1 Introduction

All languages have a phonemic inventory, including a set of distinctive vowels and consonants, i.e. linguistic sounds that contribute to the meaning of a word. For instance, *chip* [ʃɪp] contrasts with *cheap* [ʃɪp] in English, on the basis of the vowel quality; in the first case, the high front vowel is lax, whereas in the second one it is tense. We therefore say that /ɪ/ and /i/ are two distinct phonemes (segments) in English (CHAPTER 11: THE PHONEME) and that [tense] is a distinctive feature (CHAPTER 17: DISTINCTIVE FEATURES) for high vowels in this language.\(^1\) While phonemic inventories are built in agreement with the principles of Universal Grammar (UG), the exact composition of a phonemic inventory varies from one language to another. Along with the suprasegmental inventory, the phonemic inventory is a good part of what allows a listener to identify a language at first glance and to distinguish it from other languages. We expect speakers to resist either dropping phonemes or phonemic contrasts from their language’s inventory, or introducing new phonemes and phonemic contrasts – although this constitutes the bread and butter of language change – since the automatic consequence of such moves is a different system. We believe that resistance to change cannot be due simply to inertia – it is not passive. In this chapter we will try to show that resistance to change is, above all, a question of contrast/category pattern resilience in the mind of the speaker, which is expressed intralinguistically (i.e. resistance to change due to the passage of time, dialect contact, etc.) and also interlinguistically (between L2 and L1, as will be illustrated in §3 with respect to loanwords). We will link contrast resilience to the traditional notion of Structure Preservation, providing a history of this notion in generative grammar in §2, and considering in §3 the question of whether it is still pertinent now that phonological rules have given way to constraints. We will also address the relation between Structure Preservation and phoneme/structure resilience in loanword adaptation from the point of view of L1 and L2. We conclude in §4.

\(^1\) Even if /i/ and /ɪ/ were to be distinguished by vowel length instead of tenseness, as proposed by some authors, the point made here would stand.
2 The history of Structure Preservation

It has long been noted that, intralinguistically, languages (or, more properly, their speakers) resist phonemic change before succumbing to and accepting a new phonemic contrast. Changes to a given phonemic inventory follow defined steps, which are gradual, and characteristically occur over a long period of time (chapter 2: Contrast). Although such sound changes can sometimes occur relatively rapidly, it is not unusual for them to take centuries to complete. Broadly speaking, a small phonetic detail becomes sufficiently large over time that what begins by distinguishing phonetic variants ends up being categorical, i.e. phonemic (see Harris 1990 and Bybee 2008 for a detailed description of these steps). Clearly, though, the forces of change are counterbalanced by resistance to change, or intralingual change would typically proceed at a much faster rate and produce much more dramatic results than it usually does (chapter 9: Lexical Phonology and the Lexical Syndrome).

The lexicon is the crucial place where the battle between the forces of change and resistance to change takes place. In Lexical Phonology, the resistance to using non-phonemic sounds or sound combinations at the lexical level was expressed through the notion of Structure Preservation (SP). In Kiparsky (1982, 1985), SP regulated the application of phonological rules, constituting a ban on the introduction of phonemes at the lexical level that are not part of the underlying inventory.

(1) Structure Preservation (Kiparsky 1985: 88)

If a certain feature is non-distinctive in a language we shall say that it may not be specified in the lexicon. This means that it may not figure in non-derived lexical items, nor be introduced by any lexical rule, and therefore may not play any role at all in the lexical phonology.²

The model assumed by Kiparsky is basically that in Figure 76.1:

![Diagram](Restricted Dictionary
Underlying phonological inventory; undervisible lexical items.

LEXICON
Word-formation rules, lexical phonology; domain of application of SP.

SYNTAX
Syntactic rules, post-lexical phonology; SP does not apply at this level.

Figure 76.1 Lexical Phonology (Kiparsky 1982)

² Kiparsky does not present this constraint formally. The constraint given here is a description of SP as presented in the text by Kiparsky (1985: 88).
As Harris (1987: 255) puts it, “the lexical segment inventory of a language (the output of the lexical rules) must be isomorphic with the underlying inventory.” Bybee (2008: 111) adds: “... alterations that are restricted to the word level involve only contrastive features. Segments or feature combinations that are non-contrastive must be introduced by postlexical rules ...”

Mohanan (1986) considers the formulation of SP given in (1) to be too restrictive. According to Mohanan, the Malayalam and English facts cannot be explained if SP is interpreted as in (1), so he softens it, saying instead, “the alphabet used for syntactico-phonological representations is the lexical alphabet” (1986: 174). The lexical alphabet refers to the phoneme inventory at the lexical level, which is the result of lexical (as opposed to post-lexical) application of phonological rules. In Figure 76.1, Mohanan’s lexical alphabet would be generated in the lexicon module by phonological rules that apply at this level. Of particular present relevance, the lexical alphabet in the view of Mohanan and Mohanan (1984) and Mohanan (1986) can contain distinctions that are absent from the underlying inventory (found in the restricted dictionary in Figure 76.1). The Malayalam case, detailed in Mohanan and Mohanan (1984), focuses primarily on contrasts in the system of nasals. The crux of the issue is that to achieve an elegant analysis of apparently complicated surface distributional restrictions on stops and nasals in Malayalam, one needs to assume that at the underlying level there are three nasals (bilabial, alveolar, retroflex), but that at the lexical level there are seven (bilabial, dental, alveolar, palato-alveolar, retroflex, palatal, velar). At the heart of their analysis is the clearly lexical application of two phonological rules (one that changes post-nasal voiced stops to nasals, and another that changes intervocalic [-continuant] velars to palatals when preceded by front vowels), which produces nasals with places of articulation that are not underlying for that class of sounds.

Still, the most widespread interpretation of SP in Lexical Phonology remains essentially the same: phonological rules are not expected to generate new phonemes or phonemic contrasts at the lexical level, nor are phonemes expected to undergo absolute neutralization at this level (CHAPTER 80: MERGERS AND NEUTRALIZATION). Any operations that introduce features that are not distinctive underlyingly are predicted to be necessarily post-lexical. For instance, French has a rich vocalic system that includes the mid-back lax and tense vowels /ɔ/ and /o/ (e.g. *hotte [ɔt] ‘hood’ vs. *haute [o] ‘high’). Although both vowels are frequent, /ɔ/ is prohibited word-finally in French (*ɔ/[^#/]), at the lexical level. If a morphological operation produces a word-final /ɔ/ in the course of a derivation in French, it is systematically turned into /o/. Various morphological operations generate such a result; they include abbreviation (e.g. Caroline [karolin] → Caro [karo], condonimation [kɔdominjɔm] ‘condominium’ → condo [kɔdo]), gender inflection (e.g. sotte [sɔt] ‘silly (fem)’ vs. sot [sɔt] ‘silly (masc)’), verbal and adjectival derivation (e.g. roter

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3 Sproat (1985: 454) says that Structure Preservation could be interpreted as a restriction on contrasts that are the output of lexical rules; rather than a restriction on underlying representations. However, as Harris (1987: 259) points out, “given its inherent circularity [this interpretation] of Structure Preservation is hardly worthy of serious consideration.”

4 Mohanan and Mohanan (1984: 590) and Mohanan (1986: 12) consider that phonological rules are all part of a single independent phonological module and that they interact with either the lexical or post-lexical level or both, according to their domain specifications. Application in one domain or the other is subject to different restrictions. Notably, lexical application is subject to SP; provided that SP is interpreted in the less stringent manner indicated above.
[ro] 'to belch' vs. [ro] 'belch' (N)), reduplication (e.g. *dormir [dɔrmir] 'to sleep' > *dodo [dɔdɔ] 'sleep (n., child language)'), etc. The result is always the same: */θ#/ → [θ]#. Nonetheless, the restriction */θ#/ in French does not apply at the post-lexical level. For instance, in Quebec French, final /a/ is systematically pronounced either as [ɑ] or [ɔ] (e.g. chocolat [ʃɔkɔlɛ], [ʃɔkolɔ] 'chocolat'; matelas [matlɛ], [matlɔ] 'mattress') or something in between, despite the fact that the lexical restriction */θ#/ also applies in this variety of French. We know that [ɔ] and [ɑ] are variants of /a/ in such cases because derivatives such as chocolaté [ʃɔkolɛt] 'with chocolat' and matelassé [matlɛsɛ] 'padded' indicate that the underlying vowel is /a/. Gradient and unstable rules such as /a/ → [ci] or [ɔ] in Quebec French are typically post-syntactic rules that are predicted not to occur at the lexical level (Mohan 1986: 174). The existence of clearly necessary categorical constraints, such as */θ#/ alongside the existence of forms that clearly do not obey them is the kind of case that SP is intended to explain: a phonetic process can apply at the post-syntactic level in spite of the fact that its effect contradicts that of a phonotactic constraint at the lexical level.

