Unmarked Structures and Emergent Rankings in Second Language Phonology[1]

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Abstract

One of the most interesting features of language contact situations involves the appearance of systematic patterns that are not manifested in either of the two languages in contact. A full analysis of such patterns may require constraint rankings that differ from those of both the native and the target languages. I examine possible sources of these constraint rankings with respect to the devoicing of final obstruents in learners whose native language contains either no final consonants or no final obstruents, and whose target language contains both voiced and voiceless final obstruents. I conclude that the interlanguage ranking follows from the frequency of different input structures, given the assumption that constraint rankings are stochastic (Boersma and Hayes, 2001), and that final devoicing is an effect of positional markedness constraints. I then consider possible alternative explanations of interlanguage final devoicing: as a reflection of native language rankings of positional faithfulness constraints; as an effect of perceptual filtering; and/or as a function of articulatory difficulty of sustaining voicing in final position.

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Introduction

One of the most interesting features of language contact situations involves the appearance of systematic patterns, either in loanword adaptation or in interlanguages, that are not manifested in either of the two languages in contact. Such patterns, which appear not to be motivated by the input data, have often been taken to reveal universally preferred structures that emerge in the flux of grammar construction. While it has long been recognized that universal principles of markedness play a role in second language acquisition, it has not been clear how these principles shape the grammar.

The framework of Optimality Theory provides a partial answer to this question, since this framework assumes a universal set of constraints that are present in all grammars. Among these are constraints that mandate particular types of prosodic structure (universally preferred syllables, feet, and prosodic words) and universally preferred patterns of alignment between prosodic and morphological categories. Because languages differ in how these universal constraints are ranked, not every constraint will play a visible role in a particular language. But each constraint is nonetheless assumed to be part of the grammar of each language, and language contact may sometimes create situations in which those constraints that are ranked so low in the native language as to have no visible effects can emerge as visible forces in shaping the form of outputs. For example, many researchers have noted that when Mandarin Chinese learners of English attempt to produce English words ending in consonants that are not permissible codas in

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Mandarin, they show a tendency to insert a final vowel when the English form is monosyllabic, but to delete the final consonant in bisyllabic inputs (Heyer, 1986, Wang, 1995, among others). A similar tendency toward producing bisyllabic outputs has been attested in the adaptation of loanwords in Cantonese (Silverman, 1992, Yip, 1993); Silverman (1992) reports retention of [r] in input 'print,' rendered as *pilin*, but deletion of the [r] in bisyllabic 'printer,' rendered as *pinta*. As Yip (1993) and Broselow, Chen, and Wang (1998) argue, this preference for bisyllabic outputs can be seen as the effect of universal constraints mandating that each word should contain a foot, that optimal feet are binary (in this case, bisyllabic), and that ideally, each foot edge is aligned with the edge of a prosodic word. The preference for bisyllabic words follows from the interaction of these constraints, since they are best satisfied by a word consisting of a single bisyllabic foot. For native speakers of Mandarin and Cantonese, the native language does not provide direct evidence for such constraints, because otherwise pronounceable monosyllabic input words are produced faithfully (in contrast to languages such as Lardil, in which a monosyllabic input is augmented by addition of a vowel (Prince and Smolensky, 1993)). But the language learning situation provides a richer range of inputs, including monosyllables that are not pronounceable according to the patterns of the target language. In Mandarin Chinese, obstruents do not constitute licit syllable codas, and native language inputs lack final obstruents. English inputs, however, frequently contain final obstruents. At the stage in which the learners' interlanguage grammar will not allow the faithful production of obstruent codas, this violation of coda constraints is repaired, either by inserting a vowel or by deleting the offending consonant. Because the L2 input cannot be produced faithfully, faithfulness constraints will be violated by

any repair option, either deletion of the consonant or insertion of a final vowel. The choice of repair strategy then falls to the latent constraints favoring bisyllabicity. Thus, the answer to the question of how universal principles are incorporated into the interlanguage grammar is this: these universal principles were present in the grammar all along, but become visible only given the wider range of inputs provided by the second language.[1]

