

**The role of conceptual and word form representations in
lexical alignment: Evidence from bilingual dialogue**

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Declaration

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“Conversation is an art in which a man has all mankind for his competitors, for it is that which all are practicing every day while they live.”

- Ralph Waldo Emerson (American Poet,
Lecturer, and Essayist, 1803-1882)

Abstract

During dialogue, interlocutors come to use the same words for referents, a phenomenon termed *lexical alignment*. Pickering and Garrod's (2004) *Interactive Activation model* proposes that automatic priming mechanisms operate at each level of representation (e.g., conceptual, lexical, phonological) and percolation between the levels enhances alignment at the lexical level. However, from previous research it is unclear whether lexical alignment is wholly driven by alignment at the conceptual level, or whether it is partly driven by the repetition of word form. Using non-cognate translation equivalents (i.e., words that are highly similar in meaning, but do not share the same, or similar, word form) this study investigated this issue in a bilingual population. The results show that within-language lexical alignment is greater than between-language alignment. Such results suggest lexical alignment is partly driven by the repetition of word form. If alignment were wholly based on conceptual alignment, the alignment effect would have been of similar magnitude in both within- and between-languages. As this study involved the use of bilingual participants, it also offered an investigation into how alignment operates in a second language and whether it occurs cross-linguistically. Proficient bilinguals were found to align to the same extent in their dominant and non-dominant languages, which suggests that alignment mechanisms can be extended to a second language. Cross-linguistic alignment effects were also obtained. The results are discussed in relation to the implications for the Interactive Activation model, and the possible extension of this model to account for bilingual dialogue.

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Speakers adapt the way they speak to their conversational partner during dialogue. Such co-ordination of linguistic behaviour is obvious when interlocutors (i.e., participants in a conversation) come to use the same terms for referents. Such convergent lexical choice is termed *lexical entrainment* or *lexical alignment* (e.g., Brennan & Clark, 1996). Pickering and Garrod's (2004) (henceforth, P&G) *Interactive Activation Model* (IAM) proposes such alignment as being due to automatic priming mechanisms, operating at the phonological, conceptual¹, and lexical levels of representations. However, as words are inherently connected to their conceptual and phonological representations, establishing whether lexical alignment is wholly driven by conceptual alignment or whether it arises partly due to the repetition of word-form is difficult. This study disentangles these effects by comparing alignment on words from one language, that share conceptual and phonological representations, to alignment on words from two languages, sharing only their conceptual representations (i.e., non-cognate translation equivalents). As this is the first study, to our knowledge, that examines lexical alignment in a bilingual population, a secondary aim is to establish whether alignment effects are of similar magnitude in the dominant and non-dominant language, and whether language proficiency modulates this alignment.

In this introduction, the importance of interaction in our communicative lives shall be discussed first. Secondly, evidence and proposed explanations for lexical alignment will be outlined before focusing on the IAM, and the possible role of word-form and conceptual representations. Thirdly, issues relating to alignment in a second language will be explored.

A Shift from Monologue to Collaborative Dialogue

Despite the demanding nature of dialogue (e.g., deciding when to speak, listening to your partner and providing feedback while simultaneously planning your next utterance), conversation is the most natural form of language use for the majority of the world's population, with even young children and illiterate adults displaying the

¹ Note that, throughout this paper, the terms *meaning*, *semantic* and *conceptual* are used interchangeably to refer to non-linguistic representations. For a discussion regarding distinguishing between semantic and conceptual representations, see Pavlenko (1999) and Francis (2005).

ability to engage in a conversation with relative ease. However, inspired by the de-contextualized sentences constructed by theoretical linguists (e.g., Chomsky, 1965), theories of language processing have long been established based on data from monologue experimental settings. Researchers are now beginning to emphasize the pervasive nature of interaction in our communicative lives. This shifting interest away from the individualistic has led to an emerging trend to investigate language in interactive, rather than isolated, contexts, where participants are tested in pairs or in small groups (e.g., Clark, 1992; Clark & Kyrch, 2004; Tanenhaus & Trueswell, 2005). Conversations are a joint activity, where what is said is not predetermined, but rather emerges as interlocutors' co-ordinate their communicative behaviour in order to reach a common goal (Clark, 1996; Clark & Schaefer, 1989). This ability to co-ordinate our linguistic behaviour with that of our conversational partner is deemed to be fundamental to successful communication (Garrod & Pickering, 2004; Goleman, 2006; Pickering & Garrod, 2004).

Such co-ordination is evident during dialogue, as interlocutors tend to converge, or *align*, on many non-linguistic and linguistic levels. At non-linguistic levels, interlocutors are found to imitate each other's facial expressions (e.g., Meltzoff, 1977, 1983), bodily posture (e.g., Shockley, Santana, & Fowler, 2003) and actions (e.g., if one person yawns, others in the company of this person will also yawn, Province, 1986).

Alignment also occurs at many linguistic levels. For example, during conversation interlocutors tend to align their choice of syntactic constructions (e.g., Branigan, Pickering, & Cleland, 2000; Gries, 2005; Levelt & Kelter, 1982), speech rate (Giles, Coupland, & Coupland, 1991; Wilson & Wilson, 2005), accent (Giles, 1973), and adopt similar phonetic realizations for re-occurring words (Pardo, 2006). The most obvious form of linguistic alignment relates to interlocutor's lexical choice. When interlocutors repeatedly refer to an object/person, they tend to come to use the same name to refer to that object (e.g., Brennan & Clark, 1996; Clark & Wilkes-Gibbs, 1986; Garrod & Anderson, 1987; Schober & Clark, 1989). This tendency has been termed *lexical alignment*².

² Throughout this paper, similar to Branigan, Pickering, Pearson, & McLean (2010), we use the term *alignment* to refer to convergent linguistic behaviour (e.g., interlocutors are said to be *aligned* when they both refer to a type of vehicle as a *coach* rather than a *bus*). However, strictly speaking, the notion of alignment, according to Pickering and Garrod (2004; see also Costa, Pickering, & Sorace, 2008) refers to interlocutors' mental representations, rather than their overt linguistic behaviour. For example,

Lexical Alignment in Dialogue

The referential use of language requires a speaker to formulate a referring expression (i.e., word or phrase) that will accurately convey the referent to their addressee. Such a linguistic task may seem simplistic; however, the same object has a wide variety of potential labels (e.g., Bolinger, 1977; Clark, 1987; Furnas, Landauer, Gomez & Dumias, 1983, 1987). Referential communication tasks, where one participant must describe an object or tangram figure (i.e., an abstract geometric shape) to their partner in order to allow them to accurately identify this target item among an array of items, show that lexical variability is high *between* conversations, with the likelihood that two separate pairs of participants would use the same label for the same common object being only 10% (Brennan, 1996). However, lexical variability is low *within* conversations (e.g., Brennan & Clark, 1996; Garrod & Anderson, 1987).

Brennan and Clark (1996) found that once speakers had aligned on a particular name for an object (e.g., *pennyloafer*) they were more likely to re-use this name, even when a more basic level name (e.g., *shoe*) would have been sufficient for successful referring. In this study, pairs of participants, a director and a matcher, engaged in a dialogue game in which directors had to describe a set of cards showing pictures of common objects (e.g., a particular dog, car, fish or shoe) to allow the matchers to reconstruct the director's set of cards. In the first set of trials, where the targets were all unique in their categories, participants tended to use a basic level name (e.g., *shoe*), as this was sufficient for the matcher to select the appropriate card. In the non-unique trials, multiple objects from the same category were presented (e.g., *pennyloafer*, *sneaker*, *black dress shoe*). In this case, as a basic level name was not sufficient to successfully discriminate between the objects, participants tended to use a subordinate term (e.g., *pennyloafer*). In the critical trials, only one object from each category was presented, so a basic level term would again be sufficient. However, participants often continued to use the subordinate name. Similarly, Garrod & Anderson (1987) found that participants used the same name to refer to parts of a maze (e.g., *box* rather than *square* to refer to a node on the maze). Lexical alignment limits our choice of words within a conversation, which simplifies the act of referring.

interlocutors may have aligned on the use of the term *coach* even if one of them never overtly produced this word.

Brennan and Clark (1996) proposed that lexical alignment occurs due to the establishment of a *conceptual pact* (i.e., a temporary agreement to conceptualize an object in a certain way). Moreover, such conceptual pacts were proposed to be partner-specific based on the finding that speakers continued to appeal to the over-informative subordinate term with a continuing addressee; whereas they were more likely to revert back to the sufficiently informative basic level terms with new addressees (see Metzging & Brennan, 2003; cf. Horton & Gerrig, 2005). However, it is important to stress that when interacting with a new partner, speakers often employed the previously used term first, and only altered their lexical choice after the new addressee provided negative feedback, which runs counter to the claims of a partner-specific conceptual pact.

Alternatively, Jucks, Becker, & Bromme (2008) argued that it is the availability of information in the mind that underlies lexical alignment. In their study investigating lexical alignment in written discourse, doctors' use of technical language was more frequent when patients had used technical language, which may be due to the doctor's beliefs about the patient's knowledge (see also, Bromme, Jucks, & Wagner, 2005). However, they also found that, independent of the patients' use of technical language, the tendency for doctors to use technical terms increased when they consulted a medical source. Such findings contradict the proposal that lexical alignment was due to the doctor's beliefs about the patient. According to Jucks et al., consultation with the medical source made technical terms more available; and hence, such terms were more likely to be used, despite the fact that patients' may not understand these terms. Similarly, Barr and Keysar (2002) proposed once a word-referent mapping, or *linguistic precedent*, is established in memory, interlocutors are more likely to use the same word to refer to that same referent due to the high availability of that precedent (see also Keysar, Lin, & Barr, 2003; Wu & Keysar, 2007).

In sum, it has been argued that lexical alignment is *not* due to partner-specific conceptual pacts. Instead studies suggest lexical alignment may be due to the increased availability of words in the mind. The increased availability of lexical representations due to recent use is also a claim made by P&G's IAM model, which shall now be discussed in more detail.

Interactive Activation Model

The current study focuses on P&G's *Interactive Alignment Model* (IAM). P&G's central claim is that there is a parity of representation between language production and comprehension systems (i.e., activation of the representation of a word in comprehension maintains its activation during production). According to P&G, through alignment at many linguistic levels (i.e., syntactic, phonological, lexical, and semantic), interlocutors come to understand relevant aspects of their worlds in the same way. This is based on the idea that interlocutors build multi-dimensional mental models of the situation under discussion (i.e., situation models), which encode dimensions such as causality, time, space, and intentionality (see Johnson-Laird, 1983; Zwaan & Radansky, 1998).

Alignment is proposed to be largely due to automatic priming mechanisms (see Garrod & Pickering, 2007). Priming, very crudely, refers to enhanced processing of a stimulus due to prior exposure. Based on such proposals, P&G suggest that production of an utterance by one interlocutor increases the likelihood that the other interlocutor will re-use this word. For example, if *A* refers to a specific vehicle as a *coach*, *B* is more likely to produce *coach* when referring to that vehicle; but if *A* produces *bus*, then *B* is more likely to produce *bus* (e.g., Brennan & Clark, 1996; Garrod & Anderson, 1987). Hearing, or comprehending, a word (e.g., *coach*) produced by their conversational partner, activates the representation associated with this word in the addressee's mind. As this representation does not decay immediately, he is more likely to re-use this word (e.g., *coach*) when it is his turn to speak. Thus, simple priming mechanisms are proposed to underlie interlocutors' tendency to repeat each other's lexical choices (i.e., lexical alignment). P&G suggest that by developing aligned representations interlocutors build *implicit common ground*. Therefore, conscious modelling of mental states is not necessary, but is available as a cognitively costly, optional strategy occurring at a later stage in processing.

Importantly, P&G also propose that there is percolation between the levels of representation (i.e., alignment at one level leads to alignment at another level). This is supported by studies that show syntactic alignment (i.e., the tendency for interlocutors to use the same syntactic constructions) is enhanced when the content words (e.g., nouns, verbs) are repeated (e.g., Branigan, et al., 2000; Cleland & Pickering, 2003; Schoonbaert, Hartsuiker, & Pickering, 2007). For example, Branigan et al. found that

after hearing the confederate describe a picture card using the double-object (DO) form (e.g., *the pirate giving the swimmer the book*) participants were 26% more likely to use this same form when the verb was not repeated. When the verb was repeated, participants' were 55% more likely to use the same DO form (i.e., *lexical boost*). Such percolation between levels underlies the proposal that alignment at linguistic levels leads to aligned situation models. In addition to establishing how these levels interact within the individual (vertical arrows), the IAM also establishes the inter-connectedness of these levels between interlocutors (horizontal arrows) (see *Figure 1*).

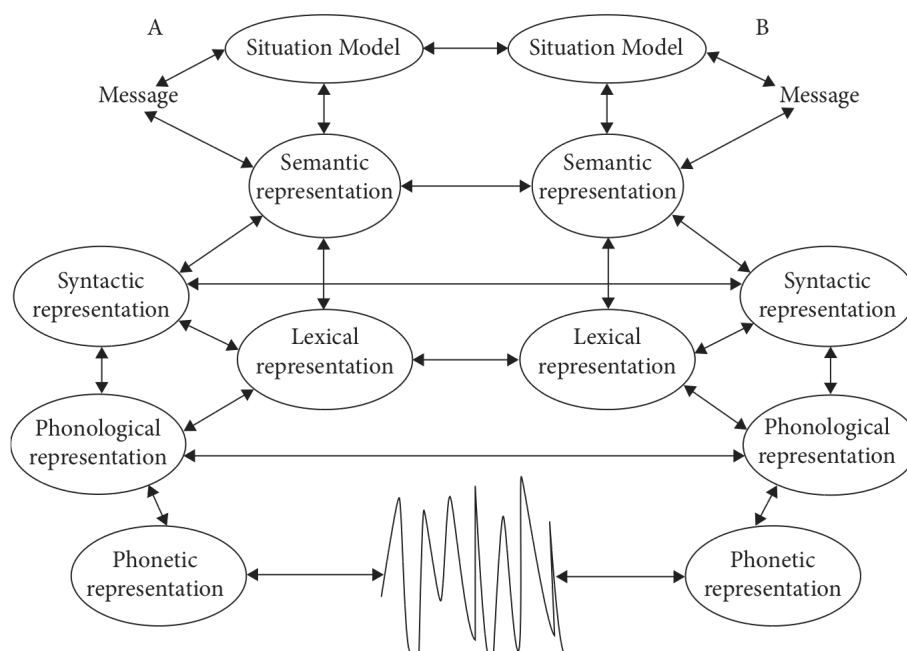


Figure 1. The Interactive Alignment Model. Reproduced from Pickering and Garrod (2004).

Direct priming links are posited to exist between the levels of representations across individuals. These priming links, as well as the assumption of percolation between the levels within an individual, led P&G to claim that what is activated during lexical alignment “roughly corresponds to a lexical entry” (Garrod & Pickering, 2007, p. 2), which incorporates lexical, syntactic, semantic, phonological and morphological information (Levelt, 1989). However, the exact locus of lexical alignment has not been empirically studied. As proposed by P&G, it may be the case that lexical alignment is due to activation of a lexical entry, which would suggest that it is partly

driven by the repetition of word-form. For example, if *A* refers to a person as a *cook* rather than a *chef*, the associated conceptual and lexical-phonological representations (e.g., /k/) are activated in *B*. This pattern of activation increases the likelihood that, if referring to the same person, *B* will re-use the term *cook*. Alternatively, due to the direct priming link between conceptual representations, it is possible that interlocutors re-use the same word for a referent because they have aligned on a certain conceptualization of that object (e.g., calling a vessel a *dish* rather than a *bowl* involves an alternative conceptualization of that object). This possibility is supported by Garrod and Anderson's (1987) finding that not only do interlocutors repeat each other's lexical choices; they also maintain the same interpretation of that word (e.g., using the word *line* to refer to a horizontal set of nodes in the maze, such as that displayed in *Figure 2*). Therefore, lexical alignment may be driven by a shared conceptualization (i.e., alignment at the conceptual level).

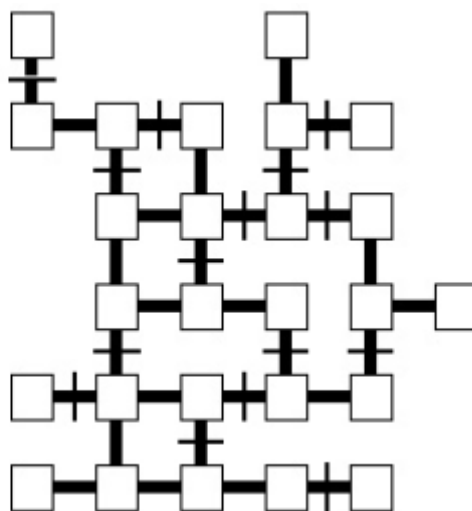


Figure 2. Example of a maze used in Garrod and Anderson (1987).

The IAM provides an elegantly simple model to account for the processes involved in dialogue; however, more rigorous testing of the mechanisms that underlie lexical alignment is needed. It is not enough to assume that lexical alignment occurs due to activation of the representations involved in a lexical entry (e.g., phonological, semantic, conceptual), such a proposal must be empirically investigated. The next section will focus on establishing how alignment may be partly driven by the repetition of word-form, and alternatively, how shared conceptualizations may drive lexical alignment. We will focus on each of these alternative views in turn.

The effect of the repetition of word-form on lexical alignment: Bidirectional flow from sub-lexical to lexical levels

In order to establish the possible impact of the repetition of word-form (i.e., the phonological sound) on lexical alignment, it is necessary to outline current theories regarding the flow of activation from sub-lexical to lexical levels. Word production is not an orderly process where only the intended word is activated. Instead, based on the assumption of spreading activation (Collins & Loftus, 1975), word production is quite chaotic with words that are semantically, or phonologically, related being activated simultaneously (e.g., Cutting & Ferreira, 1999; Dell, 1986; Levelt, 1989; Morsella & Miozzo, 2002; Peterson & Savoy, 1998). Models generally assume activation spreads between semantically related concepts (e.g., *HORSE*, *DONKEY*, *ZEBRA*) at the conceptual level and spreads to the lexical representations of these concepts (e.g., *horse*, *donkey*, *zebra*) (e.g., Levelt, 1989; Caramazza, 1997). The general assumption is that the intended word is successfully selected, as it receives the highest level of activation (e.g., Dell, 1990; Garret, 1980; Levelt, Roelofs, & Meyer, 1999; Roelofs, 1992).

