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Melinger, Alissa

Published in:
Cognition

DOI:
10.1016/j.cognition.2017.12.006

Publication date:
2018

Document Version
Peer reviewed version

Distinguishing languages from dialects:

A litmus test using the picture-word interference task

Alissa Melinger

University of Dundee, Scotland

Address for correspondence:
Alissa Melinger
School of Psychology
University of Dundee
Dundee, DD1 4HN
Scotland, UK
Tel: +44 (0)1382 384610
Email: a.melinger@dundee.ac.uk

Running Head: Language or dialect?

Word count: 9220

Keywords: Bidialectalism, lexical selection, picture-word interference, bilingualism, lexical organization

Abstract

Linguists have been working to develop objective criteria for distinguishing languages from dialects for well over half a century. The prevailing view amongst sociolinguists is that no objective criteria can be formulated. The aim of this study is to examine whether language processing can provide insights into this problem by comparing bidialectal behavioural effects to bilingual effects reported in the literature. Previous research has demonstrated that when bilinguals name an object in Lx while simultaneously processing a translation equivalent distractor word in Ly, naming times are sped up relative to an unrelated condition (Costa, Miozzo, & Caramazza, 1999). Using the same methodology, we evaluated whether a comparable facilitation effect arises when the distractor word is a dialectal or register variant of the picture name. Across 5 experiments we found no trace of translation equivalent facilitation. Instead, we repeatedly observed between-dialect and between-register interference, in contrast to the between-language facilitation effect. This behavioural divergence between bilingual vs. bidialectal processing suggests that this paradigm could provide an objective litmus tests for identifying the boundary between dialects and languages.

A language is a dialect with an army and a navy.

Max Weinreich

1. Introduction

Linguists have been trying to formulate an objective method for distinguishing languages from dialects for well over half a century. In linguistic circles, the language vs. dialect distinction is often drawn on the basis of size, prestige, and mutual intelligibility (Hudson, 1996; Wei, 2000). All three of these criteria are problematic and can lead to artificial distinctions and inconsistent classification. Norwegian, Danish, and Swedish are granted full language status (prestige) despite high levels of mutual intelligibility, whereas Mandarin and Cantonese are classified as dialects of Chinese (low prestige), despite low levels of mutual intelligibility. In these examples we see situations where size and prestige conflict with mutual intelligibility. Wei (see also Hudson, 1996) argues that 'language' and 'dialect' cannot be objectively distinguished since they are socially and politically constructed. But what if languages and dialects were processed differently? If such a difference could be identified, might that offer an objective tool for addressing this complex and long-standing question? The aim of this paper is to evaluate the potential for just such a psychological approach.

The problem of distinguishing languages from dialects can complicate scientific and political enterprises. Simple questions such as 'how many languages do you speak' can become difficult to answer. If you speak two dialects of Chinese, are you a monolingual, bilingual, or bidialectal speaker? And what does the latter term mean, from a processing perspective? Psycholinguistic research has largely focused on monolingual and bilingual processing without considering the potential relevance or role of dialects. From one perspective, bidialectal speakers could be classified as

monolingual, since they only speak one language. From another perspective, they could be viewed as similar to bilinguals who speak highly related mutually intelligible languages.

As more and more of the world's population becomes bilingual, interest in bilingual language processing has grown. A pervasive question within the bilingualism literature asks how bilinguals control the selection of the language appropriate to the conversational situation, avoiding catastrophic interference from the unintended language. Some models of bilingual language production propose that words, rules, and structures belonging to a language are bound together by a common representation that allows them to be activated or inhibited en masse (de Bot, 1992; de Bot & Schreuder, 1993; Green, 1986, 1993, 1998; Poulisse & Bongaerts, 1994). These models use these grouping representations to accommodate the well-established finding that both languages of a bilingual are active during speaking (and listening). According to these models, representations from both languages receive activation, i.e., the flow of activation is not restricted to one language. Then, all representations associated with the unintended language node are reactively inhibited. This prevents them from being inadvertently selected or from causing too much interference. These reactive inhibition models can be contrasted with other models which eschew the need for system-wide inhibition in favour of a language-specific selection mechanism (Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Roelofs, 1998). Models that incorporate language-specific selection also acknowledge that representations from both of a bilingual's languages become active during speaking (and listening), but they propose that the lexical selection mechanism can effectively ignore the activation of elements from the unintended language. Under

both of these model types, language independence and separation are achieved via some organizing principle such as a language membership tag.

Unlike bilingualism, the existence of bidialectalism is not well established. In fact, Hazen (2001) argues that there are no true bidialectal speakers, although many people can comprehend multiple dialects of their native language. Hazen notes that "no one has seriously investigated whether humans are capable of maintaining two dialects in the same way they can maintain two languages" (2001; p. 88). For Hazen, true bidialectalism entails the stable native-like mastery of two distinct dialects, without any cross-contamination or merging of phonology, vocabulary, or syntax. It also implies the ability to switch between the two dialects, without mixing the features from the two systems, just as bilinguals can do (but see Goldrick, Runnqvist, & Costa, 2014 for evidence for cross-contamination between languages for later learners).

Thus, for bidialectalism to exist, according to Hazen's definition, dialects would need to be represented and processed like languages, i.e., bound together via a shared dialect tag. But Labov (1998) argues that dialects are more co-dependent than languages. In a study of the tense/aspect system of African-American Vernacular English, Labov contends that the two varieties are not separate systems but are rather co-dependent. He argues that if the sets of rules for two dialects are not mutually exclusive (instances of code switching aside) then the two systems cannot be said to be separate or independent. This notion of co-dependence suggests that dialect membership for rules and representations might not be as clear cut as for languages; many rule and representations would be associated with both of a speaker's dialects. As a result, the set of rules and representations belonging to a dialect might not be bundled together as they would be for a language and therefore cannot be inhibited or

ignored in the same way. If correct, we would not expect to see similar behavioural effects from bilinguals and bidialectals in experimental investigations; instead, we would expect bidialectal processing to mirror monolingual processing. The picture-word interference paradigm has provided some clear cases where monolingual and bilingual speakers produce different behavioural outcomes, and these tasks may provide a possible test case for evaluating lexical selection and dialect control processing in bidialectal speakers.

1.1. Within-language effects from the picture-word interference paradigm

The picture-word interference paradigm has been used extensively to investigate lexical selection processes. The paradigm capitalizes on the well-known fact that multiple lexical candidates are activated when trying to select a single word. Participants name pictures while ignoring simultaneously presented distractor words. Depending on the nature of the relationship between the target word and the distracting stimulus, naming times can be sped up or slowed down. When the distracting stimulus is drawn from the same semantic category as the target word (e.g., target = CAT; distractor = pig), picture naming times are slowed down relative to an unrelated condition (e.g., target = CAT, distractor = pin). This observation has been termed the *semantic interference effect* (Glaser & Düngelhoff, 1984; Schriefers, Meyer, & Levelt, 1990). It arises due to activation from the distractor word converging with activation of a semantic alternative to the target picture. In other words, the distractor word strengthens a lexical candidate that is not the intended word, resulting in slower target selection times. Some findings suggest that the magnitude of the interference effect is negatively correlated with the semantic distance between target and distractor (Aristei & Abdel Rahman, 2013; Vigliocco,

Vinson, Damian, & Levelt, 2001), although the reverse has also been reported (Mahon et al., 2007).

In contrast, distractor words that share phonological content with the target picture (e.g., target = CAT, distractor = car) speed picture naming relative to an unrelated condition — the classic *phonological/orthographic facilitation effect* (Glaser & Düngelhoff, 1984; Lupker, 1979; Schriefers, Meyer, & Levelt, 1990; Starreveld & La Heij, 1995, 1996). This effect arises due to activation from the distractor word converging with activation from the target word onto shared phonological representations, resulting in faster selection times. The magnitude of this effect is positively correlated with the amount of segmental similarity; the more segments shared between target and distractor, the larger the facilitation effect will be (Abdel Rahman & Melinger, 2008), with maximal facilitation in the identity condition, when the distractor word is the name of the target picture (Glaser & Glaser, 1989).

None of the above distractor effects emerges as the result of a single processing mechanism. Rather, the magnitude and direction of distractor effects results from a trade off between component effects arising at different processing stages (c.f., the Swinging Lexical Network account proposed by Abdel Rahman & Melinger, 2009). For example, semantic interference will only be observed if priming at the conceptual level is smaller than lexical competition. Similarly, phonological facilitation will only be observed if priming from the distractor at the word form level is larger than any costs incurred during lexical selection.

1.2. Between-language effects from the picture-word interference paradigm

The challenges arising from the co-activation of semantic alternatives is compounded for bilinguals, as the non-target language is active during processing (e.g., Green, 1986; Poulisse & Bongaerts, 1994). Despite evidence that both linguistic systems are active, even when processing in a monolingual context, representations from the non-target language do not always interfere with picture naming. Specifically, translation equivalents, which could be expected to generate the largest semantic interference effects due to their perfect semantic match with the picture, actually speed picture naming (Costa & Caramazza, 1999; Costa, et al., 1999). Costa and colleagues presented bilingual speakers with pictures for a naming response. Pictures were simultaneously presented with distractor words from either the target language or the non-target language. The semantic relationship between the distractor words and the target picture was also manipulated, such that the distractor word either denoted the picture itself (same meaning), a categorically related alternative (same category), or a semantically unrelated word. Compared to the unrelated conditions, same category distractors from both languages slowed picture naming times comparably, replicating previous demonstrations of between-language interference (Hermans et al., 1998). However, and crucially for our purposes, the different-language same meaning distractors sped picture naming. We will refer to this as the *translation equivalent facilitation effect*.

Costa and colleagues (Costa et al., 1999; Costa & Caramazza, 1999) interpret this finding in support of a language-specific selection mechanism (see also Roelofs, 1998; but see Hall, 2012 & Hermans, 2004 for alternative interpretations). In other words, although words from both languages are activated during production, only those representations from the target language compete for selection and slow naming

times. Consistent with the trade off view put forward in the SLN account, translation equivalent distractors prime the meaning of the picture, speeding conceptual level processes, but the distractor itself will not compete for selection, incurring no selection time penalty, resulting in a net facilitation effect. This pattern was observed in L1 and L2 naming (Costa & Caramazza, 1999, Exp 1 and Exp 2, respectively) as well as in a language mixing context, where both languages were engaged (Costa et al., 1999, Exp 2). It has also been observed for balanced bilinguals (Costa et al., 1999) and non-balanced bilinguals (Hermans, 2004) and for similar (Spanish-Catalan) and dissimilar (Spanish-English) language pairs. Hence, it is a robust and unique marker of bilingual lexical selection that has no known correlate in the monolingual literature. It therefore provides a test bed for studying bidialectalism.

