

OT - SOME CRITICAL REMARKS (1995)

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This is a talk on, presented on December 18, 1995 at the Max Planck Institute as a commentary on a talk presented by Alan Prince. (My remarks which sound a bit harsh were more critical than expected by the speaker and those who invited me to deliver the commentary.)

0 Introduction

In this note I wish to make a few critical remarks and raise some questions about a number of aspects of OT.

I do not share the widespread enthusiasm about the OT research program. Despite the fact that I have spent a considerable amount of time studying incoming manuscripts or listening to presentations, I have, after roughly three years of being exposed to OT, learned very little about the structure of languages. Only in a few cases did I experience the excitement of gaining new insights, seeing new connections or being confronted with novel and intriguing questions. In most cases, it seemed to me that various aspects of the phenomenon under OT-analysis were not touched upon and sometimes this involved what are, to my mind, the more interesting aspects.

Puzzled about the extraordinary success of OT, I am therefore honestly interested in understanding the basic contributions that OT makes. I wish to know which cases crucially motivate the OT approach, thus cases that could not be satisfactorily be handled under other current approaches, and I wish to know what kinds of phenomena refute the basic tenets of OT, thus how it can be put to the test.

It follows, then, that I am in principle not interested in OT-applications that show how the theory deals with cases that are neither crucial nor especially problematic for this approach. Unfortunately, there are many such applications and their numbers increase every day. Showing that a new approach can deal with the phenomena that were not problematic under the old approach is certainly necessary, but the results should, firstly, do justice to the whole range of relevant phenomena and, secondly, not be presented as crucial support for the new approach.

New research programs always seem to involve a phase of expansion and exploration. This is, in principle, a good and inevitable thing. But at the same time, we should not forget that ultimately (and perhaps all along) normal methodological criteria must apply. So, on the one hand we should allow the pioneers of the new paradigm to push its horizons without being too critical at each point with respect to undesirable consequences of adopting new analytical tools, but on the other hand such developments must be examined critically, rather than be followed blindly.

Today OT has become the fashion in phonology, and also makes way in morphology and syntax. The fashionable side has a number of negative effects on our field. The fear "not to be part of it" encourages hasty and unimpressive results, a trend that is supported by organizers of conferences and members of job selection committees. In addition, electronic modes of information distribution

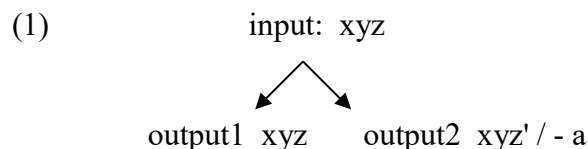
allow access to material that has not undergone standard quality control procedures. All this causes the emergence of a rather large flow of mediocre contributions involving OT formalizations of rather crude aspects of well-studied phenomena, as well as of phenomena that are hardly understood. It seems as if within OT everything can be handled and the danger of descriptivism is therefore very real.

In the following remarks I will first discuss the general architecture of OT. Then I turn to the types of cases that have motivated OT in the first place, arguing that the leap from these cases to a full-scale generalization of constraint ranking is not self-evident. Then I turn to the constraints. Thirdly, I discuss the empirical content of OT. Finally, I summarize my main points. In my comments I do not touch upon the learnability aspects of OT.

1 The problems of opacity and the non-derivationality of OT

A theory of phonology explains the systematic properties of the form of linguistic utterances. Virtually all approaches to generative grammar share the idea that a central part of this task is to specify the function that maps input forms onto output forms. Input forms are generally taken to be lexical entries, whose phonological form serves as an address for storing and retrieving them. To this was add complex words formed in the morphology. Output forms provide the information that is necessary to generate the linguistically relevant properties of the actual signal.

A general analytical premise of generative phonology is that variant output forms correspond to a single input form, the choice of a specific output form being dependent on the local context in which the output form appears:



Thus the string xyz appears as xyz' if immediately preceding the string a.

The function that maps xyz into xyz' in the relevant context can take various forms. In standard generative phonology, the function takes the form of a partially extrinsically ordered set of rules that constitute a derivation that has various intermediate levels.



The rules create a unique output for each input.

The rules express linguistically significant generalizations that SPE stated in the form of rewrite rules as in (3a). An alternative manner of expressing the generalizations is to state a negative target and a repair. This is, for example what Hockett proposed, who referred to repair rules as 'automatic rules' (cf. Stewart 1987):

- (3) a. $z \rightarrow z' / - a$
- b. i. not: $z a$ (constraint)
 ii. $z \rightarrow z'$ (repair)

Languages typically display partial regularities, that is regularities which are not completely surface true. An important aspect of generative phonology is to allow rules to be formulated in a maximally general form, even when not all output forms seem to warrant such general formulations. The magic word is RULE ORDERING.

