Social categories are shared across bilinguals' lexicons

Anita Szakay
Macquarie University

Molly Babel
University of British Columbia

Jeanette King
University of Canterbury

Addresses for correspondence:

Anita Szakay
Department of Linguistics
Macquarie University
NSW Australia 2109
anita.szakay@mq.edu.au

Molly Babel
Department of Linguistics
University of British Columbia
Totem Field Studios
2613 West Mall
Vancouver, BC Canada V6T 1Z4
molly.babel@ubc.ca

ABSTRACT

Dialects and languages are socially meaningful signals that provide indexical and linguistic information to listeners. Are the indexical categories that are shared across languages used in cross-linguistic processing? To answer this question English (L1)-Māori (L2) bilingual New Zealanders participated in a priming experiment which included English-to-Māori and Māori-to-English translation equivalents, and within-language repetition priming for Māori and English. Half of the English words were produced by standard New Zealand English (Pākehā English) speakers and half by Māori English speakers. We find robust evidence for within-language repetition priming for both Māori-only and English-only trials. Across languages, there is L1-L2 priming: both Pākehā English and Māori English successfully prime Māori. The effect size, however, is larger for Māori English–Māori trials than Pākehā English–Māori trials. In the L2-L1 direction Māori only primes Māori English, not Pākehā English. These results support the hypothesis that indexical categories – e.g., ethnic identity – facilitate word recognition across languages, particularly in the L2-L1 direction, where translation priming has not always been obtained in the literature. Lexical items and pronunciation variants are activated through conceptual links and social links during bilingual speech processing.

Keywords: auditory priming, Māori, bilingual speech perception, sociophonetics

Highlights:

- The activation of social information operates under a shared system across the L1 and L2.
- In addition to the previously proposed conceptual link, the L1 and L2 are also connected through a social category activation link.
- Social information can facilitate translation priming.

1 Introduction

The processing of spoken language is an exercise in mapping the relationship between variable phonetic signals, socio-pragmatic context, and abstracted phonological representations. This is a complicated process in monolingual contexts and is further compounded in multilingual environments where listeners have additional information to track. In terms of the interaction between phonetic information and social groups, listeners' expectations about social groups bias perceptual responses within a language based on associations with, for example, regional accents (Niedzielski, 1999), age (Drager, 2011; Hay et al., 2006), and socioeconomic class (Hay et al., 2006). These associations can prime expectations such that the likelihood of perceiving a particular phonetic feature becomes more likely.

For bilingual listeners, do expectations and associations between language varieties and perceived talker ethnicity carry over across languages? In this study, we ask how social categories that straddle two languages affect spoken language processing in each language. We examine how social information is represented across speech varieties, and specifically, how social information is shared across the two languages of a bilingual listener by testing the effect of ethnically associated dialects on bilingual and bidialectal language processing. The language varieties used in this study are Māori, the indigenous Polynesian language of New Zealand, as well as two ethnic varieties of New Zealand English, namely the standard Pākehā English variety and the non-standard Māori English variety, which is largely, but not exclusively or inclusively, spoken by the indigenous population.

By necessity, our study is somewhat interdisciplinary. Therefore, we first briefly review some of the bilingualism literature in terms of the established connections between first languages (L1) and second languages (L2) in Section 1.1. We connect this to the sociophonetic speech perception literature to demonstrate the established role of experience in monolingual situations in Section 1.2 before describing the unique language context of New Zealand in Section 1.3

1.1 Connections between the first language and second language

Research on the relationship between L1 and L2 knowledge has largely focused on how lexical information is shared between a bilingual's two languages (e.g., Kroll and Stewart 1994, Jiang and Forster 2001, Dijkstra and Van Heuven 2002, Basnight-Brown and Altarriba 2007). The nature of these bilingual connections is often investigated using three types of word pairs as visual stimuli: (i) *Translation equivalents*, which have the same meaning but different forms in the two languages (e.g. English 'girl' and French 'fille'); (ii) *cognates*, which have the same meaning, and the same (or similar) form (e.g. English 'lip' and Dutch 'lip'); and *interlingual homographs* (false friends), which have different meanings, but the same (or similar) forms (e.g. English 'room' and Dutch 'room' meaning 'cream' in English). Research suggests that the activation of translation equivalents works through a conceptual (or lemma) activation link (e.g., de Groot and Nas, 1991; Gollan et al., 1997; Jiang and Forster, 2001; Keatley et al., 1994), such that, for example, the activation of the L1 English word *snow* will simultaneously result in the activation of the L2 French word *neige*, as both words are connected to the concept of *snow*. The activation of cognates also happens through the conceptual activation link but it makes use of the lexical activation link as well (e.g., de Groot and Nas, 1991; Sanchez-Casas et al., 1992). Finally, the activation of interlingual homographs can only happen through the lexical activation link, as these false friends share a lexical form but not a meaning (e.g., De Groot et al., 2000; Dijkstra et al., 1998; Gerard and Scarborough, 1989).

Lexical activation across languages is often estimated using a priming paradigm. Priming was originally defined as "the facilitative effects of an encounter with a stimulus on subsequent processing of the same or a related stimulus" (Tulvig et al., 1982: 336). The phenomenon was observed as early as the 19th century by Cattell (1888/1947), who noticed that people can identify a word more quickly if they have recently been exposed to a word with a related meaning (e.g., semantic priming). The initial word is referred to as the prime, while the subsequent word is called the target, as it is the object to which participants are intended to respond. In a bilingual visual priming paradigm the prime and target are taken from the two different languages of the bilingual speaker. For example, if an English-French bilingual is presented with the the letter string *snow* in English, then sees the translation equivalent in French, she will be faster at processing *neige*, the French translation equivalent, than if she had not been exposed to the English translation first. Trials with translation equivalents like *snow* and *neige* are related pairs and participants' response times to these related pairs are compared to performance on identifying *neige* after being presented with unrelated English control items like *cat.*

Priming paradigms have been used to demonstrate that the conceptual link is stronger in the L1-L2 direction than in the L2-L1 direction, a phenomenon dubbed the bilingual translation asymmetry. This means that, for example, for our English-French bilingual the English L1 word *snow* activates the French L2 translation equivalent *neige* to a larger extent than the L2 word *neige* activates the L1 translation equivalent *snow* (e.g., Basnight-Brown and Altarriba, 2007; Duñabeitia et al., 2010; Duyck and Warlop, 2009; Schoonbaert et al., 2009). The degree of asymmetry seems to be related to proficiency in the L2, with more proficient bilinguals showing no asymmetry (e.g., priming in both L1-L2 and L2-L1 directions; Basnight-Brown and Altarriba, 2007; Duñabetitia et al., 2015). On the other hand, some do not find any evidence of L2-L1 priming at all (Gollan et al., 1997; Finkbeiner et al., 2004; Jiang and Forster, 2001).

While evidence for cross-language activation in the visual domain through orthographically presented items has been extensive, bilingual word recognition in the auditory domain has a shorter history. This growing area of research has investigated different aspects of bilingual lexical organization using a diverse range of methodologies. For example, eye-tracking techniques have been used to analyze auditory lexical access and language-nonselectivity in bilingual word recognition (e.g., Spivey and Marian, 1999; Marian et al., 2008), showing both within-language and between-language phonological dynamics that are modulated by the direction of lexical activation. Cross-language phonological overlap with the L2 leads to lexical competition, and thus delayed lexical decision in the L1, while phonological overlap with the native language facilitates lexical decision in the L2. Auditory-visual cross-modal priming paradigms have been used to investigate the processing of interlingual homophones (e.g., Schulpen et al., 2003) and how perceptually difficult phonemes affect the activation of L2 words (Broersma, 2012). This work suggests that non-native listeners have difficulties deactivating unintended cross-language phonological competitor words, especially when those words contain sounds that the L2 listeners find perceptually challenging (e.g., the contrast between English /æ/ in *flash*, and /ɛ/ in *flesh*). Within-L1 and within-L2 auditory-only lexical decision tasks have been applied to assess the role of cross-language phonological overlap (Marian et al., 2008, Experiment 3), and to examine processing of interlingual minimal pairs (Pallier et al., 2001; Sebastian-Galles et al., 2005) as well as interlingual homophones (Lagrou et al., 2011, 2015). In addition to providing further evidence for cross-language activation, Lagrou et al. argued that language-specific subphonological cues related to a non-native accent (e.g. a Dutch accent in the production of English stimuli) do not cancel cross-language interactions during bilingual speech perception, showing that Dutch (L1) – English (L2) listeners responded to interlingual homophones (e.g., lief *sweet* – leaf /li:f/) slower than to control words in a within-L2 auditory lexical decision task. Generally, however, cross-language L1-L2 auditory lexical decision tasks have been used relatively scarcely in the study of bilingual lexical activation.

