Optimality and Functionality: Objections and Refutations[1]

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To appear in *Natural Language & Linguistic Theory* 20.1

The Classical Generative View

The classical generative theory of knowledge of language is that a speaker's mental grammar is a pure combinatorial engine, blind to typology and resistant to grammar-external forces. It arises from domain-specific innate principles of UG, whose parametric variation becomes fixed upon exposure to a given linguistic experience. In this classical epistemology, markedness hierarchies such as the animacy hierarchy cannot play a role in the individual synchronic grammar of a present-day English speaker. These hierarchies are not universal; they are exception-ridden, both across languages and even within the individual languages where their effects sometimes appear. They also have no obvious structural basis in generative representations. Hence, they are regarded as at best vague tendencies reflecting scalar properties of human perception and cognition or socio-cultural categorizations, external to the specific domain of linguistic structure. Their appearance in languages typologically distant from English (e.g. Lummi, Dyirbal, Navajo) shows merely that grammar-external forces may leave their marks upon languages historically. On this view, some of the grammatical structure found in existing languages may be the conventionalized residue of external pressures on historical change, which are no longer active synchronically. But present-day speakers have no knowledge of typology, nor of the external pressures that

[1]Of the many colleagues who helped us, we thank in particular Beth Levin and Luis Casillas for gathering relevant works on English genitives, Anette Rosenbach for generously sharing her own related research on this topic, Edward Flemming and Martin Haspelmath for discussion of the relations between innateness and functionality, and Chris Manning and Shipra Dingare, for helping to develop key ideas and evidence we draw on. None of them may fully agree with the views expressed here, of course, and we alone remain responsible for the content of this work. Thanks also to two anonymous reviewers for their comments.

This research is based in part on work supported by the National Science Foundation under Grant No. BCS-9818077 (PI Bresnan) and Grant No. BCS-9818177 (PI Aissen).

have affected typological distributions—and their mentally represented grammars reflect this.

On this view the burden of explaining the recurrent syntactic effects of markedness hierarchies across languages is shifted from synchronic grammar to diachrony, where it remains a mystery. By what mechanisms can grammar-external forces leave their 'conventionalized residues' in a generative syntax? Classical generative theories of formal grammar are designed with mathematically discrete and logically deterministic formal architectures. On these theories, frequentistic processes (such as the conventionalization of usage preferences) must belong either to grammar-external 'performance' along with speech errors and memory limitations, or to external choices among competing dialect grammars. Yet neither of these alternatives is an adequate model of variation and change, as first pointed out by Weinreich, Labov, and Herzog (1968). The same is true of the variable effects of markedness hierarchies on syntax.

'Functional' Optimality Theory

The emergence of Optimality Theory has introduced new ways of thinking about these fundamental issues, in phonology and syntax alike. In OT, there *is* a 'combinatorial engine', a generator (GEN) of possible linguistic structures, but it is not deterministic of individual languages nor of the typological space of all natural languages. It merely provides a common vocabulary for precisely describing all kinds of linguistic structures, natural and unnatural, for any given linguistic content (the 'input'). Which structures are selected as the outputs of particular grammars is determined by the relative strength of very general but violable constraints external to GEN. Given the language-particular constraint strengths, the selection process (the optimization function) minimizes the maximum constraint violation.[2] This optimization function is shared by both the original OT (Prince and Smolensky 1993) and recent generalized versions of OT that allow variable outputs of the same input (e.g. Anttila 1997a,b, in press, Boersma 1997, 1998, Boersma and Hayes 2001). The OT architecture thus provides a very natural way of modelling substantive functional/typological theories of linguistic struc-

[2] Boersma (1998: chapter 10) discusses various optimization strategies including the "bookkeeper's strategy" of minimizing the weighted sum of constraints and the OT-style strategy of "minimizing the maximum problem," giving several arguments in favor of the latter over the former.

ture, and integrating variation and change into the general theory, as many phonologists have already recognized. The same is true in syntax.

