

## Language diversity and bilingual processing

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### Introduction

This Special Issue on Language Diversity and bilingual processing is based on papers presented at the Exploratory Workshop on Speaking, Thinking and Gesturing in two Languages, convened by Panos Athanasopoulos and Jeanine Treffers-Daller at the University of Reading in September 2012, and sponsored by the European Science Foundation [IM/SCH/EW11-145]. The workshop brought together a multidisciplinary team of researchers interested in exploring how language affects cognition both in terms of structuring information for the purpose of communication, and in terms of non-verbal categorisation and perception of reality and the world. It is now established that considerable linguistic diversity exists not only at lower stages of processing such as phonology and lexical selection, but also in higher levels of representation such as grammar, syntax, and concepts. Such diversity may give rise to differences between speakers of different languages both when selecting and structuring information for the purposes of communication (the thinking-for-speaking hypothesis, Slobin 1991, 2003) and when perceiving and classifying entities such as objects, colours, and motion events (the linguistic relativity hypothesis, Whorf, 1956; Lucy, 1997).

Research shows that the information speakers select to describe events and how they package that information is to some extent dependent on the language they speak. Speakers of English, for example, pay more attention to manner of motion than speakers of French (Hickmann and Hendriks 2006). Other studies have found that there are important differences between speakers of different languages with respect to colour perception (Regier and Kay

2009), object categorisation (Lucy and Gaskins 2003), gesturing about motion (Gullberg 2011, Özyürek et al. 2008). In other words, speakers develop language-specific routines to encode and verbalise their thoughts. These routines are referred to as conceptualisation patterns.

Because the research to date has largely focused on monolingual speakers, there is a gap in our knowledge about the thinking processes of bilinguals and L2 learners. Given that the majority of the world's population uses more than one language in order to communicate (Cook 2002), the current workshop made it possible to establish a forum of discussion for researchers who are interesting in applying the methods used to uncover mental representation of the world to the domains of bilingualism and foreign language learning. Indeed, recent research shows that significant breakthroughs in this field can be obtained by researchers who focus on L2 users. Studies in the areas of object categorisation (Ameel, Malt, and Storms 2008; Pavlenko 2011), gestures (Gullberg 2011), event conceptualisation (Daller, Treffers-Daller and Furman, 2011; Treffers-Daller and Tidball in press, von Stutterheim et al. 2012) and colour perception (Athanasopoulos 2009) reveal that L2 users differ significantly from monolinguals in how they conceptualise events, how they categorise objects and also in the gestures they make to accompany their speech. In addition, the variables that modulate such restructuring of conceptualization and cognitive patterns in bilinguals include increasing L2 proficiency, age of onset of bilingualism, and length of stay in the L2-speaking country. Thus, studying bilinguals allows us to trace the developmental trajectory of language and cognition in the human mind, and thus gain important new insights into the correlation between linguistic and sociocultural variables on the one hand and cognitive categories on the other hand, which studies of monolinguals do not reveal (Athanasopoulos 2011).

At the workshop linguists, psycholinguists and cognitive psychologists who are experts in the field of bilingual processing of domains such as motion event construal or object categorisation shared the most recent methods, including new technological tools to carry out experiments and to analyse language corpora, with each other. The special issue contributions comprise a truly diverse pool of interdisciplinary research, including papers from cognitive neuroscientists (e.g. Guillaume Thierry), linguists (e.g. Andreea Calude, Raphael Berthele, Eirini Sanoudaki, Jeanine Treffers-Daller), psycholinguists (e.g. Panos Athanasopoulos, Manne Bylund, Monique Flecken, Johannes Gerwien,), and experimental and cognitive psychologists (e.g. Eef Ameel, Barbara Malt, Gert Storms), with the common thread of bilingual cognitive and language development from a cross-linguistic perspective.

#### Contents and structure of the special issue

The special issue begins with an exploration of cross-activation of the bilingual lexicon and object category formation in development in the face of conceptual non-equivalence between object names and their referents in different languages (Storms, Ameel and Malt). It then moves to the relatively novel domain of cross-activation at the syntactic level, taking the diversity that exists in word order concerning nouns and their modifying adjectives (Sanoudaki and Thierry). The focus from then on shifts to motion events, given its recent centrality in the language-thought debate (Papafragou 2015). Two papers consider the implications of cross-linguistic differences in grammatical aspect on event apprehension (Gerwien and Flecken) and on non-verbal event categorization (Bylund and Athanasopoulos). The following paper by Treffers-Daller and Calude focuses on cross-linguistic differences in the expression of manner of motion in the main verb, and its interaction with whether the event involves change of location or not, while the final paper by Berthele examines the

semantic domain of caused motion, and focuses on cross-linguistic differences in verbs of putting.