One of the first studies to use cross-language auditory translation priming with a lexical decision task (the method used in the present study) was Woutersen et al. (1994), which examined the processing of Dutch dialects by residents of Maastricht. The study used two types of items – cognates, where the two dialects differ minimally (e.g., *aap* ‘monkey’ for both the standard and Maastricht varieties) and noncognates, where the two varieties use completely different words (e.g., standard Dutch (SD) *ziek* ‘sick’ and the Maastricht dialect (MD) equivalent *kraank* ‘sick’). Half of the participants were native speakers of the Maastricht dialect with near-native proficiency in standard Dutch, while the other half were native speakers of the standard dialect with a lower proficiency in the Maastricht dialect. The experiment included both intralingual and interlingual repetition priming conditions, where prime-target pairs consisted of all possible combinations of the two dialects. Thus, the within-dialect condition contained MD-MD (*aap-aap*) and SD-SD (*aap-aap*) prime-target trials, while the cross-dialect conditions contained MD-SD (*kraank-ziek*), SD-MD (*ziek-krank*) noncognate trials, as well as MD-SD (*aap-aap*) and SD-MD (*aap-aap*) cognate trials. The results showed overall significant within-dialect repetition priming for both standard Dutch and Maastricht dialect words. Native Maastricht dialect speakers, however, showed no cross-dialect priming, which the authors speculated was due to near-native proficient bilinguals developing two separate concepts for Dialect 1 (D1) and Dialect 2 (D2). The native standard Dutch speaking participants showed priming in the SD-MD (*ziek-krank* and *aap-aap*) direction, but not the reverse (MD-SD, *kraank-ziek* and *aap-aap*). In other words, priming only occurred when the prime was in their D1 standard variety. These standard Dutch speakers are D2 learners of the Maastricht dialect with lower proficiency levels, and are showing priming in the D1-D2 direction but not in the D2-D1 direction. This is comparable to the bilingual asymmetry results in the visual paradigm mentioned earlier, where the degree of asymmetry seems to be related to proficiency levels in the second code, with highly proficient bilinguals showing no asymmetry (Basnight-Brown and Altarriba, 2007;

Duñabetitia et al., 2015). These results suggest that the organization of dialect variants is not fixed, but based on experience, potentially like bilingual lexical organization.

Since Woutersen et al. (1994), only a handful of studies have used an auditory primed lexical decision task to investigate bilingual lexical organization. De Bot et al. (1995) and Woutersen et al. (1995) applied the same cross-linguistic priming technique in Dutch-English experiments with very proficient bilinguals and found significant auditory priming both within and across languages. More recently, Nahrkhalaji et al. (2014) also showed significant auditory translation priming for Persian-English unbalanced proficient bilinguals using a primed cross-language lexical decision task. Together, these studies provide evidence for activation of the L1 and L2 lexicons during bilingual word recognition that is determined by proficiency and experience with the language varieties. However, the common use of mainstream dialects in the studies using the auditory modality (a notable exception is Woutersen at al. [1994]) means that the phonetic variation in the speech communities of multilinguals is often ignored in the study of bilingual representations.

1.2 Social information, experience, and speech perception

We are interested in how socially meaningful phonetic variation in the speech communities of multilinguals may be used by listeners, as we know it is in monolingual populations (for a review see Babel and Munson, 2014). Of particular relevance to the current study are social indexical features (Abercrombie, 1967). Socio-indexical features are those aspects of linguistic structure that correlate with non-linguistic factors, such as speaker differences in gender, age, socio-economic status, ethnicity, group affiliations, regional background, and individual identity. Users of spoken language can extract these indexical features from the visual field (e.g., Hay, Warren, and Drager, 2006; Mitchel, Gerfen, and Weiss, 2016), from expectations given experimental manipulations (e.g., Niedzielski, 1999; Johnson, Strand, and D'Imperio, 1999), and from the auditory signal itself (e.g., Munson et al., 2006; Fogerty, 2015). Listeners' abilities to adapt their linguistic expectations based on social categories suggests that listeners encode information about who talks like what when.

These expectations are derived from experiences. Experience with particular social categories (e.g. dialects) is a critical aspect of processing sociophonetic variation. Sumner and Samuel (2009) examined the role of dialect experience on the processing of non-rhotic New York City (NYC) and rhotic General American (GA) pronunciation variants of post-vocalic /ɹ/. Using a series of priming tasks the study tested whether words like *slender* are equally effective as primes in their r-less and r-full pronunciations. Listener experience varied along both speech perception (individuals who were accustomed to hearing the r-less variants) and speech production (individuals who used r-less productions in their own speech) dimensions. Three different participant groups were used: a GA group with little prior exposure to the NYC dialect and who were r-ful in their own speech, and two NYC groups who both would have perceptual experience with r-less varieties but differed based on their own speech production: an r-less Overt-NYC group and an r-ful Covert-NYC group. A short-term repetition priming task found that GA listeners received no benefit from hearing r-less primes (e.g., *slender* as [slɛndə]), but both the Overt and Covert NYC groups did. All listener groups showed priming when the prime was produced by a GA speaker (e.g., *slender* as [slɛndɹ]). These results suggest that listeners who have experience with both dialects (i.e., the two NYC groups) are more flexible in form processing, as they show greater perceptual malleability.

Using paradigms similar to those used in the cross-linguistic processing literature, some studies have found processing benefits for standard and local varieties compared to non-local, non-standard dialects (Floccia et al., 2006; Impe et al., 2008), while others have found more complicated patterns of processing costs and benefits for dialects. For example, Clopper (2014) reports processing benefits were observed when items were produced by a speaker of standard General American English and not a speaker of the Northern dialect of American English, even for listeners from the Northern dialect region (see also Clopper, Tamati, and Pierrehumbert, 2016). Again, the linguistic experience of participants has been shown to play a critical role in the perception of dialect variation, where increased mobility of the listener lends itself to more accurate dialect perception (e.g., Preston, 1986; Tamasi, 2003; Clopper, 2004). Linguistic experience also plays a role in the perception of ethnic varieties. In the New Zealand context, for example, high previous exposure to the Māori English variety has been shown to have a beneficial effect on perception and accuracy in ethnolect identification tasks even when listeners only have access to suprasegmental information in the speech signal, such as rhythm (Szakay, 2008a), intonation (Szakay, 2008b), and voice quality (Szakay, 2012b).

Together, the literature points to the role of experience in processing different language varieties and how under certain contexts both local dialects and standard dialects experience processing benefits. The linguistic landscape of New Zealand provides the opportunity to investigate dialect standardness in a priming task, alongside our cross-linguistic inquiries. When we ask how bilinguals process the language varieties in their communities, we are able to include three codes familiar to our participants: Māori, Māori English, and Pākehā English. These three codes are described in the following section.

1.3 The Linguistic Landscape of New Zealand

New Zealand has three official languages: English, Te Reo Māori (i.e., the Māori language, which we abbreviate as MR), and New Zealand Sign Language. New Zealand English itself has two main varieties, namely Māori English (referred to as ME herein), spoken mainly by the indigenous population, and Pākehā English (referred to as PE), which is the standard English variety spoken mainly by people of European descent. The Māori language (Eastern Polynesian; Polynesian; Austronesian) is the indigenous language of New Zealand. As a Polynesian language, Māori has a relatively small phoneme inventory, with ten consonants (/p t k m n ŋ f h ɾ w/), five vowels (/a e i o u/), and phonemic vowel length. In addition to the five monophthongs there is also a range of diphthongs, such that any vowel plus a higher vowel can form a diphthong, for example, *tai* 'sea', *tae* 'arrive', *toi* 'art', *toe* 'be left over', *tao* 'spear', *tau* 'year', *tou* 'anus, tail of a bird' (Harlow 2007:69). Māori has a (C)V(V(V)) syllable structure.

It is estimated that 14.9% (~598,605) of New Zealanders identify as ethnically Māori (Statistics New Zealand, 2013). The Māori language is reportedly spoken by 3% of the total population of New Zealand, and 21% of all ethnically Māori New Zealanders (http://www.Māorilanguage.info/mao_lang_faq.html). Most of these speakers of Māori are second language speakers. Māori became a minority language towards the end of the 19th century as a result of increasing numbers of European settlers from the United Kingdom and Australia, and was subsequently informally banned in schools. By the end of the 20th century less than 20% of the Māori population was fluent in the language (Benton, 1991), and this has subsequently ignited language revitalization efforts. *Kōhanga reo* (preschool language nests) were set up across the country where many older native speakers of Māori provided total immersion schooling for young children, leading to a range of primary and secondary school Māori language immersion initiatives (Benton and Benton, 2001). While the number of native Māori speakers has decreased and English has become the dominant language of most ethnically Māori individuals, there has been a rise in a new variety of English in New Zealand: Māori English.

Māori English emerged to express ethnic identity and positive attitudes toward Māori culture (Holmes, 2005). Now acquired as a native language, ME is considered the fastest growing variety of New Zealand English (Maclagan et al., 2008a). Efforts to identify unique ME features have been unsuccessful (Benton, 1991; Bayard, 1995); rather, a difference in frequency of use of particular phonological variables more accurately describes the differences between Māori and Pākehā Englishes (Maclagan et al., 2008a). For example, ME speakers have been shown to produce a higher percentage of final-z devoicing, /u/- or GOOSE-fronting (Bell, 2000), θ-fronting (Kennedy, 2006), and a more monophthongized /ou/ or GOAT vowel with a fronted and raised onset (Maclagan et al., 2008b).[1] Suprasegmental features also differ across the English varieties in New Zealand. ME has a significantly more syllable-timed rhythm (Holmes and Ainsworth, 1997; Warren, 1998; Szakay, 2006), more High Rising Terminal intonation contours (Warren and Britain, 2000; Szakay, 2008b), and a higher overall mean fundamental frequency (Szakay, 2006). While some of the linguistic features of Māori English may be historically related to the Māori language, such as speech rhythm (Vowell et al., in press), ME is now acquired in the absence of Māori acquisition (Maclagan et al., 2008a, Richards, 1970). Even with today's revitalization efforts, major synchronic influence from Māori seems unlikely as the English skills of bilingual children in immersion schools are comparable to the English skills of Māori children in mainstream schools (Murray, 2005:4). In fact, Māori language influence on Māori English segmental features has been discounted in terms of θ-fronting (Warren and Bauer, 2004) and GOOSE-fronting (Maclagan et al., 2009). Māori English GOAT-monophthongization (Maclagan et al, 2008b) appears to be a recent innovation that Warren and Bauer (2004) do not yet mention in their survey of Māori English, but is unlikely to be affected by contemporary phonological patterns in Māori. Listeners are aware of these differences between the two codes, at least insofar as they are able to identify ethnic identify from auditory stimuli (Szakay, 2012b).

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[1] Following Wells (1982), we use the lexical sets GOOSE and GOAT.

