

MINDS. MOVEMENT. MOVING IMAGE.

SYMPOSIUM I / SPATIAL COGNITION AND THE BUILT ENVIRONMENT

SYMPOSIUM II / VISUO-AUDITORY PERCEPTION AND THE MOVING IMAGE

Symposia Convener

Mehul Bhatt

Örebro University, Sweden

An initiative of:

CoDesign Lab EU / Cognition. AI. Interaction. Design.

www.codesign-lab.org

ICSC 2018 – 7TH INTERNATIONAL CONFERENCE ON SPATIAL COGNITION

Rome, Italy

ABOUT THE SYMPOSIA

ABOUT THE SYMPOSIUM

This symposium -conducted in two parts - explores the confluence of empirically-based qualitative research in the cognitive and psychological sciences, focusing on visual and spatial cognition, with computationally-driven analytical methods, rooted in artificial intelligence, in the service of communications, media, design, and human behavioural studies. With a focus on architecture and visuo-auditory media design, the twin symposia will demonstrate recent results and explore the synergy of research methods for the study of human behaviour in the chosen (design) contexts of socio-cultural, and socio-technological significance.

The symposium brings together experts and addresses methods and perspectives from:

- Visuo-Spatial Cognition and Computation
- Artificial Intelligence
- Cognitive Systems
- Cognitive Science and Psychology
- Design Cognition and Computation
- Multimodality and Interaction
- Neuroscience
- Communications and Media Studies
- Architecture, Built Environment
- Design Studies (focus on architecture and visuo-auditory media)
- Evidence Based Design

The symposium particularly emphasis the role of multimodality and mediated interaction for the analysis and design of human-centred, embodied, cognitive user experiences in everyday life and work. Here, the focus is on multimodality studies aimed at the semantic interpretation of human behaviour, and the empirically-driven synthesis of embodied interactive experiences in real world settings. In focus are narrative media design, architecture and built environment design, product design, cognitive media studies (film, animation, VR, sound and music design), and user interaction studies. In these contexts, the symposium emphasises evidence-based multimodality studies from the viewpoints of visual (e.g., attention and recipient effects), visuo-locomotive (e.g., movement, wayfinding), and visuo-auditory (e.g., narrative media) cognitive experiences. Modalities being investigated include, but are not limited to:

- visual attention (by eye-tracking), gesture, speech, language, facial expressions, tactile interactions, olfaction, biosignals
- human expert guided event segmentation
(e.g. coming from behavioural or environmental psychologists, designers, annotators, crowd-sensing)
- deep analysis based on dialogic components, think-aloud protocols.

The scientific agenda of the twin-symposia also emphasises the multi-modality of the embodied visuo-spatial thinking involved in “problem-solving” for the design of objects, artefacts, and interactive people-experiences emanating therefrom. Universality and inclusion in “design thinking” are of overarching focus in all design contexts relevant to the symposium; here, the implications of multimodality studies for inclusive design, e.g., creation of presentations of the same content in different modalities, are also of interest. The symposium provides a platform to discuss the development of next generation embodied interaction design systems, practices, and (human-centred) assistive frameworks and technologies encompassing the multi-faceted nature of embodied design conception and synthesis. Individual contributions / talks within the two symposia address the themes under consideration from formal, computational, cognitive, design, engineering, empirical, and philosophical perspectives.

SYMPOSIUM I / Spatial Cognition and the Built Environment / Six Panelists, addressing:

// How can cognitive modalities constitute the foundational building blocks of design education, discourse, systems & assistive technologies, and the professional practice of spatial design for architecture? //

SYMPOSIUM II / Visuo-Auditory Perception and the Moving Image / Six Panelists, addressing:

// What are the visual-auditory cues that drive attention? How can research in visuospatial cognition influence the design of digital media? What kinds of paradigm shifting multimodal media platforms seem likely to emerge in the future, and how can the cognitive and psychological sciences serve a guiding role towards this? //

SYMPOSIA SPEAKERS

- Prof. Mehul Bhatt
Örebro University, Sweden
- Prof. Ann Sloan Devlin
Connecticut College, United States
- Prof. Kay O'Halloran
Curtin University, Australia
- Dr. Paul Hemeren
University of Skövde, Sweden
- Prof. Lissa Holloway-Attaway
University of Skövde, Sweden
- Vasiliki Kondyli
University of Bremen, Germany
- Dr. Juhyun Lee
University of South Australia, Australia
- Prof. Daniel Levin
Vanderbilt University, United States
- Prof. Juval Portugali
Tel-Aviv University, Israel
- Jakob Suchan
University of Bremen, Germany
- Dr. Chiao-I Tseng
University of Bremen, Germany
- Prof. Barbara Tversky
Stanford University & Columbia University, United States

SYMPOSIA PROGRAMME

SYMPOSIUM I

MINDS. MOVEMENT. MOVING IMAGE.

