Reinterpreting loanword adaptations: the role of perception

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ABSTRACT

Standard phonological accounts of loanword adaptations state that the inputs to the adaptations are constituted by the surface forms of the words in the source language and that the adaptations are computed by the phonological grammar of the borrowing language. In processing terms, this means that in perception, the phonetic form of the source words is faithfully copied onto an abstract underlying form, and that adaptations are produced by the standard phonological processes in production. We argue that this is at odds with speech perception models and propose that loanword adaptations take place in perception and are defined as phonetically minimal transformations.

1. INTRODUCTION

Loanword adaptations are transformations that apply to words when they are borrowed into a foreign language. Words from a source language that are ill-formed in the borrowing language are thus transformed into well-formed words.[1] The so-called repairs [3] involve general phonological processes, such as segmental (1a) and suprasegmental (1b) changes as well as epenthesis (1c) and deletion (1d). The examples in (1) concern English words borrowed into various languages.

(1) Repair strategies in loanwords

a. [rəntən]	<	*London*	Korean [2]
b. [wɔkmán]	<	*walkman*	French
c. [sɯfiŋkɯsɯ]	<	*sphinx*	Japanese [4]
d. [pe.si]	<	*pepsi*	White Hmong [5]

Linguists typically account for these adaptations in terms of the same conceptual framework used for standard phonological processes in the native language. That is, loanword adaptations are part of the native phonology and treated on a par with other phonological facts within the borrowing language.

Quite independently, psycholinguists have studied a different set of phenomena, pertaining to language-specific processing. Our processing system appears to be tuned for our native language. In particular, recent studies have demonstrated that the native language distorts the way in which we produce, but also memorize, and even perceive foreign sounds. The phenomenon of phonological 'deafnesses' that is, the inability or extreme difficulty to discriminate certain nonnative contrasts, involves segmental and suprasegmental contrasts, as well as contrasts based on the presence versus absence of a segment. Some examples are given in (2).

(2) Phonological 'deafnesses'

a. [liːd - riːd]	Korean listeners [6]
b. [vásuma - vasúma]	French listeners [7]
c. [ebzo - ebuzo]	Japanese listeners [8]

Interestingly, there is a substantial degree of formal similarity between the phenomena exemplified in (1) and those in (2). Indeed, the change from [l] to [r] in loanwords in Korean (1a) is echoed by the difficulty that Korean speakers have with discriminating between [l] and [r] (2a). Likewise, the stress shift in loanwords in French (1b) is paralleled by the difficulty that French speakers have with the perception of stress contrasts (2b), and the epenthesis in loanwords in Japanese (1c) by the difficulty that Japanese speakers have perceiving the difference between consonant clusters and those clusters broken up by the vowel [u] (2c). It is only deletion in loanwords (1d) for which no corresponding 'deafness' has been documented.

In this paper, we argue that the general similarity between loanword adaptations and phonological 'deafnesses' is no accident, and that loanword adaptations are not due to the phonological grammar, but rather, to perceptual processes involved in the decoding of nonnative sounds. These perceptual processes, we argue, are sensitive not so much to the phonological properties of the language as to its phonetic properties.

2. THE PHONOLOGICAL THEORY OF LOANWORD ADAPTATIONS

Standard linguistic accounts of loanword adaptations attempt to model these within the phonology of the native language. Their basic assumptions are that the input to loanword adaptations are constituted by the phonetic representation of the words in the source language and that the output is computed by the phonological grammar of the borrowing language [9,10,11,3,12,5]. Within a speech processing framework, this amounts to saying that in

[1] Recently, attention has been paid to transformations of foreign words that are well-formed in the borrowing language, but do not conform to some default pattern [1,2]. These transformations, which we might call regularizations, are not considered here.

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perception, the phonetic form of the source words is faithfully copied onto an abstract underlying form, and that adaptations are produced by the standard phonological processes in production.

Both assumptions are presently debated in the phonological literature. First, let us consider the nature of the input to the adaptations. Some authors explicitly mention faithful perception [3,12]. In their view, the phonetic representation of words in the source language is transparently available to the language user who performs the adaptation. By contrast, others have proposed that perception plays a limited role in loanword adaptations. In particular, both certain segmental changes and several cases of segment deletion have been argued to apply in perception [10,11,13,14]. Segment insertion as seen in Japanese, by contrast, is uniformly attributed to the production module. One should note that even though these linguistic analyses share the intuition that perception is not faithful, they do not rely on experimental evidence to attribute specific adaptation phenomena to perception.

