# Grammatical and Non-Grammatical Factors in Loanword Adaptation

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**ABSTRACT**

This study extends the approach of loanword research to include not only phonological differences between borrowing and donor language, but also factors which may not depend solely on these differences, e.g. similarity, frequency and gradient grammaticality. The influence of these factors on the performance of English speakers in a shadowing task of Russian words with English-illegal initial clusters was tested. The frequency of potential adapted onsets in the English lexicon does not correlate with the strategy of adaptation. Judgments about the grammaticality of words containing illegal initial clusters and the similarity between pairs of words partially containing illegal onsets were obtained from English native speakers. Similarity of a target to an adaptation was shown to be a predictor of its rate of use. The perceived grammaticality of a target cluster influenced performance in two ways: high-grammaticality target clusters were modified less often, and low-grammaticality clusters were mostly associated with vowel epenthesis.

## 1 BACKGROUND

Loanwords are words from one language which are incorporated into another, the borrowing language, and in the process are usually adapted to fit the sound system of the borrowing language. Loanword research has traditionally viewed this process as a purely phonological one, with the input being the form of the word in the donor language, the output the form in the borrowing language, and the differences between the two grammars resulting in the mapping of one onto the other. The main issues have been whether this mapping is determined by (generative) rules or (optimality theoretic) constraints, and whether these are universal, i.e. active in all loanword adaptation processes, or mostly identical to the phonology of the borrowing language. The former view can be found in Paradis and LaCharite's (1997) Theory of Constraints and Repair Strategies, putting forward universal loanword principles such as favouring epenthesis of a new segment over deletion unless a threshold of two steps of changes is crossed (however, the notion of a step is not very precisely defined). With the rise of Optimality Theory the opposite view has gained ground, i.e. that loanword phonology is merely the native phonology 'in action', where the input is evaluated by the same hierarchy of constraints, possibly with a promotion of faithfulness in the hierarchy applied to foreign words (Ito & Mester 1998, Davidson 2001). Recently, however, there have been attempts to move beyond the traditional approach and to

incorporate e.g. perceived similarity (Steriade 2001, Kenstowicz 2001) into the adaptation process. This takes up the question whether loanword adaptations are purely grammar-driven, or whether other factors such as perception also play a role. Second language research has shown that the perception of foreign phonemes is influenced considerably by the learners' native phonology and thus a major source of mistakes and difficulties with the phonological system of the learned language. In loanword research the influence of the native system on perception has so far only been a minor focus, largely rejecting perception as a factor. Jacobs and Gussenhoven (2000) claim that humans possess a "universal phonological vocabulary", i.e. perceive sounds from other languages without mistake, and thus that perception plays no role in adaptation. Silverman (1992) maintains that foreign *segments* are adapted at the perceptual stage. Both Silverman and Jacobs and Gussenhoven agree that phonotactic differences between two languages, which are those concerning the possible combinations of phonemes, do not influence the perception of foreign words. In contrast, Dupoux et al. (1999) studied Japanese listeners perceiving the epenthetic vowels they insert between consonant clusters of foreign words to achieve CV structure. The conclusions are, however, problematic, as they are drawn on the basis of a long-standing loanword tradition with frequently used, established strategies of dealing with foreign words, rather than determining the *origin* of these strategies.

The present study gathers empirical evidence about the factors in loanword adaptation in the case of phonotactic differences, specifically with English speakers adapting (in a production experiment) Russian words that contain English-legal segments, but are illegal in English because of their initial cluster combinations. There are very few loanwords from Russian in English; this hypothetical rather than a real loanword situation was chosen to exclude confounding historical factors such as orthography and established strategies as in Japanese. Additional motivation to choose Russian as a source language comes from its wealth in consonant clusters, the majority of which are illegal in English, e.g. initial /dv, fp, vl, zb/. The aim of this paper is to study the influence not only of perception, but also of three further factors on performance, and the choice of strategy when confronted with phonotactically illegal foreign words:

*(1) degree of grammaticality*, as predicted by the hierarchy of violated constraints within Optimality Theory (e.g. sonority distance and Obligatory Contour Principle);
*(2) phonetic similarity*, as predicted by consonant similarity values calculated from structured specification (Frisch 1996);
*(3) frequency*, as measured in the CELEX database.