[2] A more detailed description of the VAS task is available in Szakay (2012a).

[3] Eight of our participants had scores at the median. As median scores "are typically assigned arbitrarily to one of the two categories" (Weinberg and Abramowitz, 2002: 116), we decided to include these participants in the High MII Group. Previous research suggests that a score of 12 on the MII scale signals high exposure to Māori English in terms of both speech production and speech perception (Szakay, 2008a), therefore we

An important caveat is necessary in our presentation of Māori English. Not all ethnically Māori New Zealanders speak ME, and some Pākehā speakers also use ME features in their speech (King, 1993). Crucially, the segmental and suprasegmental differences are not absolute between the two varieties; rather, there is a quantitative difference where ME speakers make use of these features in higher proportions than PE speakers. These facts all support the idea that ME is better conceptualized as an ethnolinguistic repertoire available to speakers, rather than a distinctive ethnic variety (Benor, 2010). We use the terms ethnic variety and ethnic dialect as shorthand, fully acknowledging the fact that there is variation and fluidity within both ME and PE, where speakers may use more or less of the available features depending on the context, social meaning, and identity they are trying to convey.

1.4 Hypotheses and predictions

While previous research has demonstrated that social information influences speech perception processes, the ways in which social information might be shared across the two languages of a bilingual has, to our knowledge, not been investigated. In the experiment that follows we test whether the activation of social information operates under a shared or a separate system across languages for bilingual listeners. We argue for a shared system, showing that L1 and L2 socio-indexical labels interact during speech perception. The social feature we investigate here is apparent talker ethnicity; listeners implicitly assess from the speech signal whether the speaker is Māori or Pākehā and process the item accordingly.

The main hypothesis behind this study is that the activation of social categories operates under a shared system between the L1 and L2. Based on this hypothesis we predict that activating lexical items associated with a particular ethnicity in the L1 (English) will in turn activate linguistic material in the L2 (Māori), which is also associated with the same ethnicity. That is, we examine whether presentation of Māori English *snow* [snɵʉ̞] facilitates processing of Māori [hʉ̞kɐ̞] more than Pākehā English *snow* [snɐʉ] because of the shared Māori social connection between Māori and Māori English. In testing this hypothesis, we include within-language trials to confirm priming for L2-L2 (Māori-Māori) and L1-L1 trials, as the presence of within-language priming has been claimed to be a precondition for cross-language priming to appear (e.g., Woutersen et al., 1995). Further inspiration for the within-English cross-dialect conditions comes from Sumner and Samuel (2009). Thus, the L1-L1 English-only trials include within and across dialect pairings, which allows us to test whether the mainstream dialect and the Māori-associated ethnolect are processed equivalently. Our participants are all English (L1) – Māori (L2) speakers with varying levels of Māori proficiency. To assess their assumed native English variety, we use the Māori Integration Index (Robertson 1994, Szakay 2006, 2008a) as a proxy, which has been shown to correlate with the frequency of use of Māori English features in speech production (Szakay, 2006). The assumption is that participants with a high integration index are native speakers of the non-standard Māori English variety, who are also regularly exposed to the standard variety. Individuals with lower levels of integration into the Māori community are likely regularly exposed to Māori English, but are more likely to be native speakers of more standard Pākehā English. There are competing predictions with respect to the within-English trials. While the native and more familiar accent is often touted as the variety that most facilitates processing, standard varieties have also been shown to facilitate processing. Thus, we predict to find interactions with Māori cultural integration in the cross-dialect English trials, as high and low Māori integration individuals are assumed to have different native dialects.

Focusing on the cross-linguistic component, Figure 1 demonstrates the hypothesized operation of social category activation under a shared system across the two languages of a bilingual listener, where social categories can activate and interact with each other across the L1 and L2 lexicons in both directions. The design of Figure 1 takes inspiration from several contemporary models, namely, Pierrehumbert (2002), Freeman and Ambady (2011), and Sumner et al. (2014). In this model phonetic representations are associated with relevant social categories, while lexemes are dynamically updated abstract generalizations over probabilistic distributions of such phonetic representations. The hypothesized L1-L2 social category activation operates in the following way. Phonetic representations of the English lexeme *snow*, for example, that are produced by a speaker of Māori English are associated with Māori ethnicity, while *snow* produced by a speaker of Pākehā English is associated with a Pākehā ethnicity. Phonetic representations of Māori language lexemes will be associated with Māori ethnicity. Being exposed to the Pākehā English phonetic representation *snow* [snɐʉ] will activate the concept of *snow*, which in turn will pre-activate the Māori translation equivalent *huka*, through previously proposed conceptual links (e.g., Kroll and Stewart, 1994), and hence facilitate the processing of *huka*. In a similar fashion, being exposed to the Māori English phonetic representation *snow* [snɵʉ̞] will also activate the concept of *snow*, which in turn will pre-activate the Māori translation equivalent *huka*. However, in addition to this lemma activation link, the Māori English pronunciation will also activate other phonetic representations associated with Māori ethnicity, including the L2 translation equivalent [hʉ̞kɐ̞]. Due to the additional social category activation link, this will result in a stronger activation of [hʉ̞kɐ̞] by the Māori English phonetic representation [snɵʉ̞], than by the Pākehā English phonetic representation [snɐʉ]. Throughout this paper the Pākehā English phonetic representations are based on the vowel transcriptions in Bauer et al. (2007), while the Māori English and Māori language phonetic representations are based on the vowels described in Watson et al. (2016).

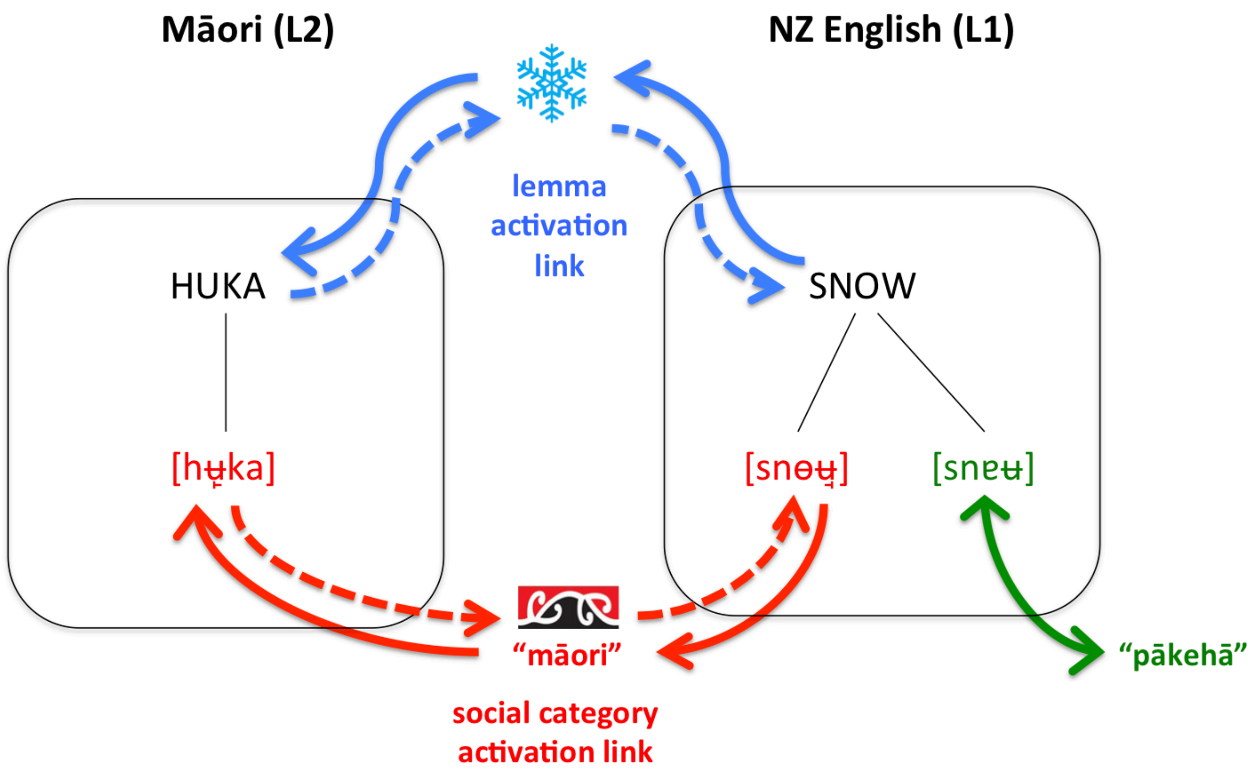

Figure 1. Hypothesized operation of social category activation under a shared system across the two languages of a bilingual listener. The prediction is that social categories can activate and interact with each other across the L1 and L2 lexicons in both directions, with stronger links in the L1-L2 direction (solid lines), and weaker links in the L2-L1 direction (dashed lines).

Thus, we predict that

(i) Due to the lemma activation link and the social category activation, we expect stronger priming effects for trials consisting of Māori English and Māori translation equivalents compared to Pākehā English and Māori trials.

(ii) Individuals with high Māori cultural integration, who we assume to be speakers of Māori English (Robertson, 1994; Szakay, 2008a) and also receive regular exposure to Pākehā English as the supra-local standard, will exhibit greater flexibility in processing both Māori English and

Pākehā English than participants who are less integrated in Māori society and are, hence, less proficient processors of Māori English. This greater flexibility might manifest as priming or priming of a larger magnitude in cross-dialect conditions, or as a general processing benefit in terms of faster reaction times to both of these codes for highly integrated individuals compared to individuals with lower Māori integration.

2. Cross-linguistic and cross-dialect priming

The goal of this experiment was to understand whether bilingual processing of L1 and L2 forms is affected by L1 ethnolectal variants. To this end, we created a cross-language/cross-dialect auditory primed lexical decision paradigm, which also provides us with within-language controls to confirm L1-L1 and L2-L2 priming and assess the role of dialect in L1-L1 priming across the local varieties of English.