Apparent under- and overapplications of rule 1 can be shown to follow from interactions with other rules that either produce outputs that meet the SD of rule 1 (feeding) or that destroy the environment that triggered rule 1 in the first place (bleeding). If potentially feeding or bleeding rules are ordered after rule 1, we have COUNTERFEEDING and COUNTERBLEEDING rule orders, respectively:

(4) COUNTERFEEDING	COUNTERBLEEDING
1. $z \rightarrow z' / - a$	1. $z \rightarrow z' / - a$
2. $b \rightarrow a / - c$	2. $a \rightarrow b / - c$
I $z a(c)$ zbc	I $z a$ $z a c$
1 $z' a(c)$ -	1 $z' a$ $z' a c$
2 $z a c$	2 b
O $z' a(c)$ $z a c$	O $z' a$ $z' b c$

In both cases we have an output that contradicts rule 1. In the counterfeeding case, rule 2 creates an output that makes it seem as if rule 1 has failed to apply (i.e., that it has seemingly *underapplied*), whereas in the counterbleeding case rule 2 destroys the context that triggered rule 1 in a subset of its application so that it seems as if rule 1 has where it should not have (i.e. it seemingly *overapplied*).

If counterfeeding and counterbleeding ordering is disallowed, it follows that rule 1 does not express a *surface regularity*, because the regularity that rule 1 expresses holds at an *intermediate level* only, i.e., the level that forms the input to rule 2 in both cases.

Turning now to OT we note that the fundamental difference between this theory and SPE is that the function F is completely differently. F does not involve a *derivation* with intermediate representations that uniquely produces the correct output, rather it involves a procedure to dismiss all the logically possible outputs for a given input but one. Going from the input to the output involve just one derivational step.

However, the procedure actually includes two steps. First, for a given input there is a universal, so-called Generator that generates all possible so-called candidate outputs for any given input; this is an infinite set, but in practice we only consider possible outputs that are 'reasonable' when we evaluate the candidate set against a set of ordered constraints.

We look at all the candidate outputs and we choose the one that best satisfies a set of ranked constraints, which we organize in such a way that the first constraint.

The candidates differ from the input in one or more respects, for example:

(5)

Input /za/	Constraint 1	Constraint 2	Constraint 3	Constraint 4
[z'a]					
[a]					
[za']					
[zwa]					
[za]					
[az]					
...					

The so-called Generator produces the various candidates, including ridiculous ones, and many more by applying changes to the input:

(6)

GEN

z -> z'
z -> -
a -> a'
za -> zwa
z -> z
z -> 'banana'

...

We now consider a set of constraints. There are two kinds of constraints:

(7)

a. markedness constraints

delete x
change x
insert x
reorder x and y
...

b. Faithfulness constraints (also called DEP constraints)

don't delete anything
don't change anything
don't insert anything
don't change the order of phonemes
...

In both cases, 'real' constraints are more specific. For example for every change that affect a feature F, there is a constraint that disfavors changing F.

Markedness constraints modify the input to make it easier to pronounce or easier to perceive, whereas faithfulness constraints resist such change.

If the optimal output has a change vis-à-vis the input, say, it misses a phoneme, than the markedness constraint that ‘favors’ the deletion outranks the faithfulness constraint that forbids deletion.

This is the crux: depending on how we order the constraints, one of the candidates will be the optimal candidate because all other candidate violate a constraint that the winner does not violate.

In the following tableau, we ‘explain’ why [z’a] is the optimal output:

(8)

Input	*reorder	*delete	z>0	*insert	0 > w	*change	a>a’	z>z’	*change
za	er	z		w		a>a’			z>z’	
z’a									*	
a		*								
za’						*				
zwa				*						
za							*			
az	*									
...										

We have a winner!

There you have it: this is OT.

(The whole procedure looks a bit like when the volunteer for a dangerous job is selected not because he steps forward, but because all others go one step backward.)

Why OT cannot handle counterfeeding and counterbleeding opacity.

