

## Essay review

**Cognitive Processing in Bilinguals.** Edited by Richard J. Harris. Amsterdam: Elsevier Science. 1992. Pp. x+592. Cased, \$115.50.

For most laypeople, a bilingual is a person with a roughly equal level of proficiency in two different languages. However, for those who study how a second language (L2) is acquired or represented mentally, such a person is described as a 'balanced bilingual', the simple term 'bilingual' being used irrespective of the degree of expertise in L2. At the most extreme, someone who had been enrolled in a foreign-language class for a couple of months could be regarded as a bilingual. Balanced bilinguals are usually thought by laypeople and professionals alike to be a fairly rare species. However, in the broader sense of the word, bilinguals are to be found in large numbers all over the world and are sometimes estimated to outnumber monolinguals. These bilinguals, and particularly the adults among them, are the focus of attention in most of the 33 contributions to this volume, written by 53 active workers in the field of bilingual research and edited by Richard J. Harris of Kansas State University.

The volume arose from the editor's observation that, unlike topics such as second-language acquisition, bilingual education, and social and cultural aspects of bilingualism, cognitive aspects of bilingualism have received relatively little attention in the specialist literature. Where studies on cognitive functioning in bilinguals have been published, they have been scattered over many books and journals. As a consequence, to get a general idea of the questions that feature in this literature and the way in which they are approached in different lines of research is a laborious project. The editor's purpose was to gather a large number of studies on bilingual cognition under a single cover, thus making the task of achieving a comprehensive view of the field easier and more efficient. In these terms, the book is a success. Many themes of interest, not only to those involved with bilingualism but also to a more general readership, received attention, if sometimes only superficially so. In the following discussion, I have only partly adopted Harris' organization of the book.

### Separate or shared mental representations?

One theme that crops up in a number of chapters is how a bilingual's two language systems are stored mentally. In most of these contributions the focus is on the representation of word knowledge rather than higher-level knowledge. The views which are traditionally contrasted under different names are the separate-storage and shared-storage hypotheses. According to the separate-storage view, the knowledge that bilinguals have of their two languages is represented in two language-specific systems. According to the shared-storage view, this knowledge is represented in a single, integrated, language-independent system.

Across the large number of studies that have been carried out to try to resolve this issue, a large number of different tasks have been used (tests of both episodic and semantic memory and both conceptually driven and data-driven tasks). The fact that specific task requirements appear to determine the results of these studies has led a number of researchers (starting with Durgunoglu and Roediger, 1987, and elaborated in this book) to conclude that the problem of the nature of the representational system in bilinguals is irresolvable. Other authors, however, see a way out of this conflict by explicitly assuming two layers in the representational system: one layer represents the word forms, the second their meanings. For the word level, two separate stores are assumed, one for each of the two languages of the bilingual; the representations at the meaning level are thought to be shared by the two languages. Different experimental tasks exploit the two different layers in the system, which is why they produce

results that are *seemingly* contradictory. Tasks where performance is based on the word level of representation produce data consistent with the language-specific view, while tasks in which performance is based on access to the meaning level of representation produce data that suggest a language-independent store.

This hierarchical or 'three-code' model was first introduced in the literature in the early 1980s (e.g. Potter, So, Von Eckardt & Feldman, 1984). Kroll and Sholl extend this model by assuming directional asymmetries in the strength of connections between the various stores, and these asymmetries have consequences for processing in a number of tasks (word translation, semantic priming and incidental recall). Votaw discusses the relevance of language choice (whether constrained by sociolinguistic and psychological pressures or unconstrained) to developing models of lexico-semantic organization.

### Proficiency in L2

In some of the above studies on mental representation in bilinguals, the role of the bilingual's proficiency in L2 is discussed. It is assumed that with increasing proficiency in the new language the representational system evolves from a shared to a language-specific structure or from a 'word association' to a 'concept mediation' structure.

Chen provides an illustration of this view in a discussion of studies comparing performance in picture naming and word translation and studies using the interlingual version of the Stroop colour-naming tasks (see also below). He also argues that, in addition to L2 proficiency, both the L2 learning strategy and the orthographic similarity between the first language (L1) and L2 determine the structure of bilingual representation and, consequently, the way words in L2 are processed. A further relevant conclusion reached by Chen is that the age at which L2 acquisition begins (during childhood or during adulthood) appears to be immaterial.

