



Workshop: Relations between space, language, and numbers



Wednesday, April 10th, 2024

Time	Format	Speakers	Content
12:00 pm – 1:30 pm	Reception and lunch		Participants and speakers will be received at the welcome desk in the institute, will be served lunch, and will have a first opportunity to get to know other participants and speakers.
1:30 pm – 1:45 pm	Welcome	Lilly Roth & Elena Albu	The organizers will give a short welcoming talk, present the timetable and structure of the workshop, and provide a brief introduction into the topic.
1:45 pm – 3:00 pm	Keynote talks	Roi Cohen Kadosh (online) & Rocco Chiou (in-person)	Numbers, actions, language, & space: How do they interact in the brain? Decades of neuroimaging and behavioural research have shown that numerical processing interacts with the motor system (e.g., children's finger counting), language (e.g., storing simple arithmetic facts as the multiplication table), and space (e.g., the SNARC effect). In this session, Rocco will first talk about how such cross-domain interactions inform us about the organisational principles of the human brain. Roi will go on to talk about the cognitive and neural mechanisms that underly number-space associations.
3:00 pm – 3:30 pm	Coffee break		
3:30 pm – 4:30 pm	Keynote talk	Hans-Christoph Nürk	Psychological Markedness as integrating principle for human cognition: The case of numerical cognition Linguistic markedness has long been suggested to influence human cognition and in particular, numerical cognition, such as in the MARC (Linguistic Markedness of Response Codes) effect. In the current talk, Hans-Christoph suggests that markedness is a psychological construct that evolved but is distinct from its linguistic origins in that it is embodied, graded and tied to individual and cultural specifics. The speaker proposes how psychological markedness could be a unifying account for previously unconnected phenomena and outline a future research agenda derived from this account.



4:30 pm – 5:30 pm	Keynote talk	Max Louwerse	<p>What language can tell us about space and spatial cognition, and numbers and numerical cognition</p> <p>Many studies have argued that space and numbers have little to do with the symbolic system called language. And yet, much meaningful information about space and numbers can be extracted from language statistics. This presentation gives an overview of various studies that show how findings attributed to non-linguistic information ought to be ascribed to the language system itself.</p>
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Thursday, April 11th, 2024

Time	Format	Speakers	Content
9:00 am – 10:15 am	Keynote talk	Bodo Winter	Session cancelled.
10:15 am – 10:45 am	Coffee break		
10:45 am – 11:45 am	Keynote talk	Andrea Bender	<p>The evolution of cognitive tools for quantification</p> <p>A variety of cognitive processes concerned with numbers (including the discrimination and comparison of different quantities, their exact enumeration, and mental arithmetic) depend on the availability of cognitive tools such as numeral systems. Such systems vary across cultures and languages, and their distinct properties affect how numbers are represented and processed. Numeral systems are thus a prime example of the close dovetailing of culture, language, and cognition, and a paradigmatic case of both distributed and embodied cognition. This talk will present the "Evolution of Cognitive Tools for Quantification", a highly interdisciplinary project aiming to investigate how these systems evolved, developed, and diversified, and which cognitive implications arise from their specific properties.</p>
12:00 pm – 2:30 pm	Poster session 1 and lunch	Participants	Participants will present traditional posters about their conducted studies (including results and interpretations). At the same time, lunch will be served.
2:30 pm – 3:45 pm	Interactive methodological talk	Ulf-Dietrich Reips, Yury Shevchenko & Annika Tave Overlander	<p>iScience Part I: Methods, Best Practice & WEXTOR</p> <p>After an overview, Ulf will introduce and discuss methods, pitfalls, and best practices of Internet-based research. He and Anni will then introduce WEXTOR.eu as a tool for online research and show an exemplary workflow of creating an online experiment, tailored to individual needs.</p>



3:45 pm – 4:15 pm	Coffee break		
4:15 pm – 5:00 pm	Interactive methodo- logical talk		<p>iScience Part II: Samply – A Web and Smartphone Application for Conducting Experience Sampling Studies</p> <p>Yury will introduce Samply as a tool for experience sampling studies. Participants will be able to design their own studies and discuss issues related to the use of Samply and the methodology of smartphone-based research.</p> <p>The iScience session will conclude with an interactive discussion between all three presenters and the audience.</p>
7:00 pm – open end	Social networking event		<p>Participants, speakers, and organizers will have dinner together for networking purposes, to exchange about their research and discuss the content of the first two workshop days. The social event will take place at the Saints and Scholars restaurant, which is an Irish Pub in 10 min walking distance from the Department of Psychology.</p>

