Bilingualism: Functional and neural perspectives

Bilingualism, defined as the regular use of two (or more) languages (Grosjean, 1992), is more a rule than an exception on our planet. In The Netherlands, home base of Acta Psychologica, for example, about 80% of the population claim to speak English as a second language (Graddol, 2004). Bilingualism poses important challenges for the psychological and neurocognitive study of language, which traditionally has constructed functional and neural theories of the exceptional case of unilingualism. These challenges include the issues of how bilinguals represent linguistic information from each language in their minds and brains, whether the same organizational principles apply to the first and second languages, and how they keep their languages apart. It is a goal of this special issue to bring together research that tackles these challenges, and in particular to begin to bridge two clefts. The first cleft is that between a functional perspective, which asks how language is represented and processed in a cognitive system, and a neural perspective, which asks how language is represented and processed in the brain. The second cleft is that between the domain of lexical representations, which focuses on the organization of the mental lexicon(s) in bilinguals, and the domain of grammar, which asks how bilinguals process sentences.

The special issue is a result of two workshops that were held in Rovereto, and supported by the CIMEC and University of Trento, Italy, in September 2005 and in September 2006. Both workshops had the explicit aim to build bridges between different approaches towards a rigorous study of bilingual language use, and in particular between functional and neural perspectives. The 2005 workshop focused on the issues of linguistic representation and cognitive control in the first language (L1) and the second language (L2) of bilinguals. The 2006 workshop focused on sentence processing (both in production and comprehension) in bilinguals.

The special issue consists of three review papers and six empirical papers. They cover research on the lexical and the syntactic level, in production, comprehension, and translation, using behavioral methods and neurocognitive methods. Despite these differences in the linguistic level of interest, modality, and perspective, all these papers are concerned in one way or another with the issue of whether the two languages of a bilingual are integrated or separated in the mind/brain, and how bilinguals can deal with the price one has to pay for an integrated system, namely potential interference from the language that is not in use. In the domain of the lexicon there is indeed a plethora of evidence for language integration: Whenever bilinguals recognize or produce a word in one language there is co-activation of words from the other language. The issue here is how bilinguals keep their languages apart. In word production, the question is how despite considerable co-activation of words from the non-target language, bilinguals almost always manage to restrict their output to the target language (Poulisse & Bongaerts, 1994). In word recognition, the question is what, if any, contextual or linguistic cues bilinguals can exploit to restrict lexical search to the language of the input (e.g., Dijkstra & Van Heuven, 2002). The first three papers are concerned with lexical activation and selection.

The contribution of Kroll, Bobb, Misra, and Guo reviews the evidence for parallel activation of the two languages in word production, and argues for parallel activation at all levels of lexical representation. The article then asks how speakers control the language of output and raises two possibilities. On one account, speakers activate words in the non-target language, but these words never enter into a competition for selection (Costa, Miozzo, & Caramazza, 1999; Finkbeiner, Gollan, & Caramazza, 2006). On another account, these words do enter the competition, but the speaker can selectively inhibit words from the non-target language (Green, 1998). Based on a review of data from several behavioral and ERP-production paradigms (e.g., Stroop-like tasks, language-switching tasks), the authors argue for the latter account.

An interesting argument in Kroll et al.’s paper is that language-selection cues by themselves are insufficient to restrict lexical access to the target language. The paper by Van Hell and De Groot reports evidence from word recognition that is consistent with this claim. The authors report three experiments in which bilinguals read cognates, either
in an isolation or in a sentence context. Cognates are processed more quickly than non-cognates, a finding that is often taken as evidence for parallel activation of the two languages. If it were the case that a language-selection cue, like the language in which a sentence is written, could restrict lexical access, one would expect the cognate effect to disappear in a sentence context. However, in Van Hell and De Groot’s experiment, the cognate effect survived in a sentence context (with low semantic constraints), both when the task was to perform a lexical decision on the cognate and to translate the cognate.

The paper by Portin, Lehtonen, Harrer, Wande, Niemi, and Laine also investigates visual word recognition and asks whether bilinguals transfer morphological strategies from their first to their second language. The authors compared visual recognition of inflected vs. monomorphemic nouns in L2 Swedish in speakers with first languages (Hungarian and Chinese) with different morphological systems. The authors observed that the Hungarians took longer to read inflected than monomorphemic words, (at least when the words were of low or medium frequency) while in contrast, the Chinese had no morphological processing cost. These results suggest that bilingual readers indeed transfer morphological strategies between languages.