## 2 PRODUCTION TASKS

Initially it was necessary to determine the kinds of adaptation that occur when English speakers attempt to produce a Russian-sounding word, since there are no Russian to English loanwords. To this effect, production experiments with Russian pseudo-words containing initial clusters that are illegal in English were performed.

The first experiment was a shadowing task, in which participants were instructed to repeat the Russian words they heard. The results of this, however, can reflect the influence of a number of factors, including articulation, phonotactic wellformedness *and* perception. Therefore an orthographic task, in which the participants had to give orthographic

representations of what they heard[1], was added. This was meant to exclude articulation-based adaptations, and to focus on the role of perception. The expectation was that, if articulation is not the major factor, the results of the two tasks would differ only to a small extent.

Correct response rates were expected to be higher for English legal and marginal clusters, and lower for English illegal clusters. The rate of correct responses was predicted to rise with sonority distance (SD), since this has been the traditional measure of the legality of clusters, and English has been described as requiring a minimal SD of 2, except in s-initial clusters (see Davidson 2001). Any adaptations were predicted to result in an improvement of legality in English, either by changing the cluster to a legal sequence, be it a cluster or a single onset, or by increasing SD.

### 2.1 Production tasks

*Materials*. The Russian pseudo-words used in the experiments contained 22 initial consonant clusters of various types (e.g. stop-stop, fricative-stop, fricative-fricative). Of these clusters, two are legal in English (/sp, fr/), three are marginal in English (/sf, ʃp, ʃm/), and 17 are illegal in English (/pn, sr, zr, vr, vl, tv, dv, ps, ʃv, sv, zv, vz, pt, fp, vb, zb, ʒb/). Five pseudo-words were designed for each cluster, with the stress on the second syllable, and the vowels (/u, ʌ, ɛ, ɨ/) were chosen such that no palatalisation of the consonants occurred. These words were recorded by a female Russian speaker. One target word was excluded as faulty. This resulted in a set of 109 target words for shadowing.

*Participants.* 10 native speakers of British English (with no knowledge of Russian), recruited at the University of Edinburgh.

*Procedure*. The stimuli were presented via headphones, in randomised orders. In the first part participants were shown a computer screen with a carrier sentence with a gap marked for the target word, and were asked to read out the carrier sentence with the target after hearing the target word twice. The sentences were designed such that it was impossible to syllabify the first consonant ($C_1$) of the target word with the last syllable of the word preceding the gap, e.g. "Look at this fantastic ____ I bought!", where a $C_1$ of the target word other than /s, t/ cannot syllabify with the final /k/ of *fantastic*. The second part of the shadowing task consisted of repeating the stimulus without a carrier sentence after hearing it once. The experimenter activated the next target word after the response was complete.

*Analysis*. The responses were recorded and digitised, and analysed auditorily as well as using wide-band spectrograms.

*Results.* The most frequent repair strategies in both the sentence and word conditions were found to be vowel epenthesis (/ʒbe'dom/ > [ʒəbe'dom]) and segment changes of one or both consonants (/fpu'rot/ > [spu'rot]), followed by deletion (/vza'na/ > [za'na]). Roughly half the segment-change repairs resulted in a legal English cluster. For the other half there was an

[1] This might have been problematic in the case of a focus on vowels because of the nature of the English orthography, however with the consonants used here the transcriptions were unambiguous.

improvement in that the sonority distance between the two consonants was increased, e.g. /ʒbe'dom/ > [ʃbe'dom].

