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We spend much of our lives talking and listening. Being human involves communicating, but how do we learn to do it? The CALACEI project is probing this fundamental mystery. Partners ranging from linguists to physicists will tackle practical and theoretical barriers to conduct studies of newborns and infants that have not been possible until recently. The project could reveal much about how we learn to use language, and may point the way to applications in medicine and artificial intelligence.

Looking into talking

The complex linguistic abilities of humans are unique, but how we acquire our language skills during early development is far from fully understood. Improving our understanding is important as a basic research issue that may help us understand language disabilities, and may improve artificial language recognition systems.

The CALACEI project is examining this issue as part of the NEST PATHFINDER initiative on 'What it means to be human'. After all, what is more characteristically human than our language faculty?

To understand the uniqueness of human language, the project is designed to gain knowledge of how human infants acquire syntax, and how a child learns to handle the properties of a specific language. This includes investigating the anatomical and physiological processes in the infant brain, and relating them to the adult brain.

The challenge facing CALACEI straddles many disciplines, and the project partners are a diverse collection of experts in psychology, physiology, linguistics, physics, medicine and the functional imaging of the brain. This range of expertise comes from the International School for Advanced Studies, in Italy, The Berlin NeuroImaging

Center in Germany, The Max Planck Institute of Human Cognitive and Brain Science, in Germany, and The Centre for Brain and Cognitive Development in the UK.

Viewing the infant brain

In recent years, several methods have been developed to visualise which parts of the brain are most active during specific tasks. Some of these brain imaging processes, especially functional near-infrared optical topography and electroencephalography, will be used for a range of studies in this project. For example, one approach will explore how the brains of newborn babies and infants respond to languages that differ in their rhythmic structure. Another will look at the response of the infant and adult brain to vowels and consonants. Some pioneering work with newborn infants will investigate the extent to which they can distinguish between different kinds of syllables.

Parts of the project will employ a form of computing known as neural network modelling, to represent learning processes of the brain computationally.

One crucial aspect of CALACEI is to develop the practical aspects of the imaging methods





CALACEI

What is more characteristically human than our language faculty?

AT A GLANCE

Official title

*Universal and Specific Properties of a Uniquely Human Competence
Tools to study language acquisition in early infancy: Brain and Behavioural Studies*

Coordinator

Italy: International School for Advanced Studies, Cognitive Neuroscience, SISSA

Partners

- *Germany: Berlin NeuroImaging Center*
- *Germany: Max Planck Institute of Human Cognitive and Brain Science*
- *United Kingdom: Centre for Brain and Cognitive Development*

Further information

*Prof. Jacques Mehler
International School for Advanced Studies,
Cognitive Neuroscience, SISSA
via Beirut 4
34014 Trieste, Italy
Fax: +39 040 378 7615
Email: mehler@sissa.it*

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to make it easier to gain more useful information from newborn babies and infants. Little functional imaging has been done with very young infants due to the absence of suitable methods. Very high safety standards must obviously be met in any such work, and the experimenters have to learn how to cope with the low level of co-operation of their young subjects. The project is going to explore methods to gather data from healthy babies in a non-invasive and ecologically valid fashion. The partners will develop some new techniques and improve the existing ones for gathering data from infants, and will make this technology available to other researchers working in this field.

What is more characteristically human than our ability to speak?

Theory to build on

The CALACEI project is addressing fundamental theoretical issues about what it means to be human. Its end results in terms of theoretical advancement should confirm,

refute or refine a variety of hypotheses about the precise way in which very young human infants acquire language skills. With fundamental research it is not possible to promise specific applications at such an early stage. It is the nature of basic science, however, that it leads on to practical and often unpredictable applications in the future.

Problems in learning how to use language are both commonplace, and very debilitating. The more we learn about how this uniquely human process is acquired, the greater are the chances that we will find new ways to understand what causes these (development) problems and how to correct them.

The research also addresses the challenges facing a multilingual society, such as the European Union. Decisions about teaching several languages at different ages can be made with more confidence when the processes underpinning language acquisition are properly understood.



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