Friday, April 12th, 2024

Time	Format	Speakers	Content
9:00 am – 10:30 am	Talks and interactive debate	Valter Prpic (in- person) & Benjamin Pitt (online)	<p>The role of order and magnitude in Spatial Numerical Associations</p> <p>Theoretical accounts on Spatial Numerical Associations propose different mechanisms to explain the phenomenon. These are typically based either on numerical magnitude or on the ordinal properties of the stimuli. Contrasting evidence exists on the role of magnitude and order in determining the spatial representation of numbers, recently sparking a theoretical debate in the field. In this session, we will aim to provide an overview on the state of the art and discuss the adequacy of experimental paradigms to investigate the question of magnitude and order.</p>
10:30 am – 11:00 am	Coffee break		
11:00 am – 12:00 pm	Podium discussion	<p><i>Moderator:</i> Elena Albu</p> <p><i>Invited Guests:</i> Krzysztof Cipora, Barbara Kaup, Max Louwerse</p>	<p>The podium discussion will be led by Elena Albu with some guiding questions about the influence of language on the spatial representation of numbers. Participants and speakers are welcome to ask questions and contribute to the discussion. Guests on the podium will be Krzysztof Cipora, Bodo Winter, and Barbara Kaup.</p>



12:00 pm – 2:00 pm	Meet-the-experts session, and lunch	Participants and speakers	This session will offer the opportunity for informal supervisory or mentoring discussions between PhD students and leading experts in the fields (e.g., to discuss how to deal with obstacles, to think of future studies, to create collaborations, or to arrange lab visits). Lunch will be served in the same room to create an informal and comfortable atmosphere.
2:00 pm – 3:30 pm	Interactive methodological talk	Krzysztof Cipora, Jean-Philippe van Dijck, & Lilly Roth	Time after time: what can we learn about cognitive phenomena by looking into their temporal stability with the Ironman paradigm? Most studies in experimental psychology investigate cognitive phenomena by collecting data from participants for a task at one time point. Two implicit generalizations of results are (1) that an observed phenomenon is present among all participants and (2) that it is stable over time. In this session, we introduce the Ironman paradigm, which allows testing the validity of these two generalizations. With this paradigm, we found that the SNARC effect, which is robust at the group level, is not present in all participants, and varies dramatically within participants.
3:30 pm – 4:30 pm	Poster session 2 and coffee break	Participants	Participants will present preregistration posters about their planned studies (including a theoretical introduction, planned method, and planned data analysis). At the same time, drinks and snacks will be served.
4:30 pm – 5:30 pm	Developing collaboration projects	Participants & speakers	Participants and speakers will group by research interests, with the intention to develop future collaborative research projects. The aim is to address open questions about the relation between space, language, and numbers that might have arisen during the workshop, and to brainstorm together about potentially innovative paradigms and methodologies that could be used in future projects.



Information about the speakers

Elena Albu

(Post-Doc at the Department of Psychology at the University of Tübingen, Germany)

Elena is a postdoctoral researcher in the DFG Research Unit "Modal and Amodal Cognition". Her research focuses on the interplay between modal and amodal encodings underlying space-metric associations. She is particularly interested in the nature of the SNARC and SNARC-like effects and the factors triggering them. With a background in linguistics, she is equally interested in language and negation processing.

Andrea Bender

(Professor at the Department of Psychosocial Science, University of Bergen, Norway)

Andrea is a PI in the NFR-funded Centre for Early Sapiens Behaviour (SapienCE) at the University of Bergen, and one of four PIs of the project "Evolution of Cognitive Tools for Quantification (QUANTA)", funded by the European Research Council with a Synergy Grant. As a cognitive scientist with background in anthropology, she studies the relationship between cognition, language, and culture, and their (co-)evolution.

Rocco Chiou

(Lecturer at the University of Surrey, UK)

Rocco is a cognitive neuroscientist interested in how the brain represents conceptual knowledge. He uses methods such as fMRI, psychophysics, and brain stimulation to investigate cognitive control, perception, semantic memory, & numerical cognition. He is a lecturer of cognitive neuroscience at the University of Surrey.

Krzysztof Cipora

(Lecturer at the Centre for Mathematical Cognition at Loughborough University, UK)

Krzysztof investigates Spatial-Numerical Associations: how they are influenced by language, culture, and how they are linked to mathematical skills. Moreover, he explores the individual prevalence of cognitive effects and their intraindividual stability over time. Krzysztof also works on mathematics anxiety and its links to mathematics achievement in different groups.

Roi Cohen Kadosh

(Head of School of Psychology and professor of Cognitive Neuroscience at the University of Surrey, UK)

Roi is the Head of School of Psychology and professor of Cognitive Neuroscience at the University of Surrey. His research delves into the intricate interplay between psychological and biological factors shaping mathematical learning and cognition. Leveraging different methods such as brain stimulation, cognitive training, and artificial intelligence, his research explores ways to optimise these functions in various populations, including those with mathematical learning difficulties and those exceeding in mathematical abilities.

