Master's Thesis

(Research paper, TFM)

Research lines for Psychology branch students

University of Barcelona (UB)
University Rovira i Virgili (URV)
University Pompeu Fabra (UPF)
Research in our lab (APAL Lab, UB-Hospital Sant Joan de Déu) focuses on the study of infant speech perception abilities, attention development and early language learning processes, both in normally developing infants (monolingual and bilingual) and in infants at risk for language and neurocognitive disorders. Our methodological approach is mainly behavioral, with procedures that rely on attention measures to auditory only or audiovisual stimuli. Classical habituation and familiarization-preference paradigms in infancy research are used, with settings that rely on video (offline coding) and eye-tracking recordings. Recent studies done in collaboration with the Cognition and Brain Plasticity research group (Bellvitge Biomedical Research Institute) also include electrophysiological measures in response to linguistic material. Measures from standardized infant developmental scales and parental reports on expressive and receptive language and social behavior are also used as tools in our research. Early language/dialect differentiation and native language recognition abilities, multimodal (audiovisual) speech perception, phonetic categorization and perceptual narrowing, word segmentation skills, word recognition and novel word learning are different topics addressed in our recent research projects. Research involving older children and adults complement our infant studies on attention and language learning.

Recent publications:


Brain Mechanisms of Language Learning

Researcher: Ruth de Diego (ICREA)

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http://brainvitge.org/groups/language-learning/

Comprehending the cognitive processes involved in language learning is of critical importance for our understanding of why under certain conditions language learning is impaired. Language learning research has often offered explanations bounded within the language domain, ignoring the importance of other cognitive functions. Our group uses an integrative approach at the edge of different research fields combining information from brain-damaged patients and imaging in healthy individuals to understand the neural and cognitive mechanisms engaged since the earliest stages of contact with a new language. We are particularly interested in (1) the role of the attentional system in the acquisition of different aspects of language; (2) the role of the striatum as a brain structure that could make the interface between language and other cognitive functions necessary in the learning process; (3) how is the acquired information consolidated and modified by additional new information.

Recent publications:


Dynamics of memory formation

Researcher: Lluís Fuentemilla (Dept. Cognition, Development and Education Psychology, UB)

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We want to understand how experiences are initially encoded, undergo further consolidation and are later retrieved. We use behavioral (including Eye movements), psycho-physiological (Skin Conductance) and neural (fMRI, EEG, iEEG) measures to help us learn more about the cognitive and neural operations that contribute to episodic memory. We further extend our investigation to neurological patients, in special those with lesions in medial temporal lobe regions. Current research addresses the study of brain mechanisms supporting the formation of discrete episodic memories and how prior knowledge influences the formation of new memories. Previous findings suggest that human hippocampus plays a crucial role in coordinating brain information to be stored in the brain. This coordination brings up the possibility to associate, integrate and consolidate new information in long-term memory but also to reinstate it to flexibly manipulate it in our on-going day life. We attempt to study information reactivation as one of the fundamental aspects of human memory, and how, in interacting with other cognitive mechanisms, concerns behavioral adaptation. We are also interested to investigate how implicit and explicit forms of long-term memories interact, with special emphasis on how it influences forgetting rate, memory representation and decision making.

Recent publications:


Numerical cognition and math anxiety

Researcher: M. Isabel Núñez (Dept. of Social Psychology and Quantitative Psychology, UB)

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Our main interest is to study the cognitive mechanisms involved in the processing of numerical information by recording electrophysiological and behavioral measures. Our work has three lines of research. First, we study the calculation strategies used to solve arithmetic problems, focusing on the factors that may determine their selection and their efficiency – for example, problem size, type of arithmetic operation, or math ability. Second, we aim to gain a fuller understanding of the difficulties that high math-anxious individuals face when solving numerical problems. Finally, we were also interested in studying the role of spatial processing ability on numerical cognition.

