

Rethinking the Bilingual Brain

The Neurolinguistics of Bilingualism: An Introduction

by Franco Fabbro

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Review by Arturo E. Hernandez

Bilingualism is very relevant in today's society. As immigrants move from country to country, people with different languages come in contact, and bilinguals appear every day at an accelerated rate. This has created a number of issues in psychology. For example, one might wonder whether a bilingual person thinks like a monolingual person or whether one should educate bilinguals in one language or two. However, the topic of this book, "the neural underpinnings of bilingualism," could be considered an esoteric topic which lies on the outskirts of contemporary cognitive neuroscience and cognitive psychology. Franco Fabbro's book will convince the reader of the absurdity of this thought. In this extremely comprehensive book, the author provides not only a clear rendering of the state of research in this growing field but also a comprehensive introduction to speech, language processing, and cognitive neuroscience. Although there are a few books on bilingualism and the brain, none approach the topic with such breadth, by starting from the bottom and moving up.

Language and Brain

Fabbro begins his book with a compelling account of language. He asks simply, "What is language?" The answer is provided in his first chapter. Clearly, language is not just communication. It involves what linguists call *generativity*, the ability to use a finite number of pieces to communicate an infinite number of verbal messages. At the base is double articulation, the sounds that compose language. It is termed *double* because it involves spoken language at the level of words (which can be used to

compose an infinite number of phrases, sentences, or longer passages) and phonemes (the sound pieces that can be used to compose the large number of words in any particular language). The author continues by explaining phonetics and phonology, grammatical structure or syntax, and morphology and semantics. Fabbro clearly denotes the limitations of the study of language. For example, he notes that theoretical linguists have done little to help those who study and work with language-impaired people. He goes on to note that a rule-governed grammar may be a temporary approach to understanding how the human brain organizes syntax.

Fabbro continues by explaining how language sounds are perceived and produced, including one of the clearest and most concise descriptions of acoustics that I have ever read. He continues by describing which structures are involved in vocalization. All of this is achieved in a mere 29 pages, a testament to both the clarity and efficiency of Fabbro's writing.

It is at this point that we begin where many other books would have begun, considering how language is represented in the brain and what Fabbro terms *neurolinguistics*. He gives

us the regular tour on language representation in the brain. This includes the history of the study of language breakdown (aphasia), beginning with the father of neurolinguistics, Paul Broca. He then proceeds to describe the work of Wernicke and includes two original case studies that led him to develop his theory. Fabbro continues by describing clinical aspects of aphasia. This includes a very nice glossary of aphasia, which describes different types of language disorders and the nature of the errors that are made. In addition, Fabbro guides us through the standard types of aphasia, ranging from the classically defined aphasia up to more esoteric varieties. He also considers the role of the right hemisphere in controlling voice intonation and in understanding the deeper meaning of speech as is needed in comprehension of metaphors and complex texts. Finally, he describes the different types of tools that are used in both bilingual and monolingual aphasia assessment. Many books have been written about language disorders and aphasia. What is admirable is that once again Fabbro accomplishes his feat in very few pages.

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Beyond Aphasia

Unlike many other volumes, Fabbro ventures beyond the traditional realm of books on aphasia. For example, he considers the role of subcortical structures in the motor programming of verbal motor codes. The author also notes the similarity between the types of sensory motor stages that aphasics show in recovery with those seen in the learning of a foreign language. Fabbro tempers his speculation with a good dose of reality by suggesting that the models of motor programming must be more clearly articulated before they can contribute to a general theory of aphasia.