Another classic example of a lexical (hence structure-preserving) rule, is velar softening in English (and also in French), where /k/ yields [s] before a high front vowel (e.g. electric [ɪkˈtrɪk] vs. electricity [ɪkˈtrɪsɪ].) As reiterated by Bybee (2008: 112), this rule does not apply between words, is unproductive, lexically restricted, and morphologically conditioned. In contrast to this lexical alternation, /k/ in English, as in French, has a palatal variant [ç] before a front vowel, as in key /ki/ → [çi], kiss /kɪs/ → [çɪs], etc. (in French, qui /ki/ 'who' → [çi], quitter /kɪtɛ/ 'to leave' → [çiɛ], etc.). The emergence of the palatal variant in both languages is automatic, productive, and neither lexically nor morphologically restricted. SP embodies the claim that such an assimilation rule could not apply at the lexical level because, in both French and English, it would introduce at this level a sound, [çi], that is not part of the phonemic inventory of either language (see Kiparsky 1985 for a discussion of many other assimilation and harmony processes that are non-structure-preserving and which he shows are post-lexical).

However, SP has been challenged on a variety of fronts. Its domain of application has been debated vigorously. Kiparsky (1982, 1985) proposes that lexical rule application is subject to SP but post-lexical application is not. However this neat division of territory between structure-preserving and non-structure-preserving rule application has proven to be doubtful. For example, Kaisse (1990), Rice (1990), and Hyman (1993) agree that SP is not necessarily turned off in the post-lexical component. In other words, post-lexical rules can be subject to SP. On the other hand, Harris (1987: 256) argues, mainly on the basis of a certain type of vowel harmony in southern Bantu languages, that “failure to preserve structure cannot be reliably considered proof of a rule’s postlexical status.” That is, lexical rule application is not necessarily subject to SP.

Harris (1987, 1989, 1990) discusses other allophonic processes that must be lexical, but that are not structure-preserving (see also discussions in Mohan 1995 and Steriade 1995), but one of the best-known problematic cases is the distribution of [ç] and [x] in modern German. According to Hall (1989), there is no underlying contrast between velar and palatal fricatives in German; the feature [back], though distinctive for vowels in German, is not distinctive for fricatives. The [ç] vs. [x] contrast results from a rule of fricative assimilation that spreads the backness feature from a vowel to a following voiceless high fricative. Crucially, fricative
assimilation applies lexically and it produces a phoneme/phoneme contrast that is not underlying. Hall (1989: 1) concludes that the rule of fricative assimilation is "a blatant counterexample to SP." We will address this case more thoroughly later.

Macfarland and Pierrehumbert (1991) propose an alternative view, which is intended to salvage the integrity of SP. In their view, non-distinctive features introduced at the lexical level stem from spreading, resulting in doubly linked structures. In the German case just discussed, the [back] feature of the vowel spreads to the feature matrix of the following fricative /X/, which is unspecified for backness. This results in the feature [back] being simultaneously linked to the vowel and the following fricative consonant. By virtue of their double linking, such structures are technically exempt from SP (as well as from a condition they call the marking condition). Though the solution might work for this and some other problematic cases that challenge SP, it does so at the cost of seriously weakening the SP constraint. Iverson (1993) proposes instead an approach that re-examines the relationship among some of the constellation of properties originally intended to distinguish between lexical and post-lexical rules or rule application, namely SP, and the restriction of applying to derived environments. In classical Lexical Phonology, a lexical rule had certain properties, two of which were that it preserved structure and that it applied in derived environments. SP is a consequence of a rule's lexical status in that view. Iverson turns this relationship on its head (1993: 265); if a given rule preserves structure, then it observes the derived environment constraint. This argues for a clustering of properties previously considered to be diagnostics of a rule's lexical or post-lexical status, but it implies that SP is a property of some, but not necessarily all, lexical rule applications. Indeed, Iverson concludes (1993: 270) that "...structure-building applications of lexical rules need not (though may) be structure-preserving."

As the previous discussion suggests, SP, as formulated by Kiparsky (1982, 1985) was inextricably linked to the overall architecture and other principles (e.g. the Strict Cycle Condition and the Derived Environment Constraint) and theoretical tools (e.g. underspecification) of Lexical Phonology. To reiterate, SP was part of a set of properties that distinguished lexical from post-lexical rule applications. Like many other notions of Lexical Phonology, SP was found to be problematic for a variety of reasons. For instance, even if we accept the view of Mohanan and Mohanan (1984: 589) that phonological rules whose domain of application is lexical yield the "lexical alphabet" - to be distinguished from the underlying one, found in the restricted dictionary in Figure 76.1 - it seems clear, as indicated by the work of a number of phonologists working on several different languages, that we cannot uphold the position that lexical rule application is necessarily structure-preserving while post-lexical rule application is not. For example, as mentioned previously, Iverson (1993) argues that lexical rules are not necessarily structure-preserving, while Rice (1990) argues that post-lexical rules may be. However, this is only one problem facing SP. Another is that SP has resisted formulation, interpretation, or application in any way that can be universally applied to yield felicitous results. Different attempts, including reformulation (e.g. Mohanan 1986: 174; Borowsky 1989: 148), reinterpretation (e.g. Macfarland and Pierrehumbert 1991: 179; Iverson 1993: 265), or restriction of its application to some, but not all, lexical levels - often on a language-specific basis (e.g. Borowsky 1986, 1989) - yield no universally satisfactory outcome. Moreover, such attempts often
have extremely damaging consequences for the theory and the SP principle. For example, the effect of Mohanan and Mohanan’s (1984) analysis of Malayalam and their distinction between an underlying and a lexical alphabet is to allow rules to introduce contrasts that are not underlying. This is clearly at odds with Kiparsky’s (1982) view of the role that SP plays. A closely related problem is that, under no formulation or interpretation, in any language through which the principle has been test-driven to any extent, has SP been found to be exceptionless (see the discussion of Bybee 2008 below).

What has the outcome of the challenges to SP been? Sproat (1985), who rejects Lexical Phonology’s approach to word formation altogether, considers SP completely dispensable, along with the rest of the theory. However, few phonologists would go this far. Although some, such as Mohanan (1989: 609) and Hall (1992: 233), have given up on reformulating SP, or tweaking the conditions of its application, and concluded that it is not a linguistic universal, they still consider it a cross-linguistic tendency. As Steriade (2007: 146) asserts, “... Structure Preservation cannot be abandoned altogether....”

