphoneme, or partially specified segment (minimally [-son, +cor, +cont]). One set of targets for deletion are monomorphemic words ending in -S: e.g., *menos* "less", *ônibus* "bus"; in such cases deletion produces no ambiguity or threat to morphological distinctness. But another set of targets contain the nominal plural marker, most commonly a suffixed -S (e.g., *casas* "houses").⁴ If deletion applies to plurals, it can produce forms equivalent to the bare singular. Hence this case offers another test of the DC.

The issue of redundancy arises because Portuguese has plural agreement. In the standard variety, noun phrase agreement (NPA) applies obligatorily across the NP: *sg a casa branca* "the white house" vs. plural *as casas brancas*. Therefore, deletion of one plural -S from a multiword NP will not necessarily produce ambiguity, as long as number is still marked elsewhere in the phrase. Hence we can examine the question of contrastive vs. radical distinctness in the PBP data.

Table 4 shows, in the last two columns, overall totals for -S absence in PBP from Guy (1981). The results appear strikingly counterfunctional: final -S is MORE likely to be absent where it constitutes a morphological marker, not

Table 4. -S Absence in popular Brazilian Portuguese (PBP)

	Inflectional vs. noninflectional -S (Guy 1981 corpus)					
	Stressed		Unstressed		Totals	
	% Absent	N	% Absent	N	% Absent	N
Inflectional -S	27	781	37	9007	36	9788
Noninflectional	7	8879	53	1392	15	10271
	(counterfunctional)		(functional)		(counterfunctional?)	

less. No version of the DC predicts this. But the rest of the table suggests an important reason for caution in interpreting the figures. Deletion is highly sensitive to the stress of the syllable containing the -S: the deletion rate is appreciably lower in stressed syllables. Also, the morphological classes are profoundly skewed with respect to stress: over 90% of inflectional -S tokens are unstressed, while noninflectional -S's are nearly 90% stressed. Consequently, the totals column in Table 4, which fails to control for the intervening variable, confounds the functional effect with the stress effect, and is invalid as a measure of either alone.

The statistically correct solution to this problem is to identify intervening variables and control for them. In Table 4, therefore, the functional hypothesis is tested separately for the stressed and unstressed data. In stressed syllables, the functional hypothesis appears to fail: there is significantly more deletion of plural -S than noninflectional -S. But for the unstressed syllables, the DC seems to succeed: inflectional markers are deleted less.

Distinctness therefore has a mixed record in predicting Portuguese -S deletion. But perhaps its failure in the stressed tokens is due to still other intervening variables not yet considered. As it happens, there are several other significant constraints on this rule. To give the DC a fair test, we must consider certain syntactic facts that affect the rate of occurrence of plural -S markers. And although this is not the place to examine factors irrelevant to functionality, all the data presented below will be drawn from multivariate analyses that control for all known factors affecting the process.

Apart from stress, the most important factor affecting -S occurrence concerns the plurals: the position of a plural word within the noun phrase. All quantitative studies of PBP have consistently shown that plural -S absence is rare in the first word of an NP, but progressively more common in subsequent

Table 5. -S Absence in PBP by position and redundancy (factor weights)

Occurrence of preceding plural markers:	Position in NP		
	1	2	3
Impossible	.02		
Present		.65	.67
Absent		.04	.89
		(functional)	(counterfunctional)
(Ns:	5247	2729	179
		70	131)

words. This pattern is illustrated in Table 5, which gives Varbrul factor weights for plural -S absence by linear position in the NP. These figures also address redundancy by looking at other potential occurrences of plural markers preceding each target word in the same phrase. If plural markers have already occurred on previous words in the phrase, the current marker is redundant and exempt from the protection of contrastive distinctness, but if the preceding markers have not been expressed, the marker in the current word is nonredundant at the moment of utterance.

The figures in Table 5 clearly show the positional effect, especially the strikingly low rate of -S absence in first position. Can the DC explain this? Radical distinctness cannot, because it protects all markers, but contrastive distinctness can supply a possible functional interpretation. At the moment of utterance, the first plural marker in a phrase is a unique bearer of semantically relevant information. Consequently one could argue that is protected by a contrastive DC. But subsequent markers are redundant, and hence unprotected.

Note, however, that this argument involves an additional assumption about temporal order, that a distinctive morphological category must be indicated at the first opportunity. This assumption is not intrinsic to the DC; contrastive distinctness could just as well work on a 'last chance' principle, protecting the last possible marker. Cross-linguistic evidence shows a variety of phrasal and clausal positions for the presentation of information about categories like tense and number. Consider English number marking: Old English had number agreement in the NP, like Portuguese, but it subsequently lost number marking of adjectives and determiners, retaining it only on the head noun, which is usually LAST in the NP. So either the English developments were massively counterfunctional, or there is no universal preference for early marking. In the latter case, the DC only 'explains' the Portuguese facts at the cost of stipulating a language-specific preference for early marking.

The redundancy breakdown in Table 5 also gives mixed results. There is an apparently functional effect in second position: deletion of redundant -S markers (preceded by another 'present' marker) is high at .65, but deletion is very low when the preceding marker is absent: .04 (percentages of deletion are 75% and 10%, respectively). This is consistent with contrastive distinctness. But the third position results are counterfunctional: absence of a preceding plural marker is associated with more, not less, deletion.

