

# OC P EFFECTS IN TELUGU

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## ABSTRACT

The antiantigemination phenomenon in Telugu is a case study of the relationship of the role of the OCP in lexical phonology, formal post-lexical phonology and phonetics. In this paper a number of different experimental findings relating to the OCP in various compartments of the grammar – the lexicon, the phonological component and the phonetic component – that seem like unrelated phenomena are brought together by using a gestural OCP account that is elaborated using the framework of Suzuki [6].

**Keywords:** antiantigemination, gradient post-lexical effects, experimental OCP

## 1. INTRODUCTION

The calculation of identity or segmental similarity, i.e., what it means for two segments to be ‘the same type’ is crucial for the application of the OCP in phonological processes. Depending on whether two segments are identical or sufficiently identical in a language, the *OCP effects* either apply or do not apply in a particular sequence. These *OCP effects* include antigemination – which prevents syncope from applying between sufficiently identical consonants, and antiantigemination – which permits syncope to apply only between sufficiently identical consonants. Languages differ in determining what constitutes ‘sufficiently identical’ in (anti)antigemination contexts. The determination of what constitutes identity and the computation of strength of identity has been the subject of debate in the phonological theory for quite some time, and various independent methods have been proposed by which to predict the formation ‘identical’, ‘sufficiently identical’ or ‘similar’ in a particular language.

The computation of identity also plays an important role in determining co-occurrence restrictions in the lexicon. Ever since Greenberg demonstrated the gradient pattern of co-occurrence restrictions in Arabic based on shared features, a cottage industry of studies have investigated the nature of co-occurrence restrictions in a wide

variety of genetically unrelated languages and the computation of identity that underlies the gradient pattern of co-occurrence restrictions. These studies have found that languages differ in the pattern of co-occurrence restrictions found in their lexicons, which is attributed to the different weights languages give to the features that go into the computation of identity. Two methods for computing identity in determining co-occurrence restrictions are current. One, the Natural Class Similarity metric developed by Frisch, et al. [4], which computes identity based on the number of shared and unshared natural classes. Two, the feature agreement based OCP constraint family developed by Coetzee and Pater [2] that uses an elaborate set of constraints that are fine-tuned to the feature agreements that a language is sensitive to in determining co-occurrence restrictions. Both these formalisms use their respective metrics to determine the strength of identity between any two segments in a language and this in turn determines the strength of co-occurrence restriction between the two segments in the lexicon of that language.

This paper proposes that the same notion of identity and the same grammar involved in the calculation of similarity in the lexicon is also involved post-lexically when determining whether the OCP applies in a particular context or not. Taking Telugu as a case study, I examine the ‘static’ *OCP effects* in the Telugu lexicon, and the ‘active’ *OCP effects* in the post-lexical phonological process of antiantigemination (elision of intervening vowel only between identical or sufficiently identical consonants) and show that the same grammar that encodes markedness based on the strength of identity and explains the gradient pattern of co-occurrence restrictions in the lexicon also explains the gradient pattern of elision seen in the antiantigemination process post-lexically in Telugu.

## 2. OCP EFFECTS IN TELUGU LEXICON

To establish this, I first conduct an investigation into the co-occurrence restrictions in the Telugu lexicon and evaluate which of the two formalisms

for the computation of identity – the Natural Class Similarity metric developed by Frisch, et al. [4], or the feature agreement based relativized OCP constraint family developed by Coetzee and Pater [2] – provides the best fit for the lexical data.

The investigation of non-local co-occurrence restrictions in the Telugu lexicon showed that adjacent consonants with the same major place of articulation are dispreferred. The prohibition in Telugu is not as strong as in the prototypical case of Arabic. The strength of the restriction in Telugu patterns with languages like Yamato Japanese and Muna. Non-adjacent consonants sharing the major place of articulation, on the other hand, are not subject to co-occurrence restrictions, and are in fact overattested. Exact identity is not an escape hatch from restriction, like it is in Muna. It is also not an absolute prohibition, like it is in Arabic. The restrictions on identical homorganics are, quite clearly, comparable in strength to the restrictions on non-identical homorganics. This ties in well with the results from the experimental study, where the elision rates between identical homorganics are found to be similar to the elision rates between nonidentical homorganics. In Telugu, Coronals have the least co-occurrence restrictions among them, compared to the other major places of articulation – labial and dorsal. As Telugu also has a larger sub-inventory of coronals than the other two major places, it supports Frisch, et al. [4]’s claim that the asymmetry in strength of restrictions between the major places is due to the asymmetry in the size of the sub-inventory among the major places, with less perceived similarity among the members of the class with the larger sub-inventory. Agreement for specifications like [voice], [sonorant] etc., also play a role in determining strength of restriction. Earlier studies have shown that sonorancy agreement is the prime predictor of attestedness in Arabic, and there is a balanced contribution of [voice], [sonorant] and [stricture] in Muna. In Telugu, the specifications [sonorant] and [stricture] have an equal strength in restricting co-occurrence, whereas agreement in [voice] does not have any significant effect on co-occurrence. This means that exactly identical homorganics and homorganics which differ just in voicing, pattern together in co-occurrence restrictions, or relative ‘badness’ or markedness of the sequence. This also ties in with the experimental findings in the production study, where stop pairs that are exactly identical and

those that differ only in [voice] are clubbed together into the identical category.