On Spatial Cognition and the Built Environment

// How can cognitive modalities constitute the foundational building blocks of design education, discourse, systems & assistive technologies, and the professional practice of spatial design for architecture? //

- Embodied Architecture Design: On People-Centred Design of Visuo-Locomotive Cognitive Experiences
Prof. Mehul Bhatt
Örebro University
Sweden / <http://www.mehulbhatt.org>
- Healthcare Environments and Evidence-Based Design: The Missing Role of Spatial Cognition
Prof. Ann Sloan Devlin
Connecticut College
United States / <https://www.conncoll.edu/directories/faculty-profiles/ann-s-devlin/>
- Precedent-Based Parametric Design: Computationally Generated Spatial Morphologies Satisfying Behavioural-Based Design Constraints
Vasiliki Kondyli
University of Bremen
Germany / <http://www.design-space.org>
- Multi-Cultural Design Communication: Cognition, Design Information, and Spatial Language
Dr. Juhyun Lee
University of South Australia
Australia / <https://www.newcastle.edu.au/profile/juhyun-lee>
- On the relations between cognitive maps and images of cities
Prof. Juval Portugali
Tel-Aviv University
Israel / www.tau.ac.il/~juval/
- Cross-Cultural Differences in Visualizations
Prof. Barbara Tversky
Stanford University, and Columbia University
United States / www-psych.stanford.edu/~bt/ | <http://datascience.columbia.edu/barbara-tversky>

SYMPOSIUM II

MINDS. MOVEMENT. MOVING IMAGE.

On Visuo-Auditory Perception and the Moving Image

// What are the visual-auditory cues that drive attention? How can research in visuospatial cognition influence the design of digital media? What kinds of paradigm shifting multimodal media platforms seem likely to emerge in the future, and how can the cognitive and psychological sciences serve a guiding role towards this? //

- Cognitive Media Studies: Potentials for Spatial Cognition and AI Research
Prof. Mehul Bhatt
Örebro University
Sweden / <http://www.mehulbhatt.org>
- Multimodal Rhetoric in Online Media Communications
Prof. Kay O'Halloran
Curtin University
Australia / <https://staffportal.curtin.edu.au/staff/profile/view/Kay.Ohalloran>
- Actions, intentions and environmental constraints biological motion perception
Dr. Paul Hemeren
University of Skövde
Sweden / http://www.his.se/en/about-us/Facts-and-figures/staff/paul_hemeren/
- Designing Game-based Narratives and Interactive Worlds for Cultural Engagement
Prof. Lissa Holloway-Attaway
University of Skövde
Sweden / http://www.his.se/en/about-us/Facts-and-figures/staff/lissa_hollowayattaway
- How People Represent Space and Events While Viewing Cinema
Prof. Daniel Levin
Vanderbilt University
United States / <https://my.vanderbilt.edu/daniellevinlab>
- Machine Coding of Narrative Structures in Visuo-Spatial Imagery
Jakob Suchan
University of Bremen
Germany / <http://www.cognitive-vision.org>
- Cohesion in Film and Graphic Novel
Dr. Chiao-I Tseng
University of Bremen
Germany / <https://www.chiaointseng.de>

SYMPOSIUM I

ON SPATIAL COGNITION AND THE BUILT ENVIRONMENT

// How can cognitive modalities constitute the foundational building blocks of design education, discourse, systems & assistive technologies, and the professional practice of spatial design for architecture? //

SYMPOSIUM I

SPEAKER I of 6

Mehul Bhatt
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EMBODIED ARCHITECTURE DESIGN: ON PEOPLE-CENTRED DESIGN OF VISUO-LOCOMOTIVE COGNITIVE EXPERIENCES

This presentation focusses on the analysis and design of human-centered, embodied, cognitive user experiences from the perspectives of spatial cognition and computation, artificial intelligence, and human-computer interaction research. Focussing on large-scale built up spaces (in particular hospitals), this presentation will particularly address:

“how can human-centred cognitive modalities of visuo-locomotive perception constitute the foundational building blocks of design education, discourse, systems, and the professional practice of spatial design for architecture. (In other words: addressing technology-mediated design of built-up environments in order to better engineer the spaces of everyday life and work)”

The presentation will emphasise evidence-based multimodality studies from the viewpoints of visuo-locomotive (i.e., pertaining to vision, movement, and wayfinding) cognitive experiences. Modalities being investigated include: (1). visual attention (by eye-tracking), gesture, language, facial expressions; (2). human expert guided event segmentation (e.g. coming from behavioural or environmental psychologists, designers, annotators); (3) deep analysis based on dialogic components, think-aloud protocols.

We call for an integrated approach combining analytical methods (rooted in AI & computational cognition) and empirical methods (rooted in psychology & perception studies) for developing human-centred architectural design technologies, and technology-mediated design synthesis.

Keywords: spatial cognition, artificial intelligence, design cognition – architecture, evidence-based design, architectural education

Select Publications

Bhatt, M., Schultz, C. (2017). People-Centered Visuospatial Cognition: Next-generation Architectural Design Systems and their Role in Conception, Computing, and Communication. In (edited volume): The Active Image: Architecture and Engineering in the Age of Modeling. Editors: Ammon, S. and Capdevila-Werning, R. Pages: 291, Volume 28 of Philosophy of Engineering and Technology, Springer International Publishing, ISBN: 331956465X, 9783319564654, 2017.