The contrast between independence and co-dependence, as characterized by Labov (1998), is depicted in Figure 1. In the left panel, based on models proposed for bilingual speakers, lexical items are organized around their association to a dialect membership tag, which allows representations to be activated, inhibited, or ignored en masse (Green, 1998). This captures the independence of the two lexica. In the right panel, words from both the standard and the non-standard dialects are combined in a single lexicon. Translation equivalents are distinguished by a conceptual level dialect feature, as proposed by La Heij (2005). This conceptual feature is like any other conceptual feature and therefore does not have the same function to constrain the response set or inhibit representations like a dialect tag would. Hence, in the right panel the two vocabularies are co-dependent. Relating these models back to Costa et al's empirical findings, the lexical organization on the left could account for translation equivalent facilitation while the organization on the right could not.

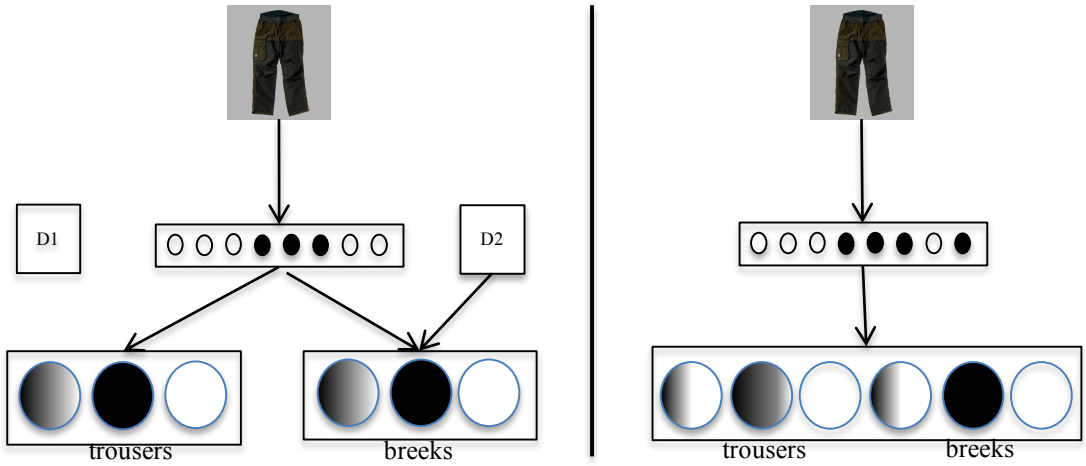

Figure 1: Independent (left frame) and co-dependent (right frame) lexical organization (adapted from Kroll, Bobb, & Wodniecka, 2006)

1.3. The present study

In the present study we replicate the structure of the experiments reported by Costa et al. (1999) to investigate bidialectal lexical selection processes. In Experiments 1-4, we compare distractor words drawn from two distinct dialects of English, namely Scottish and Standard (Scottish) English. Extending the investigation to another type of language variation, in Experiment 5, we compare distractor words drawn from two distinct registers of English (the similarities between dialects and registers and the rational for this comparison will be discussed in Section 5.3). Mirroring the previous experimental design, we asked Scottish bidialectal participants to name pictures of common objects in Standard Scottish English, their dominant dialect, or in Scots, their less preferred dialect. At the same time, participants also heard distracting stimuli. We manipulated the dialect of the distractor word and the semantic relationship between the target picture and the distractor. If lexical items belonging to one dialect are bundled together via something akin to a dialect membership tag, as has been suggested for languages, then we should find a translation equivalent facilitation effect when pictures are presented together with

their dialectal translation equivalents. If dialects of a language are structured co-dependently, then we would expect to observe a pattern similar to what is seen for within-language semantic interference effects, producing a dialect translation interference effect. A same category interference effect and an identity facilitation effect are expected on all accounts.

If dialects are found to behave like languages, it would lend support to the view that a single grammar or lexicon can be bifurcated into two separate and independent dialects, contrary to the views of Hazen (2001) and Labov (1998). However, if dialects are found to behave differently from languages, that would be consistent with the co-dependence view, where dialect membership is not a core organizing principle of the linguistic system. Crucially, the latter finding would suggest that similar methods could be applied to other, more contentious dialect pairs, for purposes of objectively characterising the distinction between languages and dialects.

We focus on Scottish participants as our bidialectal sample. The majority of Scottish people speak Standard Scottish English, but Scotland also has a rich variety of regional dialects, which we will refer to generically as Scots English. Like distinct but related languages, Scots English has phonetic, lexical and syntactic differences from Standard Scottish English, as well as considerable systemic overlap. In a recent survey of dialect usage and attitude funded by the Scottish Executive (Maddox, 2010), 85% of Scots claimed to use Scots English regularly and they viewed it as a valuable cultural characteristic that should be preserved. At the same time, the majority of people polled did not consider Scots English to be a distinct language from Standard (Scottish) English.

Scottish bidialectalism is an interesting test case because language is tightly associated with Scots' national identity; Scots predominantly self-identify as Scottish rather than British while the English and Welsh both self-identify more as British than as English or Welsh, respectively (Kerswill, 1987; McCrone, Stewart, Kiely, & Bechhofer, 1998). Scots also use dialect as a primary cue to discriminate between Scots and non-Scots (McIntosh, Sim & Robertson, 2004). Finally, the degree of deviation between Scots and Standard English is greater than for other regional dialects (Hughes, Trudgill, & Watt, 2005).

Although Scots English is much more distinctive than other regional dialects of British English, in the larger scheme of linguistic diversity, the two variants are very closely related. However, it is unclear whether degree of similarity modulates processing effects for bilinguals. On the one hand, Brauer (1998) found distinct between-language Stroop effects for similar and dissimilar languages; while proficient speakers of two similar languages (e.g., English and German) produced significant Stroop interference, proficient speakers of dissimilar languages (e.g., Greek-English and Chinese-English) did not. Brauer concluded that lexical items from dissimilar languages are stored in separate lexica whereas lexical items from more similar languages are stored in a single lexicon, resulting in between-language interference.

However, that conclusion has not been supported by subsequent investigations. A variety of tasks are unaffected by language similarity, including cognate facilitation (Hoshino & Kroll, 2008), translation facilitation (Costa & Caramazza, 1999; Costa, et al., 1999), structural priming (Cai, Pickering, Yan, & Branigan, 2011), language switching (Costa, Santesteban, & Ivanova, 2006), and some indices of the bilingual advantage (e.g., Costa, Santesteban, & Ivanova, 2006).

Costa et al. (2006) concluded that language similarity does not "affects the way bilinguals control their speech".

2. Experiment 1

Experiment 1 used the experimental design from Costa, et al. (1999), applied to the bidialectal context. Using the classic picture-word interference paradigm, participants named pictures in English while simultaneously hearing distractor words in either English or a Scottish dialect. (To avoid confusion, for the remainder of this paper, the term *English* will be used to refer to standard varieties, including Standard Scottish English, and *Scottish* will be used to refer to Scots English.) Distractor words could either refer to the picture, a categorically related object, or an unrelated object. Of particular interest was whether the dialect translation equivalent of the picture name would speed picture naming times, as language translation equivalents do, or slow picture naming, as within-language competitors do.

2.1 Method

2.1.1. Participants

Twenty-five Scottish participants were recruited to take part in this study. All were monolingual native English speakers who grew up in Scotland and were familiar with a Scottish regional dialect.

2.1.2 Materials

We selected twenty-four pictures of common objects drawn from 9 common categories. All objects had phonologically distinct English and Scottish labels. Scottish items were identified using native informants, online resources, and a Scots dictionary (Warrack, 2006). To estimate the relative frequencies of the English and

Scottish picture labels, spoken frequencies of occurrence were compiled from the Scottish Corpus of Texts and Speech (www.scottishcorpus.ac.uk). This corpus consists of 4.6million words, 23% of which (N = 1,058,000) comes from spoken language resources, including interviews and parent-child interactions. The average spoken frequency of the English picture names was 47 occurrences per million while the average spoken frequency of the corresponding Scottish labels was 18 occurrences per million. Despite this apparent frequency discrepancy, a paired t-test revealed no significant difference, $t(23) = 1.65$, $p=0.11$[1]. The fact that the English words are more or as frequent as their Scottish counterparts, even in the Scottish Corpus, gives some indication of the amount of dialect mixing that occurs in this population.

Each picture was paired with six distractor words, two same meaning distractors, two same category distractors, and two different meaning distractors. Distractor words were also either drawn from English or Scottish vocabularies. Thus, we had a 3 (distractor relatedness) x 2 (dialect) design. In the same meaning conditions, target pictures were either paired with their English name (e.g., target = TROUSERS$_{\text{E}}$, distractor = trousers) or their Scottish name (e.g., target = TROUSERS$_{\text{S}}$, distractor = breeks). In the same category condition the distractors were category coordinates of the target picture either in English (e.g., target = TROUSERS$_{\text{E}}$, distractor = slippers) or in Scottish (e.g., target = TROUSERS$_{\text{S}}$, distractor = baffies). In the unrelated condition these same English and Scottish distractor words were paired with unrelated pictures (e.g., target = CHIMNEY$_{\text{E}}$, distractor = trousers or breeks). Care was taken when pairing distractor words with target pictures to prevent any spurious semantic, associative, phonological or orthographic relationship between the

[1] Two of the Scottish words were homonymous with unrelated English words (e.g., the Scottish word for 'sandwiches' is *pieces*, which is a high frequency unrelated English word). Removing the two homonymous Scottish items, as well as their corresponding English labels, expands the frequency differences to 48.2 vs. 10.5 occurrences per million, respectively, $Mdiff=37.7$, $t(21) = 2.13$, $p=.04$.

distractor word and the target picture name. Because the Scottish picture names were never produced in this experiment, phonological overlap between the Scottish picture name and distractor words was allowed. A full set of stimuli can be found in Appendix A.

Pictures were scaled to fit within a 3.5cm square and always appeared centred on the computer screen. Distractors were presented auditorily over headphones at an SOA of -150ms (Damian & Martin, 1999). Distractors were recorded by a Scottish male and were all pronounced with a noticeable Glaswegian accent. Each individual sound file was edited to include 200ms of silence before each word onset and a cue was embedded in the sound file at 350ms (150ms post-speech onset), which triggered the presentation of the target picture.

Stimuli were presented in 2 blocks consisting of 144 trials each, with the order of trials in each block varying across participants. Each picture appeared twice in each condition, once in each block. The block trials were pseudo-randomized with the restriction that the same picture, the same distractor word, the beginning phoneme of picture names, and the picture category did not appear in consecutive trials. There was also the restriction that stimuli from the same experimental condition could appear in no more than two consecutive trials. A further control was that the distractor word in trial n could not be the name of the picture in trial n+1.