Storms, Ameel and Malt's study examines the diversity that exists in naming concrete objects, and for the first time tracks the developmental trajectory of such naming patterns in bilingual speakers. They begin by illustrating that seemingly translation equivalents rarely have exactly the same conceptual referents. For example, the set of objects typically denoted by the word *bottle* in English only partially correspond to objects denoted by its translation equivalent in Dutch (*fles*), French (*bouteille*) and a number of other languages. Naming categorization studies show that bilinguals converge their conceptual categories, resulting in less complex, broader categories than monolinguals. For example, while the referents of Dutch *fles* are typically differentiated by French monolinguals into *bouteille* (larger bottle) and *flacon* (smaller bottle), Dutch-French bilinguals assign most bottles to the category *bouteille* and only a few to the category *flacon* (Ameel et al. 2005). A small round styrofoam container typically called *piala* by Russian monolinguals, was called *chashka* by Russian-English bilinguals, in line with the English typical name *cup*, while bilinguals showed further over-extension of the *chashka* category in line with the referents of the English word *cup* to include containers that fell under different categories in the naming patterns of Russian monolinguals (Pavlenko and Malt 2011). Mapping object names to their referents developmentally is a slow process, not fully adult-like until age 14 in monolingual children. Given the extent of diversity in naming patterns, and the long process by which those mature in monolingual children, bilingual children face a considerable challenge in mastering word-to-referent mappings in their two languages. The researchers asked adult and children French and Dutch monolinguals, and Dutch-English bilinguals to name 73 photographs of storage containers (such as bottles and jars). Bilingual did this in both of their languages. The children were divided into 5 age groups: five-year olds, eight-year olds, ten-year olds, twelve-

year olds, and fourteen-year olds. The findings showed that the developmental trajectories of bilingual and monolingual children were strikingly similar. Both groups showed an increasing number of different words used in the naming task and an increasing number of dominant names, while qualitatively the same words were initially over- or underextended, and the naming pattern of both groups takes at least until the age of 14 to become adult-like. The findings also revealed that in bilingual children, convergence emerges after an initial stage of language separation. That is, the bilingual children treat their language-specific categories as distinct initially and only later on make them more alike in their two languages because of cross-activation from words in one language to words in the other language.

The paper by Sanoudaki and Thierry takes as its starting point the well-established cross-activation of languages in the bilingual mind at the lexical level, and asks whether and to what extent such cross-activation can be found at the syntactic level. Their study focused on cross-linguistic differences between English and Welsh in word order. In English adjectives typically precede nouns, while the reverse is true in Welsh. Sanoudaki and Thierry tested sensitivity to this grammatical constraint in English monolinguals and early Welsh-English bilinguals who were residing in North Wales, a bilingual community where Welsh and English are used interchangeably with high frequency. A picture – sentence matching decision task in English was utilized, where participants saw sentences containing adjective-noun (the English structure) and noun-adjective (the Welsh structure) pairs, and were instructed to respond only when either the adjective or the noun matched the characteristics of a preceding picture. The bilinguals were also asked to perform a verbal fluency task, where eight semantic categories (clothing, animals, vegetables, fruits, body parts, musical instruments, occupations, furniture) were named, half in Welsh, half in English. Bilinguals were then divided into two groups based on their relative fluency in the two languages, a low Welsh fluency group and a high Welsh fluency group. The results from the main task showed

that in adjective-noun trials, when the adjective in the sentence did not match the picture, participants inhibited their response until after they could read the noun, as shown by a significant modulation of the N200 component of the Event Related Brain Potential, an early index of inhibition of response in the human brain occurring around 200 ms post-stimulus. However, in noun-adjective trials, only the Welsh-English bilinguals with high Welsh fluency showed a response inhibition effect, indicating that they were ready to process an impending adjective in post-nominal position, even though this is ungrammatical in English (all the sentences were presented in English). These findings provide evidence that knowledge of the post-nominal adjectival placement of Welsh syntax is fully accessible during the processing of sentences exclusively presented in English. The fact that both of the bilingual groups had early ages of onset of bilingualism and had overall comparable proficiency in Welsh and English, pins down the variable of verbal fluency in a specific language as the determining factor modulating the degree of cross-activation of languages at the syntactic level, at least in simultaneous bilinguals living and using their languages in a bilingual society.