Kondyli, V., Schultz, C. P.L., and Bhatt, M. (2017) Evidence-Based Parametric Design: Computationally Generated Spatial Morphologies Satisfying Behavioural-Based Design Constraints. Conference on Spatial Information Theory (COSIT): 11:1-11:14, 2017.

Bhatt, M., Suchan, J., Schultz, C., Kondyli, V., Goyal, S. (2016). Artificial Intelligence for Predictive and Evidence Based Architecture Design: Integrating Spatial Reasoning, Cognitive Vision, and Eye-Tracking for the Analysis of Embodied Visuo-Locomotive Experience in the Built Environment. In: Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16 - Demo track), February 12-17, 2016, Phoenix, Arizona USA.

Bhatt, M., Schultz, C., Thosar, M. (2014). Computing Narratives of Cognitive User Experience for Building Design Analysis: KR for Industry Scale Computer-Aided Architecture Design, in: Principles of Knowledge Representation and Reasoning: Proceedings of the 14th International Conference, KR 2014, Vienna, Austria.

Bhatt, M., Schultz, C., Huang, M. (2012). The Shape of Empty Space: Human-Centred Cognitive Foundations in Computing for Spatial Design. IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC) 2012, Innsbruck, Austria.

SYMPOSIUM I

SPEAKER 2 of 6

Ann Sloan Devlin
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HEALTHCARE ENVIRONMENTS AND EVIDENCE-BASED DESIGN: THE MISSING ROLE OF SPATIAL COGNITION

"You can check out any time you like, but you can never leave!" The lyrics from this well-known song "Hotel California" by the American rock band The Eagles points to a major problem in the design of healthcare environments today: the relative lack of attention given to the role of successful wayfinding in the healthcare experience. The aim of the session is to present an overview of evidence-based design within the healthcare arena, with specific attention to the findings related to navigation and wayfinding, pointing to opportunities for researchers to further contribute to this domain and the challenges in conducting research in healthcare settings. In addition, consideration will be given to the role of wayfinding in architectural education and practice.

Keywords: evidence-based design, theory of supportive design, wayfinding, architectural education

[Select Publications](#)

Devlin, A. S., & Andrade, C. (2017). Quality of the hospital experience: Impact of the physical environment. In G. Fleury-Bahi, E. Pol, & O. Navarro (Eds.), *Handbook of environmental psychology and quality of life research* (pp. 421-440). Cham, Switzerland: Springer.

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Devlin, A. S. (2014). Wayfinding in healthcare facilities: Contributions from environmental psychology. *Behavioral Sciences*, 4, 423-436. doi:10.2290/bs4040423

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SYMPOSIUM I

SPEAKER 3 of 6

Vasiliki Kondyli
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PRECEDENT-BASED PARAMETRIC DESIGN: COMPUTATIONALLY GENERATED SPATIAL MORPHOLOGIES SATISFYING BEHAVIOURAL-BASED DESIGN CONSTRAINTS

Parametric design systems serve as powerful assistive technologies in the design process by providing flexibility and assisting at the generation of a vast number of design alternatives. However, parametric systems currently are focusing more on low-level engineering and structural forms and less on people-centered aspects of design. We propose a precedent-based design approach for parametric systems that introduces people-centred criteria rooted in empirical behavioural evidence. We present examples from a list of precedents defined through a behavioural multi-modal analysis of a wayfinding study conducted in two healthcare environments, and we formulate design constraints that can be embedded into parametric design systems, such as freeCAD and Python-Grasshopper. Finally, we present a number of morphologies generated in parametric design systems that satisfy people-centred design rules for wayfinding.

Keywords: precedent-based design, design computing, parametric design, behavioural studies, wayfinding

Select Publications

Kondyli, V., Bhatt, M. (2018). Rotational Locomotion in Large-Scale Environments: A Survey and Implications for Evidence-Based Design Practice. Special Issue on Cognition and the City, Editor: Juval Portugali., Journal: Built Environment. Volume 44, Number 2, Summer 2018, pp. 241-258(18). Alexandrine Press. doi: <https://doi.org/10.2148/benv.44.2.241>

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Kondyli, V., Bhatt, M. and Hartmann, T. (2017) Towards people-centred precedents for parametric design: The case of wayfinding in large-scale buildings. In Lean & Computing in Construction Congress (LC3), Vol. 2 (CONVR), Heraklion, Greece, July.

Bhatt, M., Suchan, J., Kondyli, V., Schultz, C. (2016). Embodied Visuo-Locomotive Experience Analysis: Immersive Reality Based Summarisation of Experiments in Environment-Behaviour Studies. Proceedings of the ACM SIGGRAPH Symposium on Applied Perception (SAP 2016), Anaheim, USA.

Bhatt, M., Suchan, J., Schultz, C., Kondyli, V., Goyal, S. (2016). Artificial Intelligence for Predictive and Evidence Based Architecture Design: Integrating Spatial Reasoning, Cognitive Vision, and Eye-Tracking for the Analysis of Embodied Visuo-Locomotive Experience in the Built Environment. In: Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16 - Demo track), February 12-17, 2016, Phoenix, Arizona USA.