Let us now examine a counterfeeding situation. In *Simplified Catalan*. In this language’ we have two rules:

- (9)
1. $n \rightarrow \emptyset / - \#$
 2. $t \rightarrow \emptyset / - \#$

Given two input, man and mant and the known outputs ma and man, we must be dealing with a counterfeeding order. There is a rule deleting final /n/ and a rule deleting final /t/, but if the latter rule causes a final /n/, this is not removed by the former rule:

- (10)
- | | | | |
|----|-----|------|--|
| I: | man | mant | |
| | 1 | ma | (1: $n \rightarrow \emptyset / - \#$) |
| | 2 | man | (2: $t \rightarrow \emptyset / - \#$) |

O: ma man

The output [man] for underlying /mant/ creates opacity because it makes it look as if the n-deletion rule failed to apply; so this is apparent *under*application of rule 1. The question is now can we get the result [ma] as the optimal output for /mant/ in OT? Here we consider constraints corresponding to what the two rules ‘forbid’:

(11)

Input /mant/	*not /n/#	*not /t/#		*not /t/#	*not /n/#
⊖man	*				*
ma					
...					

Under both constraint orderings the optimal output of /mant/ is [ma] which is wrong.

We could invoke a constraint ‘don’t delete’ and rank it higher than both other constraints, the order of which then does not matter anymore:

(12)

Input /mant/	*delete	*not /n/#	*not /t/#		*delete	*not /t/#	*not /n/#
man	*	*			*		*
ma	**				**		
...							

That gives us the correct results. (Note that [ma] violates the constraint *delete twice which is worse than only violating it once as in [man].) But now, let’s see what this ranking predicts when the input is /man/ for which the correct output in this language is [ma]:

(13)

Input /man/	*delete	*not /n/#	*not /t/#		*not /t/#	*not /n/#	*delete
man		*				*	
⊖ma	*						*
...							

We fail to get [ma] as the optimal output.

The conclusion is that counterfeeding opacity cannot be accommodated in OT. Given the necessary constraint ranking for input /mant/ which selects the correct output [man] (which is an ‘opaque’ with respect to constraint *n#), this same ranking cannot get us output [ma] for input /man/.

What about the counterbleeding situation?

Imagine another language *Fake Catalan* which has a constraint that forbids monosyllabic words which triggers a repair rule of vowel insertion. Assuming that this language also has rule that

deletes final /n/, the vowel insertion rule would bleed the n-deletion rule if it precedes it. Let's suppose that the language in question shows the output form /man/ as [mai], where [i] is inserted:

(14) Opacity COUNTERBLEEDING

1. $n \rightarrow \emptyset / -]$
2. $1\text{syll} \rightarrow 1\text{syll}+i$

I		man	baman	mant
	1	ma	bama	-
	2	ma-I		manti
O		ma-i	bama	manti

The correct output for /man/, namely [mai] shows unmotivated n-loss (overapplication) because /n/ is missing even though it is not final. This is opacity.

What could be an OT grammar that delivers this result?

(15)

Input /man/	*monosyll	*n#	*insert		*n#	*monosyll	**insert
man	*	*			*		
ma	*				*		
mani			*				*
mai			*				*

This 'grammar' does not pick out a unique winner.

Which grammar could differentiate between [mani] and [mai]? How could [mai] possibly be a better output? To invoke a constraint that forbids deletion clearly does not help:

(16)

Input /man/	*1syll	*not /n/#	*insert	*delete		*n#	*1syll	*delete	*insert
man	*	*				*			
ma	*					*			
mani			*						*
⊗ mai			*	*				*	*

Under both ordering the transparent form [mani] wins, whereas the opaque form [mai] is the correct output.

Let's try another constraint, one that penalizes each phoneme. This would prefer [mai] over [mani]. But to prevent that [ma] would than win (since it has fewer phonemes), we have to rank *delete higher than *phoneme. However, we then penalize [mai] and again [mani] wins!

(17)

Input /man/	*1syll	*not /n/#	*insert	*delete	*phoneme				
man	*	*							

One way or the other, OT accounts will run into trouble.

The final alternative is to appeal to levels:

- (14) Lexical phonology:
- | | | | | | |
|---|--------|---|-----------|---|--------------|
| I | --F--> | O | (Level 1) | \ | |
| | | | | | Lexical |
| I | --F--> | O | (Level 2) | / | |
| I | --F--> | O | | | Post-lexical |

This way-out renders the non-derivationality claim of OT meaningless, unless independent criteria can be established for postulating levels in the first place.

This seems like the right place to raise another point: The fact that level ordering is not incompatible with OT, implies that inputs to higher levels are subject to the evaluation of a ranked constraint set, namely that of lower levels. Thus the constraints that bear on the output of level 1 also bear on the input of level 2. This now leads to the possibility of assuming a constraint set that bears on the input of level 1. We can see this constraint set as picking out the set of level 1 inputs from the set of all conceivable inputs.

