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Lexical Access in L1 Attrition—Competition versus Frequency: A Comparison of Turkish and Moroccan Attriters in the Netherlands

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Lexical access and lexical diversity are often assumed to be vulnerable to first language (L1) attrition. They also differ between monolinguals and nonimmersed bilinguals. This raises the question whether lexical attrition can be ascribed to nonuse or to competition between the two languages. We compare two populations of late L2 learners of Dutch living in the Netherlands. One of them was largely monolingual prior to emigration (Turkish migrants), while the other comes from a highly multilingual society (Morocco). While both experimental populations should be affected by erosion due to nonuse, we expect competition effects to be more strongly pronounced when compared against a monolingual versus a multilingual baseline population. The results show that this is not the case with attrition effects being even stronger in the Moroccan group than in the Turkish group. Furthermore, there is no impact of individual measures of frequency of exposure or language attitudes among the attriters. We conclude that being immersed in an L2 environment leads to weakening of lexical access.

1. INTRODUCTION

Recent research into bilingualism and first language (L1) attrition has substantially augmented our understanding of the interaction of multiple languages in the mind of the learner/speaker. A number of studies have drawn attention to the fact that the acquisition and use of an additional language affects preexisting linguistic knowledge in complex ways, leading to the creation of a 'linguistic supersystem' and a change in the way all languages, including the native one, are processed and used (e.g. Herdina and Jessner 2002; van Hell and Dijkstra 2002; Cook 2003; de Bot 2007; Pavlenko 2009; Schmid and Köpke 2017).

All linguistic levels (lexicon, phonology and phonetics, morphosyntax, semantics and conceptual representations, etc.) may be affected by L2-to-L1 transfer to varying degrees (Schmid 2011a; Schmid and Köpke 2017). The

most immediate effect appears to be a decline in the ability to quickly retrieve and recognize words (Schmid and Köpke 2009), both in experimental tasks and in free speech (Schmid and Jarvis 2014).

The differences found between bilingual populations experiencing language attrition and the (predominantly) monolingual controls are usually ascribed to a reduction in the accessibility of lexical items due to extended periods of nonuse or reduced use leading to more effortful retrieval (e.g. Paradis, 2007; Jarvis 2019). However, L1 attrition, as it has been defined and researched to date, is a process which depends not only on the reduction of L1 exposure and use and its effect on accessibility but also on the presence and development of the L2. Language access is inherently more effortful for bilinguals than monolinguals, as they have to differentially access and inhibit linguistic items and language systems that are in constant competition with each other (e.g. Green 1998). However, all investigations of language attrition conducted to date concern speakers who concurrently experienced both a decrease in exposure to the L1 and the onset of bilingualism from the time of migration—that is, speakers who prior to migrating had used only one language in their daily lives.

This raises the question of whether, as is often implicitly assumed, attrition phenomena are to be ascribed to forgetting due to nonuse or rather to characteristics inherent to the experience of becoming or being bilingual (or to both). The latter explanation is suggested by studies finding similar changes in lexical accessibility and processing to those commonly observed in L1 attrition in bilingual populations who remain immersed in the L1 community (Kroll and Gollan 2014). It is unclear, however, to what degree each of these two factors—reduced exposure to the L1 on the one hand and competition effects in bilingual processing on the other—contribute to attrition effects.

In order to tease apart the differential effects of frequency of use on the one hand and less efficient processing due to competition between languages on the other, this study compares L1 attrition against a baseline of monolingual versus multilingual native speakers who remain immersed in the L1 environment. In other words, our comparison involves speakers who have immigrated from a predominantly monolingual community (Turkish speakers from Turkey) on the one hand, and immigrants who originate from a multilingual society (Moroccans) on the other. Both populations are compared with otherwise matched speakers in their country of origin (monolingual in the former case, multilingual in the latter), to compare the level of change which they have experienced as a result of being removed from their L1 environment. In addition, both of the migrant populations are stratified with respect to the amount of use they make of their L1 in their daily lives, in order to assess the impact of frequency of exposure on lexical access. This variable is matched across the two groups.

The comparison of these two populations to a baseline of speakers in their countries of origin has the potential to shed light on the question of the effect of lack of exposure versus crosslinguistic competition: We assume that

attrition effects which are the result of bilingual competition should appear attenuated in the multilingual attriter population (Moroccans), since they are compared to a multilingual reference population who should also experience competition effects to some degree, while such effects should be entirely absent in the monolingual reference group. Effects of frequency of use, on the other hand, should affect both attriting populations similarly, since they are compared with reference groups who have not experienced a change in the amount of use they make of their L1, while they themselves live in an L2-dominant society with more restricted exposure to the native language.

We thus investigate attrition effects in two long-term immersed immigrant populations who arrived in a new linguistic environment (The Netherlands) in adulthood with no or minimal knowledge of the language spoken there (Dutch), but who differ with respect to their linguistic habits prior to emigration: One population (Turkish speakers) comes from a predominantly monolingual background and did not know any languages other than their native one before acquiring Dutch. The other group (native speakers of Moroccan Arabic), however, originates from a multilingual society and was proficient in more than one language prior to emigration. For both populations, attrition effects should be modulated by external/personal factors such as amount of use of the L1 in different contexts, length of residence, and language attitudes.

BILINGUAL COMPETITION EFFECTS: LEXICAL ACCESS AND SPEECH FLUENCY

Bilingual speakers[1] are different from monolinguals in that they have a larger lexical repertoire which contains competing representations (translation equivalents) that need to be managed selectively. Active bilinguals are exposed to linguistic input from and processing demands in more than one language, and their cognitive system gains flexibility by adapting to the changing communication needs and selectively raising and lowering activation levels for each of the language systems according to the context (e.g. Grosjean 1997; Green 1998; Paradis 2004; Duncan *et al.* 2016). While activation levels of each language may vary, it is impossible to completely deactivate the nontarget language(s) (Green 1986; Poulisse and Bongaerts 1994; de Bot and Schreuder 1993; Kroll and Sunderman 2003; Kroll *et al.* 2006).

A number of neuroimaging studies have confirmed that individuals acquiring two or more languages create a compound/unitary language system within which both languages are subserved by common neural structures, and that therefore a bilingual's brain cannot avoid automatically processing the nontarget language (e.g. Paradis 2004; Abutalebi *et al.* 2005;). The conceptual system spreads activation to the lexical representations of both languages, and links between concepts, lemmas and word forms are triggered regardless of the language selected for production or task performance, so that words from the other language compete for selection (e.g. de Bot 1992; Kroll and Stewart

1994; Kroll *et al.* 2010). For bilingual speech production, a mechanism is needed to decide which of the competing lexical representations will be activated for further processing and to inhibit the competitors (Green 1998, 2011).