However, while this approach accounts for some aspects of the emergence of unmarked structures in second language phonology, it by no means accounts for all such cases. In many cases, a full analysis requires not just the presence of some constraint or constraints, but also very specific constraint rankings, rankings that may differ from those of both the native and the target language grammars (see Broselow, 1999, Davidson, Juszczyk, and Smolensky, 2000, Grijzenhout and van Rooy, 2000, among others). For example, the literature on second language acquisition contains a number of reports of learners devoicing final obstruents in the interlanguage, though neither the native nor the target language manifests any evidence for such devoicing (Eckman, 1981, Flege, McCutcheon and Smith, 1987, Yavas, 1994, Wissing and Zonneveld, 1996, Broselow, Chen, and Wang 1998, Grijzenhout and van Rooy, 2000, among others). This tendency to devoice final obstruents is consistent with the assumption (justified on the basis of language typology) that voiced obstruents are marked in syllable coda, and hence that universal grammar includes a constraint against voiced obstruent codas. But to explain this pattern (as well as many other patterns of interlanguage phonology), it is not sufficient to say that a constraint against voiced obstruent codas is present in the interlanguage grammar. Only a specific ranking of constraints will allow the constraint(s) against final voiced obstruents to play

an active role in the interlanguage.

In this paper, I will examine possible sources of the constraint rankings of interlanguage grammars, to determine whether these rankings can be motivated solely by input data (either from the native or the target languages), or must be considered a reflex of universal default rankings. I begin by sketching a model of second language acquisition within standard Optimality Theory. I then show that the constraint rankings required to describe the tendency to devoice syllable-final obstruents in the interlanguage are in many cases not consistent with the rankings of either the native or the target languages. I argue that these interlanguage grammars can be understood by adopting the view of Boersma and Hayes, 2001 that constraint rankings are stochastic and that constraint reranking is a gradual process. I then consider alternatives to the explanation of final devoicing as a function of the ranking of constraints in the production grammar; reasonable alternatives would appeal either to perceptual filtering effects or to simple articulatory difficulty of voiced obstruents.

First Language Acquisition, Second Language Acquisition, and Loanword Adaptation

Work within the OT framework has yielded explicit hypotheses concerning the properties of the initial state of the grammar, the sorts of evidence that are required to change this state, and the developmental stages that are to be expected as acquisition proceeds. Recent proposals in OT provide a very clear model of first language acquisition. The initial state consists of a set of largely unranked constraints, though it has been compellingly argued (Gnanadesikan, 1995, Prince and Tesar,1999, Hayes, 1999) that initially, all markedness constraints (including those

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which inveigh against marked prosodic structures such as closed syllables and non-binary feet) outrank all faithfulness constraints (those that demand faithfulness to underlying representations). The initial ranking of markedness constraints above faithfulness constraints ensures that learners begin with the most restrictive grammar, one that allows only unmarked structures. Any deviations from this ranking are motivated by direct positive evidence in the form of structures which violate markedness constraints while obeying faithfulness constraints–for example, a child who begins with a grammar disallowing syllable codas (reflecting the dominance of the markedness constraint NoCoda over faithfulness constraints that would preserve codas) will not demote NoCoda unless exposed to syllables containing codas. As noted by Tesar and Smolensky (1998), Hayes (1999), and Prince and Tesar (1999), this provides a solution to the subset problem (Berwick,1985): if children initially posit a grammar that is less restrictive than that of their native language, only negative evidence would require them to retreat to a more restrictive grammar. This is a problem since children appear not to make use of negative evidence. If, on the other hand, children begin with the most restrictive grammar, all that is needed to force them to revise that grammar is positive evidence, consisting of input forms that are inconsistent with their initial, overly restrictive grammar.

This model is in principle applicable to second language acquisition as well, with one difference. The learner who has acquired one language has presumably acquired a set of constraint rankings consistent with the data of that language. The well-known phenomenon of language transfer can be accounted for by making the reasonable (though not uncontroversial) assumption that the initial state for second language acquisition differs from the initial state of

the child acquiring a first language, in that the L2 learner begins with the rankings motivated by the L1 data.[2] In the course of learning the second language, the learner will encounter L2 data that is not consistent with the L1 grammar, and will begin to construct an L2 grammar by reranking the constraints to generate L2 forms. Learners will achieve varying degrees of success, ranging from complete transfer of L1 rankings, through fossilization at various midpoints between the L1 and L2 grammars, to complete mastery of the L2 grammar.[3]