Let us take as an example one among the many factors (topic continuity, aspect, person, animacy, formality, and the like) that influence passivization. The pressure to passivize to maintain topic continuity in discourse has been widely studied within a variety of functional linguistic approaches (see Cooreman 1982, 1987, Thompson 1987, Shibatani 1988, Givón 1994, Birner and Ward 1998 for a sampling). In OT this pressure can be represented by a constraint (or constraint family) to avoid noncontinuous subjects, as Aissen (1999) proposes, building on Legendre, Raymond, and Smolensky (1993). This constraint (family) is functionally motivated; yet it appears to be much stronger in some languages than others—it may be over twice as strong in Bella Coola as in English, for example, judging by the relative frequency of passivization of semantically transitive clauses with topical/nontopical arguments (cf. Forrest 1994, Estival and Myhill 1988). Some languages even favor passives over actives. Maori is a famous example, on the passive analysis of Chung 1978, and the prevalence of passives over actives has been widely interpreted as a late stage in one historical path to the ergative (Anderson 1977, 1988, Trask 1979, Estival and Myhill 1988, Garrett 1990).[3] Now the strength of a given constraint is an arbitrary, conventional property of a particular grammar. After all, in OT the strength of a constraint is simply its ranking, and the ranking of the constraints is what defines a language-particular grammar.

What determines the strength of a constraint in a particular grammar is incidental to its functional motivation (maintaining topic continuity in our example). In general, a syntactic output selected by some constraint(s) in the optimization function may be used or come to be disused for all sorts of reasons, such as its morphological or phonological properties or its perceived formality or social value amongst certain groups of speakers. All such properties of the output will jointly determine its currency, and its currency will in turn affect the ranking of the syntactic constraint(s) that select it, under OT learning algorithms such as the Gradual Learning Algorithm (GLA, Boersma 1997, 1998, 2000). An interesting case where the social value of an output arguably determines constraint ranking in OT appears in the interactions of negation and auxiliary inversion in three dialects of English (Standard,

[3] The close relation to the ergative is one reason why the passive analysis in Maori and other Austronesian languages has been controversial.

Scots, and Hiberno-English) analyzed by Bresnan (2001a, in press). Other cases where the determinants of constraint strength are incidental to the utility or functionality of the constraints themselves are the phenomena associated with style shifting, which can be formally modelled in OT as the speaker's control of constraint ranking (van Oostendorp 1997, Boersma and Hayes 2001).

In this conceptual framework there is no longer a mystery about how the 'conventionalization' of preferences into formal grammars can occur. An output which appears variably and only in restricted contexts may become preferred, used more frequently in wider contexts, ultimately becoming entrenched as a categorical part of grammar, and this process of expanding conventionalization can be straightforwardly modelled as the rise in strength of the constraints that favor that output in the grammar over those that oppose it. As the constraint rises in its strength (ranking value), it becomes more active in determining the outputs of the grammar, but its original motivation, which derives from a substantive theory such as the effect of discourse topic continuity on subject selection in our example, does not change with its rank.

These developments have led us to reconsider the role of markedness hierarchies in syntax and to attempt to build a bridge between the insights and results of functional/typological work on the one hand, and the explicit modeling techniques of formal grammar on the other. In recent and ongoing research with collaborators and students, we have built on these ideas.

The Immediate Context of the Debate

Fritz Newmeyer has long been a proponent of the classical generative theory of knowledge of language, and he has aimed to address rather than ignore functionalist linguistic theory. In his last book (Newmeyer 1998), for example, he argued that having the grammar encapsulated from external pressures could itself be functionally motivated, by preventing instability of the linguistic system. (Of course, lacking evidence about the comparative stability of different grammatical architectures, he could just as well have asserted the opposite: that linguistic integration with non-linguistic cognitive systems avoids the excessive fragility and lack of robustness of purely combinatorial domain-specific systems.) In recent work (Newmeyer to appear, a revision of Newmeyer 2000), Newmeyer speculates on the attractions of functionally motivated OT by verbally painting an amusing portrait of syntacticians gazing at phonology with envy, and trying to imitate its successes. After recapitulating Aissen (1999, 2000), he then argues that this work, which he calls 'Functionally-based Optimality Theory', is a conceptual and empirical failure.

In what follows we answer each one of the substantive arguments in Newmeyer (2001). We show that the views he expresses, although they may be common currency among (some) generative linguists, embody serious misconceptions of the functionalist ideas associated with OT as well as OT itself.

Objections and Refutations[4]

3.1.1. The content of the claim that all constraints are motivated functionally.

Argument 1: It is too easy "to contrive some functional motivation for almost any given constraint" (p. 22).