FRANCO FABBRO, *University of Trieste, Trieste, Italy.*

ARTURO E. HERNANDEZ, *Department of Psychology, University of California, Santa Barbara, California 93106-9660. Electronic mail may be sent to hernandez@psych.ucsb.edu.*

The book also adds a very different flavor by considering the role of memory in language. This was one that caught me by surprise. In no way am I disputing the relevance of memory to language (or vice versa). Both fields have touched on many overlapping topics over the years. However, for the most part, these two fields are kept apart. Fabbro describes memory systems for a purpose. Specifically, he suggests that memory has a key role in bilinguals. Whereas a mother tongue most likely involves implicit (i.e., unconscious) memory systems, a foreign language most likely involves explicit (i.e., conscious) memory systems. The implication of this is that a first and second language may be accessed by way of cortical systems that have been found to differ for implicit and explicit memory. The book also provides a good synthesis of working memory research and provides a very startling link between working memory, language disorders, dyslexia, and foreign-language learning. Work on first-language learning difficulties and dyslexia is widespread. However, Fabbro reflects on whether working memory deficits may be the underlying cause of dyslexia and of first- and second-language learning problems. What emerges is the view that bilingual language research and neurolinguistics could gain a substantial amount from considering the role of memory and learning on language processing in monolingual, bilingual, and language-impaired populations.

What About Bilingualism?

From the review so far you might infer that this is a book on neurolinguistics with the bilingual absent. It is during the second half of the book that we get to the topic of bilingualism. Chapter 11 begins with a simple question, What does it mean to be bilingual? In addressing this question the author takes advantage of previous work by Grosjean (1989, 1992) and Paradis (1977, 1983, 1987). Furthermore, a pragmatic solution is offered. Bilingualism goes beyond formal language boundaries. It involves any combination of languages and

dialects. There are, however, a few deviations from the standard view on bilingualism. For example, Fabbro recasts some of the views of Ervin and Osgood (1954) by referring to compound bilingualism (learning of both languages in succession) as compact bilingualism. Nevertheless, Fabbro provides an accurate rendering of what it means to be bilingual.

It is in the last part of the book that Fabbro moves through the complicated landscape which is found when one considers language recovery in bilingual aphasics. Up front he provides us with the complexity of the issue. Not all bilinguals show the same pattern of recovery. Forty percent show parallel recovery of both languages, 32 percent show better recovery of the first language, and 28 percent show better recovery of the second language. What rules might account for these patterns of recovery? He begins with Pitres (the Broca of bilingual aphasia), and his original view on language loss and recovery in bilingual aphasics. Specifically, Pitres and his colleagues felt that languages were localized in a common area and that language loss was due to inhibition of that language. Furthermore, he describes very well how Pitres felt that recovery progressed from the language most used before the insult to the least-used language.

At this point Fabbro provides us with some meat and potatoes; case studies that illustrate the nature of recovery in bilingual aphasics. He describes two case studies of first-language impairment before proceeding to consider second-language impairment. Like other volumes that precede it (Albert & Obler, 1978; Paradis, 1977; Paradis, 1983; Paradis, 1995a; Paradis, 1995b), *The Neurolinguistics of Bilingualism* considers the work of Minkowski on the role of familiarity, literacy, psychological, and emotional factors on second-language recovery. Fabbro's account does fall short in one respect. Fabbro describes work that suggests that a second language is less automatized than a first language. In this case, he cites work from Gomez-Tortosa, Martin, Gaviaira, Charbel, and Ausman (1995). How-

ever, in this case the patient had learned their second language (English) at the age of 10. Work by others with early sequential bilinguals suggests that when a second language is acquired early, the pattern dominance may be reversed (Kohnert, Bates, & Hernandez, 1999; Kohnert, Hernandez, & Bates, 1998) even in neurologically unimpaired populations. Work on early sequential bilinguals is often overlooked in the bilingual literature and Fabbro is not an exception to this rule.