2.1 Stimuli

Related prime and target pairs were made up of English-to-Māori and Māori-to-English translation equivalents. Half of the English words were produced by PE speakers, and half by ME speakers, thus creating four bilingual test conditions (e.g., *snow*-*huka*, *huka*-*snow*): ME-MR, PE-MR, MR-ME, MR-PE. Four English-only repetition priming conditions were also included (e.g., *snow*-*snow*): PE-PE and ME-ME (within dialect), and PE-ME and ME-PE (cross-dialect), as well as a within Māori (MR-MR) repetition priming condition. This creates a total of nine conditions, which are illustrated in Table 1 using the translation pair *thing* (English) and *mea* (‘thing’ in Māori). For example, in the bilingual ME-MR condition the θ-fronted ME variant [fɘ̆ŋ] serves as a prime for the Māori translation target word *mea*. Similarly, in the MR-PE condition the Māori word *mea* serves as the prime for the Pākehā English translation target word [θəŋ].

Table 1: Examples of all combinations of prime and target language pairs, illustrated by the English-Māori translation pair *thing* and *mea*.

Condition	Prime Language	Target Language	Prime Example	Target Example
MR-MR	Māori	Māori	[më̞ɐ̞]	[më̞ɐ̞]
MR-ME	Māori	Māori English	[më̞ɐ̞]	[fɛ̈ŋ]
MR-PE	Māori	Pākehā English	[më̞ɐ̞]	[θəŋ]
ME-MR	Māori English	Māori	[fɛ̈ŋ]	[më̞ɐ̞]
ME-ME	Māori English	Māori English	[fɛ̈ŋ]	[fɛ̈ŋ]
ME-PE	Māori English	Pākehā English	[fɛ̈ŋ]	[θəŋ]
PE-MR	Pākehā English	Māori	[θəŋ]	[më̞ɐ̞]
PE-ME	Pākehā English	Māori English	[θəŋ]	[fɛ̈ŋ]
PE-PE	Pākehā English	Pākehā English	[θəŋ]	[θəŋ]

Eighty-one English-Māori translation pairs (i.e., test items) were created using four segmental variables that are used at different rates in ME and PE: θ-fronting, GOOSE-fronting, final-z devoicing and GOAT-fronting and monophthongization. Test items and phonetic transcriptions are provided in Appendices 1-5. To serve as controls in the priming task, eighty-one unrelated pairs were also created by randomly re-pairing items from the related list. Filler words (unrelated real words) and pseudo-words were also included for all three language varieties. None of the English filler words contained any of the four sociophonetic variables. The pseudo-words were based on real words by changing only one phoneme (this varied across different words), ensuring that the non-word forms obeyed the rules of English and Māori phonotactics. Overall, efforts were made to exclude homophones (e.g., *nose*/*knows*) and items where using the sociophonetic variant in Māori English could potentially create homophones (e.g., θ-fronting: *thin*/*fin*, or final-z devoicing: *phase*/*face*).

To avoid priming due to mere voice similarity, prime words were produced by female voices and target words were produced by male voices. Six speakers in total were recorded for the stimulus material, representing each language variety: one female ME speaker, one female PE speaker, and one female MR speaker for the prime words; and one male ME speaker, one male PE speaker, and one male MR speaker for the target words. All six speakers came from the city of Christchurch. The two Māori English and two Pākehā English speakers were specifically chosen by the authors because their accents were judged to be particularly representative of their respective dialects. This was then confirmed by the results of a Visual Analogue Scale (VAS) task, where 15 English-Māori bilingual participants were asked to evaluate the 81 critical items pronounced by each speaker, based on how Māori- or Pākehā-sounding they perceived each word. The results indicate that the ME speakers were indeed significantly more Māori-sounding than the PE speakers (Wilcoxon signed rank test, $V=2886000$, $p < 0.001$). Figure 2 presents the distribution of ratings broken down by the four sociophonetic variables, where high numbers indicate that the word was perceived as Māori-sounding, and low values indicate that the word was perceived as Pākehā-sounding.[2]

[2] A more detailed description of the VAS task is available in Szakay (2012a).

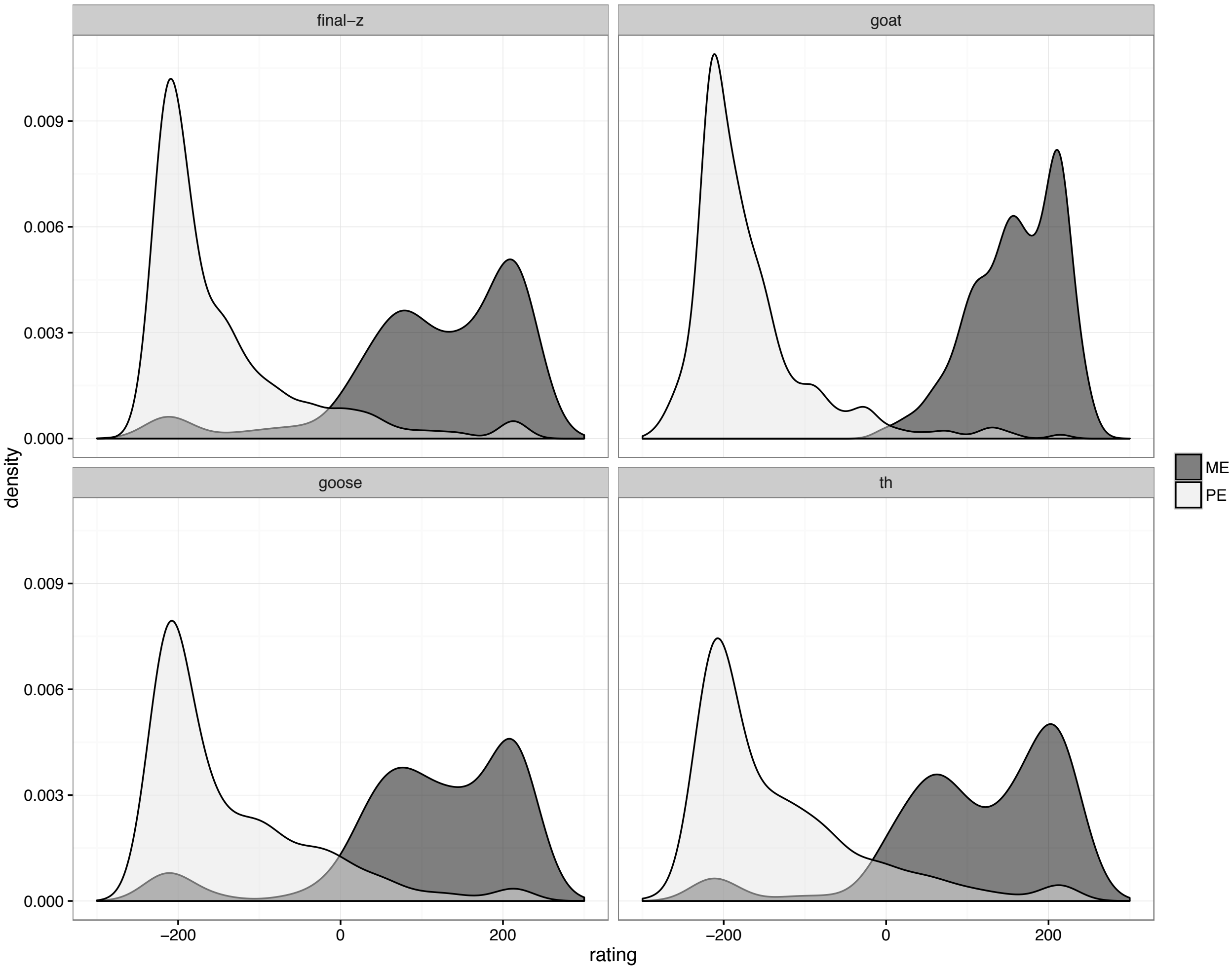

Figure 2. Rating distributions of the Māori English (ME) and Pākehā English (PE) stimuli in a VAS accent-rating task plotted separately for the four sociophonetic variables. High numbers indicate that a word was perceived as Māori-sounding, low values indicate that a word was perceived as Pākehā-sounding.

All speakers were presented with the word list on a MacBook Pro laptop screen and read the words out loud at their own pace. Each speaker received the words in the same order, and the Māori words on the Māori list were presented in the same order as their English equivalents on the English word list. The word lists were broken into subgroups, where the speakers first read the critical items, followed by the fillers then finally the pseudo-words. The recording task was completed within 30 to 40 minutes by all speakers. The sound files were recorded directly onto the laptop by the built-in microphone using Praat (Boersma and Weenink 2010). The original sampling frequency of 44,100 Hz was downsampled to 22,050 Hz. Peak-amplitude of all tokens was scaled to 70 dB. As we are interested in reaction times, we examined whether there were any differences in target word duration across the three language varieties. Word segmentation and duration measurements were carried out in Praat. The onset and offset of each word was marked by the following criteria. Word-initial and word-final boundaries of sonorant segments and fully voiced stops were marked at the start or end of the periodic activity, respectively. The initial boundary of a voiceless stop was placed at the onset of the burst, while the offset of word-final stops was placed at the end of physical evidence for the stop release. For fricatives the onset or offset of the aperiodic activity was used as a segmentation criterion. To investigate potential duration differences within the stimulus material, an ANOVA was carried out in R (R Core Team, 2014) on target words, i.e. only on those words that participants were required to make lexical decisions on. We included target word duration as the dependent variable, and language variety (ME, PE, MR) as independent variables. As all target words were produced by male voices, talker gender was not included in the analysis. The results showed a significant effect of language variety ($F(2,240)=46.91$, $p<0.001$), where post-hoc analysis revealed that the Māori English target words ($M=688$ ms, $SD=135$) were significantly longer than both the Pākehā English target words ($M=505$ ms, $SD=113$) (Tukey's HSD, $p<0.001$) and the Māori language target words ($M=515$ ms, $SD=155$) (Tukey's HSD, $p<0.001$). Differences in target word duration were also investigated with regard to the four phonetic variables contained in the English test items. An ANOVA was carried out on English target words only, with duration as the dependent variable and language variety (ME, PE) and phonetic variable (final-z, θ, GOOSE, GOAT) as the independent variables. An ANOVA revealed a main effect of variable ($F(3,158)=9.61$, $p<0.001$), and post-hoc analysis indicated that words with the final-z variable ($M=700$ ms, $SD=150$)

are significantly longer in duration than words containing the other three variables (θ: M=535 ms, SD=125; GOOSE: M=587 ms, SD=156; GOAT: M=572 ms, SD=143; Tukey's HSD, p<0.001). This was true for both Pākehā English and Māori English. No other significant length differences were observed with regard to the phonetic variables. Lexical frequency information was also collected for both languages. Data for the English words was obtained from the CELEX database (Baayen et al., 1993) (log values for test items: mean = 2.97, range = 1.5-4.7), while the values for the Māori words came from Boyce's (2006) compilation of a Māori language written broadcast corpus (log values for test items: mean = 1.76, range = 0-3.8). There were no significant lexical frequency differences amongst the English words containing the four different phonetic variables.