Adaptation of loanwords can also be described as a function of the differences in constraint rankings in the grammars of the lending and the borrowing languages. Borrowers begin with the rankings of their L1, which are often contradicted by the non-nativized loanword forms. The final outcome of borrowing will vary according to the degree of language contact and bilingualism in a speech community. Frequently, borrowed words are fully nativized in accord with L1 rankings; for example, English, which forbids [h] in syllable codas, will delete coda [h] in words borrowed from Arabic (e.g., *ahmad*). However, sufficient borrowing may indeed affect the L1 grammar by loosening restrictions on possible structures; for example, a sufficient number of words beginning in palatal fricatives followed by consonants (*shtick, shlemiel*) have been borrowed from Yiddish into English that most English speakers will produce these onsets faithfully, though native vocabulary lacks such initial clusters. And in situations of prolonged and consistent language contact, the rankings of the L1 grammar may be altered to accommodate the borrowed forms (for example, in pre-Norman English, [v] was restricted to intervocalic position, but the influence of French led to the relaxing of the restrictions on the distribution of this sound in English). These three models–of first language acquisition, second language acquisition, and loanword adaptation–can be summarized as in (1), where M signifies the set of markedness

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constraints, and F the set of faithfulness constraints:

(1) a. First language acquisition

     Initial state: M>>F

     Input: NL data, causing ranking of some F >> some M

     Final state: Adult grammar

  b. Second Language Acquisition

     Initial State: L1 rankings, based on NL data

     Input: TL data, causing some reranking for IL grammar

     Final state: Grammar ranging from fossilization of interlanguage to full mastery of L2

grammar

  c. Loanword Adaptation

     Initial State: L1 rankings

     Input: Foreign language forms

     Final state: ranging from preservation of L1 rankings (full adaptation of borrowed words) to

      revision of L1 grammar to accommodate borrowed forms

All three models assume accurate perception on the part of the learner/borrower, though it is equally

likely that all or some errors and adaptations are caused by learners' or borrowers' failure to

accurately perceive contrasts of the target or lending language (see Silverman, 1992, among others).

We will return to the question of perception below.

     The four possible types of rankings among any pair of constraints are as in (2):

(2)   a. M >> F

     b. F >> M

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    c. M >> M

    d. F >> F

The ranking (2a) with a particular markedness constraint above a faithfulness constraint, represents the initial state ranking, while the other three ranking possibilities presumably arise only after confrontation with input data that motivate reranking. In some cases, however, input data is insufficient to motivate crucial rankings for every pair of constraints. It is unclear in this case what the endstate of the native language grammar will be: Tesar & Smolensky (2000) argue that learners choose (presumably arbitrarily) some fixed ranking for constraints whose relative ranking is indeterminate, while Ross (1996) argues that such constraints are left to 'float,' with no fixed relative ranking. Thus, cases in which interlanguage data or loanword adaptations require crucial rankings like the ones in (2b-d), and where that ranking is not motivated by the data of either the native or the target language, can potentially shed light on this issue.

    In the following sections I discuss a case in which a preference for particular prosodic targets (less marked syllables) emerges in second language acquisition or loanword adaptation. This pattern appears to require a ranking of constraints as in (2c). And because this ranking is neither the default M>>F ranking, nor consistent with the data of either the native or the target languages, it provides an important probe into the process of the acquisition of constraint rankings.

Final Obstruent Devoicing (M >> M): A Constraint Reranking Analysis

    As is well known, languages frequently impose restrictions on what sorts of consonants may occur in syllable codas, ranging from a prohibition against any sort of coda to a prohibition of only certain consonant types. In the latter category, some languages (such as Mandarin Chinese) ban obstruents from coda position, while others (such as German, Dutch, Russian)

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allow only voiceless obstruents in syllable codas. We can derive these different restrictions on

codas from the following set of constraints:

(3)   a. NoCoda: Syllables may not have codas.

        b. NoObsCoda: Syllables may not have obstruent codas.

        c. NoVObsCoda: Syllables may not have voiced obstruent codas.[4]

Ranked with respect to faithfulness constraints that prohibit deletion of consonants, insertion of

vowels, or changing of features, these constraints give us the following (admittedly incomplete)

typology:

(4)   a. Type I (Tswana): no codas of any type

        NoVObsCoda, NoObsCoda, NoCoda >> F

        b. Type II (Mandarin Chinese): sonorant codas

        NoVObsCoda, NoObsCoda >> F >> NoCoda

        c. Type III (German): sonorant codas and voiceless obstruent codas

        NoVObsCoda >> F >> NoObsCoda, NoCoda

        d. Type IV(English): sonorant codas and voiced or voiceless obstruent coda

        F >> NoVObsCoda, NoObsCoda, NoCoda

Since the three markedness constraints range from more to less specific, it is not always possible

to determine their relative rankings. In Type I languages, for example, the high rank of NoCoda

automatically rules out obstruent codas, whether voiced or voiceless, making the other two

constraints irrelevant. However, I follow the model sketched above in assuming that in the

absence of conflicting data, markedness constraints outrank faithfulness constraints.

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An interesting second language phenomenon is the loss of TL voicing contrasts in syllable-final obstruents by second language learners, due to devoicing of final obstruents (as in the realization of English *bed* with a final [t]). Most strikingly, this phenomenon has been noted in cases where the native language of Type I or Type II allows no syllable-final obstruents of any type, and the target language of Type IV allows both voiced and voiceless obstruents in that position. In this case, neither the native nor the target language provides evidence for final devoicing. The literature on second language acquisition contains a number of reports of final devoicing of this type in both second language acquisition and loanword adaptation (see for example Eckman, 1981, Flege and Davidian, 1984, Flege, McCutcheon, and Smith, 1987, Yavas, 1994, Wissing and Zonneveld, 1996, Broselow, Chen, and Wang, 1998, Grijzenhout and van Rooy, 2000).

Final devoicing unmotivated by either the NL or the TL appears to pose a serious problem for a model of second language acquisition in which constraint rankings are motivated solely by input data. Take the example of Mandarin Chinese, a Type II language which allows only sonorant codas. To master English, speakers of Mandarin Chinese must move from the Type II ranking in (4b) to the Type IV ranking (4d) above. This process requires speakers to demote the markedness constraints prohibiting obstruent codas below the constraints mandating faithful realization of input structures. But as various studies have shown, Mandarin learners frequently exhibit an intermediate stage in which at least some voiced obstruent codas are produced as voiceless (Eckman, 1981, Flege and Davidian, 1984, Broselow, Chen, and Wang, 1998). The interlanguage grammar at this stage is essentially that of a Type III language like German, in

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which NoObsCoda has been demoted below the faithfulness constraints, but NoVObsCoda still

maintains a high ranking. This ranking will map an underlying final voiced obstruent onto a

voiceless output:

(5) Interlanguage Ranking

/bed/	NoVObsCoda	MAX(C), DEP(V)	NoObsCoda
a. bed	*!		*
b. be/bede		*!	
☞ c. bet			*

      This is a puzzling pattern, since neither the native language nor the target language

presents the learner with any evidence for a differential ranking of the two markedness

constraints NoVObsCoda and NoObsCoda: voiced and voiceless obstruent codas are equally bad

in the NL, and equally good in the TL. We can compare the rankings of the faithfulness

constraints with respect to the two markedness constraints, the more specific NoVObsCoda and

the more general NoObsCoda, in the three different grammars:

(6)   a. Native language: Mspecific, Mgeneral>>F (no obstruent codas)

          b. Target language: F>>Mspecific, Mgeneral (both voiced and voiceless obstruent

                                 codas)

          c. Interlanguage: Mspecific>>F>>Mgeneral

In the interlanguage grammar, the more specific markedness constraint NoVObsCoda must be

ranked not only above the faithfulness constraints (as the TL requires) but also above the more

general markedness constraint NoObsCoda (contra the TL ranking). The model of acquisition

sketched above requires that any deviation from the default ranking M1, M2...>>F1, F2... be

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motivated by the data available to the learner. But the learner will receive English input data requiring both the more specific and the more general markedness constraint to be demoted below the faithfulness constraints.