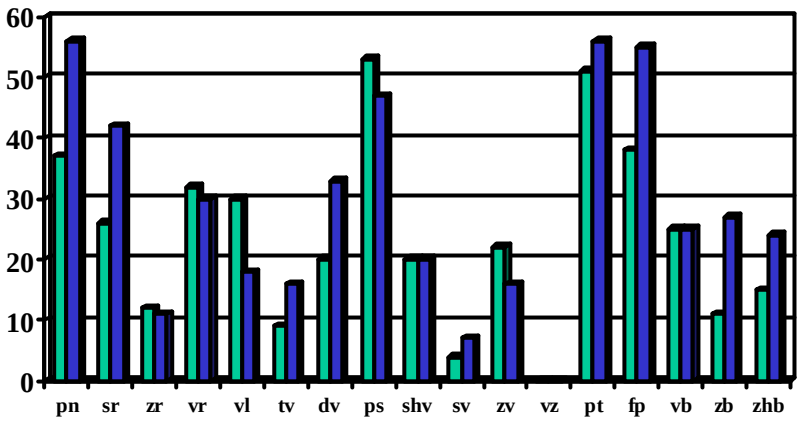


Figure 1. Rate of correct responses per cluster for shadowing task - sentence (left) and word (right) conditions.

Overall, 80% of adaptations improved the cluster in both the sentence and word conditions. However, the results showed large differences between the target clusters in terms of percentage of correct, i.e. unadapted, responses (Fig.1), as well as in terms of preferred adaptation. Targets with initial /dv/ were mostly epenthesised, /zb/ was frequently altered to /sb/, whereas /vz/ clusters were reduced to /z/ almost without exception. SD was not found to correlate with the rate of correct responses ($r_p$=.128, n=67, NS).

## 2.2 The orthographic task

*Materials*. The same materials were used and recorded onto DAT tape in randomised order, with two repetitions each.

*Participants.* A different group of 11 speakers.

*Procedure*. Participants were asked to listen to the two repetitions of each word from DAT player via headphones and to write down an orthographic representation that best fit the stimuli. There was no instruction of a specific notation system. The experiment was self-timed.

*Results.* This experiment yielded similar results to the shadowing task, with slightly more correct responses overall ($F(1,202)=5.439$, $p<.05$). An overall comparison of the types of changes that occurred in the different tasks shows that phonotactically triggered changes, i.e. those resulting in an improvement of the cluster, still made up about 50% of the responses, as can be seen in Figure 2.

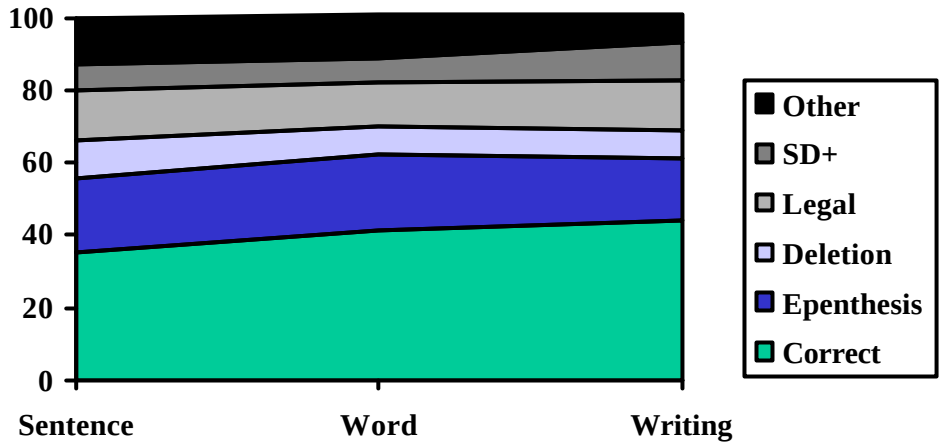


Figure 2. Percentage of adaptations in shadowing task (sentence and word) and orthographic task (writing).

