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Insertion and Deletion in English: A Phonological Approach

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Abstract

Optimality theory has spent the past three decades attempting to construct a new framework for phonological considerations. Even if it has not been able to propose a 'perfect' theory that fits most data and makes accurate predictions, it has still steered conceptual understandings of phonology and has provided fodder for intense theoretical debate. Essentially, OT has proposed that the underlying representations of sounds/words are input, that are then processed and evaluated until an ideal surface form is found and pushed out (as output). The mode through which these evaluations occur is "constraint-based analysis". Throughout the process, OT offers an informative display alongside the surface realization form. OT came into discussion as a descriptive-analytical model. This paper attempts to show the basic procedures of how OT works, especially in case of insertion and deletion, and how OT provides an ideal surface form considering the competing candidates who have also the possibilities to surface. This paper also emphasizes that OT is not here to take the place of SPE. However, it has the potential to act as an advanced process in phonological analysis. This paper looks at the bigger picture which will allow readers to understand that OT does not just provide the surface form but quench our thirst to know why and why other competing candidates do not deserve to be surfaced. This research paper will help to understand that even with the limitations, OT offers more information about the phonological process and this framework is very much open for further development. OT is a bigger field to work on. This paper will be a resource to the interested who wants to take OT to the next level working on its limitations.

Keywords: alignment, constraints, faithfulness, hierarchy, optimality, markedness

1. Introduction

Optimality theory (OT) is considered as a non-derivational phonological approach within the framework of generative grammar theory. OT argues surface forms emerged from a hierarchy of constraints, not rules. This hierarchy takes input, produces participants of output, and selects the output that follows the order of constraints thus being evaluated as an optimal. The input in OT is considered as underlying representations and the outputs as surface form/realizations. Prince and Smolensky (1993) introduced OT for the very first time as a constraint-based analysis in the 90s. Until then rule-based phonology was reigning over the whole empire of phonology.

Alan Prince and Paul Smolensky are considered to be the introducers of this theory. They first mentioned the term in a talk in 1991 and later in 1993 they again discussed OT in an article. Though the first discussion revolved around phonology only, subsequently, linguists showed their interest to use OT in other branches of linguistics like morphology and syntax. In 1994, McCarthy and Prince worked together focusing on Morphology. Their article got published as "The Emergence of the Unmarked Optimality in Prosodic Morphology". They emphasized the importance of the unmarked (McCarthy & Prince, 1994). Throughout their article, they tried to consider this property as essential and fundamental notions of constraint ranking and violation under domination. They demonstrated (in their paper) that in some cases, "even the dominated constraints may be visibly active" (1994, p. 29). The paper focused significantly on morphology and presented the analyses that showcased that the facts of reduplication, infixation, and epenthesis are on the side of OT. McCarthy and Prince (1994) also emphasized that "Constraints on syllabic structure, metrical footing, and word form (that are demonstrably violated in a given language) are nonetheless active in determining properties of the reduplicative and epenthetic structure of that very language" (p. 29). This paper concludes its discussion saying "The fallacy of perfection rests on an illusion of homogeneity; ranking, violation, and emergence of the unmarked in optimality theory rests on the fact of multidimensional conflict" (p. 30). In 1995, the same authors brought another article focusing on faithfulness and reduplicative identity. McCarthy and Prince discussed this notion again from the morphological approach.