These processes of selection, activation and inhibition slow down bilingual lexical access: Monolingual speakers are able to name an object on average 600–1,200 ms after seeing a picture (Levelt *et al.* 1999; Bates *et al.* 2003) and retrieve about two to three words per second in normal conversation (Levelt *et al.* 1999). However, among bilinguals, reaction times have been commonly documented to be somewhat delayed (e.g. Gollan *et al.* 2005; Bialystok and Luk 2012; Kroll and Gollan 2014; Duncan et al. 2016) and speech production to be more disfluent (e.g. Bergmann *et al.* 2015), not only in the L2 (e.g. de Jong *et al.* 2015; Segalowitz *et al.* 2017) but also in the L1 of bilinguals (Dostert 2009; Schmid and Beers Fägersten 2010; Schmid and Jarvis 2014; Bergmann *et al.* 2015). Both second language learners and attriters therefore tend to perform differently from monolinguals in free speech with respect to factors such as the diversity of the productive vocabulary and the frequency and distribution of disfluency markers and in their performance on controlled tasks such as picture or word naming or verbal fluency. These effects are commonly taken to be an outcome of the differences between monolingual versus bilingual linguistic processing (e.g. Segalowitz 2016).

FREQUENCY OF EXPOSURE: THE FREQUENCY LAG EFFECT

An alternative explanation of the different performance of monolinguals and bilinguals with respect to lexical access centres on the frequency of exposure and therefore activation. Even for monolinguals, word frequency is an important factor for retrieval speed. For bilinguals, who have to divide their time between their languages, the frequency of all items is necessarily reduced and 'being bilingual is analogous to having a lexicon full of lower frequency words, relative to monolinguals' (Gollan et al. 2005: 1220; see also Ransdell and Fischler 1987; Kroll and Gollan 2014).

One of the theoretical frameworks underpinning this account is the Activation Threshold Hypothesis (ATH) proposed by Paradis (1993, 2004). The basic assumption of the ATH is that the effort involved in retrieving a word stored in the lexicon is determined by its activation threshold. The level of this threshold constantly changes depending on the frequency of use and on the recency of its activation. Items that are more frequently activated have low activation thresholds and need fewer neural impulses to be reactivated than items that occur less frequently, but when they are not called upon, the threshold gradually increases. The amount of energy required is further determined by the activation levels of other competing items which need to be inhibited—the more active they are, the harder they become to inhibit and the more effortful retrieval of the target becomes (Green 1986).

When a bilingual elects to speak in one language rather than another, the activation threshold of the components of this language reduces and the activation threshold of the nonselected language simultaneously rises. In an L2 environment where there is prolonged lack of L1 input and exposure, both in terms of how long an individual has lived there and how often they are exposed to their L1, L1 knowledge does not disappear or become permanently inaccessible but more difficult to retrieve due to an increase in the threshold (Schmid and Köpke 2017). Items within the L1 system will eventually require more effort in order to be activated, and insufficient practice or stimulation will lead to language attrition (Paradis 1993). Therefore, the most important predictive factors for language attrition within this framework are the frequency of use of the L1 along with the length of residence (Paradis 2004, 2007).

Long-term disuse has different implications for linguistic items depending on whether they are maintained by implicit (procedural) or explicit (declarative) memory (Paradis 2004). Areas of linguistic knowledge that are assumed to reside in implicit memory comprise phonology, morphosyntax, rules, and procedures about the language. All of these, once internalized, are applied automatically. Therefore, frequency of use is not a primary issue for their accessibility and they are more resistant to attrition. The lexicon, on the other hand, is subserved by declarative memory and consciously acquired, controlled, and retrieved. Accessibility of lexical items is therefore predicted to be strongly linked to their overall frequency as well as to how frequently an individual speaker uses the language and the item in question (Paradis 2009).

Another essential factor for attrition versus maintenance within this framework is attitude (Paradis 2007). A positive emotional orientation toward one's native language and culture may reinforce the traces in the neural circuits and lower the activation threshold, enabling easier access. Emotional affiliation with the home language and culture is therefore considered conducive to L1 maintenance. In an immigration context where the L1 is highly valued and where there is strong adherence to cultural traditions and ethnic affiliation, while the orientation toward the L2 is largely instrumental (e.g. to function in society and find a job), the L1 may therefore be preserved more easily. On the other hand, if members of the immigrant community desire to participate in social life and culture in the host country and to become a part of the target language community (integrative motivation), they may prioritize learning and using the L2, which would potentially affect L1 development in the opposite direction (e.g. Gardner 2001).

A number of studies of native language attrition have been conducted in migrant settings where the language of the host society prevails in most domains of life and the L1 gradually loses its social, emotional and economic significance. It is usually assumed that amount of language contact and emotions/attitudes toward native language and culture play an important role for attrition versus maintenance (de Bot *et al.* 1991; Ammerlaan 1996; Soesman 1997; Köpke 1999; Hulsen 2000; Schmid 2002; Ben-Rafael and Schmid 2007; Opitz 2011), in accordance with the predictions made by the ATH. However,

empirical evidence has demonstrated repeatedly that frequency of L1 use or length of residence cannot predict fluency or lexical diversity in free speech (e.g. Keijzer 2007; Schmid 2007; Dostert 2009; Schmid and Dusseldorp 2010; Cherciov 2011; Varga 2012; Schmid and Jarvis 2014; for a recent overview, see Schmid, 2019), and neither do cultural/emotional preferences correspond with the degree of attrition across a range of linguistic levels. The external factors modulating the attritional process therefore probably exist in a complex interaction which may furthermore affect individual speakers differently based on characteristics such as language aptitude (Schmid and Yılmaz 2018), making it very hard to gain a comprehensive picture of what does and what does not facilitate lexical attrition.

SUMMARY

The performance of bilingual speakers on various tasks measuring the speed of lexical access in their native language has been theoretically predicted to be influenced by two sets of factors: the frequency with which they are exposed to and make use of this language on the one hand (*accessibility effect*), and the degree of competition they experience from their other language(s) on the other (*bilingualism effect*). To date, the relative role of these two factors has not been established in the context of L1 attrition.

While previous investigations of L1 attrition have consistently found that long-term migrants experience a reduction in lexical accessibility, evidenced through phenomena such as slower lexical naming, higher levels of disfluency, and the use of a less sophisticated vocabulary, it remains unclear what exactly causes this reduction. It therefore remains unclear to what extent attrition phenomena are simply the outcome of the general process of becoming bilingual, as opposed to the specific situation of the migrant who is removed from the native linguistic community.