Bybee (2008) has picked up the idea of SP as a cross-linguistic tendency rather than a true synchronic generalization or principle of language. She proposes to interpret the constraint as a result of “paths of change,” saying “Three well-documented universal paths of change occur in parallel and lead to the synchronic situation that is described as Structure Preservation” (Bybee 2008: 114). She also says that it is some sort of restatement of the older structuralist principle of “separation of levels” where phones are distributed by phonetic criteria and phonemes by lexical and morphological ones. In Bybee’s view, because SP is an emergent property of recurring mechanisms of language change (that feed and complement each other), counterexamples to this constraint are unavoidable and expected. The thinking behind this is that since the transition from phonetic to phonemic status is gradual, there will always be linguistic sounds that are introduced in a language lexicon with the initial status of phone, either native or foreign, which will later acquire the status of phoneme. However, while some instances make the transition from variant to phoneme, others instances do not, or at least not at the same time. More concretely, Bybee explains that purely phonetic sounds can gradually be disassociated from their phonetic conditioning and become associated with particular lexical or morphological conditions. An example discussed extensively in the structuralist and generativist literature, and already pointed out in this section, is the case of German [x] and [ç] (see Bybee 2008: 112 for a synopsis and Hall 1992 for more detailed discussion). In brief, [ç] and [x] were originally variants, with [ç] occurring after a front vowel in German. When the German diminutive suffix -chen [çen] lost its conditioning front vowel and the shortened suffix -chen [çen] started to appear after a back vowel, [x] and [ç] (arguably) became distinctive (e.g. Kuchchen [kuçen] ‘little cow’ vs. Kuchen [ku:xen] ‘cake’). The distinctiveness of /ç/ vs. /x/ was reinforced by the fact that /ç/ could also occur at the beginning of loanwords in some German dialects, where

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5 Except that SP avoids the duplication problem that classical phonemics (structuralists) faced. Indeed, in classical phonemics, a generalization had to be stated twice, once at the level of phonemes and once again at the level of phones, because of the separation of levels.

6 However, Macfarland and Pierrrehumbert (1991: 171) do not recognize this as a minimal pair because “Kuchen is a monomorphemic noun [as opposed to Kuchchen ‘little cow’].” They maintain that there are no true minimal pairs distinguishable only by [ç] vs. [x] in German.
the initial phonetic conditioning (the preceding front vowel) is obviously absent. To take another example, this time from English, the non-anterior voiced fricative /ʒ/, which initially occurred in the Early Modern English Period as a result of stress-conditioned palatalization (/ʒ/ > /ʒ/; e.g. pleasure [plezə] from French plaisir), has begun to be allowed in word-final and even word-initial position under the influence of more recent French borrowings such as rouge [ruʒ], beige [beiʒ], garage [gærʒ], massage [mæsʒ], camouflage [kæməflæʒ], luge [luʒ], genre [ʒær], joie de vivre [ʒwadəviv], etc. (see Millward 1996: 252-253). Similar to the German situation, the appearance of /ʒ/ in these environments cannot be due to phonetic conditioning. In short, the picture that emerges is that what originated as phonetic variants in the German and English examples might have become phonemes (albeit ones with sometimes restricted distribution) due to, among other things, the pressure of loanwords.

This is one path of change; concurrent with that are two others. The second is that small phonetic changes tend to become larger ones over time, leading to a greater phonetic distance between the original sound and its variant. If we take the [ʃ] ~ [ʃ] alternation, the variant [ʃ], which is unstable and phonetically close to /ʃ/, is becoming more stable and more clearly distinct phonetically from /ʃ/ over time (see Bybee 2008: 113). The third related path of change discussed by Bybee is loss of productivity as phonetic processes become lexicalized. To sum up, variants come to occur at the lexical/morphological level because of the diachronic tendency of phonetic changes to become linked to particular lexical items or morphological processes, creating a shift from the purely phonetic to the lexical level. As a result of being linked to particular morphological or lexical conditions, the phonetic conditions that originally give rise to the variant can lose their automatic productive power. Once the link between a sound and its (phonetic) conditioning environment is broken, the sound is “liberated,” as it were, and free to enjoy wider phonotactic/syllabic distribution, giving it phonemic as opposed to purely phonetic status (see also Harris 1990: 93). SP has exceptions because such change does not affect the entire vocabulary at once, but rather proceeds via normal processes of lexical diffusion (see e.g. Phillips 2006 on lexical diffusion and its links to various sound-based phenomena).

Is that the end of the story? Kiparsky (2008) clearly disagrees with the diachronic view. He summarizes the situation as follows:

An increasingly popular research program seeks the causes of typological generalizations in recurrent historical processes, or even claims that all principled explanations for universals reside in diachrony. Structural and generative grammar has more commonly pursued the reverse direction of explanation, which grounds the way language changes in its structural properties. (Kiparsky 2008: 52)

Kiparsky points out (2008: 27) that, once spelled out, historical explanations like those proposed by Neogrammarians or, more recently, those working in the diachronic view (e.g. Bybee 2008) often turn out to appeal implicitly to tendencies that are themselves in need of explanation. In other words, there must be principles

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7 According to Marc van Oostendorp (personal communication), there might remain some sort of phonetic conditioning in loanwords, however, since [ʃ] can occur only before a front vowel word-initially.
governing the nature and extent of change, which are ultimately responsible for the tendencies that are observed. He proposes criteria to distinguish true universals, which constrain language change, from typological generalizations, which result from language change, and adds: "The issue goes well beyond the simple question how cross-linguistic generalizations originate. It is about the nature of those generalizations themselves" (Kiparsky 2008: 27). He also raises the possibility (2008: 25) that functional explanations for language change might have become biologically within UG itself, through language use, thereby constraining change also via acquisition.

Though the argument we present below does suggest that a guiding principle of grammars is the pressure to preserve structure, which cannot be simply a side-effect of sound change over time, our goal in this chapter is not to argue whether SP is a basic principle of UG, as opposed to an emergent property of converging processes of language change. Rather, we hope to show, using primarily the phonological treatment of loanwords, that distinctive information is, indeed, highly resistant to destruction or alteration at the lexical level, not only intralinguistically, but interlinguistically too. Whatever problems SP has faced, or continues to face, there is no doubt that distinctive phonological information is resistant to change, so some notion of Structure Preservation is still needed, even under current constraint-based approaches, both derivational and non-derivational. The essence of our argument is that if there were no notion of Structure Preservation synchronically active in grammars, we could not explain why a borrower works so hard to preserve distinctive information from a foreign system (L2) in his/her own language (L1). Why should he/she care in the first place?

3 A broader perspective of Structure Preservation

3.1 Structure Preservation in loanword adaptation

Languages . . . which have undergone striking changes in their lexicons through the additions of thousands of borrowed words can no doubt be expected to trouble phonologists for some time. (Kaisse 1990: 141)

Because borrowing normally takes words conforming to the sound patterns and restrictions of one language (the source language, L2) and makes them conform to those of another (the borrowing language, L1), loanwords routinely present the need to modify or destroy phonological information (cf. also Chapter 95: Loanword Phonology). A priori, borrowing includes three phenomena that seem to challenge the notion of Structure Preservation. These are the modification of sounds, the deletion of sounds, and, apparently paradoxically, the importation of sounds at the lexical level. Of these three phenomena, deletion and importation are, on first impression, the most problematic. However, as we will see, phoneme deletion seldom occurs and importation is respectful of L2's phonological integrity. We believe this, along with other facts to be discussed, makes loanwords especially relevant to the study of Structure Preservation, provided one accepts an enlargement of its scope. We will henceforth use the full form, "Structure Preservation," to refer to this larger conception of the constraint. SP will refer to the notion of Structure Preservation as defined by, and linked to, Lexical Phonology.
If, instead of seeing the Structure Preservation constraint as just a ban on the introduction of non-phonemic sounds or distinctions at the lexical level, we interpret it as a form of pressure to preserve any contrastive information (features, phonemes, phonemic patterns, unpredictable syllabic information, etc.), then observing the way loanwords are adapted becomes extremely relevant. This is what we propose to discuss here. As we will show in the next sections, especially in §3.2 where the statistics from a large loanword database, that of the CoPho Project, are presented, L2 distinctive information is very seldom squarely destroyed in L1. Instead, L2 distinctive information, when it is not imported, is normally phonologically “adapted” in the borrowing language, with as few adjustments as possible, i.e. minimally. If there were no constraint on synchronic grammars to preserve structure, then there should be no reason for phoneme deletion to be so scarce in loanwords and for adaptations to be minimal.