SYMPOSIUM I

SPEAKER 4 of 6

Juhyun Lee
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MULTI-CULTURAL DESIGN COMMUNICATION: COGNITION, DESIGN INFORMATION, AND SPATIAL LANGUAGE

Language is not only a system of communication, but it is also a reflection of the way we think and of our sociocultural differences and values. From a linguistic perspective it is accepted that language necessarily shapes the explication of spatial and formal concepts. But doesn't this also imply that, in a general sense, language shapes design, or more specifically, that design cognition is linguistically dependent? This research investigates the impact of linguistic and cultural differences on design communication and cognition in the architecture studio.

This talk illustrates the results of a study that compares the cognitive processes of three cultural groups of architectural designers. The research develops cognitive and linguistic approaches to investigate multi-cultural design process. At the core of this research is a triple-coding system for protocol analysis, which can formally capture both cognitive and linguistic characteristics of the design process. The results of the experiment demonstrate the effectiveness of the coding system facilitate the in-depth exploration of design cognition and its relationship to spatial language. The research also confirms that there are similarities and disparities in design communications between three cultural groups. This multi-focused approach contributes to advancing fundamental knowledge about the relationship between design and language.

Keywords: design cognition, spatial language, protocol analysis, design communication

Select Publications

- Lee, J. H., Ostwald, M. J., & Gu, N. (2017). Cognitive Challenges for Teamwork in Design. In R. Tucker (Ed.), *Collaboration and Student Engagement in Design Education* (pp. 55-75). Hershey PA: IGI Global.
- Lee, J. H., Ostwald, M. J., & Gu, N. (2016). The language of design: Spatial cognition and spatial language in parametric design. *International Journal of Architectural Computing*, 14(3), 277-288.
- Lee, J. H., Gu, N., & Ostwald, M. (2015). Creativity and parametric design? Comparing designer's cognitive approaches with assessed levels of creativity. *International Journal of Design Creativity and Innovation*, 3(2), 78-94.
- Lee, J. H., Gu, N., & Williams, A. P. (2014). Parametric design strategies for the generation of creative designs. *International Journal of Architectural Computing*, 12(3), 263-282.
- Lee, J. H., Gu, N., Jupp, J., & Sherratt, S. (2014). Evaluating Creativity in Parametric Design Processes and Products: A Pilot Study. In *Design Computing and Cognition '12* (pp. 181-200). Texas A & M University, USA: Springer.

SYMPOSIUM I

SPEAKER 5 of 6

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ON THE RELATIONS BETWEEN COGNITIVE MAPS AND IMAGES OF CITIES

Tolman's "Cognitive maps in rats and me" and Lynch's *The Image of the City* are two of the seminal works at the foundations of studies on spatial cognition and the built environment. The apparent similarity between the notions 'Cognitive map' and 'Image', has deceived many scholars in this domain to erroneously assume that the 'Image' (of the city) is a synonym of, just another name for, a 'Cognitive map' (of the city). Approaching the processes of cognitive mapping and imaging from the conjunctive perspective of SIRN (synergetic inter-representation networks) and IA (information adaptation), I show that while cognitive maps and images ontologically differ from each other, they are still interrelated in several interesting ways.

Keywords: cognitive maps, images, information adaptation, inter-representations

Select Publications

Portugali, J. (1993). *Implicate relations : society and space in the Israeli-Palestinian conflict*. Dordrecht ; Boston : Kluwer Academic Publishers.

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Haken, H., Portugali, J., (2015). *Information Adaptation: The interplay between Shannonian and semantic information in cognition*. Springer, Berlin. SpringerBriefs series.

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SYMPOSIUM I

SPEAKER 6 of 6

Barbara Tversky
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CROSS-CULTURAL DIFFERENCES IN VISUALIZATIONS

As the world becomes increasingly mobile and increasingly pixellated, visual communications become more ubiquitous and more important. They map meanings to marks in space and place in space and are consequently more transparent than words, whose mapping to meaning is arbitrary. Despite their ubiquity, cultural differences are evident in their design, differences that could lead to misunderstandings. Here we present research showing effects of culture and language in a variety of visual communications including comics, covers of children's books, and math diagrams.

Keywords: visualization, diagram, cultural differences, language differences

Select Publications

Tversky, B. (2016). Lines: Orderly and messy. In Y. Portugali & E. Stolk (Editors), Complexity, cognition, urban planning, and design. Dordrecht: Springer.

Kang, S. and Tversky, B. (2016). From hands to minds: Gestures promote understanding. Cognitive Research: Principles and Implications. DOI 10.1186/s41235-016-0004-9.

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Tversky, B. (2008). Spatial cognition: Situated and embodied. In P. Robbins and M. Aydede (Editor). Cambridge handbook of situated cognition. Cambridge: Cambridge University Press.

Tversky, B. (2005). Functional significance of visuospatial representations. In P. Shah & A. Miyake (Editors.), Handbook of higher-level visuospatial thinking. pp. 1-34. Cambridge: Cambridge University Press.