THE STUDY

The present study investigates L1 lexical access in free speech and in controlled experimental production (picture naming task) among long-term immigrants in the Netherlands. Half of the participants originated from Turkey and were monolingual prior to immigration while the other half lived in a multilingual country, Morocco, and were proficient in languages other than their L1 before they emigrated. Both populations are compared to reference groups in the country of origin matched for sociolinguistic characteristics such as gender, age, and education level (see Participants section).

The Turkish and Moroccan community in the Netherlands

The Turkish and Moroccan immigrant communities in the Netherlands were established in the late 1960s through mass migrations of guest workers toward

Western and Northern Europe (Extra and Verhoeven 1993). Migration from Turkey and Morocco still continues in the form of family formation and unification, albeit at a decreasing rate. According to the central governmental statistical agency (CBS) for 2020, Turkish migrants form the largest group of immigrants in the country, with 418,574 individuals of whom slightly more than half (52.7 per cent) are second-generation. Moroccan immigrants constitute the second largest group with 410,770 individuals (58.1 per cent of whom are second-generation) (CBS 2020).[2]

These two populations were chosen not only because of their numerical importance and similarity but also in order to compare lexical access in the L1 of a population which was monolingual prior to its arrival in the Netherlands with that of another which originates from a traditionally highly multilingual society. The Turkish language is not only the majority but also the only officially recognized language of Turkey. There are a number of minority groups such as Kurdish speakers (the largest minority population, consisting of 15–20 per cent of the total population), and speakers of Arabic, Armenian, Greek, and several Caucasian languages (each <2 per cent of the total population), but most if not all of the members of these groups speak Turkish as a second language. Within the Turkish education system, particularly in the 1950s and 1960s, foreign language classes (mainly English and French) offered at schools were rather limited and not very effective; therefore, the Turkish immigrants often had little or no prior exposure to a foreign language (Yılmaz 2013).

The Moroccans on the other hand, come from a society where multilingualism is practiced daily, with each language fulfilling a different linguistic function/covering a specific domain (Jamai 2008). Standard Arabic and Berber are the two official languages; the former is used in commerce, business and education, while the latter is an everyday language spoken in homes and on the streets by about 40–50 per cent of the population. Moroccan Aabic (MA) is spoken by the majority of Moroccans (about 90 per cent of the total population) and is the language of family and social life and entertainment media. Berbers generally learn MA as a second language and use it as a lingua franca, since not all varieties of Berber are mutually intelligible (Ennaji 2005). Importantly, MA is not a written language, and Standard Arabic is used for writing purposes. French, Morocco's prestige language (along with Standard Arabic) serves as a lingua franca, too, with around 50 per cent of the population having some level of proficiency in it. It is taught universally at schools and is Morocco's primary language of international commerce and economics. It is also widely used in education and government. Spanish is another language spoken on a daily basis in the Northern areas, a legacy from the Spanish occupation. English, while still far behind French and Spanish in terms of the number of speakers, has been rapidly spreading in the 2000s (Ennaji 2005).

In contemporary Morocco, multilingualism is highly valued in the education system and widespread among the individuals of the society, most of whom have the ability to read and speak several languages. Speakers often code-switch and -mix in order to overcome the linguistic constraints of one

language over the other, no matter how typologically distinct the languages are. Code-switching is also a means of expressing solidarity and signaling one's socio-economic and educational status (Bentahila 1988; Nortier 1990; Aabi 1999).

A number of studies have investigated the L1 change/attrition of Turkish and MA in various countries in an attempt to explore the nature and the causes of this process (Tekinay 1982; Boeschoten and Verhoeven 1985; Nortier 1990; Backus 1992, 1996, 2004; Huls and van de Mond 1992; Extra and Verhoeven 1993; Johanson 1993; Schaufeli 1996; El Aissati 1997; Türker 2000; Yağmur 1997; Yağmur and Akıncı 2003; Doğruöz and Backus 2007; Jamai 2008; Gürel and Yılmaz 2011; Yılmaz 2011; Yılmaz and Schmid 2012). The present study adopts a comparative perspective by looking at both of these communities.

Research questions

The present study aims to investigate to what extent lexical attrition effects, such as less diverse vocabulary, increased disfluency in free speech and decreased performance on experimental tasks under time constraints, may be ascribed to lower accessibility due to competition between languages ('bilingualism effect'), on the one hand, and/or to reduced exposure ('accessibility effect'), on the other.

We address the following research questions/hypotheses:

Bilingualism effect:

Research Question 1: Is lexical attrition attenuated in previously multilingual vs. previously monolingual attriters as compared to a multilingual vs. monolingual reference population?

Hypothesis 1: If attrition is modulated by bilingualism, attrition phenomena should be more pronounced among a population of attriters who were monolingual prior to emigration to the Netherlands (Turkish group) than among speakers who were already multilingual before their emigration (Moroccan group) when compared to reference groups in the country of origin (i.e., there should be between-group differences in the form of a main effect for language).

Accessibility effect:

Research Question 2: Is lexical attrition moderated by factors relating to frequency of exposure and attitude?

Hypothesis 2: If lexical attrition is contingent on amount of exposure and attitude, participants with longer periods of residence, less frequent use of the L1 in daily life, and a less positive attitude

toward their L1 will show stronger attrition effects than more recent arrivals, speakers with more exposure, and with stronger affiliation with their L1 (i.e., there should be within-group differentiation according to these predictors).

THE STUDY

Participants

Personal background The present study investigates a total of 104 speakers; 52 of whom are native speakers of MA and 52 of Turkish (TR). Half of the speakers in each language group ($n = 26$) continue to live in their country of origin, while the other half had lived in the Netherlands for upward of 10 years at the time of data collection.

In keeping with previous research, the minimum age of migration was set at 15 to ensure that the L1 system had fully developed before migration (Köpke and Schmid 2004; Bylund 2009, 2019; Schmid 2011a). The minimum residency requirement in the Netherlands was set at 10 years, to ensure that attrition would be sufficiently developed (Hutz 2004; Köpke and Schmid 2004; Beganović 2006; Schmid 2011a). A maximum age of 65 years at testing was set for both populations in order to eliminate any impact of aging on language performance (following Goral 2004). The four populations—two groups of attriters and two reference groups—were similar in age, and the two attriting populations were similar to each other with respect to their age of emigration and length of residence (Table 1).