2.1.2.1 Familiarity and synonym rating

To ensure Scottish stimuli were indeed regionally defined synonyms of their English counterparts, a rating study was conducted. 16 Scottish & 12 English participants who had never lived in Scotland participated. English words and their Scottish equivalents (e.g., *cast – stookie* or *ear – lug*) were presented along with a

selection of filler pairs. First, participants were asked to rate, on a 7-point Likert scale, their familiarity with each of the two words. The order of the two words (English–Scottish or Scottish–English) was randomized across word pairs. Next, participants were asked to rate, on a 7-pt scale, whether the two words meant the same thing or not. Semantically similar but not synonymous words would be scored in the middle of the scale while unrelated word pairs would be scored at the bottom of the scale and synonyms at the top of the scale. For instance, participants would be presented with the translation pair *cabin-bothy* and asked to evaluate a) how well they knew and used the word *cabin*, b) how well they knew and used the word *bothy*, and c) the extent to which the words mean the same thing. In total, ratings for 90 word pairs were elicited, including a selection of dialect and register pairs. From these responses we could identify which words were unfamiliar to the English population yet familiar to Scots. We could also select words rated highest for synonymy.

Based on the results from this rating study, we selected words with our desired characteristics. Specifically, we choose target words which were better known to the Scottish participants than the English participants and which were rated high on the synonym scale by the Scottish participants. The scores from this rating study for our selected stimuli are presented in Table 1[2]. As expected, both Scottish and English participants were equally familiar with the English words, Mdiff = .02; $t(21) < 1$. And unsurprisingly, both Scottish and English participants were more familiar with the English words than their Scottish equivalents, for Scottish participants, Mdiff = 1.26, $t(21) = 5.37$, $p < 001$; for English participants, Mdiff = 3.3, $t(21) = 9.46$, $p < .001$. Crucially, the English participants were significantly less familiar with the

[2] Two pairs of words were included in the experiment for which we did not obtain ratings. These words, horsefly-cleg and woodlouse-slater, were included after informal polling suggested they satisfied our criteria. In the post-experiment vocabulary test, 21/25 participants correctly translated slater and 9/25 correctly translated cleg.

Scottish words than the Scottish participants, Mdiff = 2.1, t (21) = 7.8, p < .001. This confirms that our stimuli were known regionally. The synonym ratings between groups also differed, t (21)=7.6, p <.001[3].

Table 1: Average familiarity and synonymy ratings of English and Scottish word pairs by Scottish and English participants.

	Scottish Participants	English Participants
English word ratings	6.82	6.80
Scottish word ratings	5.56	3.51
Synonym ratings	5.0	2.9

2.1.3. Procedure

Each trial began with a centrally presented fixation cross displayed for 500ms on a light grey screen. Then, a 250ms blank screen preceded the onset of the distractor word. 150ms after the onset of the distractor word, the target picture was presented for 2000ms. Participants were instructed to name the picture as quickly and accurately as possible while ignoring the distractor words. Naming latencies were measured with a voice key and each response was recorded into an individual .wav file. During testing, participants were monitored for naming or other production errors; these were noted for later exclusion. The entire testing session lasted approximately 45 minutes. Presentation of the experiment was controlled using DMDX software.

Prior to the experiment participants were familiarized with the pictures and their English names. Pictures and their English names appeared on the computer screen and the participants advanced to the next item by pressing the space bar.

[3] When participants did not know one of the two words of a pair, their synonym rating was N/A rather than 1. These N/A responses were treated like zeros when calculating mean synonym values. English participants responded N/A significantly more often than Scottish participants (45% vs. 11%, respectively, Mdiff = .34, t (21) = 7.4, p < .001).

Following this familiarization phase, participants practiced naming each picture once. No mention of the Scottish alternative names or of Scottish dialect was made at any point in the instructions to the experiment. Prior to the main experiment, 16 practice trials with distractor words from the unrelated conditions were presented.

2.2. Results

Mean response times (RTs) for correct trials, standard deviations and mean proportion of errors in the experimental conditions are presented in Table 2. Trials in which the participant produced the wrong word, stuttered, hesitated or failed to respond, and trials with voice key failures, including any trial with RT faster than 250ms, were classified as errors and discarded from the RT analysis (N=516). Additionally, any trial which was 2.5 standard deviations from a participant's condition mean was treated as an outlier (N=150). In total, 6535 trails were included in the final analysis.

Table 2: Mean response times (RTs) for correct trials, standard deviations and mean proportion of errors in the experimental conditions

	Dialect			
	English		Scottish	
Distractor Conditions	RT (errs)	*SD*	RT (errs)	SD
Same meaning	705 (.08)	97.5	750 (.09)	105
Same category	762 (.1)	100	761 (.1)	121
Unrelated	731 (.08)	109	723 (.09)	107
Identity effect (unrelated – same meaning)	+25 (0)		-27 (0)	
Categorical Interference (unrelated – same category)	-32 (-.02)		-38 (-.01)	

The data were submitted to 3 (distractor relatedness) by 2 (dialect) analyses of variance (ANOVAs) to investigate the effect of distractor word relatedness and dialect on picture naming response times. Separate analyses were conducted with participants *(F_1)* and items *(F_2)* as random variables. The analysis revealed a moderate main effect of distractor relatedness, $F_1(2,48) = 15.6$, $p < .001$, $\eta p2 = .394$, $\varepsilon^4 = 0.8$; $F_2(2, 46) = 6.7$, $p = .003$, $\eta p2 = .226$, but the main effect of dialect did not reach significance, $F_1(1,24) = 2.4$, $p = .131$, $\eta p2 = .093$; $F_2(1,23) = 2.72$, $p = .112$, $\eta p2 = .106$. Crucially, we observed a significant interaction between distractor relatedness and dialect, $F_1(2,48) = 11.1$, $p < .001$, $\eta p2 = .317$; $F_2(2,46) = 7.93$, $p = .001$, $\eta p2 = .256$. This moderate interaction reflects the fact that the same meaning condition induced significant facilitation when distractors were in English, $t_1(24) = -2.4$, $p = .027$; $t_2(23) = 1.5$, $p = .142$, but significant interference when the distractors were in Scottish, $t_1(24) = 2.68$, $p = .013$; $t_2(23) = 2.7$, $p = .012$. Hence, we observed significant within-language facilitation and significant between-dialect interference. Additionally, both English, $t_1(24) = 3.8$, $p < .001$; $t_2(23) = 1.88$, $p = .07$, and Scottish, $t_1(24) = 5.4$, $p < .001$; $t_2(23) = 3.9$, $p = .001$, same category distractors slowed naming times relative to their respective unrelated conditions. The Scottish same category condition did not differ significantly from the Scottish same meaning condition, Mdiff = 11.4ms, $t_1(24) = 1.2$, $p = .25$; $t_2(23) = 1.2$, $p = .24$, indicating that increasing semantic distance between target picture and distractor did not impact the magnitude of the interference effects (cf. Mahon et al., 2008; Aristei & Abdel Rahman, 2013).

Because error rates were higher than expected, they were submitted to the same 3 (distractor relatedness) x 2 (dialect) analyses of variance with participants *(F_1)*

[4] When the sphericity assumption was violated in any of the experiments, the respective Huyhn-Feldt ε value for correction is reported together with the uncorrected degrees of freedom.

and items *(F_2)* as random factors in separate analyses. This analysis revealed a small effect of dialect in the by-participants analysis, $F_1(1,24) = 5.4$, $p = .03$, $\eta p2 = .184$; $F_2(1,23) = 2.3$, $p = .145$, $\eta p2 = .09$, reflecting higher error rates when distractors were presented in Scottish compared to English. The small main effect of distractor relatedness was marginally significant in the by-participants analysis, $F_1(1,48) = 2.6$, $p = .087$, $\eta p2 = .097$; $F_2(1,46) = 1.6$, $p = .22$, $\eta p2 = .064$. The interaction did not approach significance in either analysis, $Fs < 1$.

2.3. Discussion

Experiment 1 provides a clear contrast between the affect on picture naming times of a dialect translation equivalent distractor compared to a language translation equivalent distractor. Costa and colleagues (Costa et al., 1999; Costa & Caramazza, 1999) repeatedly observed between-language translation facilitation in both highly related (Catalan & Spanish) and moderately related (English & Spanish) language pairs. Yet we find between-dialect interference. This contrast is consistent with the co-dependence view, specifically that dialects do not achieve the sort of systemic separation that is seen for even highly related language pairs. Thus, we have identified a diagnostic tool for objectively discriminating between dialects and languages. However, before we draw that strong conclusion we must first ensure that no aspect of the experimental design gave rise to the pattern of effects.

Although we followed the experimental design used by Costa et al. (1999), it is possible that the combination of distractor conditions induced a response expectation bias towards an interference effect. Hantsch, Jescheniak, and Schriefers, (2009) observed that the proportion of response congruent trials in an experiment could influence the polarity of some distractor effects. In their study, congruency was

defined in terms of the taxonomic hierarchy, including superordinate and subordinate alternatives for a picture name. Hantsch et al. presented pictures for a basic name response (e.g., target = CAR). Congruent distractor words could be superordinate (e.g., *vehicle*) or subordinate (e.g., *mini cooper*) labels for the picture. When the experiment included a higher proportion of these 'congruent' trials, facilitation was observed; when a lower proportion of congruent trials was included, the polarity of the effect flipped to interference. In Experiment 1, 33% of our trials were congruent according to the definition whereby picture and distractor word converge on a single concept (Kuipers, la Heij, & Costa, 2006; Kuipers & La Heij, 2008). To ensure that the between-dialect translation interference effect is not influenced by the proportion of response congruent trials, as has been demonstrated for between-level interference effects, we replicated Experiment 1 with a simplified design.

3. Experiment 2

In Experiment 2, we excluded the two same category conditions, thereby boosting the proportion of congruent trials to 50%. If our observation of semantic interference for between-dialect translation equivalents is driven by the proportion of message congruent trials, then we should see a polarity reversal of the between-dialect translation interference effect in Experiment 2, bringing our dialect translation effect closer in line with the between-language translation facilitation effect. However, if our observation of between-dialect translation interference results from fundamental lexical selection processes and reveals an authentic contrast between between-dialect and between-language processing, then we should see the same translation interference effect observed in Experiment 1.

3.1. Methods

3.1.1. Participants

Twenty-one Scottish participants were recruited to take part in this study. However due to a technical error, one participant's data was not usable. All were monolingual native English speakers who grew up in Scotland and were familiar with a Scottish regional dialect.

3.1.2. Materials and procedures

We selected twenty-two of the twenty-four pictures from Experiment 1. Two pictures were omitted due to higher error rates in Experiment 1. Four distractor conditions were created by re-pairing English and Scottish picture names with target pictures, creating two same meaning distractor conditions and two unrelated distractor conditions. Thus, we had a 2 (distractor relatedness) by 2 (dialect) design. In the same meaning conditions, targets were either paired with their English names (e.g., target = TROUSERS, distractor = trousers) or their Scottish names (e.g., target = TROUSERS, distractor = breeks). In the unrelated condition, these same English and Scottish distractor words were paired with unrelated pictures (e.g., target = CHIMNEY, distractor = trousers or breeks). A full set of stimuli can be found in Appendix B.

