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Optimality Theory in Syntax Géraldine Legendre

Within generative approaches to syntax, OT stands as an alternative theory of constraint interaction to the Principle-and-Parameter Theory (PPT) of Universal Grammar articulated in Chomsky (1981). Comparing both theories helps understand what OT syntax is and what it is not.

The fundamental claim of OT is that universal well-formedness constraints on syntactic representations are operative in all grammars but surface-violable (Prince and Smolensky, 1993). In contrast, PPT takes 'universal' to mean 'inviolable', forcing universal principles to be supplemented by parameters to account for cross-linguistic variation.

According to Speas (1997:184-5), inviolable principles augmented by parameters are in fact problematic as an account of cross-linguistic variation. She points out that hedges in the formulation of inviolable constraints in PPT (e.g. *if ...then*) has the result of restricting the domain in which principles are inviolable. She argues that all principles in the Government-Binding (GB) version of PPT have this character. Moreover, economy principles are crucially violable in the Minimalist Program (MP, Chomsky 1995).

For proponents of OT, there is an immediate advantage to viewing all constraints as surface-violable. Constraints can be stated in a simple and general fashion, with the burden of the explanatory work shifted towards the conflict-based interaction among the constraints themselves.

Standard OT is best known as a representational theory. This follows naturally from several properties of the system: i) It is an output-oriented theory; i.e. *Con* is a universal set of constraints that technically are output filters ii) Evaluation of outputs is global in the sense that output filters evaluate a single representation in parallel (as opposed to serially); iii) There are no intermediary levels of representation at which constraints are thought to operate. This is not to say that OT cannot be reconciled with a derivational approach to syntax. It not only can (Legendre, Smolensky, and Wilson 1998:285-7); it must, according to Müller (1997). Rejecting parallelism of constraint evaluation, Müller proposes an alternative view of OT syntax which incorporates derivations (as in MP) and serial optimizations. Yet, the representational view within the OT syntax community is dominant because it is the most natural one. (Historically, the advent of OT in generative phonology in the early 90's marks the transition from a derivational to a representational theory. In generative syntax, that transition had already taken place a decade or so earlier).

An Optimality-Theoretic UG provides a function *Gen* (Generator) mapping a given input into a universal set of output representations or candidates and a function *H-Eval* (Evaluator) which assesses the *relative harmony* of competing candidates and determines the optimal candidate. Each evaluation yields an optimal candidate which, by definition, is grammatical. In a given language, the optimal candidate may violate universal constraints but it always does so *minimally*, that is, less than all its competitors. A simple example of constraint conflict and its resolution is provided by comparing languages which make use of expletive (or dummy) subjects (e.g. English *It rained*) and languages which don't (e.g. Italian *Piove*). Building on Chomskyan principles like the Extended Projection Principle (requiring every clause to have a subject) and the Principle of Full Interpretation (banning elements that do not contribute to the semantic interpretation of a syntactic structure),

Grimshaw and Samek-Lodovici (1998) propose to derive the two patterns from the interaction of these two universal constraints for zero-argument verbs like 'to rain'. The two constraints are in conflict: It is not possible to satisfy both simultaneously. To resolve the conflict they must be ranked with respect to each other. If EPP/SUBJECT is satisfied but FI is violated the optimal structure is one with an expletive subject. If FI is satisfied but EPP/SUBJECT is violated, the optimal structure contains no expletive subject.

The example of expletive constructions further serves to illustrate two theoretical consequences of the OT approach to syntax. One is that having conflicting constraints interact may obviate (at least some of) the need for extensive abstract structure in syntactic representations, including empty categories like *pro*, covert movement, or an elaborate system of functional projections, including some headed by null categories. More importantly perhaps, the relative jobs and priority of the lexicon and the syntactic component highlight a fundamental difference in architecture between OT and theories under MP. In MP the locus of parametrization is the lexicon: Whether a language makes use of expletive subjects or not is a lexical property manifest in the *array* (the MP version of the input to the computational system). In OT, the locus of variation is in the syntactic component: Whether a language makes use of expletive subjects or not is derived from constraint interaction.