Models tend to diverge with regards the activation between the lexical and sub-lexical (i.e., phonological segments) levels. Strictly *serial* models (e.g., Levelt, 1989; Levelt, et al., 1999; Levelt, et al., 1991; Schriefers, Meyer, & Levelt, 1990) propose that lexical selection occurs initially, with only the selected lexical representation activating its phonological properties. In contrast, *cascade* models (e.g., Costa, Caramazza, & Sebastian-Gallés, 2000; Costa, Miozzo, & Caramazza, 1999; Dell & O'Seaghdha, 1991; Navarrete & Costa, 2005; Rapp & Goldrick, 2000; Starreveld & La Heij, 1995, 1996) assume that any activated lexical representation spreads activation to sub-lexical (i.e., phonological) representations. According to these models, activation spreads forwards and backwards through the different levels of representation, with the activation of the phonological word-form of the target word (e.g., <*horse*>) spreading activation back to the lexical representation of the target word (*horse*) and to lexical representations of phonologically related words (e.g., *house*, *hose*).

In line with cascade models, the IAM postulates the existence of an interactive network with a bidirectional flow of activation between the levels of representation, as well as between individuals. As a result, they claim lexical alignment is enhanced

by the flow of activation from conceptual and phonological levels. For example, producing *palm* activates the representations associated with the lexical entry *palm* in *A*. Hearing *A* produce *palm* activates the representations associated with the lexical entry for *palm* in *B*, due to direct priming links between that semantic, lexical and phonological representation (e.g., phonology of *palm*, such as /p/ receives activation). As activation at these levels does not decay immediately and assuming percolation between the levels (e.g., flow of activation from the conceptual and sub-lexical levels), *B* is more likely to also use the word *palm* to refer to the picture, rather than the alternative name, *hand*. In other words, *A*, and *B* develop an aligned activation pattern across the various levels of representation. Therefore, lexical alignment may be partly driven by alignment at the sub-lexical level, as lexical representations receive activation from the conceptual and phonological overlap. However, alignment can also occur without the repetition of word-form with interlocutors aligning on a shared conceptualization of the referents under discussion.

Conceptual alignment and the role of shared conceptualizations in lexical alignment

When speakers choose a certain word to describe a referent, they are not only choosing a word, but are also proposing a specific conceptualization of that referent (Clark, 1987, 1988, 1990). For example, when interlocutors refer to *the sailboat* they are conceptualizing the object as a sailboat, not merely as a boat, or a generic sea vessel (Brown, 1958). However, meanings are negotiable such that the meanings reflected by lexical choice in conversation may not reflect the words' dictionary meanings (see Brennan, Galati, & Kuhlen, 2010; Schober, 1998). For example, interlocutors engaged in a referential communication task, in which they must describe abstract, tangram figures to each other (see *Figure 3*), develop various conceptualizations of these tangram figures, which is reflected in their idiosyncratic descriptions (see Table 1).

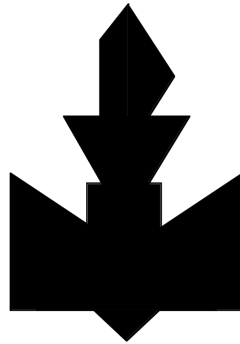


Figure 3. The tangram figure being described in Table 1.

Table 1

Examples of the varied referring expressions (taken from Brennan, 1996) used by interlocutors to describe the tangram figure in Figure 3.

“a bat”
 “the candle”
 “the anchor”
 “the rocket ship”
 “the Olympic torch”
 “the Canada symbol”
 “the symmetrical one”
 “shapes on top of shapes”
 “the one with all the shapes”
 “the bird diving straight down”
 “the airplane flying straight down”
 “the angel upside down with sleeves”
 “the man jumping in the air with bell bottoms on”

Furthermore, labelling a stimulus in a certain way may affect the memory representation associated with it (e.g., Daniel, 1972; Schooler & Engstler-Schooler, 1990; Schooler, Ohlsson, & Brooks, 1993). For example, the label heard to describe a line drawing (e.g., *stirrup* vs. *bottle*) results in participants’ distorting later reconstructions of that object towards the description heard (e.g., Carmichael, Hogan, & Walter, 1932; see *Figure 4*). Therefore, the choice of referring expressions proposes a certain conceptualization of a stimulus, and impacts the subsequent processing of this stimulus (see also Jörg & Hörmann, 1978). Based on these findings, it seems plausible that interlocutor’s lexical choice may reflect underlying shared conceptualizations

(i.e., conceptual alignment), which may enhance the likelihood that they will use the same term to refer to that object.



Figure 4. Example of participant's drawings after hearing the central line drawing being called either a *bottle* (left picture) or a *stirrup* (right picture). Reproduced from Clark (1997, p. 5).

Conceptual alignment is difficult to establish as it relies on indirect evidence of its occurrence, unlike linguistic alignment (e.g., it is clear when interlocutors have aligned at the syntactic level as they tend to re-use the syntactic constructions used by their partner³). However, it has been found that alignment is not restricted to linguistic levels of representations and also occurs at meaning-related levels of representation, such that interlocutors not only tend to re-use the same words, they also tend to interpret words in the same way (e.g., interpret *row* as a reference to a horizontal set of nodes in the maze; Garrod and Anderson, 1987). Garrod and Anderson had pairs of participants partake in a computerized maze game task. In this collaborative task, participants were required to move their positional markers through the maze, made up of interconnected nodes (see *Figure 2*) in order to reach a “goal” node. Some of the paths in the maze were blocked by “gates”, which the participants had to open by guiding each other on to “switch” nodes. As both participants were required to refer to their locations on the maze, Garrod and Anderson analyzed the transcripts of the dialogue to investigate how location description schemes developed throughout the game. They found that pairs of participants converged on a particular description scheme. For example, if one player used the description, *I'm three along, one up*, her partner tended to use this *path* description scheme when it was his turn to describe his position on the maze *I'm one along, two up*. Alternatively, if one player used a *co-*

³ It must be pointed out that, as noted by Costa et al. (2008), interlocutors can be aligned at a certain level of representation without any overt evidence of such alignment. For example, if the speaker uses the term *seat* to refer to an object, rather than *chair*, their partner may have aligned on this referring expression even if, throughout the course of the conversation, they do not overtly produce the word *seat*.

ordinate description scheme (e.g., *I'm at C4*), her partner also adopted this type of description (e.g., *I'm at A2*). By aligning on one of these description schemes, the interlocutors were also aligning on common conception (i.e., a shared conceptual representation) of the maze configuration (i.e., conceptual alignment). Such alignment does not occur at the lexical level, as people align on a co-ordinate scheme that does not rely on the repetition of lexical items (e.g., *A1* primes the use of a similar description scheme such as *D5*, without the repetition of lexical items). This finding indicates that conceptual alignment can occur without the repetition of lexical items.

Table 2

Excerpt of dialogue transcript from Garrod and Anderson (1987)

-
- (1) **B:** OK Stan, let's talk about this. Whereabouts – whereabouts are you?
 (2) **A:** Right: er: I'm: I'm **extreme right**.
 (3) **B:** **Extreme right**.

- (8) **A:** You know the **extreme right**, there's one box.
 (9) **B:** Yeah right, the **extreme right** it's sticking out like a sore thumb.
 (10) **A:** That's where I am.
 (11) **B:** It's like a **right indicator**.
 (12) **A:** Yes, and where are you?
 (13) **B:** Well I'm er: that **right indicator** you've got.
 (14) **A:** Yes.
 (15) **B:** The **right indicator** above that.
 (16) **A:** Yes.
 (17) **B:** Now if you go along there. You know where the **right indicator** above yours is?
 (18) **A:** Yes.

-

This shared conceptualization of the maze configuration also led to the repetition of lexical choice. Participants tended to use the same word (e.g., *right indicator*) to refer to the certain part of the maze (see Table 2). Once a word had been used with a particular interpretation it was not normally used with a different interpretation (e.g., if *line* has been used to refer to a horizontal row of nodes, it would not be used to refer to a vertical column). This is related to Clark's (1993) *principle of contrast*, which proposes that any new word that is introduced is assumed to have a

different interpretation from the previous word. It seems that conceptual alignment (i.e., a shared conceptualization of the configuration of the maze) leads to the development of a sub-language (i.e., a restricted set of terms), which constrains the variability in lexical choice and interpretation, and may drive lexical alignment.

Further investigations of alignment of spatial representations have shown that interlocutors also tend to align on the interpretation of spatial expressions such as *left* and *right* (Schober, 1993, 1995; for a review of spatial language in dialogue see Coventry, Tenbrink, & Bateman, 2009). Similarly, Watson, Pickering, and Branigan (2004) found that pairs of participants aligned their spatial representations during dialogue. For example, after hearing the confederate produce an *intrinsic* reference frame to describe an object's location (e.g., *the dot right of the camera*), participants were more likely to use an intrinsic reference frame, rather than an alternative *relative* reference frame (e.g., *the dot above the camera*). Crucially, by altering the participant's perspective, this study demonstrated that alignment of spatial reference frames was not due to lexical priming (i.e., the effect was not due to the participant repeating the preposition (e.g., *right* or *above*) used by the confederate). Taken together, the results show that, independent of the repetition of lexical items, alignment extends beyond the linguistic levels of representation and can occur at meaning-related levels (i.e., conceptual level).

It must be noted that alignment on description schemes, and spatial reference frames, is only one aspect of conceptual alignment, which deals with abstract, spatial conceptualizations. It could be argued that having participants refer to their position on a maze, or even describing abstract tangram figures to one another, imposes unnatural demands on the language resources of the individuals. As such tasks are quite complex, the efficiency gained by a successful reference to location on the maze is particularly high. Furthermore, the range of possible conceptualizations for a maze, or a tangram figure, is a lot larger than for normal, everyday objects. Possible conceptualizations, and hence linguistic choices, are much simpler in natural dialogue (e.g., referring to an animal as a *sheep* or a *lamb*). Horton and Gerrig (2002) refer to such an observation as reflecting a difference in *linguistic codability* (i.e., extent to which there is common agreement among native speakers about what to call a given object; see Lachman, Shaffer, & Hennrikus, 1974). They suggest that as abstract objects (e.g., tangrams) have relatively low linguistic codability, interlocutors must depend more strongly on the interaction to develop a shared conceptualization of that

item. On the other hand, everyday objects are more lexicalized and are linked with similar representations across individuals.

At linguistic levels (e.g., lexical level), the comprehension of a word directly activates the same lexical representation of that word in the addressee's mind. It can be assumed that the lexical representation associated with that word is the same in both interlocutors. Arguably, interlocutors do not enter a dialogue with similar conceptualizations of a maze; hence, direct priming between such conceptual representations may not occur. However, conceptual representations of everyday things are generally shared between individuals (e.g., it can be assumed that the word *horse* will activate the same semantically related concepts, such as *DONKEY*, *ANIMAL*, *MARE*, more strongly than unrelated concepts, such as *DOOR* across individuals). Therefore, the semantic network of activation should be similar across individuals, making it possible for priming mechanisms to operate at this level of representation. As alignment of spatial language is more related to abstract conceptualizations of space, this direct priming link, proposed by P&G (see *Figure 1*) to exist between the conceptual/semantic representations of interlocutors has not been empirically tested at the level of more natural, and arguably more simplistic, level of aligning on a conceptualization of an everyday referent (e.g., *sheep* vs. *lamb*).

Such a direct priming link between the conceptual representations of interlocutors would strengthen the argument that lexical alignment may be wholly driven by conceptual alignment. According to Levelt (1989), conceptualization (i.e. formulation of the pre-verbal message) is the only process in language production that is controlled, with the processes at other levels being more automatic. In comparison to monologue, conceptualization in dialogue is distributed between the interlocutors, which may make this process more automatic (Garrod & Pickering, 2007). Conceptual alignment may work to limit the number of potential semantic representations activated, which in turn limits the number of associated lexical representations available for selection, leading to more automatic lexical selection, and hence lexical alignment. The IAM does not claim that alignment removes the need for intentional control of lexical selection; it claims that comprehending a word, or aligning on a concept, makes it more likely for this word, or conceptualization, to be re-used. Therefore, even though interlocutors may be aware of the concept inherent in the lexical choice of their partner (e.g., describing a picture of a man in a robe using the word *priest* rather than *monk*), this does not make the process of lexical alignment

any less automatic. Such distributed message planning may underlie the ease of conversation compared with monologue. If interlocutors align on the conceptualization of a certain object as a *desk* rather than a *table*, then lexical alignment may reflect this conceptual alignment. These issues can be disentangled by comparing alignment for words that share the same both meaning and word-form (i.e., words within a language), and words that share meaning but not word-form (i.e., non-cognate translation equivalents).

In order for conceptual alignment to occur cross-linguistically, it is important to establish that conceptual representations are shared between the bilingual's two languages and that this shared concept activates lexical representations in both languages.

Language integration in the bilingual mind

There is general consensus in the literature that bilinguals have a shared conceptual store and that each conceptual representation is connected to separate lexical representations for non-cognates (e.g., De Bot, 1992; De Groot, 1992, 1993; Green, 1986; Kroll & Stewart, 1994; Kroll & Tokowicz, 2001; cf. Kolers, 1963; Kolers & Paradis, 1980, for a review see Francis, 2005; Gollan & Kroll, 2005). Support for this proposal of a shared conceptual store comes from numerous studies that have found cross-language semantic priming (e.g., Chen & Ng, 1989; De Groot & Nas, 1991; Grainger & Beauvillain, 1987; Keatley, Spinks, & De Gelder, 1994). Semantic priming refers to the facilitation of lexical decision (i.e., deciding whether a presented string of letters is a word or a non-word) when the target word is preceded by a semantically related prime word, compared with an unrelated prime word. For example, in a group of Spanish-English bilinguals, Schwanflugel and Rey (1986) found faster lexical decisions when the semantically related prime (e.g., *body*) was in the same language as the following target word (e.g., *arm*), or in a different language (e.g., *brazo* [arm]). The interpretation of these results is that the presentation of the prime activates some of the same conceptual representations as those activated by the target word, which in turn facilitates lexical decision. This finding of a shared conceptual store is essential for the design of this study to work. It would not be

possible for cross-language conceptual alignment to occur if conceptual representations were not integrated in the bilingual mind.

This shared conceptual store is proposed to spread activation in parallel to the lexical representations of the two languages (i.e., language non-selectivity; e.g., Gollan & Acneas, 2004; Jared & Kroll, 2001; Schwartz & Arêas da Luz Fontes, 2008). Cross-language lexical activation has been found in studies focusing on word production (e.g., Colomé & Miozzo, 2010; Costa, Santesteban, & Ivanova, 2006, Hermans, Bongeaerts, De Bot, & Schreuder, 1998) and word comprehension in the visual modality (e.g., Dijkstra, Grainger, & Van Heuven, 1999; L hmofer & Dijkstra, 2004; Van Heuven, Dijkstra, & Grainger, 1998) and in the auditory modality (e.g., Blumenfeld & Marian, 2007; Cutler, Weber, & Otake, 2006; Marian & Spivey, 2003a, 2003b). For example, in an adaptation of the phoneme-monitoring task (developed by Wheeldon & Levelt, 1995) used by Colom  (2001), Catalan-Spanish bilinguals were presented with a target picture (e.g., “taula” [“table” in Catalan]) and required to decide if a certain phoneme (e.g., /m/ or /f/) was present in the Catalan name of this picture. They found it was harder for the participants to reject a given phoneme (e.g., /m/) if this phoneme was present in the Spanish translation of the name for the picture (e.g., “mesa” [“table” in Spanish]), than when it was not (e.g., /f/). Although such effects are located at sub-lexical levels (i.e., phonological representations), “the only way they can be explained is by appealing to the previous lexical stage” (Colom , p. 730). Taken together, these studies suggest that words from the bilinguals’ two languages are simultaneously activated by a shared conceptual representation. This conclusion suggests that when an Irish-English bilingual is speaking in Irish, not only are Irish words activated, but English words are also activated. Such an integrated and interactive approach to bilingual representation accords well with the interactivity proposed by the IAM. The existence of a shared conceptual store, and parallel activation of lexical representations, allows alignment at the conceptual level to be reflected irrespective of the language of use, and independent of the repetition of word-form. Furthermore, the above studies suggest that the bidirectional flow between the levels of representation proposed by the IAM can extend to the bilingual’s two languages.

To summarize, in this section we have outlined how the IAM proposes to account for the phenomenon of lexical alignment and discussed how such alignment may be partly driven the repetition of word-form or wholly driven by conceptual

alignment. Evidence that bilinguals' have a shared conceptual store for the two languages was highlighted in order to establishment that conceptual, between-language alignment is possible. We now shift our focus to the secondary aim of this study, which is to investigate alignment in a second language.

Alignment in a Second Language

Given the widespread nature of bilingualism, many conversations involve one of the interlocutors speaking in their non-dominant language (L2) (henceforth, L1-L2 dialogue) or indeed both interlocutors speaking their L2 (L2-L2). It can be assumed that conversations with non-native speakers (NNSs) with a low proficiency in their L2 will be generally less fluent than those involving monolingual speakers, or those involving competent L2 speakers. Costa et al. (2008) note that dialogue is difficult for NNSs, or second language learners, due to "restricted vocabulary, word-finding problems, faulty prosody, incomplete knowledge of grammar, and so on" (p. 529). As a result of such limited linguistic competence, NNSs may deliberately avoid aligning with their interlocutor in L1-L2 dialogue, as they may not know the word. On the other hand, NNSs generally have a goal of learning and use conversations with native speakers to facilitate L2 learning (e.g., Gass, 2003). Therefore, they may deliberately align to a greater extent with the native speaker.

With regards the native speaker in L1-L2 dialogue, such non-automatic alignment may also be evident, such that the native speaker adapts his/her speech based on their beliefs about the NNS's language knowledge (i.e., "foreigner talk", e.g., Gass, 1997; Larsen-Freeman & Long, 1991; Pica, 1994). For example, Bortfeld and Brennan (1997) found that native speakers lexically aligned with non-native speakers, even when this involved using highly disfavoured, inappropriate referring expressions (e.g., referring to the wheels of an office chair as *tires*). Similarly, Ivanova, Costa, Pickering, & Branigan (2007, as cited in Costa et al., 2008) found native speakers were twice as likely to use a disfavoured name for a picture (e.g., *dish* rather than *bowl*) when interacting with a NNS than with another native speaker. This alignment via one's beliefs about the language knowledge of the interlocutor is further supported by studies examining human-computer interaction (HCI) which show that people align to a greater extent with computers, rather than with human partners due

to the assumption of limited linguistic competence (e.g., Branigan, et al., 2004; Pearson, Hu, Branigan, Pickering, & Nas, 2006; for a review, see Branigan, et al. 2010). Similarly, speakers adjust their speech to experts vs. novices (Isaacs & Clark, 1987; see also Fussell & Krauss, 1992). Such conscious decisions to align, or not align, are non-linguistic, non-automatic routes to alignment and, are cognitively costly.