Language proficiency As can be seen in Table 1, all of the Moroccans reported intermediate to advanced proficiency in languages other than their L1 or Dutch (on a five-point scale from 'poor' to 'very good', we counted all languages that were self-rated at 3—'sufficient'—or above). The most frequently reported additional language among the Moroccans was Standard Arabic, which all speakers said they knew, followed by French (known by 23 speakers in the attrition group and 24 in the control group, respectively) and English (12/10). Some of the speakers furthermore reported knowing Berber, Spanish or German. None of the Turks spoke a language other than Turkish (and Dutch, in the case of the attriters) above very basic levels: in both Turkish populations, six participants reported 'very poor' proficiency in English, no-one reported proficiency higher than that. All participants were asked to self-rate their proficiency level in Dutch on a five-point scale from 'poor' (coded as 0) to 'high' (coded as 1). This was similar across both groups, with the Moroccans self-rating at an average 0.63 (stdev 0.16) and the Turks only slightly lower at 0.58 (0.23).[3] This slight difference between the two groups was not significant ($t(46) = 0.723$, $p = 0.473$). None of them had any but the most minimal knowledge of Dutch prior to their arrival.

Table 1: Participant characteristics

	Experimental group I Moroccans in the Netherlands (MANL) ($n = 26$)	Control group I Moroccans in Morocco (MACG) ($n = 26$)	Experimental group II Turks in the Netherlands (TRNL) ($n = 26$)	Control group II Turks in Turkey (TRCG) ($n = 26$)
Personal background				
Age (range, stdev)	46.4 (30–65, 10.9)	45.1 (25–60, 11.1)	41.4 (28-53, 7.16)	42.2 (29–55, 8.0)
Age at emigration (range, stdev)	23.9 (18–32, 4.1)		20.6 (15–30, 4.0)	
Length of residence (range, stdev)	22.4 (10–43, 9.8)		20.6 (12–34, 6.67)	
Gender				
Male	22	20	12	13
Female	4	6	14	13
Self-rated proficiency in Dutch (0 = poor, 1 = high)				
Mean (SD)	0.63 (.16)		0.58 (0.23)	
Number of other languages known above basic levels (not counting Dutch)				
1	4	2	—	—
2	5	9	—	—
3 or more	18	16	—	—

L1 exposure and attitudes The populations reported on here were included in a wider study of language dominance, alongside other populations (Schmid and Yılmaz 2018). The authors of that study conducted a Principal Component Analysis of self-reported background variables relating to the frequency of exposure to and use of the L1 and attitudes toward this language. This analysis yielded the following factor sets, which will also be used in the present study (for full details of the individual questions and responses by group, see online supplementary materials, Table 1):

- *interactive use*, comprised of nine questions relating to the frequency of casual and informal use of the L1 and the L2, that is, with family and friends and
- *attitude*, comprised of five questions relating to the importance to maintain the L1, transmit it to the children, language and culture of preference, and the frequency of use of L1 media (books, TV, radio).

Table 2: Language use and linguistic/cultural affiliation

	Moroccans		Turks		*t*-tests		
	Mean	SD	Mean	SD	*t* (50)	*p*	Cohen's *d*
Interactive L1 use	0.56	0.81	0.54	0.92	0.120	0.905	0.023
Attitude	−0.03	0.83	0.26	0.87	−1.261	0.213	0.341

In selecting the participants for the present study, we ensured that these factors would not differ between Moroccans and Turks (see Table 2). Both measures were normally distributed (Kolmogorov–Smirnov $p > 0.2$).

Materials and procedure

Participants were tested by native speakers of MA or TR with no knowledge of Dutch in order to encourage, as far as possible, an L1-only mode of interaction (see Green 1998). Each participant was tested individually at their homes or in a quiet office space. All steps of the data collection sessions were recorded.

Data were elicited by means of two tasks. The first was a semi-structured interview lasting 20–30 min, designed to elicit naturalistic speech alongside background information; while the second was a picture naming experiment.

Semi-structured interview Following Schmid (2011a), the semi-structured interviews were guided by a catalogue of 78 questions on topics of daily life in Morocco/Turkey and the Netherlands, hobbies, holidays, and experiences as migrants, language habits, and language/cultural attitudes (https://languageattrition.org/resources-for-researchers/experiment-materials/sociolinguistic-questionnaires/). The interviewers tried to ensure a spontaneous informal conversation by encouraging a natural exchange and helping the participants focus on the topic of the conversation. All participants were asked the same questions (excepting questions about the migrant experience which were only put to the participants in the experimental groups). All interviews were audio-recorded and transcribed by native speakers.

Picture naming task The second task was a PNT as a measure of speed of lexical access. The assumption is that this task requires the individual to lexicalize the concepts into words in the same way in which planning and selection occurs before speaking (Glaser 1992; Levelt 2001). Participants were presented with a set of experimental stimuli consisting of 78 pictures that belonged to three categories of frequency (high, medium, and low, $n = 26$ in each category) selected from the standardized set originally developed by Snodgrass and Vanderwart (1980). Due to the lack of a standard word frequency measure for MA or TR, the frequency ratings were based on the familiarity index in

Snodgrass and Vanderwart. We controlled for cultural appropriateness, cognate status, and semantic and phonological relatedness between consecutive items. Culture specific items (e.g. soccer helmet) and cognates between the L1s and Dutch were excluded (quite a few items were MA-TR cognates, but since no speaker reported knowledge of the language of the other group, this was deemed unproblematic). The full list of lexical items and pictures is provided in the Supplementary materials.

Stimuli were presented in four orders, counterbalanced among participants. An HP laptop computer and serial response box with voice key controlled the presentation of the stimuli and the collection of response times. The participants had a maximum of 3,000 ms to name the picture they had seen, but were encouraged to do so as quickly as they could. The moment from the onset of the stimulus to the onset of the word was registered as the reaction time. Following Bates et al. (2003), a response was coded as valid if it was the target name and had a valid reaction time (i.e. if the trigger was not initiated by false starts, hesitations, coughs, etc.). All other responses were categorized as invalid, including incorrect responses, utterance repair or correct responses with invalid reaction times (<250 ms), responses which were not loud enough to trigger the voice key as well as correct responses, which were not given within 3,000 ms and trials where there was no response at all. While the participants were instructed very clearly about how to do the task and a practice block was administered to allow them to get used to the task, the rate of invalid responses remained relatively high (around 20 per cent) among all groups. This is partly due to the fact that exclusions did not only affect incorrect responses but also false triggers.