As it stands, an OT grammar of, say, Dutch does not produce "actual Dutch", but rather "possible Dutch". Dutch, for example, does not have clicks. Where and how is this generalization expressed? And is it worth expressing? We could assume a constraint NoClick and order this before all parse constraints. The effect of this is that no input click will ever reach the output and thus that an absolute neutralization constraint like NoClick effectively is a constraint over the input. Ultimately, lexical items themselves are the most specific form of constraints that characterize the input. What follows from this?

2 Top-down effects

OT argues against derivational procedures. The argument seems especially compelling in case of top-down effects, when, for example, primary accent location determines matters of footing or syllable structure. We seem to be dealing with two notions of derivation. Firstly, we have the derivation of one level of representation to the next, involving changes in the segmental string. OT rejects, as we have seen a derivation with intervening levels of representation and maps input directly into output, allowing selection from a pole of candidates. In many cases of this type a derivational deterministic alternative is available that makes no crucial appeal to extrinsic rule ordering; feeding & bleeding orders result from transparent relations between rules and outputs.

Secondly, we have the derivation that is involved in completing a representation by building up the prosodic organization that is associated with the string of segments. Here the argument against

derivation involves the problem that when building a lower level, knowledge is required about a higher level.

A point to bear in mind in these top-down cases is that the argument against derivations only holds if syllable structure, foot structure and primary accent structure are constructed in the SAME PLANE. If these groupings are represented on different planes, no paradox is involved. Primary accent can be computed "first" without running into the problem that foot structure has not yet been assigned.

3 "only if" and "except when" syndromes

Prince & Smolensky (1993) call our attention to phenomena that call for rule-based approaches involving so called "only if" and "except when" syndromes.

Typical examples: final syllables are extrametrical EXCEPT WHEN the remaining part of the word gets too small to foot it

This they argue is a typical case showing constraint ranking. There is a constraint requiring words to be footed and a constraint disallowing the final syllable to participate in the domain of footing. The former outranks the latter leading to the EXCEPT WHEN situation.

This particular example is not very useful, however, since in this case the ranking is presumably universal.

In joint work, Sam Rosenthal and I have investigated a number of cases involving variable weight of closed syllables.

- (15) Except when/Only if
 - a. CONSONANT EXTRAMETRICALITY (Arabic, English)
Closed syllables are heavy, except when final

 - b. CARIB
Closed syllables are heavy, except when initial in odd-numbered words

 - c. CHUGACH
Closed syllable are heavy, only if initial

Cases of this type support a ranked constraint approach if no reasonable other story can be provided for them. It seems more important at this point to focus on such cases instead of applying OT to situation that do not crucially call for it.

4 Constraints

4.1 The power argument and extrinsic ordering

An obvious resemblance between SPE and OT is the crucial appeal to the notion of ORDERING. In SPE, rules express significant generalizations and in order to deal with opacity, ordering must be invoked. In OT, constraints express significant generalizations and in order to state them in the most general form, ordering must be invoked.

Some will be inclined to remember that SPE was severely criticized for appealing to extrinsic ordering. What about ordering constraints?

With n constraints we have $n!$ (n factorial) possible orderings. Thus each new constraint we add, multiplies the number of grammars by $n+1$. For three constraints (a,b,c) we have 6 orderings: $3 \times 2 \times 1 = 6$. For each of these a new constraint creates four possible new grammars:

(16) a b c d a b c a d b c a b d c a b c d
 b a c
 b c a
 a c b
 c a b
 c b a

In contrast, adding a parameter to a parametric systems multiplies the set of grammars by 2.

Although one would think that this difference leads to a great reluctance to propose new constraints, the opposite seems to be the case. Thus, the fact that the number of grammars for even a moderate number of constraints is enormous does not seem to bother OT proponents. For the crucial cases, namely those in which different ranking produce different outputs, they tend to show that the resulting factorial typology is fully instantiated and in some case, such factorial typologies have been successfully displayed. The caveat is that OT also allows certain rankings to be universally fixed. Strictly speaking, this means that the introduction of some constraint does not commit the responsible phonologist to come up with factorial typologies.

This seems a point that needs serious attention. Unless independent criteria are developed to distinguish universal from language-specific orderings, factorial typologies or their absence do not bear on the validity of a given constraint set.