However, I will argue, this pattern does in fact emerge from input data, given a particular view of how reranking proceeds. Levelt and van de Vijver (1998), Boersma and Levelt (1999), and Boersma and Hayes (2001) have argued for a model of acquisition in which constraint ranking is sensitive to the frequency of different categories of input data. As in standard OT, constraints are envisioned as ranked along a linear scale, with some constraints higher than others, and following work by Tesar and Smolensky (1998), the acquisition of ranking is error-driven: upon encountering forms that are inconsistent with the grammar, learners will change constraint rankings so as to maximize the fit between grammar and data. But whereas much early work in the acquisition of constraint ranking abstracts away from the role of frequency of particular types of input forms in the data (and from the question of how much data is required to motivate the learner to rerank constraints), the model of Boersma and Hayes, 2001 builds in the role of frequency.[5] Rather than assuming that each constraint occupies one fixed point on the ranking scale, Boersma and Hayes (2001) express constraint rankings as probabilities, so that a constraint has a range of possible rankings. The central point on the bell-shaped ranking curve associated with each constraint is the ranking point that the constraint is most likely to occupy in any given instance of speech production. Thus, a constraint that is ranked at point 90 (for example) will have a rank of 90 in the majority of instances of production, but may in some small number of instances be ranked anywhere between 85 and 95. Each piece of input data results in

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"small perturbations to the constraints' locations on the scale" (Boersma and Hayes, 2001, page 46). This model therefore provides a direct connection between the frequency of different types of data and the rate at which constraints will be reranked.

Once input frequency is taken into account, it is easy to see how the learner could arrive at a stage in which the more specific constraint NoVObsCoda is ranked higher than the more general constraint NoObsCoda. The learner has begun with both markedness constraints ranked above the constraints that mandate faithful realization of obstruent codas, and this ranking has not been contradicted by any native language data. But in attempting to master English, the learner is confronted by numerous forms that violate this ranking, consisting of words that end in obstruents, such as *bet* and *bed*. Each obstruent-final datum encountered provides an impetus for demoting NoObsCoda below the faithfulness constraints, leading to preservation of syllable-final obstruents. Under the weight of this evidence, NoObsCoda will creep down the ranking scale to a position below the faithfulness constraints. Similarly, words ending in voiced obstruents (such as *bed*) provide evidence for demoting the more specific constraint NoVObsCoda, as well as the more general NoObsCoda. But the descent of NoVObsCoda will necessarily proceed more slowly, because the evidence for this demotion is less abundant-- while every form that violates the more specific constraint also violates the more general constraint, the reverse is not true. Given this, we should expect a stage in which NoVObsCoda is ranked above NoObsCoda-- and indeed, we would predict that in both first language and interlanguage grammars, we should find patterns like these in which a more specific markedness constraint is ranked above a more general markedness constraint. Children do tend to avoid final voiced obstruents even after they

have acquired final nasals and final voiceless obstruents; among the strategies they use to avoid

final voiced obstruents in English are deletion, nasalization, and final devoicing (Smith 1973,

Clark and Bowerman, 1986, Stemberger, 1996).

Probabilistic Constraint Ranking and Output Variation

The probabilistic approach to constraint ranking has another desirable result. Second

language learners typically exhibit a good deal of variation, so that one speaker may in the course

of a single day (or even a single experiment) devoice final voiced obstruents, delete final

obstruents, insert vowels after final obstruents, and produce final obstruents, even voiced ones,

faithfully (see Broselow, Chen, and Wang, 1998, Xu, 2003 on variation in Mandarin speakers'

production of final voiced obstruents). The possibility of variation is built into the Boersma and

Hayes, 2001 model, where constraint rankings are probabilistic. That is, in standard Optimality

Theory, the ranking of constraints can be envisioned as a line, with each constraint at some fixed

point on that line; for example, if C1 is ranked at position 90 and C2 at position 85, then C1

dominates C2 (where the numbers 90 and 85 are simply arbitrary points illustrating the ranking

relationship of the constraints). In contrast, Boersma and Hayes (2001) argue that constraint

rankings should be envisioned not as a single fixed point on the ranking scale, but as a range of

points along that scale. At each instance of production (that is, each time the speaker converts an

underlying representation to a spoken form), a given constraint may be found at any position

within its ranking range. For example, the possible rankings of C1 could include the range from

95 to 85, while C2 could range from 90 to 80. Thus, while C1 will outrank C2 in the majority of

productions, in some instances the ranking may be reversed (when C1 is ranked at the bottom

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and C2 at the top of their respective ranges). This possibility of ranking reversal is the

mechanism that gives rise to variation in output forms, in Boersma and Hayes' system. (See Xu,

2003 for arguments that variation in Mandarin Chinese speakers' interlanguages can be modeled

using Boersma and Hayes' Gradual Learning Algorithm).

