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Further Opacity Issues: Spontaneous L2 Opacity

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Abstract

Opacity continues to be the major problem confronting Optimality Theory (OT). In this talk I will discuss a type of spontaneous opacity that occurs in second language (L2) learning. Korean learners of English show a chain shift in their L2 in environments preceding high front vowels: “thin” → “sin” → “shin” The most interesting aspect of this spontaneous chain shift is that it does NOT reflect properties of their original L1 grammar, the target L2 grammar or of Universal Grammar. OT treatments of chain-shifts are typically complex, employing mechanisms such as constraint conjunction (see especially Ahn (this conference)). In this case, the intermediate stage in L2 acquisition must be significantly more complex than either the L1 or the target grammar. This example is similar to other L2 examples discovered by Eckman and Iverson (1997, 1999), and I will offer an analysis modeled on their findings. The key to an explanation of the spontaneous chain shift is the persistence of two rules of Korean into the L2 grammar: the assimilation of palatality ([high front]) from /i/ and default [strident] and [alveolar] for fricatives. The analysis relies on a delay between the acquisition of contrastive [strident] and the suppression of the related rules. At the chain-shifting stage, the English interdental fricative is correctly recovered as a non-strident fricative by Korean speakers, but they persist in adding default [strident] to it in speech production. Only by employing persistent RULES can we correctly create the conditions for chain-shift; persistence of constraints and constraint-rankings into the L2 does not correctly induce the chain-shifting behavior.

1 Introduction

Cho and Lee (2000) and Lee and Cho (2000) discuss a case of spontaneous opacity in the grammar of Korean speakers learning English as a second language (L2). At an early or intermediate stage in their acquisition of English, Korean speakers (and also Japanese speakers) show a chain-shift of fricatives: θ → s → f in the environment of a following high front vowel. Thus, the target word “thin” is pronounced similarly to “sin”, but the target word “sin” itself is pronounced like the target word “shin” (which is also pronounced like “shin”). The motivation for three categories of fricatives in the L2 grammar comes from the tripartite behaviour of the fricatives in two environments – preceding /i/ and preceding other vowels – as summarized in (1).

(1) English Target | L2 Production before /i/ | L2 Production before other vowels
\[\theta\] | [s] ‘thin, thing, think, thick’ | [s] ‘thank, thirst’

[s] | [] ‘sit, sick, sink, sing’ | [s] ‘circle, sun, soap, sand’

[] | [] ‘ship, sheet, she, sheep’ | [] ‘shoes, shop, shirt, shell’

The astute reader will notice that if we take the implied analysis at face-value we are faced with an absolute neutralization of θ/ If we faced this data without knowing the target sources, we would
almost certainly see it differently and would find instead two non-alternating segments [s] and [j] and a third segment which alternates between [s ~ j]. Adopting the standard archi-phonemic solution to such a case would entail postulating that the alternating segment would be underspecified for the relevant contrast or contrasts. Adopting for expository convenience the descriptive place features [alveolar] and [palatal], the archi-phonemic analysis could specify the alternating segment (say as Coronal) without fully specifying its minor place features. The feature [palatal] would be the appropriate default before /j/ and [alveolar] will be the default elsewhere. Such an analysis can be done in Optimality Theory (OT, Prince and Smolensky 1993, McCarthy and Prince 1993, etc.), and will be sketched in section 3. Before doing that, however, we should briefly consider some phonetic issues about the Korean L2 pronunciations which will affect our analysis.