To make sure that no target word is primed by more than one item, it was crucial that during the course of the experiment no words, variants of a word, or translation equivalents of a word were repeated for any participant outside the actual test trial. This means that if, for example, a participant heard the related pair /θɪŋ/ (PE) - /mea/ (MR), these two items were not part of any other trial and the same participant would also not hear the fronted ME variant /fɪŋ/ any time during the experiment. Similarly, if another participant heard the related pair /θɪŋ/ (PE) - /fɪŋ/ (ME), these two forms as well as the Māori translation equivalent *mea* were not part of any other trial. In order to achieve this design, nine separate counterbalanced lists were created, each containing all nine language conditions presented in Table 1 (ME-MR, PE-MR etc.). Within each list, five of these conditions were assigned related prime-target pairs, and four conditions were assigned unrelated prime-target pairs. Which conditions included related as opposed to unrelated pairs was counterbalanced across all lists. For example, List 1 included related trials in the following five conditions: ME-ME, ME-MR, PE-PE, MR-ME, MR-MR, and unrelated trials in the following four conditions: ME-PE, PE-ME, PE-MR, MR-PE. (See Appendix 6 for the full counterbalanced design across the nine lists). Each of the nine language conditions contained nine prime-target test pairs, therefore each list had a total of 45 related pairs and 36 unrelated pairs. On top of these 81 test pairs each list also included 99 filler pairs (33 related repetition pairs, and 66 semantically and phonologically unrelated pairs) and 180 pseudo-target pairs (real word prime, non-word target). Filler and pseudo-target pairs did not vary across lists, and were evenly distributed across the nine conditions. Note, that because the related pairs (test trials) and their corresponding unrelated pairs (baselines) within the same condition were always on separate lists, only across-subject analyses are carried out. Table 2 illustrates each of the four trial types (related, unrelated, filler, pseudo-target) using English prime – Māori target bilingual pairs as an example.

Table 2: Example trial types illustrated by English prime – Māori target bilingual pairs.

	Prime (English)	Target (Māori)
Related pair	*truth*	*pono* (‘truth’)
Unrelated pair	*truth*	*kēhua* (‘ghost’)
Filler pair	*land*	*puta* (‘hole’)
Non-word target pair	*body*	*kuno* (non-word)

The distribution of the four socio-phonetic variables amongst the 81 English lexical items used in the related pairs was nearly equal: 20 contained the GOOSE vowel, 20 contained the GOAT vowel, 20 contained the final-z variable, and 21 words contained the /θ/ variable (see full list with phonetic transcriptions in Appendices 1-5). Each of the nine counterbalanced lists featured a total of 54 English target words from the test pairs, that is, those target words that contain the sociophonetic variables: 13 with a GOOSE vowel, and depending on the list 12-13 words with the GOAT vowel, 13-14 words with a final-z, and 14-16 words with a /θ/.

As we use two different English dialects in this cross-language and cross-dialect paradigm, two-thirds of the words contained in the test pairs were in English, and only one-third in Māori. To make up for this difference, proportionately more Māori words than English words were used as fillers, to result in an overall 50% English words and 50% Māori words ratio in the experiment. The non-word ratio and the relatedness proportion were also controlled (Altarriba and Basnight-Brown, 2007; de Groot, 1984). In each each of the nine counterbalanced lists the real word/non-word target ratio was 50%, and of the total 360 prime-target pairs only 78 were related (45 test pairs and 33 filler pairs), which resulted in a 21.6% relatedness proportion.

2.2 Procedure

The experiment was run using E-Prime software (Schneider, Eschman, and Zuccolotto, 2007) on a portable laptop PC. All participants were individually tested in a quiet room, and prime and target pairs were presented over headphones. Primes were always female-produced tokens, targets were male-produced, and there was a 250ms ISI (interstimulus interval) between the prime and target pairs. Listeners' task was to decide whether the target word pronounced by the male speaker was a real word or a non-word. Participants were instructed to press the right arrow key for a real word response, and the left arrow key for a non-word response. Participants were given 2500ms to make a lexical decision on the target word before the program moved on to the next trial.

Subjects were told that they would hear several different speakers and that the words could be either in English or Māori. They were, however, not informed that half of the English words would be in Māori English while the other half in Pākehā English. They were instructed to respond as fast as possible without compromising accuracy. As feedback, their reaction time was displayed on the screen after each trial for 1500 ms. The next trial started 1500 ms after a lexical decision was made. The total duration of the experiment was approximately 35 minutes; participants were given a break after 180 trials. Trials were presented in a different random order for each participant.

After the priming task participants answered questions which evaluated their experiences with Māori and Māori English. Participants self-reported their Māori language proficiency in response to the question "How well are you able to speak Māori in everyday conversation?" on a five point scale: (i) Very well (I can talk about almost anything in Māori; (ii) Well (I can talk about many things in Māori; (iii) Fairly well (I can talk about some things in Māori; (iv) Not very well (I can only talk about simple/basic things in Māori; and, (v) No more than a few words or phrases. Participants who responded with (i) or (ii) were grouped together as advanced speakers and those who responded (iii) and (iv) were coded as the low proficiency group. No participant chose option (v).

To assess participants' exposure to Māori English through their involvement in the Māori community, we used a Māori Integration Index (MII), a social network measure used in earlier linguistic research (Robertson, 1994; Szakay, 2008a). The MII is composed of 8 questions and scores theoretically range from 0-17. Our participants' MII scores ranged from 5.5 to 16 (median=12, mean=11.9). A median split separated participants into a Low MII Group (n=29) and a High MII Group (n=43).[3] Even though the MII aims to measure previous exposure to the Māori English dialect rather than the Māori language itself, a chi-square test revealed a significant relationship between listeners' self-rated Māori language proficiency and their MII Group [$\chi(1)=4.5$, $p < 0.05$], we therefore never use both measures in a given analysis. As eight of our nine language conditions include English stimuli, we consider the Māori English exposure score as a more relevant measure for this particular study, and opt to use the MII Group measure in our analyses below to maintain uniformity in participant groups across Māori and English analyses. As a

[3] Eight of our participants had scores at the median. As median scores "are typically assigned arbitrarily to one of the two categories" (Weinberg and Abramowitz, 2002: 116), we decided to include these participants in the High MII Group. Previous research suggests that a score of 12 on the MII scale signals high exposure to Māori English in terms of both speech production and speech perception (Szakay, 2008a), therefore we felt it would be counterintuitive to assign them to the Low MII Group.

consequence, however, the MII Group measure might not be sensitive enough to gauge participant differences in our within-L2, Māori language only condition.

2.3 Participants

Seventy-two individuals (36 females, 36 males; mean age 26.2, age range = 18-40) participated in the task. All participants were English (L1) – Māori (L2) bilinguals. No participant reported any hearing impairment. Subjects were recruited by the snowball method in the cities of Christchurch and Auckland, and all received monetary compensation for their participation. Sixty-seven participants identified themselves as ethnically Māori, two as Samoan, and three as of European descent.

Lexical processing in bilinguals has been found to differ depending on the degree of language proficiency and dominance, age of acquisition (AoA), mode of acquisition, and language use (e.g., Chen, 1992; Kroll and de Groot, 1997; Mo et al., 2005; Li et al., 2009). All listeners in our experiment were English language dominant and according to their self-reports use Māori between 5-50% in their every day life (mean=17%). The AoA ranged from birth to 35 years of age (mean=11.7); 8 participants reported to have been exposed to Māori since birth. Thirty-two participants attended some form of total immersion Māori language education program as a child. Table 3 provides a summary of the participant information in relation to MII group membership. It shows that the High MII group has a larger percentage of advanced L2 speakers who started learning Māori earlier and use it more in their daily life than the Low MII group. More participants who attended language immersion programs fall within the Low MII group.

Table 3: Participant information by Māori Integration Index group membership.

	Low MII Group	High MII Group

L2 proficiency = advanced	28%	56%
immersion schooling = attended	52%	40%
mean AoA (years)	13	10
mean daily L2 usage (%)	13%	20%

2.4 Assessing priming and cross-code associations

The measure of interest in the analyses below is the facilitation of recognizing related items correctly as words. This is quantified as the difference in response time in related trials compared to unrelated trials. Significant priming is observed in a condition if we obtain an effect of trial type in the analysis. In other words, if reaction times are significantly faster on related trials than on unrelated trials, then priming is achieved.

