THE UNIVERSITY OF MELBOURNE

Melbourne School of Psychological Sciences

Complex Human Data Hub

The science behind how we measure human experience and behaviour

We are in the midst of a revolution in psychological methodology. Innovations in wearable technologies and devices which connect to the internet provide us with ways of measuring the environments in which we operate, while social network data for the first time allows us to record relationships and interactions between people to get an unprecedented view of the environments in which people exist.

ABOUT

The Complex Human Data Hub aims to use technologies to build a new kind of psychological science - one that is intimately tied to the real world. We combine this rich data with sophisticated computational modelling, which enables us to better explain, predict, and influence human behaviour on multiple levels, from individuals to populations. One goal is to produce actionable knowledge and technology for behaviour change in fields ranging from health to national security to sustainability.

The Complex Human Data Hub aims to build a more comprehensive, ecologically valid and translationally relevant psychological science by:

- drawing big data from wearable sensors, the internet of things, ecological momentary assessment and online social networks
- building big models of psychological processes using advances in Bayesian techniques, machine learning and computational linguistics
- crossing different levels of analysis - from individuals to groups to populations.

ENGAGE WITH US

We welcome community and industry participation and seek to enable our partners to leverage our expertise in complex human data.

The Complex Human Data Hub is a highly active, collaborative, and internationally networked group of researchers who foster and lead rewarding partnerships world-wide.

Whether you are interested in sponsoring a research project, or forging a long-term strategic alliance, we'll help you launch a successful and rewarding collaboration with researchers who are leaders in their fields.

OUR RESEARCH

MEMORY AND LANGUAGE LABORATORY

The Memory and Language Laboratory utilises large-scale real-world data, experimental paradigms and computational modelling techniques to investigate the cognitive architecture underlying memory and language. They simulate human performance looking for ways in which memory and language phenomena are manifestations of the same neural structures. Researchers use probabilistic models, machine learning techniques, signal processing approaches and dynamic systems methods to analyse data and to uncover how the cognitive system works.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/mall/lab

COMPUTATIONAL COGNITIVE SCIENCE (CCS) LABORATORY

The Computational Cognitive Science (CCS) Laboratory focuses on quantitative approaches to higher-order cognition: categorisation, concepts, language acquisition and evolution, decision-making, and social learning and transmission. They use mathematical and computational models to understand the why and the what within these topics. What goals are human learners and reasoners trying to achieve in particular situations? What constraints (cognitive, informational, environmental) do they operate under? How do these factors shape their behaviour?

psychologicalsciences.unimelb.edu.au/research/hubs/chdh/ccs

VISION, COGNITION AND BEHAVIOUR LABORATORY

The Vision, Cognition and Behaviour Laboratory focuses on the underlying processes of visual perception, situation awareness and decision making. We do this using both behaviourial investigations and computational modelling. We are particularly interested in expertise in medical imaging and optimising medical training routines by using perceptual learning. We are also very interested in social norms and better understanding how they can be used to alter human behaviour for the better. We have been involved in a number of applied studies investigating how to “nudge” people to adopt more beneficial behaviours. We also conduct research into decision making with view to making this process more robust and reliable. Finally, we have conducted a number of pedagogical research projects. For a detailed listing our research please see our lab webpage.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/visual-cognition-behaviour/lab

SOCIAL ACTION LABORATORY

The Social Action Laboratory is concerned with the antecedents and consequences of meaningful human social action. As we engage in meaningful everyday activities, we are influenced by our social and cultural landscape, while simultaneously participating in its construction. The team’s focal point of interest is cultural dynamics, namely, the stability and change of culture over time, and how our everyday activities (e.g., language use, storytelling, interpersonal interactions) contribute to the formation, maintenance, and transformation of culture. The current research focus is on culture and sustainability broadly conceived. The Laboratory are interested in how culture intersects with sustainable lifestyles, and how we can transform our own cultures so that we can meet our needs without compromising future generations‘ ability to meet their needs.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/social-action-laboratory/lab

KNOWLEDGE, INFORMATION & LEARNING LABORATORY (KNOWLAB)

The Knowlab focuses on understanding complex decision making. Complex decisions require the integration of multiple sources of evidence that might conflict or interact in surprising ways. The aim of Knowlab is to reveal the processes and representations that underlie these decisions.