Costa et al. (2008) focus their discussion on the potential automatic and non-automatic paths to alignment in L1-L2 and L2-L2 dialogue. However, what is directly relevant to this paper is their prediction that “when the L2 speaker is more proficient, L1-L2 dialogues will be more similar to L1-L1 interactions...[and they] predict that automatic linguistic alignment should take place relatively normally in both speakers” (p. 548). Unlike NNSs, proficient bilinguals do not have restricted knowledge or a goal of learning. Therefore, it is unlikely that they should consciously choose to align, or not align, as NNSs are proposed to do, and alignment should be largely automatic. This assumption leads to the proposal that, in proficient bilinguals, the magnitude of alignment should be the same in their L1 and L2.

The role of language dominance in alignment

In their paper on alignment in a second language, Costa et al. (2008) suggest that NNSs, with a low proficiency, may fail to align with their native speaker interlocutor on the use of an infrequent word. As the NNSs would have infrequently used this word its representation is, thus, less available. However, in this study, the unbalanced, English-dominant bilingual group had acquired Irish before the age of 5 and were reasonably proficient. Therefore, the situation may be quite different. There is evidence in the bilingual literature that bilinguals have weaker links between conceptual and lexical representations in their non-dominant language (e.g., Gollan, Montoya, & Werner, 2002; Gollan & Silverberg, 2001; Gollan, Montoya, Fennema-Notestine, & Morris, 2005; Kroll & Stewart, 1994). However, for the current study, language proficiency and dominance may be best characterized as a frequency phenomenon. In monolingual research, less frequently used words benefit more from repetition, or priming, than low-frequency words, due to a lower resting level of activation (Griffin & Bock, 1998). Therefore, such words benefit more from priming,

compared with high-frequency words that are closer to ceiling levels of activation. Kroll, Bobb and Wodniecka (2006) suggest that an analogy can be drawn between low frequency words and representations in the bilingual's less dominant language. Therefore, Kroll et al. suggest that priming will show a greater boost in the less active L2, than the more active L1. Such a suggestion is in line with usage-based accounts of language use that suggest the frequency of usage of word (or construction) impacts its representation in the language system (see Croft & Cruse, 2004; Theakston, 2004). Such a proposal can also apply to bilingualism (see Hernández, Li, & MacWhinney, 2005). Due to the less frequent use of their non-dominant language, linguistic preferences in L2 are less well established, or less "entrenched". In other words, due to the less frequent practise of referring to objects in their L2, unbalanced bilinguals may not display the same linguistic tendencies demonstrated by balanced bilinguals, or monolinguals of that language (e.g., preference of referring to a picture of a chair as a *chair* rather than a *seat*). In unbalanced bilinguals, this preference to use *chair* is less entrenched in their L2, and so is less resistant to being replaced by a disfavoured name (*seat*). Therefore, unbalanced bilinguals may be more susceptible to priming, and hence show greater alignment in their L2. In the case of balanced bilinguals, the activation of the more entrenched form, or preference, is harder to overcome and therefore, they may be less likely to align. With regards the current study, we propose the tentative hypothesis that unbalanced bilinguals will align to a greater extent in their non-dominant language than balanced bilinguals, due to enhanced benefits of priming for this less active language, as well as the suggestion that their linguistic preferences will be less entrenched.

The Current Study

In this study, we aim to further examine the locus of lexical alignment, in order to establish whether such alignment is wholly driven by conceptual alignment or whether it is partly driven by the repetition of word-form. We have suggested that lexical alignment may be driven by an activation pattern across many levels of representation (i.e., conceptual, lexical and phonological), with the repetition of word-form boosting lexical alignment. However, as the impact of each level of representation cannot be disentangled (as words are inherently connected to their

conceptual and phonological representations), it may be the case that lexical alignment is driven by conceptual alignment. According to this approach, lexical alignment reflects the interlocutors shared conceptualization of the object/person under discussion. In order to investigate whether lexical alignment is driven by conceptual alignment, or whether it is partly driven by the repetition of word-form, we examined lexical alignment in two groups of bilingual speakers both within- and between-languages using non-cognate translation equivalents (i.e., words that share meaning but not word-form)⁴. Because translation equivalents are highly similar in meaning, if lexical alignment is wholly driven by conceptual alignment (i.e., shared conceptualizations), the magnitude of the alignment effect should be the same within- and between-languages. On the other hand, if lexical alignment is partly driven by the repetition of word-form, alignment effects should be greater within-, rather than between-languages. This would be due to lexical representations receiving activation from priming at many levels within-language (e.g., phonological and conceptual overlap), compared with between-languages where the only source of activation is conceptual in nature (for non-cognates).

As lexical alignment has not been studied in a bilingual population before, this design is also ideal for assessing the alignment effects in a second language. Although the IAM does not make specific predictions regarding bilingual dialogue, Costa et al. (2008) proposed that when bilinguals are competent in both their languages, the mechanisms of alignment should operate the same in their two languages. Therefore, a subsidiary aim of this study was to examine whether bilinguals align to the same extent in their dominant and non-dominant languages, and whether this is impacted by the degree of proficiency in the non-dominant language. We tested two groups of bilinguals: highly proficient Irish-English bilinguals, and English-Irish bilinguals who had a lower proficiency in Irish, which were divided into such groups based on their responses in a detailed language history questionnaire. Reasonable proficiency was required to ensure they were familiar with all the words used in the experiment in order to prevent disrupted alignment due to incomplete knowledge and to reduce the risk of them consciously choosing to align as a learning strategy, as outlined in the section on alignment in a second language.

⁴ A similar approach, exploiting translation equivalents, was used by Schoonbaert et al. (2007) in order to disprove Griffin and Weinstein-Tull's (2003) assertion that the lexical boost observed in syntactic priming studies may in fact be due to semantic similarity between the prime and target forms.

The task used in this study was closely modelled on that used by Branigan, Pickering, Pearson, McLean, & Nas (in preparation). In this task, pairs of participants were seated opposite each other, separated by a head-high screen, and told they were to engage in a dialogue game in which they would take turns to name pictures, and match pictures to their partner's names. On matching trials, participants were required to respond to their partner's description by saying which side of the page the named picture was displayed on (e.g., "*left*" or "*right*"). This feedback ensures that participants know their partner has understood their description, and has selected the appropriate picture. (For a discussion of the effects of feedback in successful dialogue, see Bavelas, Coates, & Johnson, 2000). Unbeknownst to the actual, naïve participant, their partner was actually a confederate of the experimenter who read from a script (i.e., confederate-scripting technique; Branigan, et al., 2000).

Experimental trials involved the presentation of pictures that could be accurately described by two alternative names, which were non-cognate translation equivalents in Irish and English. Cognates were not included in the experiment as they share similar phonology and orthographical properties and might induce priming independent of meaning. One of these terms was the strongly favoured name for the picture (in both languages); however, the disfavoured name was also completely acceptable (in both languages). This task is ideal to investigate conceptual alignment as picture naming is found to be conceptually mediated (e.g., Durso & Johnson, 1979; Potter & Faulconer, 1975) in both a bilingual's dominant and non-dominant language (e.g., Chen & Leung, 1989; Kroll & Stewart, 1994; Potter, So, Von Eckardt, & Feldman, 1984).

We also manipulated the language used to name the prime picture (i.e., confederate's description) and the language used to name the target picture (i.e., participant's description) by placing either an Irish flag or a Union Jack flag underneath the picture to be named. On within-language trials, the prime and target pictures were named in the same language (i.e., Irish-Irish, English-English). On between-language trials, the prime and target pictures were named in different languages (i.e., Irish-English, English-Irish). This manipulation allowed us to examine whether alignment was greater within- or between-languages, and also allowed the investigation of alignment in the bilinguals' dominant and non-dominant languages. We measured alignment by comparing the proportion of target responses on which the

participants used the same name as the confederate, compared with the proportion of target responses on which they used a different name.

Unlike the choice of syntactic constructions which go largely unnoticed, interlocutors may be more aware of the meaning encoded in their own utterances and whether it matches the meaning of the word produced by their partner. Therefore, a post-experimental questionnaire was devised to establish participant's conscious awareness of alignment. This questionnaire also queried their use of a strategy, assumptions of the goal of the task, and any suspicions they may have had about the identity of the confederate. It is important that participants did not figure out the actual purpose of the task or suspect that the confederate was not a genuine participant.

To recap, we have two main aims in the current study, which can be summarized as follows:

- (1) Is the extent of lexical alignment the same within- and between-languages?
- (2) Do bilinguals align to the same extent in their dominant and non-dominant language, and is this impacted by proficiency?

With regards the first aim, by examining the extent of alignment both within- and between-languages, it is possible to isolate the contribution of conceptual alignment to lexical alignment. Such a design also allows investigation of the influence of the repetition of word-form on alignment. If lexical alignment is wholly driven by conceptual alignment (i.e., shared conceptualizations), the alignment effect should be the same within- and between-languages. If lexical alignment is partly driven by the repetition of word-form, alignment effects should be greater within-, rather than between-languages. If alignment does occur between-languages it also provides evidence for the existence of a direct priming link between conceptual representations across individuals.

Our second aim is to examine the extent of lexical alignment in the bilingual's two languages. More specifically, the question is whether bilinguals align to the same extent in their dominant (L1) and non-dominant language (L2)? We further assessed whether this alignment is impacted by the degree of proficiency in each language. In line with Costa et al. (2008), we hypothesize that proficient bilinguals will align to the

same extent in their L1 and L2. Less proficient bilinguals are hypothesized to align more in their L2 than their L1, due to less exposure to the non-dominant language.

Method

Participants

Thirty-two bilinguals, with no history of language or speech disorders, from the National University of Ireland, Galway community were paid €5 to participate in the experiment (mean age = 21.8 years ($SD = 3.51$), range 17-30 years). The participants were divided into two groups (i.e. *balanced* and *unbalanced bilinguals*) on the basis of their responses on a language history questionnaire (largely based on Dunn and Fox Tree (2009) and Li, Sepanski and Zhao (2006) (see Appendix A). The language background characteristics of the two groups are shown in Table 3. Across the different measures it is indicated whether there was a significant difference between the two groups.

Balanced bilinguals. Sixteen of the participants (7 males, 9 females) were proficient bilingual speakers who lived in a Gaeltacht (i.e., Irish-dominant, bilingual region), and spoke Irish, or a mixture of Irish and English, at home. They had acquired both Irish ($M = 0.06$ years, $SD = 0.25$) and English ($M = 1.88$, $SD = 2.25$) at an early age and had received a minimum of thirteen years formal education in both languages. A section of the questionnaire required participants to rate how often they used both their languages (i.e. frequency of usage) in an academic context and in a social context during childhood, adolescence and nowadays using a 5-point scale (1 = never, 5 = very frequently). Overall, there was no significant difference ($t(15) = 0.33$, $p = 0.75$) between the frequency of usage of Irish ($M = 3.99$, $SD = 0.67$) and English ($M = 4.05$, $SD = 0.47$). Participants self-evaluated their language proficiency by rating their speaking, listening, reading and writing ability in each of their languages using a 7-point scale (1 = very poor/ no ability, 7 = excellent/ native-like). Self-evaluated proficiency scores show that this group of bilinguals were highly proficient in both Irish ($M = 6.38$, $SD = 0.75$) and English ($M = 6.39$, $SD = 0.83$). There was no significant difference between their self-evaluated proficiency in both languages (t

(15) = 0.09, $p = 0.93$). Based on their responses to questions incorporated into the questionnaire from Dunn and Fox Tree's (2009) 'Bilingual Dominance Scale', this group of bilinguals were classed as *balanced bilinguals*.

Unbalanced bilinguals. A further sixteen participants (10 males, 6 females) were less proficient bilinguals who reported living in a monolingual community where English was the dominant language. These bilinguals had acquired English from birth, but reported learning Irish in early childhood ($M = 4.81$ years, $SD = 1.11$). Similar to the balanced bilinguals group, this bilingual group had received a minimum of thirteen years formal education in both languages. These bilinguals reported using English ($M = 4.96$, $SD = 0.17$) significantly more frequently than Irish ($M = 2.32$, $SD = 0.66$) ($t(15) = 14.58$, $p < .001$). The self-evaluation of language proficiency revealed they were significantly more proficient in English ($M = 6.84$, $SD = 0.41$) than in Irish ($M = 4.70$, $SD = 0.97$) ($t(15) = 16.86$, $p < .001$). However, they were reasonably proficient in Irish and would certainly have known the names and translations of all the experimental material used. Based on their responses on the language history questionnaire this group of bilinguals were classed as English-dominant, *unbalanced bilinguals*.

These participants are referred to as *naïve participants* to distinguish them from the confederate who also participated in the dialogue game. A male Irish-English bilingual, of comparable age, served as the confederate for all experimental sessions. The confederate was highly proficient in both Irish and English.

Table 3
Language background characteristics of the balanced and unbalanced bilingual groups

Measure	Group				Between-group statistics
	Balanced		Unbalanced		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Age	21.4	(3.36)	22.2	(3.51)	
<u>English</u>					
Age of acquisition (in years)	1.88	(2.25)	0.00	(0.00)	***
Years of formal education	13.56	(2.97)	13.88	(1.93)	
Self-rated speaking ability ^a	6.25	(0.86)	6.94	(0.25)	**
Self-rated listening ability ^a	6.56	(0.87)	6.88	(0.34)	
Self-rated reading ability ^a	6.50	(0.82)	6.81	(0.40)	
Self-rated writing ability ^a	6.25	(1.00)	6.75	(0.58)	
Overall self-rated proficiency	6.39	(0.83)	6.84	(0.41)	*
Frequency of usage in an academic context ^b	3.77	(0.63)	4.92	(0.33)	***
Frequency of usage in a social context ^b	4.33	(0.68)	5.00	(0.00)	***
Overall frequency of usage	4.05	(0.47)	4.96	(0.17)	***
<u>Irish</u>					
Age of acquisition (in years)	0.06	(0.25)	4.81	(1.11)	***
Years of formal education	13.31	(1.62)	13.06	(1.44)	
Self-rated speaking ability ^a	6.44	(0.63)	4.50	(0.97)	***
Self-rated listening ability ^a	6.63	(0.50)	4.81	(1.33)	***
Self-rated reading ability ^a	6.31	(0.87)	4.81	(0.66)	***
Self-rated writing ability ^a	6.13	(0.89)	4.69	(0.70)	***
Overall self-rated proficiency	6.38	(0.75)	4.70	(0.94)	***
Frequency of usage in an academic context ^b	3.88	(0.80)	2.79	(0.70)	***
Frequency of usage in a social context ^b	4.10	(0.70)	1.85	(0.86)	***
Overall frequency of usage	3.99	(0.67)	2.32	(0.66)	***

^a Seven-point scale (1 = no ability, 7 = native-like ability)

^b Five-point scale (1 = never, 5 = very frequently)

Note. The *p*-values reported indicate whether there was a significant difference between the two groups on each measure, which was assessed using independent samples t-tests.

* $p < .05$, ** $p < .01$, *** $p < .001$

Material

Experimental items. Thirty-two experimental items were constructed, which consisted of a prime picture and an identical target picture. Prime and target pictures were paired with different distractor pictures. Each experimental picture could be labelled using two alternative names, a highly favoured name and a fully acceptable but disfavoured name. These alternative names were non-cognate translation equivalents in English and Irish. For example, one item consisted of a prime picture of a chair/ seat, a distractor picture of a feather, the two alternative names for the prime picture in English (e.g. *chair* and *seat*) and in Irish (e.g. *cathaoir* and *suíochán*), the target picture of a chair/ seat, and a distractor picture of a door (see *Figure 5*).

Pretests. In order to generate the experimental items, three pretests were run to establish prime/ target pictures that could be labelled using two alternative names, one of these names was highly favoured to describe the picture, but the disfavoured name was also completely acceptable. A fourth pretest was run to ensure that the alternative names in English and Irish were indeed translation equivalents.

All participants in the pretests were drawn from the same population as those used in the actual experiment. No participant took part in more than one pretest, nor did any of these participants partake in the actual experiment. For all four pretests the presentation of material was randomized individually for each participant.

For the first pretest, 122 black and white line drawings (taken from Snodgrass & Vanderwardt, 1980 and other sources) were selected that could potentially be labelled with more than one name. Ten participants were asked to generate as many names as possible for each picture in English, and a further ten participants generated possible names in Irish. Pictures with alternative names that were generated by 70% of participants, and had a non-cognate translation equivalent in the other language, were selected (English names: $M = 77.75\%$, $SD = 0.90$; Irish names: $M = 78.20\%$, $SD = 1.03$). This resulted in 74 pictures being included in the second pretest.

For the second pretest, ten participants rated how acceptable each alternative English name was to label that picture on a 7-point scale (1 = completely unacceptable, 7 = completely acceptable). Another ten participants rated how acceptable each alternative Irish name was for that picture. Sixty-one pictures with two alternative names that had translation equivalents in Irish and English were

selected. Each name had an acceptability rating of more than 4.5 (English names: $M = 5.79$, $SD = 1.22$; Irish names: $M = 5.94$, $SD = 1.08$).

For the third pretest, ten participants indicated on a forced choice task which of the two alternative English names they would use to name each picture. Another ten participants completed this task in Irish. Forty-one pictures were selected that had one English name favoured by at least 70% of the participants ($M = 83.66\%$, $SD = 11.56$), and had a translation equivalent in Irish that was also favoured by at least 70% ($M = 83.17\%$, $SD = 11.28$) of the participants.

In the final pretest, to ensure that the two alternative names were indeed translation equivalents, seven participants translated the names from English to Irish, and a further seven participants translated the names from Irish to English. Names that were translated in the same way by at least 6 out of 7 participants were included as experimental stimuli. The complete list of experimental items is provided in Appendix B.

Filler items. In addition to the experimental items, 104 filler items were constructed, which consisted of a picture to be named and a distractor picture, and the picture to be matched, and a different distractor picture. For example, one item consisted of a picture of a fork, paired with a distractor picture of an accordion; and the same picture of a fork paired with a distractor picture of a car. Fillers were included in order to make the relationship between primes and targets less apparent. Additional pictures, that only had one name, were selected to serve as distractor pictures and these were paired with prime/ target pictures. All filler and distractor pictures were drawn from a pool of 172 pictures. As experimental items were repeated (i.e., prime picture was repeated as the target picture), 53 of the filler pictures were also repeated twice (i.e., displayed on a confederate naming turn and a participant naming turn). This was done to ensure participants' attention was not drawn to the critical trials. Eight items were also constructed to serve as practice stimuli, which provided four practice trials.

To mirror the experimental trials, the filler trials and practice trials were divided into four conditions based on the language used by the confederate and the language subsequently used by the naïve participant, such that for half of the filler trials, the language used by the confederate to name a picture was the same as the language used by the participant to name a subsequent picture (i.e. English-English,

Irish-Irish). In the other half, the language used by the confederate and subsequently by the participant was different (i.e. English-Irish, Irish-English).