3.1 A formal analysis of -S deletion

Overall, the Portuguese data give a mixed picture. The functional hypothesis fails to predict, or is contradicted by, several quantitative results. Can a formal model can give a better account of these facts? The most important point is that plural -S is sometimes absent even more than noninflectional -S. This is a problem for any functional account, and also for formal models that look only at -S deletion. Trying to account for all of these facts in one rule of -S deletion raises serious theoretical issues about grammatical modularity and autonomy, and produces a very messy rule. In what formal phonological theory can one plausibly state a rule that deletes segments according to their information content or the position of their word in a phrase? These are morphosyntactic facts about the distribution of syntactic features, so a plausible formal account of these data will involve the syntax. Specifically, the data suggest variation in the syntactic process that assigns plural marking, i.e., the number agreement rule. If this rule is variable, not categorical in PBP, then some of the 'absent' tokens of inflectional -S were never inserted by the syntax. Hence the -S deletion rule won't have to apply preferentially to plurals; rather the elevated rates of -S absence found for some plural positions arise not from excess deletion but underinsertion.

This model accounts for the position effect as follows. Assume that NP agreement is a feature-copying rule, working from left to right across the phrase, with a low probability of recursion. This would generate high rates of plural marking early in NPs with a declining rate in later positions. Once inserted, all tokens of -S are subject to the phonological rule of -S deletion, which is why inflectional -S also reflects phonological constraints like stress.

Strong corroborating evidence for this analysis can be found in PBP irregular nominal plurals. Portuguese has several types of plurals that are distinguished from corresponding singulars by more than just the -S suffix. Some examples are given in (1a-b). If forms like these undergo -S deletion, the resulting output is not ambiguous, but still recognizably plural, as in (1c). Such forms do occur in PBP utterances. But more frequently, in non-initial position in an NP, these words appear in the bare singular form, as in (1d), which cannot be generated by -S deletion! The widespread occurrence of such forms implies that the syntactic agreement rule (NPA) is itself variable, because variable non-application of plural-marking is the only way to generate such 'singulars' in plural contexts.

1. Some 'irregular' nominal plurals in Portuguese.
 - a) singular forms:
a nação o mar o móvel
 - b) fully plural-marked forms:
as nações os mares os móveis (or [móvis])
 - c) plural-marking plus -S deletion:
as nação os mare os móvei (or [móvi])
 - d) nouns not underlyingly plural-marked:
as nação os mar os móvel

Now if syntax and phonology are both variable, how can we test the DC? If some absent plural -S tokens are never underlyingly inserted, valid estimates of the deletion rate for inflectional -S cannot be obtained without controlling for this intervening source of -S absence. But this is not easy. In the regular plurals (which constitute the great majority of cases), there is no way to tell what the derivation of any S-less token was; it could arise either by non-insertion, or by syntactic insertion followed by phonological deletion.

However, despite the ambiguity about individual derivations, the overall quantitative effect of syntactic variability is clear: it inflates the number of plural -S's absent on the surface. Of course, noninflectional -S's are unaffected by this process, because they are present in the lexicon. So, comparing figures that control for other constraints (like stress), we would expect to find fewer surface inflectional -S's than lexical ones. This explains the apparently counterfunctional effect found for stressed tokens in Table 4.

This model also explains the counterfunctional results for redundancy in Table 5, where third position words show more deletion when preceding markers are absent. This would follow as a consequence of the operation of plural-marking. Formally speaking, the rule copies recursively from the left, so once it fails to apply to some word, it stops, and all subsequent words to the right should be unmarked. Thus sequences like marker-marker-zero, or marker-zero-zero are possible, but marker-zero-marker or zero-zero-marker cannot be generated by the syntax. Hence third position words after an absent marker in Table 5 are highly likely to be also unmarked. A functional account would not predict this finding, but it follows directly from the recursive copying mechanism proposed here. Of course, the apparently functional results for second position in Table 5 are not predicted by this formal account, but an explanation for them will be offered below in section §6.

Finally, recognizing syntactic variability in respect of the nominal plurals resolves the theoretical problem about formulating the constraints on the phonological rule. Instead of one messy, mixed-level deletion rule, putatively phonological but sensitive to syntactic position and semantic redundancy, two variable rules are involved: a syntactic one sensitive to syntactic features, and a phonological one whose constraints are purely phonological. Agreement rules DO have to be sensitive to information content and syntactic position: for example, they are triggered by features like PLURAL and are limited to syntactically-defined domains. But phonological rules, in most current theories, do not have such powers.

3.2 -S deletion and distinctness

Having controlled for the separate problem of syntactic variability in number marking, we can now make a valid test of whether the DC affects the purely phonological rule. The figures suggest that the first position in the NP is essentially always plural marked underlyingly in PBP. Any absent first position S's should therefore result from phonological deletion. So a straight comparison can be made between deletion rates for inflectional S's in this position and noninflectional S's (remembering to control for stress). The results are given in Table 6, and they show a dramatic functional effect. In unstressed syllables, first position plural -S is deleted at only a tenth of the rate found for noninflectional -S. Here, at least, the DC seems clearly supported, possibly even its radical version. But note that these results can also be explained by a purely formal analysis in terms of boundary effects, like the one proposed above for English coronal stop deletion.

