Factors contributing to the attrition of the Polish nominal declension system in Polish immigrants

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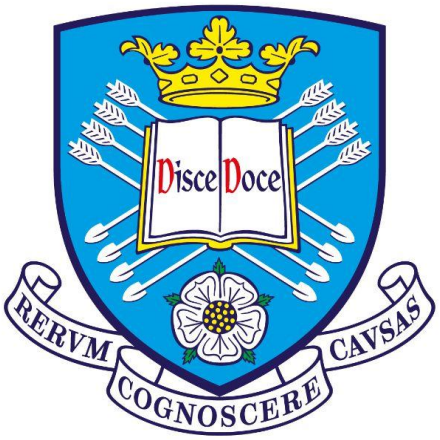

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Dedication

I dedicate this dissertation to my family and friends, who have always supported and encouraged me in everything I do.

Acknowledgements

I would like to sincerely thank Professor Neil Bermel and Dr Justyna Drobnik-Rogers of the University of Sheffield for their much-valued input, guidance, and support with this dissertation. That said, I should emphasise that any remaining errors are entirely my own.

Thank you to everyone who has made my time studying in this great city and university so enjoyable over the last four years.

Abstract

Given its recognised potential to further understanding of language acquisition (de Bot & Weltens, 1995) and the relative dearth of research in the field (Park, 2018), the importance of further research into language attrition should not be underestimated. Despite a rise in interest over the last thirty years (Ecke, 2004; Kupske, 2019), one of the main questions that still engenders wide discussion surrounds the main predictor(s) of language attrition (Köpke, 2004, p. 4). This study investigates the significance of the age of arrival (into the L2 environment) as a predictor for L1 attrition, whilst keeping focus on two other widely-cited attrition predictors: length of residence in the L2 environment and sociolinguistic factors pertaining to the L1. Also investigated is the controversial (Strid, 2016) question concerning the existence (or not) of a critical period for language attrition, which goes hand-in-hand with maturational age factors. The results of this study point towards a relatively strong relationship between age of arrival and extent of attrition, and age of arrival being the most significant attrition predictor. That said, sociolinguistic factors are also suggested to be of importance. Interesting findings regarding the existence of a critical period for L1 attrition around puberty are recorded, which, whilst falling short of a confident assumption regarding its existence, highlight convincingly the need for further research into this question.

Contents

Abbreviations

L1	the native language of the participants; here, Polish (Poland)
L2	the second language of the participants; here, English (UK)
Score%	the nominal declension test score, as a percentage
AoA	age of arrival; the age at which participants immigrated to the UK, from Poland (in years)
AS	affiliation score; the degree to which the participants are affiliated with the Polish language
LoR	length of residence; the number of years a participant has lived in the L2 environment (here, UK)
Nom	nominative
Acc	accusative
Gen	genitive
Loc	locative
Inst	instrumental
Dat	dative
Voc	vocative
CPH	Critical Period hypothesis (for language attrition, unless otherwise stated)
ATH	Activation Threshold hypothesis
BLP	British Lexicon Project
df	degree(s) of freedom

1. Introduction

Despite a rise in prominence in the latter part of the twentieth century (Weltens & Cohen, 1989; Schmid, 2016), language attrition is a relatively under-researched area of linguistics (Park, 2018; Ecke, 2004). Köpke (2004, p. 3) defines attrition as '[...] the non-pathological loss of a language in, usually, bilingual subjects'. As (Schmid, 2013a, p. 1) laments, there is an 'overwhelming bias' in research to focus on language acquisition and transfer as opposed to attrition. This is unfortunate, given the worthy place of attrition in the field of neurolinguistics. Indeed, '[...] in order to fully understand the nature of bilingual language development and to resolve important and fundamental questions about the human capacity for language learning, processing and use, we need to [...] [better understand] [...] how the mechanisms that drive and constrain L2 acquisition may also affect already established linguistic knowledge [...]' (Schmid & Köpke, 2017, p. 5). Schmid (2013a, p. 3) goes as far to say that attrition studies could be the 'missing link' in solving conflicting views on bilingual development. As Köpke (2004) highlights, the processes underlying attrition may indeed be related to the general workings of the human brain. The benefits of further attrition research are neatly summarised by Hansen (2001, p. 61): 'Attrition research provides another window on the dynamism of language [...]'. Given its clear potential for shedding light on questions spanning not only multiple areas of linguistic study, but also general neurological investigation, the importance of further research into the relatively new field of language attrition is evident.

Whilst the phenomenon of language attrition has, over the years, been examined from a variety of angles, a more concentrated and empirical perspective was adopted in the early 1990s, with an increasing number of investigations centering around the loss of the L1 (Schmid, 2016)[1]. As Schmid (2016, p. 186) highlights, this brought about '[...] more clearly defined theoretical foundations and predictions for the field from a variety of perspectives, such as the impact of socio-/ethnolinguistic factors [...]'. Indeed, these different perspectives have given rise to important questions. For example, it has been widely established that full L1 development relies on its early acquisition (Mayberry, 2007; Schmid, 2011a). This leads us to question the effects a dual language context has on previously-acquired elements of the L1, as the brain adapts to a new linguistic environment and system.

Another major pillar of investigation in attrition is what causes it; indeed, this was the first of the three main questions of attrition delineated by Köpke (2004, p. 4). Various predictors of L1 attrition have been proposed and explored, such as education (Schmid & Köpke, 2009), use and affiliation (Köpke & Schmid, 2004; Köpke, 2007), and length of residence in the L2 environment (Ventureyra, 2005), among others. This leads to the question, then, of whether there is a main predictor for attrition, and if so, what it is. In this regard, attention has often been drawn towards the distinctions between early and late bilinguals. Studies have compared the linguistic capabilities of early bilinguals to that of L2 learners, and, on the other hand, noted little-to-no indications of attrition among late bilinguals (Köpke & Schmid, 2004). A specific age-related predictor that appears to engender particular interest is the age at which monolinguals become bilingual: the age of arrival (into the L2 environment) (Köpke, 2004; Ahn et al., 2017). It has been proposed that, over time, the neural circuits of the brain which are responsible for

[1] In this work, *attrition* refers to first language (L1) attrition, unless otherwise stated.

language learning gradually lose plasticity (Pallier, 2003). Meisel (2008, p. 36) highlights that consequently, '[...] part of the cognitive capacities which subserve language acquisition become[s] inaccessible [...]'. Köpke and Schmid (2004, p. 20) note that before a certain age, previously acquired L1 knowledge can easily be replaced by an L2. Despite these insights, it remains the case that studies specifically focussing on the effect age has on the L1 are scarce (Schmid, 2011a; Ahn, et al., 2017). As noted by Ahn, et al. (2017), the significance of age as a predictor of attrition is unclear. More research is therefore necessary, and it is in this work that I will proffer that age of arrival is the main predictor of attrition (among length of residence and L1 affiliation).

If it is being proposed that age of arrival is the main predictor of L1 attrition, another question naturally arises: is there an age at which we can suggest a speaker is especially susceptible to language attrition? The hypothesis of a critical period, both for acquisition and attrition, has, and continues to be, a source of wide debate (Pallier, 2007; Schouten, 2009; Veríssimo et al., 2017). Indeed, the need for further research into a critical period for attrition has been specifically noted (Ahn, et al., 2017). Similar to the critical period hypothesis for language acquisition, the CPH for language attrition holds that there is a specific age range after which susceptibility to language attrition is entirely unlikely (Montrul, 2008). Numerous studies have noted a more severe level of attrition to varying degrees before the onset of puberty and a more stable, less severe attrition after this age. Therefore, this work will also set out to provide a valid contribution to the question regarding the validity of CPH for attrition.

In terms of the language(s) investigated, this study will focus around the spoken Polish of Poland-UK immigrants. With a considerably large diaspora and a large wave of immigration towards the end of the 20th and start of the 21st century (Okólski & Salt, 2014; UK Government, 2016), the UK provides an opportune canvas on which to investigate L1 attrition. Furthermore, the L2, English, is not closely related with Polish. This plays a vital role in our study, allowing us to effectively rule out crosslinguistic influence as a contributing factor to any language loss (Odlin, 1989, p. 29). Additionally, as Polish is characterised by a high degree of homogeneity (Swan, 2002, p. 5), dialectal and regional variations do not cause the same degree of concern as with other languages. It should also be noted that despite the recognised richness of Slavic languages in cognitive linguistic research (Divjak et al., 2007), there is a dearth of research focusing on Polish (Barski, 2017). It is hoped, then, that this study will be a worthy contribution not only to attrition research, but also to more general research into the Polish language.

To summarise, the aim of this study is to shine a light on two major questions surrounding language attrition. Firstly, it will attempt to provide evidence for age of arrival as the main predictor of language attrition, out of three overarching predictors. Secondly, it will attempt to explore the existence (or not) of a critical period for L1 attrition. Throughout the study, the complex nature of attrition research should be borne in mind. Indeed, Schmid and Seton (2016, p. 6) describe attrition predictors as a '[....] complex, non-linear interplay [...]'. Thus, virtually no study can give definitive answers; it is hoped, however, that this research will contribute to the crucial questions of the kaleidoscope that is attrition

research, which has a great potential to deepen our understanding of not only how languages are lost, but many other areas and phenomena also.

