

### Morphology and Language Attrition

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### Summary and Keywords

Language attrition is the loss of linguistic abilities or the regression of specific grammatical properties and overall fluency in linguistic skills. It impacts language use, lexical access, and grammatical integrity. Non-pathological attrition is natural in situations of language contact and bilingualism and can occur in the first, native, language as well as in a second language. As a gradual and dynamic process of accommodation that occurs when bilinguals use the second language extensively, attrition is a highly individualized phenomenon and hard to predict a priori. If attrition eventually happens, it affects individuals differently, with some exhibiting more widespread loss than others. Two factors that determine the extent of language attrition in bilinguals are the availability of input and the age of the individual at the onset of the reduction in input in their native language. An important question is whether attrition mainly occurs at the level of processing or whether it affects actual linguistic competence. Theoretical approaches to attrition have emphasized its relationship with L1 acquisition, the selectivity of attrition by linguistic modules, the effects of language use on memory, and the interplay between the L1 and the L2 along the life span. We still lack understanding of how attrition affects linguistic representations and processing and the external and individual cognitive factors that modulate, predict, or prevent attrition in bilinguals.

Morphological attrition is far more common and extensive in children than in adults and it manifests itself in a variety of ways: morphophonemic leveling, morphological simplification, including omission of required morphology in obligatory contexts, paradigmatic reduction, simplification/reduction of suffixal allomorphy, regularization of irregular forms, and the replacement of synthetic forms for analytic/periphrastic forms. Morphological attrition has often been discussed in the context of language death and language loss at the community level for both child and adult bilinguals. The scant empirical evidence to date seems to indicate that the processes of omission, regularization, and suppletion that are common in attrition occur regardless of the dominant morphological type of a language. Both inflectional and derivational morphology are affected under language attrition and seem to undergo similar processes of reduction and simplification, regardless of the morphological type of the language. Within inflectional morphology, nominal morphology (gender, number, case) is more prone to attrition in the actual number of occur-

rences than verbal morphology (agreement, tense, aspect, mood), and attrition occurs more rapidly and extensively.

Keywords: attrition, immigration, adoption, bilingualism, age effects, inflectional morphology

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# 1. Language Attrition

Language attrition is “the (total or partial) forgetting of a language by a healthy speaker” (Schmid, 2011, p. 3). More specifically, language attrition is the loss of linguistic abilities or the regression of specific grammatical properties and overall fluency in linguistic skills. Although language attrition can be caused by neurological insult (aphasia) or by other neuro-debilitating conditions (Alzheimer’s disease or other forms of dementia), it can also arise more gradually as a result of the normal aging process. Non-pathological attrition is natural and common in situations of language contact and bilingualism and can occur in the first (L1), native, language as well as in a second language (L2). This article will focus only on the loss of the first or native language in situations of bilingualism. For studies of second language attrition see Lambert and Freed (1982), Bahrck (1984), de Bot and Weltens (1995), Hansen (1999), and Bardovi-Harlig and Stringer (2010).

Language attrition research has tended to focus on the native language of adults (immigrants who are immersed in a second language environment), but it also occurs in children. A salient linguistic characteristic of immigrant populations across the world is that first language skills are often affected when speakers are immersed and start using the dominant language of the host country. While some adult immigrants may already possess some knowledge of the language of the host country upon arrival, intensive exposure to the language of the host country (L2 of the immigrants) and further development of the L2 occur after immigration. Some of these late bilinguals might eventually become more dominant in the second language than in their first language. As their proficiency in the L2 increases, they might gradually reduce their first language use, and eventually exhibit changes or loss in their L1 (Major, 1992; Iverson, 2012). These changes are very salient to the L1-speaking peers from their country of origin, who can readily tell that a speaker showing signs of attrition in an immigrant setting sounds different and has lost their status as a native speaker (Schmid & Hopp, 2014). Nevertheless, language attrition is a highly individualized phenomenon and hard to predict a priori. That is, not every bilingual exhibits signs of language attrition, and if attrition eventually happens, it affects individuals differently, with some exhibiting more widespread loss than others.

Two factors that determine the extent of language attrition in bilinguals are the availability of input and the age of the individual at the onset of the reduction in input in their native language. Montrul (2008) and Bylund (2009) independently argued that just as there are well documented age effects for L2 acquisition, there are also age effects for L1 attrition: the younger the individual is when reduction of input in the first language occurs in a bilingual situation, the more severe the attrition will be. As in L2 acquisition, the criti-

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cal age that determines whether the native language is likely to undergo attrition appears to be immediately before and around puberty. Yeni-Komshian Flege and Liu (2000) and Ahn, Chang, Lee Ellis, and DeKeyser (2017) document age effects in attrition in two empirical studies of the pronunciation and phonological abilities of Korean immigrants in the United States. Age effects in L1 attrition have also been observed in the domain of morphosyntax. Flores (2010) found that Portuguese-German bilinguals who immigrated to Portugal after puberty retained more accurate syntactic knowledge of German than those who emigrated before puberty. These three studies show that younger bilinguals exhibit more phonological and morphosyntactic changes in their L1s, which can be considered evidence of attrition, than bilinguals who receive intense exposure to the L2 after they have reached adulthood in the L1 setting.