Table 6. -S Deletion in PBP: Inflectional vs. noninflectional -S (controlled)

	Unstressed syllables only	
	% Deleted	N
Plural -S, first position in NP	5	5247
Noninflectional -S	53 (functional!)	1392

4. Denasalization in PBP

Functional issues also arise for another PBP rule that threatens a morphological distinction. Popular dialects in Brazil variably denasalize final unstressed nasal vowels: e.g., *órfã* "orphan" > *órfa*, *ontem* "yesterday" > *onte*.⁵ This is potentially dysfunctional, because nasality in final vowels happens to mark plurality in verbs. In most verb tenses, the only indicator of the number distinction in the 3rd person is an oral vowel in the singular vs. the corresponding nasal vowel in the plural: *fala-falam*, *sobe-sobem*, *falava-falavam*, etc. Obviously, if denasalization applied to these plural forms, a basic morphological distinction would be eliminated, so Kiparsky's condition should apply.

However, just as in the case of -S deletion, the situation is complicated by variability in the syntax. There is clear evidence that subject-verb agreement (SVA) is also variable in PBP. As in the case of NPA, this can be seen in 'irregular' plurals like those in (2). The same three-way alternation that we saw above for nominal plurals is illustrated in (3).

2. Examples of 'irregular' verbal plurals in Portuguese.

gloss:	"be"	"made"	"spoke"
singular:	<i>é</i>	<i>fez</i>	<i>falou</i>
plural:	<i>são</i>	<i>fizeram</i>	<i>falaram</i>
3. a) Plural marked verb:
Eles fizeram uma bagunça. "They made(pl) a mess."

b) Plural marked verb plus denasalization:
Eles fizeram uma bagunça. "They made(pl) a mess."

c) Verb not underlyingly plural-marked:
Eles fez uma bagunça. "They made(sg) a mess."

Case (3a) shows an underlyingly plural verb unaffected by denasalization; (3b) shows underlying plural marking followed by denasalization, yielding *fizeru* or *fizera*, which are still unambiguously plural. But (3c) shows a verb that was never plural-marked, because no justifiable PHONOLOGICAL rules will derive *fez* from underlyingly *fizeram*.

The syntactic variability of SVA affects the analysis of denasalization. If plural marking is variable, fully regular verbs like *sobe-sobem* have two potential derivations when expected plurals appear as surface singulars. They

could arise from nonapplication of SVA, or from underlying plural-marking followed by denasalization. This derivational ambiguity makes it hard to use such forms to test the DC on the phonological rule, since it is uncertain whether the rule was involved in their derivation.

Nevertheless, we can begin by testing other forms whose derivation is not ambiguous, like those in (2-3). The relevant data are given in Table 7. Noninflectional tokens are 66% denasalized, and the irregular plurals are denasalized at an essentially identical rate of 67%. No functional effect is observed: plural verbs, where nasality represents a morpheme, are not protected from the rule. Of course, in these verbs, the nasality is a REDUNDANT plural marker, and denasalization does not create surface ambiguity. So contrastive distinctness is not contradicted by these data, although the radical version is.

In regular verbs, the surface rate of nasal absence in Table 7 is much higher than the other categories: 85%. This seems counterfunctional, but of course it combines deletion with syntactic omission. Although individual tokens in this category are derivationally ambiguous, for a large corpus some statistical estimates can be made of the range of likely values for each variable process. The first step is to estimate the rate of application of the syntactic (plural marking) rule. One estimate can be obtained by looking at another category of verbs that have final stress, (e.g., *dá-dão*, *está-estão*). Since denasalization never applies to stressed syllables, any of these verbs that occur as surface singulars must represent nonapplications of SVA. Approximately 37% are thus unmarked (i.e., 63% agree).

If 37% is the general rate of nonapplication of SVA, then about 1400 of the 3783 regular verbs in Table 7 were never underlyingly nasalized, and hence did not constitute input to the phonological rule. This left 2383 with underlying nasals, of which 567 show a surface nasal. Therefore, under this hypothesis the remaining underlying nasals (1816 out of 2383) were removed

Table 7. Denasalization in PBP: Inflectional status and redundancy of nasality

	% Denasalized	N
Noninflectional nasality (e.g., /õmĩ/ 'man')	66	1258
'Irregular' plural verbs (redundant marker) (e.g., /fizerũ/, cf. sg /fez/)	67	1446
Regular plural verbs (unique marker) (e.g., /sobĩ/, cf. sg /sobi/)	85	3783

by denasalization: a rate of 76%. This is lower than the apparent rate of 85%, but still appreciably higher than the rate found for the other two classes.

Although these calculations depend on the assumption that the rate of application of SVA in regular verbs is the same as in the *dá-dão* class, the basic procedure can be used to estimate a range of possible rates of application for the two rules.⁶ They show that if the regular verbs underwent denasalization at the same rate (66%) as the noninflectional class, their rate of plural marking by SVA would have to fall to 44%. It is mathematically possible for the regular forms to show a denasalization rate significantly lower than the other categories (as predicted by the DC), but for this to occur, the rate of syntactic plural marking would have to be implausibly low. Hence the best conclusion seems to be that, even in nonredundant categories, no functional constraint is apparent on this rule.