Rebuttal: On the contrary, a case can be made that it is much harder to provide a theory in which constraints are motivated within substantive causal theories than it is to proliferate arbitary formal constructs lacking any motivation independent of the data patterns they are originally hypothesized to account for. Newmeyer's caricature does a disservice to the careful empirical work of functionally oriented linguists whose research proceeds by detailed descriptive fieldwork, studies of language use in context, cross-linguistic comparison, qualitative and quantitative analysis, computational simulations, and psycholinguistic experiments, as well as the design of formal representations of linguistic structure. That said, it is also true that almost all contemporary linguists, regardless of their (formal or functional) persuasion, practice a division of labor, mastering only a few methodologies in their researches. They expect the results of their studies to be interpreted within a larger research enterprise. How many generative linguists, in motivating new theoretical proposals inconsistent with earlier ones, continue to pay easy lip service to "the child's innate endowment" or to the competence/performance distinction, without having performed a single relevant experiment? The innatist explanation is too easily contrived for almost any given formal construct. Newmeyer's criticism here is quite parochial.

[4]Section numbers refer to Newmeyer's text.

3.1.2. On correlations between rankings and functions.

Argument 2: "...there is no clear relationship between the importance of the function that a constraint serves and its typical ranking" [= its "mean cross-linguistic ranking", p. 27] (p. 26).

Rebuttal: This is so, and with good reason: it is senseless in OT to assess the relative functionality of individual constraints in this way, for the reasons we have already discussed above. As phonologists have emphasized, faithfulness and markedness are in tension, and the dimensions of markedness are themselves multiple and often conflicting. The resolution of these tensions through constraint ranking means there is no expected correlation between functional motivation and mean cross-linguistic ranking. The ranking of constraints is a conventional property of grammars, which can be altered by style shifting and influenced by the social value attached to outputs, and by a myriad of other factors independent of the theory embodied in the constraints.

Given the theory of factorial typology (and for purpose of the argument setting aside fixed subhierarchies of constraints), the "mean cross-linguistic ranking" of OT constraints is a constant, the same for all constraints:

$$\text{“mean cross-linguistic ranking”} = (n+1)/2$$

(This formula is just the statistical mean of the n elements 1,2 ,...,n, which are the ordinal ranking values for n constraints.) The factorial typology is fundamental to OT, and (modulo constraint subhierarchies) requires all constraints to be rankable in every order. There is no way to measure relative functionality by taking the mean ranking of a constraint in all OT grammars. If one instead proposes to take the mean ranking of a constraint in the grammars of *observed* languages, the problem is that the same language can be the result of many different constraint rankings, so that the mean ranking of any single constraint need not be informative at all. Argument 2 is thus a straw man of Newmeyer's own invention.

Several of Newmeyer's subsequent arguments depend on the key misconception in this argument: that rankings of functionally motivated constraints must be functionally motivated rankings of constraints. We wish to reemphsize that there is no necessary connection between the functional motivation of a constraint and that constraint's rank.

3.1.3. Constraint functionality and speaker knowledge

Argument 3: Grammatical structure is a conventionalized residue of functional pressures on historical change.

The current state of English grammar "is a product of over a thousand years of changes, many functionally motivated when they occurred, but preserved in the language primarily by the force of conventionality" (p. 31). Functional pressures lead to changes in grammatical structure such as the word order changes in the English genitive, but in the synchronic grammars the functional pressures no longer exist.

Newmeyer "challenges any advocate of FOT to demonstrate that that particular functional force [on the word order of adnominal genitives in English—JB,JA] is a motivating factor in the grammars of English speakers today and to identify the particular constraints to which this factor is linked. Among other problems that would need to be addressed is the fact that the functional differentiation is only partial. That is, inanimates can occur in the GEN-N construction ('the table's leg' is not horribly unacceptable) and animates can occur in the N-GEN construction ('the mother of the lawyer')" (p. 31).

Rebuttal: Because the strength or rank of a constraint is conventional and incidental to its motivation, as we pointed out above, there is nothing inconsistent in grammatical structures being both the products of historical processes of conventionalization and the outputs of an optimization function over motivated constraints in a synchronic grammar. Newmeyer's assumption to the contrary arises from the misconceptions discussed above.