Pictures, sound files, and randomized presentation orders were prepared as in Experiment 1. Stimuli were presented in 2 blocks consisting of 88 trials each, with the order of trials in each block varying across participants. Each picture appeared twice in each condition.

The procedure was identical to Experiment 1 in all respects except that only 14 practice trials were used. Also, rather than observing participants for errors during

testing, recorded responses were inspected post-test for accuracy using CheckVocal (Protopapas, 2007). Testing lasted approximately 30 minutes.

3.2. Results

Mean response times (RTs) and standard deviations for correct trials in the experimental conditions are presented in Table 3. Trials in which the participant produced the wrong word, stuttered, hesitated or failed to respond were classified as errors and discarded from the RT analysis (N=120). Voice key failures were corrected automatically using CheckVocal (Protopapas, 2007) Additionally, any trial which was 2.5 standard deviations from a participant's condition mean was treated as an outlier (N=95). In total, 3305 trails were included in the final analysis. Due to the error rate being only 3.4%, errors were not analysed further.

Table 3: Mean response times (RTs) and standard deviations for correct trials in the experimental conditions

	Dialect			
	English		Scottish	
Distractor Conditions	RT	*SD*	RT	SD
Related	683	78.6	772	95.6
Unrelated	757	95.6	746	100.5
Identity effect (unrelated – related)	+74		-26	

The data were submitted to 2 (distractor relatedness) by 2 (dialect) analyses of variance (ANOVAs) to investigate the effect of distractor word relatedness and

dialect on picture naming response times. Separate analyses were conducted with participants *(F_1)* and items *(F_2)* as random variables. The analysis revealed a small main effect of distractor relatedness by subjects, $F_1(1,19) = 6.7$, $p = .018$, $\eta p2 = .261$, but not by items, $F_2(1,21) = 1.8$, $p = .188$, $\eta p2 = .081$, demonstrating faster overall naming times when distractors conveyed the same meaning than unrelated meanings. It also revealed a moderate main effect of dialect, $F_1(1,19) = 19.36$, $p < .001$, $\eta p2 = .505$; $F_2(1,21) = 11.9$, $p = .002$, $\eta p2 = .362$. This finding reflects faster overall naming times when distractors are in English compared to Scottish. Crucially, we again observed a significant interaction between relatedness and dialect, $F_1(1,19) = 54.2$, $p < .001$, $\eta p2 = .740$; $F_2(1,21) = 60.4$, $p < .001$, $\eta p2 = .742$. This interaction reflects the fact that the same meaning condition induced significant facilitation when distractors were in English, $t_1(19) = 6.2$, $p < .001$; $t_2(21) = 3.861$, $p = .001$, but significant interference when the distractors were in Scottish, $t_1(19) = -2.4$, $p = .026$; $t_2(21) = 1.53$, $p = .140$, although this difference only reached significance in the by-subjects analysis.

3.3. Discussion

In Experiment 2 we increased the proportion of congruent trials to ensure that the interference effect observed for between-dialect translation equivalents did not turn on the combination of distractor conditions included in the experiment. Consistent with the results from Experiment 1, we again found a significant within-dialect identity facilitation effect and a significant between-dialect translation interference effect, in the by-subjects analysis. Replicating the key finding from Experiment 1 supports the proposal that this effect can serve as an objective tool for distinguishing within- from between-language effects. Thus, we may be on our way to

developing an objective psychological method for distinguishing languages from dialects.

The failure to replicate the between-dialect interference effect in the items analysis is problematic, however. It is possible that this failure is due to the decrease in item power, from 24 to 22 items. A power analysis of the simple by items between-dialect interference effect from Experiment 1 suggested that 23 items were necessary to achieve 95% power but only 22 items were used here. However, a more likely explanation might be due to noise in the data resulting from the regional vocabulary variation across Scottish dialects. Although all of our participants were Scottish and all reported using a regional dialect, not all of them came from the same region of Scotland. We have observed that some vocabulary items are unique to specific regions. For instance, the word 'baffies' is commonly used in the area of Dundee but is unknown in nearby Fife. The noise in the data resulting from this regional variation may have been greater in this experiment than in Experiment 1. Given the potential variation across participants in their familiarity with specific Scottish items, we feel the more reliable results come from the subjects analysis.

Experiments 1 & 2 demonstrate that Scottish dialectal translation equivalent distractor words slow English picture naming times. Although these experiments were modelled after those conducted by Costa et al, (1999), the polarity of these distractor effects reversed for dialectal processing compared to bilingual processing. This is an important finding, as it highlights a clear processing contrast that may be directly linked to structural differences in how dialectal, as opposed to bilingual, lexica are organized. In Experiment 3, we continue to probe this between-dialect translation equivalent distractor effect by introducing an SOA manipulation to track the time course of this interference effect.

In addition to establishing the cross-language identity facilitation effect, Costa et al (1999) also investigated the time course of the effect. In their Experiment 4, they manipulated SOA to vary the interval between distractor and picture presentation. By including 3 different SOAs, they could contrast the time course of the same- and different -language facilitation effects, to test the hypothesis that the former involved two facilitative processes, namely a lexical and a phonological effect, while the latter involved just a lexical facilitation effect. They observed that the within-language facilitation effect emerged across all SOAs while the cross-language facilitation effect was only reliable when the distractor word preceded the target picture.

Thus, in Experiment 3 we examined the time course of our cross-dialectal interference effect by varying SOA. Following Hermans et al, (1998), who also used auditory distractor words, we presented distractors at 3 SOAs, -300ms, -150ms, and 0ms. We take the -150ms SOA in the auditory modality as the equivalent of 0 SOA in the visual modality (Damian and Martin, 1999). Because we interpret our cross-dialectal interference effect as emerging from the same processes that give rise to traditional categorical interference effects, we predict that cross-dialectal interference effects should be largest at the earliest SOA and negligible at late SOAs. Mirroring the results from Costa et al, we expect our within-language facilitation effect to persist across early and late SOAs.

4. Experiment 3: The time course of same- and different-dialect identity effects

In Experiment 3, pictures and distractors were presented with 3 different SOAs, to track the time course of the distractor effects.

4.1. Methods

4.1.1. Participants

Twenty-four Scottish participants were recruited to take part in this study. All were monolingual native English speakers who grew up in Scotland and were familiar with a Scottish regional dialect. Data from three participants were lost due to a technical failure.

4.1.2. Materials and procedures

Materials, including pictures, distractors, and their pairings, were identical to those used in Experiment 2. In addition to the 2 (distractor relatedness) by 2 (dialect) design, we added the within subjects factor SOA with 3 levels (-300 ms, -150 ms, 0 ms). Pictures, sound files, and randomized presentation orders were prepared as in Experiment 1. The only difference was that pictures were presented across 3 blocks, with SOA varying in each presentation blocks. Order of SOA block presentation was also counterbalanced across participants. Each picture was named 4x in each block, once in each distractor condition, for a total of 264 trials per participant.

The procedure was identical to Experiment 2 in all other respects. Testing lasted approximately 45 minutes.

3.2. Results

Mean response times (RTs) and standard deviations for correct trials in the experimental conditions are presented in Table 4. Trials in which the participant produced the wrong word, stuttered, hesitated or failed to respond were classified as errors and discarded from the RT analysis (N=185). Voice key failures were corrected using CheckVocal (Protopapas, 2007). Additionally, any trial which was 2.5 standard deviations from a participant's condition mean was treated as an outlier (N=151). In total, 5208 trials were included in the analysis. Due to the error rate being only 3.4%, errors were not analysed further.

Table 4: Mean response times (RTs) and standard deviations (SD) for correct trials in the experimental conditions across SOAs

	Dialect									
	English					Scottish				
	Same meaning		Unrelated		Diff	Same meaning		Unrelated		Diff
SOA	RT	SD	RT	SD		RT	SD	RT	SD	
-300	608	79	677	77	69	697	93	688	81	-9
-150	650	95	713	89	63	738	98	715	98	-23
0	684	104	747	106	63	759	105	749	103	-10

Mean reaction times were subjected to a 3-way within subjects ANOVA, with Dialect (English, Scottish), Distractor Relatedness (Identical, Unrelated), and SOA (-300, -150, 0) as within-subjects factors. Separate analyses were conducted with participants *(F_1)* and items *(F_2)* as random variables. The analysis revealed a significant effect of distractor relatedness, $F_1(1, 20) = 34.14$, $p<.001$, $\eta^2p = .631$; $F_2(1, 21) = 4.3$, $p = .05$, $\eta^2p = .17$, driven by faster naming times on average in the same meaning compared to the unrelated conditions. The main effects of Dialect, $F_1(1, 20) = 94.75$, $p < .001$, $\eta^2p = .826$; $F_2(1, 21) = 24.8$, $p < .001$, $\eta^2p = .542$, and SOA, $F_1(2, 40) = 21.61$, $p < .001$, $\eta^2p = .519$; $F_2(2, 42) = 194.0$, $p < .001$, $\eta^2p = .90$, were also significant. The latter finding reflects increases in naming times as the interval between the distractor and the picture onset decreased. Critically, Distractor Relatedness interacted significantly with Dialect, $F_1(1, 20) = 65.52$, $p < .001$, $\eta^2p = .766$; $F_2(1, 21) = 54.7$, $p < .001$, $\eta^2p = .723$, reflecting the fact that picture naming times were 65ms faster in the same

meaning condition compared to the unrelated condition when distractors were in English, F_1 (1, 20) = 176.3, $p < .001$, $\eta^2 p = .898$, F_2 (1, 21) = 19.5, $p < .001$, η^2_p = .481, whereas they were 14ms slower in the same meaning condition compared to the unrelated condition when the distractors were in Scottish, although this difference was not significant, F_1 (1,20) = 3.1, $p = .093$, $\eta^2 p = .135$, F_2 (1,21) = 1.4, p =.25, $\eta^2 p$ = .06. Neither Distractor Relatedness nor Dialect interacted with SOA, all Fs < 1.5. The 3-way interaction was also non-significant, $Fs < 1$.