5. A Formal Explanation of the Portuguese Results

The two Portuguese cases thus give opposite results. After we dispose of intervening variables and refine our analysis, -S deletion appears strongly constrained by the DC, possibly even in redundant contexts, but denasalization shows no evidence of a functional constraint, even in unique morphemes. Why the contradiction?

A coherent answer again depends on looking at formal, not functional, differences between the rules. Functionally, both rules obliterate plural markers, but structurally, they are quite distinct. S deletion targets a segment easily demarcated from the root, but denasalization affects a mere feature: [+nasal]. Most morphological theories will therefore supply a formal representation in which the morphological structure of the former case is transparent, but the latter is opaque. This provides an excellent test case for choosing between formal and functional explanations. As we noted in §1, such empirical tests are only possible when form and function make conflicting predictions, which occurs in two situations: identical forms with different functions, or identical functions filled by differing forms. The English data provided us with the first kind of situation (contrasting *-ed* in its past and participial functions). The Portuguese data show the second: one function (plural marking) expressed by two different formal devices: adding a segmental suffix or altering a feature in

the root. While functionalism predicts the resistance of both plural markers to erosion, the formal analysis that I will now present allows them to behave quite differently.

The details of a formal treatment of course depend on the specific theory adopted. I do not argue here for a particular model of morphology, but sketch the analysis in fairly general terms. Both phonological processes are relatively superficial; thus both are affected by surface stress, and both are subject to cross-word-boundary conditioning (cf. Guy 1981). Morphologically, the nominal -S plural is also derivationally late. It is a regular inflectional affix, which is always attached last in a series of affixes. But the [+nasal] feature marking plurality in certain verb forms is usually treated as having a deeper derivational history. It has a narrow morpholexical range of occurrence, being found only in the 3rd person, and in many forms (systematically in certain tenses and lexically-specific in irregular cases) it occurs as just a part of a larger plural affix (cf. exx. 2-3). In the standard analysis of Mattoso Câmara (1972), the surface nasal is derived from a postulated abstract nasal suffix (i.e., an autosegment not associated with a C slot), which becomes attached to the preceding vowel during the derivation, triggering certain vocalic changes.

Given these facts, the simplest account is that both -S deletion and denasalization apply to surface forms, subject to boundary conditions. Nominal plurals have a morpheme boundary before the suffix that inhibits -S deletion (e.g., #casa#s# vs. #menus#). Then the putatively 'functional' effect in Table 6 can be expressed by the same formal constraint proposed above for English coronal stop deletion: don't delete after a morpheme boundary. The absence of a functional constraint on denasalization is explained by the formal fact that on the surface, the feature indicating plurality is not demarcated by boundaries, but is merely a component of a segment in the stem (compare #falã# "they speak" and #orfã# "female orphan"). Short of developing a theory that allowed morphological boundaries around features within a segment, the DC cannot be formally expressed in these cases, precisely where no functional inhibition of the rule occurs.⁷

Hence for Portuguese, as for English, a formal explanation gives a superior account of the data. A 'functional' constraint is evident just for -S deletion, where it is formally expressible as a boundary condition, limiting deletion of plural -S. But in denasalization, where there is no formal difference between the inflectional and noninflectional cases (at least at the level where the rule operates), the 'functional' constraint evaporates.

6. The Researcher's Paradox

In the empirical tests applied above, the distinctness condition essentially fails. In all three cases, formal models provide a superior explanation of the facts. 'Functional' constraints only appear when they can be formally explained by morphological structure or derivation. When form does not follow function, the facts follow form; the formal models also predict the results that the DC fails to account for. Therefore, the DC is not a direct constraint on the operation of phonology. This is an attractive result, for it allows us to preserve the autonomy of phonology and the modular architecture of grammar.

But despite its theoretical attractiveness, this result doesn't really resolve the question of functionalism, but rather relocates it. The principle that restricts coronal stop deletion in English and S deletion in Portuguese from deleting morphemic units may be formally stated (don't delete in the context #_#), but it is highly functional in its effect. Although the quantitative results do show small counterfunctionalities, languages have, in the long run, successfully avoided large-scale dysfunction. What we have established is that the DC is not a condition on phonological production; we must now investigate other potential locations for functional maintenance: principally perception and acquisition.

The first step towards a solution lies in what I have termed the 'researcher's paradox': how can we recover the unrecoverable? The data indicate that the DC does not constrain production. If this is true, then speakers must sometimes produce utterances that contain no surface indication of the marked morphological category that they have in mind — no tense marker in the English case, no plural markers in the PBP cases. But how can we demonstrate that this actually happens? In some of these cases, the intended category can be correctly inferred from the context or the discourse, but at least occasionally, the omitted or deleted categories will be completely unrecoverable: an underlyingly past tense utterance will appear without any evidence of its past time reference, or a plural referent will be spoken of without any indicators of plurality. How does a researcher deal with such cases?

Clearly, the researcher — or any hearer — will systematically misconstrue such tokens as instances of the unmarked category (present tense, or singular)! Normal parsing requires us to interpret things as what they seem to be, in the absence of evidence to the contrary, so we understand tokens that are

singular in form to be singular in meaning, and present tense verbs to have present tense referents. We cannot look into speakers' minds and see their intentions and underlying forms, but can only infer these from evidence. If the overt morphological evidence of the marker is deleted, and there is no other information in the context to allow the correct inference, then the hearer will understand the utterance as meaning what it appears to mean, not as what was intended but never uttered.