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SYMPOSIUM II

ON VISUO-AUDITORY PERCEPTION AND THE MOVING IMAGE

// What are the visual-auditory cues that drive attention? How can research in visuospatial cognition influence the design of digital media? What kinds of paradigm shifting multimodal media platforms seem likely to emerge in the future, and how can the cognitive and psychological sciences serve a guiding role towards this? //

SYMPOSIUM II

SPEAKER I of 7

Mehul Bhatt
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COGNITIVE MEDIA STUDIES: POTENTIALS FOR SPATIAL COGNITION AND AI RESEARCH

Cognitive media studies has developed as an area of research at the interface of disciplines as diverse as aesthetics, psychology, neuroscience, film theory, and cognitive science. In this context, the focus of this talk is on the foundational significance of artificial intelligence and visuo-spatial cognition and computation for the design and implementation of integrated analytical–empirical methods for the (multi-modal) analysis of human behaviour data vis-a-vis a range of digital visuo-auditory narrative media. The presentation focusses on the methodological foundations and assistive technologies for systematic formalisation and empirical analyses aimed at, for instance, the generation of evidence, establishing and characterising correlates between principles for the synthesis of the moving image, and its cognitive —perceptual, embodied visuo-auditory, emotional etc— recipient effects and influence on observers.

In the backdrop a completed and ongoing experiments, we emphasize the core results on the semantic interpretation of human behaviour vis-a-vis digital narrative media and their visuo-auditory reception. We demonstrate the manner in which semantic interpretation of human behaviour, founded on AI-based models for machine coding, inference and learning, serves as basis to externalise explicit and inferred knowledge about embodied visuo-auditory reception, e.g., using modalities such as diagrammatic representations, natural language, complex (dynamic) data visualisations.

DEMONSTRATION

The presentation will particularly showcase methods and tools developed to perform perceptual narrativisation or sensemaking with multi-modal, dynamic human-behaviour data (e.g., visuo-spatial imagery such as video, eye-tracking, head-tracking) for a chosen set of experimental material based on existing films, as well as lab-developed experimental content.

Keywords: visual perception, event perception, computational models of narrative, cognitive vision, cognitive film studies

Select Publications

Suchan, J., Bhatt, M. (2016). Semantic Question-Answering with Video and Eye-Tracking Data ? AI Foundations for Human Visual Perception Driven Cognitive Film Studies. IJCAI 2016: 25th International Joint Conference on Artificial Intelligence, New York City, USA.

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Bhatt, M., Suchan, J., Schultz, C. (2013). Cognitive Interpretation of Everyday Activities - Toward Perceptual Narrative Based Visuo-Spatial Scene Interpretation. Computational Models of Narrative (CMN) 2013., a satellite workshop of CogSci 2013: The 35th meeting of the Cognitive Science Society, Editors: M. Finlayson., B. Fisseni., Benedikt Löwe., J. C. Meister. OASIs proceedings volume. OpenAccess Series in Informatics (OASIs). Dagstuhl, Germany

Bhatt, M., Flanagan, G. (2010). Spatio-Temporal Abduction for Scenario and Narrative Completion (a preliminary statement). In International Workshop on Spatio-Temporal Dynamics, European Conference on Artificial Intelligence (ECAI 2010), Lisbon, Portugal.

SYMPOSIUM II

SPEAKER 2 of 7

Kay O'Halloran
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MULTIMODAL RHETORIC IN ONLINE MEDIA COMMUNICATIONS

The proliferation of media channels enables political sub-communities to manage and control the creation and dissemination of alternative rhetorical discourses that are increasingly supplanting traditional consensus based media frameworks to perpetuate various viewpoints of world events. Multimodal discourse analysis, which is the study of the meaning arising from the integration of language, images and other resources in texts, interactions and events, is integrated with social network theories, computer vision, machine learning and natural language understanding systems to provide evidence-based assessment of the multimodal strategies (text, images and videos) which are used and how the global community responds in terms of re-using the images and videos for various purposes.

Keywords: media communications, multimodal rhetoric, language, image, video

Select Publications

O'Halloran, K. L., Tan, S., Pham, D.-S., Bateman, J., & Vande Moere, A. (2018). A Digital Mixed Methods Research Design: Integrating Multimodal Analysis with Data Mining and Information Visualization for Big Data Analytics. *Journal of Mixed Methods Research*. 12(1): 11-30. DOI: 10.1177/1558689816651015.

O'Halloran, K. L., Tan, S., Wignell, P., Bateman, J., Pham, D.-S., Grossman, M. & Vande Moere, A. (2016). Interpreting Text and Image Relations in Violent Extremist Discourse: A Mixed Methods Approach for Big Data Analytics. *Terrorism and Political Violence*. DOI: 10.1080/09546553.2016.1233871.

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Tan, S., O'Halloran, K. L., Wignell, P., Chai, K. & Lange, R. (2018). A Multimodal Mixed Methods Approach for Examining Recontextualisation Patterns of Violent Extremist Images in Online Media. *Discourse, Context and Media*. 21: 18-35. <https://doi.org/10.1016/j.dcm.2017.11.004>

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SYMPOSIUM II

SPEAKER 3 of 7

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ACTIONS, INTENTIONS AND ENVIRONMENTAL CONSTRAINTS BIOLOGICAL MOTION PERCEPTION

In many ways, human cognition is importantly predictive. We predict the sensory consequences of our own actions, but we also predict, and react to, the sensory consequences of how others experience their own actions. This ability extends to perceiving the intentions of other humans based on past and current actions. We present research results that show that social aspects and future movement patterns can be predicted from fairly simple kinematic patterns in biological motion sequences. The purpose of this presentation is to demonstrate and discuss the different environmental (gravity and perspective) and bodily constraints on understanding our social and movement-based interactions with others. In a series of experiments, we have used psychophysical methods and recordings from interactions with objects in natural settings. This includes experiments on the incidental processing of biological motion as well as driving simulator studies that examine the role of kinematic patterns of cyclists and driver's accuracy to predict the cyclist's intentions in traffic.