Later in 2005, Brasoveanu and Prince published another article highlighting the importance of ranking in OT. The paper came out as "Ranking and Necessity: The Fusional Reduction Algorithm". They introduced an algorithm named fusional reduction, abbreviated as, FRed in this paper. This algorithm offers a concise and informative display of data, calculating the ranking conditions of any set of given candidates. Since the conditions provide the formal shape of the grammar. Though this notion of the algorithm was first proposed by Brasoveanu in 2003, it took 2 more years to get a breakthrough as a simplified analytical enterprise. Alan Prince also collaborated with Brasoveanu in this research. Afterwards, another significant contributor to linguistics i.e., Idsardi (2006) brought a small paper where they argued that the optimality theory is computationally intractable. He proclaimed that the generation problem of optimality theory is NP-hard. To compare with rule-based phonology, he chimed with a previous study that, "Rule-based derivational systems are easily computable, belonging to the class of polynomial time algorithms" (Eisner, 2000, p. 32). A bunch of articles got published thereafter on OT. One of the most recent articles got published last year (April, 2019). Joe Pater, the professor from University of Massachusetts, added a new dimension in the study of Optimality. The paper came out as "phonological typology in optimality theory and formal language theory: Goals and future directions". This paper considers two main possibilities; the first one is- OT grammars are specified to generate only regular languages while the second possibility intends to find that the tools of formal language theory might be used for constructing phonological theories similar to those within optimality theory (Pater, 2019). Throughout the paper, Pater showed his support to the first possibility that OT grammars are constrained to generate only regular languages but he questioned about the second possibility as he assumed that the tools of formal language theory might not be used for constructing phonological theories alike within optimality theory. Though Jardine (2019) shared the opposite of Pater's opinion earlier in an article "Computation also matters: A response to Pater 2018". Jardine found skeptical about the first possibility but supported the second one in his paper published in 2019 but earlier than Pater's this research. Jardine argued in his research that, "…just as substantive statements can be made in OT by stipulating the content of CON, we can similarly make substantive statements in FLT phonotactic grammars through stipulations on what constraints are available to grammars" (Jardine, 2019, p. 2). Both of these works considered to focus on the phonological typology in terms of OT and formal language theory (FLT).

However, all these researches focus more on specific areas of OT but barely talk about the overall structure and practicum, especially in case of insertion and deletion. From here, we found my motive to lead a discussion on OT; how it works in case of insertion and deletion in English and how it relates or varies from SPE, the most used derivational process of phonology. My research will provide a better understanding of this newly emerged notion in terms of phonological analysis.

OT shows the relation between UF and SF though evaluation by a set of constraints. In OT, there are no derivations, no phonological rules, no rule orderings, what they have are constraints, unlike SPE. The ultimate goal of this constraint-based phonology is to capture generalizations over the sets of phonological data. OT shares three basic components. These three basic components in OT are considered as universal. They are "generator (gen)", "constraint component (con)", and "evaluator (Eval)". Gen takes an input and generates the list of possible candidates to find the output, thus the name. Con provides the criteria or laws to decide between candidates in the form of strictly ranked violable constraints. This set of candidates is then evaluated by the set of constraints contained in the function "evaluator (Eval)".

Among all the candidates, which is realsized as "the most harmonic" (Davenport & Hannahs, 2010, p. 199), is selected as the optimal one and denoted with a pointing figure ( ) in the tableau. Here, Harmonic means the correct surfacing form. This process is abbreviated as,

Input — > GEN — > Candidates — > EVAL — > Optimal Output

Constraints are classified into three sections. They are- faithfulness constraints, markedness constraints, and alignment constraints.

1) Faithfulness Constraints ensure that output is faithful to the input. Faithful refers to the matching of output segment to the input segment. DEP- IO, IDENT (IO), MAX-IO are some examples of faithfulness constraint. To explain, IDENT-IO(voice) means outputs match input in terms of voicing.

2) Markedness Constraints impose requirements on the structural well-formedness of the output. This type of constraint deals with specific structural configurations. For instance, NoCoda expresses the universal tendency for languages to prefer syllables without codas. Some of these constraints are context-free and some are context-sensitive. For example- $*V_{nasal}$ states that vowels must not be nasal in any position and is thus context-free, whereas $*V_{oral}N$ states that vowels must not be oral when preceding a tautosyllabic nasal and is thus context-sensitive (Kager, 1999, p. 29-30).

3) Alignment Constraints are caused to ensure structural alignment between different linguistic structures. This constraint helps ~~to~~ make sure that the right edge of a word coincides with the right edge of a syllabus (Davenport & Hannahs, 2010, p. 200).

OT supports the richness of base which indicates that there are no language-specific restrictions in generating input. Therefore, a language can produce as many inputs as it wants. The eval chooses the optimal one evaluating the ranking of constraints. However, constraints must follow three basic features (1, 2, and 3). They are as follows:

1. Constraints should be violable.
2. They are not of equal importance in every language. Language determines the rankings of constraints of any particular language. Some might be the most important constraints in one language but least for the others.
3. Constraints are assumed to be universal. All human languages share the same set of constraints, the difference comes in its rankings. That is how the languages are phonologically different.