Although the interaction with SOA was not significant, planned comparisons were pursued because the main aim of the experiment was to examine the time course of the translation equivalent interference effect. Across all three SOAs, picture naming times were significantly faster when the distractor word was identical to the target word, compared to the corresponding English unrelated condition, SOA -300: Mdiff = 69ms, $t_1(20) = 11.3$, $p < .001$; t_2 (21) = 4.1, $p < .001$; SOA -150: Mdiff, 63ms, $t_1(20) = 8.0$, $p < .001$; t_2 (21) = 3.9, $p = .001$; SOA 0: Mdiff = 63ms. $t_1(20) = 9.2$, p <.001; $t_2(21)$ 4.1, $p < .001$. In contrast, picture naming times were slowed by the translation equivalent of the picture name, compared to the corresponding Scottish unrelated condition. However, the difference only reached significance at SOA -150 SOAs, SOA -300: Mdiff = -9ms, $t_1(20) = 1.0$, p = .337; t_2 (21) = .56, p = .58; SOA -150: Mdiff = -23ms, t_1 (20) = 2.7, p = .01; t_2 (21) = 1.6, p = .12; SOA 0: Mdiff = -10ms, t_1 (20) = .86, p = .40; t_2 (21) =1.0, p = .35. Note that these differences did not reach significant in the by-items analysis. This could again be due to reduced item power, as each picture was named only once per condition at each SOA, compared to 2 naming instances per condition in previous experiments.

The results show that the identity facilitation effect has a long-lasting time course, remaining significant across all three SOAs. This is consistent with

predictions, given that the distractor words and target pictures in the identity condition share semantic, lexical, and phonological representations. This is also consistent with findings from Costa et al (1999), who also found their identity facilitation effect to persist across all three SOAs. In contrast, the manipulation of SOA revealed that the translation equivalent interference effect had a comparatively narrow time course, only emerging at the -150 SOA, despite numerical differences at all 3 SOAs. Again, this parallels Costa et al.'s findings for the translation equivalent facilitation effect. Specifically, they found that cross-language same meaning distractors only facilitated picture naming at SOA -200; the effect was not reliable at 0 or +200ms SOA. On the basis of this narrow and early emergence of the facilitation effect, Costa et al. argued that cross-language facilitation arises at the conceptual level.

In contrast, the co-dependence model implicates conceptual and lexical level processes in the translation equivalent interference effect. Therefore, we reasoned that the translation equivalent interference effect should have a time course that resembles within-language semantic interference effects, which are typically observed at early SOAs (cf, Glaser & Düngelhoff, 1984; Jescheniak & Schriefers, 1998; Damian & Martin, 1999; Schriefers et al, 1990). Consistent with this view, translation equivalent interference was observed at SOA -150. However, although semantic interference effects have been observed at early SOAs as long as -200ms in the visual modality, few studies have actually evaluated semantic interference effects from auditory distractors at early SOAs in excess of 200ms (e.g., Jescheniak & Schriefers, 1998; Schriefers et al, 1990). This is perhaps because, even in the written modality, effects are not consistently found at longer negative SOAs. Glaser & Düngelhoff tested SOAs extending to -400ms and only observed reliable semantic interference at SOAs ranging from -100 to +100. That said, in an L2 picture naming study with auditory

distractors and the same SOA intervals as the present study, Hermans et al (1998) observed significant semantic interference at SOA -300, but the effect disappeared when distractors were drawn from L1. Therefore, it may be that the longer negative SOA selected here was in fact on the very edge of when semantic effects are reliably observed.

Experiment 3 demonstrates that the between-dialect translation equivalent interference effect emerges in a time window associated with semantic interference, albeit in a narrower window. This result is consistent with the predictions of a co-dependence model which views the translation equivalent interference effect as emerging from the same mechanisms that give rise to semantic interference. To further test the boundary conditions of this interesting polarity reversal, in Exp 4 we asked participants to name pictures in their less-preferred dialect, namely in Scots. Intuitively, presenting the preferred picture names as a distractor should induce strong interference effects. From this perspective, we might expect more robust interference effects than were seen when naming in English. On the other hand, we have suggested that the inter-stimulus variability due to individual and regional differences in Scottish vocabulary usage might contribute to the less robust effects emerging from our by-items analyses. Costa and colleagues (1999) demonstrated that translation equivalents facilitated picture naming even when naming in their L2. However, they tested highly proficient bilinguals (see also Hermans, 2004). Geukes and Zwitserlood (2016) recently reported that German translation equivalent distractors had no reliable effect on L2 picture naming when the L2 picture names were newly learned words. Relating that finding to the investigation of dialectal words with variable familiarity and usage, if our marginal item effects reflect variability in the robustness of Scottish lexical representations, we might find weaker effects when naming in the D2.

5. Experiment 4: D2 naming

In Experiment 4, participants named pictures in their dispreferred dialect.

5.1 Methods

5.1.1. Participants

Twenty-five Scottish participants were recruited to take part in this study. All were monolingual native English speakers who grew up in Scotland and were familiar with a Scottish regional dialect.

5.1.2. Materials and procedures

Materials, including pictures, distractors, and their pairings, were identical to those used in Experiment 1. When pairing items for Experiment 1, we allowed phonological overlap between distractor words and the Scottish picture name, since the Scottish picture name was never produced. Here, however, those relationships remained. In four instances, the Scottish related distractor word shared the initial consonant with the picture name and in one instance the English unrelated distractor shared its initial phoneme with the picture name.

The procedure for this experiment followed that of Experiment 1. The only difference was that participants were familiarized with the Scottish picture names and practiced naming them in Scots twice, rather than just the once in Experiment 1. As in Experiment 2, naming trials were checked for accuracy using CheckVocal (Protopapas, 2017). The procedure was identical to Experiment 1 in all other respects. Testing lasted approximately 45 minutes.

5.2 Results

Mean response times (RTs) for correct trials, standard deviations and mean proportion of errors in the experimental conditions are presented in Table 5. Trials in which the

participant produced the wrong word or mispronounced the word, stuttered, hesitated or failed to respond, and any trial with RT faster than 250ms, were classified as errors and discarded from the RT analysis (N=583). Additionally, any trial which was 2.5 standard deviations from a participant's condition mean was treated as an outlier (N=249). In total, 6368 trails were included in the final analysis.

Table 5: Mean response times (RTs) for correct trials, standard deviations and mean proportion of errors in the experimental conditions

	Dialect			
	English		Scottish	
Distractor Conditions	RT (errs)	*SD*	RT (errs)	SD
Same meaning	830 (.07)	80.0	753 (.05)	79
Same category	844 (.09)	72	851 (.09)	67
Unrelated	829 (.08)	70	804 (.09)	63
Identity effect (unrelated – same meaning)	+1 (.01)		+51 (.04)	
Categorical Interference (unrelated – same category)	-15 (-.01)		-47 (0)	

The data were submitted to 3 (distractor relatedness) by 2 (dialect) analyses of variance (ANOVAs) to investigate the effect of distractor word relatedness and dialect on picture naming response times. Separate analyses were conducted with participants *(F_1)* and items *(F_2)* as random variables. The analysis revealed a significant main effect of distractor relatedness, $F_1(2,48) = 39.6$, $p < .001$, $\eta p2 = .623$, $\varepsilon = 0.8$; $F_2(2, 46) = 9.7$, $p < .001$, $\eta p2 = .296$, and of dialect, $F_1(1,24) = 26.2$, $p < .001$,

ηp2 = .522; $F_2(1,23) = 24.8$, $p < .001$, *ηp2* = .519. We again observed a significant interaction between distractor relatedness and dialect, $F_1(2,48) = 31.66$, $p < .001$, *ηp2* = .569; $F_2(2,46) = 14.0$, $p < .001$, *ηp2* = .379. This interaction is driven by a large facilitation effect in the Scottish same meaning condition, $t_1(24) = -5.9$, $p < .001$; $t_2(23) = -4.9$, $p < .001$. The between-dialect same meaning condition, in contrast, did not differ significantly from its corresponding unrelated condition, *t*s < 1. Hence, we observed significant within-language facilitation but no between-dialect interference, in contrast to results observed for Exp 1-3. Additionally, Scottish, $t_1(24) = 7.2$, p < .001; $t_2(23) = 2.7$, $p = .01$, but surprisingly not English, $t_1(24) = 1.9$, $p = .07$; $t_2(23)$ <1, same category distractors slowed naming times relative to their respective unrelated conditions. The English same category condition did not differ significantly from the English same meaning condition, Mdiff = 13.8ms, $t_1(24) = 1.7$, $p = .1$; $t_2(23)$ <1, indicating that the same meaning condition did not benefit from a facilitation effect. In sum, when naming in D2, semantically related distractor words from the preferred dialect had no reliable impact on naming times. This absence of semantic effects from the preferred dialect may be due, in part, to an unexpected slowdown in naming times in the unrelated condition when distractors were English words, compared to when they were Scottish words, $t_1(24) = 2.2$, p = .041; $t_2(23) = 2.4$, p = .028.

Because error rates were again higher than is typically observed in PWI experiments, they were submitted to the same 3 (distractor relatedness) x 2 (dialect) analyses of variance with participants *(F_1)* and items *(F_2)* as random factors in separate analyses. The effect of Dialect did not approach significance, $F_1(1, 24)$ = 1.5, $p = .228$, *np2* = .06; $F_2(1, 23) = 2.5$, $p = .124$, *ηp2* = .1, indicating that error rates were not reliably influenced by the dialect of the distractor word. The main effect of

Distractor Relatedness was significant, $F_1(2,48) = 12.7$, $p < .001$, $\eta p2 = .347$; $F_2(1,46) = 11.8$, $p < .001$, $\eta p2 = .340$. The interaction between Dialect and Distractor Relatedness did not approach significance in the by-subjects analysis, F_1 (2, 48) = 2.3, $p = .112$, $np2 = .087$, but it was marginally significant in the by-items analysis F_2 (2, 46) = 3.0, $p = .059$, $np2 = .116$.

Interpreting the main effect of Distractor Relatedness, contrasts reveal that significantly fewer errors were produced in the same meaning condition compared to the same category condition, $ps < .001$, and the unrelated condition, $p_1 = .004$; $p_2 = .016$. Error rates in the same category condition and the unrelated condition did not differ from one another, $p_1 > .1$; $p_2 = .059$.

5.3 Discussion

In Experiment 4 participants named pictures in their dispreferred dialect, Scots, while hearing distractor words from their D1, English, and their D2, Scots. As in Experiments 1-3, we again observe a large identity effect and robust semantic interference from Scottish distractor words. However, unexpectedly, we did not observe any reliable effects, facilitatory or inhibitory, from English distractor words. This result was unexpected from both the independent and co-dependent models of dialectal lexical organization. If dialect alternatives are lexically organized within a single system, effectively as near-synonyms, then we would have expected to replicate the between-dialect semantic interference effect observed in Experiment 1. In contrast, if dialects are organized into separate linguistic systems, bundled together by a functional dialect tag, then we would have expected to observe between-dialect semantic facilitation. Neither of these predictions was born out. However, this result is consistent with results reported by Geukes and Zwitserlood (2016), when investigating the processing of newly learned foreign vocabulary.

The results from Exp 4 are unclear and equivocal. On the one hand, we did not observe a facilitation effect from the translation equivalent distractor words, which supports the co-dependence model. On the other hand, the English distractor words did not reveal any reliable effects, which complicates the interpretation of the translation equivalent condition. We will return to a discussion of this experiment in the General Discussion.