Consequently, the corpus collected by the researcher cannot contain any examples of the purest violations of contrastive distinctness! For a study of coronal stop deletion, or -S deletion, or denasalization, one only collects tokens that are believed to contain the relevant feature underlyingly. If nothing in the data permits the inference that a given item is relevant to the study in this way, it is not included. Truly counterfunctional deletions of unique morphological markers cannot be studied, because they cannot be found.

In this sense, contrastive distinctness is undisprovable and untestable. Counter-examples can never be collected, only supporting evidence. Radical distinctness is easily testable of course, as I have shown here, but the defender of contrastive distinctness can always argue, for any recovered token, that the disambiguating contextual evidence that allowed us to recover the token was precisely what permitted deletion. One can never prove conclusively that some utterance is a genuine violation, because this would involve 'proving', without evidence, that it REALLY means something else.

Nevertheless, there are two possible strategies for circumventing the paradox, which I have applied to the Portuguese data. One is statistical: to look for quantitative evidence of the collective existence of such cases. The other is to search for individual tokens that are just across the frontier of ambiguity: apparently singular tokens for which there are marginal arguments for an underlying plural reference. The model I propose predicts such cases should occur, while contrastive distinctness implies that all cases should be clear: if they are not clear, deletion should be blocked. First, let us consider the statistical evidence.

If tokens are lost from the corpus by misconstrual, they might well leave statistical gaps in the data from which their existence could be inferred, like black holes occulting the light of a neighboring star. In my -S data such a case occurs. The results showed that first position words in NP's occur without plural markers 4.6% of the time. This implies that, among words in *second* position, 4.6% should be preceded by first-position words with a zeroed

plural-marker. Is this what is actually found? There are 2799 second-position words in my corpus; 4.6% of them would amount to 128 tokens that should be preceded by a zero-marked word. But in fact, only 70 such tokens were found. Therefore, about 58 tokens are missing. What happened to them? The likely explanation is that these tokens belonged to two-word NP's in which neither word bore any surface plural-marker, and which, in the absence of other disambiguating information, were lost from the corpus.

This explains the apparently functional finding for second position in Table 5, which was left unexplained by my formal account. When the preceding plural marker is missing, second position words show a very low rate of -S-absence: only 7 of the 70 tokens have no -S. Although this seems functional, it is explained by the researcher's paradox. By the calculations just made, most unmarked words in this position have been lost from the corpus. If they were restored, the true -S-absence rate here would be over 50% (65/128).

Of course, this statistical evidence is circumstantial, and the case would be stronger with a *corpus delecti*. Let us consider the borderline cases. I carefully searched the data for singulars co-occurring in a text with plural referents. A few cases turned up that are possible instances of data lost to the Researcher's Paradox. Examples are given in (4).

4. a) *Simpresmente eles cantaru um hino. Cantaru um hino bacana e tal; então eles pediu nossa opinião, o quê que achou daquilo, e tal. Ele perguntou cada um de nós.*
 "They simply sang(pl) a hymn. (They) sang(pl) a nice hymn and so on; then they asked(sg) our opinion, what one thought of that and so forth. He asked(sg) each one of us." (Speaker 20: 4A:116)
- b) *O pessoal apagaru a luz, que eles tava fazendo muita safadeza... Apagaru a luz pra dançar... Tinha só as coleguinha dela, era P., T., R., R., N.. Todo mundo dançando no escuro. Ele queria dançar com a luz escura. Se eu passasse pra lá, ele ia reclamar comigo.*
 "The people put(pl) the light out, 'cause they was (sg) fooling around. (They) put(pl) the light out to dance. There was only her friends, there was [names of five people]. Everybody dancing in the dark. He wanted(sg) to dance with the light out. If I had gone by there he would have(sg) argued with me." (Speaker 11: 7A:530f)

Both texts are narratives describing interactions between the speaker and a group of others. The third person references relevant to my argument are underlined. In each case the story begins with fully explicit plural reference in both NP and verb: *eles* and *cantaru* in (4a), and *o pessoal* (morphologically singular but semantically plural), *eles*, and *apagaru* in (4b). But the level of plural-marking declines in subsequent coreferent NP's and verbs, so clauses like *eles pediu*, *eles tava* appear, with plural subjects and singular verbs. Finally, each text concludes with a clause or two with only singular forms of subject and verb: *ele perguntou* "he asked" in (4a) and *ele queria* "he wanted", *ele ia* "he would have" in (4b).

Do these final clauses represent an abrupt shift to a different, singular referent, or are they continuing the same plural reference as the preceding text, but omitting all plural markers? One could argue on discourse grounds that the latter is more likely, because the abrupt introduction of a (singular) pronoun without specifying its antecedent or referent would create an ill-formed text. These narratives could be interpreted as showing some kind of text planning, where the introduction of characters and references is allocated to particular clauses or sections of the text. But one could also argue the other position: that when these speakers said 'He did X...', they were referring to one particular person, and their failure to specify that person is simply a discourse-level 'performance error'. Because of this uncertainty, such examples were not included in my corpus, but there exists a reasonable possibility that these are some of the 'lost data'. Therefore, on the basis of both the statistical evidence and these specific examples, I conclude that speakers sometimes do delete or omit irretrievably all traces of a particular morphological category.