Chitiri, Sun, Willows and Taylor also study the role of L2 proficiency. They compare native speakers of a language and two groups of learners of that language, more and less skilled, in terms of their performance in two word-recognition tasks, letter cancellation and same-different judgement, and find differences between all three groups. Further issues concerning L2 proficiency are dealt with in the chapters by Bentahila and Davies, by McDonald and Heilenman, and by Mägiste. These will be discussed under some of the other themes below.

### Age of acquisition

Chen's conclusion that the age of acquisition of L2 is immaterial only concerns bilingual lexical representation and should not be automatically generalized to other aspects of bilingual functioning. Indeed, a number of other chapters in this volume discuss the role of age of acquisition and conclude that it is an important factor. McWhinney, in a chapter on transfer from L1 to L2 learning, briefly discusses the age-of-acquisition literature and emphasizes the specific (though not exclusive) problems which the older L2 learner has with the phonological patterns of the new language. He attributes this to a higher level of automatization of the L1 system in older as opposed to younger learners: the more automatized the L1 system, the more 'fossilized' performance in L2 will be.

The issues of fossilization and age of acquisition in L2 use also both features in the contribution of Hyltenstam. He specifically focuses on the role of age of acquisition in determining the ultimate attainment of L2. An interesting feature of this study is that both of his age-of-acquisition groups consisted of bilinguals who had begun learning their L2 well before puberty. Such a design has the potential to unravel the roles of age of acquisition (younger or older) and learning period in relation to puberty (before or after) in L2 learning. In many studies, these two factors are confounded.

### Transfer from L1 to L2

The chapter by MacWhinney discussed above deals primarily with transfer (both positive and negative) from L1 to the learning of L2. He discusses transfer in the context of the 'competition' model, originally developed to account for monolingual language processing. A central tenet of this model is that the

language comprehender uses language forms as cues that activate alternative competing functions, whereas in language production the underlying functions of language are cues that activate alternative competing forms. MacWhinney applies the competition model to L1-to-L2 transfer at several levels of L2 processing: phonological, lexical and syntactic. The word-association model, briefly mentioned above in the discussion on language-specific vs. language-independent lexico-semantic representation, is an example of transfer at the level of lexical items: old L1 word meanings are linked through L1 word-form representations to new words in L2. In contrast, the carry-over of word order as a cue to actor and object assignment in a sentence is an example of transfer from L1 to L2 at the syntactic level.

The paper by McDonald and Heilenman is devoted to investigating the way in which both native speakers of a language and learners of that language use cues like word order, verb agreement and noun animacy to assign actor roles to nouns in sentences. Languages differ from one another in how reliable each of these cues is. The authors show that during the initial stages of L2 acquisition learners use the cue with the highest validity in L1 in determining the actor roles in the L2 sentences, even if in L2 this cue is not very reliable. With increased experience in L2, learners adopt the cue that is the most reliable when processing sentences in L2.

Durgunoglu and Hancin deal exclusively with transfer to reading in L2. Their decision to focus upon L2 reading was motivated by the observation that most previous transfer studies had involved L2 acquisition and L2 production. They systematically decompose the reading process into its constituent components (e.g. orthographic and phonological processing; morphological processing; syntactic processing) and look for evidence of cross-language transfer at each of these processing levels. Lasisi and Onyehalu investigate the influence of the learner's cultural background (here, Yoruba vs. Ibo, two Nigerian ethnic groups with different cultural identities) on text comprehension in L2. They show that the comprehension of the same English (L2) text by Yoruba English and Ibo-English bilinguals differs, and that the specific interpretation which each group assigns to the text directly reflects the group's unique cultural identity.

### Code switching

In the literature on bilingualism, the term 'code switching' is used in two different ways. It refers to the switches that occur spontaneously in the language productions of bilinguals, as well as to what could be called 'experimenter determined' switches, where code-switched texts (in which some words or phrases are presented in one language, and others in the other language) are presented to the bilingual subject and the effects of this switching upon processing are studied. The contribution by Bentahila and Davies deals with code switching in the former sense. Their study strongly suggests that the patterns of switches that occur depend heavily upon the L2 proficiency of the bilingual. The balanced (Moroccan-French) bilinguals in their study fairly often switched between whole clauses, whereas subjects clearly dominant in one language (Moroccan) switched extensively between smaller constituents within clauses. Ultimately, so these authors argue, both switch patterns arise from the interactions between the communicative intentions and the language background of the respective bilingual groups. Their conclusions match the statement by Malakoff in this volume that code switching is a deliberate activity rather than a sign of linguistic confusion (although cf. the chapter by Arnberg and Arnberg).