The grammar of an individual language corresponds to the language-particular constraint ranking established on the basis of interacting syntactic phenomena (as is standard in generative linguistics). By definition, constraint domination is *strict*. Violating a single higher-ranked constraint is always more costly than violating lower-ranked constraints. Given a pair of candidates, the one incurring the worse violations is suboptimal, regardless of the number of lower-ranked constraints violated and regardless of the number of violations of any single lower-ranked constraint incurred. *Gradient* constraints exemplify the latter pattern. Many studies on word order (e.g. in Legendre, Grimshaw, and Vikner, 2001) rely on gradient *alignment* (McCarthy and Prince, 1993) with the edge of some syntactic domain. Candidates typically differ with respect to how far from the edge the element targeted for alignment is, commonly resulting in multiple violations of constraints. (Tableaux are often used to make patterns of violations explicit with, by convention, constraints listed from highest-ranked to lowest-ranked, starting with the leftmost one).

Given a universal input space and a set of structural descriptions of those inputs (the candidate sets), the set of universal constraints (*Con*) defines the typological space of possible grammars. First, the analysis of a particular language immediately makes predictions concerning all languages, by virtue of OT's only source of variation, *constraint reranking*. In particular, there are candidates whose corresponding pattern of violations is always worse than that of a competitor, independently of any ranking. They are *harmonically bound* candidates and they are universally suboptimal (i.e., ungrammatical). Second, a total ranking guarantees a *factorial typology*. Strict ranking imposes a numerical limit on possible grammars. See Samek-Lodovici (2001) for further discussion.

OT is not infrequently mischaracterized as predicting huge typologies because the concept of 'possible languages' is confused with 'possible rankings'. To take just one example, Legendre, Raymond, and Smolensky (1993) propose a set of eight constraints governing the mapping between thematic roles and their morphosyntactic realizations, yielding a factorial typology of case and voice systems. A set of eight constraints yields about 40,000 rankings. The number of possible languages is considerably lower: a mere 13. In other words, many rankings produce the same optimal candidates.

OT cannot be construed as merely an enriched system of parameters because there is a fundamental difference between a parameter that is switched off and a constraint that is ranked low in the constraint hierarchy. The important role of a low-ranked constraint emerges when violation of such

a constraint is fatal to a candidate. Given a constant constraint ranking, some suboptimal candidates will typically be eliminated by higher-ranked constraints. However, this is not always the case. The best two candidates in a given optimization could equally violate one or more higher-ranked constraints and differ only with respect to a lower-ranked one. The latter constraint becomes the decisive one. The emergence of lower-ranked constraints has no equivalent in a parametric system like PPT.

A theory of grammatical constraint interaction, in general, is not a theory of syntax per se without its own substantive constraints. In other words, the structural representations that *H-Eval* operates on and the formulation of individual constraints are largely independent of the optimizing system. For example, OT is flourishing in LFG circles as is evident from the work of Joan Bresnan and her students. Proponents of LFG, and more generally 'linking' theories, typically invoke a natural affinity with OT, whereby (in LFG) a f-structure constitutes the input and a c-structure the output. Optimization determines the optimal correspondence mapping between the two (Bresnan, 2000). Any theory of syntax, in fact, may provide its own vocabulary and theoretical constructs and combine them with a formal competition-based input-output system. For reasons having largely to do with individual backgrounds and preferences in theories, as well as the desire to link with previous claims in the dominant paradigm of the 80's, much of the work published to date builds on insights gained from transformational studies (e.g. Grimshaw, 1997).

A unique property of OT syntax is its explicit commitment to UG as a fully optimizing system. There is, however, another fundamental property that is unique to OT, hence (at least potentially) to OT syntax. It pertains to the role of faithfulness in syntax and its implications for the nature of inputs and candidate sets as well as the relation between syntactic structures and their semantic interpretations. It is useful to start with some shared assumptions.