Barbara Kaup

(Full professor at the Department of Psychology at the University of Tübingen, Germany)

Barbara is currently the head of the Department of Psychology at the University of Tübingen and the leader of the DFG research group on Modal and Amodal Cognition. Her research addresses the processes and representations involved in language comprehension, with a particular focus on the way in which semantic and pragmatic factors affect the processing of negative sentences.

Max Louwerse

(Professor of Cognitive Psychology and Artificial Intelligence at Tilburg University, and Professor by Special Appointment at Maastricht University, Netherlands)

Max is Professor of Cognitive Psychology and Artificial Intelligence at Tilburg University, and Professor by Special Appointment at Maastricht University, the Netherlands. He has published extensively on symbolic and embodied cognition, neurophysiology, and virtual, mixed and augmented reality.



Hans-Christoph Nürk

(Full professor at the Department of Psychology at the University of Tübingen, Germany)

Hans-Christoph is heading the lab Diagnostics and Cognitive Neuropsychology and the Tuebingen Brain and Number Group. His research focusses mainly on the (neuro)-cognitive underpinnings, the development and the impairment of numerical cognition as well as its diagnostics, possible interventions and educational impact. He is also exploring the relation of numerical cognition and spatial processing in various, frequently cooperative projects.

Benjamin Pitt

(Research fellow at the Institute for Advanced Study in Toulouse, France)

Benjamin studies how people conceptualize abstract domains like time and number. His work across cultures, contexts, and age groups shows how even these fundamental aspects of cognition are shaped by language and culture, at multiple timescales. By studying conceptual diversity, he seeks to clarify the mechanisms that underlie human's extraordinary cognitive abilities.

Valter Prpic

(Assistant professor at the Department of Philosophy and Communication Studies at University of Bologna, Italy)

Valter's main research interest is in Spatial-Numerical Associations, and in particular in the role of order and magnitude in determining the origins of these effects. Additionally, Valter is also interested in perception, attention and music cognition.

Lilly Roth

(PhD student at the Department of Psychology at the University of Tübingen, Germany)

Lilly is a third-year PhD student investigating spatial mental representations of numbers and automatic number processing. She runs large-sample online studies to investigate the replicability of basic findings on the SNARC effect ("Spatial Numerical Associations of Response Codes"). Moreover, Lilly is interested in research methodology and statistical data analysis and strongly commits to Open Science practices.

Ulf-Dietrich Reips

(Full professor at the Department of Psychology at the University of Konstanz, Germany)

He focuses on Internet-based research methodologies, the psychology of the Internet, measurement, experimental methods, personality, privacy, data science, and mobile experience sampling. Ulf was a founder of the German Society for Online Research and has [published](#) more than 180 scientific articles and book chapters, six books and four special journal issues. Serving the research community, Ulf and his [iScience team](#) develop and provide free Web tools and apps for researchers, teachers, students, and the public that are available from the [iScience Server](#).

Yury Shevchenko

(Post-Doc at the Department of Psychology at the University of Konstanz, Germany)

Yury did his PhD at the Chair of Experimental Psychology at the University of Mannheim, Germany. His interests lie in the intersection of psychology and computer science with a focus on methods and programming. Yury has developed Open Lab, a web platform for conducting online experiments, and Smply, web and mobile application for experience sampling studies. Since 2019 he has been working as a Post-Doc at the University of Konstanz.

Annika Tave Overlander

(PhD student at the Department of Psychology at the University of Konstanz, Germany)

Anni is a first-year PhD student in psychological methods. Her interests mostly lie in online research and statistics as well as decision making. She also works on several online studies on the SNARC effect, specifically on the technical side of experimental coding. With her background in psychology as well as neuroscience, she plans to tackle statistical and methodological challenges by developing tools for research and data analysis to make proper research techniques more accessible.



Jean-Philippe van Dijck

(Lecturer and researcher at Thomas More University, and visiting research professor at Ghent University, Belgium)

In his scholarly investigations, Jean-Philippe utilizes insights from the domains of numerical and mathematical cognition to elucidate variations in mathematical proficiency among individuals in educational settings. In addition, he aims to develop tests for the (early) detection of mathematical learning difficulties. His research particularly concentrates on the associations between numbers, serial order in working memory and space, as well as the psychological aspects of math anxiety and psychometry. In addition to conducting research, Jean-Philippe instructs in the courses of General Psychology, Neuropsychology, and Research Methods.

The organizers would like to thank the sponsors of this event:



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The organizers of this workshop are Lilly Roth, Elena Albu, Hans-Christoph Nürk, Ulf-Dietrich Reips, Krzysztof Cipora, Gabriella Daróczy, Xinru Yao, and Mine Avcil.

In case you have questions about this workshop, visit our website at <https://uni-tuebingen.de/de/256925> and feel free to contact the organizers via email: numcog@psycho.uni-tuebingen.de