The notion of minimal adaptation is closely tied to the generally agreed idea that in loanword adaptation, languages normally seek to replace unacceptable foreign sounds with those that are “closest.” There is disagreement over how closestness is defined: a matter of some contention in the field of loanword adaptation is whether closeness is determined primarily on phonological grounds, as we maintain, or whether it is determined mainly phonetically (CHAPTER 98: SPEECH PERCEPTION AND PHONOLOGY). Our present purpose is not to debate this issue, but rather to present statistics from large corpora of loanwords in several languages that indicate that L2 distinctive information is routinely maintained to the maximum allowed by the L1 phonological constraints. In the parlance of the Theory of Constraints and Repair Strategies (TC), this is attributable mainly to two principles, the Preservation Principle and the Minimality Principle, which conspire, we believe, to produce this result. As we will endeavor to show, both principles could be instantiations of the pressure to preserve structure in the larger sense that we propose here.

3.2 Adaptation, deletion, and Structure Preservation

The data used to illustrate the effects of preservation in loanwords are taken from the CoPho Project’s loanword database, which includes general corpora of French borrowings in Canadian English, Moroccan Arabic, Kinyarwanda, and Lingala, and English borrowings in Calabrese Italian, Japanese, Mexican Spanish, Quebec French, Parisian French, etc. The main findings yielded by the analysis of the CoPho database are summarized in Table 76.1.

The first relevant point to note about the figures in Table 76.1 is that L2 distinctive phonological information is systematically adapted in L1 (34,070/50,092 cases, i.e. 68 percent), as opposed to being deleted (3.3 percent of cases). Phonological adaptation, which is simply called “adaptation” here, is the modification/replacement (i.e. repair) of an L2 sound or structure to comply with one or more L1 phonological constraints. Adaptation is linked to Structure Preservation insofar as it is geared to ensuring that the L1 contrastive system remains unchanged (see

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8 CoPho stands for constraints (Co) in phonology (Pho). The project is supervised by Carole Paradis at Laval University, Quebec City.

9 TC (previously TCRS) was originally proposed by Paradis (1988).
Table 76.1 The CoPho Project loanword database of phonemic and supraphonemic malformations (updated August 2009)

<table>
<thead>
<tr>
<th>Corpora</th>
<th>Loans</th>
<th>Forms</th>
<th>Total</th>
<th>Phonological cases</th>
<th>Non-phonological cases</th>
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<td>Importations</td>
<td>Deletions</td>
<td>Total</td>
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<td>4,275</td>
<td>3,979</td>
<td>3,104</td>
</tr>
<tr>
<td>Kinyarwanda</td>
<td>756</td>
<td>2,130</td>
<td>4,639</td>
<td>4,207</td>
<td>4,119</td>
</tr>
<tr>
<td>Lingala</td>
<td>672</td>
<td>1,917</td>
<td>3,734</td>
<td>3,408</td>
<td>3,396</td>
</tr>
<tr>
<td>Fula</td>
<td>532</td>
<td>1,081</td>
<td>1,118</td>
<td>1,012</td>
<td>908</td>
</tr>
<tr>
<td>Total for all corpora</td>
<td>12,452</td>
<td>29,355</td>
<td>54,443</td>
<td>50,092</td>
<td>34,070</td>
</tr>
</tbody>
</table>

* Percentages of phonological and non-phonological cases are calculated on the total number of malformations.

* Percentages of adaptations, non-adaptations, and deletions are calculated on the total number of phonological cases.
LaCharité and Paradis 2005, Paradis and Tremblay 2009, and Paradis and LaCharité, forthcoming, for discussion), and is the norm.

Table 7.6.1 also shows that if foreign sounds are not adapted, they are normally imported, i.e. left unadapted, as opposed to being deleted. Importations/non-adaptations account for 14,391/50,092 (28.7 percent) of the phonological cases (importation is discussed in §3.5). Deletions, which might be seen as prima facie counterexamples to the idea that structure is preserved in loanword adaptation, are rare in the database overall. Deletions that have been classed as phonological are those that can be explained by the phonological principles of the theory; the others have been classed as non-phonological precisely because they cannot be predicted on phonological grounds. In the phonological cases, the rate is well below 10 percent in any individual corpus and is only 3.3 percent in the corpora overall (1,631/50,092 phonological cases). Non-phonological cases represent only 4,351/54,443 cases (8 percent). Therefore, whether we consider only phonological cases, or we include non-phonological cases (8 percent) as well, deletion of a phoneme is uncommon in the CoPho loanword database. Moreover, not all non-phonological cases involve deletions, and those that do may not always be best explained as such. As shown in Paradis and LaCharité (2008), who address the treatment of non-phonological cases in three corpora of old and recent Quebec French, phoneme deletion is uncommon even in non-phonological cases. Very often, it results from analogy, real or false (e.g. QF [lip-sí] instead of [lip-sú] for English lip-sync; the absence of /k/ in the QF borrowing is not a case of phoneme deletion per se, but rather a case of false analogy to the English verb to sing). Lexical truncation, such as QF tan for English (sun) tan, is also sometimes responsible for the disappearance of L2 phonemes (here sun); cf. also lexical truncation in QF parking from English parking lot and French pull from English pullover. In our view, these lexical truncations should not be seen as phoneme deletion, since deletion does not occur on the basis of phonemes, but of lexical items. Paradis and LaCharité (2008, forthcoming) suggest that these non-phonological processes, along with hypercorrection, phonetic approximations, etc., are responsible for many so-called “divergent repairs” and “unnecessary repairs” (see CHAPTER 95: LOANWORD PHONOLOGY).

We attribute the rarity of deletion to the Preservation Principle in (2) (see e.g. Paradis et al. 1994; Paradis and LaCharité 1997).

(2) **Preservation Principle**

Phonemic information is maximally preserved, within the limits of constraint conflicts.

The Preservation Principle is a TC mechanism first proposed by Paradis et al. (1994) and used extensively to analyze the CoPho loanword database (see e.g. Paradis and LaCharité 1997). However, we are not the only ones working in loanword adaptation to have seen the need for such constraints; for example, Calabrese (2005)

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10 TC is not restricted to loanwords; we do not maintain that the processes observed in loanwords are independent of general phonology. Nonetheless, it might be that the Preservation Principle is more evident in loanword adaptation than in native phonology, where the influence of morphology and residual historical processes play a greater role.
invokes comparable mechanisms, the Principles of Economy and Last Resort. As previously stated, deletions are prima facie violations of (2). However, not only are L2 phoneme deletions rare in the CoPho database, but most are also highly predictable. As we will try to show, deletion is, for the most part, phonologically predictable, and most phonologically predictable deletion can be reconciled with the notion of Structure Preservation.

There are two main scenarios in which phoneme deletion occurs. The first scenario involves deletion of a guttural – sounds characterized by a Pharyngeal node – by languages that do not use this primitive in the representation of the sounds of their native inventories. A language that does not employ this primitive cannot adapt a guttural (see Paradis and LaCharité 2001 for a detailed discussion on the treatment of gutturals in loanwords). For instance, neither French nor Italian have a guttural in their phonemic inventories, so neither language is equipped to adapt a phonemic guttural such as English laryngeal /h/. Instead, they delete it (e.g. English hamburger [haemma'berj] yields Quebec French (QF) [laemba'gær] and Italian [la'mərβʃgj]). The systematicity of guttural deletion is indicated by the figures of the three contemporary QF corpora (see Paradis and LaCharité 2001: 264). There are, overall, 173 cases of /h/ in English loanwords in QF; deletion applies in 163 cases (92.4 percent). The remaining ten cases are importations in the Montreal French corpus. The figures for the Calabrese Italian corpus reinforce this point and further illustrate the fact that guttural deletion accounts for the preponderance of deletions in the CoPho database. In the Calabrese Italian corpus of English loanwords, there are 296 cases of /h/ in the English input. In only 23/296 cases (7.8 percent) is English /h/ imported; the rest of the time it is deleted, meaning that there are 273 /h/-deletions in the Calabrese Italian corpus. Since there are only 278 deletion cases in that corpus overall, this means that /h/-deletion accounts for 98.2 percent of them (273/278). The vast majority of the 3.3 percent of deletions in the CoPho database concern guttural consonants in languages that do not exploit the Pharyngeal node. Such deletions would not be a violation of Structure Preservation from the point of view of L1, because the borrowing languages do not have a native guttural contrast to preserve and are not phonologically equipped to preserve that of L2, as argued in Paradis and LaCharité (2001).