7. Perception and Acquisition: The reproduction of functional constraints

The empirical evidence shows that function does not actively constrain synchronic variation in production. Radical distinctness can be recast in formal terms, while a contrastive version is ultimately untestable. But it still seems eminently reasonable that language should avoid deeply dysfunctional states of affairs. Function may not directly determine form, but it still must have something to do with it. What is the mechanism of influence? The answer lies in the researcher's paradox, and its effect on diachrony.

The researcher's paradox is actually a problem of perception, not production. A speaker who omits all evidence of a morphological category is not thereby confused; he or she still knows what the intended meaning was. Only the hearer is affected by absent markers. What is the nature of this effect? Native hearers must experience the researcher's paradox the same way as a researcher. If a speaker produces forms that violate the DC, in a context that makes the violation unrecoverable, the forms will be lost to the perceived corpus of hearers as surely as they are lost to ours. Hence, even though the PRODUCED corpus may contain violations of the DC, misconstrual leaves a PERCEIVED corpus without violations! In the complete absence of other disambiguating information, 'smooth' miscommunications will occur, with marked categories intended, and unmarked categories perceived, and the hearers will be under the impression that the DC is true.

Synchronically in the adult community, this may not have any serious consequences, but consider the effect on acquisition. Children learning a language try to construct grammars that emulate the corpus they perceive. Since they will not perceive violations of distinctness, they will systematically, in all languages at all times, be trying to construct grammars in which the DC is true. I hypothesize that principles of UG (the autonomous, modular organization of the mental language faculty) do not permit the construction of direct functional constraints on variability. Instead, child learners will constantly try to construct formal devices that fulfill the perceived necessary functions. In the coronal stop and -S deletion cases, this is achieved with a boundary constraint. This is not a perfectly functional solution, because, e.g., it protects the functionally empty participial affixes. But overall, it works quite well, preserving many tense and number markers from erosion.

This PERCEPTION THEORY of functional constraints does not require any particular formal solution. It could work out as a boundary constraint on a phonological rule, a rule reordering or restructuring, or a functional compensation elsewhere in the grammar, as in Hochberg's findings referred to above. Anything that works to prevent loss from the corpus of perceived forms will be favored in linguistic evolution, and in the long run, the formal mechanisms of language will be continually reshaped to functional ends.

This process is analogous in some ways to biological evolution. The function of a penguin's feathers is clearly to keep the penguin warm, but this function doesn't directly determine the form of the feathers, because sheep achieve the same ends with wool, and whales with blubber. So how is

functionality maintained, in the absence of a direct, even teleological, effect on form? In biology, the mechanism is natural selection: some individual differences in form confer a reproductive advantage on their possessors, and hence those traits are propagated at the expense of others. The biological penalty for failure to fulfill a necessary function is death for the individual and extinction for the gene.

The comparable mechanism in language is not quite so drastic. For the individual there is no penalty for violating the distinctness condition; doubtless no-one has ever died for uttering a singular form instead of a plural. But the researcher's paradox means that there is a 'reproductive' disadvantage for FORMS that violate the constraint: they can be lost from the perceived corpus, and therefore learners won't make an effort to construct grammars that generate them. On the contrary, learners will attempt to emulate the DC, adapting to this purpose any formal device of the language that preserves functionality and is permitted by UG, whether it is the linguistic equivalent of feathers, blubber, or wool.

This 'reproductive' advantage of distinctive forms can be modelled quantitatively. Suppose that in production a rule like coronal stop deletion initially applies equally to both inflectional and noninflectional tokens, at a rate of, say, 50%. Out of 100 monomorphemic words, 50 are produced without the final stop. Hearers correctly perceive all of these as instances of deletion, and therefore hear a 50% deletion rate for these tokens. But in 100 past tense tokens some of the 50 deleted cases are misheard as present tense. If, say, 25 are thus misconstrued, the hearer perceives 25 tokens as past tenses that have undergone deletion, and another 50 tokens as undeleted past tenses; hence the perceived deletion rate in this category is 25/75, or 33% — an apparent 'functional' reduction in deletion. The magnitude of this perceived functional effect is proportional to the number of tokens bled away by misconstrual. Since redundancy minimizes misconstrual, the apparent functional constraint on deletion is smaller for redundantly marked categories.

7.1 Category strength

This redundancy effect means that the perception theory can also explain the contrast in functional resistance that Kiparsky identifies between 'strong' categories (tense, number, and verb agreement in PRO-drop languages) and 'weak' ones (case, and verb agreement in languages without PRO-drop). All

of these facts derive automatically from structural redundancy, without requiring an independent scale of 'category strength'. Insofar as some category is recoverable from context in a language, it is not perceived to be 'functionally' protected. Case is usually redundant and recoverable, inferrable from word order, adpositions, or lexical/semantic evidence like verbal valency and subcategorization. The same is true of verb agreement in languages without PRO-drop. In both cases, few tokens are misconstrued, so the categories are not perceived to have reduced deletion rates.