Is there any way to tell whether OT constraints which are postulated to be low-ranked and hence relatively inactive in a given language are actually present in the synchronic state of the grammar? Three kinds of evidence have been observed in the literature. First is the phenomenon of "the emergence of the unmarked," in which low-ranked markedness constraints manifest themselves when the overriding effects of higher-ranked constraints (usually faithfulness) are removed under certain conditions, as when phonological reduplicants exhibit less marked structure than their bases (McCarthy and Prince 1994). The emergence of the unmarked has also been observed for functionally motivated markedness constraints in syntax, for example in studies of pronominal forms (Bresnan 2001b) and word order freezing (Lee 2001, cf. Costa 2001).

A second kind of evidence for the presence of low-ranked constraints in grammar comes from variation. In stochastic OT (Boersma 1998, Boersma and Hayes 2001) and partial-ordering OT (Anttila 1997a,b, in press) variable outputs for the same input are modelled by variations in effective constraint ranking. Constraints which are undominated and hence categorical in some languages, may be variably dominated in others, affecting the relative frequencies of outputs. A case in point is discussed by Bresnan, Dingare, and Manning (2001):

> In Lummi, for example, the person of the subject argument cannot be lower than the person of a nonsubject argument. If this would happen in the active, passivization is obligatory; if it would happen in the passive, the active is obligatory (Jelinek and Demers 1983). These facts follow from the theory of harmonic alignment in OT: constraints favoring the harmonic association of prominent person (1st, 2nd) with prominent syntactic function (subject) are hypothesized to be present as subhierarchies of the grammars of all languages, but to vary in their effects across languages depending on their interactions with other constraints (Aissen 1999). There is a statistical reflection of these hierarchies in English. The same disharmonic person/argument associations which are avoided categorically in languages like Lummi by making passives either impossible or obligatory, are avoided in the SWITCHBOARD corpus of spoken English by either depressing or elevating the frequency of passives relative to actives.

Studies by Estival and Myhill (1988) and Dingare (2001) confirm this result. The fact that categorical phenomena in certain languages are mirrored by frequentistic phenomena in others supports the idea that these "frequencies are principled in the same way that grammars are" (Dingare 2001: 3) and is already argued for forcefully by Givón (1979: 26–31).

The third kind of evidence that can detect the presence of hypothesized low-ranked constraints in a synchronic grammar is psycholinguistic. One explanation for Aissen's (2000) proposed harmonic alignment of the definiteness and relational hierarchies is the hypothesis that nominal expressions are most easily processed when their referents are contextually accessible and their expressions occur in perceptually salient positions (such as subject or clause-initial position) in linguistic structures (cf. Givón 1979, 1994 and Ariel 1991). The definiteness constraint subhierarchy does not have categorical effects in English, and so must be relatively low-ranked, compared to the languages investigated by Aissen. Nevertheless, one can examine referential accessibility during sentence comprehension in English to determine whether nominals differ in the predicted directions. Warren and Gibson's (2001) recent study finding evidence of accessibility hierarchy effects during English relative clause processing provides but one possible example showing how constraints which are ranked too low to have categorical effects in a language might nevertheless be empirically detected by psycholinguistic experimentation.

As for the specific phenomenon which Newmeyer takes to challenge FOT, the distribution of *'s* and *of* genitives in synchronic English has already been shown to reflect the topicality and animacy hierarchies by previous researchers (Hawkins 1981, Deane 1987, Rosenbach 2000, to appear, and references).[5] Deane's analysis very insightfully shows that asymmetries in the occurrence of the two types of genitives depend in part on the semantic type of possession and follows ultimately from the same topicality hierarchy that accounts for Silverstein hierarchy effects in the clause. Rosenbach provides psycholinguistic studies of the use of the two genitives in synchronic English, which complement corpus studies of earlier historical stages of the language. Her results very clearly demonstrate that animacy, definiteness, and the semantic prototypicality of the possessive relation correlate directly with the choice of the *'s*-genitive and inversely with the choice of the *of*-genitive in her experimental task. Although she does not develop an OT model, Rosenbach's proposed explanations in terms of iconicity and economy constraints are very similar in spirit to Aissen's (1999, 2000) work. It appears to us that the FOT framework, when generalized to account for frequentistic data (as in Bresnan et al. 2001 and Dingare 2001), can provide a unified explanation for both English-internal and typological properties of the genitive construction, although a demonstration of an explicit theory must await further development of the semantics of possession in OT.[6]

3.2. Functional motivation vs. innateness

Argument 4: Constraints cannot be both functionally motivated and innate. But if a constraint is functionally motivated, it cannot be learned in a language in which it must be low-ranked, because it would have little

[5] Some objections to Hawkins' (1981) account presented by Lyons (1985) are convincingly answered by Barker (1998).