It is important to (re)emphasize that the types of constraints, the evaluation machinery, can shift or be re-ranked depending on the language. Therefore, while violating one particular constraint in English might not be as important or as much of a deal-breaker, the same violation may eliminate the candidate in Japanese (e.g., English is more forgiving with consonant clusters than Japanese). However, every language has a definite ranking of constraints. Though there is no certain list of it, but the way it maintains the rankings is language-specific and firmed. This data set looks at a couple of different underlying forms (and candidates) in English and uses OT to decide which candidate is most optimal. Here, optimal refers to the most preferable candidate which violates the least constraint and satisfies the most. Additionally, rankings work a great deal here. A candidate might not be optimal if it violates the high ranked constraint and again one candidate may take the place of an optimal candidate in spite of violating a lot of constraints. Here the importance is given on the ranking.

2. Methodology

Table1. Sample Tableau

/Input/	Constraint A	Constraint B	Constraint C	Constraint D	Constraint E
☛ [Candidate 1]				*	
[Candidate 2]	*!	*			
[Candidate 3]			*!		*
[Candidate 4]			*!		*

Table 1 is displayed as a tableau. Data given within the slashes (/ /) refers to the underlying representation, which appears at the upper left-hand corner. On the top of the tableau, to the right of the input, constraints are listed by importance, left to right (Davenport & Hannahs, 2010). Here Constraint A is ranked as the most important. On the contrary, Constraint E is given the least importance. The solid vertical line indicates that the left-sided constraint is more important and higher ranked than the right-sided one. The dotted line is used instead if the ranking cannot be determined. Data given within third brackets ([ ]) are possible candidates generated by Gen, all listed in one column. The constraints are arranged maintaining the hierarchy of constraints, following the particular language. The leftmost constraints are the most important constraint whereas the rightmost as of least importance. An asterisk (*) in any certain cell represents that a particular constraint has been violated in the given situation. An exclamation mark following an asterisk is considered to be a fatal violation. It is used to distinguish the preferable one to another while comparing too. Cells are shaded when those become irrelevant to any further evaluation of the candidate. As you can see in Table 1, the rightmost cells are shaded for Candidate 2, Candidate 3, and Candidate 4 following a fatal violation. Since they violated the topmost constraint. A pointing figure ( ) is used to indicate the most optimal candidate. Here Candidate 1 is the winning candidate or optimal candidate as you can see, marked with the pointing finger. Since it violated the constraints least among all. However, Candidate B violated just once alike the optimal candidate. Nevertheless, it cannot be the optimal one. Since it violated the top-ranked constraint which caused it to lose its position to be considered for the winning candidate.

Linguists have a tendency to use different symbols for indicating the most harmonic candidate. Some use pointing finger, some a sign of bomb, some a tick mark and others.

2.1 Insertion and Deletion in English

For this research, two data sets have been taken from the book "Introducing Phonetics and Phonology" by Mike Davenport and Hannahs (2010, third edition). Most notably, these data sets consist of both deletion and insertion of certain sounds in the optimal candidate. This data sets provide examples from English language.

2.2 Data

FILM
Input: /fɪlm/
Candidates: [fɪləm], [fɪlm], [fɪm], [fɪl]

HAND
Input: /hænd/
Candidates: [hæn], [hænd], [hæd], [hænɪd]

2.3 Given Constraints

NoCorClust: MAX-IO; NoFin[son][nas]; MAX-IO(son); DEP- IO

NoCorClust: This constraint prohibits having two [+cor] segments at the end of a word.

MAX-IO: This constraint prohibits deletion. It shares the ideology that inputs should be maximized in the output.

NoFin[son][nas]: This constraint prohibits having a sequence of sonorant nasal at the end of a word.

MAX-IO(son): MAX-IO(son) refers that sonorants in the output should be maximized in the output. That means do not delete a sonorant.

DEP- IO: This constraint prohibits insertion. According to this constraint, the output should not contain material not present in the input (p. 218).

*It is important to note here that NoFin[son][nas] refers to consonantal sonorants (liquids)

3. Analysis

Table 2. Tableau for insertion

/fɪlm/	NoCorClust	NoFin[son][nas]	MAX-IO [son]	DEP- IO	MAX-IO
☛ [fɪləm]				*	
[fɪlm]	*!	*			
[fɪm]			*!		*
[fɪl]			*!		*

Table 3. Tableau for deletion

/hænd/	NoCorClust	NoFin[son][nas]	MAX-IO[son]	DEP- IO	MAX-IO
☛ [hæn]					*
[hænd]	*!				
[hæd]			*!		*
[hænɪd]				*!	

Analysis of the underlying forms, proposed constraints, and optimal outputs can be found in Table 3. These also demonstrate the constraint rankings, we found to be most true to the data.