Focussing on the results from Experiments 1-3, we have demonstrated and replicated a clear behavioural distinction between between-language and between-dialect translation effects. These experiments support a co-dependence model of dialectal lexical organization, suggesting that Scottish dialectal alternatives are integrated as part of the speaker's English vocabulary, not as part of a separate bundle of representations. In other words, we interpret the absence of a facilitation effect from translation equivalent dialect distractors to indicate that dialectal-specific vocabulary is integrated into a speaker's primary vocabulary, functioning like other alternative picture labels.

To further probe the accuracy of this interpretation, in Exp 5 we examined between-register synonyms, akin to between-dialectal translation equivalents or socio-linguistically marked near synonyms. Registers, like dialects, characterize systematic variations in usage patterns. However, whereas dialects are geographically-defined, registers are socially- or contextually-defined. Individuals might change their register to be more or less polite or formal, or to address children (e.g., child-directed speech). Whereas many individuals may only have competence in one dialect, all speakers are capable of adjusting their language to the social situation they are in (Hudson, 1996). In this way, using two registers is a more common phenomenon than bidialectalism and, perhaps by extension, less theoretically contentious. Because registers are

socially defined, rather than regionally defined, all items should be more familiar to our sample; problems with the items analyses are not anticipated.

Given the social drive to use context appropriate language, register membership should be tagged as a sociolinguistic feature in the lexicon. But those representations should still be part of the English vocabulary. Thus, we predict that between-register translation equivalents should produce interference, as observed for dialects. On the other hand, there could conceivably be a greater social cost to not using registers appropriately. Hence, it is conceivable that a register achieves greater system separation than regionally defined dialects. If so, we might observe between-register translation facilitation.

6. Experiment 5

6.1. Methods

6.1.1. Participants

Twenty-seven British participants were recruited to take part in this study. All were monolingual native English speakers. The majority of participants were Scottish and therefore spoke Standard Scottish English. Data from 3 participants was excluded do to recording failure resulting from experimenter error.

5.1.2. Materials

We selected twenty-six pictures drawn from nine common categories. All objects had phonologically distinct formal and informal labels. Six distractor words were paired with each target picture, two same meaning distractors, two same category distractors, and two different meaning distractors. Distractor words were also either drawn from formal or informal vocabulary. Thus, we had a 3 (distractor

relatedness) by 2 (register) design. Conditions were otherwise the same as in Experiment 1.

To estimate the relative frequencies of the Formal and Informal picture labels, spoken frequencies of occurrence were compiled from the British National Corpus (http://corpus.byu.edu/bnc/). This corpus consists of 100million words of text, 10% of which (N = 10million words) comes from spoken language sources including broadcasts, classrooms, courtroom, conversations and interviews. The search was constrained to only return nouns from the spoken portion of the corpus. Restricting the search to nouns reduces the homonymy problems identified in Experiment 1, but dos not eliminate it completely. The average spoken frequency of the Formal picture names was 84 occurrences per million while the average spoken frequency of the corresponding informal labels was 11 occurrences per million, $t(25) = 4.06$, $p < 0.01$. For comparison, the same data was extracted from the spoken portion of the Scots Corpus. Similar frequencies were obtained, with formal picture labels occurring 86 times per million on average compared to 8 times for informal labels[5]. The formal labels were significantly more frequent then their corresponding informal labels in the Scots corpus, $t(24) = 3.78$, $p = .001$. The similar frequency rates across the two corpora confirm that these forms are not regionally restricted and are used in Scotland.

In the same meaning conditions, targets were either paired with their formal name, which was usually their default label (e.g., target = DOLLAR, distractor = dollar) or their informal equivalent (e.g., target = DOLLAR, distractor = buck). In the same category condition the distractors were category coordinates of the target picture from either formal (e.g., target = DOLLAR, distractor = pound) or informal (e.g.,

[5] Data for the item pair 'party-do' were excluded from this average as the verb form of 'do' could not be excluded in searches of the Scots corpus.

target = DOLLAR, distractor = quid) registers. In the unrelated condition these same formal and informal distractor words were re-paired with unrelated pictures (e.g., target = DOLLAR, distractor = mouth or gob). A full set of stimuli can be found in Appendix C.

Distractor words were recorded by an English male. Pictures, distractor words, and random presentation orders were otherwise prepared as in Experiment 1.

6.1.2.1. Rating study

To evaluate the synonymy of our formal and informal word pairs, we first consulted the rating study from Experiment 1. 25 word pairs from that test were identified as register alternates. They were characterized by high synonymy ratings and similar response rates by Scottish and English participants (mean synonymy ratings out of 7pt scale: 5.17 for Scottish participants and 5.9 for English participants. Mean response rates 97% and 92%, respectively). Because there were insufficient semantic pairs in the set of register synonyms included in the rating study from Experiment 1, the rated items were used as a starting point only. An expanded set of potential stimuli was constructed, consisting of 14 items from the ratings study plus 12 new items. Pictures corresponding to these items were prepared, as in Experiment 1, and these pictures were presented in another rating study to 19 British participants. Pictures were presented twice, once with their formal label and once with their informal label. Participants were asked to rate the formality of the words, on a 7-point Likert scale (1=very formal; 7= very informal). They were also asked to identify whether they used the word to refer to the depicted object or if there was an alternative word they would prefer. The ratings confirmed our pre-classification of word formality; words which were pre-classified as formal were rated much lower on the scale than words

preclassified as informal (mean rating for 'formal' words = 3.16; mean rating for 'informal' words = 6.14). Additionally, the formal words were judged as appropriate labels for the pictures more often than the informal labels. Alternatives to the formal labels were provided in just 11 instances, whereas alternatives for the informal labels were provided more often (N=77). The vast majority of these alternatives corresponded to the formal names of the objects (e.g., the alternative provided for 'gig' was 'concert'). Those words which were identified as appropriate for the picture by at least half of the participants were selected for inclusion in the experiment.

The procedure was identical to Exp. 2.

6.2. Results

Mean response times (RTs) and standard deviations for correct trials in the experimental conditions are presented in Table 6. Trials in which the participant produced the wrong word, stuttered, hesitated or failed to respond were classified as errors and discarded from the RT analysis (N=238). Voice key failures were corrected automatically using CheckVocal (Protopapas, 2007). Additionally, any trial which was 2.5 standard deviations from a participant's condition mean was treated as an outlier (N=182). In total, 7068 trails were included in the final analysis. Due to the error rate being only 5%, errors were not analysed further.

Table 6: Mean response times (RTs) and standard deviations for correct trials in the experimental conditions.

	Register			
	Formal		Informal	
Distractor Conditions	RT	*SD*	RT	SD
Same meaning	730	118.7	780	122.8
Same category	788	128.3	784	123.0
Unrelated	764	131.3	758	132.1
Identity effect (unrelated – same meaning)	+34		-22	
Categorical Interference (unrelated – same category)	-24		-26	

The data were submitted to 3 (Distractor Relatedness) by 2 (Register) analyses of variance (ANOVAs) to investigate the effect of distractor word relatedness and register on picture naming response times. Separate analyses were conducted with participants *(F_1)* and items *(F_2)* as random variables. The analysis revealed a moderate main effect of Distractor Relatedness, $F_1(2,46) = 18.6$, $p < .001$, $\eta p2 = .447$, $\varepsilon = .857$; $F_2(2, 50) = 8.5$, $p = .001$, $\eta p2 = .254$, and a small main effect of Register, $F_1(1,23) = 4.6$, $p = .041$, $\eta p2 = .169$, which was marginally significant in the items analysis, $F_2(1,25) = 4.0$, $p = .056$, $\eta p2 = .139$. Crucially, we observed a moderate interaction between Relatedness and Register, $F_1(2,46) = 22.4$, $p < .001$, $\eta p2 = .493$, $\varepsilon = .83$; $F_2(2,50) = 12.7$, $p < .001$, $\eta p2 = .337$. This interaction reflects the fact that the same meaning condition induced significant facilitation when distractors were formal, $t_1(23) = 3.9$, $p = .001$; $t_2(25) = 2.9$, $p = .008$, but significant interference when the

distractors were informal, $t_1(23) = 3.8$, $p = .001$; $t_2(25) = 3.1$, $p = .005$. Both formal, $t_1(23) = 4.5$, $p < .001$; $t_2(25) = 2.0$, $p = .053$, and informal, $t_1(23) = 4.5$, $p < .001$; $t_2(25) = 3.0$, $p = .006$, same category distractors slowed naming times relative to the unrelated conditions. The informal categorical condition did not differ from the translation equivalent, Mdiff = 4.5ms, both $ts < 1$, again suggesting that semantic distance is not significantly influencing the magnitude of the interference effect (cf. Mahon et al., 2008; Aristei & Abdel Rahman, 2013; Rose et al, submitted).

These results replicate the pattern observed in Exp. 1 very closely, with vocabulary items that were familiar to all participants and did not depend on regional variation. Once again, we observed a significant within-register facilitation effect and a significant between-register interference effect; same meaning distractors from another socio-linguistically marked subsection of the lexicon, register in this case, interfered with picture naming. Hence, both dialects and registers are influencing picture naming times in a manner that is distinct from a different language. As predicted, by using stimuli with more consistent familiarity across participants, results were more consistent across analyses.

7. General Discussion

The aim of this study was to identify a behavioural observation appropriate for use as a diagnostic to distinguish between languages and dialects. To this end, we evaluated whether *between-dialect* translation equivalents behave like *between-language* translation equivalents in a picture-word interference task. Previous research has demonstrated that between-language translation equivalents facilitate picture naming. We reasoned that, if bidialectalism produced representational

independence and separation akin to that proposed and observed for bilinguals, we should see a similar pattern of results for between-dialect translation equivalents.

Across five experiments designed to parallel the relevant bilingual PWI experiments, we found no evidence for a dialectal translation equivalent facilitation effect. In three experiments, (Exps 1, 2, and 3), testing the processing impact of Scottish dialect distractor words on English picture naming, we found that between-dialect translation equivalents slowed picture naming, relative to dialect-matched unrelated distractors. Experiment 3 revealed that this effect emerged in the time window most strongly associated with within-language semantic interference effects, although it did not emerge at the earliest time point tested, which was perhaps outside the window where such effects can emerge in the auditory domain (Schriefers et al, 1990; Damian & Martin, 1999; but see Hermans et al, 1998). Experiment 5 extended these findings to British registers and we again found between-register translation interference.

In Experiment 4, when testing the impact of English distractor words (D1) on Scottish picture naming (D2), no significant effects were observed, either in the same or the relate meaning conditions. This null effect was unexpected and we discuss its origin below. Critically, for our primary purpose and consistent with Exps 1-3&5, there was no trace of a facilitation effect in the same meaning condition, as would have been expected by the independence model of dialectal lexical organization.