Conditions

There were eight conditions which differed with respect to whether the language used to name the prime picture was English or Irish (i.e. prime language), whether the language used to name the target picture was English or Irish (i.e. target language) and whether a favoured or a disfavoured name was used as a prime (i.e. prime type). Hence, the eight conditions consisted of a combination of three factors: Prime Language (English vs. Irish), Target Language (English vs. Irish), and Prime Type (Favoured vs. Disfavoured). The confederate described the target picture using the favoured name for half of the experimental items, and the disfavoured name for the other half. Fully crossing the factors yielded both within-language (i.e., Irish Prime Language/ Irish Target Language; English Prime Language/ English Target Language) and between-language (i.e., English Prime Language/ Irish Target Language; Irish Prime Language/ English Target Language) trials. In within-language trials, the prime language and the target language was the same. For example, in an English within-language trial (English Prime Language/ English Target Language), the confederate named the prime picture of a chair/ seat in English (*chair*), and the participant was subsequently required to name the target picture of a chair/ seat in English. In between-language trials, the prime language and the target language were different. For example, in an Irish-English between-language trial (Irish Prime Language/ English Target Language), the confederate named the prime picture of a chair/ seat in Irish (*suíochán*), and the participant was subsequently required to name the target picture in English.

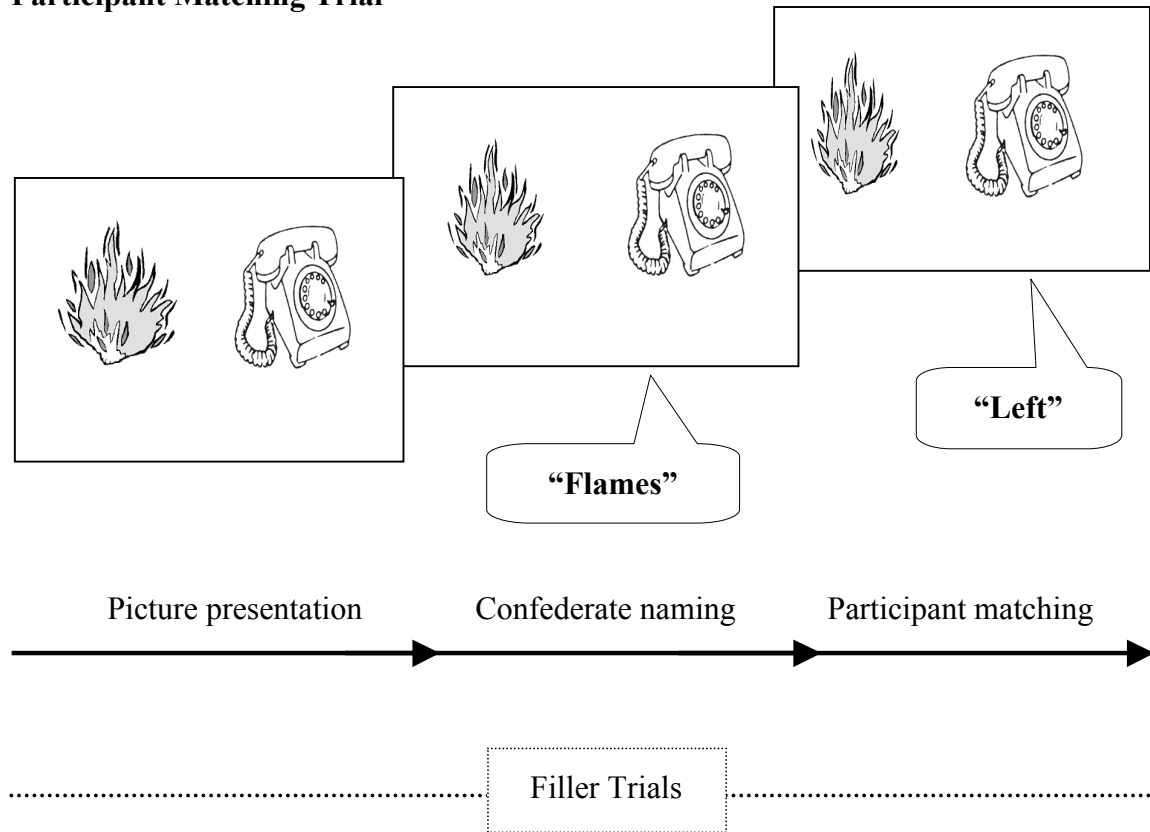
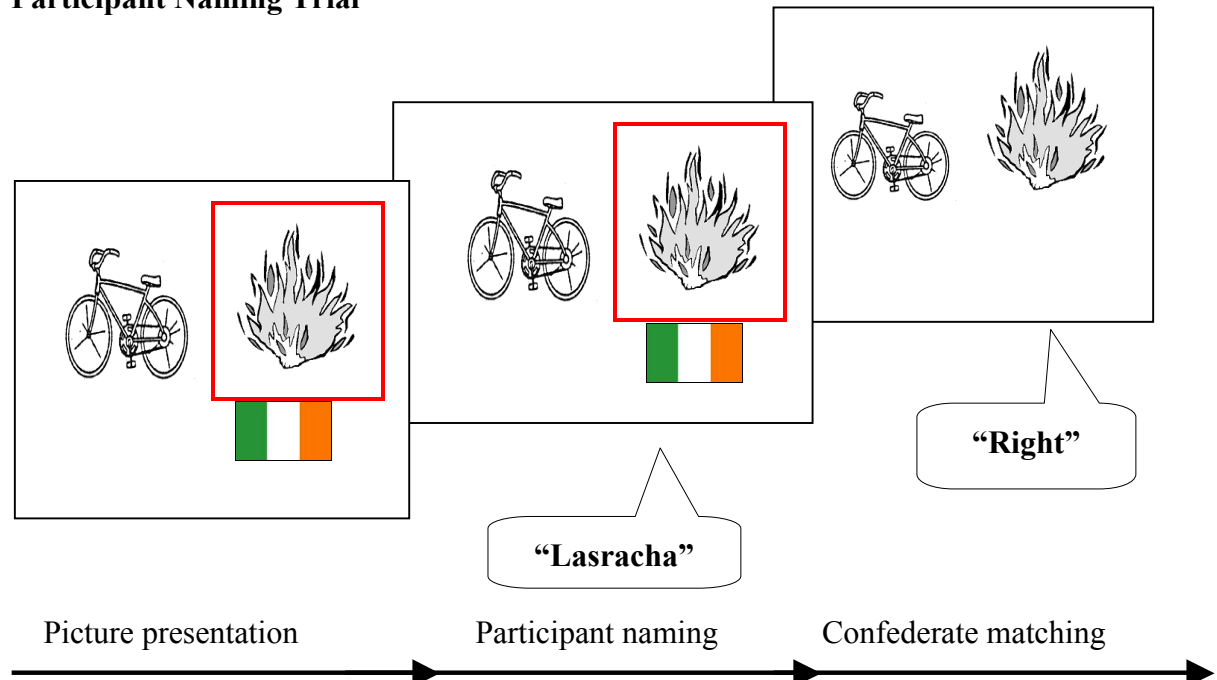
Participant Matching Trial**Participant Naming Trial**

Figure 5. Picture presentation of one experimental item (favoured name *fire* [*tine*], disfavoured name *flames* [*lasracha*]) in the between-language condition consisting of a participant matching turn for the prime picture and associated participant naming turn for the target picture.

List Construction

We constructed eight experimental lists, each containing thirty-two experimental items in one condition, as well as 104 filler items and 8 practice trials. Participants saw four experimental items in each of the eight conditions. The order of the experimental items was randomized individually for each participant. Due to practical reasons, filler items were displayed in a fixed randomized order. There was always one filler trial between the confederate naming turn for an experimental item and the participant's naming turn of the target picture. The participant naming turn of the target picture and the next experimental trial was separated by two filler trials. Eight filler trials were presented before the presentation of the first experimental item. Half of the pictures to be named/ matched were displayed on the left and half were displayed on the right.

Procedure

The experimental procedure used was largely based on the picture-naming/ picture-matching paradigm developed by Branigan, et al. (in preparation). Participants were tested in a quiet room on the National University of Ireland, Galway campus. The naïve participant and the confederate were seated opposite each other and were separated by a head-high screen, such that neither could see their partner, nor their partner's pictures.

Participants were presented with a ring binder containing two pictures (i.e. an experimental item or a filler item, as well as a distractor picture) on each page (one on the left and one on the right) (see *Figure 5*). The names to be produced by the confederate were printed underneath the appropriate picture. At the beginning of the experiment, naïve participants were shown the first few pages of the confederate's ring binder, which did not scripted names, to ensure that they believed both ring binders were identical, and that the confederate was a genuine participant.

Participants were fitted with clip-on microphones, which recorded their responses throughout the experiment. A set of written instructions, in both Irish and English, was provided which explained the experimental procedure. The language of the instructions was counterbalanced; half of the participants read the Irish

instructions first, and the other half read the English instructions first. The instructions were provided in both languages to ensure participants were in bilingual mode (Grosjean, 2001). In the instructions, participants were informed that the aim of the experiment was to assess how bilinguals communicate in both their languages when they cannot see one another's facial expressions. They were told they were to engage in a dialogue game, in which they would take it in turns to describe pictures to their partner, and match pictures to their partner's descriptions. They were instructed that they could request a repetition of the picture description by saying "please repeat", but could say nothing else.

On participant matching turns, two pictures were displayed side-by-side (i.e. one on the left hand side of the ring binder and one on the right hand side). The confederate pretended to name one of these pictures, although he was actually reading scripted prime names. One of these pictures matched the confederate's description (i.e. prime picture), whereas the other did not (i.e. distractor picture). The matching picture was displayed on the right for half the trials, and on the left for the other half. The participant was required to listen to their partner's (i.e. the confederate's) description and mark an 'X' under the appropriate column marked *LEFT* or *RIGHT* on a separate score sheet. They were also required to say either "*Left*" or "*Right*" aloud. For example, if the matching picture was displayed on the right hand side of the ring binder, they would mark an 'X' under the column marked *RIGHT* on the score sheet and say "Right". This verbal matching allowed participants to receive feedback from their partner and gauge whether their partner had understood their description and had matched the appropriate picture. The inclusion of a score sheet was intended to distract participants' attention from the actual aim of the study. The confederate named the picture in Irish for half of the trials, and in English for the other half.

On participant naming trials, two pictures were again displayed side-by-side (i.e. a target picture and a distractor picture). The target picture was surrounded by a red highlight, which indicated to the participant that this was the picture to be named. The highlighted (target) picture was also accompanied by a flag, which was displayed under the highlighted picture and cued participants to use a specific language when describing that picture. When the highlighted (target) picture was accompanied with an Irish flag, participants were required to name that picture in Irish. When a Union Jack accompanied the highlighted picture, participants were required to name the

picture in English. Language-switching studies often use a similar ‘background-colour-cueing procedure’, where the colour of the background determines the language to be spoken (e.g. Costa & Santesteban, 2004; Kootstra, van Hell, & Dijkstra, 2010). The use of flags to determine the language of use simplifies the task by removing the need to remember which colour cues which language). Participants were cued to name the picture in Irish for half the trials, and in English for the other half. The confederate matched the participants’ description by saying which side the matching picture was displayed on (i.e. “left” or “right”). The confederate was instructed not to respond too fast on all matching trials, as consistently rapid responses might arouse suspicion.

Each experimental trial consisted of a confederate naming turn for the experimental item (i.e. prime), and subsequent participant matching turn; a participant naming turn for a filler item, and subsequent confederate matching; a confederate naming turn for a filler item, and subsequent participant matching; a participant naming turn for the experimental item (i.e. target), and subsequent confederate matching turn. The form and language of the confederate’s prime description, and the subsequent language of the participant’s target response, were manipulated. The confederate produced the favoured name for the prime pictures (i.e. favoured prime) for half of the experimental items and the disfavoured name for the prime picture for the other half (i.e. disfavoured prime). On within-language trials the language of this prime description and the language used by the participant to name the target picture were the same (e.g. the confederate named the prime picture in English and the participant was required name the target picture in English). On between-language trials, the confederate named the prime picture in one language (e.g. English), and the participant was required to name the target picture in the other language (e.g. Irish). We examined whether the participant produced the favoured or the disfavoured name when naming the target picture. Throughout the experiment, the confederate acted like, and was treated by the experimenter as, a genuine participant (e.g. the confederate requested clarifications of the procedure involved). The confederate always took the first turn in order to allow priming.

Participants engaged in eight practice trials (i.e. four confederate naming trials, and subsequent participant matching trials; and four participant naming trials, and subsequent confederate matching trials). The participant always took the first turn on practice trials.

After the experimental session, a post-experiment questionnaire was administered which queried participants' thoughts regarding the aim of the experiment, and whether they had done anything in order to help their partner complete the task. A language history questionnaire was then administered to obtain information regarding the participant's language background. Following the completion of these questionnaires, participants were provided with a debriefing sheet. The entire experiment took approximately 20-25 minutes to complete.

Scoring

All experimental sessions were manually transcribed. Thirty-two target responses were produced by every participant, four items in each of the eight condition. Participants target responses were scored as *Aligned*, *Non-aligned* and *Other*. An *Aligned* response was defined as an instance when the participant named the target picture using the same name used by the confederate. If they used the alternative name, their response was coded as *Non-aligned*. Responses were coded as *Other* if participants used neither the favoured or disfavoured name to describe the target picture.

Results

The participants produced 1024 target responses (512 between-language and 512 within-language). Overall, there were 745 (73%) *Aligned* target responses and 259 (25%) *Non-aligned* target responses. Twenty (2%) of the target responses were coded as *Other* (i.e. the participant produced a name for the target picture other than the favoured or disfavoured name) and were excluded from the analysis. The measurement of alignment (i.e. *alignment effect*) consists of the proportion of times participants used the same term as their partner compared with the proportion of times participants used the alternative term to their partner.

The dependent variable "target response" had a binomial distribution (i.e. "aligned" or "non-aligned"). Therefore, the *lme4*-package (Bates, Marchler, & Dai, 2007) in R [version 2.10.1, R Development Core Team, 2009] was used to model participants' responses using logit mixed-effects models (Bates & Sakar, 2007;

Breslow & Clayton, 1993; Debroy & Bates, 2004). Logit mixed-effects models are ideal for analyzing categorical data (Jaeger, 2008) as the inclusion of random effects by-participant and by-item removes the need to conduct separate *F1* and *F2* analyses (e.g., Baayen, 2008; Baayen, Davidson, & Bates, 2008). Also, the inclusion of random intercepts for participants and items ensures the generalizability of the results of the present study (Clark, 1973). A further advantage of logit mixed-effects model noted by Kootstra, et al. (2010), is that rather than combining participants' responses to calculate a mean response per condition, participants' actual responses are analyzed (see also Dixon, 2008).

To measure the contributions of the various factors to the model's ability to predict the likelihood of producing an aligned response, predictor variables were added to the model in the order: Prime Type (favoured vs. disfavoured), Language Condition⁵ (within- vs. between-languages), and Group (balanced vs. unbalanced). The best-fit model with Prime Type and Language Condition as fixed effects, and participant and item as random effects, revealed two main effects and no interactions (see Table 4). The following analysis is divided into subsections that deal with specific questions related to the hypotheses.

Table 4

Summary of the fixed effects in the logit mixed-effects model

Predictor	Estimate	SE	Wald Z	P
<i>Prime Type + Language Condition ($\chi^2(1) = 6.43, \log\text{-likelihood} = -451.63, N = 1004$)</i>				
Intercept	3.10	(0.25)	12.42	< .001
Prime Type: Disfavoured	-2.65	(0.21)	-12.54	< .001
Language Condition: Between	-0.43	(0.17)	-2.56	< .05

⁵ We use the term 'Language Condition' here even though the experiment was not explicitly designed with these conditions. By fully crossing the factors (Prime Type, Prime Language and Target Language) we had within- and between-language trials. For the purpose of these results it was deemed easier to refer to these as within- and between-language conditions.

Was there an alignment effect?

Participants produced the same name for a picture that their partner (i.e., the confederate) had used very frequently (73% of overall trials), compared with the frequency with which they used a different name (25%) (i.e., there was a 48% alignment effect). Therefore, it was assumed that the type of name (i.e., favoured vs. disfavoured) used by the confederate had a strong effect on the participant's target response. In the best-fit model, there was a main effect of Prime Type (see Table 4). Overall, participants were more likely to produce an aligned response after a favoured prime than after a disfavoured prime (see Table 5).

Table 5

Raw number of aligned and non-aligned target responses across favoured and disfavoured prime conditions

Prime Condition	Aligned	Non-aligned	Alignment Effect
Overall	745	259	48%
Favoured prime	468	33	85%
Disfavoured prime	277	226	10%

To establish a significant alignment effect in both favoured and disfavoured conditions, we conducted separate analysis on subsets of the data. In order to allow this closer analysis, a new dependent variable was created where favoured target responses were coded as “1” and disfavoured target responses coded as “0”. A second dependent variable was created where disfavoured target responses were coded as “1” and favoured target responses were coded as “0”. It must be clarified that when focusing on favoured target responses, the alignment effect is characterized as the proportion of favoured target responses after favoured primes compared with the proportion of disfavoured target responses after favoured primes. For disfavoured target responses, the alignment effect is the proportion of disfavoured target responses after disfavoured primes compared with the proportion of disfavoured target responses after favoured primes. As an aligned response after a favoured prime may reflect the use of the favoured name rather than an aligned response, disfavoured

target responses are of particular interest as, based on pretest results, this name would not have been used to describe the picture over 70% of the time.

Focusing on favoured target responses, the best-fit model included an interaction between Prime Type and Language Condition (see Table 6), with participant and item as random effects. Although the best-fit model at the significance level of 95% included no interaction effect due to the small sample size we decided to report such a marginal significance (at $p < .1$). Participants were 47% more likely to produce a favoured target response after a favoured prime than following a disfavoured prime (see Table 7, *Figure 6*).

Table 6

Summary of the fixed effects in the logit mixed-effects model for favoured responses

Predictor	Estimate	SE	Wald Z	P
<i>Prime Type X Language Condition ($\chi^2(1) = 2.80, \log\text{-likelihood} = -394.54, N = 1004$)</i>				
Intercept	3.54	(0.41)	8.66	< .001
Prime Type: Disfavoured	-4.00	(0.35)	-11.53	< .001
Language Condition: Between	-0.12	(0.40)	-0.30	= .77
Interaction Disfavoured : Between	0.75	(0.45)	1.65	< .1

Table 7

Raw number of favoured and disfavoured target responses in each prime condition

Target Responses	Favoured Primes	Disfavoured Primes	Alignment Effect
Favoured response	468	226	47%
Disfavoured response	33	277	48%

Focusing on disfavoured target responses, the best-fit model included an interaction between Prime Type and Language Condition (see Table 8), with participant and item as random effects. Participants were 48% more likely to produce a disfavoured target response following a disfavoured prime than a favoured prime (see Table 7, *Figure 6*).