In the analysis of final devoicing above, the interlanguage grammar must not only rank

one markedness constraint (NoVObsCoda) over another (NoObsCoda), but also must rank one

set of faithfulness constraints over another (as pointed out by Grijzenhout and van Rooy (2000)

in their discussion of devoicing by Zulu speakers). While the constraints prohibiting insertion or

deletion of segments are ranked below NoVObsCoda, the constraint prohibiting change of a

feature (Ident(Voi)) must be ranked below NoObsCoda, since the winning (devoiced) form

violates this faithfulness constraint:

(7) Interlanguage Ranking

/bed/	NoVObsCoda	MAX(C), DEP(V)	NoObsCoda	Ident(Voi)
a. bed	*!		*	
b. be/bede		*!		
☞ c. bet			*	*

Since this ranking does not obviously emerge from the input data, we might look for evidence

that it represents a universal default ranking. Steriade (2000) provides possible evidence for such

a default ranking, noting that crosslinguistically, the strategy used by native speakers of Type I

languages to repair NoVObsCoda violations is final devoicing, rather than any of the logically

possible alternatives. She argues that this fact is grounded in perceptual similarity: an output

form differing only in the voicing of the final obstruent is acoustically closer to the input form than any of the logically possible alternative outputs. A universal default ranking of faithfulness constraints ensures that if final voiced obstruents are banned, they are realized as voiceless obstruents rather than as any less perceptually similar structure.

However, the second language facts do not fit so neatly with this picture, since in fact second language learners do also employ consonant deletion and vowel insertion as repair strategies. Given the large amount of variation among learners, it may not in fact be that the data motivate a fixed ranking of faithfulness constraints for any one speaker's grammar. These questions await careful speaker-by-speaker analysis.

Alternative Analysis: Transfer of Rankings

The account of final obstruent devoicing in interlanguage presented above relies upon a particular set of assumptions: that the learners correctly perceive target language voicing contrasts, but fail to produce them because their production grammars prevent realization of voicing in certain positions, and that their production grammars contain positional markedness constraints in a subset-superset relationship (NoVoiObsCoda, NoObsCoda). In this section I consider alternative assumptions leading to alternative analyses of interlanguage final devoicing.

First, while maintaining the assumption that final devoicing is an effect of the learner's production grammar, we might appeal to a different set of constraints. An alternative analysis of final devoicing relies not on positional markedness constraints, but rather on positional faithfulness constraints (as proposed by Lombardi, 1999):

(8) a. *VoiObs: Obstruents must not be voiced

    b. Ident(Voi): An output segment must have the same voicing as its input correspondent.

    c. Ident(Voi)Onset: An output segment in onset position must have the same voicing as its input correspondent.

In this approach, the contrast between Type III and Type IV languages is accounted for by means of a general markedness constraint against voiced obstruents in any position (8a), which can be overridden by either a general faithfulness constraint demanding preservation of all voicing contrasts (8b), or a positionally restricted faithfulness constraint mandating faithful realization of voicing only in syllable onset (8c). The ranking Ident(Voi)>>*VoiObs gives Type IV languages like English (voiced obstruents are realized as voiced in all positions), while the ranking Ident(Voi)Onset>> *VoiObs>> Ident(Voi) gives Type III languages like German (obstruent voicing contrasts are realized in onset but not in coda). (I abstract away from other contexts, such as obstruents in clusters or before sonorant consonants; see Lombardi, 1999 and Steriade, 1999 for discussion).