The six further papers all discuss the domain of grammar. Here, the issue of whether languages are integrated is much more debated than in the domain of the lexicon. Several papers in this issue make reference to two influential theories, both of which claim that sentence processing in L2 is fundamentally different from that in L1. According to Clahsen and Felser (2006), sentences in L2 (in contrast to L1) are processed in a shallow way, that is, without full syntactic analysis. According to Ullman (2001), L1 and L2 grammar use two largely different neural systems, corresponding to procedural and declarative memory, respectively. Such theories predict that processing sentences in L2 is qualitatively different from processing sentences in L1.

In contrast, Abutalebi’s review of neuroimaging studies shows abundant evidence that grammatical processing in L1 and L2 employs largely similar areas of the brain. This paper also offers an account for some of the differences that are nevertheless observed. In unbalanced bilinguals, processing the first language is much more automatized than processing the second language. Hence some, or all, of the differences are likely reflections of more controlled processing in L2.

Hartsuiker and Pickering’s review of behavioral sentence production studies likewise pleads for the view of commonalities between grammatical processing in L1 and L2. The authors argue that for many types of sentence, bilinguals need to represent the structure only once. Such a shared-syntax account (Hartsuiker, Pickering, & Veltkamp, 2004) predicts that cross-linguistic priming effects of structure are as strong as within-language effects, and this is borne out by the data of several studies. In contrast, the view that a given sentence structure is represented differently for the first and second languages incorrectly predicts stronger within- than between-language priming.

Hartsuiker and Pickering’s model was mainly developed by testing sentence priming within and across languages, but the contribution of Ruiz, Parades, Mactzo, and Bajo provides evidence for shared syntax in a different domain, namely translation. They report two experiments in which translators read sentences with the purpose of translation or in a control condition. They found a reduction in the time to read for translation if the translation equivalent of the word had a high frequency in the target language, even though the frequency of the source words was controlled. They also found a reading time advantage if a phrase had an identical structure in source and target language versus a different structure. The findings suggest that translators activate lexical and syntactic representations in the target language while they are still reading the input sentence and that this process can benefit from syntactic representations being shared.

The three studies on sentence comprehension reported in this issue all provide converging evidence for similarities between parsing in L2 and L1, in contrast to the view that L2-comprehension is fundamentally different (e.g., more ‘shallow’) than L1-comprehension. Dussias and Cramer Scaltz first show in a norming study that Spanish–English bilinguals are sensitive to English verb subcategorization biases when reading temporarily ambiguous sentences in L2 English. There is now much evidence that the resolution of temporary ambiguities, such as the often studied ambiguity between a direct object and a sentence complement reading, is strongly influenced by the frequency with which particular verbs occur in each construction (verb bias). Dussias and Cramer Scaltz first show in a norming study that Spanish–English bilinguals have learnt the subcategorization biases of English verbs (even though the translation equivalent verbs in Spanish sometimes have different biases!). Furthermore, their self-paced reading data demonstrated that the bilinguals, like a group of English monolinguals, were sensitive to these biases in on-line sentence processing. This ability to keep track of the syntactic preferences of verbs and to exploit this information on-line strongly argues against a view by which L2-parsing is syntactically shallow.

The studies by Kotz, Holcomb, and Osterhout and by Frenck-Mestre, Osterhout, McLaughlin, and Foucart largely confirm this picture. Both studies asked to what extent brain responses to syntactic violations and syntactic ambiguities are similar in L1 and L2. Kotz et al. tested early and highly proficient Spanish–English bilinguals and native English speakers while brainwaves were recorded. The sentences could contain syntactic anomalies or they could be temporarily ambiguous; both manipulations are known to elicit the P600 component. In contrast to the view by which L2-sentence comprehension is fundamentally different from L1-comprehension, both the monolinguals and the bilinguals showed a P600 in response to both manipulations, although with differences in latency and in scalp distribution.
Frenck-Mestre et al. also measured ERPs in response to syntactic anomalies, namely errors of subject–verb person agreement. Their participants were native speakers of French or late German–French bilinguals. The violations were either phonologically distinct from the correct word (as in “je mangez”) or homophonous to the correct word (as in “je manges”). The native speakers showed a P600 in response to both anomalies, but the P600 was reliably larger in the phonologically distinct condition. The bilinguals also showed a P600 to the phonologically distinct anomalies, but there was no significant P600-effect with homophonous anomalies. Importantly, both the Kotz et al. and Frenck-Mestre et al. studies show that although brain responses in native speakers and bilinguals are not identical, there are considerable commonalities in the pattern of on-line brain responses.

In conclusion, the nine papers of this special issue consistently argue for a view of a bilingual language system that is largely integrated. They help to bridge the cleft between functional and neural perspectives by demonstrating that these perspectives provide converging evidence for an integrated view. They also help to bridge the cleft between work that focuses on the grammatical and the lexical levels, by showing that an integrated view holds in both domains. Finally, the research reported in this Special Issue opens new challenges that will generate future investigation in the field.

References