2 A brief phonetic clarification

Following not just Cho and Lee (2000), but also tradition, typographic convenience, Romanization conventions and English ears, we have represented the Korean L2 pronunciations of ‘sip’ and ‘ship’ with the alveo-palatal fricative [j] in the previous section. However, phonetic studies (such as those by T. Cho (1998), H. Kim (to appear) and Beckman and Pierrehumbert (2000)) all show that the Korean L1 pronunciation of /s/ has a palatalized s, [s'] rather than an alveo-palatal. Continuing to use the features of convenience [alveolar] and [palatal], the pronunciation of ‘sip’ and ‘ship’ will then have both features, and this reflects the insight that any co-articulation analysis will give the palatalized variant two sets of articulatory specifications – one from the underlying /s/ and one from the following front vowel (here one can understand [palatal] as shorthand for [front high]). Given that our account must ultimately rely on transfer from L1 (see below), we will therefore also assume that the Korean L2 pronunciations of English are also palatalized (this claim is the subject of current research at the University of Delaware). If we wish to continue to pursue the archi-phonemic analysis of the previous section, we will need to identify a feature specification for the non-alternating [s] that will contrast with [palatal]. It is not immediately obvious what the content of the feature would be. For example, [apical] may well also be a characteristic of the palatalized variant, and thus would not be unique to the non-alternating [s] Nor is a feature like [-palatal] reasonably defensible as a positive specification of articulatory intent (and to that end we will continue to employ privative specifications in this paper). In fact, if we take the co-articulation account seriously, [s'] must contain everything that [s] contains plus everything that [j]/[j] contains. Furthermore, Korean does NOT enhance the contrast between plain and palatalized [s] by velarizing the plain one (as Russian does), and therefore we do not seem to be left with a privative contrast between [s] and [s']. This makes the archi-phonemic analysis in section 1 difficult (though not impossible) to maintain. We can simply choose an arbitrary (and therefore abstract) feature (which we will for obvious presentational reasons call [dental]). We turn now to the details of such analyses in OT.

3 An OT analysis and an abstract(?) alternative

In this section we will consider two possible OT analyses of the chain shift – one that conforms to the phonetic assumptions and one that also conforms to the archi-phonemic analysis. The underlying representations for the Korean L2 speakers are given in (2).

(2) Target (L1 SR) L2 SR's Analysis 1 UR Analysis 2 UR
[θ] [s] [j] [dental]
[s] [s ~ s'] [alveolar] [alveolar]
[ʃ] [s'] [palatal] [alveolar palatal]

Of course the task now is to allow each half of the chain shift which preventing “thin” from being pronounced “shin”. In Analysis 1 this means that we can add either [alveolar] or [palatal], but not both – that is, we need a conjoined constraint Dep[alveolar]&Dep[palatal]. The second analysis seems to offer a slightly different alternative – we could see the “big” shift as both losing [dental] while gaining

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[palatal] – which would instead conjoin Max[dental]&Dep[alveolar]. Anticipating the commentary in the following sections with regard to the learning implications of this analysis, we can further modify these analyses so as to involve the conjunction of a Markedness constraint with a Faithfulness constraint, for example *[palatal]&Dep[alveolar]. We will obviously also require a Palatalization constraint mandating the sharing of [palatal] and various Faithfulness constraints for the (privative) features. The crucial ranking of the constraints is given in (3).

(3)  *[dental], *[palatal]&Dep[alveolar] >> Palatalization >> *[palatal], Dep[alveolar]

Tableaux for target [Bi], [si] and [j] are shown in (4).

\[
\begin{array}{|c|c|c|c|c|}
\hline
\hline
\text{a} & /\text{[dental]}j/ & ! & ! & ! & ! & ! \\
\text{b} & /\text{[alveolar]}j/ & *[dental] & *[palatal]& Dep[alveolar] & Palatalization & *[palatal] & Dep[alveolar] \\
\text{c} & /\text{[alveolar]}j/ & *[dental] & *[palatal]& Dep[alveolar] & Palatalization & *[palatal] & Dep[alveolar] \\
\hline
\end{array}
\]

The same analysis can be applied to either of the assumed representations for target [Bi] – with or without [dental]. The question of which representation is employed by the learner depends on certain ancillary assumptions within OT, relating to perception and Lexicon Optimization, discussed in Smolensky (1996). Once the issue of perception is involved, it is not as clear any longer which analysis is “abstract.” The less-specific analysis in which target [Bi] is represented without [dental] is less abstract in terms of the relation between the UR’s and the production outputs. But representing target [Bi] with [dental] makes for a simpler relation between the UR and the presumed perfect perception of the target. We will return briefly to this question in section 5, below.