Table 8

Summary of the fixed effects in the logit mixed-effects model for disfavoured responses

Predictor	Estimate	SE	Wald Z	P
<i>Prime Type X Language Condition ($\chi^2(1) = 2.80$, log-likelihood = -394.54, $N = 1004$)</i>				
Intercept	-3.54	(0.41)	-8.66	< .001
Prime Type: Disfavoured	-4.00	(0.35)	11.53	< .001
Language Condition: Between	0.12	(0.40)	0.30	= .77
Interaction Disfavoured : Between	0.75	0.45	-1.65	< .1

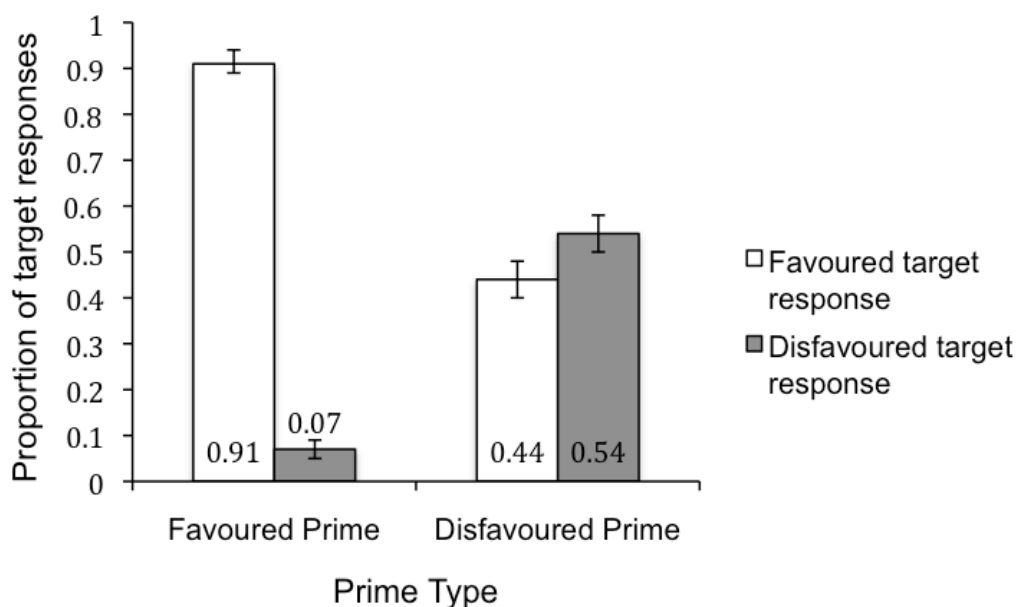


Figure 6. Proportion of favoured and disfavoured target responses after favoured and disfavoured primes, including 95% confidence interval error bars.

Did bilinguals align to the same extent in within- and between-language trials?

In the best-fit model there was a main effect of Language Condition (i.e. within- vs. between-language) (see Table 4). Participants were 54% more likely to produce an aligned response when they named the target picture in the same language used by their partner (i.e. within-language trials) compared with a 41% alignment effect in between-language trials. To verify that alignment did occur in both within- and between-language conditions, we ran further analysis on a subset of the data.

Focusing only on within-language trials revealed that participants were 54% more likely to produce an aligned response than a non-aligned response ($B = 3.95$ ($SE = 0.37$), $z = 10.70$, $p < .000$). On between-language trials, participants were 41% more likely to produce an aligned response, than a non-aligned response ($B = 3.19$ ($SE = 0.33$), $z = 9.64$, $p < .000$). There was no significant interaction between the two main effects of Prime Type and Language Condition ($B = 0.11$ ($SE = 0.42$), $z = -0.25$, $p = 0.80$). This suggests that, irrespective of the prime (i.e., favoured vs. disfavoured), there was a greater alignment effect on within- rather than between-language trials (see Table 9, *Figure 7*). Table 10 shows the alignment effect for favoured and disfavoured target responses in within- and between-language conditions.

Table 9

Raw number of aligned and non-aligned target responses in within- and between-language trials

Condition	Aligned	Non-aligned	Alignment Effect
Within-language	390	115	54%
Between-language	355	144	41%

Table 10

Raw number of favoured and disfavoured target responses in within- and between-languages trials in each prime condition

Target Response	Language Condition	Favoured Primes	Disfavoured Primes	Alignment Effect
Favoured response	Within-language	238	101	53%
	Between-language	230	125	41%
Disfavoured response	Within-language	14	152	53%
	Between-language	7	125	42%

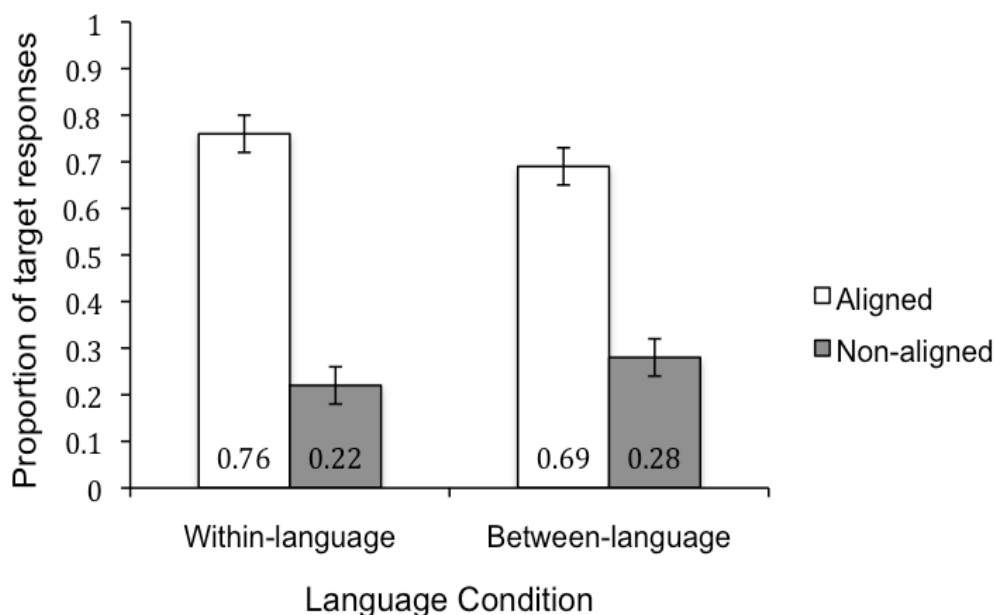


Figure 7. Proportion of aligned and non-aligned target responses in within- and between-language conditions, including 95% confidence interval error bars.

Was there a difference in alignment in the balanced and unbalanced bilingual groups?

To assess whether balanced bilinguals and unbalanced bilinguals align to the same extent Group was added to the model as a predictor variable. The inclusion of Group did not lead to a significant improvement of the model ($B = 0.22$ ($SE = 0.19$), $z = 1.17$, $p = 0.24$, $\chi^2(1) = 1.32$, $\log\text{-likelihood} = -450.97$, $p = 0.25$). The overall alignment effect did not differ between the balanced bilinguals (45%) and unbalanced bilinguals (47%, see Table 11). There was no significant interaction effect between Group and Prime Type ($B = -1.13$ ($SE = 0.71$), $z = -1.58$, $p = 0.11$), Group and Language Condition ($B = -1.49$ ($SE = 0.85$), $z = -1.75$, $p = 0.10$), nor any three-way interactions between these three variables ($B = 1.61$ ($SE = 0.95$), $z = 1.69$, $p = 0.11$). The alignment effect for favoured target responses and disfavoured target responses did not differ across groups (see Table 12, Figure 8).

Table 11

Raw number of aligned and non-aligned target responses in balanced and unbalanced bilingual groups

Group	Aligned	Non-aligned	Alignment Effect
Balanced	368	137	45%
Unbalanced	377	122	47%

Table 12

Raw number of favoured and disfavoured target responses in balanced and unbalanced bilingual groups

Target Response	Group	Favoured Primes	Disfavoured Primes	Alignment Effect
Favoured response	Balanced	241	124	45%
	Unbalanced	227	102	51%
Disfavoured response	Balanced	13	127	45%
	Unbalanced	20	150	51%

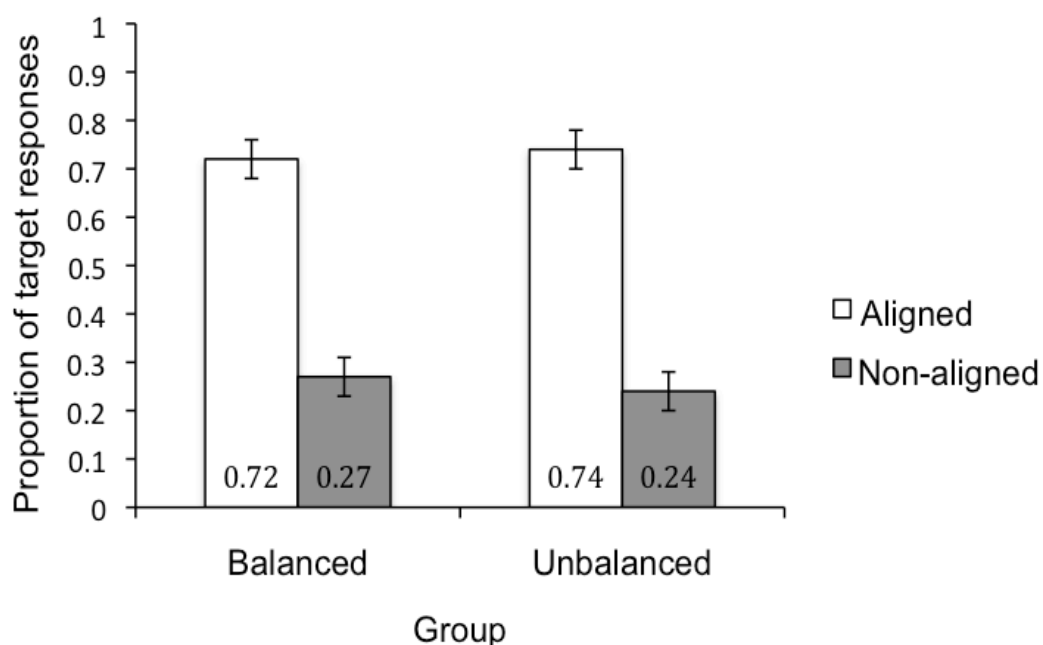


Figure 8. Proportion of aligned and non-aligned target responses in balanced and unbalanced bilingual groups, including 95% confidence interval error bars.

Was there greater alignment in within-language trials in English or in Irish, and did this differ across groups?

In order to analyze the within-language alignment effect in greater detail regarding the language involved (i.e., participants' dominant and non-dominant languages), we assessed whether there was greater alignment on English-English trials (i.e. Prime Language: English, Target Language: English) or Irish-Irish trials (i.e. Prime Language: Irish, Target Language: Irish). To address this question, a dummy variable was created for which was coded as "1" for cases in which the prime and target language was English, and was coded "0" for cases in which the prime and target language was Irish. This allows for a comparison in alignment between these two conditions. There was no significant difference between the alignment effect on English-English (48%) and Irish-Irish (59%) within-language trials ($B = -0.31$ ($SE = 3.01$), $z = -0.10$, $p = 0.92$) (see Table 13). A non-significant interaction with Prime Type ($B = -0.71$ ($SE = 2.76$), $z = -1.41$, $p = 0.61$) reveals alignment did not differ as a function of the prime type.

Analyzing a subset of the data, focusing on the responding pattern of balanced bilinguals, we found there was no significant difference in the alignment effect on English-English (54%) and Irish-Irish trials (55%) for this group of bilinguals ($B = -0.07$ ($SE = 0.75$), $z = 0.09$, $p = 0.93$). Similarly, for unbalanced bilinguals, there was no significant difference in the alignment effect in English-English (43%) and Irish-Irish trials (63%) ($B = -0.89$ ($SE = 0.92$), $z = -0.197$, $p = 0.33$). There was no significant difference in alignment between balanced and unbalanced bilinguals in English-English ($B = -0.23$ ($SE = 0.73$), $z = -0.31$, $p = 0.75$) or Irish-Irish within-language trials ($B = 0.39$ ($SE = 0.56$), $z = -0.70$, $p = 0.49$) (see Table 13, *Figure 9*).

Table 13

Raw number of aligned and non-aligned target responses in English-English and Irish-Irish within-language conditions

Language Condition	Group	Aligned	Non-aligned	Alignment Effect
English-English	Overall	188	64	48%
	Balanced	98	30	54%
	Unbalanced	90	34	43%
Irish-Irish	Overall	202	51	59%
	Balanced	98	28	55%
	Unbalanced	104	23	63%

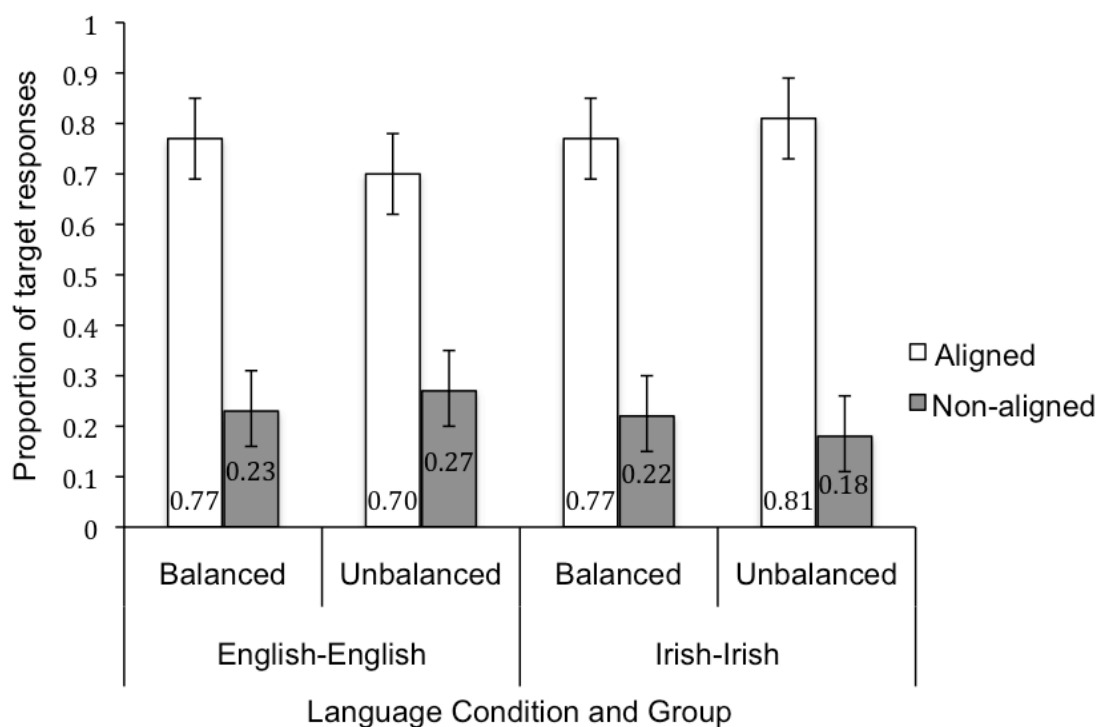


Figure 9. Proportion of aligned and non-aligned target responses in balanced and unbalanced bilingual groups across English-English and Irish-Irish language conditions, including 95% confidence interval error bars.

Was there greater alignment in the English-Irish, or the Irish-English between-language trials, and did this differ across groups?

In order to analyze alignment in English-Irish (i.e., Prime Language: English, Target Language: Irish) and Irish-English trials (i.e., Prime Language: Irish, Target Language: English), we repeated the process of creating a dummy variable which was coded as “1” for cases in which the Prime Language was English and the Target Language was Irish, and was coded as “0” for cases in which the Prime Language was Irish and the Target Language was English. There was no significant difference in alignment effect between English-Irish (41%) and Irish-English (41%) trials ($B = 0.01$ ($SE = 0.21$), $z = -0.05$, $p = 0.96$). Alignment did not differ as a function of the prime used, as there was no significant interaction with Prime Type ($B = -1.01$ ($SE = 3.09$), $z = -2.21$, $p = 0.47$). Analyzing the responses of balanced bilinguals revealed that there was no significant difference in the alignment effect on English-Irish (31%) and Irish-English (41%) between-language trials for this group of bilinguals ($B = -0.22$ ($SE = 0.57$), $z = -0.39$, $p = 0.70$). For unbalanced bilinguals there was also no significant difference in the alignment effect on English-Irish (50%) and Irish-English (42%) between-language trials ($B = 0.28$ ($SE = 0.29$), $z = 0.96$, $p = 0.34$). There was no significant difference in alignment between balanced and unbalanced bilinguals in English-Irish ($B = 0.51$ ($SE = 5.05$), $z = 0.10$, $p = 0.92$) or English-Irish between-language trials ($B = 0.02$ ($SE = 0.31$), $z = 0.06$, $p = 0.96$) (see Table 14, *Figure 10*).

Table 14

Raw number of aligned and non-aligned responses in English-English and Irish-Irish within-language conditions

Language Condition	Group	Aligned	Non-aligned	Alignment Effect
English-Irish	Overall	176	71	41%
	Balanced	82	42	31%
	Unbalanced	94	29	50%
Irish-English	Overall	179	73	41%
	Balanced	90	37	41%
	Unbalanced	89	36	42%

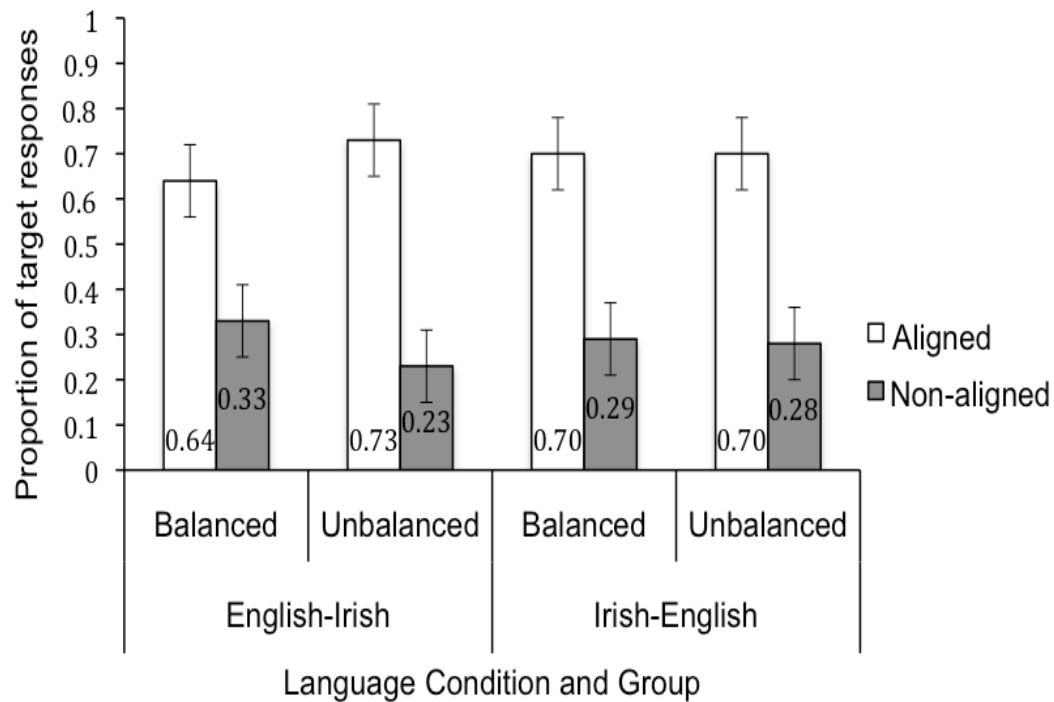


Figure 10. Proportion of aligned and non-aligned target responses in balanced and unbalanced bilingual groups across English-Irish and Irish-English language conditions, including 95% confidence interval error bars.