The second general source of phoneme deletion involves the loss of a coda /r/ in borrowings by languages that do not allow (rhotic) codas (Chapter 30: The Representation of Rhotics). This is the case in Japanese, which allows only N or the first part of a geminate in codas (see Itô 1986 for details of the coda condition in Japanese). Coda consonants in English borrowings in Japanese are systematically adapted by vowel insertion; this has the effect of moving the problematic coda consonant to the onset of the following new syllable (e.g. English

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11 Calabrese’s (2005: 20) principles of Economy (“Use the minimal amount of maximally relevant units”) and Last Resort (“Use a maximally relevant operation minimally”) are highly reminiscent of TC’s Preservation and Minimality Principles, and serve the same structure-preserving function.

12 French [r] and [l] are just two of the numerous variants for the coronal /r/ in French; in contrast with /h/ in Arabic, these sounds are not phonemic in French.

13 Another predictable, but statistically marginal, source of deletion results from violation of the Threshold Principle (Paradis and LaCharité 1997). This principle offers an explanation for several “atypical” deletion cases, including vowel-initial deletion in French polysyllabic loans introduced in Moroccan Arabic (see Paradis and Béland 2002 for an in-depth discussion of this case and, more generally, Paradis and LaCharité, forthcoming).
optimism [ap̩tʰəmiz̪əm] > Japanese [oputīmizumuu]). However when the coda is a rhotic, instead of having vowel insertion, merger of the rhotic with the preceding vowel occurs (804/804 cases; e.g. English order [ɔːrdə] and corner [kɔːrnər] > Japanese [ɔːrdɑ] and [kɔːrnə]).\(^{14}\) Deletion of /r/ also causes vowel lengthening in Thai, where it is not permitted in the coda. For instance, English care [kɛə], carbon [kaːbən], cartoon [kaːtən], party [pærɪ], poker [pɔkər], and star [stɑr] are pronounced [kʰɛː], [kʰɑrən], [ɡɑtən],\(^{15}\) [pɑtɪ], [pɔkər], and [sɑtɑ:], respectively.\(^{16}\) Deletion of /r/ is not limited to loanwords that come from English. It also occurs in loanwords from French. For instance, French Argentine [aʁʒɔtɛ̃], arrière [aʁjɛʁ], beurre [boʁ], carte [kaʁt], carton [kaʁtɔ̃], orchidée [ɔʁkide], and radar [radɑr] yield Khmer [aːrʒɔtɛ̃],\(^{17}\) [aʁjɛʁ], [boʁ], [kaʁt], [kaʁtɔ̃], [ɔʁkide], and [radɑr], respectively. In some cases, the French rhotic is replaced with /a/ or a glottal stop, as in [ɔpətlu] and [peʔmi] from French haut-parleur [ɔpəlʁœʁ] and permis [permi]. As can be seen, the deletion of /r/, which is prohibited in coda position in Khmer, causes vowel lengthening even in closed syllables, as in [kaʁt] from French carte.\(^{18}\) This latter set of examples in Khmer shows that apparent /r/-deletion is not influenced by the pronunciation of /r/ in the donor language, since French and English have very different rhotics. Vowel lengthening suggests that /r/ might not really be deleted but rather fused with the preceding vowel, when it is not replaced with /a/ or a glottal stop. This is why we have not incorporated these cases in the deletion column of the statistics in Table 76.1. If we are correct in viewing vowel lengthening as /r/-adaptation rather than /r/-deletion, it does not contradict the idea of Structure Preservation that is invoked here. However, even if we did consider these cases of deletion, the deletion rate would still remain very low (2,435/50,091 - 4.9 percent instead of 3.3 percent).

In Paradis and LaCharité (forthcoming), we attribute /r/-deletion to the fact that /r/ is vowel-like and can easily be fused with the preceding vowel, whether it results in vowel lengthening or not. We envision that, perhaps, as in the case of /h/-deletion in English loanwords in French, Italian, Portugese, etc., the answer lies in the phonological structure of /r/. Rhotics with a variety of phonetic realizations are prone to deletion, cross-linguistically, and they exhibit several phonological behaviors that are not yet well understood. For example, in many different languages, where the rhotics exhibit diverse phonetic realizations, a coda /r/ is deleted, or merged with, transformed into, or replaced by, a vowel. To cite just a few of many possible examples, in German, where /r/ is phonetically uvular, coda /r/ can lower to something akin to a low vowel, so that tür ‘door’ is realized as [tʏr̩] in the singular (Wiese 1996) but tür [tʏr̩] in the plural, that is with the full rhotic, where it is in onset position. In Quebec French, coda /r/, which can be realized as a uvular or a coronal, is often deleted word-finally in informal speech (e.g. bonjour /bɔʒʊr/ ‘good day’ → [bɔʒʊ])]. During the Middle Ages, /r/-deletion prevailed for so long in French that /r/ almost disappeared

\(^{14}\) Tones are omitted here, because they are irrelevant.

\(^{15}\) [g] is a variant of unaspirated /k/ in Thai.

\(^{16}\) Data gathered during fieldwork in Thailand in February and March 2010.

\(^{17}\) Even though French is no longer spoken by young people in Cambodia and Laos, Lao and Khmer speakers, both young and old, almost always import the French nasal vowels in French loanwords, which are very numerous in both languages.

\(^{18}\) Data gathered during fieldwork in Cambodia in March 2010.
as a coda phoneme (Zinc 1986). The deletion of /r/ also applies in many Spanish dialects (Moreno de Alba 1988; Rojas 1988; e.g. mar ‘sea’ → [ma] in Caribbean Spanish and cliquear from English to click, which is realized as [klıkə] in Spanglish). Interestingly, English short is realized [ʃo] in Spanglish when it is singular but [ʃoʊ] in the plural, i.e. with the full rhotic when it is no longer in coda position, thus indicating that the rhotic is present in the L1 lexical representation of the borrowing. Examples of this type are common cross-linguistically. It could be that a post-vocalic rhotic is actually part of a diphthong, as proposed by several phonologists (e.g. see Nikiema and Bhatt 2003 for their analysis of post-vocalic /r/-deletion in Haitian Creole).

Nonetheless, we know there are some languages where coda /r/ is ill-formed, but its deletion does not yield vowel lengthening. Although the general CoPho loanword database does not include such languages, we would view these cases as true deletions and, as such, challenges to the idea that structure is preserved in loanword adaptation. Our targeted corpus on aspiration in Mandarin Chinese (MC) (see also Hall-Lew 2002 on this) shows that this is what happens in English loans in Mandarin Chinese. The English coda rhotic, which is disallowed in Mandarin Chinese, is dropped without yielding systematic vowel lengthening (e.g., English laser [lezər], cigar [σɪɡər], cartoon [kɑɹtən], and sardine [særdɪn], which yield MC [lej ʂaˀ], [sja tʂaˀ], [kʰa tʂuŋ] and [ʂaˀ tɕin], respectively). The coda rhotic is not adapted in /l/, as in onset position (e.g. English radar [ˈreɪdər] and trust [truːst] > MC [lej ta] and [tʰwə las]). The net result with respect to a discussion of Structure Preservation is that one must consider /r/-deletion/fusion to be very common across languages in both native and borrowed words, and that there seems to be a phonological explanation for many such cases that avoids conflicts with Structure Preservation.