Second, let us consider the nature of the adaptation process. Loanword adaptations generally receive a phonological analysis, according to which they constitute phonologically minimal repairs that render illegal foreign forms in conformity with the native phonology. However, more than one such phonologically minimal repair is often available. For instance, there can be more than one possibility to turn a non-native segment into a native one by a single feature change. Likewise, illegal consonant clusters can either be broken up by vowel epenthesis or undergo consonant deletion; in the former case, moreover, more than one vowel might be available for epenthesis. In the absence of evidence in the native phonology as to which repair should be applied, loanword adaptations appear to be unlearnable within a purely phonological grammar [15]. However, several authors, especially those who attribute a role to perception in loanword adaptations, have argued that the choice between two or more phonologically equivalent repairs is defined by a principle of phonetic minimality. For instance, Cantonese lacks the voiced fricative [v]. In loanwords from English, it is changed into [w], not [f], arguably because [w] more closely approximates the acoustic properties of English [v] [10]. In a similar vein, it has been argued that the choice for deletion rather than epenthesis in adaptations of illegal consonant clusters can depend on the phonetic implementation of the offending clusters in the source language. To give another example from Cantonese, both epenthesis and deletion are used to repair ill-formed syllable structure loanwords from English; words containing a final obstruent cluster undergo epenthesis if the final consonant is a fricative and deletion if it is a stop. It has been argued that this pattern is due to the fact that in English, fricatives have stronger phonetic cues than stops in word-final position, especially since the latter are often unreleased [10,11]. The final stop – being closer to ∅ than the fricative - is thus more apt to deletion. Finally, it has been argued that the inserted vowel in languages that apply epenthesis in loanword adaptations is phonetically the most unmarked vowel, i.e. the one that is closest to ∅ [1,14]. For instance, the default epenthetic vowel in loanwords in Japanese is [ɯ]; it is the shortest vowel of Japanese, and among the two vowels that systematically undergo vowel devoicing, i.e. [ɯ] and [i], it is the most central one.

To sum up, although standard phonological analyses assume that adaptations take place in production and are phonological in nature, it has been argued that at least some adaptations take place in perception and that at least some are defined by a phonetic rather than a phonological distance metrics. In the next section, we propose that indeed all adaptations apply in perception and that they are always phonetic in nature.

3. REPAIRS AS PHONETICALLY-BASED PERCEPTUAL ADAPTATIONS

We outline a novel and psychologically plausible model of loanword adaptations, which draws on current theories of speech perception. We distinguish a phonetic decoding module, which maps a continuous acoustic signal onto a discrete representation called the phonetic surface form, and a phonological decoding module, which maps the surface forms onto potential underlying forms. During phonetic decoding, a given input sound will be mapped onto the closest available phonetic category, where 'closest' is defined in terms of either acoustic proximity [16] or proximity in the sense of fine-grained articulatory gestures [17]; thus, phonological proximity as reflected in the featural structure of segments is irrelevant. Phonetic decoding, then, acts as a filter, in that many fine-grained acoustic details of speech sounds are lost as these sounds are mapped onto phonetic categories. With respect to nonnative sounds, this mapping is of course massively unfaithful, since the phonetic categories to which these sounds are mapped in the foreign language can simply be absent from the native one. A loss of contrast is the result. That is, if two nonnative sounds are closest to the same native category, they will both be mapped onto this category at the phonetic surface level and listeners will have difficulties perceiving the contrast.

The phonetic decoding module is thus the source of phonological 'deafnesses' at the segmental level (cf. 2a), and, by logical extension, responsible for the transformation of illegal segments in loanword adaptations (cf. 1a). In fact, given that nonnative sounds are recoded as native ones during perception, adaptations of illegal forms in loanwords take place during phonetic decoding in perception. Note that this explains why phonetic distance is relevant to the adaptation of [v] as [w] in Cantonese, mentioned above. The prediction is made that indeed all segmental adaptations are phonetically minimal transformations. Crucially, we argue that phonetic decoding equally accounts for suprasegmental 'deafnesses' and 'deafnesses' due to phonotactic

constraints (cf. 2b-c), as well as to the corresponding repairs in loanword adaptations (cf. 1b-d). That is, the phonetic decoder takes not only the inventory of segments into account but also those of suprasegments and syllables. Hence, nonnative suprasegments and syllable types are mapped onto the closest native ones. This, then, explains the role of phonetic distance in the deletion and epenthesis patterns in Cantonese and Japanese, respectively, mentioned above as well. More generally, we predict that loanword adaptations involving suprasegments and syllable structure will always be phonetically minimal transformations.