Did the use of a strategy impact the results?

In the post-experimental questionnaire no participant reported any suspicions regarding the identity of the confederate. Therefore, we are confident that no participant was aware that the confederate was not a genuine participant. In response to a question querying their knowledge of the actual aim of the experiment (“Did you do anything, or use any strategy, in order to help your partner complete the task effectively?”) only one participant, in the balanced bilingual group, reported using the same names for pictures that their partner had used beforehand. This participant may have realized that some pictures had two alternative names and consciously chose to repeat the name used by their partner. However, the inclusion of Strategy (“strategy” vs. “no strategy”) as a predictor variable led to no significant improvement of the overall model ($B = -0.16$ ($SE = 0.67$), $z = -0.25$, $p = 0.81$, $\chi^2(1) = 0.06$, $\log\text{-likelihood} = -394.51$, $p = 0.81$) Therefore, the participant who had reported using a strategy did not show greater alignment than those who had not used a strategy.

Discussion

Lexical alignment refers to the tendency for interlocutors to repeat each other's lexical choices. The IAM accounts for this repetition of word-choice by appealing to automatic priming mechanisms, which operate based on the assumption of parity of representation between the language comprehension and production systems. However, it was unclear from previous research whether lexical alignment was wholly driven by shared conceptualizations (i.e., conceptual alignment), or whether it was partly driven by the repetition of word-form. This study explored this issue by investigating within- and between-language lexical alignment in a bilingual population using non-cognate translation equivalents (i.e., words that have a shared meaning but do not share the same, or similar, word-form). Using the confederate-scripting technique, participants were required to name pictures to their partner (i.e., confederate), and match pictures to their partner's description. We investigated alignment by examining whether the name used by the participants to describe the target picture was the same as that used by the confederate to name the prime picture.

Our investigation found that the participant's choice of names for target pictures was strongly impacted by the name previously used by the confederate. Overall participants were 48% more likely to produce an aligned, rather than a non-aligned target response. Participants were 47% more likely to produce a favoured target response after a favoured prime than after a disfavoured prime. Similarly, participants were 48% more likely to produce a disfavoured target response following a disfavoured prime, compared with a favoured prime. Such a result is striking as, based on pretest results, participants would not have chosen that name for the target picture over 70% of the time. Thus, the impact of a partner's choice of words was strong enough for participants to overcome strong preferences.

An alignment effect was found when the participant and their partner used the same language (i.e., within-language), and when they spoke different languages (i.e., between-language). However, the extent of alignment was greater in within-language trials (54%) compared with between-language trials (41%). Furthermore, the magnitude of the alignment effect did not differ as a function of group membership (i.e., balanced and unbalanced bilinguals did not differ on the extent of alignment on within- and between-language trials). The results also revealed that the language of the prime or target did not affect alignment. Overall, there was no significant

difference in the alignment effect in English-English (48%) compared with Irish-Irish (59%) within-language trials, or between English-Irish (41%) and Irish-English (41%) between-language trials.

Our results add to the existing body of literature that has shown evidence for the pervasive nature of linguistic alignment in dialogue, and extends the occurrence of lexical alignment to a bilingual population. This discussion is divided into two main parts. We will firstly discuss the implications of the results for the IAM focusing on the effect of the repetition of word-form and conceptual alignment on lexical alignment. Our second focus is on alignment in a second language, and how the IAM can account for bilingual dialogue.

Lexical alignment: Enhanced by, but independent of, the repetition of word-form

The first aim of this study was to investigate the role of word-form and conceptual representations in lexical alignment. Our results show that the magnitude of lexical alignment was greater within- rather than between-languages, supporting the hypothesis that lexical alignment is partly driven by the repetition of word-form. Such results are in line with monologue studies investigating repetition priming, which also find within-language priming effects to be greater than between-language priming (Hernandez and Reyes, 2002). When interlocutors are speaking the same language, there is an enhancement of conceptual and phonological links to lexical representations. Contrarily, when interlocutors are speaking a different language, lexical representations receive activation solely from priming at the conceptual level (for non-cognates). These results support P&G's claim that lexical alignment results from activation of representations roughly corresponds to a lexical entry. Interlocutors align on an activation pattern across the various levels of representation (e.g., phonological, lexical, conceptual), and percolation between these levels increases the likelihood of lexical alignment. For example, if *A* refers to an object as a *seat*, the conceptual representation *SEAT*, and the phonological word-form <*seat*> spread activation to the lexical level and increases the likelihood that *B* will use *seat* to refer to that same object. In comparison, if *B* is required to name the object in a different language, only the conceptual representation is primed. These results are in line with previous studies that have found evidence for the percolation between levels. For

example, syntactic alignment is found to be enhanced when the prime and target content words are repeated (e.g., Branigan, et al., 2000) or are semantically related (e.g., Cleland & Pickering, 2003). The priming of phonological representations may explain how lexical alignment can occur without conceptual alignment (e.g., Branigan, 2004; Schober, 2005). For example, Garrod & Clark (1993) found that children used the same words to refer to a maze even when they did not have a shared conceptualization of the maze, and such lexical alignment disrupted successful communication. However, lexical alignment can also occur independent of the repetition of word-form.

Although weaker than the alignment effect on within-language trials, there was also an alignment effect on between-language trials. As this is the first study to examine lexical alignment between-languages it is unclear whether the term “lexical alignment” is accurate, as interlocutors do not repeat an identical word, but a translation equivalent. However, for current purposes, we will term this effect *cross-linguistic lexical alignment*. When participants were required to name the target picture (e.g., fire/flames) in a different language than the prime (e.g., *flames*), they tended to produce the translation equivalent of the prime word (e.g., *lasracha* [flames]). As non-cognate translation equivalents do not share similar word-form between languages, cross-linguistic lexical alignment reflects the priming of similar conceptual representations across individuals. This suggests that alignment can occur independent of the repetition of word-form, through alignment at the conceptual level. As there is parallel activation of the bilingual’s two languages, this shared conceptualization spreads activation to the associated lexical representation in both languages, which increases the likelihood that the same word will be used, irrespective of the language of use. This finding provides evidence for a direct priming link between the conceptual representations of interlocutors, as proposed by P&G.

However, it must be noted that although cross-linguistic lexical alignment occurs due to priming at the conceptual level, activation at other linguistic levels may also be involved. To illustrate this point we use an example. Hearing *A* name a picture using the word *hen* activates the conceptual representation associated with *hen* in *B*. Assuming the shared conceptual store spreads activation in a language non-specific manner to lexical representations in the bilingual’s two languages, both the lexical representation for *hen* and the Irish translation *cearc* are activated. The phonological

representations of *hen* are also primed and spread activation back to the lexical level. Therefore, when it is *B*'s turn to name the same target picture, the lexical representation associated with *hen* is the most strongly activated. When required to name the picture in Irish, *B* may then consciously translate *hen* into Irish (*cearc*). Some researchers argue that translation occurs entirely at the lexical level, which would lead to the conclusion that cross-linguistic lexical alignment is based at the lexical level, rather than a product of conceptual alignment. However, when the two languages are acquired at an early age, and the bilinguals are relatively fluent, the general consensus is that translation processes in such bilinguals are conceptually mediated (e.g., De Groot & Poot, 1997; Kroll & De Groot, 1997; Kroll & Stewart, 1994; Potter et al., 1984). Therefore, translation in both language directions, is assumed to be conceptually mediated in our bilingual groups. Such a conscious translation strategy does not weaken the findings of the present study, as it is priming at the shared conceptual level that allows spreading activation. Hence, conceptual alignment can be said to drive cross-linguistic lexical alignment. Furthermore, P&G do not claim to remove the need for conscious control of lexical selection; their claim is that alignment makes repetition of a lexical choice more likely.

Previous evidence for conceptual alignment has come from studies where participants aligned on a shared conceptualization of a maze (e.g., Garrod & Anderson, 1987) or spatial reference frame (e.g., Watson, et al., 2004). Such alignment leads to lexical alignment, as partners reflect their underlying conceptualizations by limiting their lexical choices to those used by their partner (e.g., using the word *square* rather than *box* to refer to a node on the maze). As noted in the introduction, such abstract, spatial representations may enhance the occurrence of conceptual alignment due to the high variability of possible conceptualizations. Thus, aligning on certain conceptualization results in a huge gain in efficiency. The results of the present study extend the evidence for conceptual alignment away from spatial language to more natural language use, through the inclusion of everyday objects as stimuli. Presumably, participants engaged in the maze task do not start with similar conceptualizations of the maze. In contrast, the pictures of everyday objects used in this study (e.g., chair, sheep) have a “conventionalized lexical entry” (Krauss & Fussell, 1996, p. 86) and relatively high ‘linguistic codability’ (i.e., general agreement among native speakers about what name is preferred for a given object; Horton & Gerrig, 2002). Therefore, the finding of conceptual alignment, which in turn leads to

cross-linguistic lexical alignment, is all the more striking as interlocutors overcome strong preferences in order to align with their partner.

In sum, the results of this study show that lexical alignment is enhanced by the repetition of word-form but is not entirely dependent on it. It may be the case that, similar to studies of repetition priming within individuals, that lexical alignment is primarily driven by conceptual alignment, and that percolation of activation from the sub-lexical level serves as a short-lived boost. Research has shown that while syntactic alignment effects persist, the lexical boost to syntactic alignment (i.e., enhanced priming effects when the prime and target content words are repeated) is short-lived, with reduced effects emerging with increasing lag (i.e., number of intervening trials between the prime and target; e.g., Hartsuiker, Bernolet, Schoonbaert, Speybroeck, & Vanderelst, 2008). Similarly, in a recent study Branigan et al. (in preparation) found that lexical alignment was reduced when eight trials intervened between the prime and target. This would suggest the repetition of word-form acts as a short-lived boost to lexical alignment. Furthermore, Hernandez and Reyes (2002) found within-language repetition priming effects were reduced with increasing lag and suggested that enhancement of the links between phonological and lexical representations decays over time, whereas lag had no effect on the magnitude of conceptually-driven between-language priming. Further research could investigate whether the number of intervening trials between the prime and target impacts cross-linguistic lexical alignment. Based on the findings that between-language repetition priming effects do not decay over time, we hypothesize that cross-linguistic lexical alignment will not interact with lag (i.e., will persist independent of the number of intervening trials). Such an investigation may lead to an establishment of the persistence of conceptual alignment within dialogue, as unlike the present study where there was always two filler trials separating the prime and target, natural dialogue would involve a much more variable lag.

Another potential avenue of future research would be to establish the magnitude of the alignment effect in translation equivalents with overlapping form and meaning (i.e., cognates), such as the English-Irish *hat-hata*, or *prison-príosún*. The representations of cognates in the language system are proposed to be more language-independent than the representations of non-cognates (e.g., De Groot, 1995). For example, compared to non-cognates, cognates are proposed to have larger conceptual overlap (e.g., Van Hell & De Groot, 1998). Furthermore, as cognates share

similar, or identical, word-form, activation at the sub-lexical level is proposed to feed language non-selective activation back to the lexical representations of both languages (e.g., Costa et al., 2000). For example, activation of the phonological representations associated with the word-form <hat> spreads activation of the phonemes shared across languages (e.g., /h/, /a/, /t/) to the lexical representation associated with the cognate translation (e.g., *hata*). As the IAM also assumes such spreading activation, it may be hypothesized that lexical alignment will be greater for cognates than non-cognates, due to overlapping conceptual and phonological representations. The design of the current study can be easily extended to investigate such a hypothesis through the inclusion of cognates, with complete and/or partial overlapping word-forms. Cognates that share identical word-form (e.g., *piano-piano*) may lead to a greater enhancement of lexical alignment than partial cognates (e.g., *cap-caipín*) due to the activation of phonemes shared between the two languages.

As an investigation of the locus of the alignment effect was only one aim of the current study, we now turn to our secondary aim, which was to investigate alignment effects in a second language.

Alignment effects in bilingual dialogue

The second focus of the present study was to assess whether bilinguals align to the same extent in their dominant (L1) and non-dominant (L2) languages, and whether alignment was modulated by the degree of proficiency in the language. Although the IAM remains silent about the mechanisms involved in bilingual dialogue, based on the bilingual literature establishing a substantial degree of language integration and language non-selective activation of the bilingual's two languages, the mechanisms involved in bilingual dialogue should be comparable to monolingual dialogue (Kootstra, et al., 2010). In line with this observation, our results show that the alignment effect in English-English and Irish-Irish within-language trials was of similar magnitude in both balanced and unbalanced bilingual groups, which suggests that balanced bilinguals, and bilinguals with a reasonably high proficiency in both languages, align to the same extent in conversations in their L1 and L2. This confirms Costa et al.'s (2008) suggestion that, when both interlocutors are proficient in their L2, that L2-L2 dialogue would be similar to L1-L1 dialogue. Although more extensive empirical research is necessary, this finding suggests that when a bilingual

is reasonably proficient in their L2, automatic priming mechanisms seem to operate in a similar manner to monolingual dialogue, with activation at the conceptual and phonological levels enhancing L2 lexical alignment. Therefore, the IAM in its current state can account for alignment in proficient L2 dialogue.

In contrast to our hypothesis that unbalanced bilinguals would align to a greater extent in their L2, we found no significant difference between alignment on English-English and Irish-Irish within-language trials. As the unbalanced bilinguals in our study were reasonably proficient in Irish, and had received a minimum of thirteen years formal education, it may be the case, especially with the simple names used as experimental stimuli in this study, that their proficiency in Irish was high enough for similar alignment effects to emerge in their L1 and L2. Similarly, in between-language trials, the magnitude of alignment did not differ between English-Irish, and Irish-English trials, nor was there a significant difference between balanced and unbalanced bilingual groups. Such a finding would be expected based on the assumption of language non-selective activation spreading from the shared conceptual store to lexical representations in both Irish and English, which would increase the likelihood of re-using the same words independent of the language of use.

However, such non-significant results may be due to a small sample size (e.g., when assessing the alignment effect of one of the groups in a subset of the data, for instance Irish-Irish, there were only 128 observations in total). There was a strong trend in the data, suggesting that unbalanced bilinguals align to a greater extent in their non-dominant language (i.e., Irish-Irish) which had an alignment effect of 63% compared with 43% in their dominant language (i.e., English-English). In line with these results, in between-language English-Irish trials, there was also a trend in the data to suggest that unbalanced bilinguals aligned more when responding in Irish (50%), compared with balanced bilinguals (31%). Less proficient bilinguals are proposed to have weaker links between conceptual and lexical representations in their L2 (e.g., Kroll & De Groot, 1997), and such weakened links may benefit more from priming, similar to the enhanced priming effects found for less frequent words (e.g., Griffin & Bock, 1998). Furthermore, as the frequency of usage of a word impacts its representation in the language system (e.g., Croft & Cruse, 2004), the infrequent use of the L2 results in linguistic preferences that are less well established, or less entrenched. In other words, such bilinguals have less frequently referred to an object using a particular label in their L2, and are hence more likely to accept the label used

by their interlocutor. This entrenchment effect, coupled with the enhanced priming of the links between conceptual and lexical representations in the less active L2, may explain the greater alignment effect in the non-dominant language of unbalanced bilinguals. However, it must be noted that such a tentative explanation requires further empirical research before it can be confidently concluded to explain such effects.

Potential limitations of the current study

Although much has been learnt about the potential mechanisms involved in dialogue through the use of goal-orientated tasks, such as that used in this study, a question remains about how such findings can generalize to natural conversation. While it is desirable to retain some form of experimental control and reliability, in this study the goals of communication were established in advance and were not motivated by anything other than the experimental task, which is far removed from everyday language use. Furthermore, this task may enhance lexical alignment due to the highly constrained topic of conversation, which limits lexical variability. Although aware of such limitations, this task was chosen in order to control the language of both comprehension (i.e., prime) and production (i.e., target). Such control allowed the creation of within- and between-language trials, which was essential to investigate the questions posed.

A further limitation of the current study is that the experimental stimuli were not ideal due to highly restricted criteria. It was challenging to find pictures that could be described by a favoured and disfavoured, but acceptable, phonologically unrelated name in Irish and English. Preferences (i.e., which name was favoured or disfavoured) were also required to be the same across the two languages. As a result, rather than having highly similar concepts with one frequently used, and a less frequently used label (e.g., *glasses* and *spectacles*), some of our experimental stimuli had two possible conceptualizations (e.g., *horse* vs. *donkey*). Such stimuli are ideal for establishing whether participants were aligning on a shared conceptualization of a presented picture, but are not ideal for testing our entrenchment hypothesis, as presumably *horse* and *donkey* would not differ substantially on the degree of entrenchment as both words may have similar frequency of usage.