Outcome variables *Free speech*: The sociolinguistic interviews described above were transcribed according to the CHAT conventions (MacWhinney 2000). The free spoken data elicited by the interviews comprised 225,549 words (average 2,349 words per person, stdev = 1,908). Two measures were derived from this corpus: the lexical diversity measure VOCD (McKee *et al.* 2000) and an overall measure of disfluencies, comprising a count of the total numbers of retractions, repetitions and filled pauses in each interview, recalculated to 1,000 words of spoken data (Table 3).

There was a marked distinction between the language groups for these measures (as is only to be expected, due to structural differences between these languages, e.g. the strongly agglutinative character of Turkish) so each individual's score was expressed as a percentage of the mean for the control group of the relevant language. The resulting standardized measures were normally distributed (K-S >0.200).

PNT: Response times (in milliseconds) were averaged over all valid items. The resulting measure was normally distributed (K-S >0.200) but showed, overall, somewhat faster responses among the Moroccan group than among

Table 3: Lexical diversity (VOCD) and disfluencies across populations

VOCD	Experimental group I Moroccans in the Netherlands (MANL) ($n = 26$)	Control group I Moroccans in Morocco (MACG) ($n = 27$)	Experimental group II Turks in the Netherlands (TRNL) ($n = 26$)	Control group II Turks in Turkey (TRCG) ($n = 27$)
Mean	95.84	112.36	210.04	192.96
SD	17.26	41.12	18.31	35.11
All disfluencies				
Mean	89.36	50.39	66.06	37.46
SD	40.03	24.49	39.61	19.37
Filled pauses				
Mean	59.57	31.72	38.96	30.67
SD	34.61	20.83	36.48	16.72
Repetitions				
Mean	12.92	10.02	2.93	1.57
SD	6.10	8.15	2.19	1.25
Retractions				
Mean	10.60	8.19	7.84	5.67
SD	4.01	7.35	3.55	2.83

the Turks, both in the experimental and the control populations ($t(91.315) = 3.461$, $p < 0.01$, Cohen's $d = 0.679$).

In order to make group results comparable, all individual scores were standardized to the control group means in the same way as described for VOCD above.

RESULTS

The impact of language background (between-group effect)

As the descriptive statistics provided in Outcome variables section show, the attriters in both language populations were outperformed by the controls for all three of the dependent variables: their free speech was less lexically diverse and more disfluent, and their response times in the PNTs were slower than those of the controls (Table 4). These differences are visualized in Figures 1–3.

In order to detect whether there was a statistically significant main effect for group (attrition vs. control) as well as for language (TR vs. MA), linear regressions were conducted for each of the three outcome variables (RTs, VOCD,

Table 4: Average reaction times on PNT (ms) across populations

RT	Experimental group I Moroccans in the Netherlands (MANL) ($n = 26$)	Control group I Moroccans in Morocco (MACG) ($n = 27$)	Experimental group II Turks in the Netherlands (TRNL) ($n = 26$)	Control group II Turks in Turkey (TRCG) ($n = 27$)
Mean	1,069	955	1,143	1,092
SD	188	155	136	112

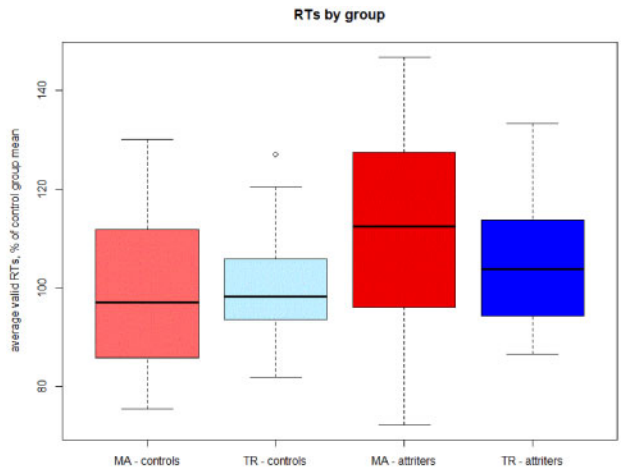

Figure 1: Average standardized RTs by population

and disfluencies). All models were built with the lme4 package, version 1.1-23 (D. Bates *et al.* 2015) in R 4.0.2 (R Core Team 2019).

First, the personal background predictors' age and then gender were entered into the model. After each step, the more complex model was compared to the simpler one. If the addition of the new predictor significantly improved the model (as indicated by a decrease of at least 2 in Akaike's information criterion in the more complex model), the predictor was retained for the next step, otherwise, it was removed. Next, the dichotomous predictors L1 (TR vs. MA) and then ATTCON (attriters vs. controls) were entered into the model, followed by the interaction term L1*ATTCON. The resulting models are summarized in Table 5. The highest variance inflation factor (VIF) for any of the predictors in the final models was 1.42, indicating no problematic levels of multicollinearity.

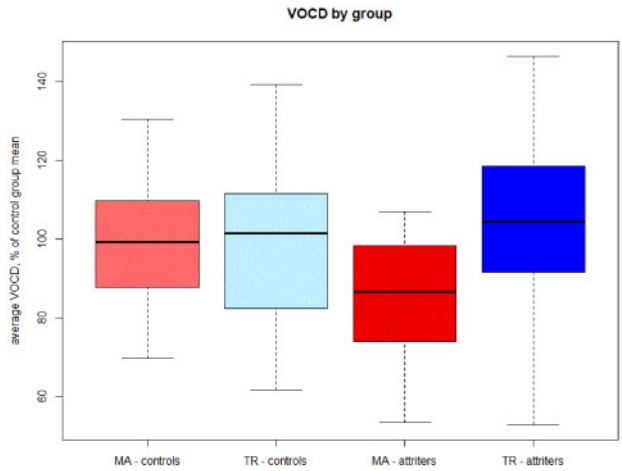

Figure 2: Average standardized VOCD by population

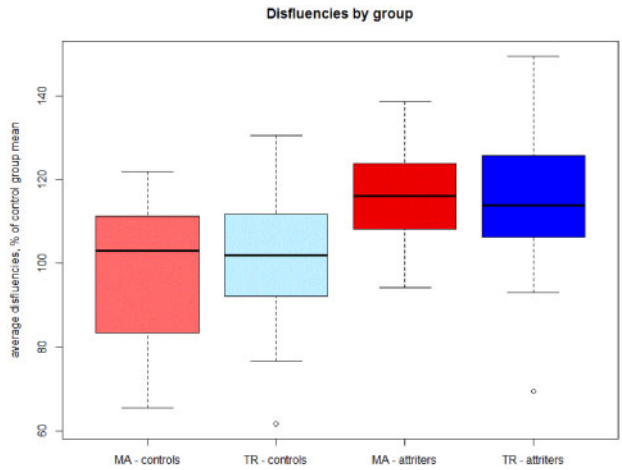

Figure 3: Average standardized disfluencies by population

As these models demonstrate, significant attrition effects obtain for all of the three variables under investigation. Gender does not affect any of the outcome variables, while age affects VOCD and disfluencies with older speakers having a more diverse vocabulary and being less disfluent.