4 The Ontology of Constraint Rankings

Having completed the analysis in the previous section, we much now ask ourselves how the learner would construct such an analysis. That is, what is the technical implementation of the chain shift and what is the evidence employed by the learner to induce this form of the grammar? The answer to the first question is the constraint ranking proposed in (3). But what can the various rankings be attributed to? There are three plausible answers to this question – 1. Universal Grammar (UG, i.e. the initial state of CON), 2. the persistence of rankings from the I.I (i.e rankings motivated within the grammar of Korean which depart from UG), and 3 rankings learned from the target language (i.e. rankings motivated within the grammar of English which depart from UG). Unfortunately, none of these three possibilities straightforwardly apply to all of the constraint rankings here. Let us consider each one in turn.
The high ranking of *[dental] can plausibly be attributed to UG, according to the Biased Constraint Demotion (BCD) algorithm of Prince and Tesar (2000), in which the initial state of CON has all Markedness constraints ranked above all Faithfulness constraints (schematically M >> F). Since *[dental] is a Markedness constraint, and there is no reason to demote it in the Korean L1, it is perfectly reasonable to have it high ranking in the initial acquisition of the English L2. Obviously, the ultimate accurate acquisition of English pronunciations will eventually require *[dental] to be demoted. The low ranking of Dep[alveolar] is likewise not surprising given BCD considerations as it is a Faithfulness constraint. We can view this low-ranking as simple persistence from UG.

Since Korean also has (allophonic) palatalization, the ranking of Palatalization >> *[palatal] is motivated within the L1 grammar of Korean, and therefore it is also not surprising to observe this ranking in the interlanguage. This is a case of the persistence of a ranking from the L1.

But now consider the conjoined constraint *[palatal]&Dep[alveolar] which is crucially ranked above Palatalization. Where is this constraint ranked in UG? Or in Korean? The position of conjoined constraints in UG is not entirely clear within the theory. Smolensky's original formulation of constraint conjunction posits the construction of conjoined constraints only as the data warrants. In other words, there are no conjoined constraints in the initial CON, and constraint conjunction is a new method of relating constraints (in addition to the regular ranking), and is invoked only as a last resort to extend the usual constraint set. This position has a number of attractive consequences, one of which is a universal principle whereby a conjoined constraint A&B must outrank its constituent constraints A and B. Prince and Tesar take a different point of view, but it is not entirely clear how they would rank such constraints in UG. However, another tenet of OT, the Richness of the Base, comes into play here. OT eschews direct constraints on underlying forms; the set of available underlying forms is arrived at only indirectly through constraint ranking and Lexicon Optimization (see especially Smolensky (1996)). Since Korean does not contrast place specification in fricatives at all, Richness of the Base insists that we offer an analysis that can deal with any proposed representation for fricatives. The obvious alternative within Korean that we must consider are the presence or absence of [alveolar] from the underlying representation of the Korean fricatives. But [alveolar] is predictable, and *[palatal]&Dep[alveolar] is not motivated by the facts within Korean Lexicon Optimization will prefer that we store the fricative with [alveolar], but Richness of the Base insists that we consider what would happen to a form without [alveolar].

To summarize, since there are no facts within Korean motivating the restriction of Palatalization to just underlyingly [alveolar] segments, we must conclude that Korean does not offer any motivation for *[palatal]&Dep[alveolar] to be ranked highly. Since there also seems to be no good motivation for ranking conjoined constraints highly in UG (in fact such a ranking flies in the face of having pure Markedness constraints undominated in UG), we must therefore conclude that we have no principled reason to rank *[palatal]&Dep[alveolar] where it is in (3). That is, its ranking is not motivated by UG, nor by Korean, nor by the target language English, none of which have the chain shift. In fact, adequate mastery of English will remove the need for this constraint entirely, as eventually Dep[palatal] will come to dominate Palatalization. So the question for this OT analysis is: why do learners conjoin *[palatal]&Dep[alveolar] rather than simply raising Dep[palatal] to its appropriate location in the target grammar? Why do the learners invent a more opaque grammar than the target language requires? Can we get a better explanation by using rules? We will turn to that question now.