It is interesting to note that results from the pretests revealed balanced Irish-English bilinguals, and English-dominant bilinguals had opposite preferences for

some pictures (e.g., for a picture of a rock/stone, 80% of Irish-English bilinguals favoured the name *cloch* [stone], whereas 70% of English-Irish bilinguals favoured *rock* [carraig]). In Irish, the word *carraig* [rock] is associated with huge boulder, and would rarely be used to refer to an object instead of *cloch*. Most researchers assume conceptual representations are the same across languages and across different bilinguals. However, such results reveal that translation equivalents may differ slightly in their conceptual representations. Concepts are not static entities, but are based on the language experience and exposure of the bilingual. Therefore, knowledge of more than one language, and proficiency within these languages, as well as the frequency of use of a certain language, may impact how bilinguals conceptualize certain words and may have implications for the organization of the bilingual lexicon (see Ameel, Malt, Storms, & Can Assche, 2009; Ameel, Storms, Malt, & Sloman, 2005; Dong, Gui, & MacWhinney, 2005; Malt, Sloman, & Genneri, 2003). In order for conceptual alignment to occur via a direct priming link between the conceptual representations of two interlocutors, such conceptual representations, presumably, need to be highly similar, or identical. However, bilingualism may impede the automatic priming of conceptual representations across individuals as the languages they speak, and the lexicalized conceptualizations within this language, shape the conceptual system of each bilingual. Language-specific conceptualizations may impact lexical alignment as particular concepts, or thoughts, can be better expressed in one language over the other (e.g., in Irish there is no direct way to say *I love you*). Such cross-language differences may cause bilinguals to switch languages in order to convey the intended meaning (Heredia & Altarriba, 2001). Such a language switch may disrupt lexical alignment. A recent study by Kootstra et al. (2010) outlines how the IAM can successfully account for code-switching behaviour (see also Angermeyer, 2002), as well as contentious issues within bilingualism literature, such as language selection and language choice. For example, language selection (i.e., how a bilingual manages to select words from the intended language in the face of co-activation of the two languages) is explained by different theories within the literature, each proposing an alternative mechanism (e.g., language selection mechanism, Costa, 2005; reactive inhibition, Green 1986; language cue, La Heij, 2005). Although a discussion of this approach is beyond the scope of this paper, the IAM can solve the issue of language selectivity due to its postulation of an interactive network, such that language selection is not due to any specific mechanism

but emerges from the interactivity of the system. Such research represents an important step towards extending the IAM to account for many aspects of the bilingual experience, which should be a central focus of future research.

Conclusion

The pervasive nature of alignment in interactive communication is supported by the results of this study. Interlocutors' lexical choice was found to be strongly impacted by the words used by their partner. The finding that lexical alignment is enhanced by the repetition of word-form is in line with previous research that has shown percolation between the levels of representation. However, the occurrence of cross-linguistic lexical alignment indicates that such an effect can also be wholly driven by conceptual alignment. This finding provides evidence for a direct priming link between conceptual representations across individuals, as proposed by P&G. Regarding alignment in L2 dialogue, proficient bilinguals were found to align to the same extent in their L1 and L2, which suggests that automatic alignment mechanisms are also operational in L2. Our results establish that the IAM can be extended to account for bilingual dialogue. Such an extension would enrich the IAM, which currently remains silent on issues of bilingualism, and the use of interactive, experimental settings would allow an investigation of bilingual processing in a natural context.

(15,892 words)

References

- Agresti, A. (2002). *Categorical data analysis*. Hoboken, NJ: Wiley.
- Ameel, E., Malt, B. C., Storms, G., & Van Assche, F. (2009). Semantic convergence in the bilingual lexicon. *Journal of Memory and Language*, *60*, 270-290.
- Ameel, E., Storms, G., Malt, B.C., & Sloman, S. (2005). How bilinguals solve the naming problem. *Journal of Memory and Language*, *53*, 60-80.
- Angermeyer, P.S. (2002). Lexical cohesion in multilingual conversation. *International Journal of Bilingualism*, *6*, 361-393.
- Baayen, R. H. (2008). *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge University Press.
- Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*, 390-412.
- Barr, D. J., & Keysar, B. (2002). Anchoring comprehension in linguistic precedents. *Journal of Memory and Language*, *46*, 391-418.
- Bates, D., Maechler, M., & Dai, B. (2007). lme4: Linear mixed-effects models using S4 classes. R package version 0.999375-27. <<http://lme4.r-forge.r-project.org/>>.
- Bates, D. M. & Sarkar, D. (2007). Lme4: Linear mixed-effects models using S4 classes. R-package version 0.99875-6.
- Bavelas, J. B., Coates, L., & Johnson, T. (2000). Listeners as co-narrators. *Journal of Personality and Social Psychology*, *79*, 941-952.
- Blumenfeld, H. K., & Marian, V. (2007). Constraints on parallel activation in bilingual spoken language processing: Examining proficiency and lexical status using eye-tracking. *Language and Cognitive Processes*, *22*, 633-660.
- Bolinger, D. (1977). *Meaning and form*. London: Longman.
- Bortfeld, H., & Brennan, S. E. (1997). Use and acquisition of idiomatic expressions in referring by native and non-native speakers. *Discourse Processes*, *23*, 119-147.
- Branigan, H. P. (2004). Full alignment of some but not all representations in dialogue. *Behavioural and Brain Sciences*, *27*, 23-24.
- Branigan, H. P., Pickering, M. J., & Cleland, A. A. (2000). Syntactic coordination in dialogue. *Cognition*, *75*, B13-B25.

- Branigan, H. P., Pickering, M. J., Pearson, J., & McLean, J. F. (2010). Linguistic alignment between people and computers. *Journal of Pragmatics*, *42*, 2355-2368.
- Branigan, H. P., Pickering, M. J., Pearson, J., McLean, J. F., & Brown, A. (in preparation). The role of beliefs in lexical alignment: Evidence from dialogues with humans and computers. Unpublished manuscript, University of Edinburgh.
- Branigan, H. P., Pickering, M. J., Pearson, J., McLean, J. F., Nass, C. I., & Hu, J. (2004). *Beliefs about mental states in lexical and syntactic alignment: Evidence from human-computer dialogs*. Poster presented at the 17th CUNY Conference on Human Sentence Processing, College Park, MA.
- Brennan, S. E. (1996). Lexical entrainment in spontaneous dialog. In *Proceedings of the International Symposium on Spoken Dialogue* (pp. 41-44). Philadelphia: ISSD-96.
- Brennan, S. E., & Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *22*, 1482-1493.
- Brennan, S. E., Galati, A., & Kuhlen, A. K. (2010). Two minds, one dialog: Coordinating speaking and understanding. In B. H. Ross (Ed.), *The Psychology of Learning and Motivation*, Vol. 53 (pp. 301-344). Burlington: Academic Press.
- Breslow, N. E., & Clayton, D. G. (1993). Approximate inference in generalized linear mixed models. *Journal of American Statistical Society*, *88*, 9-25.
- Bromme, R., Jucks, R., & Wagner, T. (2005). How to refer to “diabetes?” Language in on-line health advice. *Applied Cognitive Psychology*, *19*, 569-586.
- Brown, R. (1958). *Words and things*. The Free Press, Glencoe: IL.
- Caramazza, A. (1997). How many levels of processing are there in lexical access? *Cognitive Neuropsychology*, *14*, 177-208.
- Carmichael, L., Hogan, H. P., & Walter, A. A. (1932). An experimental study of the effect of language on the reproduction of visually perceived form. *Journal of Experimental Psychology*, *15*, 73-86.
- Chen, H. C., & Leung, Y. S. (1989). Patterns of lexical processing in a nonnative language. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *15*, 316-325.

- Chen, H. C., & Ng, M. L. (1989) Semantic facilitation and translation priming effects in Chinese-English bilinguals. *Memory and Cognition*, 17, 454-462.
- Chomsky, N. (1965). *Aspects of the theory of syntax*. Cambridge, MA: MIT Press.
- Clark, H. H. (1973). The language-as-fixed-effect fallacy: A critique of language statistics in psychological research. *Journal of Verbal Learning and Verbal Behavior* 12, 335-359.
- Clark, E. V. (1987). The principle of contrast: A constraint on language acquisition. In B. MacWhinney (Ed.), *Mechanisms of language acquisition* (pp. 1-33). Hillsdale, NJ: Erlbaum.
- Clark, E. V. (1988). On the logic of contrast. *Journal of Child Language*, 15, 317-335.
- Clark, E. V. (1990). On the pragmatics of contrast. *Journal of Child Language*, 17, 417-431.
- Clark, H. H. (1992). *Arenas of language use*. Chicago, IL: University of Chicago Press.
- Clark, E. V. (1993). *The lexicon in acquisition*. Cambridge: Cambridge University Press.
- Clark, H. H. (1996). *Using Language*. Cambridge University Press: Cambridge.
- Clark, E. V. (1997). Conceptual perspective and lexical choice in acquisition. *Cognition*, 64, 1-37.
- Clark, H. H., & Krych, M. A. (2004). Speaking while monitoring addressees for understanding. *Journal of Memory and Language*, 50, 62-81.
- Clark, H. H., & Schaefer, E. F. (1989). Contributing to discourse. *Cognitive Science*, 13, 259-294.
- Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition*, 22, 1-39.
- Cleland, A. A., & Pickering, M. J. (2003). The use of lexical and syntactic information in language production: evidence from the priming of noun phrase structure. *Journal of Memory and Language*, 49, 214-230.
- Collins, A., & Loftus, E. (1975) A spreading activation theory of semantic processing. *Psychological Review*, 82, 407-428.
- Colomé, À. (2001). Lexical activation in bilinguals' speech production: Language-specific or language-independent. *Journal of Memory and Language*, 45, 721-736.

- Colomé, À., & Miozzo, M. (2010). Which words are activated during bilingual word production? *Journal of Experimental Psychology: Learning, Memory and Cognition*, 36, 96-109.
- Costa, A. (2005). Lexical access in bilingual production. In J. F. Kroll & A. M. B. De Groot (Eds.), *Handbook of bilingualism: Psycholinguistic approaches* (pp. 308-325). New York, NY: Oxford University Press.
- Costa, A., Caramazza, A., & Sebastián-Gallés, N. (2000). The cognate facilitation effect: Implications for the models of lexical access. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 26, 1283-1296.
- Costa, A., Miozzo, M., & Caramazza, A. (1999). Lexical selection in bilinguals: Do words in the bilingual's two lexicons compete for selection? *Journal of Memory and Language*, 41, 365-397.
- Costa, A., Pickering, M. J., & Sorace, A. (2008). Alignment in second language dialogue. *Language and Cognitive Processes*, 23, 528-556.
- Costa, A., & Santesteban, M. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *Journal of Memory and Language*, 49, 491-511.
- Costa, A., Santesteban, M., & Ivanova, I. (2006). How do highly proficient bilinguals control their lexicalization process? Inhibitory and language-specific selection mechanisms are both functional. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 32, 1057-1074.
- Coventry, K. R., Tenbrink, T., & Bateman, J. (Ed.) (2009). *Spatial language and dialogue*. Oxford, UK: Oxford University Press.
- Croft, W., & Cruse, D. A. (2004). *Cognitive linguistics*. Cambridge: Cambridge University Press.
- Cutler, A., Weber, A., & Otake, T. (2006). Asymmetric mapping from phonetic to lexical representations in second-language listening. *Journal of Phonetics*, 34, 269-284.
- Cutting, J. C., & Ferreira, V. S. (1999). Semantic and phonological information flow in the production lexicon. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 25, 318-344.
- Daniel, A. (1972). Nature of the effect of verbal labels on recognition memory for form. *Journal of Experimental Psychology*, 96, 152-157.
- De Bot, K. (1992). A bilingual production model: Levelt's "speaking" model

- adapted. *Applied Linguistics*, 13, 1-24.
- De Groot, A.M.B. (1992) Determinants of word translation. *Journal of Experimental Psychology: Learning, Memory, and Language*, 18, 1001-1018.
- De Groot, A.M.B. (1993) Word-type effects in bilingual processing tasks. In R., Schreuder, & B. Weltens (Eds.), *The Bilingual Lexicon* (pp. 27-51). Amsterdam: John Benjamins.
- De Groot, A. M. B. (1995). Determinants of bilingual lexicosemantic organisation. *Computer Assisted Language Learning*, 8, 151-180.
- De Groot, A.M.B., & Nas, G. (1991). Lexical representation of cognates and non-cognates in compound bilinguals. *Journal of Memory and Language*, 30, 90-123.
- De Groot, A. M. B. & Poot, R. (1997). Word translation at three levels of proficiency in a second language: The ubiquitous involvement of conceptual memory. *Language Learning*, 47, 215-264.
- Debroy, S., & Bates, D. M. (2004). Linear mixed models and penalized least squares. *Journal of Multivariate Analysis*, 91, 1-17.
- Dell, G. S. (1986). A spreading activation theory of retrieval in sentence production. *Psychological Review*, 93, 283-321.
- Dell, G. S. (1990). Effects of frequency and vocabulary type on phonological speech errors. *Language and Cognitive Processes*, 5, 313-349.
- Dell, G. S., & O'Seaghdha, P. G. (1991). Mediated and convergent lexical priming in language production: A comment on Levelt et al. *Psychological Review*, 98, 604-614.
- Dijkstra, T., Grainger, J., & Van Heuven, W. J. B. (1999). Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and Language*, 41, 496-518.
- Dixon, P. (2008). Models of accuracy in repeated-measures designs. *Journal of Memory and Language*, 59, 447-456.
- Dong, Y., Gui, S., & MacWhinney, B. (2005). Shared and separate meanings in the bilingual mental lexicon. *Bilingualism: Language and Cognition*, 8, 221-238.
- Dunn, A. L., & Fox Tree, J. E. (2009). A quick, gradient bilingual dominance scale. *Bilingualism: Language and Cognition*, 12, 273-289.
- Durso, F. T., & Johnson, M. K. (1979). Facilitation in naming and categorizing

- repeated pictures and words. *Journal of Experimental Psychology: Human Learning and Memory*, 5, 449-459.
- Francis, W. (2005) Bilingual semantic and conceptual representation. In J. Kroll, & A.M.B. de Groot (Eds.), *Handbook of Bilingualism: Psycholinguistic Approaches* (pp. 251-267). Oxford: Oxford University Press.
- Furnas, G. W., Landauer, T. K., Gomez, L. M., & Dumias, S. T. (1983). Statistical semantics: Analysis of the potential performance of keyword information systems. *Bell Systems Technical Journal*, 62, 1753-1806.
- Furnas, G. W., Landauer, T. K., Gomez, L. M., & Dumias, S. T. (1987). The vocabulary problem in human-system communications. *Communications of the ACM*, 30, 964-971.
- Fussell, S. E., & Krauss, R. M. (1992). Coordination of knowledge in communication: effects of speakers' assumptions about what others know. *Journal of Personality and Social Psychology*, 62, 378-391.
- Garrett, M. F. (1980). Levels of processing in sentence production. In B. Butterworth (Ed.), *Language Production: Vol. 1. Speech and talk* (pp. 177-220). London, England: Academic Press.
- Garrod, S., & Anderson, A. (1987). Saying what you mean in dialog: A study of conceptual and semantic co-ordination. *Cognition*, 27, 181-218.
- Garrod, S., & Clark, A. (1993). The development of dialogue co-ordination skills in schoolchildren. *Language and Cognitive Processes*, 8, 101-126.
- Garrod, S., & Pickering, M. J. (2004). Why is conversation so easy? *Trends in Cognitive Sciences*, 8, 8-11.
- Garrod, S. & Pickering, M.J. (2007). Automaticity in language production in monologue and dialogue. In A.S. Meyer, L.R. Wheeldon, & A. Krott (Eds.) *Automaticity and control in language processing* (pp. 1-21). Hove: Psychology Press.
- Gass, S. M. (1997). *Input, interaction, and the second language learner*. Mahwah, NJ: Lawrence Erlbaum.
- Gass, S. M. (2003). Input and interaction. In C. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 224-255). Oxford, UK: Blackwell.
- Giles, H. (1973). Accent mobility: A model and some data. *Anthropological Linguistics*, 15, 87-105.

- Giles, H., Coupland, N., & Coupland, J. (1991). Accommodation theory: communication, context, and consequence. In H. Giles, J. Coupland, & Coupland, N. (Eds.), *Contexts of accommodation: Developments in applied sociolinguistics* (pp. 1-68). Cambridge: Cambridge University Press.
- Goleman, D. (2006). *Social Intelligence*. Bantam Books.
- Gollan, T. H., & Acenas, L. A. R. (2004). What is a TOT? Cognate and translation effects on tip-of-the-tongue states in Spanish–English and Tagalog–English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *30*, 246-269.
- Gollan, T. H., & Kroll, J. F. (2001). Bilingual lexical access. In B. Rapp (Ed.), *A handbook of cognitive neuropsychology: What deficits reveal about the human mind/brain* (pp. 321-345). Philadelphia: Psychology Press.
- Gollan, T. H., Montoya, R. I., Fennema-Notestine, C., & Morris, S. K. (2005). Bilingualism affects picture naming but not picture classification. *Memory & Cognition*, *33*, 1220-1234.
- Gollan, T. H., Montoya, R. I., & Werner, G. (2002). Semantic and letter fluency in Spanish–English bilinguals. *Neuropsychology*, *16*, 562-576.
- Gollan, T. H., & Silverberg, N. B. (2001). Tip-of-the-tongue states in Hebrew–English bilinguals. *Bilingualism: Language & Cognition*, *4*, 63-84.
- Grainger, J., & Beauvillain, C. (1988). Associative priming in bilinguals: Some limits of interlingual facilitation effects. *Canadian Journal of Psychology*, *42*, 261-273.
- Green, D. (1986). Control, activation, and resource: A framework and a model for the control of speech in bilinguals. *Brain and Language*, *27*, 210-223.
- Gries, S. T. (2005). Syntactic priming: a corpus-based approach. *Journal of Psycholinguistic Research* *34*, 365-399.
- Griffin, Z. M., & Bock, K. (1998). Constraint, word frequency, and the relationship between lexical processing levels in spoken word production. *Journal of Memory & Language*, *38*, 313-338.
- Griffin, Z. M., & Weinstein-Tull, J. (2003). Conceptual structure modulates structural priming in the production of complex sentences. *Journal of Memory and Language*, *49*, 537-555.
- Grosjean, F. (2001). The bilingual's language modes. In J. Nicol (Ed.), *One Mind*,

- Two Languages: Bilingual Language Processing*, (pp. 1-22). Malden, MA: Blackwell.
- Hartsuiker, R. J., Bernolet, S., Schoonbaert, S., Speybroeck, S., & Vanderelst, D. (2008). Syntactic priming persists while the lexical boost decays: Evidence from written and spoken dialogue. *Journal of Memory and Language*, *58*, 214-238.
- Heredia, R.R., & Altarriba, J. (2001). Bilingual language mixing. Why do bilinguals code-switch? *Current Directions in Psychological Science*, *10*, 164-168.
- Hermans, D., Bongaerts, T., de Bot, K., & Schreuder, R. (1998). Producing words in a foreign language: Can speakers prevent interference from their first language? *Bilingualism: Language and Cognition*, *1*, 213-230.
- Hernandez, A., Li, P., & MacWhinney, B. (2006). The emergence of comepting modules in bilingualism. *Trends in Cognitive Sciences*, *9*, 220-225.
- Hernandez, A. E., & Reyes, I. (2002). Within- and between-language priming differ: Evidence from repetition of pictures in Spanish-English bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *28*, 726-734.
- Horton, W. S., & Gerrig, R. J. (2002). Speaker's experiences and audience design: Knowing when and knowing how to adjust utterances to addressees. *Journal of Memory and Language*, *47*, 589-606.
- Horton, W.S., & Gerrig, R.J. (2005a). The impact of memory demands on audience design during language production. *Cognition*, *96*, 127-142.
- Isaacs, E. A., & Clark, H. H. (1987). References in conversations between experts and novices. *Journal of Experimental Psychology: General*, *116*, 26-37.
- Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, *59*, 434-446.
- Jared, D., & Kroll, J. (2001). Do bilinguals activate phonological representations in one or both of their languages when naming words. *Journal of Memory and Language*, *44*, 2-31.
- Johnson-Laird P. N. (1983) *Mental models: Toward a cognitive science of language, Inference and consciousness*. Cambridge, MA: Harvard University Press.
- Jörg, S. & H. Hörmann. (1978). The influence of general and specific verbal labels on the recognition of labeled and unlabeled parts of pictures. *Journal of Verbal Learning & Verbal Behavior*, *17*, 445-454.

