ELSEVIER

Journal of Neurolinguistics 21 (2008) 558–576

Journal of NEUROLINGUISTICS

www.elsevier.com/locate/jneuroling

Understanding the link between bilingual aphasia and language control

David W. Green[a,*], Jubin Abutalebi[b]

[a]*Department of Psychology, University College London, Gower Street, London WC1E 6BT, UK*
[b]*Centre for Cognitive Neurosciences, University Vita-Salute San RaffaeleVia Olgettina 58, 20132 Milano, Italy*

Received 11 May 2007; received in revised form 15 January 2008; accepted 15 January 2008

Abstract

The study of bilingual aphasia is important because we need to be able to recommend treatments consistent with a plausible estimate of the course of recovery. Yet we lack a causal account of recovery patterns. We distinguish between the neural representation of a language network and the regions involved in the control of that network. Contrary to some claims, we argue on the basis of normal data that a single adapted network underlies the representation of more than one language and identify a frontal–(parietal)–subcortical network in its control. In terms of patient data, the broad expectation is that recovery of L1 and L2 will parallel premorbid levels of proficiency where there is no problem of language control. Recent advances mean that such an expectation can be tested on samples of patients rather than by sampling cases reported in the literature. Voxel-based morphometry can be used to relate variations in grey-matter density to variations in task performance. Understanding this relation can then help provide an estimate for future patients of the likelihood of improvement over time or a yardstick against which to measure the effectiveness of any intervention. In addition to this large sample approach, the study of individual cases remains key to achieving an understanding of the connections between representation and control and recovery patterns. We review recent cases of the effects of frontal–subcortical damage in bilinguals and argue that they provide evidence of effects on language selection and control rather than evidence for distinct neural networks underlying the processing of a second language. We conclude that there are good prospects for substantially improving our understanding of recovery patterns and that neuroimaging studies during recovery will provide further constraints on the mechanisms of control.

Keywords: Bilingual aphasia; Language control; Cortical and subcortical circuits

*Corresponding author.
E-mail addresses: d.w.green@ucl.ac.uk (D.W. Green), abutalebi.jubin@hsr.it (J. Abutalebi).

0911-6044/$ - see front matter
doi:10.1016/j.jneuroling.2008.01.002

1. Introduction

There is a pressing need to understand the causal basis of recovery patterns in bilingual aphasia in order to have a principled basis for treatment. As Paradis (1995) noted, we currently lack such an understanding yet the incidence of bilingual aphasia is likely to increase and become a clinical issue of primary importance because modern society is becoming more and more bilingual and multilingual. In the case of the United States, Paradis (2001) estimated, on the basis of census data, that there will be well over 45,000 new cases per annum. A similar incidence is to be expected in Western Europe because of a migrating workforce. In this paper, we argue for a specific approach to this problem.

1.1. Overview of the paper

We first distinguish between the language network and the circuits involved in its control that allow individuals to select one language over another or to translate between them. This distinction is relevant for understanding patterns of recovery in bilingual aphasics. For instance, the selective recovery of one language (see Paradis, 1998, 2004 for a description of the variety of recovery patterns, also Section 4 below) is consistent with a traditional "localizationist" view that different languages are represented in distinct processing areas. A lesion affects neural substrate supporting processing in that language. However, if the acquisition of a second language (L2) utilises, right from the start, the devices used for processing the first language (L1) then it is plausible to suppose that the languages of a bilingual are represented in a shared network rather than in distinct processing networks. We argue on the basis of both neuroimaging and neuropsychological data that languages are represented in a shared network (see Section 2). But if this is the case, we need another account of selective recovery. We argue for a more "dynamic" view in which selective recovery reflects an impairment of language control, i.e., the ability of the system to select one language over another. Cortical and subcortical (basal ganglia) circuits mediate such control and so damage to such circuits may affect the extent to which individuals recover full use of their premorbid languages.

Researchers may concede that a common substrate underlies the representation of words in different languages but hold different views on the way in which the grammatical aspects of two language are represented. We consider this matter in some detail. According to one proposal, the declarative/procedural model (Ullman, 2001a), the grammar of an L1 is represented in a procedural system that also mediates other kinds of skill whereas the lexical items of the language are represented in a declarative system that also represents other kinds of fact. Ullman (2001b) extended this notion and proposed that the grammar of L2 is likely to be represented in the declarative system. In fact, Ullman (2001b, 2005) argued for a version in which reliance on the procedural system increases with growing L2 proficiency. Neuroantomically, the procedural system is held to be mediated by frontal–basal ganglia circuits. Indeed in the literature, Ullman's model, has been used to account for the selective recovery of a language following damage to the basal ganglia. We therefore consider the claims of this model and, in particular, review evidence on the syntactic representation of L1 and L2 in bilinguals (see Section 2.1). We conclude in favour of shared representation of grammar for L1 and L2 and so argue for the importance of language control for understanding recovery patterns.