The 'stronger' categories, however, don't have such built-in structural redundancy. Tense and number are never expressed by word order. They are sometimes redundant in other ways (and then they can be deleted, as in PBP redundant plurals), but disambiguating information is never systematically available. The same is true of verb agreement in PRO-drop languages. Therefore, if the structural facts of a language allow a formal constraint, a 'functional' blocking of a reduction rule affecting these categories will be created.

The perception model also reveals why gender is problematic in Kiparsky's analysis. For a competent adult speaker, the gender of a noun is recoverable from the lexicon. The same is true of accompanying modifiers when their relation to the noun is syntagmatically clear. Therefore, deletion of a gender inflection does not produce the perceived functional constraint: gender is a 'weak' category. But how do children acquire gender categories? They don't start with lexical entries that specify gender. Faced with input that exhibits variable deletion of gender markers, they can only reconstruct the (marked) gender category when deletion has not applied. Thus in a language learner, misconstrual does occur, and a functional blocking of the rule is perceived. Gender is therefore a 'strong' category. This mixed perception of gender — sometimes recoverable and sometimes not — depends on other features of the grammar (agreement patterns, use of gender-marked determiners, etc.) One would therefore predict gender to show great cross-linguistic variability in resistance to erosion, which is true at least of the Germanic family.

The model also accounts for Kiparsky's historical examples. In German, a variable /-e/ deletion rule initially applies to all suffixes. Hearers correctly perceive its application in datives (because 'dative' is usually recoverable from verb or preposition case assignment), and in unmlauted plurals (because plurality is also signalled by umlaut). Hence hearers infer correctly that the rule freely applies in these cases. But in non-umlauted plurals, deletion of /-e/

creates forms that are heard as singular, leaving a perceived corpus rich in undeleted forms. Language learners therefore infer that deletion is constrained by the morphological class of the word. Similarly, in the Sanskrit case, -ay- deletion of unique causative markers causes misconstrual, and the perception of a functional constraint. Note that Kiparsky's 'category strength' explanation has to motivate a place on the strength hierarchy for causativity, but the perception theory of functional constraints avoids this problem.

8. Conclusions

In empirical evidence from natural language production, functionalism is elusive. Like Milton's Paradise, it is now found and now lost. But in the end, I have argued that it is not a significant factor. Three arguments were advanced in support of this view:

- The empirical results show that all the putatively functional constraints are either better accounted for by a formal model, or are artifacts of the researcher's paradox.
- On theoretical grounds, functional constraints on the formal rules of language are implausible, and operationally cumbersome. They would violate autonomy and modularity, endow low level rules with unlikely global or transderivational abilities, and need a complex extra machinery in the grammar. Therefore, they should be avoided, if possible.
- In its contrastive version, the functional hypothesis is ultimately untestable. If counterexamples cannot be collected, the proposition is beyond discussion.

Thus, for a variety of reasons, we conclude that functional factors do not actively constrain the grammar during real-time generation of speech. Nevertheless, the normal operation of perception and parsing ensures that the distinctness condition seems to obtain in the corpus that hearers perceive. Ambiguous unmarked forms will be systematically misconstrued, leaving a perceived corpus in which rules of phonology and syntax appear to be functionally constrained in inverse proportion to the degree of redundancy in the target.

This functional effect on perception is, in the long term, played back into production through the mechanism of language acquisition. The driving imperative of acquisition is to try to make the output match the input, but the

input is what the learner perceives, which is not necessarily what the learner's interlocutors intended or produced. Accordingly, language learners will always be working toward a target in which the perceived functional effects obtain. The creative adaptations of the grammar that they undertake to emulate this state of affairs are of course limited by UG, but within those limitations, learners will continually be selecting formal devices that maintain functional distinctions in language.

This solution is prefigured in Kiparsky's work. He explicitly treats the DC as a functional factor of perception, and considers similar factors in production and acquisition. What I have tried to do is elucidate a mechanism whereby a perceptual constraint can get translated through acquisition into an apparently functional constraint on production. The limitations on this translation mechanism are what generates all the confusions and lapses that appeared in the quantitative data. But in the long-run, we are promised that linguistic function, like Paradise, will be regained; in this case through the ear of the beholder.

Notes

- 1 A third possibility, that of a separate analogic change following the sound change to restore transparency and functionality, will not be considered here, as my focus is principally synchronic. For discussion of this point, cf. van Coetsem et al. (1981).
- 2 An alternative hypothesis, that distinctness works like a binary parameter in UG, is falsified by the facts. In this approach the intermediate results in Table 1 would represent an average of two groups of speakers: those with contrastive distinctness delete irregulars like monomorphemes, and those with radical distinctness conserve them like regular pasts. But Guy & Boyd (1989) show that individuals do not fall into two discrete groups; most speakers have an intermediate rate of deletion for this class.
- 3 The analogous case of final -s deletion in Caribbean Spanish (Cedergren 1973; Poplack 1980) is analyzable along the same lines sketched here for Portuguese.
- 4 European Portuguese also has a 2sg verbal -S inflection, but this is virtually unknown in the Carioca (Rio de Janeiro) dialect on which this study is based. My Portuguese data are drawn from my research on PBP (most fully reported in Guy 1981), conducted in connection with the Competências Básicas research project (Lemle & Naro 1977).
- 5 Portuguese orthography indicates nasal vowels by a tilde over the vowel or a following *m*.
- 6 The relationship between an estimated frequency of plural marking (F_p) and the corresponding frequency of denasalization (F_d) is approximately: $F_d = 1 - (.15/F_p)$

- 7 The Portuguese data can also be given a lexical phonological analysis. In plural verbs, the brackets around an abstract nasal affix must be erased before the nasal feature attaches to the final vowel of the stem; so at the end of the lexicon, inflectional and noninflectional nasals both lack internal bracketing. But the -S cases, at the same point, retain contrasting representations, with a boundary preceding the -S in plurals but not in monomorphemes.