*Discussion*. The similarity between the results of the two tasks, especially the high rate of adaptations even in the orthographic task, suggests that perception is influenced by phonotactic constraints to some extent. Furthermore, SD alone cannot predict the correct response rate, nor does it predict the differences in adaptation strategies, such as /vz/ > /z/ as compared to /zv/ > /sv/, although both target clusters have SD=0.

## 3 FURTHER EXPERIMENTS AND ANALYSIS

As sonority distance cannot predict adaptation strategies for Russian clusters used by English speakers, this section investigates three further possible factors.

### 3.1 Perceived similarity between target and adaptation

*Materials*. 102 pairs of initial sequences (e.g. /fp-sp/, /vz-z/, /dv-dəv/), each combined with 5 endings (/-ʌvoj/, /-ʌdʲiʃ/, /-ʌpat/, /-ʌsal/, /-ʌla/), with stress on the final syllable. The resulting list of 510 word pairs was divided into 2 lists of 255, to which 235 distractor pairs each were added to give two trial lists of 490 pairs. The words were recorded by a male native speaker of Russian.

*Participants.* 10 native speakers of English with no knowledge of Russian, recruited at the University of Edinburgh. Participants were paid £5 for taking part.

*Procedure*. Participants were familiarised with the method of magnitude estimation by numerically expressing judgments of line lengths (Bard et al. 1996) and then asked to use the same method to express their judgment of the similarity of word pair. The trial lists were presented via headphones in different random orders for each participant. After a practice block of 10 pairs the trial items followed in 25 blocks of 20. Five participants each gave judgments for the 2 trial lists. The experiment was self-timed.

*Results.* An ANOVA shows a main effect for the type of change ($F(3,2364)=85.350$, $p<.01$). The different types of change are epenthesis, deletion, segment change by a single feature (e.g. voicing or place of articulation changes), and combinations of changes. Homogeneous subgroup tests showed that epenthesis (mean similarity rating .382) and segment changes (.183) group together, as do deletion (-.298) and combination of changes (-.437).

### 3.2 Perceived grammaticality of target cluster

The same design as for similarity judgments was used, except where differences are pointed out.

*Materials*. 102 initial sequences (clusters, single onsets and epenthesised /CəC/) combined with 5 endings.

*Participants.* 10 further native speakers of English.

*Procedure*. Participants were asked to give judgments of the grammaticality of test words in reference to English.

*Results.* The variables tested for influence on the rating of grammaticality were SD, a violation of $OCP_{PLACE}$, and voicing as well as coronality of $C_1$ ($C_{1VOI}$, $C_{1COR}$) in clusters (the latter motivated by the cross-linguistically special status of coronal initial clusters, especially s-clusters). An ANOVA showed a main effect for voicing of $C_1$ ($F(1,2391)=9.791$, $p<.01$) only. Additionally, there were significant interactions between $C_{1VOI}$ and $C_{1COR}$ ($F(1,2391)=9.853$, $p<.01$) as well as $C_{1VOI}$ and sonority distance ($F(4,2391)=4.262$, $p<.01$) and $C_{1COR}$ and sonority distance ($F(3,2391)=2.731$, $p<.05$). Thus voiceless coronal $C_1$ has the highest rating, whereas voiced coronal $C_1$ has the lowest, with values for non-coronal clusters in between. Also, the coronality of the first consonant causes a high rating for fricative-stop clusters, which are lowest ranking in terms of SD, but occur in English (s-clusters).

### 3.3 Frequency

The frequencies of the target clusters and their adaptations, such as single onsets, other clusters or epenthesised /CəC/ sequences, were examined in the CELEX spoken corpus for English. Logarithmic type and token frequencies were found for English words beginning with each of these sequences. There was a significant correlation between type and token frequencies ($r_s= .962$, $n=75$, $p<.01$). Furthermore, there were correlations between grammaticality judgments and both type ($r_s=.634$, $n=27$, $p<.01$) and token frequencies ($r_s=.562$, $n=27$, $p<.01$), indicating that the lexicon may be decisive in judgments of grammaticality.