[6] See also O'Connor (1999a,b) and Anttila and Fong (2000) for related work.

functional motivation (assuming that the functionality of a constraint is positively correlated with its rank). Therefore, constraints with low functional motivation in a given language could not be learned.

Rebuttal: The argument assumes a correlation between degree of functional motivation and the ranking of a constraint, which, as we discussed above, makes no sense in OT, and which is clearly false in several cases we have cited.

Furthermore, there is no logical inconsistency in a constraint being both functionally motivated and innate. Much of the phonological constraint system is directly grounded in and motivated by theories of the dynamics of the (innate) human articulatory and perceptual systems. Likewise, many aspects of the more abstract grammatical constraint systems may be grounded in and motivated by theories of higher-level human cognitive and social processes and structures, which are also, in part, innate. While we do not wish to speculate here on the phylogenetic origins of language, recent coevolution scenarios (Kirby 1998, Briscoe 2000) show how functionally motivated constraints operative in many languages could become innate because language learners who assumed these constraints would have acquired language faster.

3.3. Grammatical hierarchies and FOT

3.3.1. The Thematic Hierarchy

Argument 5: The Thematic Hierarchy is not part of UG. The best evidence for this is that "after over three decades of investigation, nobody has proposed a hierarchy of theta roles that comes close to working" (p. 35). Further, passive sentences pose "a lethal problem for the attempt to link any approach that incorporates the UTAH and the hypothesis of proto-thematic roles" (p. 41). Finally, the verb 'receive' is a counterexample to Dowty's (1991) theory of proto-roles, which yields the binary Thematic Hierarchy adopted by Aissen (1999) in her theory of harmonic alignment.

Rebuttal: The fact that the Thematic Hierarchy cannot be an inviolable part of UG because it varies from language to language and phenomenon to phenomenon is not an argument against its having a universal role in OT, where all constraints are violable. The exception-ridden, variable, and 'soft' nature of such hierarchies is predicted from the OT theory of constraint interaction. Aissen's (1999) discussion of the person hierarchy as it has been used in descriptive grammars makes essentially the same point that Newmeyer makes about the Thematic Hierarchy, but she shows that OT permits a simplification and generalization of such universal constraint hierarchies precisely because constraints are both violable and universal. Likewise, the problems posed by passive for the UTAH are not problems for OT precisely because semantic role is only one of several competing forces in the determination of grammatical function (Aissen 1999).

Newmeyer's discussion of 'receive' is misleading because Dowty (and Aissen) restrict themselves to subject selection in 2-place verbs. Hence the competition for subject would be between the recipient and theme, not the recipient and source. Moreover, Dowty is concerned with entailments of verbs excluding cases of polysemy and metaphorical extension of meaning. If the latter were included, there would be *no* English verbs that entail sentience for an argument: even 'x kill y' does not entail that y is sentient if we allow 'that killed that idea'.

Even if we were to stipulate that 'receive' is an exception to the proto-role theory, whose subject-selection properties must simply be listed, it would not follow that the proto-role theory is falsified thereby. If subject selection is purely formal, then we would expect no correlation between proto-agent and subject across languages. This expectation is clearly false.

3.3.2. The Relational Hierarchy

Argument 6: If constraints that reference the Relational Hierarchy are functionally motivated, they cannot also be innate (section 3.2). If they are not innate, then they must be learned. But not every language presents evidence from which grammatical relations can be deduced. Therefore constraints which reference the Relational Hierarchy cannot be universal.

Rebuttal: The premise that constraints cannot be both innate and functionally motivated is false. See the rebuttal to Argument 4.

3.3.3. The FOT treatment of differential object marking (DOM)

Argument 7: Aissen's DOM results can be captured without assuming competition among candidates which are evaluated against the hierarchy of constraints. Instead, we can simply refer directly to the universal hierarchies as we generate individual grammatical sentences. "Surely my alternative analysis is both conceptually simpler and equal in its empirical coverage" (p. 49).