However, even when /r/-deletion does not lead to lengthening, it may not be a problem for Structure Preservation from the point of view of loanword adaptation, because in many cases such deletions stem from a native process. For example, it is common for rhotics to be deleted when they are included in a complex onset (CHAPTER 55: ONSETS). For instance, Quebec French trois [tʁwa] ‘three’, Lacroix [lakʁwa] (a proper name), and fruit ‘fruit’ [frʊ̃] are often pronounced [twɑ̃], [lakwa], and [fuœ] in casual speech. In Thai, /r/ in complex onsets is only pronounced in very formal speech (on television, for instance). In less formal/casual speech it might be replaced with /l/, but most of the time the liquid disappears altogether. For instance, the famous shopping center of Bangkok, Maboonkrong, is pronounced with the rhotic only in very formal speech. Otherwise, it is pronounced [ma.bʊŋkʰon], with no rhotic; this is what taxi drivers say, with [ma.bʊŋkʰon], a more prestigious pronunciation with the lateral, being used much less frequently. The same happens with the Thai city Trat, which is systematically pronounced [tʰat]; cf. also Thai [pʰrom] ‘carpet’, which is pronounced [pʰom] except in very formal speech (this information on /r/-deletion, as well as on /l/-deletion, is readily available in any grammar of Thai). Native /r/-deletion in complex onsets is frequent in Asian languages, so it is not surprising to see /r/-deletion apply to

19 A targeted corpus, as opposed to a general one, is a (normally smaller) corpus of loanwords collected to test a particular hypothesis (e.g. aspiration in MC, Hindi, Thai, and Lao, palatalization in Russian, etc.). Therefore, all borrowings in a targeted corpus contain a particular sound or contrast of interest to the hypothesis being tested.
their loanwords (e.g. French crème [krem] ‘cream’ which yields [kem] in Vietnamese, according to Chapter 95: Loanword Phonology; cf. also English credit card [kredit kard] and brake [brek], which are pronounced [krid(ə)ts] and [bre(ə)k] in Thai, respectively, and French programme [prɔʁam] ‘program’ and groupe ‘group’ [gʁy], which yield Lao [pɔg(l)am] and [g(l)up], respectively). Rhotic deletion in cases such as English loanwords in Thai should not be interpreted as a repair of an ill-formed L2 structure or as an "unnecessary loss," since it stems from a very productive native process related to speech register/dialectal differences.

To sum up this discussion, the vast majority of deletions are phonologically predictable and thus, despite initial impressions, pose little threat to the idea that input structure is preserved in loanword adaptation. However, the real story is that, together, predictable and unpredictable deletion affect only a small percentage (less than 5 percent) of input phonemes in the CoPho loanword database. We conclude from this that the loss of L2 phonemes is strongly avoided in loanword adaptation.\(^\text{20}\) In the case of ill-formed sounds, feature adjustments apply systematically; in the case of ill-formed clusters, that are perceived as unsyllabifiable by L1, phoneme insertion is the norm. For instance, French drapeau [drapɔ] yields [darápɔ] in Fula, not *[dəpo] or *[trapɔ] (see also French force [fɔrs] > Fula [fɔrɔ], not *fɔs] or *[fɔr], and French ministre [ministik] > Kinyarwanda [minisitiri], not *[minỉ]). This pattern consistently predominates in the general corpora of the CoPho loanword database, as well as in more recently assembled targeted corpora such as the Kashmiri one. When an English borrowing contains a cluster that is disallowed in Kashmiri, the sequence undergoes vowel insertion, not consonant deletion, despite the fact that consonant deletion would solve the problem equally well. For instance, English silk [silk], snow [sno], and flag [flæg] result in Kashmiri [silik], [sono], and [falag], and not in *[sik], *[so/ но], or *[fag], for example.\(^\text{21}\)

Why does L1 resort to phoneme insertion instead of phoneme deletion when it has to handle a problematic L2 cluster? We attribute this to the Preservation Principle in (2), which seeks to safeguard contrastive information, and which can be seen as a constraint in the Theory of Constraints and Repair Strategies to preserve structure. However, TC is a derivational constraint-based theory. One might immediately wonder whether Optimality Theory (OT), a non-derivative (non-serial) filter-based theory, can dispense with the need for SP. The crux of the issue is that standard OT posits that, underlyingly, anything goes (cf. Richness of the Base, following Prince and Smolensky 1993). The patterns that emerge from the lexicon are the result of universal surface filters, which are ranked on a language-specific basis. In short, the basic architecture and tenets of classical OT, with constraints acting as filters, suggest that there should be no particular underlying phoneme or structure inventory to protect. Itô and Mester (2001: 265) examine the possibility that some of the devices and principles of Lexical Phonology might have outlived their usefulness and have no place in a putatively non-serial framework such as OT. Is SP one such device? Itô and Mester argue for recognizing, within OT, the need for stratal organization, with lexical outputs

\(^\text{20}\) Phoneme deletion outside the context of malformations, that is when the phoneme and structure that contains it are both permissible in L1, is also very rare (see Paradis and Prunet 2000). As shown by Paradis and LaCharité (2008) and Paradis and LaCharité (forthcoming), these rare cases result mostly from analogy, morphological truncation, phonetic approximation, and hypercorrection.

\(^\text{21}\) Data gathered during fieldwork in North India in April 2009.
being structure-preserving, which they define (2001: 289) as “limitation to a restricted inventory of elements and structures...” Bermúdez-Otero and McMahon (2006) work within the framework of stratal OT and maintain, contra Itô and Mester, that “... the issue of Structure Preservation does not arise in Stratal OT...” (2006: 396). However, even if one agrees with that, and rejects Itô and Mester’s point of view, OT analyses still rely on some notion of preservation, in the form of faithfulness constraints, which occupy a high-ranked — though not necessarily undominated — place in most OT analyses (Chapter 6: Markedness and Faithfulness Constraints). All this clearly suggests that OT requires some notion of contrast preservation, an issue that some OT analyses have confronted directly (e.g. Krämer 2006). Our goal here is to point out that no current constraint-based or filter-based theory completely does away with the need for some notion closely related to Structure Preservation. Indeed, it seems more likely that, for all phonologists, it will be important to reconsider the idea of Structure Preservation and to determine its mandate in the context of our particular theories. The remainder of the discussion is framed in the TC model, because Structure Preservation has been more directly addressed in this framework, but we assume that all phonological theories need to confront the same observations concerning what appears to be preserved, as evidenced in loanword adaptation. In other words, our focus will be on the facts, not the theory used to handle them.

The preceding discussion has shown that L2 phonemes are adapted rather than deleted, that the repair of illicit clusters via ephenthesis is preferred over their repair via deletion, and that when deletion does occur, it is largely predictable on phonological grounds. The study of loanword adaptation reveals a further implication of Structure Preservation: the violation of L1 constraints is generally solved with as little loss of phonological information as possible. Thus, an ill-formed L2 phoneme is not deleted if a feature can be added or deleted to solve the problem; an ill-formed syllabic structure is not deleted if insertion of a phoneme or, in the case of a constraint conflict, the loss of a phoneme will suffice, etc. Another key observation in loanword adaptation (we see this as another side-effect of Structure Preservation), for which any theory must account, is the limited range of adaptations that predominate cross-linguistically. This issue is addressed in LaCharité and Paradis (2005). For example, English /æ/ is systematically adapted as /a/, not as /i/, /e/, /o/, or /u/, in the CoPho database. In Mexican Spanish, adaptation of */æ/ to /a/ occurs in 354/360 cases (98.33 percent); in French it occurs in 1,405/1,405 cases (100 percent), in Japanese it occurs in 536/536 (100 percent) cases, and in Calabrese Italian 1,121/1,214 cases (92.3 percent). As another example, English /ɪ/ is predictably adapted as /i/. In Mexican Spanish, */ɪ/ adapts to /i/ in 387/388 adaptation cases (99.7 percent); in Japanese, adaptation of */ɪ/ to /i/ occurs in 631/649 adaptation cases (97.2 percent); in Calabrese Italian, this adaptation occurs in 1,588/1,588 adaptations (100 percent). Even when more than one adaptation for a given sound is attested, either cross-linguistically or within a single language, the range of results is small and predictable. For

22 In Quebec French, there are cases where English /æ/ surfaces as [ɛ] in loans such as hand, gym, and pantry. We believe that this is because these words are often pronounced with the variant [ɛ] in English (e.g. [bænd], [gæm], and [pentɛl]). In these cases, we say that the English variant is imported. It sounds more “anglophone” i.e. more “in,” to pronounce these words with [ɛ], although they can be pronounced with [a] too.
example, English /v/ is adapted as /b/, /f/, or /w/ cross-linguistically. English /ʌ/ is adapted as either /a/ or /ɔ(ə)/. Why should a borrowing language not simply replace any illicit sounds arbitrarily, or with default/high-frequency sounds, if there were no pressure to remain close to the input? Even though particular sounds are illicit from the point of view of the borrowing language, as much as possible is salvaged or, conversely, as little as possible is lost. For instance, in the common cross-linguistic adaptation of */v/* to /b/, only the continuant value changes; in the adaptation to /f/, which is also found cross-linguistically in loanword adaptation, only the voicing value is modified, whereas in the adaptation to /w/, a slightly less frequent but nonetheless common adaptation, it is the sonorant value which is targeted. The adaptation of */v/* to /w/* is systematic in Fula (French civil [siwil] ‘civilian’ > Fula [siwil]; Paradis and LaCharité 1997) and in several Asian languages, including Thai in word-initial and intervocalic positions (e.g. English vitamin [vajtamin]/ [vitamun] and travel agent [taevəl edʒənt] > Thai [wittamin] and [tʰ(r)awal ejan], respectively; word-finally it is adapted as /p/ for phonotactic reasons; e.g. English serve [sərv] > Thai [səp]). Within the context of TC, this has been attributed to the Minimality Principle in (3).