### 3.4 Analysis

To determine the relative influence of frequency, similarity, and perceived grammaticality on adaptation strategies that English speakers use, the frequency values and the overall means for the similarity and grammaticality judgments were compared to the results of the production tasks. The rate of adaptation was measured in relative percent, i.e. the percentage of non-correct responses only, which is a better measure of preference for a strategy than percentage of all responses. Four hypotheses were being tested:

$H_{1a}$: Higher perceived grammaticality results in higher rate of correct adaptations. A significant correlation was found ($r_s$= .470, n=61, p<.01) for illegal and marginal clusters, as well as for the full data set with legal target clusters included ($r_s$= .675, n=61, p<.01).

$H_{1b}$: Grammaticality influences the choice of adaptation strategy (epenthesis vs. deletion vs. segment change). There were no significant correlations between grammaticality and relative percent of deletion ($r_s$=.221, n=67, NS) and relative percent of segment change ($r_s$=-.049, n=67, NS). A significant negative correlation, however, was found in the case of epenthesis ($r_s$=-.508, n=67, p<.01), showing an association of epenthesis with low-grammaticality clusters.

$H_{1c}$: The frequency of a potential adaptation in the English lexicon predicts how much this adaptation will be used. Correlation tests for type and token frequencies did not yield any significant results (type: $r_s$= -.053, n=204, NS; token: $r_s$= -.111, n=204, NS). Frequency does not correlate with the rate of adaptation.

$H_{1d}$: The similarity between a target cluster and its potential adaptation influence the rate of this particular adaptation being chosen. A significant correlation was found between similarity and relative rate of adaptation ($r_s$= .518, n=147, p<.01).

## 4 DISCUSSION AND OUTLOOK

The way that English speakers deal with phonotactically illegal foreign words cannot be predicted on the basis of a dichotomy between grammatical and ungrammatical, or on grammatical factors such as sonority distance alone. For this reason further factors, which are, in contrast to the focus of loanword research, not purely grammar-driven, and their influence on adaptation strategies have been examined. Of these factors, the frequency of a sequence in the L1 lexicon is shown to be associated with its perceived grammaticality, and a better predictor for it than grammatical factors such as sonority distance and OCP violations. However, it is not a factor in the choice of one potential adaptation over another when speakers are faced with the task of dealing with an illegal sequence of phonemes in a foreign word. The perceived ungrammaticality of the target cluster, on the other hand, does influence this choice. Whereas it is not clear whether deletion and segment change have a specific target group, the strategy of vowel epenthesis is clearly associated with clusters of a lower grammaticality rating. The third factor, the perceived similarity between a target cluster and an adaptation, is a good predictor of which changes are made to target clusters. The more similar an adaptation is perceived to be, the more likely it is to be used. The form of adaptation English speakers consider to alter the sound of a sequence least is vowel epenthesis, followed by a single kind of feature change, whereas deletion and multiple feature changes are seen as more drastic. This is interesting firstly in the light of the fact that both epenthesis and deletion change the sequence by a whole segment (in this case a vowel as opposed to a consonant), whereas segment changes only constitute the alteration of a single feature, i.e. a much smaller unit. Secondly it shows that here the adaptation most similar to the target is chosen for the most ungrammatical clusters.

The next question to be addressed is now whether this perceived similarity is determined by L1 or by general principles, such as phonetic salience, which might influence the perceptibility of differences. This issue will be investigated by comparing Russian speakers'

similarity judgments on the materials presented to English speakers. Furthermore there is the possibility that the similarity judgments collected might have been compromised by a failure to perceive the stimuli correctly. If English listeners perceive illusory epenthetic vowels in illegal consonant clusters, as claimed for Japanese listeners in Dupoux (1998), this would provide an explanation of the high similarity rating for epenthesised adaptations reported above. This will be further investigated by comparing the results of the similarity and grammaticality judgment task above with the identical task, but with orthographic stimuli.

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