Lack of input and language use contributes to language attrition, especially in childhood; in adulthood empirical support for this claim is scarce. However, in terms of access to input, a distinction must be made between reduced exposure to and use of the L1 versus interrupted exposure to the L1 altogether. Although this distinction does not seem to affect adults so much, it is critical for children. In general, adults manifest little attrition regardless of whether they discontinue using the L1 altogether or use it less frequently (Schmid, 2007). Children who immigrate with their parents—heritage speakers—continue to have exposure to the family language to varying degrees. Some develop very advanced proficiency in the native heritage language while others show variable outcomes of nonnative acquisition (Montrul, 2008, 2016). Even though these children do not use the heritage language frequently, some of them may end up becoming receptive bilinguals (Au, Knightly, Jun, & Oh, 2002; Sherkina-Lieber, 2011), with some understanding of the heritage language even if they rarely speak it. In contrast, internationally adopted children are often adopted by families who do not speak the native language of the adopted child. For these children, contact with their native language is discontinued soon after adoption (Glennen, 2005). As a result, the speed and extent of L1 attrition many adoptees experience is very fast and severe, leaving practically no overt behavioral evidence of the L1. Most adopted children undergo native language replacement, becoming monolingual in the language of the adoptive family and country (Genesee, 2016). Age effects have also been noted with these special cases: infants and toddlers experience faster and more extensive language attrition than children and adolescents.

### 1.1 What Does Attrition Look Like?

Adults undergoing L1 attrition exhibit reduced fluency (Schmid, 2011, p. 1): they tend to talk hesitantly and slowly, with many pauses, repetition of words, self-corrections, and word finding difficulties. They resort to code-switching to make up for lexical gaps, and avoid complex constructions like embedded clauses or passives. They may exhibit a foreign accent and what many fluent native speakers would consider grammatical and lexical errors (Ecke & Hall, 2013). The following examples are from a 35-year-old Spanish speaker from Guatemala who demonstrated significant attrition; she was adopted at age 9 by an American family (Montrul, 2011). Her pronunciation in Spanish sounded native, with occasional interference from English. Yet, her speech was non-fluent and labored

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when it came to lexical retrieval and grammatical accuracy. She compensated for word-finding difficulties with code switching and borrowings from English, as seen in examples (1) and (2) (underlined words represent grammatical errors, disfluencies, and code switching):

(1)

Como die-, ok, te- tenía teng- tenía casi diez años cuando mis padres americanos me adoptaron, so viví ahí en Guatemala hasta hasta que tenía completo nueve años.

“I was almost ten years when my American parents adopted me, so I lived there in Guatemala until until I had complete nine years.”

(2)

Sí, un poquito, mi abuelito nos cuidan mí a mi hermana y yo, nosotros estamos adoptado juntas

“Yes, a little bit, my granddaddy took care of me and my sister. We were adopted together.”

An important question is whether attrition mainly occurs at the level of processing or whether it affects actual linguistic competence. At least for immigrant adults, who experience intense exposure to the L2 in adulthood well after linguistic maturity in L1 was reached (after age 18), attrition mostly appears to affect processing and activation rather than deeper levels of linguistic representation (Montrul, 2008). However, language attrition has been shown to target aspects of syntax and the syntax-pragmatics interface. For example, well studied phenomena that display attrition are the overproduction of overt subjects in pragmatically infelicitous contexts in speakers of null subject languages (Sorace, 2000; Tsimpli, 2007), and the interpretations of pronouns and anaphors (Gürel, 2004; Kim, Montrul, & Yoon, 2010), which suggest that attrition may impact deeper levels of linguistic representations. Perpiñán (2013) reported changes in word order related to stylistic variation in Spanish, also regulated by the syntax-discourse interface. When these structures are measured through different behavioral tasks (oral production, sentence comprehension, truth value judgements), quantitative differences, if minor, are found between native speakers who are attrited and those who are not.

When the L1 grammar appears to undergo change—as with grammatical phenomena at the syntax-discourse interface—many of the changes seem to be induced by the L2. Bylund (2009) reported changes in the expression of motion events in the L1 of Spanish speakers living in Sweden, who seem to be influenced by the way the same events are syntactically expressed in Swedish, their L2. The Spanish speakers undergoing attrition in his study verbalized endpoints in Spanish like they would do in Swedish, and did not use the structures typically used by native speakers of Spanish to describe the same events. Gürel (2004) also attributed the changes with pronoun interpretation in Turkish speakers living in the United States and Canada to L2 influence on the L1. More recently, Schmid and Köpcke (2017), who contextualize L1 attrition within bilingualism and empha-

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size its empirical and theoretical relationship to first and second language acquisition, also acknowledge that many L1 attrition effects can be seen as due to the influence of the L2 on the L1. However, Schmid (2011) and Sorace (2000) maintain that not all changes found in attrition can be explained by L2 influence on the L1, and Perpiñán (2013) acknowledges that in her data it is hard to tease apart the role of the L2 from the role that other cognitive and universal processing mechanisms may play in attrition.