      The positional markedness account sketched in the preceding section derives final devoicing in interlanguage phonology from the interplay between TL input data and the constraint reranking process; while the native language ranking would not predict final devoicing, the reranking caused by target language input would result in an intermediate grammar that permits voiceless but not voiced final obstruents. A positional faithfulness analysis, in contrast, may provide a different account of final devoicing: as a direct result of transfer of the native language constraint rankings. The model developed in Prince and Tesar, 1999 incorporates a Biased Constraint Demotion algorithm which encourages the ranking of

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markedness constraints above faithfulness constraints whenever possible. This bias would actually cause first language learners of Type I and Type II languages (with no final obstruents) to arrive at a native language ranking that would cause any final obstruents encountered in a target language to be devoiced. Consider a language that permits both voiced and voiceless obstruents in onset position, but has no obstruent codas. Learners hear both voiced and voiceless obstruents in onset position, pushing them toward the ranking Ident(Voi)Onset>>*VoiObs. But because no obstruents appear in non-onset position, learners have no direct evidence for the relative ranking of *VoiObs and the general Ident(Voi) constraint. However, they don't need such evidence to establish a ranking: the bias toward ranking faithfulness constraints as low as possible will cause the learner to rank the general faithfulness constraint Ident(Voi) below the markedness constraint *Voi, because this M>>F ranking gives the most restrictive grammar that is consistent with the native language input. The learner will therefore arrive at the ranking Ident(Voi)Onset>>*VoiObs>>Ident(Voi) for the native language grammar. In other words, in the absence of evidence to the contrary, learners will assume that final obstruents should be voiceless. Their native language ranking will therefore be precisely the one needed to describe the interlanguage final devoicing pattern:

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(9) Positional Faithfulness Account: NL ranking for language with voicing contrast in onset only

TL input: /bed/	Ident(Voi)Onset	*VoiObs	Ident(Voi)
a. bed		**!	
☞ b. bet		*	*
c. pet	*!		**

In the positional faithfulness account, then, the final devoicing pattern that emerges in the interlanguage results from transfer of the native language rankings (that is, the default ranking, in the absence of any obstruent codas, predicts final devoicing). The positional markedness approach, in contrast, does not require that the more specific NoVObsCoda and the more general NoObsCoda be ranked relative to each other in the native language grammar, since the interlanguage ranking of specific markedness>>general markedness emerges in response to the input data, which contains more violations of the general NoObsCoda than of the more specific NoVObsCoda constraint.

One additional difference between the positional markedness and positional faithfulness accounts is that in the positional faithfulness account, the final devoicing ranking is motivated only if the native language has a voicing contrast in onset position; otherwise, the native language offers no evidence for the ranking Ident(Voi)Onset>>*Voi. This is arguably not the case for all languages whose speakers devoice target language coda obstruents. Mandarin Chinese, for example, has a contrast between aspirated and unaspirated stops, but no voicing contrast per se. In order for the analysis of interlanguage final devoicing as transfer of native language rankings of positional faithfulness over markedness constraints to be applicable to the Mandarin case, we need to assume that Mandarin speakers identify the English voicing contrast

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with the Mandarin aspiration contrast. In contrast, the positional markedness analysis set forth in

the preceding section requires only that learners identify a target language voicing contrast. For

more extensive comparison of positional markedness and positional faithfulness constraints, the

reader is referred to Zoll, 1998, and to Prince and Tesar, 1999 for discussion of the learnability

issues with respect to positional markedness and positional faithfulness constraints, and of

constraints in a specific-general relationship. This is an area that requires further investigation.

Additional Alternatives: Appeal to Perception, Phonetic Implementation

To this point we have not questioned the assumption that interlanguage final devoicing of

obstruents is a result of the production grammar; that is, that learners correctly perceive target

language voicing contrasts, but that their phonological grammars specify the target surface

realization of an underlying voiced obstruent in final position as voiceless. However, it is

certainly possible that interlanguage final devoicing is a result not of the ranking of production

constraints in the interlanguage grammar, but rather of learners' faulty perception of the target

language data. Differences in perception due to linguistic experience are well documented (e.g.,

Flege, McCutcheon, and Smith, 1987), and it seems reasonable to suppose that learners whose

language does not have a voiced/voiceless contrast in coda simply do not perceive this contrast.