We are largely interested in differences in bilingual priming between English and Māori. Two varieties of English – Pākehā English and Māori English – are used to test whether the associated Māori ethnic identity facilitates cross-linguistic processing for Māori and Māori English compared to Māori and Pākehā English. We include within-language trials in our analysis to also confirm priming in these codes for this population of listeners. We expect within-language priming, and the cross-dialect component of the English trials offers the opportunity to examine whether these two English codes prime each other equally well.

The combinations of stimuli are limited as no item, variant of an item, or the translation equivalent of an item was repeated for any participant. This was done to ensure that target words would not be primed by more than one item during the course of the experiment. What this means is that a given participant was not presented with both the related and unrelated trials for any of the nine language combinations. Each listener heard nine related test trials from each of five language conditions, and nine unrelated test trials from each of the remaining four language conditions. For example, a listener who heard the related test trials in the ME-MR condition, would not hear the unrelated baseline trials for the same ME-MR condition. This design limitation has consequences for our analyses; it means that trial type (related, unrelated) is the only within subject variable, thus most of our variables are across-listeners. Across language condition by trial type comparisons, for example, in our analyses are not paired.

3. Analysis and Results

All analyses were done in R (R Core Team, 2014). Overall performance in the task was high, with an average of 88% (range across conditions = 85% - 95%) accuracy on test trials. To quantify priming, we analyze response times for correct responses to related and unrelated critical trials. Outliers over 2.5 SD away from the mean were eliminated, resulting in the removal of 2.3% of the data set. We log-transformed each listener's averaged response times; these log-transformed response times were used as the dependent variable in all of the analyses. In the first analysis trial type (related, unrelated), prime language (Pākehā English, Māori English, Māori), target language (Pākehā English, Māori English, Māori), and MII group (High, Low) were the independent variables. There was a main effect of trial type [$F(1, 537) = 228.25$, $p < 0.001$], indicating a robust priming effect. Listeners responded to related trials ($M = 852$ ms, $SD = 142$) faster than unrelated trials ($M = 963$ ms, $SD = 138$). This analysis also indicated main effects of prime language [$F(2,537) = 7.47$, $p < 0.001$] and target language [$F(2,537) = 20.66$, $p < 0.001$], in addition to two-way interactions between type and prime language [$F(2, 537) = 7.21$, $p < 0.001$], prime language and target language [$F(4,537) = 29.73$, $p< 0.001$], prime language and MII group [$F(2, 537) = 6.24$, $p = 0.002$], and target language and MII group [$F(2, 537) = 4.91$ $p = 0.008$]. There were also three-way interactions between type, prime language, and target language [$F(4, 537) = 3.35$, $p < 0.001$] and prime language, target language, and MII group [$F(4, 537) = 5.17$, $p < 0.001$]. To better understand these effects and interactions we take the main effect and many interactions with prime language as our focus, and conduct separate analyses for each prime language – Pākehā English primes (3.1), Māori English primes (3.2), and Māori primes (3.3) – in the subsections that follow.

3.1 Pākehā English primes

The trials with Pākehā English primes (PE-PE, PE-ME, PE-MR) were analyzed in an analysis of variance with the logarithm of the response times as the dependent variable and trial type (related, unrelated), target language (PE, ME, MR), and MII Group (high, low) as independent variables. There was a main effect type [$F(1,133)= 102.04$, $p < 0.001$], indicating an effect of priming. Listeners responded more quickly to related trials ($M = 873$ ms, $SD = 136$) than unrelated trials ($M = 973$ ms, $SD = 123$) when Pākehā English items were the prime. There was also a main effect of target language [$F(2, 133) = 73.94$, $p < 0.001$]; post-hoc Tukey tests revealed that listeners were faster at responding to Pākehā English targets ($M = 833$ ms, $SD = 135$) than Māori English (comparison $p < 0.001$; $M = 969$ ms, $SD = 142$) and Māori (comparison $p < 0.001$; $M = 948$ ms, $SD = 99$) targets. Figure 3 shows the priming effect, where related trials are responded to more quickly than unrelated trials, by target language. There was no interaction between type and target language, only a main effect of target language; listeners were overall faster at responding to trials with Pākehā English targets when primed with Pākehā English items.

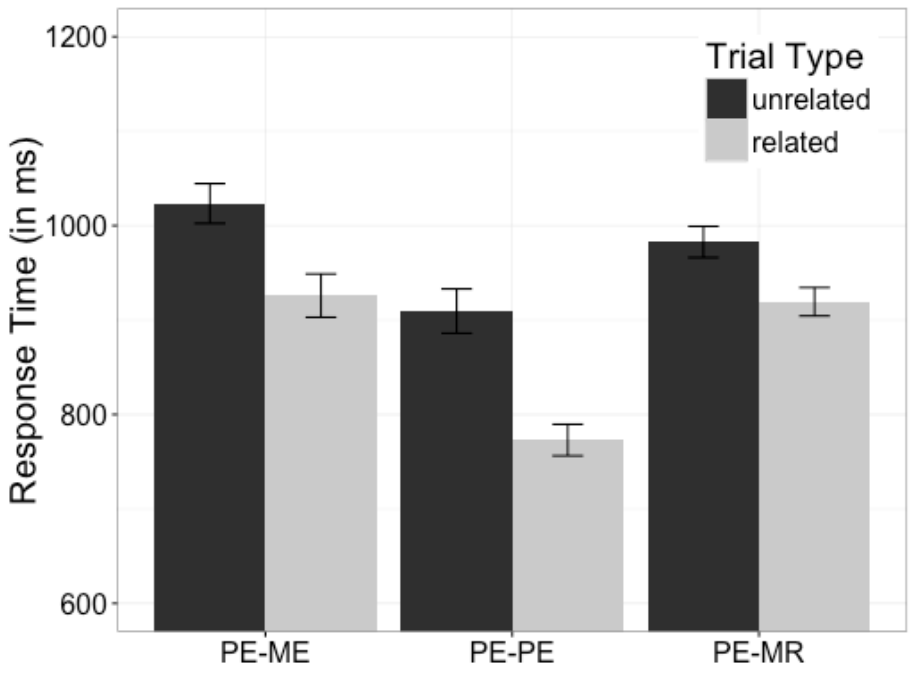

Figure 3. Response times to unrelated and related trial types for trials with Pākehā English primes.

3.2 Māori English Primes

To assess the effect of priming with Māori English prime items (ME – PE, ME – ME, ME-MR) we used an ANOVA with logged response times as the dependent measure and type (related, unrelated), target language (PE, ME, MR), and MII Group (high, low) as independent variables. There was a main effect of type [$F(1, 132) = 180.18$, $p < 0.001$]. Listeners were faster at responding to related trials ($M = 826$ ms, $SD = 123$) than unrelated trials ($M = 992$ ms, $SD = 135$). The interaction between type and target language was also significant [$F(2, 132) = 4.58$, $p < 0.01$]. Planned comparisons confirm that Māori English primed Māori English [$t(65.14) = 6.67$, $p < 0.001$, cohen's $d = 1.6$]; Māori English primed Pākehā English [$F(67.68) = 6.5$, $p < 0.001$, cohen's $d = 1.49$]; and Māori English primed Māori [$t(60.21) = 4.69$, $p < 0.001$, cohen's $d = 1.14$]. These results are in Figure 4. This figure also illustrates the main effect of target language [$F(2, 132) = 32.69$, $p <$

0.001]. Listeners were overall faster at responding to Pākehā English targets (M = 838 ms, SD = 143) when primed with Māori English, regardless of whether they were related or unrelated trials. Listeners were overall slower at responding to any trial, related or unrelated for Māori English (Tukey HSD $p < 0.001$; M = 921 ms, SD = 155) and Māori (Tukey HSD $p < 0.001$; M = 939 ms, SD = 142) items.

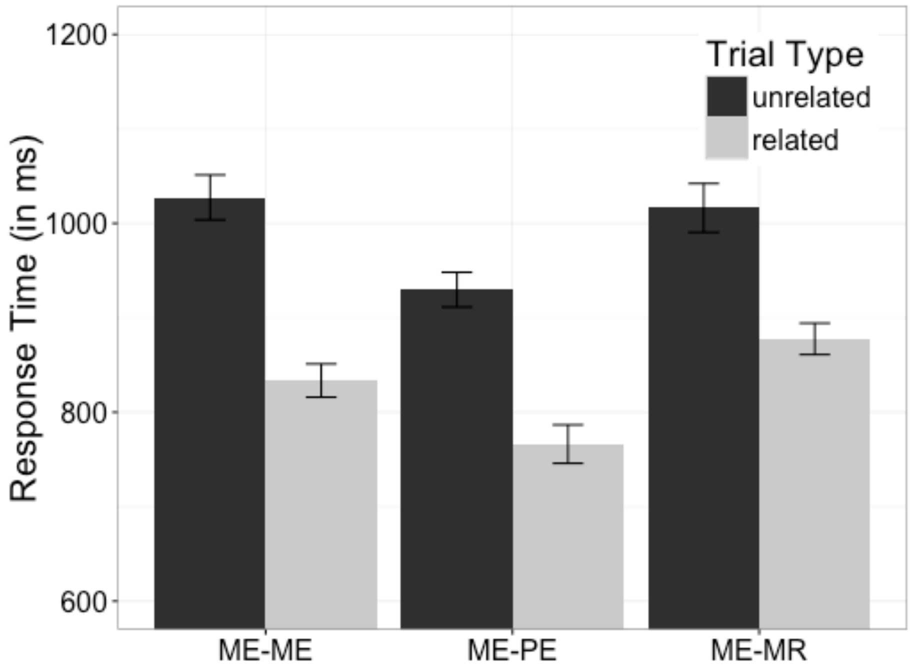

Figure 4. Response times to unrelated and related trial types for trials with Māori English primes.