2. Theoretical background

The predictors of attrition and the significance of age

To date, there remains much debate specifically surrounding the predictors of attrition (Ventureyra, 2005). Köpke and Schmid (2004, p. 3) explain that findings from individual studies appear to suggest that we can not even say with any certainty how or why attrition occurs. Whilst it is true that there is a good amount of converging evidence pointing towards age being the overriding predictor (Seliger, 1989; Flores, 2010 & 2014), there exists studies which dispute this, such as that of Yeni-Komshian, et al. (2000), which concludes that 'less native' pronunciation was not related to age or a critical period of some sort, but rather different sociological interactions between the languages of the bilinguals. This not only illustrates the need for further research into attrition predictors, but also the complex nature of attrition research.

Reflecting on the complexity of attrition, Park (2018) notes the need to not take only a single predictor into account when understanding the process. To that end, three overarching possible predictors can be drawn out from the last thirty years of attrition research: age of arrival (into the L2 environment) (AoA [(Pelc, 2001])[2], length of residence (LoR) and social factors (L1 affiliation), which will all be clarified in turn. As previously stated, it can be suggested that AoA is both the most researched and most often deemed most significant predictor of attrition (Montrul 2008), however LoR and L1 affiliation have also induced interest and been suggested to be of significance (Barski, 2017).

Let us first examine L1 affiliation in greater depth and what it means in this work. Here, L1 affiliation refers to a group of sociological factors that have received increasing attention in recent years pertaining to the amount of L1 use by a speaker, the speaker's level of education(al use) of the L1, and the degree of contact with the L1. Köpke and Schmid (2004) highlight the importance of considering these factors, yet note the difficulties posed by a lack of framework in current research. In this study, then, these sociolinguistic factors are grouped together under this term.

Whilst a handful of works have pointed towards the significance of L1 affiliation on attrition (Andersen, 1982; Hulsen, 2000; Köpke, 2007), this has also been disputed (Schmid, 2007; Cherciov, 2012). In fact, in Jaspeart and Kroon's (1989) study, language use in particular was suggested to not be a cause of attrition. Of course, L1 affiliation is not entirely separate from AoA; for instance, the amount of L1 use will inevitably decrease when a speaker moves to the L2 environment. Nevertheless, here, a significant relationship between L1 attrition and L1 affiliation would be meaningful; in this study, L1 affiliation encompasses many sub-factors surrounding the use of the L1 *within the L2 environment*. Should this prove to be the most significant predictor, it could be a useful insight for further research dealing with this predictor specifically, suggesting that use *within the context* of an L2 environment is an important factor.

[2] Sometimes referred to as *age of onset (of bilingualism)*, or *age of migration*, *age of departure* (Ammerlaan, 1996).

Similar to L1 affiliation, the significance of LoR is also disputed (Köpke & Schmid, 2004), yet a vast array of interesting findings warrant mentioning (Jaspaert & Kroon 1992; Köpke 1999; Schmid, 2011b; among others). There is a good theoretical foundation in support of LoR, centered around the activation hypothesis and the L1 becoming less easy to access the longer a speaker has been immersed in the L2 environment (Köpke, 2002; Köpke & Schmid, 2004; Ventureyra, 2005). Schmid (2011b, p. 160) gives a good theoretical summary of the hypothesis: '[...], the ATH[3] [...] predicts that L1 attrition may be affected by [LoR] and [L1] contact [and use]'. Similarly, Ammerlaan's (1996) study found links between attrition, AoA and LoR.

It is wise to consider the difficulties associated with LoR, which demonstrate well the wider complexities of attrition research. As Schmid and Seton (2016) and Schmid (2011a) note, AoA and LoR often correlate, making it sometimes difficult to assess the two independently. That said, they go on to highlight instances where its inclusion and interpretation have proved to be of importance. Thus, despite ATH not being one of the focus points of this investigation, and the complexities of the predictor, it is clear that LoR is a factor which warrants further investigation (Higby & Obler, 2017; Schmid & Yilmaz, 2018, p. 6).

The main focus of this investigation, though, is the age at which Poles moved to the UK (AoA), where there is a clear and sudden change in a speaker's geographical and, incidentally, linguistic environment. The effects a of younger or older AoA have been theoristed (Köpke et al., 2007, among others), and there has been converging evidence that a younger AoA will result in a greater extent of attrition (Lightbrown & Spada 1993; Bylund, 2009a). Nevertheless, there is still great discussion concerning the significance of AoA on attrition: studies such as Ammerlaan (1996) and Pelc (2001) have found age effects to be of great importance, whereas others, such as Schmid (2002), where sociolinguistic factors are suggested to be the most significant, do not.

Whilst numerous explanations have been given to explain a potential correlation between a younger age of arrival and increased L1 attrition, Penfield and Roberts' (1959) prospal that a maturationally-related loss in neural plasticity is responsible is often-cited (Singleton, 2007). In order to best explain this theory, it is a good idea to view it first through the prism of language acquisition. It centers around the notion that, during the first years of life, synaptic neural connections are not fully mature (Köpke, 2007), predicting that the younger the speaker, the easier and faster adaptation to a new linguistic environment will be (Gervain, 2015). Köpke (2007, p. 2) effectively applies this framework to attrition as such: 'Faster language learning due to greater plasticity might also imply strong L1 attrition in young immigrants, whereas in older immigrants, reduced brain plasticity would both hinder the adaptation to the L2 environment and prevent L1 attrition'. Hulsen (2000) proposes that the younger the speaker, the less resistant the L1 is to L2 pressures[4].

Indeed, Bylund (2009) highlights the importance of further research into the impact of AoA, and Karayayla and Schmid (2018), in their investigation of age effects on structural complexity and foreign accent, advocate for further study in this regard. As previously mentioned, however, attrition research

[3] Here: *Activation Threshold hypothesis*.
[4] This will be examined in further detail in the context of the Critical Period hypothesis.

poses its own set of challenges which should be taken into consideration (Schmid & Dusseldorp, 2010). In this study, it should be noted that age is a macro-variable and, and such, can not be entirely separated from other, more specific variables, such as level of education and L1 input, to name but a couple (Montrul, 2008). Rather, age is treated here as a variable that *could well* encompass these more specific variables, as Birdsong (2006) also highlights. Determining which specific neurocognitive or sociological factors are at play is beyond the scope of this study; nevertheless, unearthing further evidence either for or against age of arrival as being a principal predictor is important.

Critical Period hypothesis (CPH)

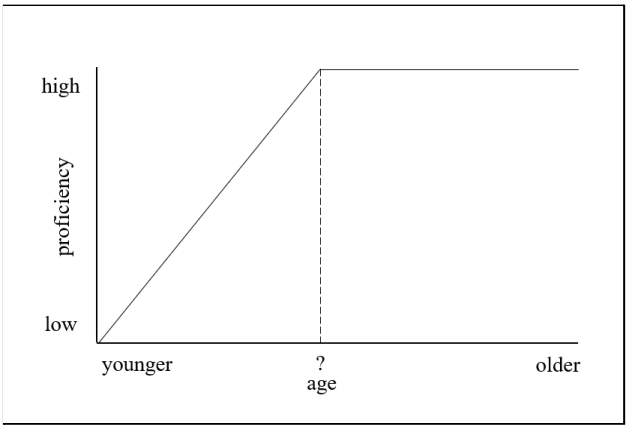
As previously mentioned, there has been converging evidence in attrition research to suggest that children experience a significantly more dramatic erosion of L1 compared to adults, where this is far less significant (Scontras et al., 2015). It is important at this point to make clear what CPH refers to in this study. As Bylund (2009, pp. 699-700) explains:

> 'In its most generic form, a critical period can be characterized as a time span during which there is a heightened sensitivity to certain experiential stimuli, the presence of which is required to set off a developmental event. [...] Applying this concept to an attrition context, one could view the heightened sensitivity as the susceptibility to attrition, the external stimulus as the necessary amount and type of L1 input, and the developmental event as the maintenance of L1.'

Applying this model, CPH refers here to the concept that there is an age (timespan) which generally leads to heightened sensitivity (greater susceptibility to attrition) to being in the L2 environment (reduced L1 input).

If age of arrival does indeed prove to be the most significant predictor of L1 attrition, is there a specific age range at which a speaker is more susceptible to language loss, and a speaker's L1 reaches a mature state? This question has led to suggestions of a given age (limit) which determines the consequences for the L1 of a complete removal from the L1 linguistic environment (Bylund, 2009b). This notion is schematised by figure 2.1 (Montrul 2008, p. 267), where the dotted line represents the hypothetical point at which the L1 'crystallises'. It is wise at this stage to illustrate the interconnectedness of attrition and acquisition; as Montrul (2008, p. 266) summarises: '[...] [the dotted line] would mark the age after which the capacity for acquiring a second language like a native speaker becomes [...] irreversibly disabled and L1 loss is less likely, and the age before which it is possible to develop native-like knowledge in a second language while vulnerability to L1 loss is still enhanced'.

Fig. 2.1



(adapted from Montrul [2008, p. 267])

With this is mind, the importance of further research into CPH should not be underestimated; Montrul (2008) draws attention to how little attention CPH (specifically in the context of L2 acquisition) has received up until now (despite the fact that the CPH can exist in the context of both areas [Pallier, 2007]), and that CPH research has predominantly centered around late bilinguals, despite CPH also having implications for early bilingualism. There is clear potential for CPH research to answer the question of when exactly a speaker becomes a 'native' speaker so that any long-term fluctuations in input, use, or education do not have any significant ramifications for L1 stability (Schmid & Köpke, 2013). The worthiness of further research into the CPH is eloquently summarised by the title of Dekeyser's (2018, p. 1) article: *The Critical Period hypothesis: A diamond in the rough*.