Experimenter-determined code switching is discussed by Grainger and Dijkstra, as part of their main theoretical focus upon how bilinguals represent and use their knowledge of which language each individual word in their bilingual vocabulary belongs to. They note that code-switched sentences and word lists are generally harder to process than monolingual materials. They explain this effect (and a number of others) in terms of a Bilingual Interactive Activation model of bilingual word recognition, which extends McClelland and Rumelhart's (1981) interactive activation model of monolingual word recognition. The extension consists of an additional layer containing just two nodes, the 'language' nodes. All words within the two vocabularies of the bilingual are connected to the corresponding language node. The delay in processing following a language switch in the presented materials arises from residual activation in the inappropriate language node.

Another central theme in Grainger and Dijkstra's paper is the notion of parallel, language-independent access to the bilingual's vocabularies upon the presentation of a word, a theme that is also focused on in the chapters by Frenck-Mestre and Vaid, by Doctor and Klein and by Beauvillain. The

latter illustrates her position that word recognition is stimulus driven and indeed indifferent to language by referring to the outcomes of studies on the processing of interlexical homographs in, for instance, lexical decision and to the occurrence of interlingual Stroop effects. These latter effects bear on questions concerning code switching because they indicate how complete these switches can be: the larger the effect, the less successful the switch to the other language. The absence of an interlingual Stroop effect would indicate a completely successful switch.

Intra- and interlingual Stroop effects are investigated in the paper by Lee, Wee, Tzeng and Hung. Their particular focus is upon the effect of script type (logographic, alphabetic or syllabic) upon the size of these effects. More specifically, they test the 'orthography-specific' hypothesis of Biederman & Tsao (1979) which predicts that logographic scripts cause larger intralingual Stroop effects than syllabaries and alphabetic scripts, and that the more different the orthographies of the two languages involved in an interlingual condition (e.g. colour naming in English of words presented in Chinese), the smaller the interlingual effects will be. The present authors do not obtain support for these predictions and consequently reject the orthography-specific hypothesis.

### Meta-linguistic awareness

Four contributions deal with the relation between meta-linguistic awareness and bilingualism. Malakoff discusses what she calls a 'metalinguistic skill *par excellence*', translation ability. She investigates this skill in English-French bilingual children and concludes that they are competent translators who are not easily misled by deliberate translation pitfalls and who show no evidence of linguistic confusion when translating. The latter conclusion relates to the central theme of the chapter by Arnberg and Arnberg, who investigate the question of how and when bilingual children manage to separate their two languages. The authors describe a 'bilingual awareness' task, and show that children who show an awareness of their two languages mix them to a lesser extent than do children less aware of their two languages. (In the above terminology, they code-switch less.) This finding suggests that language separation results from language awareness.

The contribution by Bialystok concerns the effect of bilingualism on general cognitive functioning, a theme that has been around the literature on bilingualism for decades. Some researchers think that bilingualism has little or no effect upon cognitive functioning; others adhere to the view that bilingualism has a detrimental effect; while a third camp defends the view that it is beneficial. Bialystok belongs to the latter group. She lists a large number of tasks in which bilingual children perform better than monolingual children, and she parsimoniously attributes this superior performance to a single factor: the former group seems to have a greater control of attention than the latter group.

The final paper in this cluster, by Thomas, looks at the role of metalinguistic awareness in learning a new (second or third) language. One of the questions she poses is whether bilinguals, as a result of having a higher level of linguistic awareness, are in an advantageous position (as compared with monolinguals) when learning a new language.

### Working memory/short-term memory and bilingualism

The contributions by Harrington, by Brown and Hulme, and by Ellis, all deal with the role in bilingual functioning of short-term memory (STM) or the concept that has replaced STM in the recent literature, working memory. Relevant questions that are posed are: Why do bilinguals show a reduced STM span for material presented in the less familiar language? What are the consequences of this reduced STM capacity for processing in a second language? A common answer to the first of these two questions is related to the fact that speech rate is reduced in L2 compared with L1. Memory span is often viewed as being equal to the amount of material that can be rehearsed within a fixed time span (e.g. 2 seconds). The lower speech rate in L2 then explains the reduction of span in L2. To this explanation of the effect Brown and Hulme add a second: namely, that the reduced span is due to weaker long-term memory representations in L2 than in L1.