References:


Perceptual, decisional and motor processes in complex environments

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An ubiquitous process in human daily-life behaviour is deciding between competing actions within complex and rich environments. First, optimal decisional processes depend on people representing different states of the world accurately and reliably. By means of tools rooted in the Statistical Decision Theory, we analyse how human encode different states and whether this encoding is optimal, that is, minimizes the uncertainty. Second, the range of sensory stimulation out there often exceeds by far the operating range of our senses. The nature’s solution to overcome this limitation is adaptation to the changing conditions of stimulation. This allows people to operate optimally across many different sensory conditions. We then study the underlying processes of adaptation in sensory and sensorimotor domains. Third, our actions have consequences on the states of the world. The brain predicts these consequences (forward models) and these predictions can be integrated with the actual sensory feedback to improve the precision with which we perceive the consequences of our actions on the world. We then study how humans combine these predictions with the incoming feedback in the control of our actions. Finally, these action consequences have an associated gain (or reward) or cost. We are interested in the processes that lead to optimal actions or decisions (i.e. maximize expected gain), mainly in changing environmental conditions. We use different methodologies to tackle these problems including psychophysics, modelling, virtual reality, motion tracking and neuroimage.

Publications:


Sequential action control and development of explicit knowledge

Researcher: Elisabet Tubau (Dept. Cognition, Development and Education Psychology, UB)

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The fluency of intended action, either in everyday activities or in experimental tasks, depends on specific relations between intended response and previously acquired response tendencies, which vary according to the context (e.g., timing constraints, presence of other distractors) and the individual (e.g., age, expertise). For example, in two-choice serial reaction time tasks, previous response might either prime the same response (repetition bias) or the different one (alternation bias). Similarly, in series of trials with or without conflict, the conflict effect might reverse in specific contexts, expressed as a performance cost for congruent trials (negative congruency effect). There is evidence that some of these sequential biases are reduced or eliminated in case of deterministic series; that is, in conditions in which proactive control can be applied. Nevertheless, the effectiveness of proactive control varies between the different sequential biases and between different individuals.

Interestingly, previous results suggest that the repetition bias enhances the development of explicit knowledge in deterministic series, which, in these conditions, correlates with improved proactive control. In contrast, both the alternation bias and the negative congruency effect hinder the consolidation of explicit knowledge. One specific goal of present research line is to contribute understanding this observed association between repetition bias, explicit knowledge and proactive control, and the extent to which this association would vanish in case of probabilistic series. Related to this goal, this research line aims to improve our comprehension of the different sequential effects and their different impact on learning and on fluent action control.

Selected readings and publications:


Single-case designs

Researcher: Rumen Manolov (Dept. of Social Psychology and Quantitative Psychology, UB)

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The research line is focused on the statistical analyses applicable to single-case experimental designs (SCEDs). SCEDs represent a strategy for studying the behavior of a single entity (an individual or a group) in several different conditions manipulated by the researcher, including repeated measurements in each of the conditions. Gathering several measurements for the same entity entails the possibility of the values being serially related and that they also present trend, which can change in time. Due to these specific features of single-case data, there is currently no analytical technique accepted gold standard (Smith, 2012). The studies and developments need to take into account the tradition of SCED researchers analyzing the data mainly by means of visual inspection and also the importance of introducing formal decision rules (Manolov, Jamieson, Evans, & Sierra, 2015). Additionally, applied researchers require guidelines (Manolov & Moeyaert, 2017) regarding how to proceed with data analysis, in a context in which the number of analytical options and their complexity is increasing. In order to address the previously mentioned analytical challenges, the research line deals with testing (via simulation), comparing (with real behavioral data), and proposing analytical techniques, as well as developing software implementations bringing the statistical developments closer to applied researchers.

References and selected publications:


RESEARCH INTERESTS

José E. García-Albea (jegarcia.albea@gmail.com)

- Theoretical issues on the foundations of psychology
- Philosophy of cognitive science
- How does psychology relate to other sciences
- How semantic information is represented in bilingual memory
- Language comprehension and theory of mind deficits both in normal and psychotic populations

Pilar Ferré (mariadelpilar.ferre@urv.cat)

- Recognition, comprehension and acquisition of words, as a function of their semantic richness
- The effects of lexical emotionality, abstractness and ambiguity in bilingual word processing
- Mapping of orthographic and semantic representation in bilinguals
- The structure of bilingual memory

Josep Demestre (josep.demestre@urv.cat)

- How people process the syntactic structure of sentences in their L1 (and L2)
- Syntactic ambiguity resolution
- How people comprehend anaphoric expressions
- The role of world knowledge in language comprehension
- Mapping of orthographic and semantic representation in bilinguals
José E. García-Albea, jegarcia.albea@urv.cat

For many years, I have tried to combine a special concern with theoretical issues on the foundations of psychology as a natural science and a broad involvement in the empirical research on language processing, from speech perception up to speech production.