### 1.2 Measuring Attrition

Because attrition is considered both a developmental process and an outcome of a process, it should ideally be documented longitudinally, like fossilization (arrested localized linguistic development) in L2 acquisition (Lardiere, 2007). With a longitudinal design it could be established that at Time 1 individual *x* had age-appropriate knowledge of language *y*, and at Time 2 or 3 or 4, knowledge of a given feature of *y* is unstable and shows errors, or said feature of *y* is no longer produced/understood/processed according to native speaker norms. Except for Ecke and Hall's case study (2013) of lexical retrieval and de Bot and Clyne's longitudinal study (1994) of Dutch in Australia, this ideal design has not been frequently adopted in attrition studies measuring specific linguistic changes at the level of sounds, words, or grammar. This is so because in most cases adopting such a design is not feasible. Instead, adults who grew up in a predominantly monolingual environment with prolonged exposure to a second language in a bilingual setting are considered an ideal population on which to test potential attrition, because it can be assumed that they reached linguistic maturity before attrition set in. The potentially attrited L1 of these speakers is compared or measured against the non-attrited version of the L1 as spoken by fluent adult bilingual or monolingual speakers not living in an L2 environment (Major, 1992; Montrul & Sánchez-Walker, 2013).

Another reason why longitudinal studies are not very common is because attrition is subject to high individual variation: some speakers show signs of attrition while others do not, and it would be hard to tell in advance who is going to show signs of attrition if a longitudinal study were to be planned. For example, Montrul and Sánchez-Walker (2013) found that in a group of 23 adult immigrants from Mexico, 13 demonstrated native knowledge (as measured in production and grammaticality judgement tasks) of the fact that animate objects in Spanish are marked by the preposition *a* (as in *Juan vio a María* "Juan saw Mary" vs. \**Juan vio María*), whereas 10 exhibited omission errors. Those who made the errors were older than the immigrants who did not make them, acquired English later in life, and had resided in the United States longer. The two immigrants with the lowest accuracy had been in the United States for more than 30 years.

Like many others, Schmid and Köpke (2017) conceptualize L1 attrition as a continuum ranging from online/transient effects to representational/permanent effects of the L2 on the L1, with no discrete or distinct stages. Thus, in their view, every bilingual is an L1 attriter. A meaningful way to distinguish effects of processing from representational effects is by testing, ideally, the same phenomenon in the same individuals using multiple and complementary methodologies, such as online and offline tasks. Studies using multiple

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methodologies conducted in L2 acquisition (Grüter, Lew-Williams, & Fernald, 2012) and child and adult heritage language acquisition (Montrul, Foote, & Perpiñán, 2008; Montrul, 2010; Kim, O'Grady, & Schwartz, 2018) show that it is possible to detect subtle behavioral differences in tasks tapping processing and representational effects of the L1 on the L2 or of the L2 on the L1, which can in turn be interpreted to reflect different stages of acquisition or loss. Online measures of accuracy and reaction times are typically more sensitive than offline measures, and changes not observed in offline comprehension and production can still be detected in online comprehension. If potential attriters show effects in processing tasks but not in offline tasks, then it is possible that attrition may be at an incipient stage manifesting itself as an online effect only. If attrition is detected in offline tasks, and corroborated in online tasks, it may be a sign of a representational change. Of course, whether these effects are fleeting or stable can only be determined with a longitudinal study. See Jaespert, Kroon, and van Hout (1986) on points of reference in attrition research.

### 1.3 Theoretical Approaches

Language attrition impacts language use, access, and grammatical integrity, and the most prominent theoretical approaches assumed to study attrition reflect these distinctions. Within an early generative linguistics perspective (Chomsky, 1981), Sharwood Smith (1983, 1989, 2007), Sharwood-Smith and Van Buren (1991), and Seliger (1996) considered the competence/performance dichotomy to be relevant for attrition, asking whether attrition involves qualitative changes in the L1 grammatical system at the level of linguistic representations, or more superficial difficulties with access to and control of the linguistic system during performance. At least in adults, attrition is more easily measured in lexical retrieval and pronunciation and attrition of morphology is less common. The selectivity of attrition raises fundamental questions about the nature of the mature linguistic competence of a native hearer-speaker, and about the nature of language. For example, why does attrition target certain grammatical areas and not others? Which grammatical areas are the most vulnerable to attrition and why? The selectivity of attrition by grammatical domain and language skills, much like the selectivity of fossilization in L2 acquisition, supports the modularity of grammatical subsystems (phonology, morphology, syntax, semantics, pragmatics) and the links or integration of these systems with one another and with other grammar-external systems (also known as interfaces).

Jakobson's Regression Hypothesis (1941) is the earliest model of language attrition that attempts to explain its selectivity by specifically relating language attrition to the process and developmental stages of L1 acquisition. The central thesis is that attrition is the mirror image of acquisition: structures acquired late in L1 acquisition will be first affected in L1 attrition. It is well known that phonology develops before morphology and syntax. Within phonology, morphology, and syntax, different structures follow different developmental schedules. The Regression Hypothesis captures, in a sense, the well-observed processes of simplification, redundancy reduction, and the preference for unmarked universal values that are involved in language attrition. Children's acquisition of language is assumed to be governed by universal learning principles and markedness considerations.

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Unmarked sounds, features, and parameter values are typically learned before more marked ones (e.g., coronal sounds are learned before non-coronal sounds, regular paradigms are learned before exceptions, simple sentences are learned before complex sentences, etc.). Most basic universal features of language are learned before language-specific features. Thus, in attrition, according to the Regression Hypothesis, the reverse would hold: loss of marked language-specific features, regularization of irregular morphological patterns, difficulty processing complex sentences.