Of particular interest, then, are the findings of Wissing and Zonneveld (1996), who found that

production of final voicing contrasts in English by native speakers of Tswana clearly lagged

behind perception. Only 52% of the Tswana speakers' attempts at producing voiced obstruents

were heard as voiced by English speakers, with the remaining 48% heard as voiceless. But when

Tswana speakers were asked to classify native English speakers' final obstruents as voiced or

voiceless, their performance was significantly better: they correctly identified voiced obstruents 70% of the time, suggesting that their problems in production could not be explained exclusively by appeal to perceptual factors.

Perceptual filtering might play another role, however. The transcriptions of interlanguage productions are, after all, filtered through native speakers' perceptual systems. Thus, it is possible that learners really do produce a voicing contrast in their target language production, but do not control all the acoustic cues that are used to signal this contrast in the target language, leading to misperception by native speaking listeners (and transcribers). For example, a major cue for voicing used by English speakers is the length of the preceding vowel, so if learners correctly produced a distinction in voicing while failing to produce a vowel length distinction, we might expect English listeners to perceive no difference between their voiced and voiceless consonants. Here again, the findings of Wissing and Zonneveld (1996) are relevant, since their study showed that Tswana-speaking learners of English failed to reliably control either vowel length or voicing into consonant closure. And in a study of Chinese speakers' pronunciations of English, Flege, McCutcheon, and Smith (1987) found that native speakers of English sustained voicing in English final voiced stops significantly longer than did native speakers of Chinese. Thus it appears that the pattern of final devoicing in interlanguage cannot be invariably attributed either to learners' inability to distinguish voiced/voiceless contrasts, or to native language transcribers' inability to distinguish learners' realization of a consistent voicing contrast.

Yet another approach to accounting for final devoicing would be to explain the pattern not as a result of phonological constraint ranking but as a matter of phonetic implementation.

That is, learners might correctly perceive the contrast, and their interlanguage grammar might achieve a ranking of constraints that permits faithful realization of final voiced obstruents (that is, a grammar like that of native speakers of Type IV languages). But the articulatory difficulty of maintaining voicing in syllable-final obstruents would simply cause them to miss their target of final voiced obstruents. On this account, final devoicing is essentially a performance error, rather than a competence error. (For an analysis along these lines of native language devoicing in Type II languages, see Gafos, 2003.)

It is obviously difficult to tease apart the predictions of these various accounts of final devoicing, and each of these possibilities requires careful experimental investigation. In the final analysis, it seems likely that final devoicing is not a unified phenomenon, but rather has multiple sources; interlanguage final devoicing may result in some cases from misperception of the target language, in others from a production grammar that defines the phonological target as voiceless in final position, and in still others from a failure to correctly implement a voiced target.

Conclusion

Language contact situations provide a rich source of insight into the processes of language acquisition and universal grammar. The appearance of structures in interlanguages or in loanword adaptations that differ from those of both the native and the target languages provide potential evidence both for universal constraints and for unmarked constraint rankings. I have considered one such emergent ranking, the ranking of a more specific markedness constraint over a more general markedness constraint. I argued that this ranking can be seen to be data-driven, given a particular view of the relationship between data frequency and constraint reranking.

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Other possible 'hidden' rankings are not so easily explained; in particular, the bifurcation of constraints into two classes, markedness and faithfulness constraints, is clearly an oversimplification, and subcategories of constraints will no doubt turn out to be relevant to the question of what constitutes a default ranking. The investigation of language contact cases will provide an important tool in answering this question.

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1.As a reviewer points out, this provides another case in which second language evidence may shed light on native language grammars; see for example Broselow, 1988, Vogel, 1991.

2. See for example Schwartz and Sprouse, 1996, for discussion of the hypothesis that settings of the NL grammar are transferred to the target language learning situation.

3. A question which arises at this point is what happens to constraints whose relative rankings are indeterminate according to the first language grammar. Answers to this question have ranged from the claim that learners choose (more or less arbitrarily) some fixed ranking (Tesar and Smolensky 2000) to the claim that the constraints 'float' (that is, have no fixed ranking, Ross, 1996). I will argue below that in at least one case, the rankings that emerge in the interlanguage are a function of the interaction of the form of the constraints and the patterns of the input data.

4.Note that constraint (3c) could not be replaced by a constraint NoVoicedCoda, since this would rule out (quite common) voiced sonorant codas.

5.An alternative model for building in the role of frequency in acquisition is presented in Pulleyblank and Turkel, 2000.