(3) **Minimality Principle**

a. A repair strategy must apply at the lowest phonological level to which the violated constraint refers.

b. Repair must involve as few strategies (steps) as possible.

The lowest phonological level referred to in (3a) is determined by the phonological level hierarchy (metrical level > syllabic level > skeletal level > root node > feature), an independently required organization of phonological information. Clearly, the Minimality Principle (whose effects are addressed in Paradis and LaCharité 1997) is intrinsically related to the notion of preservation. If preservation were not an issue, then why should repair not often, or even routinely, operate at a higher-than-needed level, guided by some notion of “better safe than sorry”?

### 3.3 Preservation of L2 phonemic contrast patterns in L1: English loanwords in Chinese and Hindi

Not only are individual L2 phonemes conserved, to the greatest extent possible within the limits allowed by the L1, but L2 phonemic contrast patterns are also maintained to the greatest extent possible permitted by the phonology of L1. For example, Chinese does not have a voicing distinction among stops; it does, however, distinguish stops on the basis of another laryngeal feature, aspiration. In the adaptation of English loanwords in Mandarin Chinese (MC), English voiceless stops (/p t k/) systematically yield aspirated voiceless stops (/pʰ tʰ kʰ/), and English voiced stops (/b d g/) are systematically replaced by unaspirated voiceless ones (/p t k/; see Paradis and Tremblay 2009 for an in-depth discussion of this issue, with figures and statistics). For example, English pizza [pitˈsə], hippies [ˈhɪpɪz], and tank [ˈtæŋk] yield MC [pʰi sa], [si pʰi], and [tʰan kʰ], respectively, whereas English Boeing [bɒin] and gulf [gʌlf] are adapted as MC [pəin], [loj ta], and [kaw ar fu]. This pattern of adaptation is not restricted to English loans; it also applies to French loans in MC (e.g. French Pierre Cardin [pjɛʁkaʁdɛ] and Chirac [ʃɛʁak] >
MC [pʰi or kʰa tan] and [si la kʰa]), despite the fact that voiceless stops are not aspirated in French as they are in English before a stressed vowel. The same type of pattern transfer is found in other Chinese dialects, such as Cantonese. This indicates that Chinese borrowers are aware of the systematic distinction between voiced and voiceless stops in English, and that adaptation seeks to preserve this L2 distinctive pattern, using the contrastive resources provided by the L1.

Comparative facts are found in Hindi. Hindi has a voicing distinction for stops. Thus English voiced and voiceless stops yield Hindi voiced and voiceless stops, respectively (e.g. English bellboy [bɛlboj], baggage [bægagʤ], coffee [kəfi], and frock [frɔk] > Hindi [bɛlboj], [bægagʤ], [kəfi], and [frɔk]). However, English voiced and voiceless alveolar stops are adapted as retroflex stops /t/ and /d/, which contrast with dental stops /t/ and /d/ in Hindi (e.g. English agreement [əɡreimənt], beauty parlor [ˈbjuːti ˈpɑːlər], badminton [ˈbædmɪntən], and baking powder [ˈbeɪkɪŋ ˈpɔːdər] > Hindi [əɡreimənt], [buːtu pələr], [baedmɪntən], and [beɪkɪŋ pɔːdər], respectively), while English interdental /θ/ and /ð/ are adapted as plain dental stops, that is /t/ and /d/, respectively (e.g. Thatcher [ˈθætər] and brother [ˈbrʌðər] yield Hindi [tɑːθər] and [brodər]). Again, the L2 contrast pattern is preserved in L1, using the contrastive resources provided by the latter. Adaptation of interdental to fricatives would yield a greater loss of information because Hindi has only /s/, not /z/ (except in borrowings, especially from Arabic). The voicing contrast of English interdental would then be lost. On the other hand, if English alveolar stops were adapted as phonetically more expected dental /t/ and /d/ in Hindi, there would not be any slot left for the adaptation of the interdentals, which would have to merge with the English alveolar stops in Hindi.

### 3.4 Preservation of L2 syllabic contrasts in L1: French loanwords in Russian

The adaptation of French loanwords in Russian suggests that unpredictable syllabic structure might also be preserved in loanword adaptation. French diphthongs have to be marked underlyingly, as they are unpredictable. Pairs such as oiseau [wa] ‘bird’ vs. watt [wat] ‘watt’ show this. In oiseau, wa is a diphthong (e.g. l’oiseau [lwaʃo] ‘the bird’), making the word vowel-initial, whereas in watt it is an onset–nucleus sequence, as it is in English, making watt consonant-initial (e.g. le watt [la wat]; see Kaye and Lowenstamm 1984 on diphthongs in French).

The presence or absence of an onset is shown by, among other things, the choice of singular and plural definite articles. Before vowel-initial words the singular definite article is [l], as with l’arbre [laʁbʁ] ‘the tree’. Moreover, the plural definite article triggers liaison (les oiseaux [lez zwaw] ‘the birds’, as with les arbres [lez zarbr] ‘the trees’). Preceding a consonant, the definite articles are le [la] and les [le], respectively (le watt [la wat] ‘the watt’, not *[lwa], and les watts [lɛ wat] ‘the watts’, not *lɛ zwat), as with le bateau [la bato] ‘the boat’ and les bateaux [lɛ batɔ] ‘the boats’.

In French loanwords in Russian, /wa/ is adapted as a bisyllabic sequence of /u+a/ when it is part of a diphthong (e.g. French voile [vɔl] ‘veil’, mémoire [memwɔʁ] ‘memory’, and couloir [kulwar] ‘corridor’ > Russian [vul], [memwari], and [kulwar]), whereas when /w/ constitutes an onset, it is systematically adapted as /v/ (French watt [wat] > Russian [vat]).23 English whisky [wriski] and

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23 This loan was introduced via French, even though it originates from English.
tramway [træmweɪ] > Russian [vrʲskʲɪ]) and [trəmvaɪ]). These examples might suggest that the difference in adaptation is due to the fact that /wa/ in French loans is preceded by a consonant, whereas in English loans it is not. However, English borrowings such as sweater [swætər], swap [swɒp], and swing [swɪŋ], which yield Russian [svʲɪtʲɪr], [svʲɪp], and [svʲɪn],24 not *[svuːtər] or *[svuːtər], etc., invalidate this hypothesis. The fact that /wɪn/ is treated differently when it is a diphthong than when it is an onset-nucleus sequence is interesting, because it suggests that where syllabic affiliation is unpredictable – when it is contrastive and would have to be indicated underlyingly – it is preserved. This interesting question remains to be investigated more thoroughly.