It is found that the most highly ranked constraints in English had to do with consonant clusters NoCorClust and NoFin[son][nas]; however, as the violation of NoFin[son][nas] did not hold any importance in the ultimate elimination of candidates and decision on output, it was difficult to rank. There was not enough data to make a confident decision. Thus, we decided to rank NoCorclust and NoFin[son][nas] equally; this is because they both suggest that having consonant clusters is less-than-ideal. This general connection between the two constraints functions appropriately with the rest of our data.

While deletion and insertion were both constraints in English, it is found that they were much lower priority, as both decidedly most optimal outputs violated those constraints. This encouraged us to push faithfulness constraints to a lower ranking. It is important to mention, however, that there is a relationship between sonority and faithfulness. In English, it is much more ideal to abide by a faithfulness constraint if that constraint prevents the deletion of a sonorant. In the data, none of the winning outputs violated this constraint (no sonorants were deleted). Thus, while it is undesirable to delete in general, it is more desirable to delete an obstruent than a sonorant. The data also suggests that it is more desirable to insert a sonorant than to have a consonant cluster, which further promotes the idea that sonorants generally are a more favourable presence. This may have to do with the desire to implement a more CV-based syllable structure.

Our analysis also found some struggle in the pure deletion/insertion aspects of the final two constraints (DEP-IO and MAX-IO). While we considered ranking them equally, the second set of data for "hand" demonstrates that an equal ranking would put both [hæn] and [hænɪd] as optimal outputs, not favoring one over the other. This suggested that we should rank DEP-IO higher; however, with more data, this might change.

3.1 OT vs. SPE

There has been heated debate over whether or not rule-based or constraint-based descriptions and analyses of language are more appropriate, or, for lack of a better term "relevant" (Vaux, 2008). However, it is important to recognize that these two different frameworks of thinking are just because of two different frameworks of thinking. While OT is a generative theory, SPE is a factual description. For either one of them to supplant the other across all linguistic contexts seems unnecessary.

The difficulties with OT are clear. There are a theoretically unlimited number of constraints (they are not finite) and thus can come across as an arbitrary attempt at fitting all data. If a list of candidates is missing something that would produce the output that we already know is optimal, it is very easy to develop a new constraint that fits the data perfectly. This is called overfitting the data and is not ideal.

Through this lens, using SPE to describe data is more precise. It allows us to accurately and easily convey what is happening in any given phonological situation or phonotactic environment. While this is true, and there are many instances where OT does not fit the data how we anticipate and does not predict accurate results, it is important to remember the different functions of each method. While SPE allows for a level of factual precision that OT may sometimes lack, OT proposes a predictive framework that focuses not just on what is happening but why it is happening.

Though imperfect, we cannot ignore the unique benefits of each method. Thus, it will largely depend on context when determining which to use. While SPE would have worked for this data set in terms of description, it would have done a little for us in hinting at what values may be indicated by these particular rankings. The constraint-based analysis allows us to ask: why, if consonant clusters are permitted in English, is it so important for a candidate not to have them? Why do we value the inclusion or maintaining of sonorants over that of obstruents (at least for this particular data set)?

4. Conclusion

The data provided here is limited, and the results may have been skewed by our previous knowledge of the optimal output (another potential downfall with OT), but in this analysis, both OT and SPE worked in terms of description and analysis. While SPE would have provided a snapshot of the phonological occurrences/processes, OT provided more detailed information about the relationships between different values in the English phonological system (e.g., deprioritizing clusters, and prioritizing sonorants). This allowed for a more complex picture of how different constraints work together and how different processes (here, insertion and deletion) closely relate to one another. However, OT ensures that all the possible non-occurring candidates are not selected as optimal. SPE makes sure what change to bring and where but it does not offer competing candidates. However, OT is now highly considered in Morphology and Syntax besides phonology. As we can see, OT is very much open for further development to offer the most convenient candidate. In spite of having limitations, OT comparatively leads us to a more informative analysis and the most harmonic candidate. This research paper offers the interested researchers a smooth walk in the vast area of OT. Similarly, it enables them to see the larger implications of the model. Since this paper offers a very intelligible reading about the process how OT works in general and in case of epenthesis and deletion as well. Recent works on OT will allow readers to get good grasps on specific areas of OT over and above that are offered in those papers. OT is undoubtedly a bigger field for the linguists to work on. There are still enormous lands remain unplowed in OT to take this theory to more sophisticated level.

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