Applying the natural classes similarity metric of Frisch, et al. [4] to the Telugu data shows that the similarity model does not capture all the trends in the Telugu pattern. As this model calculates similarity based on all features (including [voice] and [anterior] which were found to be irrelevant for Telugu) and not just on [sonority] or [stricture], the two features that were found to be most predictive for the Telugu co-occurrence restrictions, this undermines the fit of the similarity metric to the Telugu data. The model that uses a set of OCP constraints relativized to different places of articulation and also to different features, based on Coetzee and Pater [2], is better able to account for the gradient attestedness and co-occurrence restrictions in the Telugu lexical data. To get the constraint weights that correlate with the gradient phonotactics for the Telugu lexicon, phonological learning of the gradient pattern via Harmonic Grammar was implemented. As the aim of this investigation was to see whether the markedness constraints that are active in the lexicon parallel the markedness constraints that are active in the antiantigemination process across boundaries, co-occurrence restrictions in clusters were also analyzed along the lines of the analysis for CVC sequences, and a harmonic grammar was developed to model the co-occurrence restrictions among the clusters.

### 3. ACOUSTIC PRODUCTION STUDY OF TELUGU ANTIANTIGEMINATION

Next, an experimental study taking a detailed look at the exact pattern of elision in antiantigemination was conducted. The results of the production study showed that the elision is neither simple, categorical phonological deletion nor across-the-board phonetic overlap that happens at fast speech rates. Elision was rampant in identical and non-identical homorganic contexts but nearly absent in heterorganic contexts. This ties in with the co-occurrence restrictions on CVC sequences in the Telugu lexicon, where the identical and non-identical homorganics are marked and underattested compared to the heterorganic sequences. So when these marked sequences are brought together at word and morpheme boundaries, deletion of the intervening vowel is the strategy employed by Telugu phonology to repair the violations. The elision in the homorganic

sequences was also sensitive to phonotactics. But in none of the sequences was the elision exceptionless, indicating a gradient phonological process. Further, all the speakers tested in the experiment showed rate-dependent elision. While the earlier studies on Telugu antiantigeminaton reported regressive assimilation of voicing and also assimilation of minor place and manner, the results from this experiment showed no evidence of assimilation whatsoever. Of the two boundary conditions, elision at morpheme boundaries is significantly more than the elision at word boundaries, in homorganic sequences. This finding agrees with Cho [1] that found greater overlap between articulatory gestures across morpheme boundaries. The results also agree with a number of studies that found that there is less overlap between articulatory gestures across word boundaries, as the gestures are pulled apart at the word boundary.

### 3.1. Antigeminaton effect in monomorphemes

Sandhi has not been reported in monomorphemes in Telugu, but they were included as a control case and also to test whether the phonetic effects of antigeminaton discussed by Walter [7] manifested in this group. The results showed that elision was minimal in monomorphemes, comparable to elision in heterorganic sequences at boundaries, and not sensitive to phonotactics. The only significant predictor of elision in these two conditions is speech rate. The minimal elision seen in monomorphemes and heterorganic sequences at boundaries is due to phonetic overlap which happens during the implementation phase, and applies across-the-board. Deletion, which happens phonologically, is conditioned to apply only in homorganic sequences at boundaries. The vowel length data showed that the vowel length in the identical contexts is significantly longer than the vowel length in the near and non-identical contexts in the fast speech rate. This is similar to the phonetic antigeminaton effect found by Walter [7] in English where the vowel between flanking identical consonants is significantly longer than between non-identical consonants. While the presence of this antigeminaton effect in monomorphemes from the Telugu data is a cross-linguistic validation of the phonetic effects of antigeminaton found in Walter [7] for English, it is a surprising and unexpected finding that this antigeminaton effect is also seen in the word and

morpheme boundary conditions where there is a clear antiantigeminaton pattern of vowel syncope. This shows that the phonetic effects of antigeminaton are seen even in the contexts where the complementary (according to Walter [7] and Rose [5]) effect of antiantigeminaton is observed in the Telugu data.