There was also an interaction between type and MII group [$F(1, 132) = 3.97$, $p = 0.04$]. Planned comparisons showed priming for both listeners with high Māori Integration Index scores [$t(126.96) = 8.41$, $p < 0.001$, cohen's $d = 1.47$] and low Māori Integration Index scores [$t(77.17) = 5.09$, $p < 0001$, cohen's $d = 1.1$], although the magnitude of the effect was somewhat stronger for the high MII listeners. There was also an interaction between target language and MII group [$F(2, 132) = 5.02$, $p = 0.007$]. Post-hoc Tukey tests confirmed that when primed with Māori English, high

MII listeners responded faster to Pākehā English targets than to Māori English targets ($p < 0.05$), but there were no differences between Pākehā English and Māori or Māori English and Māori. Low MII listeners are faster at responding to Pākehā English targets than Māori targets ($p < 0.001$), but there were no differences in overall response times between Pākehā English and Māori English targets or Māori English and Māori targets; these results are shown in Figure 5.

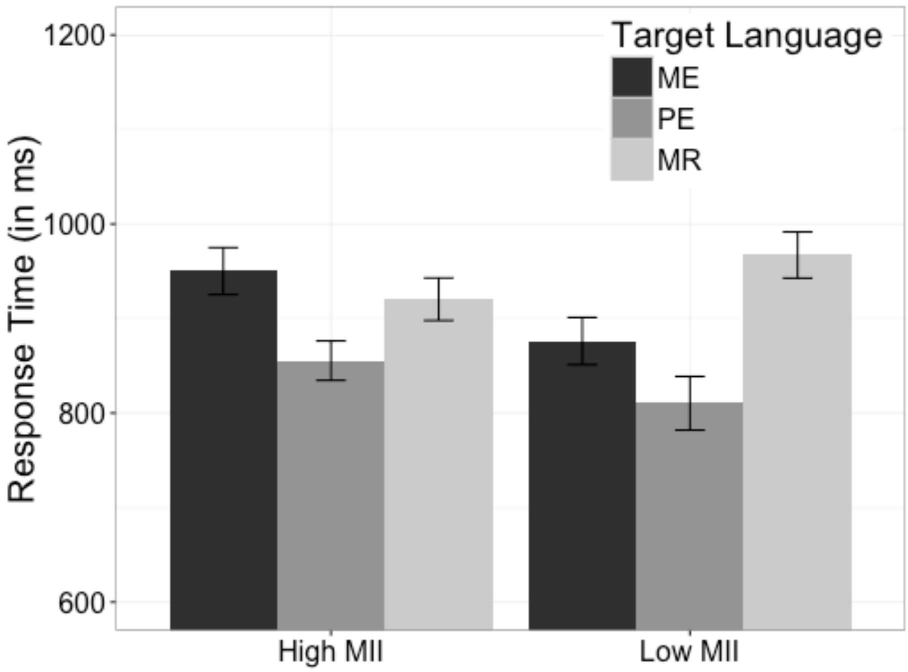

Figure 5. Overall response times to target languages by Māori Integration Index in the Māori English prime trials.

3.3 Māori primes

Trials with Māori primes (MR – PE, MR – ME, MR - MR) were analyzed in an ANVOA with logged response times as the dependent variable and type (related, unrelated), target language (PE, ME, TR), and MII group (low, high) as independent factors. There was a main effect of type

[$F(1,132) = 22.05$, $p < 0.001$] and an interaction between type and target language [$F(2, 132) = 3.23$, $p = 0.04$]. This interaction is presented in Figure 6. Comparing related and unrelated trials for each target language confirms that Māori primed Māori [$t(69) = 4.75$, $p < 0.001$, Cohen's $d = 1.09$] and Māori English [$t(70) = 2.08$, $p = 0.02$, Cohen's $d = 0.48$], but not Pākehā English [$t(66) = 0.47$, $p = 0.32$, Cohen's $d = 0.11$]. There was also a main effect of target language [$F(2, 132) = 10.22$, $p < 0.001$]. A Tukey-test confirmed that listeners were overall faster at responding to Māori target trials ($M = 832$ ms, $SD = 122$) than Pākehā English target trials ($M = 920$ ms, $SD = 101$; comparison $p < 0.01$); while Māori target trials were responded to numerically faster than Māori English trials ($M = 914$ ms, $SD = 216$), this difference was not reliable ($p = 0.06$). This target language effect was further moderated by a target language and MII group interaction [$F(2, 132) = 5.46$, $p < 0.01$]; this is shown in Figure 7. There were no differences in response times to Māori and Pākehā English trials for participants with high or low Māori Integration Index scores, however, listeners with high Māori Integration were faster at responding to Māori English trials when primed with Māori than listeners with low Māori Integration [$t(69) = -2.28$, $p < 0.05$, Cohen's $d = 0.5$].

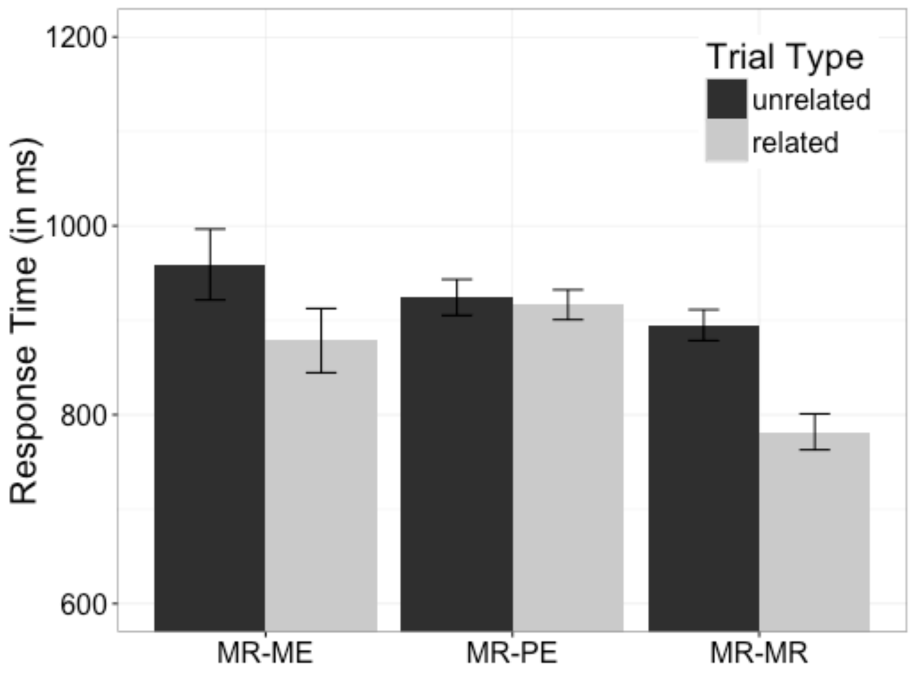

Figure 6. Response times to unrelated and related trials by target language in the Māori prime trials.

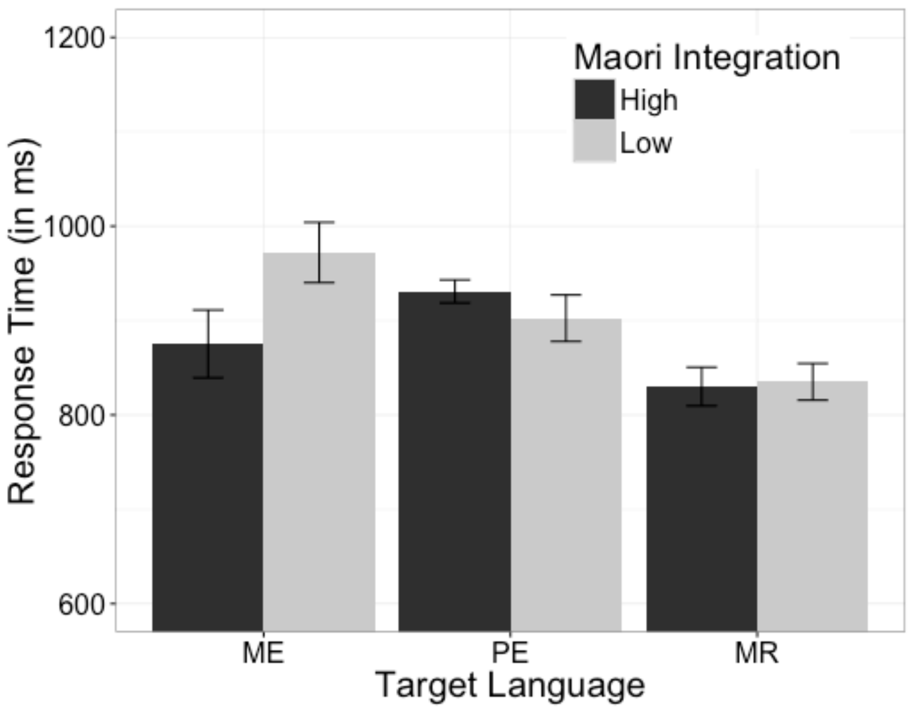

Figure 7. Response times across target languages by High and Low Māori Integration listeners in the Māori prime trials.

4. Discussion

We used a primed auditory lexical decision task with Māori, Māori English, and Pākehā English as the language varieties for primes and targets. This combination of language varieties allows us to test whether there is a stronger connection between Māori and Māori English than between Māori and Pākehā English based on a hypothesized socially-driven ethnic identity categorization, in addition to exploring cross-dialect priming with New Zealand's Englishes.