The key questions that they are interested in include:

- How does our knowledge influence how we perceive and interpret new information?
- How do we develop knowledge through experience and learning?
- And how does our knowledge affect our decisions and behaviour?

psychologicalsciences.unimelb.edu.au/research/research-initiatives/our-work/knowlab

VISION AND ATTENTION LABORATORY

Work in the Vision and Attention Laboratory seeks to explain how colour, motion, and attentional mechanisms operate within the visual system. They employ a diverse range of approaches including behavioural psychophysics, computational modelling, and electrophysiology.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/vision-and-attention-laboratory

COMPUTATIONAL MEMORY LABORATORY

The Computational Memory Lab aims to develop and test computational models of memory processes using a combination of experimental and modelling techniques. We use computational models to address a broad range of questions underlying the understanding of how memory works. These questions include: What causes forgetting? How are events encoded into memory and how are they represented? How are decisions made on the basis of what is retrieved from memory? Answering these questions can lead to a more precise understanding of how and why memory succeeds or fails.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/computational-memory-lab

SOCIAL NETWORKS LABORATORY

The social networks lab focuses on modelling different network structures and the effects that those networks may have on individual and system-level outcomes. The statistical and methodological work is driven by a highly interdisciplinary substantive research agenda with application areas in public health, safety and security, geography, demography, and related areas. Research is typically based on relationships among individuals collected through direct elicitation but may also have been quantified from archival and historical records, or even from literary texts or films. Questions central to network research include the processes of how people chose to connect to the people they do and whether you choose people similar to yourself or whether you become similar to the people you are connected to.

psychologicalsciences.unimelb.edu.au/research/msps-research-groups/Social_Networks_Laboratory/lab

OUR PEOPLE

Professor Simon Dennis

Director, Complex Human Data Hub

Simon's research utilises large scale real world data, experimental paradigms and computational modelling techniques to investigate the cognitive architecture underlying memory and language. Much of his research uses experience sampling technologies to study psychological processes. He has created an extensive data collection, retrieval, visualization and analysis ecosystem provided by Unforgettable Research Services Pty Ltd of which he is the CEO. Simon also has an interest in privacy and the concept of participant owned data.

simon.dennis@unimelb.edu.au

Associate Professor Amy Perfors

Deputy Director, Complex Human Data Hub

Amy's main research interest is in how the mind works, in the broadest sense. How do people learn new concepts? How do children learn language? How do we make decisions in an uncertain world? Amy approaches these questions using a mix of experimental methods and computational modelling techniques. Her view is that without empirical constraints, theoretical work in cognitive science can lose connection with the phenomena it seeks to explain; and without formal theoretical development, empirical work can lose direction or become difficult to make sense of.

amy.perfors@unimelb.edu.au

MEMBERS

Associate Professor Piers Howe

Piers is fascinated by a wide range of research topics. Recent research projects include: social norm research (both applied and theoretical), behavioural change research, decision making, perceptual learning, pedagogical research and a range of vision-related projects. He is currently focused on creating a quantitative theory of norm adherence and computationally modelling how societal norms can effectively create behaviour change. He hopes to use this model to explain how societal norms can encourage or inhibit the growth of ideological extremism, a project that is currently funded by the DST.

pdhowe@unimelb.edu.au

Associate Professor Charles Kemp

Charles's research focuses on computational models of learning and reasoning. Humans regularly make inferences that go beyond the data they have observed, and Charles attempts to characterize the knowledge that supports these inferences and to explain how this knowledge might be acquired. He is particularly interested in high-level cognition, and has developed models of categorization, generalization, causal reasoning, and relational learning. His interest in categorization has led to a line of work that explores the meanings of words in different languages.

c.kemp@unimelb.edu.au

Professor Yoshihisa Kashima

Yoshi's current research goal is to develop a social psychological theory of cultural dynamics, that is, how concrete individuals' context specific activities in interaction with each other can generate and transform what we call culture. More specific projects include cultural comparisons in self and identity, narrative social influence in cultural transmission and transformation, cultural dynamics of nationalism, patriotism, and stereotyping, and connectionist modelling of cultural processes.

ykashima@unimelb.edu.au

OUR PEOPLE

Associate Professor Daniel Little

Daniel's research focuses on the computational modelling of the timing and accuracy of real-time complex decisions in categorization, concept learning, and recognition memory. His work in categorization develops and tests exemplar and rule-based models of processing time with a focus on differentiating serial, parallel, and coactive processing architectures.