Another model of attrition within the generative framework—the Interface Hypothesis (Sorace, 2000, 2011; Tsimpli, Sorace, Heycock, & Filiaci, 2004; Tsimpli, 2007)—seeks to capture the selectivity of attrition by emphasizing the architecture of the language faculty, which according to this view is composed of distinct modules (phonology, morphology, syntax, semantics) and the interfaces between these modules and the external conceptual and articulatory systems. Many studies have found that adults undergoing attrition exhibit optionality and nonnative command of phenomena at the syntax-discourse interface. As mentioned earlier, the most widely studied phenomenon is the production and interpretation of overt subject pronouns in pro-drop languages (Giannakou, 2018; Sorace, 2000; Tsimpli, 2007). The Interface Hypothesis (2011) states that phenomena at the syntax-discourse interface are more prone to attrition than those in core aspects of grammar, such as morphology or syntax proper. The interface program has driven much linguistic research on L1 attrition.

Overall, attrited L1 speakers preserve a very high overall command of their L1, with very little evidence of attrition at the grammatical level (syntax, morphology, phonology). Most attrition effects have been documented with pronunciation (phonetics) and remembering words, (i.e., lexical retrieval and access as described by Schmid & Köpke, 2017), leading many researchers to believe that attrition is governed by cognitive processes rooted in memory (Köpke, 2007). It may be the case that the first language is not lost but becomes less accessible, and its processing more difficult. Crucial to this view are the psycholinguistic mechanisms behind memory and forgetting, cross-linguistic influence in bilinguals, and the cognitive processes of activation and inhibition in bilingual processing (Green, 1986).

M. Paradis's cognitive and neurologically based approach to attrition (2004, 2007)—the Activation Threshold Hypothesis—emphasizes the role of inhibition and frequency in bilingual language use (see also Grosjean, 2008). Based on an analogy with neuron action potential, the Activation Threshold Hypothesis states that a linguistic item is activated when a sufficient amount of positive neural impulses—its activation threshold—has reached its neural substrate. If the item is inactive or unselected due to disuse, its threshold of activation rises. The more an item is used, selected, or activated, the lower its activation threshold. "Attrition is the result of long-term lack of stimulation. Intensive use/exposure to one of the languages in a bilingual environment leads to a lower activation threshold for that language (i.e., it requires fewer resources), even in early, fluent, behaviorally balanced bilinguals" (Paradis, 2004, p. 28). The Activation Threshold Hypothesis also predicts that production (or recall) of a linguistic item will be more difficult than comprehen-

sion of the same item, because production requires a higher level of activation than comprehension, due to the neurological mechanisms involved. Another prediction is that the less the L1 is used, the more attrition there should be because competition from the L2 would be much higher. A study of lexical access supporting the Activation Threshold Hypothesis is Hulsen (2000), which manipulated lexical frequency and cognate status of words in three generations of Dutch speakers in New Zealand with different uses of Dutch (L1) and English (L2). Other empirical evidence shows that degree and frequency of L1 use does not correlate with degree of lexical attrition or fluency in adults (Schmid, 2007, but cf. Gürel, 2007).

The Dynamic Systems Theory (de Bot, 2007; de Leuw, Opitz, & Lubinska, 2013) is another psycholinguistic approach that sees language attrition as a dynamic process developing during the life span. As such, it considers that the L1 changes as part of a complex set of interactions between the L1 and the L2 along the life span of a bilingual in a nonlinear fashion, which includes fluctuations in input and use, and changes in the L1 and the L2. Changes of L1 and L2 over time are modulated by a wide range of factors (such as amount of use and length of exposure, aptitude, motivation, L2 proficiency, etc.) in ways that are, to date, poorly understood. Cross-linguistic influence is neither unidirectional nor linear but perhaps related to the Complementarity Principle (Grosjean, 2008): in some situations, in some settings, in some life phases, the effects of mutually interacting L1 and L2 systems may be less or more pronounced both within and across bilingual individuals. The few studies conducted within this framework have focused on the effects of external individual variables on phonological changes and lexical changes (Ecke & Hall, 2013; Opitz, 2013).

To summarize, theoretical approaches to attrition have emphasized its relationship with L1 acquisition, the selectivity of attrition by linguistic modules, the effects of language use on memory, and the interplay between the L1 and the L2 along the life span. Still lacking is better understanding of how attrition affects linguistic representations and processing and the external and individual cognitive factors that modulate, predict, or prevent attrition in bilinguals.

## 2. The L1 Attrition of Morphology

Morphology is the grammatical subsystem of the language that deals with the linguistic resources for word (or lexeme) formation and variations in the realizations of words/lexemes according to grammatical context. While irregular processes can be used to create new words/lexemes, the regular resources employed in word-formation across languages are derivational affixation, compounding, and, perhaps, conversion/zero derivation (Lieber, 2015). The variation of words/lexemes according to grammatical context is the traditional domain of inflectional morphology. Because grammatical context is provided by syntax, there is naturally an intimate connection between inflectional morphology and syntax, while the relationship between word-formation and syntax is indirect. The close relation between syntax and inflectional morphology is taken to the extreme in certain ap-

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proaches, such as Distributed Morphology (Halle & Marantz, 1993; Embick & Noyer, 2007; etc.), which do not posit a theoretical distinction between syntax and morphology but view the two as part of a unified system.