The main role of the input in OT syntax is to determine what competes. It is standard to assume that inputs include lexical items, predicate-argument structure, and functional features like Tense, Aspect, etc., or their counterparts in an LFG representation (Bresnan, 2000). An example, drawn from Grimshaw (1997), is: <seem (x), x= <leave (y), y=John>>. It is also fairly standard to assume that *Gen* defines a set of possible outputs in accordance with (some version of) X'-Theory. Note that these are not necessary features but practical decisions that allow a syntactic analysis to get off the ground. It could well turn out that argument structure and/or phrase structure themselves are subject to optimization. The inputs to these optimizations would have to be specified. A possible outcome is that inputs in syntax might be close to being totally unstructured, contrary to what is widely assumed as of 2001. Thus, *Richness of the Base* or the claim that inputs are language-independent (Prince and Smolensky, 1993) has been limited in syntax to the claim that the set of possible inputs is the same for all languages.

There is a natural way to express the relation between discourse properties and syntax in an input-output system and it has been widely exploited in OT syntax. Informational features like [Topic], [Focus], etc. routinely figure in syntactic analyses (e.g. Choi, 1996, and many papers in Legendre et al. 2001). Of course, the fine-grainedness of the relevant discourse properties is an open question. Note that incorporating discourse properties to inputs provides an avenue for incorporating to a generative analysis many insights gained from the typological-functional literature.

Specifying discourse features in inputs provides an obvious mechanism by which many instances of (apparent) optionality in syntax are eliminated. 'Optional' structures (e.g. optional fronting of an NP in Slavic languages) most often arise as optimal candidates for inputs with different specifications of discourse features, hence from different optimizations.

Another common pattern of apparent optionality in syntax involves different dialects or even registers of the same 'language'. In OT, dialects, registers, etc. are instances of variation formally

identical to cross-linguistic variation. Hence, they involve constraint reranking, possibly of a minimal sort (e. g. involving two contiguous constraints in the hierarchy). This largely remains to be explored empirically.

True optionality in adult syntax is in fact extremely rare, if it exists at all. In OT, it would have to result from a situation where two competitors exhibit exactly the same pattern of violations. In practice, this is extremely unlikely since candidates incurring exactly the same violations would tend to be identical. Alternatively, optionality results from a constraint tie, i.e. equally ranked constraints such that violations of one count the same as violations of the other. The latter has been argued to be common in the earliest stage of acquisition of syntax (Legendre, Hagstrom, Vainikka, and Todorova, 2000).

Much work in generative syntax over the last two decades has focused on the impact of scope (e.g., operator scope) on syntax. Among other things, it has led to the syntactico-semantic level of representation known as LF (Logical Form). Therefore, a third, obvious candidate for specification in the input is scope. Including it has far reaching implications because it bears not only on the nature of the candidate set, but also on the treatment of 'ineffable' structures (i.e. instances where some inputs yield no acceptable input). For example, simple multiple questions like *Who ate what?* are impossible in some languages. In OT, each competition yields an optimal candidate, therefore a grammatical input. What is the optimal output for an input containing two wh-operators like *who* and *what* in such languages?

The question can be rephrased as follows: To what extent must the competitors in a given optimization share the same LF (e.g., have the same operator structure)? One answer is to posit that there is a direct mapping between the input and the interpretation of the structure: this entails that all competitors, which by definition, share an input, must also share an interpretation. This is the position taken, for example, in Grimshaw (1997) in the context of a study of *do*-support in which all inputs yield effable structures.