Gerwien and Flecken investigate whether German L2 speakers of Dutch have acquired patterns of use of progressive aspect in event encoding (focusing on the ‘ongoingness’ of events) in their L2. In Dutch, progressive aspect is not obligatorily expressed but can be verbalized in a periphrastic construction consisting of the preposition *aan* “at” plus determiner ‘*het*’ ‘at the’, originally a locative phrase, plus a verbal infinitive. In the bilinguals’ L1 (German) events cannot be marked with progressive aspect by means of a verbal complex. The authors used a sentence priming paradigm to study to what extent L2 speakers are sensitive to formal or conceptual priming effects in an experimental task which required them to produce sentences which express progressive aspect. They introduced participants to different types of priming sentences: the formal prime sentences contained, for

example, the Dutch locative preposition *aan* “at” and a noun phrase as in *het kasteel staat aan het water* (‘the castle stands at-the water’), whilst the conceptual prime sentences contained explicit progressive event descriptions, as in *de kleuter is een film aan het kijken* (‘the toddler is a film at-the watch’; the toddler is watching a film). A third group of neutral priming sentences contained non-progressive event descriptions. The results showed that native Dutch speakers are sensitive to the conceptual prime, that is, speakers marked more event descriptions with progressive aspect after having encountered a description with this explicit perspective of ‘ongoingness’, compared to those which contained a neutral prime. In L2 speakers no such effect was found. The authors explain the differences between the L2 speakers and the native speakers by postulating that the association between the progressive syntactic frame and the progressive event perspective is much weaker among L2 speakers than among native speakers. In other words, the strength of the association between conceptual features and form features of the Dutch progressive is different in both groups. In the form prime condition no priming effects were obtained in either group, possibly because the prime and target sentences did not have the same constituent structure. In the L2 speaker group the production of progressive target event descriptions dropped below the mean in the condition where participants were presented with *locative* prime sentences (formal priming condition). The authors assume that a semantic/conceptual effect can explain this finding. By processing the *locative* prime the spatial meaning of the prepositional phrase is activated in the L2 speakers, and this could block access to the concept of ‘ongoingness’. Specific factors relevant in the study of L2 acquisition were also shown to contribute to the findings, e.g., general level of L2 proficiency, and degree of L2 exposure. The authors conclude that the conceptual basis of an explicit event perspective (in this case, ‘ongoingness’) can be primed in native speakers and that in L2 speakers, access to this conceptual information is less automatized, compared to native speakers.

Bylund and Athanasopoulos' paper also focuses on grammatical aspect, but takes the investigation into the realms of linguistic relativity: Do differences in aspectual distinctions in language give rise to differences in non-verbal categorization of motion scenes based on ongoingness or motion completion? And how are these cross-linguistic differences reconciled in the mind of the bilingual person? Previous research has provided a positive answer to the first question, by showing that speakers of languages that mark progressive aspect on the verb (e.g. English, Russian, Arabic, Spanish) pay more attention to the ongoing action of an event, rather than its endpoint or goal, whereas speakers of languages that do not mark progressivity grammatically (e.g. German, Afrikaans, and Swedish) tend to focus more on event endpoints. These differences have been found using a number of measures, such as attention allocation to different components of motion scenes, non-verbal recognition memory, and non-verbal similarity judgments of motion video clip triads (Athanasopoulos and Bylund 2013; Flecken, Carroll and von Stutterheim 2014; von Stutterheim, Andermann, Carroll, Flecken and Schmiedtová 2012). With regards to the second question, more recent research shows that the degree to which bilinguals shift towards the cognitive patterns of one or the other language depends on the frequency with which they use their specific languages, the language of schooling in primary education, the amount of exposure to the second language, and the language testing context (Bylund, Athanasopoulos and Oostendorp 2013; Bylund and Athanasopoulos 2014; Athanasopoulos et al. 2015). The novelty of the current paper lies in its exploration of cognitive restructuring in nativisation, that is, the process by which a L2 is acquired as a L1, focusing on South African speakers who learnt English as a L1 from caregivers who spoke English as a L2 and Afrikaans as a L1. Participants had to match a target scene showing motion towards a goal (intermediate degree of goal orientation) with one of two alternate videos, one that showed motion with arrival at a goal (high degree of goal orientation, the typical native Afrikaans response choice) or one that showed motion



without an obvious endpoint (low degree of goal orientation, the typical native English response choice). Two groups of speakers who had acquired their L1 through the process of nativization were compared to two native speaker groups, one of English, the other of Afrikaans. One group consisted of speakers who were functionally monolingual speakers of nativised English. The cognitive behaviour of speakers of this nativised L2 English variety aligned with that of English native speakers with no influence from Afrikaans on their cognitive behaviour. The other group consisted of speakers who were functionally bilingual speakers of Afrikaans and nativised English. This group, despite being functionally bilingual, behaved differently from native English speakers, resembling more the cognitive behaviour of native Afrikaans speakers. Correlational analysis revealed that cognitive behaviour was strongly related to frequency of language use, such that the more an individual used Afrikaans (and the less often they used English) in their daily life, the more prone they were to behave like Afrikaans native speakers. The conclusion the authors draw is that the degree of cognitive restructuring as a function of language learning is a function of degree of variation in individual learners' histories and language usage patterns.