4.2 The universality of constraints

OT claims that constraints are universal. On this aspect of the theory we will not spend a lot of time. Firstly, cases have been suggested that suggest language-specific constraints. For example: the r-insertion in Boston English. The possible way out is to assume that the universal set contains a set of constraints that militate against inserting a specific consonant:

(17) Don't insert V >> DI /m/ >> DI ... >> DI /r/

By low-ranking the constraint against /r/-insertion for a particular language we derive that forms with inserted /r/ are selected over other candidates.

The real question seems to be whether the universality claim has any content. Constraints can be buried so deep in the hierarchy that their effect will never emerge.

It seems to that this issue deserves more attention. In particular, we would like to know what the consequences are if the universality claim is given up. Why would it be so unlikely that children can extract robust patterns from what they hear or see, even if these patterns are a language specific results of coincidentally interacting historical processes.

Another point bearing on the universality claim is that most constraints refer to directly to the spoken modality of language. What about sign languages?

4.3 The excessive concreteness of constraints

Two general tendencies can be detected in the formulation of constraints. On the one hand we see that systematic properties of the output forms are approached 'holistically', i.e. taken to be the direct reflection of a single constraint.

In this way, output patterns that in older rule-based approaches were explained as the consequence of rule interaction, now simply become the explanation themselves.

Suppose a language has a vowel length (or tense) contrast and that this contrast is curiously missing in the final syllable. In an OT analysis we would immediately postulate a constraint NoFinalLength/Tense and that would be the end of the story. It ought to be clear that such a solution does not go beyond a mere description of the facts. The current state of OT encourages adopting such "pseudo-solutions" with respect to distributional restrictions that can be observed in output strings.

The specificity of constraints is also apparent from the fact that constraints (and constraint rankings?) may be specific to sets of morphemes, or even individual morphemes.

4.4 The excessive generality of constraints

With the rise of the notion of Generalized Alignment, various apparently unrelated phenomena have been brought under the same heading:

- (18)
- a. Syntax - phonology mapping
 - b. Exhaustivity in prosodic parsing
 - c. Autosegmental association

Essentially edges of units can be made to line up with edge of other units:

- (19)
- a. In other planes
 - b. At the same hierarchical level & at other levels
 - c. At different tiers

In Correspondence theory this point is pushed even further. Correspondence theory states relations between units at different levels (I-O faithfulness), between units at one level (B-R identity) in a single form and between units at one level in different form (O-O anti allomorphy). With some imagination we can see Generalized Alignment and Generalized Correspondence as instances of Generalized Orchestration.

A linguistic form will be represented as a large collection of sets, each of which consisting of a linearly ordered collection of units of some kind, and a set of "Orchestration" constraints that express relations between the members of all these sets.

I doubt whether a linguistically interesting notion of "orchestration" will result from this excessively generalized perspective.

4 The empirical content of OT

OT differs from SPE in the way the function F is specified, put differently in its derivational aspect. The other side of a phonological theory involves the form and content of its representations. SPE committed itself explicitly to a very minimalist view on representations which were essentially ordered sets of unordered feature bundles. The timespan between SPE and OT can be divided in two phases. During the first phase (lasting from before 1968 until roughly the mid-seventies) the focus of attention was on derivational matters (rule formulation, rule application and rule ordering), from the mid-seventies until the early nineties we witness a shift of attention to the nature and content of representations. The derivational aspects received attention only in the form of proposals relating to the phonology - morphology interaction (i.e. lexical phonology).

OT embodies a shift back to the derivational side of the theory. It should be clear, however, that a proposal for the I-O mapping does not in itself offer a complete phonological theory, since it does not embody a commitment to any specific theory of phonological primes, i.e. basic categories and relations. The pioneers of OT are entirely clear on this matter. OT focusses on the mechanisms of constraint interaction **WHATEVER THE CONSTRAINTS ARE**. It should thus be clear that one cannot put an approach like OT to the test if no commitment is made to the basic primitives. It is only in conjunction with a theory of representations that claims are made that are empirically testable.

This simple point does not seem to impress most of the OT practioneers. True one can make empirically testable claims about, say, reduplication without a specific commitment to a theory of intrasegmental structure, at least as long as correspondence relations between complete segments are at stake. MAX-I/O and DEP-O/I do not depend on a specific view on features. IDEN, however, does.

To take another example. One cannot propose an OT analysis of ternary systems without having a view on how to represent ternary rhythm. The theory of constraint interaction has NOTHING to say about this issue.

5 OT as a research program

-The importance of every new approach lies in challenging the old ones. The mere suggestion that things can be looked at completely differently may lead to new insights and thus ultimately progress.

-At some point it is no longer clear whether a detailed and valuable analysis of some data set crucially requires the idea of language-specific constraint ranking.