Except for VOCD, there is no significant interaction between the L1 and the experimental condition (attriters vs. controls). The interaction plot in Figure 5 illustrates that the latter effect is due to an apparent absence of attrition effects among the Turkish group for this variable. Attrition effects for RTs are more strongly pronounced in the Moroccan group than in the Turkish group (see Figure 4, note that this interaction does not reach significance, $p = 0.22$), but

Table 5: Linear regression models (estimates from last model in which predictor was retained)

	Response times in PNT	Lexical diversity in free speech (VOCD)	Disfluency in free speech
	Estimate	Estimate	Estimate
Age	0.26	0.44	**−0.36***
Sex (female)	−5.79.	−0.22	−6.00.
Education	−2.13	1.06	0.10
ATTCON	**12.01****	**−15.67****	**17.03*****
L1*ATTCON	−7.28	**19.44****	−1.63
Final model, adjusted R^2	0.07*	0.12**	0.25***

$^{*}p$ <0.05, $^{**}p$ <0.01, $^{***}p$ <0.001; where estimates are marked in bold, predictor is retained in final model.

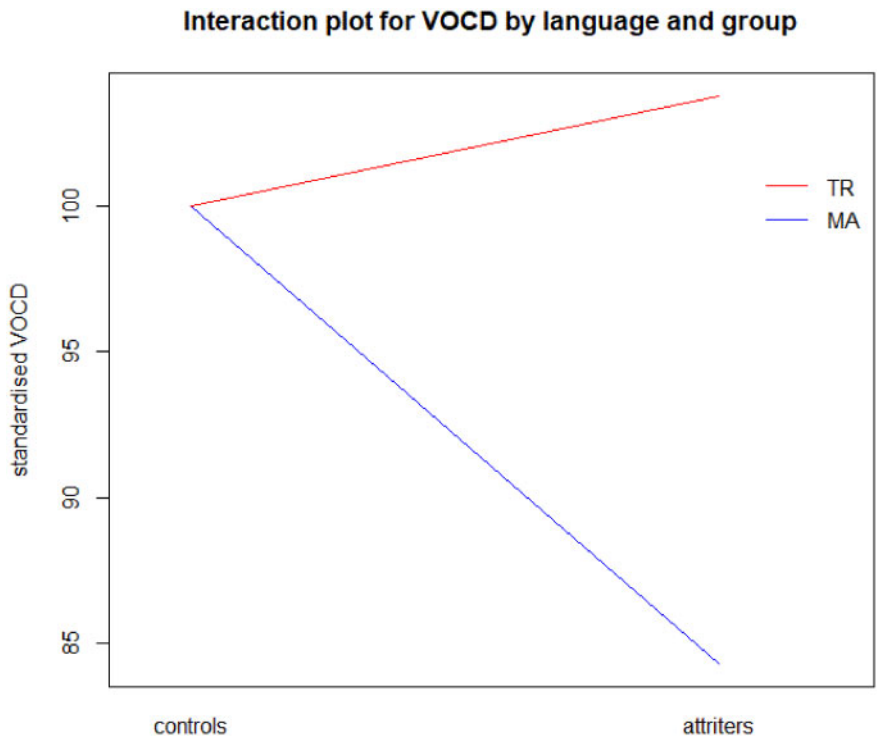

Figure 5: Interaction plot for VOCD by language and group

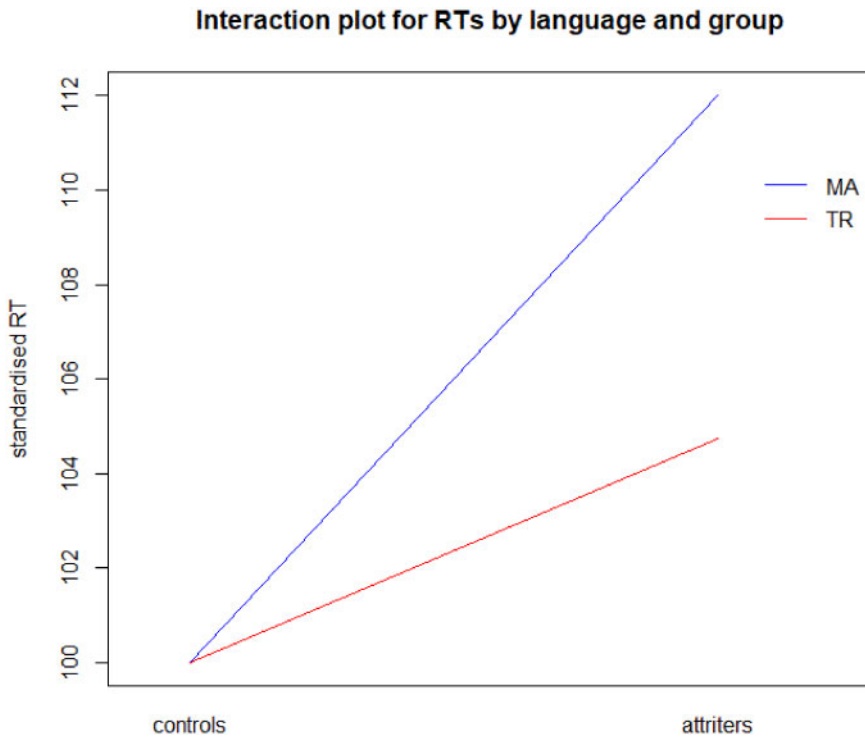

Figure 4: Interaction plot for RTs by language and group

appear to be almost exactly the same in both populations for disfluencies (see Figure 6).

We can therefore conclude that, for the population as a whole, attrition effects obtain as predicted for all three dependent variables. For reaction times and disfluencies, these differences are highly significant ($p < 0.01$), while for VOCD, they are marginally significant ($p < 0.1$). For the free speech measures VOCD and disfluencies, the explained variance is moderate (Adjusted $R^2 = 0.25$ and 0.28, respectively), while for the reaction times, it is rather weak (Adjusted $R^2 = 0.07$).