The traditionally noted differences between derivation and inflection (such as differences in productivity, in whether it can change the lexical category of the base, in the relative positions of exponence of the two types of morphology, etc.) can all be understood from the different functions of the two systems: the function of derivation is to create (classes of) new words/lexemes, while inflection deals with the different realizations of grammatical properties of words/lexemes in a particular context.

Variation in the form of words and morphemes is not restricted to inflectional morphology, however. Allomorphy that is not due to syntactic context is regularly found in derivational morphology. There are purely morphological restrictions on derivational processes, such as the restriction on the etymological type of the base that a particular derivational morpheme may attach to. And not all types of variation in form in inflection are due to the demands of syntax, but may reflect purely morphological (or ‘morphomic’, a la Aronoff, 1994) conditions within a language. Inflection/declension classes are a case in point.

Derivational and inflectional morphology employ a variety of distinct processes across languages. While the most familiar among them is the concatenative process of affixation, non-concatenative processes are fairly common across languages, including root-and-pattern morphology and various types of phonological and prosodic processes (e.g., ablaut, infixation, and reduplication). Though languages may differ in the resources employed in derivational morphology, there are much more pronounced differences among languages in their inflectional morphology, as recognized in part in the traditional, Humboldtian, typology of languages (isolating-synthetic-agglutinative-polysynthetic languages). Some languages appear not to have inflection at all, or employ it very sparingly, while others have highly developed systems of inherent inflection for its major lexical categories, in addition to possessing contextual inflection that expresses agreement/concord. Even in languages with comparable amounts of inflection, the morphosyntactic features that are encoded in inflection may differ, though there are well-known typological generalizations and universal tendencies (Greenberg, 1966; Cinque, 1999). A related issue is that in many languages with inflection, certain feature combinations (cells) in an inflectional paradigm may be expressed by more than one word—that is, analytically, or periphrastically. Periphrastic/analytic exponence of morphosyntactic features is not restricted to paradigmatic cells, however. Encoding of certain features (e.g., tense and aspect) in a language can be done entirely through periphrasis, or through a combination of periphrasis and inflectional marking (cf. English aspect).

Though the repertoire of morphological operations employed in derivation and inflection are similar, there is a sense in which inflection is more complex than derivation. This is because inflectional morphology does not just deal with the creation of appropriate morphological forms of a lexeme (like word-formation), but also checks the appropriateness of the resulting form with respect to syntax. In other words, inflectional morphology re-

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quires modulation of the morphology-syntax interface in a way that word-formation does not. We therefore expect that attrition would be manifested in inflection more commonly than in word-formation. In addition to being a more complex system, inflectional morphology lends itself easily to measurement for signs of possible attrition. This is because inflectional morphology occurs frequently and therefore is more salient than derivational morphology, given that the inflectional categories of a language, such as number, gender, and case on nominals and agreement, or tense and aspect on verbs, have to be expressed obligatorily. Any deviance from native speaker norms in the production and comprehension of these categories would be readily noticed. It is not surprising then that there are quite a few studies available reporting attrition in inflectional morphology, especially in spoken language. By contrast, attrition in derivational morphology is harder to measure, because derivational processes are not required by syntactic contexts. Syntactically, a simple noun serves just as well as a complex derived noun in a slot that calls for a noun—as long as its inflectional categories are expressed correctly. Testing the knowledge or potential loss of derivational morphology requires using elicited production tasks (e.g., Wug test) or offline and online tasks that tap into the speaker's ability to decompose and construct morphologically complex forms in terms of roots, stems, and affixes. To do this, reading tasks, similar to those used in the study of the acquisition of morphology (Kieffer & Lesaux, 2008), need to be employed.

Morphological loss or attrition manifests itself in a variety of ways: morphophonemic leveling (Hungarian, Vago, 1991), morphological simplification, including omission of required morphology in obligatory contexts (Dyirbal, Schmidt, 1991), paradigmatic reduction (Greek, Pelc, 2001), simplification/reduction of suffixal allomorphy (Breton, Dressler, 1991), regularization of irregular forms (Dutch, Keijzer, 2007), and the replacement of synthetic forms for analytic/periphrastic forms (Breton, Dressler, 1991). What we are calling morphological attrition has often been discussed in the context of language death (Gal, 1989), or language loss at the community level (Schmidt, 1985) for both child and adult bilinguals.

A question regarding morphological attrition arises in view of the fact that languages differ in the repertoire of morphological processes employed, from common concatenative processes to non-concatenative processes, in both derivational and inflectional morphology. The repertoire of processes deployed in inflectional morphology correlates in part with the morphological status of a language in terms of the traditional fourfold classification. For example, agglutinating languages (e.g., Turkish, Inuttitut) predominantly employ concatenative, affixational processes, while synthetic languages (e.g., German, Portuguese) may exploit nonlinear/non-concatenative processes, in addition to affixation. Given this typological space of variation, the question arises whether one type of morphology is more vulnerable to attrition than others. The scant empirical evidence to date seems to indicate that the processes of omission, regularization, and suppletion that are common in attrition occur regardless of the dominant morphological type of a language, but we also acknowledge that more systematic comparative work on typologically different lan-

guages would be needed before we can be certain that typology is not relevant to attrition.