Together, these results suggest that an experimental approach might be an effective tool for objectively distinguishing dialects from languages, particularly when naming in the preferred dialect. Such a tool, if validated with other dialect pairs, could finally put to bed the long-standing debate about how to draw a line along the language/dialect divide. It also contributes to the growing body of literature

investigating how dialects are processed (e.g., Antoniou, Grohmann, Kambanaros, & Katsos, 2016; Martin et al., 2016; Ross & Melinger, 2016; Kirk, Fiala, Scott-Brown & Kempe, 2014; Sumner & Samuals, 2005; 2009; Vangsnes, Söderlund, & Blekesaune, 2015).

In addition to examining translation equivalent effects, we also examined within- and between-dialect semantic interference. Three of the reported experiments included categorically related distractor words from both target and non-target dialects or registers. Replicating the previously reported findings in the bilingualism literature, within- and between-dialect and register category alternatives interfered with picture naming to a similar degree when naming in the preferred dialect (Costa, et al., 1999; Costa & Caramazza, 1999; Hermans et al., 1998). Between-dialect and between-register translation equivalents also interfered as much as the same category competitors, despite differences in semantic similarity between conditions. This observation highlights the fact that more semantic similarity does not necessarily lead to more competition in a straightforward and isomorphic manner (cf. Aristei & Abdel Rahman, 2013; Rabovsky, Schad, & Abdel Rahman, 2016; Mahon et al. 2008, but see Rose et al, submitted). Increased semantic similarity in the case of a translation equivalent is not the same as a close semantic relation. Specifically, if two lexical items point to the same conceptual representation, then the activated cohort will not be increased as much as when two semantic coordinates point to distinct conceptual representations (cf. Abdel Rahman & Melinger, 2008, Exp 1).

As already discussed, when naming in the dispreferred dialect, no semantic interference was observed from the preferred dialect, although the dispreferred dialect competitor did induce significant semantic interference. Below, we consider two accounts for this unexpected finding. One possibility, couched within a monolingual

lexical selection framework, is that the absence of interference from the preferred dialect competitor, as with the preferred dialect translation equivalent, arises from the trade-off between conceptual and lexical level effect. An alternative interpretation, couched within a bilingual lexical inhibition framework (e.g., Green, 1986), suggests that the lack of interference arises from early and strong inhibition of the preferred distractors relative to the dispreferred distractors.

7.1. Response dialect.

Translation-equivalent facilitation is a robust finding that has been observed for highly related languages (Spanish-Catalan) as well as more dissimilar languages (e.g., Spanish – English, English – Dutch), when naming in L1, L2 and in a mixed naming context, and it has also been shown for more balanced bilinguals and non-balanced bilinguals (Costa et al., 1999; Costa & Caramazza, 1999; Hermans, 2004; Roelofs, Piai, Rodriguez, & Chwilla, 2016). In the current Experiment 4, we asked participants to name pictures in their dispreferred dialect, D2, but failed to observe the translation-equivalent interference effect or the between-dialect semantic interference effect that we'd observed in our other experiments. Given that the English distractor words constitute the preferred picture names, we had predicted robust interference from the English distractors. Hence, the results from this experiment were surprising.

However, we are not the first to report null effects from L1 distractors when naming in the L2. Geukes and Zwitserlood (2016) investigated the processing of newly learned L2 vocabulary in picture-word interference experiments using the same design employed here. They trained German native speakers on novel French object names and subsequently tested for within- and between-language identity and semantic interference effects. When participants named pictures in their L1,

participant responses were significantly slower when the distractor word was the newly learned translation equivalent compared to a newly learned unrelated distractor word. Thus, just as we have reported here, Geukes and Zwitserlood observed a translation-equivalent interference effect. They interpreted this finding as evidence that newly learned words are not yet associated with an L2 language tag, which is consistent with the co-dependence account formulated herein. Specifically, if newly learned L2 words are not bundled together, then they cannot be activated or inhibited en mass and instead interfere like any other lexical candidate.

Furthermore, when participants named pictures using the newly learned picture labels, no significant effects were observed from the L1 distractors, exactly as we observed in Experiment 4. Because the numerical pattern in their experiment trended towards a facilitation effect, Geukes and Zwitserlood interpreted thier null effect in terms of a power limitation. However, such an interpretation is not consistent with our findings; We observed no hint of a facilitation effect. We consider two possible explanations for the unexpected findings in Experiment 4.

Within the context of a monolingual model of lexical selection, such as the Swinging Lexical Network account presented above (Abdel Rahman & Melinger, 2009), the absence of distractor effects from English (D1) distractor words can be explained in terms of the relative magnitude of conceptual priming induced by the more frequent distractors relative to the less frequent distractors. The English distractors, which are familiar and frequent, prime related concepts more strongly and compete lexically more strongly than their corresponding Scottish distractors. As a result, these two effects may neutralize each other, resulting in naming times that do not differ significantly from their corresponding unrelated English distractor condition. In contrast, the Scottish distractor words, which are less potent conceptual

primes but still strong lexical competitors (especially as they are produced in the experiment; cf. Dell, 1986; Roelofs, 1992), produce sufficient semantic competition to offset the concomitant semantic priming. There are several observations that similarly suggest frequency can impact distractor effects. Miozzo and Caramazza (2003) report larger interference effects from low frequency distractor words compared to high frequency distractor words. Similarly, Hermans et al (1998) found less long lived semantic interference effect from L1 distractors than L2 distractors on L2 picture naming. In both instances, an account that purely relies on lemma activation strength would have predicted the opposite pattern.

An alternative explanation for the absence of distractor effects from D1 when naming in D2 could rest with the asymmetrical inhibition required by a preferred vs. a dispreferred language[6]. According to the Inhibitory Control model (Green, 1986), to respond in a dispreferred language with a lower resting activation level, the preferred language must be strongly inhibited. In contrast, to respond in L1, little inhibition of L2 is needed because L1 has a higher default activation level. Looked at through this lens, interference from the dispreferred dialect when naming in the preferred dialect could be consistent with an independence model. If the D2 does not need to be inhibited to allow for D1 to be selected, then interference would be observed. However, if D1 does need to be inhibited to allow for the response to be made in D2, then interference would not be expected. According to this view, however, facilitation should be observed, as the conceptual priming induced by the translation equivalent would not be off-set by lexical interference. Indeed, this is what Costa and colleagues observed in their seminal bilingual studies that inspired the present investigation.

[6] We'd like to thank the reviewer for this interesting alternative interpretation of our finding.

Therefore, it is not clear that this inhibition account can explain the results from Experiment 4 either.

The interpretation of Experiment 4 is further complicated by the observation that naming times in the unrelated condition were slower with English distractors than with Scottish distractors. This was also an unexpected results not repeated in the other experiments and not predicted by either model of dialectal lexical organization. The slower response times in the English unrelated condition, which is used as the baseline against which interference or facilitation is determined, may be masking slower naming times in the same and related meanings conditions. Therefore, with an abundance of caution, no strong conclusions should be derived on the basis of Experiment 4 alone. Future investigation focussed on the selection of the dispreferred dialect are needed to properly interpret the results of this experiment.

7.2. Distractor modality.

One important methodological difference between the present study and the bilingual experiments it was based on is in the modality of the distractor presentation. While Costa and colleagues used written distractors (1999, Costa & Caramazza, 1999, see also Hermans, 2004), we used spoken distractors. This was done primarily because Scots is not a written language and speakers do not typically engage with Scots English in the written modality. Given this lack of familiarity with the written forms, and the lack of standardized spelling, using written distractor words might have engaged additional reading processes not required for the written English distractors. Furthermore, the evidence has suggested that semantic interference effects are unaffected by distractor modality (Damian & Martin, 1999), licensing the exchange of written distractors for spoken distractors.

However, several studies have called this general point into question. There are instances in the literature where the modality of the distracting stimuli does contribute to the polarity of a distractor effect. For instance, while Vitkovitch and Tyrell (1999) found that superordinate distractor words induced facilitation when presented visually, Hantsch, Jescheniak, and Schriefers (2005) found superordinate distractors induced interference when presented aurally. Similarly, Bloem and La Heij (2003) found that categorically related written distractors induced interference in a word translation task while categorically related pictoral distractors induced facilitation. Hence, there are reasons to suspect modality may be a crucial factor in determining the polarity of distractor effects. However, examining just this issue, Melinger (in prep) presented British participants with either written or spoken British and American distractor words. American vocabulary is increasingly familiar to Brits due to media exposure and, unlike Scots English, American English has a standard orthographic form. Focussing on the polarity of the translation equivalent distractor effect, Melinger found comparable interference when distractors were written, presented at SOA 0, and spoken, presented at SOA -150. Viewing these findings in the context of the current investigation, it is unlikely that the use of spoken distractors accounts for the absence of the translation equivalent facilitation effect. Furthermore, these parallel results observed for a dialect with a standard written form suggests that experience with the written form, orthographic representations, or active literacy in a language are not critical to the polarity of translation equivalent distractor effects observed in bilingual and bidialectal studies. They also indicate that these effects do not rely on active productive use of a dialect; passive receptive familiarity is sufficient to produce translation equivalent interference effects.

Furthermore, given the above-mentioned findings by Viktovitch and Tyrell (1999), it is important to have confidence that the Scottish and the register translations were interpreted by our participants as synonymous with the Standard English picture names. In other words, it is important to be assured that our participants did not interpret *stookie* as a *type of cast* rather than as *another word for* cast. We tried to maximize synonymy with our rating studies. Because items were selected only if they were rated highly on the synonymy scale, effects of alternative interpretation are unlikely to underlie our findings. If participants had interpreted the translations as having greater or smaller semantic extensions than their intended English counterparts, we might have expected to find a facilitation effect, especially in the studies reported by Melinger (in prep) which used written distractors, given that written distractors appear to be more susceptible to facilitation effect or more resistant to interference effects. Finally, Costa, Mahon, Savova, and Caramazza (2003) observed that unrelated distractors that were at a different level of specificity to the response slowed picture naming less than unrelated distractors at the same level of specificity. Again, extending this observation to the present study, if the translation distractors were interpreted as differing in their semantic extensions, differences in the unrelated condition would have been expected.

Similarly, the homophony of the Scottish (and register) words used in this study presents another challenge for the interpretation of the findings. If some of the words are homophonous, how can we be sure participants interpreted the distractor words in the anticipated way? While we have no direct evidence for which meanings were accessed, the observation of equal semantic interference in the English and Scottish same category distractor conditions does suggest that the Scottish meanings were accessed. If the alternative meanings had been accessed, the Scottish distractors

would have been semantically unrelated to the target picture, and the RTs would have reflected this. Since the same Scottish words were presented in all 3 distractor relatedness conditions, yet reaction times varied by condition, we can be confident that the Scottish meanings were accessed.

7.3. Lexical selection and dialects.

An additional aim of this study was to gain some insight into how dialectal language control is achieved. Sociolinguistic variables have received little attention in the language production literature but there are reasons to suppose that dialectal choice might be similar to language choice for purposes of lexical selection.