While we can therefore conclude that lexical access among the experimental populations is not as efficient as among the controls, characterized by slower response times in picture naming, less diverse vocabulary and more disfluencies, the findings in response to RQ1 are at odds with the bilingualism hypothesis: counter to what was predicted under this assumption, attrition effects are not only not attenuated among Moroccans as compared with Turks, but appear to be stronger in this group, except where disfluencies are concerned.

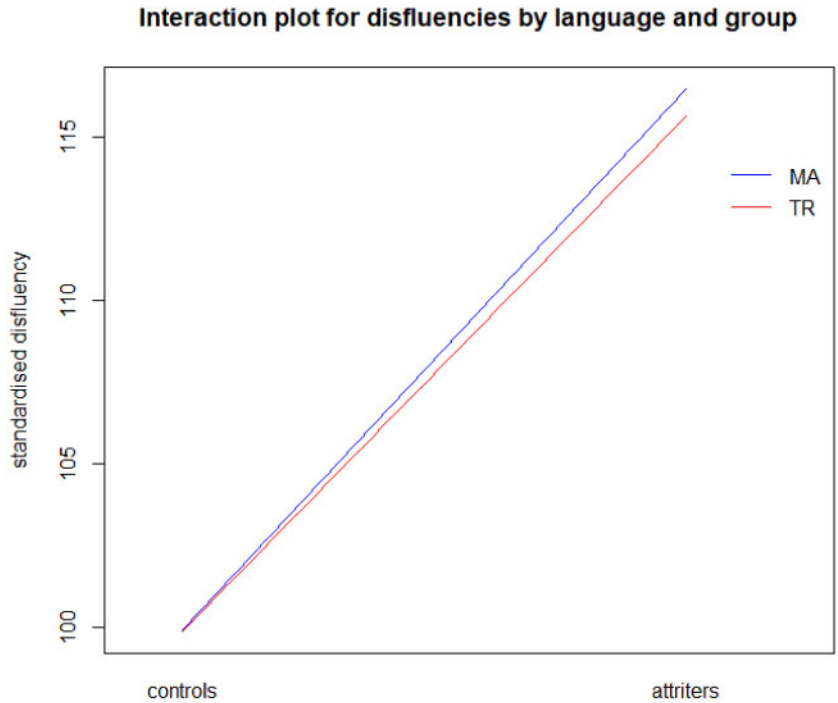

Figure 6: Interaction plot for disfluencies by language and group

The impact of language exposure and attitude (within-group effects)

In order to answer RQ2 about the impact of frequency of L1 exposure and attitudes toward the L1 on the strength of participants' attrition effects, linear regression models were built in the same way as described above (The impact of language background section). Since gender did not play a role for the population as a whole, it was omitted from the models. Instead, the following predictors were added step by step: age at testing, length of residence, amount of interactive L1 use and attitude toward L1 (see Table 6). As before, if the addition of a predictor improved the model significantly, it was retained in the next step, otherwise it was removed. VIFs in the only final model containing more than one predictor were unproblematic (<1.1).

These models establish that, for the populations under investigation, external factors linked to the migration experience, such as the length of residence, frequency of use of the L1, and attitudes toward the L1 play at best a negligible role for the maintenance or attrition of lexical accessibility, as none of these predictors reach significance in any of the model. The only predictor for which a minor impact was found was that a more positive attitude leads to a slight decrease in disfluencies (estimate −4.884, $p < 0.05$); however, that overall

Table 6: Linear regression models (estimates from last model in which predictor was retained)

	Response times in PNT Estimate	Lexical diversity in free speech (VOCD) Estimate	Disfluency in free speech Estimate
L1 (TR vs. MA)	−7.28	**19.45*****	−0.85
Age	**0.61***	**0.63***	−0.26
Length of residence	0.53	−0.50	−0.18
L1 use	−3.41	1.22	−2.76
Attitudes	−1.46	4.96	**−4.884***
Final model, adjusted R^2	0.10*	0.25**	0.07*

$p < 0.1$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; where estimates are marked in bold, predictor is retained in next step of the model.

model was the weakest with an adjusted R^2 of only 0.07. This absence of explanatory power of background factors confirms previous findings showing that they play less of a role than usually assumed *a priori*.

DISCUSSION

The purpose of the present study was to investigate lexical L1 attrition in first-generation Moroccan and Turkish long-term immigrants in the Netherlands. The main effect for group (attriters vs. controls) found for all of the tasks reported here was in line with previous findings relating to a disadvantage in lexical access for attriters. Attrition manifested itself in the present study in a slowdown of lexical retrieval in an experimental setting, reduced lexical diversity in free speech and a higher proportion of disfluency markers. The results in both spontaneous speech and the experimental task converge on the notion that being immersed in an L2 environment exerts a significant pressure on processing L1 and affects lexical retrieval ability, confirming the findings from previous studies (e.g. Yılmaz and Schmid 2012; Schmid and Jarvis 2014). While the descriptive statistics indicated a higher incidence of disfluencies and a faster response time on the PNT for the Moroccans, these did not reach statistical significance (indicated by the absence of a main effect for language). It was only for VOCD that such an effect was found, which is in all likelihood due to structural differences between the systems.

An intriguing finding was that, irrespective of language background and group (attrition vs. control), age at testing appeared to impact on performance. Interestingly, the age effect went in the opposite direction to what is usually reported, with older speakers using a more diverse vocabulary and being less disfluent. This finding is probably due to the upper threshold for age, which

was set at 65 for the present study, and reflects a more diverse experience with the L1 among those participants, both in the Netherlands and in the country of origin.

The chief aim of this study was to develop our understanding of the cognitive mechanisms underlying these disadvantages in lexical access. Specifically, our research questions focused on how attrition effects might be modulated by multilingualism prior to immigration (RQ1) and how other external factors linked to exposure and attitudes might affect attrition effects (RQ2). In other words, the present study intended to explore to what extent reduced lexical accessibility in bilinguals can be ascribed to competition for selection on the one hand, or a reduction in frequency of exposure and use on the other (Kroll and Gollan 2014). Both of these mechanisms provide a convincing narrative for predicted changes and likely play a role in the process, but how specifically each of them contributes to lexical L1 attrition has not been established. In order to provide more insight into this question, this study investigated both between-group and within-group effects.

RQ1: the impact of prior multilingualism

First, we compared attrition levels between two populations of long-term immigrants in the Netherlands. In the first population, Turkish native speakers, the attriters were distinguished from the reference population by the mere fact of being bilingual: until the time of migration they had known only the L1. These speakers were compared to monolingual native speakers residing in Turkey. The second population of attriters originated from a multilingual society (Morocco) and was compared against a multilingual reference group. We hypothesized that any impact of cross-linguistic competition should be reduced in the Moroccan group, as the controls would experience similar effects (between-group effects). Variables related to exposure and attitudes, on the other hand, should exert the same within-group effect in both populations of attriters, as both previously monolingual and previously multilingual speakers should find their Activation Threshold increased depending on how frequently they use the L1, how long they have resided in the Netherlands, and how they feel about their language and culture of origin.