### 2.1 Age Effects

Production of inflectional morphology by linguistically mature native speakers is highly accurate and stable—it is a domain of language where speakers do not vary. For example, production of gender marking in languages that encode it in inflection is at ceiling for native speakers. Developmentally, L1 acquisition of morphology takes a few years, but it is well known that morphology is very difficult to acquire in a second language, especially if L2 acquisition occurs after puberty (Slabakova, 2008). It is not surprising therefore that attrition of morphology is minimal or rare in adult immigrants who are late bilinguals but is quite extensive in sequential bilingual children (immigrant children), and among simultaneous bilinguals (children of immigrants born in the host country and exposed to the majority language since birth). Unfortunately, however, age and amount of input are confounded in studies of age effects in linguistic development and attrition, and difficult to study independently of each other.

Compared to adult immigrants, child and adult heritage speakers (children of immigrants) show more extensive evidence of attrition of inflectional morphology. Because the L1 is still fragile up until at least puberty, bilingual children are more likely to exhibit nonnative acquisition, regression, and loss of morphological elements acquired earlier in childhood if input to the heritage language is not sufficient to support the healthy development of the heritage language. Regardless of the language they speak, child and adult heritage speakers show structural changes or errors in nominal and verbal morphology, and there is a relationship between the amount of errors and their overall linguistic proficiency: those with lower proficiency in the heritage language show more loss than those with higher proficiency. These findings are consistent with the hypothesis that there are age effects in L1 attrition (Montrul, 2008). L1 attrition and heritage language acquisition are related and are part of the same developmental phenomena (Montrul, 2016, 2017). Montrul, Bhatt, and Girju's cross-generational study of differential object marking (case) in Hindi, Spanish, and Romanian in the United States (2015) tested young adult heritage speakers with different ages for the onset of acquisition of English, along with adult immigrants and younger and older native speakers in their homeland. Their study found the developmental continuity between heritage speakers and L1 attriters clearly and directly in a domain related to inflectional morphology.

In general, the empirical evidence available to date suggests that no adult undergoing attrition in a bilingual environment regresses in their native language to such an extent as to forget how to conjugate verbs or mark case and the gender on nouns (Keijzer, 2007). However, if immigration happens before puberty, as in the case of many heritage speakers (the children of immigrants), the native language is less likely to be preserved at native levels in the new environment. Attrition in these cases has a significant effect on various aspects of morphology. As noted, despite typological differences in the morphological expression of morphosyntactic features, heritage speakers of diverse languages show

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strikingly similar patterns of omission of obligatory inflectional morphology and regularization of irregular forms, processes that lead to an overall simplification of inflectional morphology in their heritage languages. The extent of morphological attrition varies significantly depending on the age of the speaker when input is reduced, as in heritage languages, or interrupted, as in international adoptees.

Because attrition is common in bilinguals, there are also intriguing parallels between L1 attrition and L2 acquisition in the structural aspects of language that are most vulnerable to attrition. To the best of our knowledge, Sorace (2000) and Gürel (2004) were the first ones to note and attempt to connect the fact that most of the grammatical patterns found in attrition are similar to the patterns found in L2 acquisition. Studies continued to show that some of the same grammatical properties that are vulnerable to attrition are also difficult to master in L2 acquisition and bilingualism (Anderson, 1999; Guijarro Fuentes, 2012; Franceschina, 2001; Montrul, Foote, & Perpiñán, 2008; Montrul & Slabakova, 2003; Montrul, 2002; Montrul & Sánchez Walker, 2013; Schmid, 2014). Morphology in general, and specific aspects of morphology in particular, are difficult to acquire and easy to lose in bilingual acquisition and attrition, respectively, due to the impact of dominant language transfer. Examples of specific areas of vulnerabilities in morphology are case, gender, and number in nominal morphology and aspect and mood in verbal morphology (see Slabakova, 2008 for a review).

### 2.2 Examples of Morphological Attrition

In general, both inflectional and derivational morphology are affected by language attrition and seem to undergo similar processes of reduction and simplification, regardless of the morphological type of the language.

#### 2.2.1 Inflectional Morphology

One topic that has been investigated is gender and number marking in the nominal inflectional system of German. German nouns belong to one of three genders: masculine, feminine, and neuter. Plural allomorphs are assigned to nouns on the basis of gender and phonological ending. Plural morphology is complex and full of irregularities. Some linguists claim that German has five plural allomorphs (Clahsen, Marcus, Bartke, & Wiese, 1996), but others contend there are nine (Köpcke, 1988). There is great variation in the frequency of these allomorphs, but overall *-en* is the most frequent and *-s* is the least frequent. Although the German nominal inflectional system is replete with irregularities, the most robust rule appears to be that feminine nouns ending in /e/ take (*e*)*n*. Other plural allomorphs vary as a function of the type of derivational affix preceding them. Given the complexity of the system, plural marking in German is difficult to master for German-speaking children (with 90% accuracy in required contexts, Brown, 1973), and even 6-year-olds still make errors (Schmid, 2002, p. 117). The most common error is to overgeneralize (*e*)*n*, the most frequent morpheme, to other less frequent regular and irregular forms.