- Jucks, R., Becker, B.-M., & Bromme, R. (2008). Lexical entrainment in written discourse: Is expert's word use adapted to the addressee? *Discourse Processes, 45*, 497-518.
- Keatley, C., Spinks, J., & de Gelder, B. (1994). Asymmetrical cross-language priming effects. *Memory and Cognition, 22*, 70-84.
- Keysar, B., Lin, S., & Barr, D. (2003). Limits on theory of mind use in adults. *Cognition, 89*, 25-41.
- Kolers, P. A. (1963). Interlingual word association. *Journal of Verbal Learning and Verbal Behavior, 2*, 291-300.
- Kolers, P. A., & Paradis, M. (1980). Introduction to a special issue on psychological and linguistic studies of bilingualism. *Canadian Journal of Psychology, 34*, 287-303.
- Kootstra, G. J., Van Hell, J. G., & Dijkstra, T. (2009). Two speakers, one dialogue: An interactive alignment perspective on code-switching in bilingual speakers. In L. Isurin, D. Winford, & K. De Bot (Eds.), *Multidisciplinary approaches to code-switching* (pp. 129-160). Amsterdam: John Benjamins.
- Kootstra, G. J., van Hell, J. G., & Dijkstra, T. (2010). Syntactic alignment and shared word order in code-switched sentence production: Evidence from bilingual monologue and dialogue. *Journal of Memory and Language, 63*, 210-231.
- Krauss, R. M., & Fussell, S. R. (1996). Social psychological models of interpersonal communication. In E. T. Higgins, & A. Kruglanski (Eds.), *Social psychology: handbook of basic principles* (pp. 655-701). New York: Guilford Press.
- Kroll, J. F., Bobb, S. C., & Wodniecka, Z. (2006). Language selectivity is the exception, not the rule: Arguments against a fixed locus of language selection in bilingual speech. *Bilingualism: Language & Cognition, 9*, 119-135.
- Kroll, J. F., & De Groot, A. M. B. (1997). Lexical and conceptual memory in the bilingual: Mapping form to meaning in two languages. In A. M. B. De Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 169-199). Mahwah, NJ: Erlbaum.
- Kroll, J. F., & Stewart, E. (1994). Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language, 33*, 149-174.
- Kroll, J., & Tokowicz, N. (2001). The development of conceptual representation

- for words in a second language. In J. Nicol (Ed.) *One Mind: Two Languages* (pp. 49-71). Malden, MA: Blackwell.
- La Heij, W. (2005). Selection processes in monolingual and bilingual lexical access. In J. F. Kroll & A. M. B. De Groot (Eds.), *Handbook of bilingualism: Psycholinguistic approaches* (pp. 289-307). New York, NY: Oxford University Press.
- Lachman, R., Shaffer, J. P., & Hennrikus, D. (1974). Language and cognition: effects of stimulus codability, name-word frequency, and age of acquisition on lexical reaction-time. *Journal of Verbal Learning and Verbal Behavior*, 13, 613-625.
- Larsen-Freeman, D. & Long, M. (1991). *An introduction to second language acquisition research*. New York: Longman.
- Lemhöfer, K., & Dijkstra, A. (2004). Recognizing cognates and interlingual homograph: Effects of code similarity in language specific and generalized lexicon decision. *Memory and Cognition*, 32, 533-550.
- Levelt, W. J. M. (1989). *Speaking*. Cambridge, MA: MIT Press.
- Levelt, W. J. M., & Kelter, S. (1982). Surface form and memory in question answering. *Cognitive Psychology*, 14, 78-106.
- Levelt, W. J. M., Roelofs, A., & Meyer, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences*, 22, 1-75.
- Levelt, W. J. M., Schriefers, H., Vorberg, D., Meyer, A. S., Pechmann, T., & Havinga, J. (1991). The time course of lexical access in speech production: A study of picture naming. *Psychological Review*, 98, 122-142.
- Li, P., Sepanski, S., & Zhao, X. (2006). Language history questionnaire: A web-based interface for bilingual research. *Behaviour Research Methods*, 38, 202-210.
- Malt, B. C., Sloman, S. A., & Gennari, S. P. (2003). Universality and language specificity in object naming. *Journal of Memory and Language*, 49, 20-42.
- Marian, V., & Spivey, M. (2003a). Bilingual and monolingual processing of competing lexical items. *Applied Psycholinguistics*, 24, 173 -193.
- Marian, V., & Spivey, M. (2003b). Competing activation in bilingual language processing: Within- and between-language competition. *Bilingualism: Language and Cognition*, 6, 97-115.
- Meltzoff A., Moore M.K. (1977) Imitation of facial and manual gestures by human neonates. *Science*, 198, 75-78.
- Meltzoff, A., & Moore, M. (1983). Newborn infants imitate adult facial gestures.

- Child Development*, 54, 702-709.
- Metzing, C., & Brennan, S. E. (2003). When conceptual pacts are broken: Partner-specific effects in the comprehension of referring expressions. *Journal of Memory and Language*, 49, 201-213.
- Meuter, R. F. I., & Allport, A. (1999). Bilingual language switching in naming: Asymmetrical costs of language selection. *Journal of Memory and Language*, 40, 25-40.
- Morsella, E., & Miozzo, M. (2002). Evidence for a cascade model of lexical access in speech production. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28, 555-563.
- Navarrete, E., & Costa, A. (2005). Phonological activation of ignored pictures: Further evidence for a cascade model of lexical access. *Journal of Memory and Language*, 53, 359-377.
- Pardo, J. S. (2006). On phonetic convergence during conversational interaction. *Journal of the Acoustical Society of America*, 119, 2382-2393.
- Pavlenko, A. (1999). New approaches to concepts in bilingual memory. *Bilingualism: Language & Cognition*, 2 (3), 209-230.
- Pearson, J., Hu, J., Branigan, H. P., Pickering, M. J., & Nass, C. I. (2006). Adaptive language behavior in HCI: How expectations and beliefs about a system affect users' word choice *Proceedings of SIGCHI conference on human factors in computing systems* (pp. 1177-1180), Montreal, Canada.
- Peng, C.-Y. J., Lee, K. L., & Ingersoll, G. M. (2002). An introduction to logistic regression analysis and reporting. *The Journal of Educational Research*, 96, 3-14.
- Peterson, R., & Savoy, P. (1998). Lexical selection and phonological encoding during language production: Evidence for cascaded processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 24, 539-557.
- Pica, T. (1994). Research on negotiation: What does it reveal about second-language learning conditions, processes, and outcomes? *Language Learning*, 44, 493-527.
- Pickering, M. J., & Garrod, S. (2004). Toward a mechanistic psychology of dialogue. *Behavioral and Brain Sciences*, 27, 169-190.
- Potter, M. C., & Faulconer, B. A. (1975, February 6). Time to understand pictures and words. *Nature*, 253, 437-438.

- Potter, M., So, K., Von Eckardt, B., & Feldman, L. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, *23*, 23-38.
- Provine, R.R. (1986). Yawning as a stereotypical action pattern and releasing stimulus. *Ethology*, *71*, 109-122.
- R Development Core Team (2009). R: A language and environment for statistical computing. Vienna: R Foundation for Statistical Computing (<<http://www.R-project.org>>).
- Rapp, B., & Goldrick, M. (2000). Discreteness and interactivity in spoken word production. *Psychological Review*, *107*, 460-499.
- Roelofs, A. (1992). A spreading-activation theory of lemma retrieval in speaking. *Cognition*, *42*, 107-142.
- Schober, M. F. (1993). Spatial perspective-taking in conversation. *Cognition*, *47*, 1-24.
- Schober M. F. (1995) Speakers, addressees, and frames of reference: Whose effort is minimized in conversations about locations? *Discourse Processes*, *20*, 219-247.
- Schober, M. F. (1998). Conversational evidence for rethinking meaning. *Social Research*, *65*, 511-534.
- Schober, M.F. (2005). Conceptual alignment in conversation. In B.F. Malle & S.D. Hodges (Eds.), *Other minds: How humans bridge the divide between self and others* (pp. 239-252). New York: Guilford Press.
- Schober, M. F., & Clark, H. H. (1989). Understanding by addressees and overhearers. *Cognitive Psychology*, *21*, 211-232.
- Schoonbaert, S., Hartsuiker, R. J., & Pickering, M. J. (2007). The representation of lexical and syntactic information in bilinguals: Evidence from syntactic priming. *Journal of Memory and Language*, *56*, 153-171.
- Schooler, J. W., & Engstler-Schooler, T. Y. (1990). Verbal overshadowing of visual memories: Some things are better left unsaid. *Cognitive Psychology*, *22*, 36-71.
- Schooler, J. W., Ohlsson, S., & Brooks, K. (1993). Thoughts beyond words: When language overshadows insight. *Journal of Experimental Psychology: General*, *122*, 166-183.
- Schriefers, H., Meyer, A. S., & Levelt, W. J. M. (1990). Exploring the time-course of

- lexical access in production: Picture–word interference studies. *Journal of Memory and Language*, 29, 86-102.
- Schwanenflugel, P., & Rey, M. (1986). Interlingual semantic facilitation: Evidence for a common representational system in the bilingual lexicon. *Journal of Memory and Language*, 25, 605-618.
- Schwartz, A., & Arêas Da Luz Fontes, A. B. (2008). Cross-language mediated priming: Effects of context and lexical relationship. *Bilingualism: Language and Cognition*, 11, 95-110.
- Shockley, K., Santana, M. V., & Fowler, C. A. (2003). Mutual interpersonal postural constraints are involved in cooperative conversation. *Journal of Experimental Psychology: Human Perception and Performance*, 29, 326-332.
- Snodgrass, J. G., & Vanderwart, M. (1980). A standardized set of 260 pictures: Norms for name agreement, familiarity and visual complexity. *Journal of Experimental Psychology: Human Learning and Memory*, 6, 174-215.
- Starreveld, P. A. & La Heij, W. (1995) Semantic interference, orthographic facilitation and their interaction in naming tasks. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 21, 686-698.
- Starreveld, P. A., & La Heij, W. (1996). Time-course analysis of semantic and orthographic context effects in picture naming. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 22, 896-918.
- Tanenhaus, M. K., & Trueswell, J. C. (2005). Eye movements as a tool for bridging the language-as-product and language-as-action traditions. In J. C. Trueswell & M. K. Tanenhaus (Eds.), *Approaches to studying world-situated language use: Bridging the language- as-product and language-action traditions* (pp. 3-37). Cambridge, MA: MIT Press.
- Theakston, A. L. (2004). The role of entrenchment in children's and adults' performance on grammaticality judgment tasks. *Cognitive Development*, 19, 15-34.
- Van Hell, J.G., & De Groot, A.M.B. (1998). Conceptual representation in bilingual memory: Effects of concreteness and cognate status in word association. *Bilingualism: Language and Cognition*, 1, 193-211.
- Van Heuven, W.J.B., Dijkstra, T., & Grainger, J. (1998). Orthographic neighborhood effects in bilingual word recognition. *Journal of Memory and Language*, 39, 458-483.

- Watson, M. E., Pickering, M. J., Branigan, H. P. (2004). Alignment of reference frames in dialogue. *Proceedings of the 26th Annual Conference of the Cognitive Science Society* (pp. 2353-2358), Mahwah, NJ: Erlbaum.
- Wheeldon, L., & Levelt, W. J. M. (1995). Monitoring the time course of phonological encoding. *Journal of Memory and Language*, 3, 311-334.
- Wilson, M., & Wilson, T. P. (2005). An oscillator model of the timing of turn-taking. *Psychonomic Bulletin & Review*, 12, 957-968.
- Wu, S., & Keysar, B. (2007). The effect of information overlap on communication effectiveness. *Cognitive Science*, 31, 169-181.
- Zwaan, R. A., & Radvansky, G. A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, 123, 162-185.

Appendix A. *Language History Questionnaire*

1. Age (in years): _____ 2. Sex: Male Female

3. Indicate at what age you **began** to learn each language.

Write the age (in years) next to the appropriate language. If you learnt a language from birth please write "0".

Irish _____ years

English _____ years

Other _____ years (please specify language: _____)

4. At what age did you start to learn **Irish** in the following situations?

Write the appropriate age (in years) next to the applicable situations.

At home _____ years

At school _____ years

Other _____ years (please specify: _____)

5. At what age did you start to learn **English** in the following situations?

Write the appropriate age (in years) next to the applicable situations.

At home _____ years

At school _____ years

Other _____ years (please specify: _____)

6. In which setting did you learn **Irish**?

Tick all relevant options.

Primarily through interaction with family/friends

Primarily through classroom tuition

A mixture of both of the above options

Other (please specify)

7. In which setting did you learn **English**?

Tick all relevant options.

Primarily through interaction with family/friends

Primarily through classroom tuition

A mixture of both of the above options

Other (please specify)

8. At what age did you feel comfortable speaking each language?

Write the appropriate age (in years) next to each language.

English _____ years

Irish _____ years

9. Please write down the language in which you received instruction in school, for each level of education:

Primary school: _____

Secondary school: _____

University: _____

10. Approximately, how many years of schooling did you receive in each language?

English _____ years

Irish _____ years

Others: _____ years (please specify language: _____)

11. Did you attend an Irish-speaking/ Gaeltacht school where all subjects (e.g. math, science) were taught through Irish?Yes No **If yes:**Did you complete all your Leaving Certificate subjects through Irish (e.g. math, biology)? Yes No Do you, or did you, study Irish at university? Yes No If yes, please specify the degree obtained
(e.g. undergraduate degree, diploma, postgraduate):

If no:Did you study Irish as a subject for your Leaving Certificate? Yes No Do you, or did you, study Irish at university? Yes No If yes, please specify the degree obtained
(e.g. undergraduate degree, diploma, postgraduate):

12. Please rate your ability in all of the languages you know in each of the aspects listed, using the scale below.

Write down the appropriate number in the table.

1	2	3	4	5	6	7
Very Poor (i.e. no ability)	Poor	Fair	Functional	Good	Very Good	Excellent (i.e. native-like)

Language	Reading Ability	Writing Ability	Speaking fluency	Listening/Comprehension ability
English				
Irish				

13. Indicate how often you use English and Irish, or other languages, in an academic context (e.g. school, university, summer language courses) and in a social context (e.g. with family, friends) during your childhood, adolescence and nowadays, using scale below.

Write the appropriate number in the table.

1	2	3	4	5
Never	Rarely/ Almost Never	Occasionally/ Sometimes	Frequently	Very Frequently

Period	Language	Frequency of use in an <u>academic context</u>	Frequency of use in a <u>social context</u>
Childhood	English		
	Irish		
	Other languages		
Adolescence	English		
	Irish		
	Other languages		
Nowadays	English		
	Irish		
	Other languages		

14. Which language do you predominantly use at home?

Tick the appropriate option.

English Irish Both **15. When doing math in your head (such as multiplying 21 x 3), which language do you calculate the numbers in?**

Tick the appropriate option.

English Irish Other (please specify language: _____)**16. When you are speaking, do you ever mix words or sentences from English and Irish?**Yes No **If yes, please rate the frequency of mixing in normal conversation with the following people using the scale below.**

Write down the appropriate number in the table.

1 Rarely	2 Occasionally	3 Sometimes	4 Frequently	5 Very Frequently
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Relationship	Frequency of mixing
Spouse/ family members	
Friends	
Co-workers	
Classmates	

17. If you had to choose which language to use for the rest of your life, which language would it be?Tick one option.English Irish

18. Do you feel that you have lost any fluency in a particular language?Yes No **If yes, which language?**English Irish **At what age (in years) do you feel you lost this fluency?**

____ years

19. What region do you currently live in?

Tick the appropriate option.

English-speaking region where English is the dominant language Irish-speaking region where Irish is the dominant language A bilingual community where both Irish and English are spoken
to the same extent

If you have any other remarks about your language history that you think may be important for your ability to use these languages, please feel free to write them here:

Thank you for taking the time to fill out this questionnaire.

Appendix B. *Experimental Items*

Favoured Name		Disfavoured Name	
English	Irish	English	Irish
Apple	Úlla	Fruit	Tortha
Bottle	Buidéal	Drink	Deoch
Boy	Buachail	Child	Páiste
Stick	Maide	Branch	Géag
Cooker	Cócairéan	Oven	Oigheann
Chair	Cathaoir	Seat	Suíochán
Bull	Tarbh	Cow	Bó
Daffodil	Lus an chromcinn	Flower	Bláth
Dog	Madra	Wolf	Mac tíre
Doll	Babóg	Toy	Breagán
Donkey	Asal	Horse	Capall
Eye	Súil	Eyebrow	Maille
Finger	Méar	Fingernail	Ionga
Fire	Tine	Flames	Lasracha
Fly	Mioltóg	Insect	Feithid
Hand	Lámh	Palm	Bos
Holly	Cuilleann	Leaves	Duilleoga
House	Teach	Building	Foirgneamh
Lighthouse	Teach solais	Tower	Túr
Mountain	Sliabh	Hill	Cnoc
Priest	Sagart	Monk	Manach
Ring	Fáinne	Jewellery	Seodra
Rooster	Coileach	Hen	Cearc
Sailboat	Bád seoil	Boat	Bád
Seagull	Faoileán	Bird	Éan
Lamb	Uan	Sheep	Caora
Skeleton	Cnámharlach	Bones	Cnámha
Runner	Reathaí	Athlete	Luthchleasaí
Stairs	Staighre	Steps	Céimeanna
Teacher	Múinteoir	Lecturer	Léachtóir
Tin whistle	Feadóg stain	Instrument	Uirlis
Wood	Coill	Trees	Crainnte

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Míle buíochas ó chroí le mo mháthair agus m'athair a thug an oiread cúnamh dhom i rith na bliana. Tá a fhios agam go n-aithríonn sé ar nós go bhfuil céim déanta agaibhse chomh maith!

Ba mhaith liom go raibh maith agat a rá le Seán chomh maith a rinne neart cupáin tae dhom agus as ucht mo chuid gramadach a cheartú.