Interestingly, however, between-group attrition effects with respect to lexical access (retrieval speed and lexical diversity) appeared to be more pronounced, not less, among the Moroccan than among the Turkish attriters, while both groups showed a similar increase in disfluencies as compared to the controls. This finding goes against the Bilingualism Effect hypothesis (Hypothesis 1). While puzzling, this finding is in line with results reported by Kan (2019) and Kan and Schmid (2019), who investigated two populations of Cantonese-English bilingual children in Hong Kong and New York City: despite the fact that the amount and contexts of both languages used in the children's daily lives were reported to be identical for both populations, the children living in the USA were shown to lag behind developmentally in

Cantonese on a range of measures, such as the perception and realization of lexical tones and the use of classifiers. Cumulatively, these findings suggest that being immersed in a language context is more conducive to cross-linguistic interaction, incomplete acquisition, and attrition than intensive L2 use in an L1 environment. Further research should investigate how the two types of L2 exposure and use differ in bringing about these interesting results,

RQ2: The impact of external factors

In a second step, we aimed to investigate which of the factors in the individual migrants' background and daily lives might explain within-group variation in attrition effects. In other words, we wanted to see why some speakers in both language groups, years or decades after immigration, were still able to perform at or even above the native norm while others had clearly deteriorated much more. We therefore explored the predictive potential of those language-related factors that have most often been invoked in the context of L1 maintenance and attrition, namely frequency of L1 exposure, length of residence in an L2 setting, and attitudes toward the L1. Our analyses show that, while there is indeed considerable variation within the experimental groups in the size of the individual attrition effect, these effects seem to have developed largely irrespective of the individual predictors. In other words, our regression models were unable to find any connection between an individual's scores on the measures of lexical accessibility applied here on the one hand and personal circumstances, such as amount of exposure or level of attitudes, on the other. In line with previous findings (see Schmid 2019 for an overview), length of residence and frequency of L1 use were not significant predictors for any of the dependent variables.

It should be emphasized that this lack of any evident linear relationship between LoR and attrition does not necessarily imply that attrition is not a gradual process which takes place over longer periods of time, merely that the impact of time may be different for each individual speaker and probably interact with many other factors, such as the amount of use (as, e.g. suggested by Schmid 2011b).[4] Patterns of bilingualism are as varied as bilingual individuals, and the development of proficiency, access, and attrition in a first language over an immigration span that lasts decades will be characterized by spurts of decline (and growth), long periods of stability and equally long periods of gradual deterioration, depending on the individual's personal situation at each moment in time. In order to disentangle all of these factors, painstakingly detailed longitudinal case studies are necessary—unfortunately, no such investigations exist to date.

The same is true for the impact of L1 use. It is probably the most puzzling overall result of attrition research that virtually no study has been able to show evidence for a clear-cut impact of this factor, and the present study is no exception. It has recently been suggested that L1 use may exist in a complex interaction with language learning aptitude (Schmid and Yılmaz 2018), where

speakers with high levels of aptitude may be able to maintain native-like levels of proficiency and accessibility even in the absence of frequent exposure, while low-aptitude individuals do need to use their L1 in order to maintain it. Much further work is needed to establish the mechanisms underpinning individual levels of attrition.

Lastly, the only impact of attitude revealed in the present study was a weak predictive effect for disfluencies, with speakers with a more positive attitude using fewer hesitation markers; however, the overall explanatory power of this variable was very weak. This finding again speaks to a long line of research on this complex, changeable and rather unpredictable factor which is beyond the scope of the present study (the reader is referred to Schmid 2011a: ch. 8 for a full discussion).

CONCLUSION

The findings from the present study suggest that the experience of being removed from the native language environment may constitute a specific factor shaping the development of the overall profile of language proficiency and language dominance which cannot easily be reduced to quantitative measures of the use of either language in daily life.

The finding that the Moroccan speakers had apparently experienced more attrition than the Turks on two of the three measures of lexical access applied in this study is somewhat puzzling and contradicts the bilingualism hypothesis. One final explanation we would like to tentatively propose here is that there may have been some impact of L1 literacy: in contrast to Turkish, MA is not a written language, and speakers of that language would instead use Standard Arabic for reading and writing. It has often been suggested that literacy may play an important role for language maintenance as well as for heritage languages . The fact that both populations behaved identically with respect to disfluency—a feature uniquely linked to spoken language—but that the Moroccans struggled more with verbal access and lexical diversity may indicate that the Turkish speakers had received some degree of reinforcement of lexical representations through reading and writing. However, as none of the tasks used in this study required literacy, this explanation can only be a very tentative suggestion, which should be further explored in future work.

To conclude, we would like to note that it is, of course, possible that these differences were caused by underlying differences present in our experimental groups which we did not address or measure in the present study. We have already alluded to language aptitude as one such potential factor, but there may be others. Much further research is necessary to shed more light on the multifaceted and puzzling phenomenon of language attrition.

SUPPLEMENTARY DATA

Supplementary material is available at *Applied Linguistics* online.

NOTES

1 For the sake of simplicity, we only refer to bilingualism (individuals speaking two languages) while fully acknowledging that similar processes apply to speakers of more than two languages.

2 The number of individuals identifying as members of these communities is likely to be much bigger because third-generation individuals are not included in the government statistics.

3 A subset of 62 participants (17 MA and 45 TR) returned for a second visit which was conducted in Dutch. Their spoken performance was later on holistically rated for grammar, lexicon and accent by three independent raters and their foreign accent evaluated by a minimum of 19 and a maximum of 54 native speakers of Dutch (see Yılmaz, 2013 for details). The self-rated proficiency scores correlated strongly with both the holistic performance ($r = 0.55$, $p < 0.001$) and moderately with the global foreign accent ratings ($r = 0.430$, $p < 0.01$), indicating a high level of accuracy of the self-perceptions.

4 Schmid (2011b) suggests an interaction effect in language attrition between LoR and frequency of use, whereby LoR does excert an effect for speakers with very low or very high levels of use, but not for intermediate users. For the purpose of the present investigation, we replicated the procedure suggested in this study by assessing LoR effects differentially in four even-sized groups of participants with different degrees of reported use of L1 in daily life. This analysis yielded no significant results and is therefore not reported on in detail here.

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