Pitres suggested that languages are represented in a common area. However, there is still an underlying question about whether each language is represented in different areas of the brain. On the surface, Fabbro's account of exceptional cases would fit with such a notion. Cases include preservation of a language used in liturgy and of classical languages with the first language being impaired after aphasia. The author suggests that the pattern of recovery has to do with the modality and manner in which it was used. In both cases mentioned above, the languages were restricted to very routinized phrases (liturgy) or to the visual modality (classical languages). He also describes a case of a woman who showed paradoxical recovery of a second language. To account for this finding, Fabbro returns to his view on memory by pointing out that implicit and explicit memory systems involve different neural circuits. Under some conditions there will be preservation of explicit memory systems used in a second language with damage to the implicit system used in a first language. Fabbro also describes cases that clearly violate the principle of one area of the brain devoted to each language. This includes involuntary switching and mixing of languages and alternating antagonism, periods of access to one language, followed by periods of access to the other language. Clearly, one lesion cannot lead to a dynamic problem in which access to a language appears and disappears.

What might account for the vast differences in the patterns of break-

down in the brain? Fabbro goes through the five hypotheses that have been put forth. This includes that each language is represented in (a) one common area, (b) two separate areas, (c) the same area with distinct neural "micro" circuits subserving each area, and (d) both common and distinct areas for each language. It is this fourth position that has garnered the most support. After all, different languages must be coded differently in the brain to some extent. If not, there would be no way to keep them apart. On the other hand, languages must take advantage of their commonalities. Given this logic, it is easy to understand why the fourth position noted above is the one that has garnered the most support.

Beyond Bilingual Aphasia

Brain lesions in adults lead to very devastating effects and very clear deficits. One of the truly fascinating aspects of neurological insult in children is what it lacks; the dramatic impact that one sees in adults. Fabbro's analysis of aphasia in bilingual children confirms and extends this point of view. Bilingual children suffering a neurological insult show recovery of both languages, but never attain the level of performance seen in their age-matched peers. The recovery is dramatic but not complete. Fabbro finishes this section by advising teachers to be patient with these students.

In another move away from the standard account of bilingual aphasia, Fabbro's book also devotes an entire chapter to translation. He explains the nature of simultaneous translation and proposes a model based on neuropsychological findings. Specifically, Fabbro has found that after two years simultaneous translators no longer show superior word recognition in their right ear. He suggests that this may be due to use of the left ear for input and the right ear for output. In short, simultaneous translators appear to exhibit modified laterality to accomplish their task. Finally, he suggests that aphasia in simultaneous translators would add more to our knowledge of language representation in the brain. Although

Fabbro tries his best, it is hard to see precisely what the link is between simultaneous translators and bilinguals. Perhaps, if it were more explicitly demonstrated that simultaneous translators were an extreme case on a bilingual continuum, his point would be clearer.

Fabbro ends by pointing out the directions that bilingual neurologists need to take. This includes clinical aspects, child bilingual aphasia, translation, and the role of subcortical structures in aphasia. But most important, Fabbro says that researchers need to develop a basic language that can be used to describe language in the brain.

There is one respect in which this book falls a bit short. Neuropsychology, one could argue, dates back as far as 300 B.C., when early Greek and Roman physicians noted that damage to the brain caused very dramatic effects on behavior. During the mid-1900s neuropsychology became a field in its own right. Neurolinguistics have followed in the neuropsychological tradition by observing the effects of brain damage on verbal behavior. However, over the past 10 years we have seen the maturation of a new field, cognitive neuroscience, which has been fostered by dramatic technological developments in brain imaging. Both positron emission tomography and functional magnetic resonance imaging have given the cognitive neuroscientist a tool to eavesdrop on the normal brain as it performs a cognitive task. By allowing functional localization of activity in the normal brain, it provides a tool for confirming and disconfirming findings in the neuropsychological literature. Fabbro does an admirable job of weaving into the text findings from neuroimaging studies. However, I left the book thinking that there should have been at least one chapter dedicated exclusively to this issue.

In summary, Fabbro writes a very concise and detailed volume. Furthermore, unlike other volumes, he spends a substantial portion of the book introducing the basics of psychology, linguistics, neuropsychology, and aphasia research. This book is a

delight to read and is an accurate rendering of the field of bilingual neurolinguistics which should be accessible to experts and novice readers alike. □

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