This conclusion is reinforced by Treffers-Daller and Calude's paper, which is one of the first papers to make a link between the field of statistical learning and the field of the L2 acquisition of motion event construal. They investigate whether L2 learners can make use of statistical learning (entrenchment and pre-emption) to learn how to talk about motion in a second language. Statistical learning (Saffran et al. 1997) is a specific case of incidental learning, that is learning without an intent to learn (Laufer and Hulstijn 2001). It is generally assumed that it is difficult for learners to reconceptualise motion in the L2 because of entrenched first language (L1) patterns but little attention has been paid to the kinds of indirect negative evidence that could be used by learners to avoid target-deviant patterns and opt for targetlike motion event patterns. This paper explores to what extent frequency of

different verbs in the input can provide such indirect evidence and help learners to recover from overgeneralisations that they might make in transferring their L1 patterns to their L2. A key question is, however, whether statistical learning is sufficient to withdraw from overgeneralisations in the field of motion, and learn what *not* to say. Learners of L2 French need to learn that manner of motion can be expressed in the main verb slot if there is no change of location involved but that this is not common if a change of location is predicated (Hickmann, Taranne, and Bonnet 2009), and in particular if this change of location involves a boundary crossing (Aske 1989, Slobin and Hoiting 1994). The study was based on transcripts of oral story tellings among 41 L1 English adult learners of French of two different levels (intermediate and advanced) and 23 French native speakers. Information about the frequency of motion verbs in English and French was obtained from Sketchengine. The authors found that both learner groups were to a certain extent able to match the frequencies of usage of native speakers, but the higher level learners, who had been on a year abroad in a French-speaking country, were better able to do this than lower level learners. The frequency of use of the motion verbs in naturalistic data (as established on the basis of the French Sketchengine corpus) also played a significant role in shaping the use of motion verbs for both the intermediate and the advanced learners. Treffers-Daller and Calude interpret these findings as strong evidence that L2 learners do indeed engage in statistical learning of motion verbs. However, a large proportion of learners failed to acquire the constraint on the use of manner verbs in boundary crossing constructions. The authors attribute this to the fact that the rules for the use of manner verbs in boundary crossings are far from transparent, which makes it unlikely that learners can acquire these by focusing on positive evidence only. In addition, students' failure is likely to be related to the lack of direct negative evidence and the limited availability of indirect negative evidence in the form of alternative expressions which could pre-empt the use of manner in the main verb in boundary crossings.

Berthele also focuses on the domain of motion, but is specifically interested in the ways in which bilinguals handle differing semantic categories in their two languages. Drawing on bilingual data from multilingual speakers of Romansh as well as from speakers of (Swiss) German, the tensions that emerge from “conflicting habits” (Weinreich 1953) in the two languages are analyzed in the semantic domain of caused motion. Verbs of putting are particularly interesting in this language pair because Romansh and German carve up the semantic space in this domain in very different ways. The choice of verbs in the German system depends on the orientation of the object (*setzen* “to sit”, *legen* “to put horizontally” and *stellen* “to put vertically”), whereas in Romansh features such as orientation of the figure are not encoded and more generic verbs of putting are used, for example *metter* ‘to put’ and *tschentar* ‘to put’. The question is now how Romansh-German bilinguals cope with the existence of these two semantic systems in their two languages. The analyses show differing degrees and different ways of reducing these tensions in the bilingual subjects. Berthele carefully distinguishes between (1) within-language variation in Romansh and German, (2) cross-linguistic differences between Romansh and German, and (3) bilingual within-subject variation across languages. Berthele first of all computes a distance measure of the similarity between individual response patterns for particular stimuli, the “unanimity index”, based on Levenshtein’s (1966) string distances, in order to assess the degree of agreement among the participants in responses to a particular stimulus. The author also uses a measure of cultural consensus (CCM), drawing on a procedure used by Ameel et al. (2005), to establish to what extent pairs of participants agree with each other in naming objects. The measure of association which is computed stands for the proportion of ‘matches’ in naming of object pairs between two participants. Finally the author shows how bilinguals’ choices in each language reveal agreement within the individual. The author concludes that there is evidence for qualitative and quantitative convergence in the domain of putting in Romansh and