Studies focusing on the language-particular ineffability question (e.g. Legendre et al., 1998) have led to the opposite claim: Competitors need not have the same LF. The reasoning goes as follows. Given that the output of a competition has to be semantically interpreted, it is redundant to include a semantic mapping in the input and then check it after the optimal output has been determined. Ineffability, for example in multiple wh-questions, arises whenever multiple wh-outputs are suboptimal because they lose to a competitor in which one of the input wh-features *is not parsed*. In other words, the optimal candidate violates the input-output faithfulness constraint PARSE(WH), resulting in a declarative structure with an indefinite reading of the argument marked [wh] in the input. Alternatively, the optimal output is a Null Parse, i.e. an empty structure, as discussed in Ackema and Neeleman (2000). Compared to a structure in which a single [wh] feature is unparsed, a Null Parse does not (typically) minimally violate Input-Output faithfulness constraints.

The existence of ineffable structures has in fact been characterized as a serious problem for an optimality-theoretic approach to core aspects of syntax, i.e., structure building and movement. Pesetsky (1997:147-150) argues that the existence of ineffable structures suggests instead that the domain of application of OT should be restricted to the pronunciation of the consequences of movement, i.e. the phonological interpretation of the structure. This conclusion, however, is unwarranted because it relies on arbitrary restrictive assumptions about the nature of the candidate set which are unnatural in an OT theory. Allowing different LFs to compete does enlarge the candidate set, but input-output faithfulness constraints will routinely eliminate candidates with an LF distinct from that intended in the input -- except where ineffability arises.

If ineffability did not exist, OT syntacticians would be left with a theoretical puzzle: Why is it that

input-output faithfulness plays no active role in syntactic competitions whatsoever, i.e., why is it that faithfulness is construed as a property of *Gen* in syntax instead of a property of *H-Eval*, as it is in other components of the grammar? This is indeed a puzzle given that OT syntax has incorporated all other theoretical constructs of the originally phonology-based proposal in Prince and Smolensky (1993).

The example of ineffable multiple wh-structures discussed above is not the only piece of evidence that relegating faithfulness to *Gen* creates serious empirical problems. The violability of PARSE constraints is crucial for capturing clitic inventories (Bresnan, 2001; Grimshaw, 2001). More generally, any neutralization of a contrast involves violations of faithfulness (Baković and Keer, 2001; Wilson, 2001). A final source of evidence that faithfulness cannot be construed as a property of *Gen* comes from its systematic low-ranked status in early stages of syntactic acquisition (Legendre et al., 2000).

A basic reference book on OT syntax is Legendre et al. (2001). It contains a more elaborate introduction to the theory than space allows here. The volume addresses theory-internal discussions (many of which are referenced above), optimization across components of the grammar (Ackema and Neeleman), as well as many empirical topics of long-standing interest to syntacticians. These include case, voice (Aissen, Sells, and Woolford), word order (Choi, Costa, Choi, Legendre, Müller, Samek-Lodovici, and Vikner), binding-related phenomena (Choi, Speas, and Wilson). Last but not least, it illustrates the claim that the formal theory of constraint interaction is independent of the substantive nature of particular constraints and representations in syntax. Other widely available volumes which incorporate specific analyses in OT syntax include Barbosa, Fox, Hagstrom, McGinnis, and Pesetsky (1998), Dekkers, van der Leeuw, and van de Weijer (2000), and Müller and Sternefeld (2000). Several Ph.D. dissertations written in the 90's are included in the bibliography. All contain references to additional studies published in journals or available from individual webpages.