Competition is an unnecessary and unrealistic complication of the model: "Could it really be the case that for each language, for each degree of definiteness, case marked and non-case marked objects are in a separate competition in speakers' heads with each other?" (p. 49).

The technical apparatus of OT tableaux, etc., are too complicated. If a generalization cannot be stated "in so many words" in a framework, then that framework is less than appealing as an approach to UG.

Rebuttal: Newmeyer's alternative analysis may or may not be simpler but it is not equal in its empirical coverage (thus its apparent simplicity is beside the point).[7]

Newmeyer underestimates the complexity of DOM systems. His analysis cannot, for example, derive DOM in the Spanish of El Cid, a language in which human-referring pronouns and proper nouns are obligatorily case marked, where human referring definites and indefinite specifics as well as inanimate proper nouns are optionally marked, and where the rest are unmarked (Aissen 2000). Neither can it account for the differences observed in frequency in the domain of optional marking.

Variation between case-marked and non-case marked outputs for the same input provides evidence of competition in actual speakers' usages. Whether a competing grammars theory is adopted (Kroch 2001 and references therein) or a stochastic or variable OT theory (Boersma 1998, 2000; Anttila 1997a,b, in press, Anttila and Fong 2000), variation is hypothesized to take place "in speakers heads", and is explained in a way that is not explained by Newmeyer's reformulation.

As for the technical apparatus of the theory, unfortunately, paraphrasability of theories into ordinary language is not a good test of their value, as any physicist or phonetician can tell us.

Conclusion

In the early days of transformational grammar some critics argued that grammars could not contain transformational rules because speakers of a language obviously don't follow rules. There is clearly some truth in the criticism, in

[7]Simplicity comparisons must take into account not only the representations, but also the procedures for interpreting them, as well as their resource demands.

that speakers of a language do not in fact follow rules in any ordinary sense. It is nevertheless beside the point, because of the very different conceptions of rules in 'transformational rules' and 'following rules'. In much the same way, the anti-functionalist criticisms that are levelled against Optimality Theory just miss the point. In the new optimization-based theories, the very concept of 'grammar' has shifted away from the classical generative view, in that generation of structure is no longer deterministic of grammaticality—and is not even very important, compared to the discovery and motivation of constraints. We hope we have clarified some of the misunderstandings that these changes have caused.

References

Aissen, Judith. 1999. 'Markedness and subject choice in optimality theory,' *Natural Language & Linguistic Theory* 17, 673–711. Reprinted in Legendre et al. (eds.), pp. 61–96.

Aissen, Judith. 2000. 'Differential object marking: Iconicity vs. economy,' draft on-line, University of California, Santa Cruz: http://ling.ucsc.edu/~aissen.

Anderson, Stephen R. 1977. 'On mechanisms by which languages become ergative,' in C. N. Li (ed.), *Mechanisms of syntactic change*, University of Texas Press, Austin, pp. 317–63.

Anderson, Stephen R. 1988. 'Morphological change,' in F. J. Newmeyer (ed.), *Linguistics: The Cambridge survey*, Cambridge University Press, Cambridge, pp. 324–362.

Anttila, Arto. 1997a. *Variation in Finnish phonology and morphology,* Ph.D. dissertation, Stanford University, Stanford, CA.

Anttila, Arto. 1997b. 'Deriving variation from grammar,' in Hinskens et al. (eds.), pp. 35–68.

Anttila, Arto. In press. 'Variation and phonological theory,' in J. Chambers, P. Trudgill and N. Schilling-Estes (eds.), *Handbook of language variation and change*, Blackwell, Oxford.

Anttila, Arto and Vivienne Fong. 2000. 'The partitive constraint in optimality theory,' *Journal of Semantics* 17, 281–314.

Ariel, Mira. 1991. *Accessing noun-phrase antecedents*, Routledge, London.

Baltin, Mark and Chris Collins (eds.). 2001. *The Handbook of contemporary syntactic theory*, Blackwell, Oxford.

Barker, Chris. 1998. 'Partitives, double genitives, and anti-uniqueness,' *Natural Language & Linguistic Theory* 16, 679–717.