daniel.little@unimelb.edu.au

Professor Philip Smith

Philip is Professor of Quantitative and Mathematical Psychology and a former editor of the Journal of Mathematical Psychology. His research is concerned with the decision processes that are involved in translating perception into action. These kinds of decisions are ubiquitous in daily life. Deciding whether to stop or go when a traffic light changes and deciding whether a person in the street is a stranger or an acquaintance are two examples of the kinds of decisions we make rapidly and effortlessly many times a day. While they seem simple and effortless, these decisions are complex computationally and neurally. To solve the problem represented by the decision task computationally, the brain must be able to answer the questions: "what is it" and "what should I do about it?" This requires that processes of perception, attention, memory and decision making cooperate to form a representation of the external world and act on it to produce a behavioural response.

philipls@unimelb.edu.au

Professor Garry Robins

Garry has been a leading figure in developing social network methodologies, particularly statistical models for social network structure, and applying them to empirical network-based research in many different areas of the social sciences. In his applied research, he has collaborated in projects relating to major societal issues such as criminal networks, organizational structure, disease spread, and public health behaviours. A recent focus has been on the management and governance of social-ecological systems.

garrylr@unimelb.edu.au

Dr Simon Cropper

Simon is a teaching and research academic in the area of human sensation and perception. He has worked in both physiology and psychology departments in the UK, Canada and Australia. His primary research interests lie in colour perception, motion perception, time perception and individual differences in perception and problem solving. Experimentally, he adopts behavioural and computational approaches and has a strong interest in durable rigorous methodology.

scropper@unimelb.edu.au

Dr Johan Koskinen

Johan's research concerns statistical modelling and inference of network data aimed at facilitating research questions about human interaction and other forms of relational data. Understanding ubiquitous phenomena such as birds of a feather sticking together, and friends of my friends are often friends, are prerequisites for understanding and modelling things such as processes on networks, for example information diffusion and disease spread. Empirical network data is often messy and incomplete, and Johan has devoted much of his research to developing statistical approaches for handling this messiness.

jkoskinen@unimelb.edu.au

Dr Mirko Uljarević

Mirko Uljarević is currently a Senior Research Fellow in the School of Psychological Sciences, University of Melbourne. Prior to his current role at University of Melbourne, he was a postdoctoral research fellow at Stanford University and La Trobe University. He has received his medical degree in Serbia and completed his PhD in psychology at Cardiff University under the supervision of Professor Susan Leekam, Inaugural Chair of the Wales Autism Research Centre. A major focus of his research has, so far, been on the phenomenology and mechanisms underlying restricted and repetitive patterns of behaviors (RRB) and more recently social processing across both typical and atypical development, in particular, autism spectrum Disorder (ASD). This work has used big data approach and focused on the psychometric evaluation of the current instruments as well as on modification of the existing measures and has combined complex latent variable modelling approaches in an attempt to clarify the structure of RRB and social processing domain.

mirko.uljarevic@unimelb.edu.au

OUR PEOPLE

Dr Adam Osth

Adam studies human memory from an empirical and computational modeling perspective. One of the first things students of memory often learn is that memory retrieval is an extremely flexible operation; there are many different ways in which we can retrieve information about an event we've experienced. Adam's overall research goal is to understand the myriad of different ways in which we can recognize or recall either information we've experienced, contextual details about what we've experienced, or the order in which we've experienced information.

adam.osth@unimelb.edu.au

Dr Meredith McKague

Meredith is the Convenor of Academic Innovation at the Melbourne School of Psychological Sciences. Meredith's research interests include word learning in first and second languages, bilingualism, the relationship between memory and language in learning, and applications of the science of learning to effective learning practices in higher education.

mckaguem@unimelb.edu.au

COMPLEX HUMAN DATA HUB POST-DOCTORAL FELLOWS

Joshua Abbott

Simon De Deyne

Vanessa Ferdinand

Julian Fernando

Yang Li

Simon Lilburn

Ilona McNeill

Frank Mollica

Maggie Webb

Hyungwook Yim

CONTACT US

We welcome your interest in our Hub. If you want to know more, or explore opportunities for collaboration, please contact the Complex Human Data Hub.

To receive updates about events hosted by the CHDH, subscribe to the Seminar Series Mailing list by clicking the 'subscribe to our mailing list' button on **https://psychologicalsciences.unimelb.edu.au/research/hubs/chdh/contact-us**, or email your request to be added to **amy.perfors@unimelb.edu.au**

psychologicalsciences.unimelb.edu.au/chdh

simon.dennis@unimelb.edu.au

@Psychunimelb

facebook.com/melbpsychtalks/

THE UNIVERSITY OF MELBOURNE

CRICOS Provider Code: 00116K