Studies such as Ammerlaan (1996) have indicated that adults exhibit much less attrition than children. In her work, Montrul (2008) noted that language attrition is very unlikely in adulthood, even at the morphosyntactic level. As previously mentioned, the actual *age* of the hypothetical critical period is yet another point of discussion, rendered foggier still by the dearth of CPH research (Montrul, 2008). Nevertheless, the 'point' of the critical period is often suggested to be puberty[5], where a discontinuity and great variability in attrition has been observed (Bylund, 2009c; Schmid, 2011; Schmid & Karayayla, 2019)[6].

As with age of arrival, it is perhaps obvious to note that even if evidence were to point towards the existence of a critical period, the hypothesis itself encompasses various neurocognitive factors and possibilities relating to declarative and procedural memory and neural plasticity, among others (Paradis, 2004; Pallier, 2007). That said, the concept of neuroplasticity is the most-cited explanation for its existence (Schmid et al., 2007). It has been suggested that in prepubescent children, unstable synaptic connections (which allow for a faster adaptation to new situations and concepts and a more rapid and passive absorption of linguistic information) allow for a more 'malleable' neural system; after puberty, these connections stabilise and make language acquisition more difficult (Ventureyra, 2005, p. 45). As previously noted, determining which specific neurocognitive factors are at play is not the aim of this

[5] In terms of a specific age of puberty, it is almost always suggested to be between 10 and 12 years (Patkowski, 1980). Here, we will deem puberty to be 12 years (Bylund, 2009b; Karaylaya & Schmid, 2018), such as in the Bylund et al. (2009) study.
[6] It should be noted that, in tandem with theories of a discontinuity around puberty, there have also been opposing suggestions of a more gradual decline which begins in early childhood and continues throughout life (see: Pallier, 2007).

study; nevertheless, CPH remains a widely debated issue (Vanhove, 2013; Abutalebi & Clahsen, 2018) which has great potential for furthering linguistic understanding (de Groot et al., 1997) and, therefore, unearthing further evidence either for or against a sensitive time window for attrition is very much needed.

Nominal case

Despite the clear benefits and importance of examining a wide range of grammatical features when testing for attrition (Flores, 2014), case receives little attention compared to other linguistic areas, such as lexicon retention (Park, 2018). Divjak et al. (2007) refer specifically to grammatical case as a feature of Slavic languages which is ripe for investigation in cognitive linguistics. By its nature, case allows us to methodologically analyse any restructuring, erosion of, or deviation from the 'correct' declension paradigm, as has been demonstrated in previous works (Polinsky, 1995; Barski, 2017). Owing to the fact that case is such a fundamental element of Polish (and indeed all Slavonic languages, with the exception of Bulgarian and Macedonian [Mileva, 2009; Wahlström, 2015]), it is, by its nature, used in the vast majority of utterances. Perhaps more importantly, though, it has been reported that inflectional morphology displays a particular vulnerability to attrition (Polinsky, 1995; Montrul, 2002; Ventureya, 2005). Specifically, studies such as Turian and Altenberg (1991) have found that case (in this instance, L1: Russian; L2: English) is vulnerable to restructuring and loss. It can be said, therefore, that case loss is a good indicator of language attrition.

It is important here to differentiate between language attrition and incomplete acquisition. Benmamoun et al. (2013, p. 28) describe incomplete acquisition as when heritage speakers[7] 'fail[...] to fully attain the target grammar during childhood'. On the other hand, language attrition concerns an interruption in L1 input which leads to the erosion or loss of a given element of the L1 that was acquired *before* that interruption. Montrul (2008, p. 4) clarifies that a well-established fact of L1 acquisition is that '[...] normally developing monolingual children succeed in acquiring the basic grammar of their environment (their native language or L1) in a relatively short period of time, typically 3-4 years [...]' and 'Before they begin school, and without receiving any instruction, children master the basic structure of their native language, including [...] morphosyntax [...]'. More specifically, it has been reported that the case system, at least in Russian and Polish, is indeed one of these elements and is virtually fully and intuitively acquired before the age of five (Smoczyńska, 1986; Łuczyński, 2002; Dąbrowska & Szczerbiński, 2006; Machowska, 2006; Olma, 2007; Łuczyński, 2010). Given that a minimum age of arrival of five will be an exclusion criterion for this study, we can be relatively confident that any evidence of loss or erosion of the case system can be attributed to attrition rather than incomplete acquisition, a distinction which Schmid (2011a) highlights as being of importance. We will explore further Polish case and its use as an investigative tool for attrition in the next section.

[7] Here: '[...] [a speaker] of language who is raised in a home where [one language; a heritage language] is spoken [and is,] to some degree, bilingual in [another language, as well as] the heritage language' (Valdés, 2005, p. 412).

Summary of hypotheses

To summarise, then, we can draw up two hypotheses going forward:

1. The age of arrival will be the most significant predictor of language attrition. The lower the age of arrival, the higher the level of attrition.
2. A significant difference in the level of attrition will be noticeable before and after the age of arrival of around puberty (deemed to be, in this study, age 12). This will be a critical period of attrition.

3. The nominal case system of Polish

Brief overview

Polish is an inflected language with a complex nominal declension system (Sadowska, 2012). The language possesses seven cases (Bielec, 1998) (delineated in table 3.1). Constituting an integral element of the language, cases are, by their nature, used in virtually every utterance. The case of a noun is denoted by its ending, or declension. The declension is governed by number (singular or plural), and gender (masculine, feminine, neuter) (Bielec, 1998; Swan, 2009). To give an idea of the number of nominal forms a speaker of Polish has to use on a daily basis, the declension paradigm for *dom* (house) is given in table 3.1.

Table 3.1

Case	Singular	Plural
Nominative	*dom*	*domy*
Accusative	*dom*	*domy*
Genitive	*domu*	*domów*
Locative	*domu*	*domach*
Instrumental	*domem*	*domami*
Dative	*domowi*	*domom*
(Vocative)	*domu, domie*	*domy*

Which case (and, therefore, nominal declension) is used depends on the preceding verb or preposition. For example:

To *jest* *ładny* *dom*.
This is (a) pretty house-NOM.SG
'This is a pretty house.'

Idę *do* *dom-u*.
I am going to (the) house-GEN.SG
'I am going to the house.'

Co *robisz* *z* *dom-em?*
What are you doing with (the) house-INST.SG
'What are you doing with the house?'

Case as an indicator of attrition

In addition to the reason outlined in the *Theoretical background*, case is a grammatical feature pertaining to the Polish language which is virtually non-existent in the L2 (Hudson, 1995). There is, therefore, no risk that speakers are actually attributing a grammatical feature of the L2 onto the L1, which would constitute language transfer (Bardovi-Harlig & Sprouse, 2017) as opposed to L1 attrition.

It was decided to focus solely on nominal declension for a handful of reasons. First and foremost, it has been shown that the nominal declension system begins to develop earlier than that of the adjectival (Łuczyński, 2010). This reduces further the risk of incomplete acquisition being at play, as opposed to attrition. Secondly, by its nature, an adjective describes a noun; the inclusion of adjectives in test questions could therefore hint participants as to which case is required. Lastly, from a logistical standpoint, as the grammar test would be carried out online, the implementation of adjectival questions could have risked confusing participants and potentially rendering answers null and void.

It is also important to note that the decision was made to exclude the vocative case from the study. As Kottum (1983) recognises, the vocative does not possess a syntactic function in a sentence; nouns declined in the vocative do not bear a direct connection to the contents of the sentences in which they find themselves. Indeed, Anstatt (2005) goes as far to say that the Polish vocative can not be described as a case, but rather a derivative category, and that there is a general view that its use is in decline. Its inclusion in this study is therefore not appropriate, owing to the risk of confusing participants unnecessarily and the likely difficulties in formulating questions that resemble the structure of that used for the other six cases.

4. The Study

Subject background

The participants are Polish immigrants who, for aforementioned reasons, have an AoA to the UK of or after the age of five and are still living there. A maximum age limit of 65 applies, as prior research has shown that in older participants, there is a risk that any disfluency (in some cases, at the morphological level [Rabadán & Iglesias, 1994]) could be caused by natural cognitive age-related decline (Burke & Shafto, 2004). For ethical feasibility, all participants are aged 18 or over at the time of completing the test.

Language survey

The method of data collection is an anonymous 'Language survey' which comprises three sections: background questions, language affiliation questionnaire, and a nominal declension test (outlined below). It should be noted that each section is named in a participant-friendly way; for example, the nominal declension test is simply titled 'Language use'. This is to ensure that participants are not discouraged by the feeling of being tested. As Schmid (2011a) warns, a risk pertaining particularly to attrition studies is upsetting participants who can sometimes feel shame or embarrassment at losing their first language. Naming the test as such reduces the risk of participant stress and any temptation to be dishonest in their responses, reinforcing that what is being tested is simply how *they* use the language.

Background questions

The main objective of this section is to gather basic, yet essential information about the participants. Participants are prompted to input their year and month of birth and the age at which they moved to the UK. This allows for the deduction of the LoR of the participants in the analysis stage. It was decided not to explicitly ask for LoR, as this would require additional work on the part of the participant, who would have to step back and calculate this. There is a risk that this could either discourage participants from continuing with the survey or, worse perhaps, lead to an inaccurate LoR calculation.