The results we present show both clear effects of "low-level" biological motion factors, such as opponent motion, on the incidental triggering of attention in basic perceptual tasks and "higher-level" top-down guided perception in the intention prediction of cyclist behavior. We propose to use our results to stimulate discussion about the interplay between expectation mediated and stimulus driven effects of visual processing in spatial cognition the context of human interaction. Such discussion will include the role of context in gesture recognition and to what extent our visual system can handle visually complex environments.

Keywords: biological motion, intention recognition, attention, social cognition

Select Publications

Hemeren, P., Thill, S., Lee, G. & Veto, P. (2017). Embodiment in social hand gestures from kinematic information in biological motion. Workshop on The body of embodiment at 5th International Conference on Human-Agent Interaction, October, Bielefeld, Germany.

Sun, J., Redyuk, S., Billing, E., Hgberg, D., & Hemeren, P. (2018). Tactile Interaction and Social Touch: Classifying Human Touch using a Soft Tactile Sensor. In HAI'17: Proceedings of the 5th International Conference on Human Agent Interaction, New York: Association for Computing Machinery (ACM), pp. 523-526.

Hemeren, P., Johannesson, M., Lebram, M., & Eriksson, F. (2017). Detecting Cyclists at Night: visibility effects of reflector placement and different lighting conditions. In Proceedings of the 6th International Cycling Safety conference (ICSC), September, Davis, California, USA.

Hemeren, P., Johannesson, M., Lebram, M., Eriksson, F., Veto, P. & Ekman, K. (2014). The Use of Visual Cues to Determine the Intent of Cyclists in Traffic. IEEE International Inter-Disciplinary Conference on Cognitive Methods in Situation Awareness and Decision Support (CogSIMA) (47-51). IEEE Press.

Dreijing, K., Thill, S., & Hemeren, P. (2015). Engagement: A traceable motivational concept in human-robot interaction. Affective Computing and Intelligent Interaction (ACII), IEEE Computer Society, 956-961.

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SYMPOSIUM II

SPEAKER 4 of 7

Lissa Holloway-Attaway
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DESIGNING GAME-BASED NARRATIVES AND INTERACTIVE WORLDS FOR CULTURAL ENGAGEMENT

Games have long been recognized as powerful tools to mediate complex stories connecting players to material and virtual worlds through strategic narrative design and complex modes of embodied, critical play. Digital games are increasingly used outside the “entertainment only” sector, for example, to explore and activate social change, in diverse educational contexts (in schools, healthcare and military practice), and to support cultural stakeholders (in museums and heritage sites). Designing the narrative structures to support such interactions requires a nuanced understanding of their complex interfaces structures that work across and among these intra-active material and virtual domains. New compositions and configurations that bring technological devices, bodies, and socio-cultural contexts for use together can benefit from deeper consideration of their embodied, affective, performative and storytelling dimensions.

In my talk I will focus on narrative-based game design for cultural applications (within heritage sites and museum settings). With reference to Mixed Reality projects developed in my research group (Media, Technology and Culture), I will demonstrate the ways in which multimodal and multisensory design aesthetics can enhance user experience. Drawing on principles of “postdigital play” and focusing on “locative”, “augmented”, “pervasive” and “affective” dimensions of performative game-based narrative structures, I illustrate an interdisciplinary framework for socio-cultural/technical development with the embodied user/interface at the centre.

Keywords: postdigital play, embodiment, game-based narrative, mixed reality

Select Publications

Holloway-Attaway, L., Rouse, R. (In press) Designing Postdigital Curators: Establishing an Interdisciplinary Games and Mixed Reality Cultural Heritage Network. Eds. Ionnides, Roko, Martin, J., Lim, V. *Advances in Digital Cultural Heritage Lecture Notes in Computer Science*: Springer Verlag.

Holloway-Attaway, L. (In press) Embodying the Posthuman Subject: Digital Humanities and Permeable Material Practice: A Feminist Companion to the Posthumanities (Eds., Braidotti, Åsberg) Springer Publishing.

Holloway-Attaway, L. (2016) *Artgames: Playing with Material Boundaries and Staking Claims: Art and Games Obstruction*, Rojal Press.

Holloway-Attaway, L. (2014) Developing a Sustainable Platform for Digital Knowledge Exchange: Artistic Practice and Creative Research. *Art Line: A Baltic Collaboration*, Blekinge Museum and Artline, 156-61.

Holloway-Attaway, L. (2014) Performing Materialities: Exploring Mixed Media Reality and Moby-Dick. *Configurations: The International Journal of Research into New Media Technologies*. Vol 20(1) 55-68.

