EUROPEAN SCIENCE FOUNDATION
SETTING SCIENCE AGENDAS FOR EUROPE

Exploratory Workshops Scheme

Standing Committee for Social Sciences (SCSS)

ESF Exploratory Workshop on

Multilingualism from an Interdisciplinary Perspective

Scientific Report

The Novartis Foundation
London, United Kingdom, 8 - 9 October 2007

Convened by:
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1. Executive summary

As stated in the case for support, the workshop sought to facilitate the interdisciplinary investigation of multilingualism, by integrating behavioural, neuroscientific and computational approaches. We achieved this by inviting experts in each of these three areas, and by dividing the workshop into sessions entitled *Multilingualism from a Cognitive Psychology Perspective*, *Multilingualism from a Computational Modelling Perspective* and *Multilingualism from a Cognitive Neuroscience Perspective*. Each of the sessions therefore focused on one domain, but there was a great deal of synergy and interaction across the domains.

The psychological, computational and neuroscientific presentations and the ensuing discussion advanced our understanding of how people can understand more than one language, whether learning non-native languages is similar or different to learning one's native language, and how brain systems are applied to processing multiple languages. Many presentations raised the question of whether models traditionally developed for understanding monolingual learning and processing could be applied to multilingualism. Indeed, a particularly interesting aspect of this was that some presenters began by considering monolingual work and asked how useful it would be to multilingualism, whereas others considered the existence of unresolved problems in multilingualism and then turned to monolingual approaches to see if they had anything to offer.

Traditional research in bi- and multilingualism addresses the unimodal case in which both languages are spoken. Research into bimodal bilingualism, involving signed and spoken languages has typically been considered separately. One of the goals of the workshop was to break down this division and to address the similarities and differences between these two forms of bilingualism. For example, bimodal bilingualism typically involves "code blending" in which both languages are used simultaneously; but unimodal bilingualism typically involves "code switching" in which the speaker changes from one language to the other at a particular point in the utterance. The presentations and discussions helped make it clear that both forms of bilingualism can be considered together.

We split the workshop into three sessions in order to address these main themes:

(a) Exploring the Behavioural Consequences of multilingualism. Can multilingual production be accounted for using any of the current theories of monolingual production? What constraints have to be postulated to capture any difference between multilingual individuals who learned their languages early, and multilinguals whose additional languages were learned after their first language? What differences are there between people who know more than one spoken language, those who know spoken and signed languages, and those who know more than one signed language?

(b) Neural Basis of Multilingualism. Does the brain encode all languages in the same network? Does it matter when these languages are learned? Do the neural networks differ among people who know more than one spoken language, those who know spoken and signed languages, and those who know more than one sign language?

(c) Computational Models of Multilingualism. Can current computational models provide us with explicit predictions concerning both the psychological and neural basis of

multilingual language production? Can the investigation of multilingualism pose critical new constraints on the type of computations assumed, allowing us to decide between different types of models?

The presentations dealt with these three issues at many different linguistic levels, including phonology, syntax, and semantics; and included talks that focused on acquisition (e.g., what neural changes occur during the acquisition of particular aspects of non-native languages) and processing (e.g., whether grammatical knowledge is shared across languages or is stored independently for each language). They also addressed the effects of multilingualism, such as whether it affects cognitive abilities more generally (e.g., the ability to task switch).

The General Discussion, as well as many of the more informal interactions, addressed questions of how the participants (and others) could further collaborate and integrate their activities in pursuit of an understanding of multilingualism. Particular directions include a serious consideration of the effects of multiple languages (e.g., confusions between different non-native languages), the comparison between signed and spoken languages, and the benefits and difficulties of extending computational models of language processing and learning to the multilingual domain.

Apart from the participants, the workshop was attended by a reporter from Science Magazine, a science writer from the Novartis Foundation, and (in part) by the Deputy Director of the Novartis Foundation. Their attendance demonstrated the importance and general interest of the workshop, and it is hoped that the workshop will be described in a forthcoming issue of Science.

2. Scientific content of the event

Following opening remarks from Professor Vigliocco and Dr. Bock (Novartis Foundation), and a presentation of the ESF from Dr. Hoogland, the workshop was divided into three main sessions and a final General Discussion. We now briefly describe each presentation:

Karen Emmorey discussed evidence on code-blending in bimodal bilinguals (ASL and English). She found that such bilinguals used ASL grammatical facial markers when producing English, and suggested that both languages were therefore active.

Robert Hartsuiker used evidence from cross-linguistic syntactic priming to argue that bilinguals share grammatical information across languages.

Albert Costa presented experiments showing advantages and costs of being bilingual versus monolingual, and suggested that bilinguals' need to switch languages may enhance their task-switching abilities more generally.

Zenzi Griffin considered the relationship between eye movements and language production in scene description and applied these findings to multilinguals.

Xavier Alario compared the production of determiners across languages using experimental and neuroscientific methods and speculated on cross-linguistic differences.

Timo Honkela applied the concept of self-organizing maps to the modelling of language learning and multilingualism.

Gerard Kempen showed how his model of parsing (using simulated annealing) could be applied to language comprehension in bilinguals.

Matthew Goldrick provided a computational account of the mechanisms involved in speech production, particularly those concerned with interactive processing, and showed how an application of this account to multilingualism could be compatible with experimental data.