5 A rule-based analysis

Lombardi (2001) presents a bleak picture of the prospects for a rule-based analysis of the chain-shifting facts:

"In a rule-based phonology such effects are disturbing on the face of it. Since there are no interdentals in the L1, there is no way the speaker as a child could have acquired a rule that changes the interdentals to anything else; there is no L1 data on which to base such a rule."

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This view assumes that rules are written for and operate on phonemes such as /θ/ But that is not the position of Generative Phonology. Rather, rules are written in terms of features, and anything matching the feature description (including non-native sounds) will be subject to the rule. That is, the hypothetical rule θ → s is a red herring. That is not the analysis. Instead, the rule-based analysis employs the two rules in (5).

\[\begin{align*}
(5) & \\
& \text{a. Palatalization:} \\
& \quad \text{Coronal [palatal]} \\
& \quad \text{x} \quad \text{x} \\
& \text{b. Defaults:} \\
& \quad [\text{fricative}] \rightarrow [\text{strident}], [\text{alveolar}] \\
\end{align*}\]

The Palatalization rule (5a) spreads the [palatal] features (whatever they are, presumably [high front]) onto a preceding Coronal. This is a process in the L1 grammar of Korean, and it is restricted to Coronal segments, as there is no significant palatalization of velars in Seoul Korean. The Defaults rule (5b) encodes the default implementation of fricatives as strident and alveolar in Korean. That is, this is the rule statement that all fricatives are strident and alveolar in Korean. The inventory restrictions in Korean (and all other languages) are a combination of UR underspecification and default implementations rules. The rules in (5) are similar to (though more general) than those discussed in Cho and Lee (2000), who further assume that the rules are extrinsically ordered. But Generative Phonology has a number of principles of intrinsic rule-ordering. In the present case the features in (5a) are all active in the phonology of Korean to provide basic contrasts. Coronal is contrasted with Labial and Dorsal in all Korean stops, and the [palatal] features ([high] and [front]) are necessary to encode the Korean vowel contrasts. In addition, the Palatalization rule can be rendered opaque in two different ways through the operation of later rules of Korean, as shown in (6).

\[\begin{align*}
(6) & \\
& \text{a. UR /syn/ ‘fifty’} \\
& \quad \text{Palatalization s’yn} \\
& \quad \text{y-Breaking [s’win]} \\
& \text{b. UR /s’ut-ita/ ‘write’} \\
& \quad \text{Palatalization —} \\
& \quad \text{ur-Deletion [s’ida]} \\
\end{align*}\]

The form [s’dwin] shows opaque surface over-application of Palatalization whereas the [s’ida] shows opaque surface under-application of Palatalization.

Thus, we have good evidence that the Palatalization rule is in the core part of the phonology of Korean. The situation is different for (5b) The features that it introduces – [strident] and [alveolar] – are not particularly active in Korean. The [strident] feature is a likely candidate for the representation of the affricates as [strident] stops, but [alveolar] has no direct, active role to play in Korean phonology. The strong hypothesis would then be that rules such as (5b) are in fact added at the interface with phonetics, that no phonological rule can follow them within Korean. Thus, we have strong reasons to believe that the ordering of (5a) before (5b) is intrinsic, as it follows from general principles of rule-ordering and it accords with the empirical fact that it is phonologically opaque.

Now we must ask ourselves: What do Korean learners recover from the acoustic signal when they hear an English [θ]? I believe that the most likely answer is that they recover only a bare [fricative] specification. The acoustic cues to place in [θ] are very weak at the best of times, and there would be good reason for learners of Korean to “tune” their acoustic detectors for Coronal to exploit the stridency cues present in those fricatives. This is a novel situation in the L2. The input seems degraded from their Korean expectations (they seemed to utter a bare [fricative]!). Either the Korean learners infer Coronal as well in such cases (in which case they can’t yet contrast between target [θ] and target [s]), or they must infer a Coronal/Ø contrast in fricatives.