Birner, Betty and Gregory Ward. 1998. *Information status and noncanonical word order in English*, John Benjamins, Amsterdam.

Boersma, Paul. 1997. 'How we learn variation, optionality, and probability,' *Proceedings of the Institute of Phonetic Sciences* 21, 43–58.

Boersma, Paul. 1998. *Functional Phonology: Formalizing the interactions between articulatory and perceptual drives*, Holland Academic Graphics, The Hague.

Boersma, Paul. 2000. 'Learning a grammar in functional phonology,' in J. Dekkers, F. v. d. Leeuw and J. v. d. Weijer (eds.), *Optimality theory: Phonology, syntax, and acquisition*, Oxford University Press, Oxford, pp. 465–523.

Boersma, Paul and Bruce Hayes. 2001. 'Empirical tests of the gradual learning algorithm,' *Linguistic Inquiry* 32, 45–86.

Bresnan, Joan. 2001a. 'Explaining morphosyntactic competition,' in Baltin and Collins (eds.), pp. 11–44.

Bresnan, Joan. 2001b. 'The emergence of the unmarked pronoun,' in Legendre et al. (eds.), pp. 113–142.

Bresnan, Joan. In press. 'The lexicon in optimality theory,' in S. Stevenson and P. Merlo (eds.), *The lexical basis of sentence processing: Formal, computational, and experimental issues*, John Benjamins, Amsterdam. Draft on-line, Stanford University: http://www-lfg.stanford.edu/bresnan/download.html.

Bresnan, Joan, Shipra Dingare and Christopher Manning. 2001. 'Soft constraints mirror hard constraints: Voice and person in English and Lummi,' in M. Butt and T. H. King (eds.), *Proceedings of the LFG 01 Conference, University of Hong Kong*, on-line proceedings, CSLI Publications, Stanford: http://csli-publications.stanford.edu/.

Briscoe, Edward J. 2000. 'Grammatical acquisition: Inductive bias and co-evolution of language and the language acquisition device,' *Language* 76, 245–296.

Chung, Sandra. 1978. *Case marking and grammatical relations in Polynesian*, University of Texas Press, Austin.

Cooreman, Ann. 1982. 'Topicality, ergativity and transitivity in narrative discourse: Evidence from Chamorro,' *Studies in Language* 6, 343–74.

Cooreman, Ann. 1987. *Transitivity and discourse continuity in Chamorro narratives*. Mouton de Gruyter, Berlin.

Costa, Joaõ. 2001. 'The emergence of unmarked word order,' in Legendre et al. (eds.), pp. 171–203.

Deane, Paul. 1987. 'English possessives, topicality, and the Silverstein hierarchy.' *Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society*, Berkeley, CA, pp. 65–77.

Dingare, Shipra. 2001. *The effect of feature hierarchies on frequencies of passivization in English*. Master's thesis, Stanford University, Stanford, CA. On-line, Rutgers Optimality Archive: http://ruccs.rutgers.edu/roa.html. ROA-467-0901.

Dowty, David. 1991. 'Thematic proto-roles and argument selection.' *Language* 67, 547–619.

Estival, Dominique and John Myhill. 1988. 'Formal and functional aspects of the development from passive to ergative systems,' in M. Shibatani (ed.), *Passive and voice*, John Benjamins, Amsterdam, pp. 441–91.

Forrest, Linda. 1994. 'The de-transitive clauses in Bella Coola: Passive vs. inverse,' in T. Givón (ed.), pp. 147–68.

Garrett, Andrew. 1990. 'The origin of NP split ergativity,' *Language* 66, 261–296.

Givón, Talmy. 1979. *On understanding grammar*, Academic Press, New York.

Givón, Talmy. 1994. 'The pragmatics of de-transitive voice: Functional and typological aspects of inversion,' in T. Givón (ed.), 1994, pp. 3–44.

Givón, Talmy (ed.). 1994. *Voice and inversion*, John Benjamins, Amsterdam.

Hawkins, Roger. 1981. 'Towards an account of the possessive constructions: *NP's N* and *the N of NP*,' *Journal of Linguistics* 17, 179–392.

Hinskens, Frans, Roeland van Hout, and W. Leo Wetzels (eds.). 1997. *Variation, Change and Phonological Theory*, John Benjamins, Amsterdam/Philadelphia.