### 3.2. Comparing ‘true’ and ‘fake’ geminates

Comparison of the ‘fake’ geminates, formed after elision between flanking identical consonants at morpheme boundaries, with ‘true’ geminates that are present in lexical items underlyingly, shows that the ‘fake’ geminates formed after vowel syncope in Telugu sandhi are produced with two gestures and not a single long gesture. This goes against the claim in Walter [7] that antiantigeminaton involves the articulation of a geminate with a single long gesture, thus avoiding repetition and becoming a complementary strategy for repetition avoidance along with antigeminaton. Comparison of contexts where a geminate and singleton sequence are brought together after vowel syncope with true geminates, reveals that the geminate-singleton sequence does not involve degemination or an extra-long geminate gesture, but two gestures, one long gesture for the geminate and one short gesture for the singleton with a closed transition between them. The comparison of homorganic clusters formed after elision with underlying clusters shows that there is no significant length difference between the two clusters. This along with the length of the ‘juncture’ geminates indicates that antiantigeminaton in Telugu does not involve the replacement of two gestures with a single long gesture (with assimilatory changes when the flanking consonants differ in voicing or minor place or manner of articulation) as claimed by Walter [7] and Rose [5]. Had antiantigeminaton in Telugu involved such a process of fusing derived sequences of adjacent (near)identical elements into a single unit, the biomechanical repetition avoidance analysis in Walter [7] and the formulation of the OCP in Rose [5] which both account for antiantigeminaton as a complementary solution to antigeminaton in avoiding repetition or the OCP, respectively, by forming one long consonant, would have had no trouble explaining the Telugu pattern. But antiantigeminaton in Telugu does not involve fusion of the adjacent

consonants after deletion. So these two analyses fail to account for the Telugu data.

#### 4. PHONOLOGICAL ANALYSIS OF TELUGU ANTIANTIGEMINATION

Using the constraints from the grammar developed for the co-occurrence restrictions in the Telugu lexicon to account for antiantigemination provides broader phonological coverage, from the gradient pattern of phonotactic restrictions in the Telugu lexicon to the gradient pattern of elision in the antiantigemination process in the active phonology of Telugu. Not only the same constraints that are responsible for co-occurrence restrictions are responsible for the gradient pattern of deletion in antiantigemination, but the same ranking of the constraints is at work in both processes. Analyzing the gradient pattern of elision, it is found that the amount of elision seen in any particular CVC sequence is dependent on the markedness of that CVC sequence – computed based on the strength of identity between the non-locally adjacent consonants in the CVC sequence – **which is the motivation for elision**, and the markedness of the CC sequence resulting from elision – also computed based on the strength of identity between the locally adjacent consonants – **which deters elision**.

Finally, the exceptional nature of elision in the *sk* sequences in the experiment is explained based on the results from Davidson [3] that show that in fricative initial sequences overlap is more prone to be seen as elision. Davidson tests this prediction by comparing the length of the /s/ in elided and unelided sequences. The same is done for the /sk/ sequences from the Telugu data. The length of the /s/ in elided sequences is found to be significantly longer, confirming that increased overlap masks the vowel as frication, thus making the /s/ longer. The high rates of elision in monomorphemic *sk* stimuli is attributed to the confounding effect of high frequency lexical items with variants that lack the intervening vowel.

#### 5. CONCLUSION

In sum, this paper shows that antiantigemination in Telugu is a process of vowel deletion between flanking homorganic consonants, without assimilatory changes, that is sensitive to the markedness of the CVC sequence prior to elision and the markedness of the CC sequence after elision. The markedness of the CVC and CC

sequences at boundaries that is deduced from the gradient elision pattern parallels the gradient markedness pattern of consonant co-occurrence restrictions observed in the lexicon. This is taken as evidence that the same constraints and grammar which are at work in the pattern of gradient phonotactics in the lexicon are at work in the gradient elision pattern of antiantigemination post-lexically. This therefore provides evidence for the 'reality' of the OCP effects in the lexicon, as they are also active post-lexically in the phonology. To account for the finer pattern of markedness and gradience the OCP constraints formulated in the Generalized OCP framework of Suzuki [6] that presents a comprehensive schema for both elements avoided, and the notion of adjacency, are found necessary. A gestural formulation of these constraints insightfully explains the antigemination effect of vowel lengthening that is observed in the antiantigemination pattern of vowel elision. It also seamlessly accounts for the small portion of elision that is due to overlap. Antiantigemination is not a counterexample to the universal principle of OCP, but is a process that follows from the application of the OCP, like the process of antigemination. Only in antiantigemination, the OCP at the **non-local CVC level of adjacency is higher ranked** than the OCP at the local CC level of adjacency. Whereas in antigemination, the OCP at the **local CC level of adjacency is stronger** than the OCP at the non-local CVC level of adjacency.

#### 6. REFERENCES

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