3.5 Importation and Structure Preservation

Non-adaptations in loanwords – that is the importation of foreign phonemes in words borrowed from another language (L2) – present a challenge to SP since they consist in the introduction of new phonemes at the lexical level. Two cases that were previously mentioned are /c/ in German and /ʃ/ in English. One might object that the German case as presented here is oversimplified and does not present an uncontroversial picture of the facts (consider, for example, the contradiction between Hall’s 1989 position and the scenario advanced by Bybee 2008), or that, in English, the phonemic status of /ʃ/ is not well established, given that its distribution is restricted to intervocalic position, except in loanwords (see Iverson and Salmons 2005: 210 on /ʃ/ in English). However, the German case seems to be problematic for SP no matter which view one takes; either a sound/sound distinction ([c] vs. [x]) that does not exist at the underlying level is introduced at the lexical level (Hall’s view) or non-native /c/ has become phonemic in German over time, under the influence of loanwords (Bybee’s view). As for the voiced palatal fricative in English, even if /ʃ/ were validly considered a phonetic variant intervocally in native English words, the fact that it is tolerated (unadapted) at the end and now at the beginning of borrowings indicates that it is a phoneme in English, though a marginal or peripheral one, in the terminology of Itô and Mester (1995).

The challenge goes beyond German and English: the literature on loanwords reports abundant cases of importation (see e.g. Ulrich 1997: 432 on the importation of an English coda palatal in Lama, and Mohanan and Mohanan 2003 on the importation of English /ʃ/ in Malayalee English). In the case of particular phonemes, importation can even be the norm. In the Moroccan Arabic corpus of the Project CoPho loanword database, /p/ is widely imported (320/454 cases, 70.5 percent) (e.g. French pape [pap] ‘pope’ > Moroccan Arabic [pap] instead of expected [bab]). Another example is /ʃ/ in the CoPho corpus of English loanwords in Mexican Spanish, which is imported in 102/138 cases (74 percent) (e.g. English shorts [ʃɔːts] and cartwash [kɔɾwɔʃ] > Mexican Spanish [ʃɔɾts] and [kɔɾwɔʃ], not *[ʃɔɾts] and *[kɔɾwɔʃ], as expected). While some foreign sounds are only occasionally, or never, left unadapted, others are imported more often than they are adapted. In some language situations, such as Spanish loanwords in Guarani, importations from Spanish are systematic; i.e. Spanish phonemes are never adapted (see Oñederra 2009 for a similar situation with Spanish loans in Basque).

24 [swʲn] also exists as a variant; it is perceived by some Russian speakers as more “English,” possibly because of hypercorrection.
We must remember, though, that in phonological situations involving language contact, including loanword adaptation, two languages are in play. Our hypothesis is that under certain sociolinguistic conditions, such as when borrowers are highly bilingual and society generally tolerant of importations (such as when the L2 enjoys widespread prestige), the preservation of the L2 system also becomes an issue, one that can be at odds with the preservation of the L1 system. In cases of adaptation, preservation of the L2 system becomes subordinated to the preservation of the L1 system; in cases of importation, the reverse occurs. This, and the fact that loanword adaptations are generally minimal, supports the view that the structural integrity of L2 is rarely left out of consideration altogether, so it is not unlikely that such concern may sometimes come to predominate. If this interpretation is correct, then identification and preservation of contrastive information is important in both L1 and L2, despite inevitable conflicts between the demands of each of the two linguistic codes.

4 Conclusion

As shown in §2, SP, as referred to in Lexical Phonology, was regularly challenged by the facts, even though most phonologists agree that it plays some role, i.e. non-phonemic sounds are generally not generated in the lexicon. Languages tend to preserve their phonemic integrity at this level. Nonetheless, the numerous exceptions to SP reported by many different authors, providing evidence from numerous different languages, might give the impression that Structure Preservation is either misguided or just an artifact of some other principles/processes with no intrinsic validity. There remains little doubt these days that SP as conceived in Kiparsky (1982, 1985) is too restrictive, not to mention its being linked to a network of other assumptions and principles that have themselves been seriously challenged. In fact, even the notions of phonological rules and their application has been subjected to a major rethinking. SP limited the power of phonological rule application, but modern frameworks eschew rules in favor of constraints; if rules have not been abandoned altogether, they have certainly lost their driving force. In a derivational constraint-based theory, such as TC, rules are context-free and functionally motivated, being limited to repairing constraint violations. Thus, their power is intrinsically more circumscribed than was the case of SPE-type rules that were, in and of themselves, the motivation for phonological change (i.e. they were essentially prescriptive devices with little or no explanatory power). In a filter-based theory, such as OT, filters, including any that favor the preservation of input structure or contrasts (i.e. faithfulness filters), are ranked on a language-specific basis. Given that feature of the theory, it is not obvious how OT would deal with a cross-linguistic tendency to preserve input structure/contrasts (see Paradis 1996 on this issue). If the faithfulness constraint Max-X (which prevents deletion of a phoneme or feature that is in the input; previously Parse) is shown to play a consistently high-ranked (though, as already mentioned, not necessarily undominated) role in OT analyses, then OT too might need to appeal to a mechanism that accounts for Structure Preservation. Therefore, the real question is: does Structure Preservation have any kind of intrinsic validity for phonological theory? We maintain that it does.

In §3, we used the adaptation of loanwords to underline the continued need for some notion of Structure Preservation. However, we see this principle as
having a broader scope than that defined for SP in Lexical Phonology. Not only do languages tend to preserve their own phonemic inventories at the lexical level as much as possible (in the spirit of SP in Lexical Phonology), but they also tend to maximally preserve the phonemic contrasts and contrast patterns of the languages from which they borrow words. Thus, the resistance to change is, above all, a question of contrast/category pattern preservation, which is expressed interlinguistically (i.e. between L2 and L1, as was illustrated in this chapter with the treatment of loanwords), as well as intralinguistically (as was illustrated with the [z/o] alternation case in French and Velar Softening in the English and French cases). As mentioned at the outset of the chapter, it is not just a question of inertia. Speakers work hard to preserve L1 or L2 phonological patterns.

If there were no (universal) pressure to preserve an input’s contrastive information, then why would deletion be so rare in loanword adaptation? Why would it not occur randomly in some 50 percent of the cases? Moreover, when deletion does occur, why is it so largely predictable on the basis of phonology? Among adaptations, why are the changes to ill-formed sounds and structures so consistently predictable in terms of minimality, and why is there such a limited range of adaptations found cross-linguistically? This is because distinctive information is as resilient and resistant to change in L1 as it is in L2 in the mind of borrowers. When L2 wins, the result is an importation (a non-adaptation), i.e. the introduction of a new phoneme or structure in L1, as discussed in §3.5. Extensive language contact is required for this to happen, though. When L1 wins, which is more generally the case in the first stages of borrowing, we obtain an adaptation, whose goal is to produce a form that meets the phonological demands of the borrowing language’s phonology. This means that some L2 contrastive information will inevitably, though minimally, be sacrificed, because the preservation of the L2 contrastive information is often at odds with preservation of the contrasts of the L1 phonological system. However, in focusing on phoneme modification (i.e. adaptation), we risk undervaluing the fact that, to the greatest extent possible, an adaptation retains most properties of the source form. In this chapter, the properties referred to have included distinctive phonemic information, as illustrated with loanwords from French and English in many different languages (Japanese, Khmer, Thai, Fula, Kinyarwanda, Kashmiri, etc.), phonemic contrast patterns from English loans in Chinese and Hindi, and syllabic contrast pattern from French loans in Russian. This is not intended to be exhaustive though. Other types of contrastive information are expected to show similar resilience. In this chapter, we have tried to emphasize that contrast resilience extends to L2; it is not limited to L1. L1 adapters feel strongly concerned about preserving L2 contrastive information; in the case of importations this is to the detriment of their own (L1) contrast system, which is forced to change.

Ultimately, we suggest that what might salvage SP, after all, is to consider it in a much broader perspective in order to deepen our understanding of its purpose and functioning. It will then be easier to circumscribe its effects in native and borrowed words and formulate it more formally, even if it is in terms of a statistically significant tendency instead of an absolute generalization.

25 Structure Preservation obviously does not have the same impact in L2 acquisition as in loanword adaptation. Its influence is necessarily reduced in L2 acquisition, since L2 learners (especially beginners) are not as knowledgeable about the L2 code as are the borrowers (see Paradis and LaCharité 1997 on the borrowers' bilingualism issue) and thus cannot be as protective of a code with which they are not sufficiently acquainted.
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