The cross-dialect within English trials were composed of within dialect trials (e.g., Māori English – Māori English) and cross dialect trials (e.g., Māori English – Pākehā English). The cross-dialect trials are in the family of repetition priming: the two varieties are the same language, but differ on both segmental and suprasegmental dimensions. Previous work on cross-dialect auditory repetition priming has shown that listener experience plays a critical role (e.g., Woutersen et al., 1994; Sumner and Samuel, 2009). Using a Maastricht-based population, Woutersen et al. showed that standard Dutch speakers in Maastricht are primed by both standard and Maastricht varieties of Dutch, while Maastricht speakers are not primed by the standard variety. Looking at processing of post-vocalic /ɹ/ variants, Sumner and Samuel (2009) found that listeners who were native processors of the nonstandard New York City dialect were primed by General American tokens (e.g., *slender*, /slɛndɹ/) and the NYC realization (e.g., /slɛndə/). Native listeners (who were also speakers) of General American English were not primed, however, by the /ɹ/-less utterances. In both the Dutch and post-vocalic /ɹ/ examples, extensive listening experience with both dialects facilitates priming. Our listeners pattern like the standard Dutch speakers living in Maastricht and the NYC listeners: there was robust priming across the varieties of English. Pākehā English was an equivalently effective prime for both Pākehā English and Māori English, and Māori English was likewise an equivalently effective prime for both varieties of Englishes. These bilingual listeners are flexible in their processing of these pronunciation variants across familiar dialects in their L1.

Pākehā English, however, was overall responded to more quickly in both Pākehā English and Māori English prime trials. This decrease in response to items produced in the more standard dialect is potentially due a generic processing benefit for the standard accent (e.g., Clopper, 2014).

There were significant effects of within language priming in Māori, our listeners' L2. Significant within-L2 auditory repetition priming in a lexical decision task has been shown for proficient Dutch-English bilinguals (de Bot et al., 1995), and for both intermediate and near-native Dutch-English bilinguals (Woutersen et al., 1995). Pallier et al. (2001) used fluent early bilinguals with either Spanish or Catalan as the L2, and obtained within-L2 auditory repetition priming for both populations. These results suggest that high proficiency bilinguals generally demonstrate auditory priming effects in their L2. In a study of long-term repetition priming (the delay was 4-28 minutes between prime and target) in Spanish learners, Trofimovich (2005) found that listeners were only primed when the primes and targets were produced by the same voice; different voice primes and targets did not achieve priming in this group's L2. Although our study was a different task – immediate repetition priming – our trials always involved different voices for primes and targets. Our listeners, thus, exhibit the ability to process their L2 at a somewhat more abstract level. The listeners in Trofimovich's study were low-intermediate proficiency, which accounts for the specificity of their L2 processing abilities, whereas our listeners spanned a range of proficiency levels. Māori Integration Index scores were included as a factor in the analysis to see if experience with Māori society, as measured by this proxy questionnaire, increased priming. While the effect of Māori Integration was not significant, there was a trend towards individuals with high Māori integration showing stronger form priming effects (mean priming = -152 ms), compared to those with low Māori integration (mean priming = -54 ms) in Māori-Māori prime-target trials. That this difference was not significant could suggest that the survey instrument, despite having been used in prior research to gauge previous exposure to Māori English (Robertson 1994; Szakay 2006; Szakay

2008a), did not adequately capture the relevant Māori language experience, leaving too much inter-subject variability within the two groups.

Figure 8 provides a visual schematic for the trials that involved cross-linguistic combinations. For cross-linguistic trials in the L1–L2 direction, we find priming – the presentation of translation equivalents in Pākehā English and Māori English facilitate processing of the equivalent item in Māori. This forward priming is well established in the literature (e.g., Gollan et al., 1997; Jiang and Forster, 2001) and is assumed to be a consequence of the L1 translation prime pre-activating the concept in the L2 lexicon, which in turn results in faster recognition of that L2 target. In the other direction – L2–L1 priming, which has been argued to be more sensitive – Māori only primes Māori English. Māori does not prime Pākehā English. The bilingual priming asymmetry is argued to be completely attenuated for highly proficient bilinguals (Basnight-Brown and Altaribba, 2007; Duñabeitia et al., 2015). Less balanced, but seemingly still quite proficient bilinguals (based on self-ratings from Table 1 p 175; Duyck and Warlop, 2009) also have shown backward priming. Our listeners showed L2-L1 priming, suggesting the necessary level of proficiency in Māori, their L2, but this priming was not across the board: Māori primed Māori English targets, but not Pākehā English targets, which suggests that an additional factor beyond proficiency in the L2 is at play. We suggest that this priming is achieved through a cooperation of concept activation of the translation equivalents and social category activation indicating Māoriness. If social category activation is beneficial in the L2 – L1 direction, do we also see evidence that it is also facilitative in the L1 – L2 direction? Māori English and Pākehā English both primed Māori, but Māori English primed Māori [$t(60.21) = -4.69$, $p < 0.001$, cohen's $d = 1.14$] at a much larger magnitude than Pākehā English primed Māori [$t(69.49) = -3.01$, $p < 0.01$, cohen's $d = 0.7$]. This suggests that the effects of the concept activation link and the social category activation link may be additive.

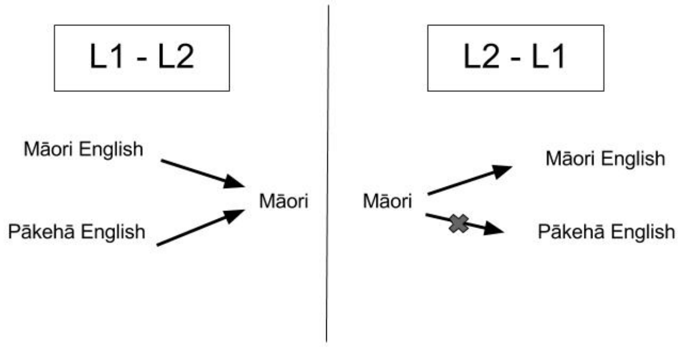

Figure 8. Schematic summary of cross-linguistic priming effects. Both dialects of English prime Māori, the L2, but Māori only primes Māori English.

To illustrate the combined effects of the concept activation link and the social category activation link let us revisit the schema in Figure 1 and our example of the English word *snow* and its Māori translation *huka*. When the bilingual listener hears the Pākehā English phonetic representation [snɐʉ], this activates the concept of *snow*, which then activates the lexemes *snow* and *huka*. This L1 to L2 conceptual activation link alone is strong enough to cause significant priming of the Māori lexical item *huka*. In addition to this conceptual activation, upon hearing the Pākehā English phonetic representation [snɐʉ], social category activation occurs as well. Pākehā English [snɐʉ] activates the concept Pākehā in the bilingual's mind. However, this activation does not facilitate the processing of the Māori target, as Māori language representations are not associated with Pākehā labels. This demonstrates that in the L1-L2 direction one strong lemma activation link is sufficient for lexical priming to occur (as in PE-MR). When the bilingual hears the Māori English phonetic representation [snɵʉ̯], this also activates the concept of *snow* in both English and Māori. Thus, we see significant conceptual priming of *huka* through the lemma activation link from Māori English [snɵʉ̯]. At the same time, the Māori English pronunciation [snɵʉ̯] also generally activates the concept Māori in the bilingual's mind, where the Māori lexical item *huka* is associated with a Māoriness category. As a result, *huka* also becomes activated through the social category activation link. Our results showed that the magnitude of priming from Māori English to Māori was larger than from Pākehā English to Māori. This suggests that the effects of the conceptual link and the social category activation link are additive, such that when both strong links are available (as in ME-MR) the priming effect is larger compared to the scenario when only the strong lemma link is present (as in PE-MR).

In terms of the L2-L1 priming, our analysis showed significant results in the MR-ME condition but not in the MR-PE condition. That is, the Māori word *huka* significantly primes the Māori English translation equivalent [snɵʉ̞], but not the Pākehā English translation equivalent [snɐʉ]. This indicates that a weak lemma link alone does not sufficiently activate the L1 target to achieve significant priming in the L2-L1 direction (as in MR-PE). However, when the social category activation link is also available, (as in MR-ME), the coupled effects of the lemma link and the social link result in significant lexical priming. That is, in L1-L2 priming, a strong lemma link is sufficient to elicit priming in the absence of a social connection, as when Pākehā English primes Māori, but with a social connection, the priming is of a greater magnitude, as is the case when Māori English primes Māori. L2-L1 priming has a weaker lemma link and priming is only achieved when coupled with a social link, as in the case of Māori priming Māori English. But with a lack of a social connection and a weaker lemma link, Māori does not prime Pākehā English.

Finally, there were a few effects related to participants' Māori Integration Index scores. In Pākehā English prime trials, individuals with low MII responded more quickly on all targets. In trials with Māori primes and Māori English targets, high MII individuals responded more quickly than low MII individuals. These complementary results suggest that individuals with high MII may be Māori English speakers themselves, thus slower on trials with Pākehā English primes and with a tighter association between Māori and Māori English, facilitating responses to Māori English trials when presented with a Māori prime. Neither of these two effects with the Māori Integration Index interacts with trial type, however; that is, the priming for related trials was not affected. High MII listeners were simply slower overall on related and unrelated trials with Pākehā English primes and faster on related and unrelated trials with Māori primes and Māori English targets. This suggests that facilitation in processing these codes does not simply travel through translation equivalents or cross-dialect lexical repetition.

5. Conclusion

The processing of spoken language involves unpacking meaning from social and linguistic signals. Social signals set up expectations and associations for how to interpret the phonetic signal, which also carries social meaning within it. Using auditory stimuli from which listeners can make assumptions about the ethnic identities of the speakers, our experiment is able to highlight the importance of social category activation between the L2 and the L1. We find significant levels of priming from the less dominant to the more dominant language, but only for the dominant language code that has a social and contextual association with the L2. Assuming the same conceptual and social links posited for the L1-L2 data, we account for the L2-L1 priming results by appealing to social categories as playing a fundamental role in spoken language recognition. Our results suggest that social information is shared across linguistic systems of bilinguals, at least in the context of multilingualism and multidialectalism in New Zealand.

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