Texas Bilingualism Language Profile Test

The purpose of this section is to gauge participants' affiliation with the Polish language at the point in time of taking the survey. An adaptation of the Texas Bilingualism Language Profile test (Birdsong et al., 2012), a well-established test battery, is used for this section. Unnecessary sections (history, proficiency) are omitted, and the language use section adapted. The questionnaire consists of nine questions; for example: 'In an average week, what percentage of the time do you use Polish with family?'. For each question, the participant is presented with a Likert scale (Likert, 1932) where they provide a rating of between 0%–100%. The rating for each question contributes to an overall affiliation score (AS) ranging from 0.00–1.00[8].

Grammar test

The main section of the survey is the nominal declension test, which allows for a percentage score based on a participant's ability to decline a series of nouns, and therefore their level of attrition. The test consists of 36 cloze-style questions. The noun appears in brackets, besides each sentence, in its nominative form. This is to ensure the participant knows exactly which noun is to be declined (discouraging the use of diminutives or synonyms). Each sentence triggers one of the six cases, and the participant has to provide the correct declension of the given nominative noun. The order of the sentences

[8] Please see the appendix for an explanation of the affiliation score and its calculation, and a full list of questions included in the questionnaire.

is randomised so that the participant has to consider all possible declensions each time. The format of the questions is shown in figure 4.1.

Fig. 4.1

Question participant sees:	Mój	brat	zawsze	pisze	---?---.	(pióro)
Correctly answered question:	Mój	brat	zawsze	pisze	piórem.	(pióro)
English translation:	My	brother	always	writes	(with a) quill	(quill)

NB: *Underlined noun denotes the correct declension; in this instance, the instrumental case is required.*

In order to confirm that the participant is computer-literate and understands the nature of the question, a control question is included. This consists of the locative declension of the noun *Polska* 'Poland', a construction which virtually all participants will be familiar with.

Various adaptations to the above format were considered. Specifically, it was decided to not include a picture of the noun. Whilst this has the advantage of not having to provide the participants with the nominative declension of the noun, it carries the serious risk of ambiguity: there is no way to discourage participants from using diminutives or other, more colloquial forms with which they are more familiar. The question of providing the nouns in English to aid understanding also arose, but was quickly decided against as it would not be possible to rule out any L1 interference.

A more complex question concerned whether or not to consider diacritic marks when deeming a declension correct or incorrect. Indeed, most diacritic marks that find themselves in the stem endings of declined nouns in Polish alter the pronunciation of the noun. For example, *książk-a*, the nominative form of 'book' and *książk-ą*, its instrumental form, are pronounced markedly differently. Nevertheless, it could be suggested that younger participants with less affiliation with Poland and Polish are less likely to have established settings on their computer or mobile device allowing them to type Polish diacritic marks and special characters (interestingly, this in itself could be an indication of lower L1 affiliation). It was eventually decided to provide guidance in the rubric of the test, and at the top of each question page. Participants are instructed to indicate diacritics with a comma should they not know how to insert them: for example, *ą* becomes *a,*. Other characters such as *ł*, *ż*, etc., which do not form part of any noun declension in this test, were disregarded.

The SUBTLEX-PL corpus (Mandera et al., 2014) was selected to determine the nouns to be included in the test as it is based on film and television subtitles, and thus best resembles spoken Polish[9]. Studies such as Hulsen (2000) have shown that the higher the frequency of a word, the less chance that word has of being vulnerable to attrition. Lemmas were therefore selected based on their Zipf value (van Heuven et al., 2014) (frequency) and cross-checked for their existence and validity in a reputable dictionary (PWN Oxford, 2002). An outline of Zipf values and corresponding examples in the BLP[10] is provided in table 4.1.

[9] As previously mentioned, this study focuses around spoken language. Conducting an oral-based test is not feasible due to the restrictions pertaining to the COVID-19 pandemic. Nevertheless, the study is constructed to focus on spoken language as far as possible.

[10] For more information on the relevance of the BLP in illustrating the Zipf value, see van Heuven et al., (2014).

Table 4.1

Zipf value	Examples in BLP
1	shoestrings, bootlegs, debug, technic, paleness, newscast
2	prefaced, searcher, postscript, smugly, adverb, transcribe
3	quarrel, starlight, dockyard, hermit, evoke, sniffer, bullish
4	rhyme, throne, lightning, cocktail, lungs, neat, banquet
5	add, sold, value, plenty, sitting, brother, fall, brown, worried
6	day, great, should, something, little, need, take, down
7	and, for, have, I, on, the, this, that, you

Adapted from: (The Center for Reading Research [Ghent University], 2013)

To provide an even distribution of common and rarer nouns, six are selected for each case: one Zipf-2 noun, two Zipf-3 nouns, two Zipf-4 nouns, and one Zipf-5 noun. Zipf-6 and -7 mostly contain pronouns and interjections, and so are unsuitable. Zipf-1 is also excluded as to include it would result in an uneven distribution of Zipf values. Among the nouns and Zipf values, the number of nouns of each gender (masculine, feminine, neuter) are evenly distributed in order to ensure that noun gender will not be a determining factor in the attrition score. Similarly, only singular nouns are included, owing to the fact that plural nouns follow a separate declension pattern; pluralia tantum such as *drzwi* ‘set of doors’, *nożyce* ‘pair of scissors’ were excluded for similar reasons (Sadowska, 2012). A participant's number of correctly declined nouns out of a possible 36 is used to determine the percentage score.

Control group

As Schmid (2011a) notes, it is wise to have a control group when testing for language attrition. Therefore, a control group of monolingual Poles living in Poland are to complete a similar survey. For obvious reasons, the affiliation questionnaire is omitted. Instead of gathering responses for the age at which participants moved to the UK, participants are asked their month and year of birth in order for biographical comparisons with the main group to be made during the analysis stage. Participants also confirm that they were born and raised in Poland and have not returned from abroad within the last year (after living there for 2 years or more). This is to ensure that time spent abroad is not substantial or recent enough to have affected participants’ proficiency as far as case usage is concerned. As Montrul and Bowles (2009, p. 363) outline, ‘A given grammar is deemed incomplete when it fails to reach age-appropriate linguistic levels of proficiency as compared with the grammar of monolingual or fluent bilingual speakers of the same age, cognitive development, and social group’. The need for the aforementioned control group is thus clear: whilst it is clearly difficult to obtain a group of monolingual speakers with matching biographical and sociographic data for direct comparison (Schmid, 2011a), testing a range of native speakers living in Poland will provide a valuable comparison of a monolingual speaker’s test score with that of an emigrated bilingual speaker.

Recruiting participants

Participants were found via the snowball sampling method, owing to its speed, cost-effectiveness and ability to locate participants who would otherwise be difficult to access (Atkinson & Flint, 2001; Naderifar et al., 2017). Additionally, this method has the best chance of allowing the target of at least fifteen participants per variable investigated, as set out by Schmid (2011a, pp. 109-110). The surveys were circulated principally through social media; after publishing a brief description of the survey in various UK-based Polish diaspora and Poland-based groups and associations, the survey quickly gained traction and visibility. The potential risk of similarity bias (Hendricks et al., 1992) was deemed to be negligible, considering the very few exclusion criteria imposed. Additionally, great care was taken initially to share the survey with groups distributed all over the United Kingdom and Poland, and not just belonging to one region.

5. Results

Results were analysed using the IBM® SPSS® Statistics package (IBM Corp., 2019)[11]. Out of 207 participants overall, seven responses were excluded from the analyses due to participants incorrectly filling out the *Basic questions* section, meaning that it was not possible to determine the age of these participants.

Hypothesis 1

The age of arrival will be the most significant predictor of language attrition. The lower the age of arrival, the higher the level of attrition.

To test the first hypothesis, correlations between each independent variable and Score% were tested using the Spearman's rank correlation coefficient (r_s)[12], first with all participants in the main group (N=147), followed by the two sub-groups (<=12 AoA [N=46]; >12 AoA [N=101]) of the main group separately (table 5.1). From this, it can be observed that among all participants in the main group (N=147), a higher AoA is associated with a higher Score% value; the correlation is statistically highly significant ($p < .001$) (Gray & Kinnear, 2012; Pallant, 2020) and displays a significant strength of association ($r_s = .508$). Furthermore, a higher AS is accompanied with a higher Score% value; the correlation is statistically significant ($p = .008$) and displays a significant strength of association ($r_s = .217$). Weaker values of correlation coefficients (but which are still statistically significant) inform us that a higher AoA correlates slightly with a AS value ($r_s = .278$, $p = .001$) and a lower LoR value ($r_s = -.193$,

[11] During certain analyses, in addition to the standard statistical significance, *p* values were also calculated using the exact method: 'IBM® SPSS® Statistics calculates significance levels [for non-parametric tests] [...] using the asymptotic method. This means that *p* values are estimated based on the assumption that the data, given a sufficiently large sample size, conform to a particular distribution. However, when the data set is small, sparse, contains many ties, is unbalanced, or is poorly distributed, the asymptotic method may fail to produce reliable results. In these situations, it is preferable to calculate a significance level [using the exact method]. This enables you to obtain an accurate *p* value without relying on assumptions that may not be met by your data' (IBM, 2012).