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A few studies have investigated potential attrition of the complex gender and number inflectional suffixes in German adults (Altenberg, 1991; Gross, 2004; Hutz, 2004; Köpke, 1999; Schmid, 2002), and found some over regularization errors like those produced by German-acquiring children, with the most frequent plural morpheme (*e*)*n* overextended to other irregular forms. In general, the percentage error rate in all these studies was lower than 5% (15 out of 1,000 words for all 35 German Jew speakers combined, or 1.5%, in Schmid's 2002 study, for example). Similarly, Keijzer's study (2007) of Dutch immigrants in Canada found practically no errors with verbal and nominal morphology of Dutch. See Håkansson (1995) for attrition of gender and definiteness marking in Swedish.

Attrition in case marking, another nominal inflectional category, has been investigated in Montrul and Sánchez-Walker (2013), Montrul (2014), and Montrul, Bhatt, and Girju (2015). These studies specifically examined the knowledge and potential loss of differential object marking (DOM) in immigrants and heritage speakers (children of immigrants). In languages that have DOM, DOM is the overt morphological marking (through inflection or periphrastically, using adpositions) of certain classes of direct objects defined semantically and/or pragmatically (Aissen, 2003). This is shown in the Spanish sentence *Juan vio a Maria* (John saw DOM Maria), where the preposition "a" is the DOM marker. English is not a DOM language and all objects are unmarked. In these studies, immigrants from Mexico to the United States (mean length of residence in the United States 25.9 years; mean age of acquisition of English 21 years) showed omission of obligatory of DOM (i.e., attrition compared to age and SES-matched native speakers in the homeland) in oral and written production, oral and written comprehension, and a bimodal acceptability judgement task. While the Hindi and Romanian-speaking heritage speakers displayed grammatical instability with DOM similar to that of the Spanish-speaking heritage speakers, unlike the immigrants from Mexico, the immigrants from India and Romania did not show attrition in production or in offline receptive measures. By comparing three languages, Montrul, Bhatt, and Girju found that language attrition among immigrant communities is selective, and by testing heritage speakers and adult immigrants they confirmed the developmental connection between these two groups by showing how age effects modulate the extent of language loss. The collective results of these three studies, which tested the same individuals with a variety of tests and found attrition effects in all tests, can be taken to suggest that, at least in these participants, the attrition of DOM is stable and at the level of linguistic representation rather than a phenomenon that emerges under language processing load. By contrast, Chamorro, Sturt, and Sorace (2016), who tested knowledge and processing of DOM in adult immigrants from Spain to the United Kingdom with an offline written task and an eye tracking while reading task, found no effects of attrition in either task, concluding that DOM in Spanish is not subject to attrition. Their participants had been in the United Kingdom for less than 10 years, so it is possible that it was still too early to detect attrition in this group.

In an extensive and critical review of several empirical studies of different languages, Montrul (2016) summarizes the most common patterns of attrition of nominal and verbal morphology in heritage speakers of several languages. These patterns in child bilinguals

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seem to emerge mostly from reduced exposure and use of the language during a critical period of later language development, though markedness also seems to be a factor.

### Nominal Morphology

1. Inconsistent use of gender in nouns and gender agreement in noun phrases
2. Regularization of irregular plural forms
3. Omission of overt case marking (marked accusative, inherent dative, ergative)
4. Simplification of case marking (from more to fewer forms)
5. Allophonic reduction and regularization patterns

### Verbal Morphology

1. Tense and agreement morphology tend to be better preserved than aspect and mood. Tense < Agreement < Aspect < Mood
2. Within tense, the morphological future is more affected than present and past
3. Within aspect, imperfect morphology is more affected than perfective morphology
4. In languages that have morphological mood, subjunctive and conditional are often replaced by indicative morphology

For example, future is more marked than past/non-past (present), and indicative mood is more common and frequent than subjunctive or conditional moods. It goes without saying that we need to investigate a more diverse range of languages for possible patterns in morphological attrition. Overall, what we find is a tendency toward simplification.

### 2.2.2 Derivational Morphology

To our knowledge, there aren't a large number of studies documenting attrition of derivational morphology. Gal's study (1989) of Hungarian speakers in Oberwart, Austria, where German is the majority language, provides vivid examples of changes in the internal structure of words. The speakers interviewed were peasant agriculturalists, especially the older generation (60+ years old) (Group A in the study). They spoke Hungarian and learned German after age 15, as a second language. The participants in the other group (Group B) were the children of Hungarian peasants who grew up speaking Hungarian and German as bilingual heritage speakers. The participants in the younger group (Group C) were children of the bilingual heritage speakers and grandchildren of the first-generation speakers (third-generation heritage speakers). Although Hungarian was their native language, these speakers had been schooled entirely in German and had the lowest levels of proficiency in Hungarian, as described by Gal. Following the sociolinguistic tradition, Gal conducted open-ended oral interviews to elicit speech samples, and calculated a lexical proficiency measure for each group. The focus of Gal's study was derivational processes in verbs, that is, how verbal forms with related meaning and words derived from verbs are formed by the productive addition of derivational suffixes. Five types of derivational processes were quantified: (1) denominal/deadjectival causative *-ít* (*rövid/rövidít* 'short/shorten'), (2) deverbal causative *-ít*, (*fordul/fordít* 'turn/make turn'), (3) deverbal causative *-tet/tat* (*ír/írat* 'write/have X write'), (4) preverb + verb: *fel + áll* (up + stand) 'stand up', and (5) general verbalizer *-ol*, (*vásár/vásárol* 'market/to shop'). Gal compared the average