One caveat is still in order. Indeed, given that loanwords are typically introduced by bilinguals, who might or might not recode nonnative sounds in the same way as monolinguals do, it is important to consider the phonetic decoder in bilinguals. Perception experiments have shown that, firstly, the phonetic decoder is acquired very early in life, and, secondly, that it is relatively non-plastic, yielding phonological 'deafnesses' even in early and highly proficient bilinguals. Specifically, the acquisition of the native phonetic categories and hence of the phonetic decoding module has been documented to occur between 6 and 12 months of life [18,19]. Once acquired, the native categories remain quite stable, and it is extremely difficult for new categories to be added. The best documented case is that of the English /r/-/l/ distinction, for which performance by Japanese listeners remains nonnative even after extensive training [20]. Similarly, the Catalan distinctions between the high-mid and mid-low vowels are hard to discriminate even by highly proficient Spanish-Catalan bilinguals who have started to learn Catalan before the age of 6 [21]. In these two cases, it seems that it is difficult to construct a new category that would significantly overlap with existing ones. From these results, we conclude that the mapping of nonnative sounds onto native ones during phonetic decoding takes place in both mono- and bilinguals.[2]

4. TESTING THE MODEL

We propose that loanword adaptations take place during perception and are due to the automatic process of phonetic decoding, which maps nonnative sound patterns onto the phonetically closest native ones. In order to test our model, it is necessary to do research at three levels. First, an assessment should be made of the precise phonetic characteristics of productions in both source and borrowing languages. Then it should be examined whether the perception of the nonnative sound patterns are as expected on the basis of the phonetic distance between the source and target categories. Finally, the perception data should be checked against loanword data.[3] We briefly comment on each one of these.

For the phonetic study it is first of all necessary to define a universal distance metrics, by determining which acoustic-phonetic dimensions are relevant in measuring the distance between various types of sounds. Once such a metrics has been established, the acoustic space that sounds occupy, defined by their prototype and extension, can be determined in terms of these dimensions.

As to the perception study, the type of experiments to be run should be planned carefully. Perceptual processes compute multiple representations, some of which contain acoustic details, and others that are more abstract. It appears however, that subjects' abilities to make fine-grained acoustic distinctions during psychoacoustical experiments far exceeds their capacity to exploits these distinctions in real time speech processing, and, therefore, for the purposes of introducing loanwords. For instance, even very large acoustic differences can be ignored when it comes to recognizing words. An example is provided by native speakers of French, who can discriminate between items that differ in the position of stress (which is signaled by three salient acoustic cues: vowel duration, F0, and intensity), but only when the items are presented in isolation or in the context of minimal phonetic variability; when the stress contrast is presented in context with phonetic variability, and when the task imposes a high memory load, the performance drops to a very low level compared to that on a control consonantal contrast [7,23]. It is exactly under these circumstances, we argue, that discrimination experiments tap the phonetic decoder.

Finally, concerning the collection of loanword data, there are two possible confounds. The first one is the influence of orthography. In an extreme form, this influence can be seen in the French adaptation of Afrikaans *boer* 'Boer' as [boɛr], where the phonetic form of the source word, [bur], is not only a possible French form, but actually one with a higher phonotactic probability than [boɛr]. In more subtle ways, orthography can be expected to play a role in all adaptations that are either based on written input or done by speakers who know the spelling of the loanwords in the source language. The second confound is the fact that older loans might have entered the language during a stage in which certain sounds in either the source or the borrowing language had different phonetic characteristics. A case in point might be the English form *strike*, which has been adapted twice in Japanese, once as [sɯtoraiki] and once as [sɯtoraikɯ], the latter being used for the technical term in base-ball. A good approach to obtain 'clean' loanword data consists of providing native

[2] Note that even if bilinguals perform better on some nonnative contrasts than monolinguals do, this does not automatically imply that loanword adaptations involving those contrasts take place in production. Indeed, it might very well be the case that the bilinguals who introduce these loanwords pronounce them as in the source language and that the adaptations are subsequently done by the monolingual population. Consequently, our proposal that adaptations take place in perception would still hold.

[3] Such a triple approach has already been applied to the adaptation of tense and lax vowels followed by unvoiced stops in English loanwords in Japanese [22].

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speakers orally with non-words and asking them how they would integrate them into their native language.

5. CONCLUSION

To conclude, we propose a research program that aims at developing a psychologically plausible account of loanword adaptations. This requires a joint effort of phoneticians, phonologists and experimental psychologists.

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