[12] The coefficient obtained ranges from -1 to +1, where -1 indicates a perfect negative correlation and +1 a perfect positive correlation (Schober et al., 2018; Pallant, 2020). This was used as opposed to other tests as the assumptions for using a parametric test, such as the Pearson correlation, were not met: namely, the normal distribution of data (see appendix: *Normal distribution tests*) (Pallant, 2020). An example of stratifications of the coefficient and their relevant interpretations according to Cohen (1988): small = .10–.29, medium = .30–.49, large = .50–1.0.

p = .019). We can also note that the relationship between Score% and LoR is not statistically significant (p = .443).

Table 5.1: Correlations between variables among all participants of the main group (N=147)

			Score%	AoA	AS
Spearman's r_s	**AoA**	Correlation coefficient	.508**		.278**
		p	.000		.001
		N	147		147
	AS	Correlation coefficient	.217**	.278**	
		p	.008	.001	
		N	147	147	
	LoR	Correlation coefficient	-.064	-.193*	-.101
		p	.443	.019	.223
		N	147	147	147

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

As outlined above, participants were then split into two groups based on their AoA (table 5.2). It can be observed that significant correlations occur only in the <=12 AoA group. It can also be noted that a higher Score% is associated with a higher AoA (p = .003, r_s = .426) and AS (p = .003, r_s = .430).

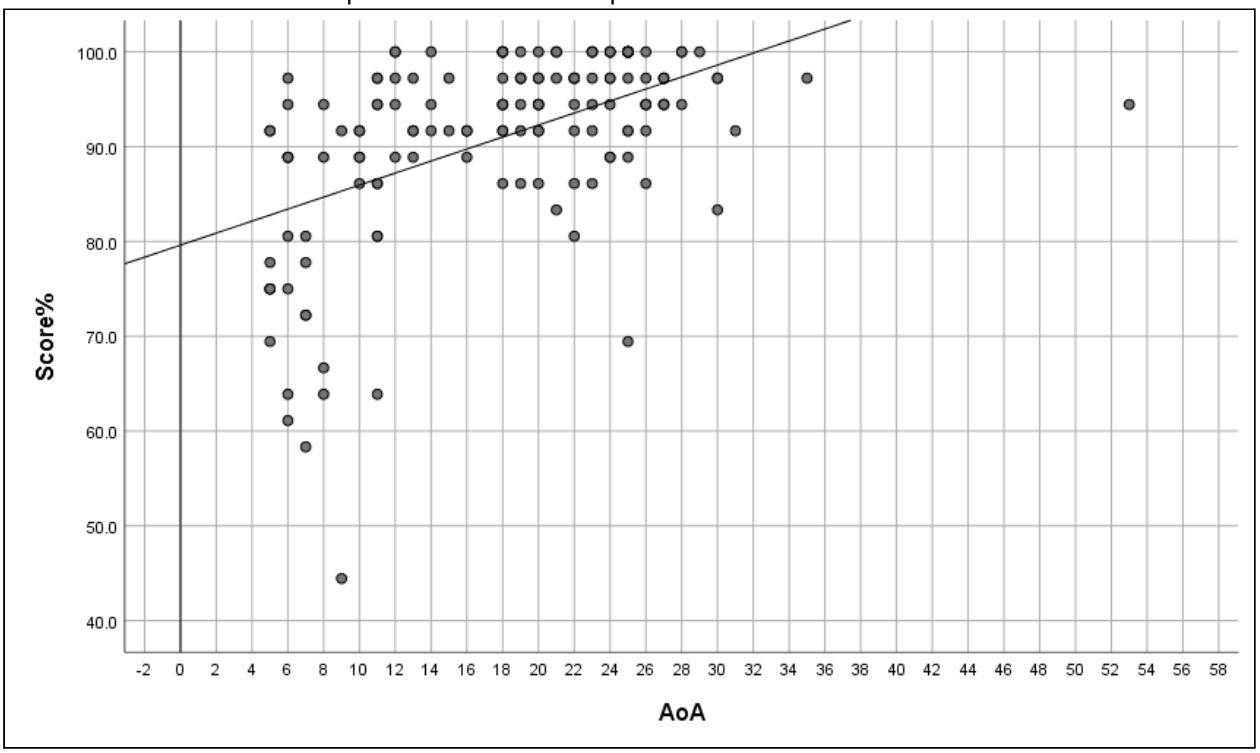
Table 5.2
Correlations between variables where the participants of the main group have been split into two sub-groups, based on AoA (<=12; >12)

Group				Score%	AoA	AS
Spearman's r_s	<=12	AoA	Correlation coefficient	.426**		
			p	.003		
			N	46		
		AS	Correlation coefficient	.430**	.408**	
			p	.003	.005	
			N	46	46	
		LoR	Correlation coefficient	.166	-.287	-.127
			p	.271	.053	.402
			N	46	46	46
	>12	AoA	Correlation coefficient	.158		
			p	.114		
			N	101		
		AS	Correlation coefficient	-.033	.104	
			p	.743	.302	
			N	101	101	
		LoR	Correlation coefficient	.086	.163	-.006
			p	.395	.104	.956
			N	101	101	101

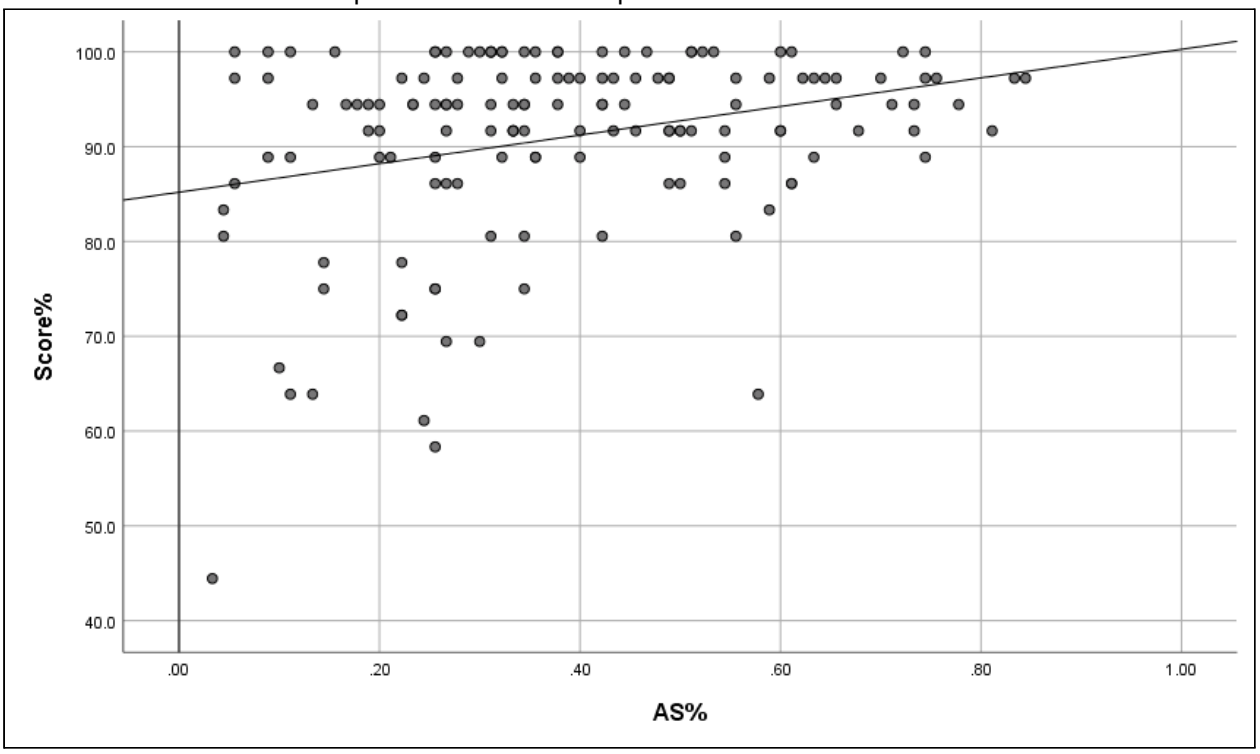
**. Correlation is significant at the 0.01 level (2-tailed).

Graphs 5.1 and 5.2 illustrate the relationship between AoA and AS with Score%.

Graph 5.1: The relationship between AoA and Score%



Graph 5.2: The relationship between AS and Score%



Hypothesis 2

A significant difference in the level of attrition will be noted before and after the age of arrival of around puberty (deemed to be, in this study, age 12). This will be a critical period of attrition.

Analysis 1

The basic test used was the non-parametric Mann Whitney U test[13]. Table 5.3 shows that respondents in the >12 AoA group generally had a higher Score% and AS, and a lower LoR compared to those in the <=12 AoA group. The differences between the groups (<=12 AoA; >12 AoA) were found to be statistically significant ($p < 0.01$).

[13] This test is used especially when the both the dependent and independent variables are measured on a quantitative scale and when the conditions for using parametric tests are not met, namely normal distribution (Pallant, 2020) (see appendix: *Normal distribution tests*).