The situation is similar with English [ʃ]. As in the OT account, the listeners recover a sound with both [alveolar] and [palatal], a combination available in Korean, but only as a result of the operation of (5a). They must now admit in their L2 the feature combination [alveolar palatal] into UR’s as well as in SR’s.
As with the OT account, it is absolutely necessary that the UR’s be expanded from the established
Korean L1 set. The chain shift data shows three behaviours so we must conclude that the learners have
acquired representations that contrast the relevant sounds. Again, as with the OT analysis, it is
reasonable to conjecture that they recover very little from the weak fricative [θ] – only [fricative]. And
it is also reasonable to assume that they recover [alveolar] falatal] from the target [s], a mistaken
impression based on the Korean L1 pattern. The difference is that the rule-based analysis has no
analog of OT’s Richness of the Base, and therefore with different UR possibilities comes different
possible outcomes for the rules.

We are now in a position to see what the rules will do given different inputs, as shown in the
derivations in (7).

<table>
<thead>
<tr>
<th>Palatalization</th>
<th>Korean</th>
<th>English targets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>rière Cor pal]/</td>
<td>0 s</td>
</tr>
<tr>
<td></td>
<td>[fric Cor pal]/</td>
<td>[fric Cor pal]/</td>
</tr>
<tr>
<td></td>
<td>[fric Cor pal]/</td>
<td>[fric Cor pal]/</td>
</tr>
<tr>
<td></td>
<td>[s']i</td>
<td>[s']i</td>
</tr>
</tbody>
</table>

The chain-shifting behaviour results immediately when we assume the underlying representations
employed in (6). That is, the only thing that we have proposed has been learned by the Korean learners
is that English has more underlying fricatives than Korean does. This was also assumed in the OT
analysis (and is required of any analysis). But in order to generate the opacity in OT we needed to
introduce the conjoined constraint *[palatal]&&Max[alveolar] whose ranking was not motivated in UG.
Korean or in English. Thus, the spontaneous opacity of the chain shift did not fall out of the OT
analysis of Korean. In contrast, the opacity does directly fall out of the rule-based analysis. As soon as
additional UR’s are inferred, the chain-shifting behaviour results immediately.

6 Restricting rules out of existence

What about the rest of the acquisition of English pronunciation? The Korean learners don’t fossilize at
the chain-shifting stage, so what else do they learn? In the OT account they must eventually raise
Dep[palatal] and lower *[dental]. In the end this will obliterate the need for *[palatal]&&Dep[alveolar],
whose work will be done more directly with Dep[palatal]. In the rule-based account the learners must
efface the operation of the rules (5a) and (5b) Eckman and Iverson (1997, 1999) offer data and an
analysis which is directly on point here. At least some Korean learners go through a stage where they
restrict (5a) to operate only in derived environments in their interlanguage. At such a stage they
pronounce ‘see’ correctly, but continue to palatalize in derived words such as ‘mess-y’. If blocking in
non-derived environments is a property attached to a process (as it is in rule-based Lexical Phonology)
this restriction is easily understood as a guess on the part of the learner as to how to reduce the
operation of the Palatalization rule. If, instead, blocking in non-derived environments is handled
through constraint conjunction in OT, we can construct an argument exactly parallel to the one offered
here. In OT, the learner must go through a more complex intermediate stage with a high-ranking
conjoined constraint to model the opacity. Again, the opacity follows as an immediate consequence
when processes are modelled as pertinacious rules, but involves otherwise unmotivated constraint
rankings when processes are modelled as the interaction of constraints.

7 Conclusion

The data considered here are exceedingly simple. Korean learners of English show a chain shift in
their production of the English targets before high front vowels: θ → s → j. Since chain shifts are
necessarily opaque, this is not a favored result in surface-oriented approaches such as OT. The
constraint-conjunction analysis of this chain-shift requires a high-ranking constraint whose position in
the hierarchy does not follow from UG, the L1 or the target L2. Therefore, the learner must postulate
this ranking without any evidence, and therefore the chain shift should not arise spontaneously. In
contrast, the rule-based analysis predicts spontaneous chain-shifting behaviour because of the intrinsic ordering of the rules in the L1. Opacity is a pervasive, ubiquitous property of human languages, so much so that L2 learners spontaneously invent new opacities not present in either their L1 or their target L2. Such spontaneous opacities are only adequately explained by assuming that processes are implemented as intrinsically ordered rules.

Acknowledgements

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References


Iverson (p.c.)

[ˈsimpəsə] “sympathy”