When the materials to be rehearsed are digits, bilinguals may have different spans in their two languages even when they are equally fluent in both. The reason is that digit length varies between

languages: the longer they are, the fewer can be articulated within the critical time span. Ellis discusses the consequences of this fact in the context of the Sapir-Whorf linguistic-relativity hypothesis. He shows that Welsh-English bilinguals perform better when counting or calculating in English (which has the shorter average digit length) than in Welsh, thus demonstrating the influence of a language feature on cognitive functioning. This has clear theoretical and practical consequences. For instance, differences between the calculation ability of two monolingual cultural groups should not be recklessly attributed to different intellectual capacities in the two groups.

Finally, Harrington discusses the role of working memory capacity in L1 processing. He reviews the literature demonstrating that individual differences in this capacity go hand-in-hand with individual differences in L1 skill. He then reports on studies aimed at examining the role of working memory capacity in L2 development and reading. He concludes that reading span as an index of working memory capacity is correlated with reading skill in both L1 and L2. Whether this relationship is a causal one remains to be seen.

### Miscellaneous topics

The remaining contributions deal with a variety of current and interesting topics. Two neuropsychological papers by Mägiste and by Hoosain both deal with *cerebral lateralization* in bilinguals. However, their conclusions do not converge. Mägiste's study suggests that language in bilinguals is less lateralized within the left hemisphere than it is in monolinguals. Furthermore, her data indicate that the degree of lateralization depends upon proficiency in L2: balanced bilinguals appear to have more bilateral representation than bilinguals who are dominant in one of their languages. In contrast, in a review of visual studies, auditory studies, time-sharing studies and aphasia studies, Hoosain challenges the idea that there is more right-hemisphere involvement in bilingual than in monolingual language functioning.

Grosjean opposes the 'fractional' view of bilingualism, according to which the bilingual is two monolinguals in one and the same person, and ardently defends the 'holistic' view which holds that bilinguals exploit two languages in a unique way to achieve their communicative intentions. His discussion clearly pertains to the notion of *linguistic relativity*, which was briefly touched on above. The chapters by de Gelder and Vroomen and by Palij and Aaronson also bear upon this issue. De Gelder and Vroomen demonstrate the validity of the linguistic-relativity hypothesis by showing differences in auditory categorical perception and in lip reading of speech sounds between native speakers of Chinese (logographic script) and Dutch (alphabetic script). They also demonstrate that knowledge of the alphabetic script by Chinese native speakers influences performance in these tasks. Palij and Aaronson discuss the role of language background in cognitive processing, provide a taxonomy for grouping people on the basis of their language background and illustrate this in an experimental study.

Doctor and Klein investigate *phonological processing* in bilingual word processing by adapting monolingual dual-route theory. A parallel search through two language-specific orthographic input lexicons and a language-independent grapheme-to-phoneme conversion mechanism are hypothesized to operate simultaneously in bilingual word recognition. Finally, Kilborn investigates how L1 and L2 speakers of English integrate syntactic and semantic information in a word-monitoring task involving spoken English sentences. Integration speed turns out to be slower for the L2 subject group.

### Conclusions

All in all, *Cognitive Processing in Bilinguals* deals with a rich set of current topics in the study of bilingualism. It contains a wealth of introductory reading for undergraduate and graduate students enrolled in specialized courses on bilingualism, as well as for students and active researchers in the broader field of psycholinguistics. For researchers in bilingualism, who are likely to be familiar with many of the topics dealt with, the volume could serve as a handy reference book. Unfortunately, the expense of this book will make it inaccessible for the majority of these potential readers.

However, this volume invites criticism as well as praise. As is the case with many edited volumes, the book suffers greatly from the diversity of the contributions, both in style and in quality. It contains

a mixture of broad review chapters and detailed reports of recent experiments on a narrow research subject. A reasonable number of the contributions are of good, sometimes excellent, quality, but the volume also contains chapters that I suspect would not have made it into the more rigorously refereed journals. Some authors do not even manage to introduce their topic in a perspicuous manner, and the point of their paper only dawns on the reader gradually through repeated reading. In my opinion the volume would have benefited had the editor been more directive and selective.

A. M. B. DE GROOT (University of Amsterdam)

Biederman, I. & Tsao, Y. C. (1979). On processing Chinese ideographs and English words: Some implications from Stroop-test results. *Cognitive Psychology*, **11**, 125–132.

Durgunoglu, A. Y. & Roediger, H. L. (1987). Test differences in accessing bilingual memory. *Journal of Memory and Language*, **26**, 377–391.

McClelland, J. L. & Rumelhart, D. E. (1981). An interactive-activation model of context effects in letter perception. Part 1: An account of basic findings. *Psychological Review*, **76**, 340–354.

Potter, M. C., So, K.-F., Von Eckardt, B. & Feldman, L. B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior*, **23**, 23–38.