Table 5.3: Means of variables and Mann-Whitney U test among all participants in the main group, and participants in the main group split based on AoA (<=12; >12)

Group		**Score%**	**AoA**	**AS**	**LoR**
<=12	Mean	82.91	8.33	0.33	14.07
	Median	87.50	8.00	0.28	14.84
	Mean rank	42.48	23.50	59.75	93.85
	N	46	46	46	46
	Std. deviation	12.80	2.50	0.20	2.76
	Minimum	44.44	5.00	0.03	6.04
	Maximum	100.00	12.00	0.84	18.61
>12	Mean	94.72	22.43	0.41	11.04
	Median	94.44	23.00	0.40	10.88
	Mean rank	88.36	97.00	80.49	64.96
	N	101	101	101	101
	Std. deviation	5.26	5.44	0.19	5.85
	Minimum	69.44	13.00	0.04	1.01
	Maximum	100.00	53.00	0.83	30.04
Total	Mean	91.02	18.01	0.39	11.98
	Median	94.44	19.00	0.34	13.34
	N	147	147	147	147
	Std. deviation	9.98	8.08	0.19	5.27
	Minimum	44.44	5.00	0.03	1.01
	Maximum	100.00	53.00	0.84	30.04
Mann-Whitney U		873.000	0.000	1667.500	1410.000
Z		-6.126	-9.718	-2.739	-3.814
p		0.000	0.000	0.006	0.000
p (exact)		0.000	0.000	0.006	0.000

Analysis 2

In order to further test the point at which a potential critical period occurs, AoA was split into four groups (table 5.4).

Table 5.4: AoA groups and frequencies

AoA	Frequency	Percentage
up to 6	16	10.9
7–12	30	20.4
13–18	23	15.6
18+	78	53.1
Total	147	100.0

The AoA groups were then tested with the Kruskal-Wallis test, to test whether Score% varied significantly by age (table 5.5). This showed that Score% does indeed vary significantly by age ($p < .001$; *p (Monte Carlo)* < .001[14]).

Table 5.5: Kruskal-Wallis test (all groups)

AoA	Average	Median	Median rank	N	Std. deviation	Minimum	Maximum
up to 6	80.903	79.167	32.69	16	11.059	61.111	97.222
7–12	83.981	88.889	47.70	30	13.700	44.444	100.000
13–18	94.203	94.444	80.78	23	4.096	86.111	100.000
18+	94.872	97.222	90.59	78	5.575	69.444	100.000
Total	91.024	94.444		147	9.984	44.444	100.000
Kruskal-Wallis H	39.823						
p	0.000						
p (Monte Carlo)	0.000						

Pairwise comparisons were then made between all groups (table 5.6). The comparisons show statistically significant differences in Score% between the following groups:

- 5–6 and 13–18 ($p = .003$)
- 5–6 and 18+ ($p < .001$)
- 7–12 and 13–18 ($p = .027$)
- 7–12 and 18+ ($p < .001$)

The differences that proved to be statistically insignificant concern the groups:

- 5–6 and 7–12 ($p = 1.000$)
- 13–18 and 18+ ($p = 1.000$)

[14] IBM (2012).

Table 5.6: Pairwise comparisons (AoA)

Sample 1 and Sample 2	Test statistic	Standard error	Standardised test statistic	Significance	Corrected p value[a]
5–6 and 7–12	-15.013	13.033	-1.152	0.249	1.000
5–6 and 13–18	-48.095	13.705	-3.509	0.000	0.003
5–6 and 18+	-57.902	11.554	-5.011	0.000	0.000
7–12 and 13–18	-33.083	11.668	-2.835	0.005	0.027
7–12 and 18+	-42.890	9.045	-4.742	0.000	0.000
13–18 and 18+	-9.807	9.989	-0.982	0.326	1.000

Each row tests the null hypothesis that the distributions of Sample 1 and Sample 2 are the same.

Asymptotic significance is displayed (two-sided tests). The significance level is 0.050.

[a.] Significance values for multiple tests were corrected using the Bonferroni method[15].

Graph 5.1 (page 20) was also used in the analysis for the second hypothesis.

Control groups

As the <=12 AoA group was only present in the main group, analyses comparing the control group with the main group were carried out twice; once taking into account the <=12 AoA group, and once excluding it[16].

Results for the main and control group, taking into account the <=12 years group from the main group

Analysis with the Mann-Whitney U test showed that Score% between the main and control group is statistically significantly different (table 5.6). Participants in the control group have higher Score% values overall.

[15] Pallant (2020).

[16] Due to the fact that the compared groups (main group and control group) differ significantly in terms of numbers, and the results in each group differ significantly from the normal distribution (see appendix: *Normal distribution tests*), the analysis of differences was, as before, performed based on the non-parametric Mann-Whitney U test (Pallant, 2020).

Table 5.6: Mann-Whitney U test; main and control group, taking into account the <=12 AoA participants from the main group

Score%							
Group	**Mean**	**Median**	**Mean rank**	**N**	**Std. deviation**	**Minimum**	**Maximum**
Main group	91.02	94.44	82.80	147	9.98	44.44	100.00
Control group	99.00	100.00	149.60	53	1.64	94.44	100.00
Total	93.14			200	9.29	44.44	100.00
Mann-Whitney U	1293.000						
Z	-7.384						
p	0.000						
p (exact)	0.000						

Results for the main and control group, without the <=12 group from the main group

Among the participants in the >12 group, it can be observed that higher Score% values are found in the control group than in the main group (table 5.7). Analysis with the Mann-Whitney U test found the differences between the groups to be statistically significant.

Table 5.7: Mann-Whitney U test; main and control group, disregarding the <=12 AoA participants from the main group

Score%							
Group	Mean	Median	Mean rank	N	Std. deviation	Minimum	Maximum
Main group	94.72	94.44	62.67	101	5.26	69.44	100.00
Control group	99.00	100.00	105.76	53	1.64	94.44	100.00
Total	96.19			154	4.82	69.44	100.00
Mann-Whitney U	1178.500						
Z	-5.968						
p	0.000						
p (exact)	0.000						

Biographical data for AoA, AS and LoR (main group) and age (control group)

Graph 5.3: Frequency of each AoA in the main group

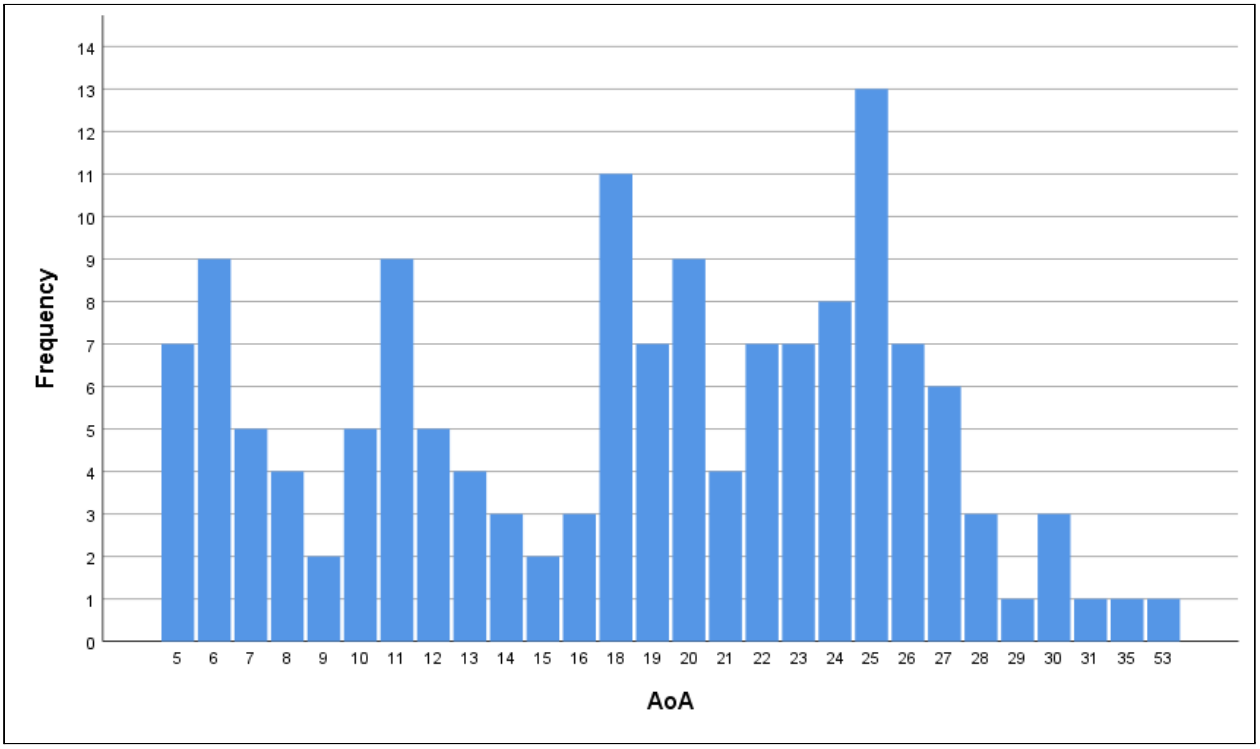


Table 5.8: Descriptive statistics of AS in the main group

	N	Minimum	Maximum	Mean	Standard deviation
AS	147	.33	.84	.37	.19

Table 5.9: Descriptive statistics of LoR (in years) in the main group

	N	Min.	Max.	Mean	Standard deviation
LoR	147	1.01	30.04	11.98	5.27

Table 5.10: Descriptive statistics of actual age (in years) in the main group

	N	Min.	Max.	Mean	Standard deviation
Age	147	18.69	67.65	30.17	8.65

Table 5.11: Descriptive statistics of actual age (in years) in the control group

	N	Min.	Max.	Mean	Standard deviation
Age	53	20.48	60.47	27.78	8.97

6. Discussion

Hypothesis 1: The age of arrival will be the most significant predictor of language attrition. The lower the age of arrival, the higher the level of attrition.