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BIBLIOGRAPHY

- Ackema, Peter and Ad Neeleman. 2000. Absolute Ungrammaticality. In Joost Dekkers, Frank van der Leeuw, and Jeroen van de Weijer (eds.), *Optimality Theory: Phonology, Syntax, and Acquisition*. Oxford University Press. 279-301.
- Barbosa, Pilar, Danny Fox, Paul Hagstrom, Martha McGinnis, and David Pesetsky (eds.), *Is the Best Good Enough? Optimality and Competition in Syntax*. MIT Press.
- Bresnan, Joan. 2000. Optimal Syntax. In Joost Dekkers, Frank van der Leeuw, and Jeroen van de Weijer (eds.), *Optimality Theory: Phonology, Syntax, and Acquisition*. Oxford University Press. 334-385.
- Choi, Hye-Won. 1996. *Optimizing Structure in Context: Scrambling and Information Structure*. PhD Dissertation, Stanford University.
- Chomsky, Noam. 1981. *Lectures on Government and Binding*. Foris, Dordrecht.
- Chomsky, Noam. 1995. *The Minimalist Program*. MIT Press.
- Costa, João. 1998. *Word Order Variation: A Constraint-based Approach*. Ph.D. dissertation, University of Leiden. HIL Publications.
- Dekkers, Joost. 1999. *Derivations and Evaluations; On the Syntax of Subjects and Complementizers*. Ph.D. dissertation, University of Amsterdam. HIL Publications.
- Dekkers, Joost, Frank van der Leeuw, and Jeroen van de Weijer (eds.), *Optimality Theory: Phonology, Syntax, and Acquisition*. Oxford University Press.
- Grimshaw, Jane. 1997. Projection, Heads, and Optimality. *Linguistic Inquiry* 28,3: 373-422.
- Grimshaw, Jane and Vieri Samek-Lodovici. 1998. Optimal Subjects and Subject Universals. In P. Barbosa, D. Fox, P. Hagstrom, M. McGinnis, and D. Pesetsky (eds.), *Is the Best Good Enough? Optimality and*

- Competition in Syntax*. MIT Press. 193-219.
- Legendre, Géraldine, Jane Grimshaw, and Sten Vikner (eds.). 2001. *Optimality-Theoretic Syntax*. MIT Press.
- Legendre, Géraldine, Paul Hagstrom, Anne Vainikka, and Marina Todorova. 2000. Evidence for Syntactic Competition in the Acquisition of Tense and Agreement in Child French. *Proceedings of the Chicago Linguistic Society*. pp?
- Legendre, Géraldine, William Raymond and Paul Smolensky. 1993. An Optimality-Theoretic Typology of Case and Grammatical Voice Systems. In *Proceedings of the Nineteenth Annual Meeting of the Berkeley Linguistic Society*. 464-478.
- Legendre, Géraldine, Colin Wilson, Paul Smolensky, Kristin Homer, and William Raymond. 1995. Optimality and Wh-Extraction. In J. Beckman, S. Urbanczyck, and L. Walsh (eds.) *Papers in Optimality Theory* UMOP 18. Amherst: GLSA Publications. 607-636.
- Legendre, Géraldine, Paul Smolensky, and Colin Wilson. 1998. When is Less More? Faithfulness and Minimal Links in Wh-Chains. In P. Barbosa, D. Fox, P. Hagstrom, M. McGinnis, and D. Pesetsky (eds.), *Is the Best Good Enough? Optimality and Competition in Syntax*. MIT Press. 249-289.
- McCarthy, John and Alan Prince. 1993. Generalized Alignment. *Yearbook of Morphology*, 79-153.
- Müller, Gereon. 1997. Partial wh-movement and Optimality Theory. *The Linguistic Review* 14: 249-306.
- Müller, Gereon, and Wolfgang Sternefeld (eds.). 2000. *Competition in Syntax*. Mouton de Gruyter.
- Pesetsky, David. 1997. *Optimality Theory and Syntax: Movement and Pronunciation*. In D. Archangeli and D.T.Langendoen (eds.), *Optimality Theory, An Overview*. Blackwell Publishers. 134-170.
- Prince, Alan and Paul Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms. , Rutgers University and University of Colorado at Boulder.
- Samek-Lodovici, Vieri. 1996. *Constraints on Subjects: An Optimality Theoretic Analysis*. PhD Dissertation, Rutgers University.
- Samek-Lodovici, Vieri. 2001. Cross-linguistic Typologies in OT. In Legendre et al. (eds.), *Optimality-Theoretic Syntax*. MIT Press. 315-353.
- Speas, Margaret. 1997. OT and Syntax: Null Pronouns and Control. In D. Archangeli and D.T. Langendoen (eds.), *Optimality Theory, An Overview*. Blackwell. 171-199.