

4.1. Bilingualism, Development and the Brain: A Neuroemergentist Perspective

Auditorio Hall

Chair:

Arturo Hernandez
University of Houston

The ability to flexibly adapt to a new set of circumstances is a hallmark of language and cognitive development. This symposium will present work that considers the nature of plasticity in the learning of a second language where the brain must adapt to two sets of sounds, scripts and meanings. The presentations consider a number of circumstances which yield variety in language processing. This includes work describing how bilingual infants adapt to processing of two languages during very early stages of development. Work with trilinguals will look at the effects of two languages on the learning of a third. The final presentation seeks to look at how language proficiency, age of second language acquisition interacts with individual differences across development. The final presentation broader view, Neuroemergentism, the notion that both the content of cognition and the neural substrate underlying it, transition from simple to complex processing in a non-linear manner. This Neuroemergentist approach offers a more nuanced view of the effects of experience which captures the dynamic nature of language development in speakers of more than one language.

Speakers:

Marina Kalashnikova
Dean D'Souza
Guillaume Thierry
C. Morrison
Arturo E. Hernandez

4.1.1. Early speech perception development in Spanish-Basque bilingual infants

Marina Kalashnikova & Manuel Carreiras
Basque Center for Cognition, Brain and Language

The effects of early bilingual exposure on speech perception development are debated. Inconsistent findings have been attributed to the inclusion of bilinguals acquiring language pairs that vary extensively in their degree of phonological and lexical overlap, and due to variability in infants' individual language exposure patterns. This study assessed speech perception in infants acquiring Spanish and Basque, two phonologically similar, but lexically and grammatically distinct languages. A visual fixation habituation paradigm was used to assess nine-month-old monolingual and bilingual infants' ability to discriminate the native /pa/-/ba/ and non-native /pa/-/pha/ contrasts. Results showed that monolingual and bilingual infants discriminated the native, $p=.034$, but not the non-native contrast, $p=.929$, demonstrating attunement to native phonetic categories. Importantly, in the bilingual group, native discrimination was correlated to individual degrees of bilingualism, $r=.615$. Thus, infants with greater bilingual exposure showed weaker attunement to their native phonetic categories even when acquiring two phonologically similar languages.

4.1.2. Is mere exposure enough? The effects of bilingual environments on infant cognitive development

Dean D'Souza¹, Daniel Brady², Luke Mason³, & Hana D'Souza⁴

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Bilinguals purportedly outperform monolinguals in nonverbal tasks of cognitive control. However, inconsistent results, combined with publication bias, has led many scientists to question whether the bilingual advantage is real. To progress beyond the controversy and advance our understanding, in addition to carrying out more studies, we must develop a framework that can account for the inconsistencies in the literature and explain when, how, and why learning two or more languages improves cognitive control. The most influential explanation for the bilingual advantage is the proposal that managing two or more languages during language production constantly draws upon, and thus strengthens, domain-general cognitive control processes. According to this model, infants raised in bilingual homes should not show a bilingual advantage before they can produce language. Yet studies suggest that they do. We argue that exposure to more varied language environments drive infants to explore more by constructing less detailed models of their environments and placing more weight on novel information. Getting by on less detailed models would allow the child to switch more and faster

to novel stimuli and thus sample more from their environments. We will present infant data (n = 102) from several experiments designed to test our hypotheses.

4.1.3. EVIDENCE FOR PARALLEL UNCONSCIOUS PROCESSING IN THE BILINGUAL MIND: DUAL POWER UNDER COVER?

Guillaume Thierry
Bangor University, Wales

In this talk I will show how bilinguals engage in high-level mental operations spontaneously even when the tasks they are asked to do require no such complex processing. I will focus on results from three experiments (Wu and Thierry 2012; Wu et al., 2016; Li et al., submitted) in which Chinese-English bilinguals either (i) filter out semantic access to negative emotional context, (ii) access the meaning of part-translations and change their looking behaviour accordingly, and (iii) access metaphors that only exist in their native language and process them in context, when the experiments were conducted in English and participants were completely unaware of their engagement in sophisticated, abstract cognitive processing. In all cases the tasks requirements were deceptively simple: (i) semantic relatedness decision, (ii) spot circle or square shapes, (iii) indicate whether gaps in time between heard stimulus and present time were 1 or 2 day/year. And in all cases, their brain manifested clear signs of engaging with cognitive operations entirely irrelevant vis-à-vis the tasks at hand but targeted by factor manipulations in the experimental designs used: (i) selective inhibition of access to Chinese translation equivalents in the case of English words with a negative valence, (ii) particular attention to English words semantically related to the concept of circle or square via translation into Chinese, and (iii) processing difficulty in the case of English dates conflicting with spatiotemporal metaphors of Chinese in terms of configurations of relative time (future / past) and physical origin in space (front / back). All in all, these findings provide support for the provocative idea that bilinguals in fact have two minds operating in parallel, both being as unconscious that the presumably unique mind operating in monolinguals.

4.1.4. DIFFERENCES IN WORKING MEMORY ERPS BETWEEN ARABIC-ENGLISH AND ENGLISH-FRENCH BILINGUALS

Morrison, C.^{1,2}, Kamal, F.^{1,2}, & Taler, V.^{1,2}
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The study of whether bilinguals exhibit cognitive advantages over monolinguals has been a controversial area of research. Inconsistent findings may be due to methodological differences within and across studies. One major limitation is that many studies focus on comparing Indo-European languages such as English, French, and Spanish. The purpose of this study was to compare working memory performance and the underlying brain activity between Arabic-English bilinguals

and English-French bilinguals. Participants completed a n-back working memory task while reaction time, accuracy, and electroencephalography were recorded. Preliminary data show that behavioural data between the groups are similar, whereas electrophysiological measures differ. The P3b was larger in English-French bilinguals than monolinguals but not Arabic-English bilinguals. Additionally, P3b amplitude did not differ between Arabic-English bilinguals and monolinguals. These results suggest that the conflicting findings across bilingualism studies may be due in part to characteristics of the languages under study.

4.1.5. GENETICS, PLASTICITY AND COGNITIVE CONTROL: A NEUOREMERGENTIST APPROACH

Arturo E. Hernandez
University of Houston

Does bilinguals have better cognitive control or does better cognitive control lead to better bilinguals? Whereas recent work in the literature has focused on the debate of whether bilingual possess some advantage over monolinguals, there has been much less attention paid to the factors that might mediate these differences. In the present talk, work that has begun to look at the potential role of genetics and language history in bilinguals will be presented. Recent work reveals that bilinguals relative to monolinguals have a higher proportion of individuals carrying the A1 allele of the Taq1A polymorphism which has been associated with better task switching performance. We have also found evidence that carrier status of this gene as well as language history factors are associated with different patterns of brain activity in bilinguals. Finally, results from language proficiency tests show that balanced bilingualism is dependent on age of acquisition and A1 carrier status. Taken together these results are consistent with a complex relationship between language experience and genetics.