The philosophy of cognitive science takes human thinking as an object of enquiry and seeks to address issues about its nature. Examples include: What is psychological explanation? How does psychology relate to other sciences—such as neurobiology and evolutionary biology? It also attempts to clarify its core notions, such as mental representation, function, innateness, etc., as well as the relations between thought and language.

On the more empirical side, I have been investigating the role of different semantic variables (e.g., lexical ambiguity, concreteness, meaning similarity, etc.), in order to determine how semantic information is represented in bilingual memory. I am also interested in how people process the syntactic structure of sentences by using a dual-task experimental paradigm, as the one involved in tone-monitoring type of tasks. Besides behavioral measures, we are now including the brain’s electrical activity (ERPs) and eye movement recordings. Another issue to which I have recently paid special attention deals with the relation between language comprehension and theory of mind deficits both in normal and psychotic populations.

Selected Publications


Pilar Ferré

My research intends to gain a better understanding of the processes of recognition, comprehension and acquisition of words, as a function of their semantic richness. By semantic richness we understand the possession of semantic features in three specific dimensions, namely, emotional content, abstractness, and ambiguity. Words that are emotionally-laden, concrete and ambiguous are defined as semantically rich, when compared to emotionally neutral, abstract and unambiguous words. The main aim of my current research is to take a closer look at the variables that modulate the influence of the three above mentioned dimensions of lexical meaning on word recognition and comprehension processes. I aim to examine the effects of these variables on the process of word acquisition, either in a native or a foreign language. Clarification of these issues will hopefully provide useful information about the nature of lexical representations and the way they are formed and become consolidated during learning.

I am also interested in the study of the effects of lexical emotionality, abstractness and ambiguity in bilingual word processing as well as in the study of the mapping of orthographic and semantic representation in bilinguals. The results of this line of research can contribute to a better understanding of the structure of bilingual memory.

Selected Publications


Josep Demestre

My primary research interests are in how the human mind/brain represents and processes language during reading and listening to speech both in one’s native language and in a second language (L2). My research primarily uses behavioral measures, but also event-related potentials and eye-tracking.

An important part of my research involves the investigation of how people process the syntactic structure of sentences. Thus, for example, we have examined the processes and mechanism underlying: (a) syntactic ambiguity resolution, (b) the establishment of dependencies between different linguistic elements in a sentence, (c) the use of different sources of information in the course of processing a sentence.

Another focus of my research concerns bilingual sentence processing. The central question is whether language-specific information is largely kept independent when bilinguals compute or parse an initial syntactic structure, or whether information from one language influences parsing decisions in the other language. Other work examines whether L2 speakers are able to use linguistic information specific to the L2 to guide on-line L2 sentence processing. For example, Spanish speakers use information encoded in main verbs to predict the presence of the subjunctive mood in subordinate clauses. The question we explore is whether L2 learners for whom these linguistic features are absent in their L1 can behave like native speakers during on-line processing.

I have also conducted research on the cognitive processes that support the proficient and non-proficient use of a L2. We investigate how bilingual speakers map orthographic representation from both languages to semantic representations. The purpose is to inform current debates about the organization of the mental lexicon in bilingual speakers.

Selected Publications


We are interested in the cognitive and brain basis of the speech production process, with a special emphasis on bilingual speech production.

More in particular our research can be divided in the following areas of investigation:

- Brain Basis of Bilingualism: Language Control in Bilingual Speakers
- Understanding accented speech
- Producing language in different modalities
- Alignment in Bilingual Dialogue
- Decision making and language processing