References

- Cedergren, Henrietta. 1973. "The Interplay of Social and Linguistic Factors in Panama". PhD dissertation, Cornell University.
- Chomsky, Noam & Morris Halle. 1968. *The Sound Pattern of English*. New York: Harper and Row.
- Guy, Gregory R. 1980. "Variation in the group and the individual: The case of final stop deletion". Labov 1980, 1-36.
- _____. 1981. "Linguistic Variation in Brazilian Portuguese: Aspects of the phonology, syntax, and language history". PhD dissertation, University of Pennsylvania. Ann Arbor: University Microfilms.
- _____. 1991. "Explanation in variable phonology: An exponential model of morphological constraints". *Language Variation and Change* 3.1-22.
- Guy, Gregory R. & Sally Boyd. 1989. "The development of a morphological class". *Language Variation and Change* 2.1-18.
- Halliday, M.A.K. 1985. *An Introduction to Functional Grammar*. London: Arnold.
- Hochberg, Judith. 1986. "Functional compensation for /s/ deletion in Puerto Rican Spanish". *Language* 62.609-621.
- Kiparsky, Paul. 1982a. *Explanation in Phonology*. Dordrecht: Foris.
- _____. 1982b. "Word-formation and the lexicon". *Proceedings of the Mid-America Linguistics Conference*, ed. by F. Ingemann. Lawrence, Kan.: University of Kansas.
- Kuno, Susumu. 1972. "Functional sentence perspective: A case study from Japanese and English". *Linguistic Inquiry* 3.269-320.
- Labov, William, ed. 1980. *Locating Language in Time and Space*. New York: Academic.
- _____. 1994. *Principles of Linguistic Change, v.1 Internal factors*. Oxford: Blackwell.
- Labov, William, Paul Cohen, Clarence Robins, & John Lewis. 1968. *A Study of the Non-standard English of Negro and Puerto Rican Speakers in New York City*. Report on Co-operative Research Project 3288. New York: Columbia University.
- Lafford, Barbara A. 1989. "Is functionalism a fact? Data from the Caribbean". *Hispanic Linguistics* 3.49-74.
- Lemle, Miriam, & Anthony Naro. 1977. *Competências Básicas do Português*. Rio: Mobral.
- Martinet, Andre. 1962. *A Functional View of Language*. Oxford: Clarendon.
- _____. 1975. *Studies in Functional Syntax*. Munich: Wilhelm Fink Verlag.

- Mattoso Câmara, Joaquim, Jr. 1972. *The Portuguese Language*. Chicago: University of Chicago Press. [translated by A. J. Naro]
- Nesbitt, Chris. 1984. "The linguistic constraints on a variable process: /t,d/ deletion in Sydney speech". B.A. Honours thesis, University of Sydney.
- Neu, Helen. 1980. "Ranking of constraints on /t,d/ deletion in American English: A statistical analysis". *Labov 1980*, 37-54.
- Poplack, Shana. 1979. "Function and Process in a Variable Phonology". PhD dissertation, University of Pennsylvania.
- _____. 1980. "The notion of plural in Puerto Rican Spanish: Competing constraints on /s/ deletion". *Labov 1980*, 55-68.
- van Coetsem, Frans, R. Hendricks & P. Siegel. 1981. "On the role of function in sound change". *Cornell Working Papers in Linguistics* 2.166-185.
- Wolfram, Walt. 1969. *A Sociolinguistic Description of Detroit Negro Speech*. Washington: Center for Applied Linguistics.
- Zwicky, Arnold M. 1984. "Autonomous components and limited interfacing: phonology-free syntax, the Halleian syllogism, and their kin". *CLS* 20.365-386.

The History of the Ancient Hebrew Modal System and Labov's Rule of Compensatory Structural Change*

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1. Consonant Cluster Simplification and the Tense System of VBE

William Labov delivered his inaugural lecture at the University of Pennsylvania in the late 1960's, when I was a graduate student in the Department of Oriental Studies. Naturally, what I remember best about that lecture is the excitement that it generated among the students, but I also recall that part of it dealt with consonant cluster simplification and the past tense suffix in Vernacular Black English (VBE).

This was among the earliest demonstrations of the variable operation of the English phonological rule which deletes word-final -t,d preceded by another consonant. Labov showed us that the rule is grammatically constrained, so that the final clusters in past tense verbs like *missed* and *bowled* are simplified (to *miss'* and *bowl'*) less often than the corresponding clusters in monomorphemic words like *mist* and *bold*. He also pointed out to us that the failure to understand that VBE forms like *miss'* and *bowl'* were the product of a phonological rule had led to misguided attempts to teach black pupils the concept of past tense. It was clear, he said, that these students had no need for such instruction, for they never confused *kep'* with *keep* or *tol'* with *tell*.