German, in the sense of “partial similarities increasing at the expense of differences” (Weinreich 1953, 395). Qualitative convergence was found in the expansion of the usage of German *legen* by some bilinguals for putting events for which monolingual Swiss German speaker do not use this verb. This leads to high within- speaker consensus in such bilinguals (because they also use only one verb, namely *metter*, for the same events in French), but low consensus between the individual’s verb choices in German with those of monolingual German speakers. Evidence for quantitative convergence was found in the overuse of the dummy verb *tun*, which can be used colloquially in German to describe the stimuli. Interestingly, in both these examples, and for this sample of multilinguals who are dominant in Romansh, the Romansh system often wins on the within speaker “battle field”. This is unexpected, because German is often perceived to have a strong influence on Romansh, because of the societal dominance of the former over the latter. Berthele assumes this can be explained on the basis of the fact that the Romansh system of verbs of putting is relatively simple (one high-frequency verb vs. at least three caused-motion verbs).

## Conclusion

Given the considerable diversity that exists across languages in concepts, words, syntactic structure and grammatical categories, the current special issue synthesizes a number of approaches and investigations into how these contrasting linguistic features are reconciled in bilingual language and cognitive processing. All the studies show that bilinguals not only master those language-specific categories, but more interestingly that their behaviour is in most cases markedly distinct from that of monolinguals of either one of their languages. The studies have uncovered the relative role of a number of different variables characterizing the bilingual person that underpin this unique behaviour: Verbal fluency, language dominance,

general level of L2 proficiency, degree of L2 exposure, frequency of usage of a specific language, and frequency of the target linguistic features in the input and in L2 usage.

Such factors in bilingual processing as revealed by the current studies highlight the dynamic nature of bilingualism. The issue of convergence or separation of language-specific mental representations in bilinguals took shape with Weinreich's (1953) postulation that different types of representations in a convergence-separation continuum may coexist (transitorily or more permanently) and change as a function of increasing proficiency, age of onset of bilingualism and language learning context, thus recognizing the malleable nature of bilingual development and memory representations. Weinreich also recognized that some degree of conceptual (non)equivalence between languages exists, and put the learning trajectory of languages in the bilingual person at centre stage. However, subsequent models of the cognitive architecture of bilingualism, in particular the concept-mediation and word-association models of lexical access in bilinguals (Potter, So, Von Eckardt & Feldman, 1984) and the Revised Hierarchical Model (Kroll & Stewart, 1994) assumed equivalence of languages at the conceptual level, reducing conceptual representation as stable word-to-picture mappings that were common across all speakers regardless of language background, and focused exclusively on inter-lingual connections in the lexicon (how fast individuals were in mapping words to pictures and in translating from one language to the other). These assumptions are questioned in more recent models of lexical processing in bilinguals (e.g. Van Hell and De Groot 1998; Dong, Gui and MacWhinney, 2005; Pavlenko 2009). The findings from the studies in the special issue support models of bilingual representation that assume cross-linguistic variation and the existence of language-specific concepts alongside shared concepts, as advocated in the Modified Hierarchical Model (Pavlenko, 2009). In addition, the studies extend the hitherto exclusive study of the bilingual lexicon to grammar and syntax. The current studies highlight conceptual non-equivalence at all levels of

representation, even in cases of seemingly direct translation equivalents, and by taking into account language diversity and placing it as the basis of their investigation, the studies shed light on the mechanisms and variables that modulate restructuring and convergence, and recast these phenomena as essentially a matter of degree of variation in individual learners' histories. Further research will need to focus on the issue of shared versus language-specific representations in bilinguals, which will shed new light on how bilinguals differ from monolinguals in how they process language.

By tracing the mechanisms of convergence and restructuring in the bilingual mind, the studies in this special issue also serve to highlight the multicompetent nature of the bilingual user. The multi-competence framework (Cook, 1992, 2002, 2003) emphasises the need to study bilinguals in their own right rather than as imperfect versions of a monolingual native speaker ideal. In this way, the person who speaks more than one language is viewed as an independent speaker/hearer/thinker, with linguistic and cognitive representations and abilities which are qualitatively distinct from those of a monolingual person. This resonates with Grosjean (1989, 1998), who has repeatedly argued that the bilingual person is not two monolinguals in the same body, but a unique language user with a complete language system. These approaches shift the terms of engagement from focusing on what L2 users cannot do and why, relative to monolingual speakers of one or the other language, to what bilinguals do differently and why, compared to those who only know one language.

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