One question that underlies much of the research into bilingual language processing is how bilinguals prevent catastrophic interference between their two languages. For most lexical concepts, bilinguals will have two equally valid lexical options to choose from. Bilingualism research has overwhelmingly suggested that both linguistic systems are simultaneously activated even when speaking in a monolingual context (Colomé, 2001; Hermans, et al., 1998; Kroll, Bobb, & Wodniekca, 2006, but see Grosjean 1999). Thus, it has been suggested that to prevent between-language interference, the non-target language must be inhibited (Green, 1986; 1998). But the findings from Costa and colleagues (1999) were interpreted in support of a language-specific selection mechanism. According to that view, although the non-target lexicon may be active when speaking, those active candidates do not impact selection times. Thus, there is no need to inhibit them. Despite the robustness of the between-language facilitation effect, several other findings are inconsistent with the broader claims of the language-specific selection proposal (e.g., Hermans et al, 1998; Meuter & Allport, 1999; see also Kroll, Bobb, Misra, & Guo, 2008 for a

discussion of the evidence supporting these two views). Furthermore, Hermans (2004) investigated the origin of the translation equivalent facilitation effect and argued that it may arise via phonological priming during translation of the between-language distractors. Hermans argued that evidence of a phonological component to the between-language translation equivalent facilitation effect was consistent with either inhibition or language specific selection models (see also Hall, 2011). Therefore, the interpretation of the translation facilitation effect remains unclear. But what is clear from the present set of results is that lexical items from the non-target dialect or register do impact lexical selection times negatively. Thus, it appears that different mechanisms are responsible for preventing between-language and between-dialectal interference.

In line with the co-dependence proposal of Labov (1998), we find no evidence that representations associated with a specific dialect are bundled together in any manner that can restrict them from engaging fully with the lexical selection mechanism. Hence, we can conclude that dialects and registers are treated like other within-language semantic alternatives. The question thus remains how the selection of the appropriate dialect or register is achieved without catastrophic interference. We have proposed, following suggestions by La Heij (2005) that features denoting register, dialect, or other sociolinguistic features are one of many semantic features that together convey word meaning. Just as a message representation can be specified as intending to be humorous or erudite, the message can be marked for politeness or regional appropriateness by activating corresponding semantic features.

7.4. Bidialectal language processing

Like bilinguals, speakers of distinct regional dialects also need to control selection processes across two linguistic systems, controlling when to use the standard and when to use the regional variant. Like distinct but related languages, standard and non-standard dialects have phonetic, lexical and syntactic differences, as well as considerable systemic overlap. This means that bidialectal speakers theoretically share a similar burden to bilingual speakers, stemming from the heterogeneity of their linguistic input and the sociolinguistic constraints on using the dialects in different contexts. Given the similar communicative costs associated with speaking a non-standard regional dialect or speaking two closely related languages, one might be surprised by the present results. Closer processing parallels between bilinguals and bidialectals might have been anticipated. However, there are several possible factors that might have contributed to the polarity of the effect reported here. Firstly, when considering the question of systematic dialectal separation, the choice of dialect pairs could be crucial. Although language similarity does not appear to influence the magnitude or reliability of bilingual processing effects (e.g., Marian & Spivey, 2003), dialect similarity may. Although the dialect used in this study is substantially different from the Standard form (Trudgill, 1983) it is important to note that the standard form, as defined by Trudgill, is not spoken by most Scots. Instead, Scots speak their specific regional dialect and Standard (Scottish) English. Thus, while the linguistic diversity evidenced in Scotland is still greater than in the South of England, it is perhaps not as great as other bidialectal situations. Certainly much of spoken Dundonian is comprehensible to speakers of non-Scottish dialects, especially after a bit of re-tuning (Norris, McQueen, & Cutler, 2003) and a bit of experience (Scott & Cutler, 1984; Floccia, Goslin, Girard, & Konopczynski, 2006). Given the high degree of

comprehensibility, it is possible that the communicative necessity to select the correct dialectal forms is insufficient to warrant setting up an independent linguistic system.

However, other dialect pairs can be virtually incomprehensible to outsiders, have comparable sizes and recognized social functions, possibly leading to a greater need for system separation. Testing such pairs would push the utility of this task as a diagnostic for distinguishing languages from dialects. Future research investigating parallels between bilingualism and bidialectalism might focus on more extreme, even diglossic, dialect examples, such as Swiss German, Arabic, or Doric, the dialect of Scots English spoken in the northeast of Scotland. The task can also be used to test the other end of the continuum, by comparing mutually-intelligible language pairs, such as Swedish and Norwegian.

The wider observation from the bilingualism literature that underpins this research is that bilinguals are extremely good at keeping their two linguistic systems separate, such that competition effects typically observed in monolinguals may not be observed for bilinguals. The present study suggests that bidialectals may not be as good at separating their linguistic systems. Taking this wider point forward, the logic developed herein should be extendable to other experiential paradigms that do not rely, for example, on the exogenous introduction of a competing lexical item. Such an extension would be a valuable addition to the developing body of work investigating bidialectal lexical processing and may help to pin down the specific mechanism that speakers use to select socio-linguistically appropriate words.

In sum, this study has taken an early step into the study of bidialectal language production, adding to the growing body of psycholinguistic research on dialect variation. By drawing out parallels between bilingualism and bidialectalism, we hope that future research into bidialectalism will shine a light on novel aspects of

sociolingustically-constrained lexical selection processes. This current study, by focussing on the effects of cross-dialect translations equivalents, has identified a clear point of processing departure between languages and dialects. This novel observation opens the door to subsequent investigations into other dialect pairs and can potentially contribute to the longstanding debate about how to define a language and how to discriminate between a dialect and a language, potentially putting to bed political arguments for a linguistic or psychological distinction.

Acknowledgements

I would like to thank all the students and research assistants who contributed to this project, including Ewa Monteith-Hodge, Riku Inhalainen, Claire Shepherd, Leanne Gillespie, Ciela Kerr, Emily Blackstone, and Egle Dalinkeviciute. This work also benefited tremendously from discussions with the members of Dundee's Language Research Centre, insights provided by Jennifer Smith, and from feedback I received from Martin Pickering and Andrea Martin. I also appreciate the expert editing by Wendy Baldwin. All errors and omissions are my own.

Supplementary materials

Supplementary data associated with this article can be found at https://osf.io/27wd5/

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Appendix A

	Same Meaning		Same Category		Unrelated	
Picture	**English**	**Scottish**	**English**	**Scottish**	**English**	**Scottish**
ear	ear	lug	armpit	oxter	river	burn
armpit	armpit	oxter	ear	lug	hill	brae
hallway	hallway	lobby	alley	wynd	cast	stookie
wall	wall	dyke	chimney	lum	slippers	baffies
alley	alley	wynd	hallway	lobby	knocker	chapper
chimney	chimney	lum	wall	dyke	trousers	breeks
hat	hat	bunnet	cast	stookie	armpit	oxter
slippers	slippers	baffies	trousers	breeks	caretaker	janny
cast	cast	stookie	hat	bunnet	wall	dyke
trousers	trousers	breeks	slippers	baffies	lock	snib
turnip	turnip	neep	sandwiches	pieces	boy	laddie
sandwiches	sandwiches	pieces	turnip	neep	horsefly	cleg
horsefly	horsefly	cleg	woodlouse	slater	sandwiches	pieces
woodlouse	woodlouse	slater	horsefly	cleg	turnip	neep
hill	hill	brae	river	burn	chimney	lum
river	river	burn	hill	brae	hallway	lobby
puddle	puddle	dub	smoke	reek	hat	bunnet
smoke	smoke	reek	puddle	dub	ear	lug
baby	baby	wean	boy	laddie	woodlouse	slater
headmaster	headmaster	rector	caretaker	janny	puddle	dub
caretaker	caretaker	janny	headmaster	rector	alley	wynd
boy	boy	laddie	baby	wean	smoke	reek
lock	lock	snib	knocker	chapper	baby	wean
knocker	knocker	chapper	lock	snib	headmaster	rector

Appendix B

	Identical		Unrelated	
Picture	**English**	**Scottish**	**English**	**Scottish**
knocker	knocker	chapper	puddle	dub
smoke	smoke	reek	ear	lug
horsefly	horsefly	cleg	sandwiches	pieces
armpit	armpit	oxter	hill	brae
trousers	trousers	breeks	lock	snib
baby	baby	wean	woodlouse	slater
ear	ear	lug	river	burn
chimney	chimney	lum	trousers	breeks
hat	hat	bunnet	armpit	oxter
turnip	turnip	neep	boy	laddie
woodlouse	woodlouse	slater	turnip	neep
sandwiches	sandwiches	pieces	horsefly	cleg
wall	wall	dyke	slippers	baffies
cast	cast	stookie	wall	dyke
lock	lock	snib	baby	wean
boy	boy	laddie	smoke	reek
hill	hill	brae	chimney	lum
slippers	slippers	baffies	alley	wynd
alley	alley	wynd	knocker	chapper
puddle	puddle	dub	hat	bunnet
hallway	hallway	lobby	cast	stookie
river	river	burn	hallway	lobby

Appendix C

	Same meaning		Same Category		Unrelated	
Picture	**Formal**	**Informal**	**Formal**	**Informal**	**Formal**	**Informal**
alcohol	alcohol	booze	tea	cuppa	friends	pals
nose	nose	hooter	breasts	knockers	food	scran
man	man	bloke	friends	pals	pound	quid
sausage	sausage	banger	roll	bap	child	nipper
candy	candy	sweets	food	scran	nose	hooter
child	child	nipper	girl	lassie	alcohol	booze
bottom	bottom	arse	mouth	gob	marijuana	weed
policeman	policeman	copper	taxi driver	cabbie	breasts	knockers
tea	tea	cuppa	alcohol	booze	underwear	knickers
breasts	breasts	knockers	nose	hooter	candy	sweets
friends	friends	pals	man	bloke	bottom	arse
woman	woman	bird	customer	punter	roll	bap
roll	roll	bap	sausage	banger	policeman	copper
food	food	scran	candy	sweets	girl	lassie
dollar	dollar	buck	pound	quid	mouth	gob
girl	girl	lassie	child	nipper	sausage	banger
mouth	mouth	gob	bottom	arse	customer	punter
taxi driver	taxi driver	cabbie	policeman	copper	party	do
concert	concert	gig	party	do	man	bloke
marijuana	marijuana	weed	cigarette	fag	tea	cuppa
party	party	do	concert	gig	woman	bird
cigarette	cigarette	fag	marijuana	weed	dollar	buck
hat	hat	beanie	underwear	knickers	taxi driver	cabbie
customer	customer	punter	woman	bird	hat	beanie
underwear	underwear	knickers	hat	beanie	cigarette	fag
pound	pound	quid	dollar	buck	concert	gig