Daniela Perani considered a number of neuroscientific factors that affect representation and processing in the bilingual brain. She focused on issues such as plasticity, innateness and the effects of language switching.

Peter Indefrey reported fMRI data showing brain responses in the early stages of non-native language acquisition that are not reflected in behavioural data, and which may be informative about the development of a "bilingual brain".

Sonja Kotz considered the way in which non-linguistic sequencing properties affect speech perception and applied the findings to monolingual and bilingual speech production.

Niels Schiller reported electrophysiological investigations of language switching in bilinguals, using methods familiar from the cognitive psychological literature, to determine the neural basis of language production in bilinguals.

Mairéad MacSwenney reported electrophysiological and fMRI studies of signed and spoken languages, and revealed that they recruit similar brain regions, in ways that are affected by the nature of the language input.

3. Assessment of the results

The workshop was very valuable as a forum for integrating psychological, computational and neuroscientific research in multilingualism. Researchers using different methods compared their approaches and draw general conclusions about the nature of multilingualism. It allowed them to contrast multilingualism with monolingualism, and to look at more specific comparisons such as bimodal versus unimodal bilingualism, the effects of native versus non-native languages, and the effects of knowing more than two languages.

The breadth of findings will inform the development of a research programme that is both cross-linguistic and cross-disciplinary. It is informed by psychology, computer science, neuroscience and linguistics, and is clearly of great relevance to all European countries. The workshop therefore brought to light many particular themes that could be tested by particular research groups in countries with particular types or groups of bilinguals, and the presentations and formal and informal discussions led to many potential collaborations and future research activities. It is clear that this workshop identified a timely research programme that is particularly suitable for the multilingual context of Europe (given current mobility and patterns of information exchange) and which would be ideally suited to European funding sources (such as the ESF).

PROGRAMME

Sunday 7 October 2007

Evening	arrival

Monday 8 October 2007

Each presentation should have 15 min devoted to the presentation of findings, 10 min devoted to exposition of outstanding questions and speculations and 5 min devoted to discussion.

08:30-08:55	**Coffee, Registration**
8:55-09:00	**Opening Remarks: Gabriella Vigliocco (London, UK)**
09:00-09:15	**Presentation of the European Science Foundation (ESF)** **Eva Hoogland** (EUROCORES programme coordinator – Cognitive Sciences)

Multilingualism from a Cognitive Psychology Perspective
Chair: D. Perani (Milano, Italy)

09:15-09:50	**X. Alario (Marseille, France)** *Cross-linguistic investigations of determiner production*
09:50-10:25	**R. Hartsuiker (Ghent, Belgium)** *Language integration in bilingual sentence production*
10:25-11:00	**A. Costa (Barcelona, Spain)** *Advantages and costs of being a bilingual speaker*
11:00-11:20	*Coffee Break*
11:20-11:55	**Z. Griffin (Atlanta, US)** *Describing a world viewed with multilingal eyes*
11:55-12:30	**K. Emmorey (San Diego, US)** *What bimodal bilinguals can tell us about bilingual language processing*
12:30-13:30	***Lunch***
13:30-14:30	**Discussion** (**P. Perniss** & **T. Honkela** as discussants)

Multilingualism from a Computational Modelling Perspective
Chair: P. O'Seaghdha (Bethlem, US)

14:30-15:05	**T. Honkela (Helsinki, Finland)** *Computational modelling of language learning and multilingualism*

15:05-15:40	**G.Kempen (Nijmegen, Netherlands)** *Large-scale overlap between the cognitive resources for grammatical encoding and decoding: the experimental evidence, and an implication for simultaneous interpreting*
15:40-16:00	*Coffee break*
16:00-16:35	**M. Goldrick (Evanston, US)** Multilingualism: A window into dynamic mechanisms of interaction in speech production
16:35-17:35	**Discussion** (**K. Emmorey** & **M. Pickering** as discussants)
18:45	***Dinner at Navarro's (67 Charlotte Street)***

Tuesday 9 October 2007

Multilingualism from a Cognitive Neuroscience Perspective
Chair: M. Pickering (Edinburgh, UK)

09:00-09:35	**D. Perani (Milano, Italy)** *Factors influencing the bilingual brain*
09:35-10:10	**P. Indefrey (Nijmegen, Netherlands)** *What drives changes in second language brain activation patterns?*
10:10-10 :45	**S. Kotz (Leipzig, Germany)** *Which role does sequencing play in bilingual speech production and perception – two sides of the same coin?*
10:45-11:00	*Coffee break*
11:00-11:35	**N. Schiller (Leiden, Netherlands)** *Electrphysiological studies on the neural basis of multilingualism*
11:35-12:10	**M. McSweeney (London, United kingdom)** *Multilingualism from an interdisciplinary perspective*
12:10-13:00	**Discussion** (**Z. Griffin** & **A. Costa** as discussants)
13:00-14:00	***Lunch***
14:00-15:30	Small group discussions: What are the next big questions? How can we pursue these questions in collaboration?
15:30-15:45	*Coffee break*
15:45-17:00	**General Discussion:** plans for follow-up research activities and/or collaborative actions

Participants and statistical information on participants

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Gender Repartition:

Male 13 Female: 10

Repartition by country of work:

BE	1
DE	2
DE	1
ES	1
FI	1
FR	1
IT	1
NL	4
UK	8
US	4
TOTAL	**24**