SYMPOSIUM II

SPEAKER 5 of 7

Daniel Levin
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HOW PEOPLE REPRESENT SPACE AND EVENTS WHILE VIEWING CINEMA

Recent research on event perception has made excellent progress not only by specifying how perceptual changes signal new events but also by exploring the representational basis of event segmentation and understanding. One key question that remains unanswered is the degree to which intensive visual representational processes occur by default, or occur only when they are functional. One reason that previous research may have overestimated the degree to which visual representations are typically useful is that many lab tasks either explicitly or implicitly force viewers to create representations that they might not rely upon in more naturalistic settings where their goal is to understand events instead of create representations in preparation for a test. I will discuss several lines of research suggesting that visual representations of event sequence and space may not be created by default in the naturalistic task of film viewing. In addition to suggesting that visual representations may be more sparse than previously assumed, this work also develops filmmaker' insights about perceptual continuity to help understand when visual representations are created and compared across views. Thus, visual cognition research inspired by the art of cinema can not only provide evidence about the representational efficiency of visual cognition, but it can also inspire novel hypotheses about when, exactly, visual represents do become important in naturalistic settings.

Keywords: visual cognition, visual representations, event, space, cinema

Select Publications

- Levin, D. T., and Baker, L. J. (2017). Bridging views in cinema: a review of the art and science of view integration. *Wiley Interdisciplinary Reviews: Cognitive Science*, 8(5).
- Baker, L.J., Levin, D.T., and Saylor, M.M. (2016). The extent of default visual perspective taking in complex layouts. *Journal of Experimental Psychology: Human Perception and Performance*.42(4), 508-16.
- Hymel, A.M., Levin, D.T., and Baker, L.J. (2016). Default processing of event sequences. *Journal of Experimental Psychology: Human Perception and Performance*, 42, 235-246.
- Baker, L.J., and Levin, D.T. (2015). The role of relational triggers in event updating. *Cognition*, 136, 14-29.
- Smith, T.J., Levin, D.T., and Cutting, J.E. (2012). A window on reality: Perceiving edited moving pictures. *Current Directions in Psychological Sciences*, 21 (2), 107-113.
- Levin, D.T. (2010). Spatial representations of the sets of familiar and unfamiliar television programs. *Media Psychology*, 13(1), 54-76.

SYMPOSIUM II

SPEAKER 6 of 7

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MACHINE CODING OF NARRATIVE STRUCTURES IN VISUO-SPATIAL IMAGERY

We present our research on computational models for representation and interpretation of narrative structures in dynamic visuo-spatial imagery. The main focus herein is on declarative models describing the semantics of visuo-spatial dynamics in the moving image, focusing on perceptual sensemaking in terms of abstraction, reasoning, and learning with dynamic visuo-spatial imagery. We demonstrate the work in the area of cognitive film studies investigating attention and recipient effects in observers vis-a-vis the moving image.

Our primary goal is to develop the conceptual, formal, and computational foundations for declarative representation and reasoning about visuo-spatial narrative structures in the moving image. These computational models are based on (declarative) qualitative abstractions of the visuo-spatial dynamics, encompassing space, motion, objects, and interaction, and build on perceptual structures (e.g., cinematographic tools, such as cuts, relative character placement, camera movement, shot types, symmetry) extracted from the visual imagery based on state-of-the-art computer vision methods. In this context, high-level interactions and events are represented using motion patterns defined as relational structures between elements of the visual imagery.

Focussing on film, we demonstrate these aspects with select case-studies from a large-scale cognitive film study, showcasing how declarative models of visuo-spatial dynamics serve as a backbone for grounding narrative structures of the moving image in the extracted visual elements, and thus facilitate deep semantic analysis aimed at computational question-answering.

Keywords: commonsense space & motion, dynamic visuo-spatial imagery, deep semantics

Select Publications

Suchan, J., Bhatt, M., Walega, P.A., and Schultz, C.P.L. (2018). Visual Explanation by High-Level Abduction: On Answer-Set Programming Driven Reasoning about Moving Objects. AAAI 2018.

Suchan, J. (2017). Declarative Reasoning about Space and Motion with Video. KI 31(4).

Suchan, J., and Bhatt, M. (2016). Semantic Question-Answering with Video and Eye-Tracking Data: AI Foundations for Human Visual Perception Driven Cognitive Film Studies. IJCAI 2016.

Suchan, J., and Bhatt, M. (2016). The geometry of a scene: On deep semantics for visual perception driven cognitive film studies. WACV 2016.

Suchan, J., Bhatt, M., and Santos, P.E. (2014). Perceptual Narratives of Space and Motion for Semantic Interpretation of Visual Data. ECCV Workshops 2014.

SYMPOSIUM II

SPEAKER 7 of 7

Dr. Chiao-I Tseng
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COHESION IN FILM AND GRAPHIC NOVEL

In this talk, we present that a particular definition of cohesive ties in film and graphic novels can be used to explain the construction of mental models during film interpretation.