The results lead us to accept the first hypothesis. Of the three predictors, AoA displays the highest strength of association ($r_s = .508$) and is statistically highly significant ($p < .001$). This is a worthy finding which is in line with previously aforementioned research. Nevertheless, it is important to note that there is still much discussion on *what* causes attrition (Schmid & Seton, 2016; Schmid & Yilmaz, 2018). Despite maturationally-related neurological explanations often being deemed the most plausible (Bylund, 2019), it is important to also consider other possibilities. As Jia & Aaronson (2003) note, for example, older immigrants tend to continue to use their L1 on a daily basis, whereas younger ones would naturally have a greater L1 exposure. If this is the case, this could point towards a greater significance of ATH, and perhaps the existence of a threshold of L1 use which must be met to stave off attrition. Should future research continue to suggest the significance of age in L1 attrition, there are still questions to be answered regarding exactly *what* is behind this significance.

It was interesting to find that a lower AS is associated with a higher level of attrition. Whilst the correlation score ($r_s = .217$) is less than that between Score% and AoA, this is still a noteworthy finding. As outlined previously, prior research has been less converging regarding the significance of factors encompassed by the AS on rates of attrition. It is important to be cautious here, however; whilst a correlation of $r_s = .217$ is noteworthy, it is relatively low and considered weak (Schober et al., 2018). Such a finding, then, does not lead to a confident assumption regarding the significance of AS. Rather, it points strongly towards the need for further research centering specifically around the significance of this predictor. Indeed, this predictor is under-studied (Köpke & Schmid, 2004, p. 11). Furthermore, in this work, specific sociolinguistic factors were measured using questions drawn from the Texas Bilingualism Language Profile test, and encompassed by the macro-variable *L1 affiliation score*. Bearing this is mind, a recommendation for future research is that these factors be studied more independently (for example, continued L1 education in the L2 environment, L1 use with family, etc.), thereby fully exploring the effects of sociolinguistic variables on attrition and expanding findings such as this.

The third variable studied, LoR, is not statistically significant, hence we can suggest that it does not contribute to attrition. This accords with Montrul's (2008) summary of findings which points towards this being the case. Furthermore, it should be reiterated that LoR did indeed warrant inclusion as its own variable. It could be thought, for example, that it is a greater length of time in the L1 environment that affects attrition rather than the cognitive implications of the AoA. That said, it is important to also note that LoR is, in one way, dependent on age. Viewing the average Score% for participants with an AoA of more than 12 (94.92%) compared the that of the control group (99.00%) illustrates this: someone who completes this test aged, for example, 40, and has spent 10 years living in the UK (and therefore has an AoA of 30) will, most likely, not display attrition to a great extent. Conversely, someone who is 18 years of age and has also spent 10 years living in the UK (and has an AoA of 8) will, most likely, display more attrition. Indeed, the average Score% drops to 91.02% when the participants with AoAs of 12 or below

are taken into consideration, suggesting this to be the case. It should be highlighted that whilst LoR does not appear to be a significant predictor here, studies such as Jaspaert and Kroon (1989) have found that it is with late attriters (in this case, those with AoAs of 17 or over) that LoR significantly affects attrition. Further research on LoR could therefore be beneficial, but would require the study to be longitudinal in order for it to be insightful. As Schmid (2011a) points out, though, the logistics of longitudinal studies can prove to be more complex than they may initially appear.

It is interesting to observe that for the group with an AoA of greater than 12 years, the AS is higher than the group with an AoA of less than or equal to 12 years (.41 and .33, respectively). One could suggest that this is unsurprising; people who left Poland later would naturally have a higher affiliation with Polish, possibly due in most part to a more expansive web of social connections and a longer exposure to the L1 education system, resulting in a more sophisticated Polish which serves them in a wider variety of scenarios.

Lastly, the few instances of a ceiling score in the declension test warrant comment. Whilst such instances have been criticised as an indication of a test being too simplistic, and therefore not a true reflection of attrition (Schmid, 2013b, Karayayla & Schmid, 2018), it is possible to view these under a different light. Concern has, in some instances, arisen regarding test batteries which require participants to perform tasks that they would not naturally have to perform, and hence it is in fact that unfamiliarity which causes any underperformance or lower score, rather than a lack of underlying knowledge (Altenberg & Vago, 2004). These few instances of ceiling scores could be suggested to indicate that unfamiliarity and abnormality are not characteristics attributable to this test.

Hypothesis 2: A significant difference in the level of attrition will be noted before and after the age of arrival of around puberty (deemed to be, in this study, age 12). This will be a critical period of attrition.

When determining the validity of the second hypothesis, each analysis was considered, including the AoA:Score% scatterplot (graph 5.1). Visually observing the distribution of points, it can be seen that lower scores (those below ~75%) do not appear in great numbers after the AoA period of around 10–12 years. In addition, the Mann-Whitney U test analysis suggests that a significant difference in Score% can be observed between the <=12 AoA and >12 AoA groups. Regarding the pairwise analyses, table 5.6 shows that a statistically significant difference was detected between the AoA groups 5–6 and 13–18, 5–6 and 18+, 7–12 and 13–18 and 7–12 and 18+ and that there was no significant difference between the 5–6 and 7–12 AoA groups, nor between the 13-18 and 18+ groups. This leads us to suggest that a critical period occurs between the periods of 6–12 years. Taking all the aforementioned analyses into account, it be *suggested* that puberty is a turning point for the degree of attrition exhibited by the speaker. Interestingly, this could suggest that maturational (and possibly neurological) changes occurring around puberty are key factors in attrition. That said, it is important to note that research into the Critical Period hypothesis is scarce, and even more so for its specific application to attrition (Montrul, 2008). Furthermore, despite a good number of participants in the <=12 and >12 AoA groups (46 and 101,

respectively), there are considerable differences in the number of participants in each AoA group in the pairwise analyses, as shown by table 5.4. Caution should be taken, then, to avoid making excessive claims regarding the validity of the second hypothesis. We can be confident, though, that these results justify further research into the validity of CPH in L1 attrition. Apart from the obvious question concerning the existence (or not) of a critical period for L1 attrition, other important questions are worth exploring. If some kind of stabilisation of a given linguistic system takes place around a certain age range, it is important to examine, in depth, what exactly causes it. As Köpke & Schmid (2004) specifically note, the distinction between literacy skill- or neurological maturation-related causes warrants further investigation.

Control groups

The control group proves to be advantageous in that it allows for important observations to be made surrounding the nature of the nominal declension test and the validity of its results. An interesting observation is that when comparing the results of the control group with those of the main group, we can note that the mean scores are relatively similar. We can note only a small decrease between the participants of the main group with AoAs of greater than 12 taken into account and a slightly greater decrease between the main group (with all AoAs taken into account, including participants with AoAs below 12) and the control group. We can therefore make an assumption regarding what occurs when people leave the L1 environment. In all groups, even those including only those who emigrated after the age of 12, some attrition can be noted in the form of a decrease in morphological competence. This is concordant with Montrul's (2008, pp. 264-265) summary of studies which showed that even at the morphological level, which is 'highly vulnerable [to attrition]', adults made very few (below 5%) errors. Furthermore, this supports previous affirmations that language learning is a continuous process which happens all the way through life (Nejadansari & Nasrollahzadeh, 2011; Orosco-Rojas, 2017; Hickey, n.d., Language acquisition). On the other hand, it could be suggested that this lower Score% between the >12 AoA-only participant group and the control group would be otherwise imperceptible, yet is observable here due to the linguistically-focussed nature of the declension test.

Slight as they may be, it is important to consider another explanation for the qualitative differences in Score% between the main and control groups. As Schmid (2011a, p. 113) notes, '[...] methodological compromise is often a frustrating constraint for attrition research'. It could indeed be the case that other extralinguistic factors, particularly sociological ones, are the cause of these differences in Score%. As Schmid and Seton (2016, p. 6) highlight, 'It is clear that more research on large populations and sophisticated statistical modeling is needed [to] gain further insight into the role and interaction of predictor[s] [...]'. With this in mind, and whilst acknowledging the challenge of doing so, it could be recommended for any similar future studies to collect this sociological data and attempt to match participants based on sociological factors, or at least analyse this during the analysis stage. It should be noted, however, that age was collected as part of this study, and the mean ages of participants in both the main and control group is 30.17 and 27.78 years, respectively. We can therefore suggest that age was not a significantly contributing factor to these slight differences in test scores.

As Köpke & Schmid (2013, p. 21) note, consideration should be given to the influence of elicited vs spontaneous data. Clearly, the test in this study was elicited, and participants had more time to think of answers than if the data were spontaneous. Attention was therefore given to highlight the anonymity of the test to participants; there was no incentive to cheat. Furthermore, whilst the corpus used was based on spoken Polish, the nature of the test required participants to both read and input answers. This was unavoidable, due to the then COVID-19-related restrictions. That said, the nature of the corpus and aforementioned allowances (such as commas substituting special characters, and the disregarding of special characters located only in noun stems) mitigated these distinctions as much as possible. Re-running this study under normal circumstances, however, an oral-based test would perhaps be more appropriate.

Implications and considerations for future research

Whilst this study has proved insightful by way of providing further evidence regarding the main predictors of attrition, as well as contributing to the dearth of research pertaining to the Critical Period hypothesis, there are clear ways in which it could be expanded on as well as recommendations for future studies of its nature.