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frequency of these five derivational processes in the first-generation speakers and the third-generation heritage speakers, those with the lowest ability in Hungarian. Gal found that the causative affixes were practically not productive in the lexicons of the third-generation heritage speakers (Group C), who rarely employed them in their speech. However, the use of preverb +verb and the general verbalizer-*ol* in (4) was higher for the heritage speakers (Group B) than for the first-generation speakers (Group A). Furthermore, these two patterns were used very productively, resulting in what is typically described in the acquisition literature as over-regularization errors. Over-regularizations of this sort occurred more often when the speakers were filling lexical gaps, showing that despite having restricted vocabulary, these heritage speakers have implicit, procedural knowledge of certain productive word formation processes.

Dressler (1991) documents attrition in Breton in contact with French. What he calls “healthy speakers,” those who are still quite fluent in Breton, have lost the ability to produce new words (morphological neologisms) spontaneously but they were capable of judging neologisms and understanding morphologically and semantically transparent words. By contrast, those Dressler calls “terminal” and “pre-terminal” speakers, who show less productive use and understanding of Breton, were unable to recognize that the derived instrumental noun *diskeller* (dis+kell+er) meant “cradle” or the derivational relationship between the word *kalz* “much” and its diminutive form *kalzig* (+*ig*). Thus, the speakers with the lowest level of competence in Breton lost the ability to derive/parse complex words via word-formation rules. In a more recent experimental study, Keijzer (2007) tested adult Dutch immigrants in Canada and compared them to adult and 13-year-old Dutch native speakers in the Netherlands. Results of a Wug test, which tested the morphology of the noun, revealed significant differences between the attriters and the adult controls on feminine agentive formation and diminutives and adjectival agreement, although the quantity of errors was minimal. The errors produced involved regularization of irregular forms, such as the replacement of the agentive suffix *-aar* by *-er*, resulting in the nonsense word *\*linderer* for *linderaar*. These are the same types of errors produced by normally developing Dutch children.

Kaufman and Aronoff (1991) report on the morphological attrition of Hebrew (which has both nonconcatenative/templatic and concatenative/suffixal morphology) in a young Hebrew-English bilingual child. Their study focused on the “disintegration” of Michal’s verbal system, a fluent speaker of Hebrew who immigrated with her parents to the United States at the age of 2;6. According to what is reported, Michal’s command of Hebrew was age-appropriate at the time of immigration. At age 2;7, one month after her arrival in the new country, Michal started attending an English-speaking nursery school three hours a day, and decline of her Hebrew proficiency soon ensued. Kaufman and Aronoff distinguish four stages of attrition, as evidenced in code-switched utterances: (1) onset of attrition; ages 2;9-3;1, after 4-7 months in the L2 environment, (2) bilingual period: ages 3;1-3;2, after 7-8 months in the L2 environment, (3) disintegration of L1: ages 3;2-3;5, after 8-11 months in the L2 environment, and (4) idiosyncratic template: ages 3;5-4;6, after 12-24 months in the L2 environment. So, the child starts to forget words in Hebrew after four months of exposure to and use of English. After almost a year in the new environment the

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child no longer produces the different morphological templates of Hebrew, and after one year in the bilingual environment, the child started to use her own version of a template for Hebrew morphology (an idiosyncratic template) instead of the templates used in Hebrew.

Kaufman and Aronoff claim that the onset of attrition began manifesting itself in the lexicon, when Michal started to insert English nouns in Hebrew sentences. At first, the English verbs borrowed were not integrated with Hebrew verbal morphology. When Michal's use of Hebrew was substantially reduced two years later, the child continued to borrow English verbs, but the verbal forms used in Hebrew had now become non-target-like. Apparently, Michal's knowledge of Semitic roots was still intact, but the templates and inflections were now incorrectly used. A few months later, Michal created a hybrid verbal pattern by adopting the most colloquial and productive template in Hebrew child language (iCaCe(C)), which she overextended to other idiosyncratic templates. The rich L1 derivational and inflectional system was reduced to one form. But even though the child misused derivational templates and the inflections were inappropriately used, the verb root was always present and recognizable, and this knowledge was retained, according to the authors, even in later stages of attrition.

### 3. Conclusion

As we have seen, attrition is a dynamic process of accommodation that occurs in bilinguals in situations of extensive use of the second language. Many of the linguistic changes observed in attrition suggest simplification and reduction of some sort, and they also parallel the same processes found in L2 acquisition, such as transfer or cross-linguistic influence, at the psycholinguistic level. Of all the levels of linguistic analysis, morphology seems to be the most vulnerable, especially in children. Of course, the phenomenon of attrition raises the more profound questions: at what level does language loss or forgetting occur? Is language attrition actual loss of linguistic competence at the representational level or does it affect memory and lexical activation and retrieval, that is, fluent language use and processing under communicative pressure? Experimental studies with brain imaging technology might prove to be critical to answer these questions (see Pierce et al., 2015).

### Links to Digital Materials

Short video: *Say it in your own language.*

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