Jelinek, Eloise and Richard Demers. 1983. 'The agent hierarchy and voice in some Coast Salish languages,' *IJAL* 49, 165–85.

Kirby, Simon. 1998. *Function, selection and innateness: The emergence of language universals,* Oxford University Press, Oxford.

Kroch, Anthony. 2001. 'Syntactic change,' in Baltin and Collins, (eds.), pp. 699–729.

Lee, Hanjung. 2001. *Optimization in argument expression and interpretation: A unified approach*, Ph.D. dissertation, Stanford University, Stanford, CA.

Legendre, Géraldine, Jane Grimshaw, and Sten Vikner (eds.). 2001. *Optimality-theoretic syntax*, The MIT Press, Bradford Books and The MIT Press, Cambridge, MA and London.

Legendre, Géraldine, William Raymond, and Paul Smolensky. 1993. 'An optimality-theoretic typology of case and grammatical voice systems,' *Proceedings of the Nineteenth Annual Meeting of the Berkeley Linguistics Society*, Berkeley, CA, pp. 464–78.

Lyons, Christopher. 1985. 'The syntax of English genitive constructions,' *Journal of Linguistics* 22, 123–143.

McCarthy, John J. and Alan S. Prince. 1994. 'The emergence of the unmarked. Optimality in prosodic morphology,' *Proceedings of the Twenty-fourth Annual Meeting of the North East Linguistic Society*, University of Massachusetts GLSA, Amherst, MA, pp. 333–79.

Newmeyer, Frederick. 1998. *Language form and language function,* The MIT Press, Cambridge, MA.

Newmeyer, Frederick. 2000. 'Optimality and functionality: Some critical remarks on OT syntax,' draft on-line, Rutgers Optimality Archive: http://ruccs.rutgers.edu/roa.html. ROA-402-08100.

Newmeyer, Frederick. To appear. 'Optimality and functionality: A critique of functionally-based optimality-theoretic syntax,' *Natural Language & Linguistic Theory.*

O'Connor, Mary Catherine. 1999. 'Harmonic alignment of participant hierarchy features and the structure of possessive DP's in Northern Pomo,' Joint UCSC/Stanford Workshop on Optimal Typology, UCSC.

O'Connor, Mary Catherine. 1999. 'The interaction of syntax and pragmatics in Northern Pomo: Towards an optimal solution.' LFG1999, University of Manchester.

Oostendorp, Marc von. 1997. 'Style levels in conflict resolution,' in Hinskens et al. (eds.), pp. 35–68.

Prince, Alan and Paul Smolensky. 1993. *Optimality Theory: Constraint interaction in generative grammar*, RuCCS Technical Report #2, Rutgers University Center for Cognitive Science, Piscataway, NJ.

Rosenbach, Anette. 2000. *Genitive variation in English. Conceptual factors in synchronic and diachronic studies*, University of Düsseldorf doctoral dissertation, Düsseldorf, Germany.

Rosenbach, Anette. To appear. 'Aspects of iconicity and economy in the choice between the *s*-genitive and the *of*-genitive in English,' in B. Mondorf and G. Rohdenburg (eds.), *Determinants of grammatical variation in English*, (Topics in English Linguistics), Mouton de Gruyter, Berlin.

Shibatani, Masayoshi (ed.). 1988. *Passive and Voice*, John Benjamins, Amsterdam.

Thompson, Sandra A. 1987. 'The passive in English: A discourse perspective,' in R. Channon and L. Shockey (eds.), *In Honor of Ilse Lehiste*, Foris, Dordrecht, pp. 497–511.

Trask, Robert L. 1979. 'On the origin of ergativity,' in F. Plank (ed.), *Ergativity. Towards a theory of grammatical relations*, Academic Press, New York, pp. 385–404.

Warren, Tessa and Edward Gibson. 2001. 'The influence of referential processing on sentence complexity,' MS., MIT Department of Brain and Cognitive Sciences, Cambridge, Massachusetts, submitted for publication.

Weinreich, Uriel, William Labov, and Marvin I. Herzog. 1968. 'Empirical foundations for a theory of language change,' in W. P. Lehmann and Y.

Malkiel (eds.), *Directions for historical linguistics. A symposium,* University of Texas Press, Austin, pp. 95–188.

Received 20 April 2001
Revision 20 September 2001

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