First and foremost, it could be suggested that the next natural step in attrition research is to attempt to explain *why* such variables, such as age of arrival, affect attrition. As mentioned earlier, age of arrival could well encompass neural or sociological factors, or indeed both. If neurological, does this involve a change in neural plasticity, or something else? Such questions were beyond the scope of this study. Nevertheless, there is a clear need to explore these variables in greater depth, in order to better understand attrition, and indeed other linguistic (and possibly neurological) phenomena.

Studies and discussions have also suggested that some features of a language may be more vulnerable to attrition than others (Köpke, 2004; Köpke & Schmid, 2011). It is important to bear this in mind when considering the findings of this study, which focused solely on morphological cases. It could well be the case that had this study tested phonological attrition or lexical retrieval (which has been shown to be the first feature to begin to deteriorate under attrition [Köpke et al., 2007]), for example, a greater extent of attrition would have been observed. A sensible consideration for future research is, therefore, to ensure that a wide range of linguistic and grammatical areas be investigated.

7. Conclusion

This study set out to contribute to the ongoing and controversial debate concerning which is the main predictor(s) of L1 attrition. It also aimed to shine a light on the widely debated and greatly under-researched Critical Period hypothesis for language attrition. Both of these questions are important for advancing the field of attrition research, which receives little attention compared with neighbouring linguistic subfields (Park, 2018). It was therefore hoped that this study would, albeit in a small way, contribute to the field.

Regarding the first hypothesis, the study provided evidence suggesting that age of arrival, out of the three overarching predictors studied, was the most significant predictor of L1 attrition of Polish immigrants in the UK. With regards to the second hypothesis, as in often the case with such work, questions remain. A lack of previous research coupled with the great variability in AoA of participants for part of the analysis was a cause for caution when considering the hypothesis. That said, the findings are solid enough to highlight the worthiness of, and justify, further research into CPH. Going forward, a study specifically centered around the Critical Period hypothesis for L1 attrition would be wise, in order for necessary methodological implementations and participant characteristics to be met.

Aside from the hypotheses, this study succeeded in contributing to the shortfall of linguistic research on the Polish language, and indeed in L1 attrition. It is hoped that more work will be carried out looking at the specificities of Polish and its diaspora in the future, as well as sustained and worthwhile research into L1 attrition.

9. References

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8. Appendix

Normal distribution tests

During the assumption-checking process, using the Kolmogorov-Smirnov and Shapiro-Wilk tests, it was concluded that the results in the main group and its subgroups deviated from the normal distribution to a great extent (table 8.1).

Table 8.1: Normal distribution test of the main group,with participants split based on AoA (<=12; >12)

		Kolmogorov-Smirnov[a]			**Shapiro-Wilk**		
		Statistic	df	p	Statistic	df	p
Score%	<=12	0.180	46	0.001	0.923	46	0.005
	>12	0.178	101	0.000	0.844	101	0.000
AoA	<=12	0.171	46	0.002	0.882	46	0.000
	>12	0.101	101	0.013	0.882	101	0.000
AS	<=12	0.164	46	0.003	0.928	46	0.007
	>12	0.066	101	0.200*	0.984	101	0.245
LoR	<=12	0.173	46	0.001	0.879	46	0.000
	>12	0.059	101	0.200*	0.964	101	0.007

*. This is a lower bound of true significance
[a] Lilliefors Significance Correction

Furthermore, the main and control groups differ significantly in terms of numbers and the results in each group differ significantly from the normal distribution (table 8.2).

Table 8.2a: Normal distribution test for analysis of control group with main group, taking into the account the <=12 group from the main group

		Kolmogorov–Smirnov[a]			**Shapiro-Wilk**		
		Statistic	df	p	Statistic	df	p
Score%	Main group	0.220	147	0.000	0.793	147	0.000
	Control group	0.426	53	0.000	0.625	53	0.000

[a] Lilliefors Significance Correction

Table 8.2b: Normal distribution test for analysis of control group with main group, without taking into the account the <=12 group from the main group

		Kolmogorov–Smirnov[a]			Shapiro-Wilk		
		Statistic	df	p	Statistic	df	p
Score%	Main group	0.178	101	0.000	0.844	101	0.000
	Control group	0.426	53	0.000	0.625	53	0.000

[a.] Lilliefors Significance Correction

Grammar test questions

Below are the questions included in the nominal declension test. It should be noted that the English equivalents are rough translations and were not included in the test, and are included here as a guide only. A native Polish speaker was consulted when writing the Polish sentences, to ensure naturalness and grammatical accuracy.

Babcia nie może tego skopiować, bo nie ma ---?---. (skaner)	Grandma can not copy this, because she does not have a ---?---. (scanner)
Twój kot ciągle leży w ---?---. (dom)	Your cat is always laying around in the ---?---. (house)
Ona ciągle mówi o ---?---. (sukienka)	She is always talking about the ---?---. (dress)
Nie mam ---?--- w tym banku. (lokata)	I do not have an ---?--- in this bank. (investment)
Ta ---?--- jest bardzo ciekawa. (książka)	That ---?--- is very interesting. (book)
Pokazałem ---?--- moje zadanie domowe. (mama)	I showed ---?--- my homework. (mum)
Jej ciągle przydarza się ---?---. (nieszczęście)	She is always running into ---?---. (misfortune)
Ten Pan jest ---?---. (klaun)	That man is a ---?--- (clown).
To twój ---?--- czy jego? (tornister)	Is that your ---?--- or his? (bookbag, satchel)
To jest ---?---. (muzeum)	That is a ---?---. (museum)
Ale fajna ---?---! (jaszczurka)	What a cool ---?---! (lizard)
Ludzie nie radzą sobie dzisiaj z ---?---. (samotność)	Nowadays, people do not cope well with ---?---. (loneliness)
Trawa rośnie w ---?--- góry. (szczelina)	Grass is growing in the ---?--- of the mountain. (crevices)
Ten jasny kolor nadał ---?--- nowy wygląd. (stół)	That bright colour gave the ---?--- a new look. (table)
To moje ---?---! (jabłko)	That is my ---?---! (apple)
Boli mnie ---?---. (gardło)	My ---?--- hurts. (throat)
W podziękowaniu daliśmy ---?--- kwiaty. (gospodarz)	As a thank you we gave ---?--- to the host. (flowers)

Miło jest spacerować na świeżym ---?---. (powietrze)	It is nice to walk in fresh ---?---. (air)
Był piękny zachód słońca i przyglądałam się ---?--- przez godzinę. (morze)	There was a beautiful sunset and I watched the ---?--- for an hour. (sea)
Ona jest dostępna pod ---?--- telefonu 07745789542. (numer)	She is available on the telephone ---?--- 07745789542. (number)
Dziewczyna była na plaży i znalazła ---?---. (rozgwiazda)	The girl was on the beach and she found a ---?---. (starfish)
Muzyk dał mu ---?---. (instrument)	The musician gave him an ---?---. (instrument)
Był zdenerwowany i czerwony z ---?---. (podniecenie)	He was nervous and red with ---?---. (excitement)
Z ---?--- przywitamy Nowy Rok. (radość)	It is with ---?--- that we see in the new year. (happiness)
Widziałem ---?--- Williama na żywo w Londynie! (książę)	I saw ---?--- William in real life in London! (Prince)
Narzędzia znajdują się w ---?--- samochodu. (podwozie)	The tools are in the ---?--- of the car. (boot)
Chłopiec bardzo bał się ---?---. (pies)	The boy was really scared of the ---?---. (dog)
Tomek poznał ostatnio ---?--- swojego ojca. (kobieta)	Tomek recently met the ---?--- of his dad. ([woman] partner)
Rodzice rozmawiają o ---?--- do ogrodu. (spryskiwacz)	Mum and dad are talking about the garden ---?---. (sprinkler)
Dajcie ten fortepian ---?---. (pianistka)	Give (pl.) that piano to the ---?---. (pianist)
Jacek nie ma już ---?---, bo wszystko wypił. (mleko)	Jacek does not have any more ---?---, because he drank it all. (milk)
Potrzebuję ---?--- do nowej kuchni. (rzecz)	I need a ---?--- for the new kitchen. (thing)
Mój brat zawsze pisze ---?---. (pióro)	My brother always writes with a ---?---. (quill)
Muszę zrobić porządek z ---?---. (biuro)	I need to tidy up the ---?---. (office)
Ale stresujący ---?--- ! (dzień)	What a stressful ---?--- ! (day)
Dużemu ---?--- w miastach towarzyszą problemy społeczne. (zaludnienie)	Large ---?--- in towns is accompanied by social problems. (populations)

Affiliation score

Participants are asked to answer each of the following questions with a percentage from a Likert (1932) scale of 0%–100% (in increments of 10%).

1. In an average week, what percentage of the time do you use Polish with friends?
2. In an average week, what percentage of the time do you use Polish with family?
3. In an average week, what percentage of the time do you use Polish at university/school/work?
4. When you talk to yourself, how often do you talk to yourself in Polish?
5. When you count, how often do you count in Polish?
6. How often do you perform academic activities (reading, writing [essays, stories, articles, etc.]) in Polish?
7. How often do you listen to Polish music?
8. How often do you watch Polish TV / Polish Internet videos?
9. How often do you listen to Polish radio?

(adapted from the Texas Bilingualism Language Profile test [Birdsong et al., 2012])

The percentage answers for each question are added together and divided by the total possible score (900) to obtain the affiliation score, which is a score on a scale of 0.00–1.00, where 1.00 denotes a strong affiliation to the Polish language and 0.00 denotes no affiliation at all. The formula is outlined below:

(total of percentage answer for all nine questions) / 900 = AS