In particular, I will show results from the framework concerning how precisely particular clues, formalised in terms of multimodal cohesive chains (Tseng, 2013, 2017), can be called upon to explain how the interpreting subject is guided to particular interpretations and then kept within particular specifiable bounds of interpretative freedom. The resulting interpretations are necessarily abstract, in that they build on particular structural configurations organising the events, characters, relationships and states of knowledge within the multimodal artefact, and support particular 'grounded' interpretations by means of a process similar to metaphor resolution (cf. Gentner, 1988). Furthermore, I will show how the cohesion analysis can be further applied to examine perennial issues in film, media and aesthetic studies such as authorship and genre blending.

Keywords: film, comics and graphic novels, authorship, multimodality, narrative analysis, stylistics

Select Publications

Tseng, C. (2017). Beyond the media boundaries: analysing how dominant genre devices shape our narrative knowledge. *Discourse, Context and Media* 20, 227–238.

Tseng, C. (2013). *Cohesion in film: Tracking film elements*. Basingstoke: Palgrave MacMillan.

Tseng, C. (2013). Analyzing characters' interactions in filmic text: A functional semiotic approach. *Social Semiotics* 23, 587–605.

Tseng, C. (2012). Audiovisual texture in scene transition. *Semiotica* 192, 123–160.

SPEAKER BIOGRAPHIES

SPEAKER BIOGRAPHIES

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BIOGRAPHY

Mehul Bhatt is Professor within the School of Science and Technology at Örebro University (Sweden), where is member of the Applied Autonomous Sensor Systems (AASS) research environment. Mehul Bhatt directs CoDesign Lab EU (www.codesign-lab.org), an initiative aimed at addressing the confluence of Cognition, Artificial Intelligence, Interaction, and Design Science for the development of human-centred cognitive assistive technologies and interaction systems. He is director of the research and consulting group DesignSpace (www.design-space.org), and pursues ongoing research in Cognitive Vision & Perception (www.cognitive-vision.org) and Spatial Reasoning (www.spatial-reasoning.com).

Mehul's research focuses on visuospatial cognition and computation at the interface of AI, Cognitive Science, HCI, and Design Cognition. His group develops human-centred technologies and artefacts for application in contexts where human-centred engineering is crucial, e.g., autonomous systems, architecture and built environment design, communications and media design. Mehul's research particularly emphasizes the study of human-behavior (embodied multimodal interaction) in naturalistic settings as a principal means of technology driven human-centred cognitive assistance in planning, decision-making, and design situations that require an interplay of commonsense, creative and specialist visuospatial thinking.

Mehul Bhatt obtained a bachelors in economics (India), masters in information technology (Australia), and a PhD in computer science (Australia). Mehul Bhatt's research has been supported by national funding agencies such as ARC Australia, DFG, DAAD and Humboldt Foundation Germany, EU FP7, CAPES and CNPq Brazil, and US NSF. Mehul has edited or reviewed for journals such as: Cognitive Systems, Artificial Intelligence (AIJ), Spatial Cognition and Computation, Journal of Experimental and Theoretical Artificial Intelligence (JETAI), Automation in Construction, Design Studies. He also serves as program committee member of conferences and symposia concerned with AI, Cognition and Design, and has established and co-steered several specialized workshops and tutorials in these contexts, a recent example being the first International School on Human-Centred Computing (HCC 2016 / <http://hcc.uni-bremen.de/school2016>). Previously, Mehul Bhatt was Professor within the Faculty of Mathematics and Informatics at the University of Bremen (Germany) and Stiftungs Professor at the German Research Center for Artificial Intelligence (DFKI Bremen).

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Ann Sloan Devlin is the May Buckley Sadowski '19 Professor of Psychology at Connecticut College. She is the current editor-in-chief of *Environment and Behavior*. Her research in environmental psychology focuses on healthcare environments as well as wayfinding behavior. She has published five books (with a 6th forthcoming): *Mind and Maze: Spatial Cognition and Environmental Behavior* (2001, Praeger); *Research Methods: Planning Conducting, and Presenting Research* (2006, Wadsworth/Thompson); *What Americans Build and Why: Psychological Perspectives* (2010, Cambridge); *Transforming the Doctor's Office: Principles from Evidence-based Design* (2015, Routledge); *The Research Experience: Planning, Conducting and Reporting Research* (2018, Sage); *Environmental Psychology and Human Wellbeing: Effects of Built and Natural Settings* (volume editor; forthcoming 2018, Academic Press). She has published in *Environment and Behavior*, *Journal of Environmental Psychology*, *Journal of Applied Social Psychology*, *The Journal of Social Psychology*, *Journal of Counseling Psychology*, *Journal of Community Psychology*, *Health Environments Research and Design Journal*, *Professional Psychology: Research & Practice*, and *Behavioral Sciences*, among others. She is past Environmental Design Research Association board member and secretary. She has received the Connecticut College John S. King Faculty Teaching Award and the Helen Brooks Regan Faculty Leadership award. She is a Fellow of Division 34 of the American Psychological Association.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Paul Hemeren is the Head of the School of Informatics at the University of Skövde. He received his PhD in cognitive science from Lund University in Sweden. His research topics include biological motion perception, attention and categorization. The primary research questions addressed in his research concern the role of human kinematics in predicting human intentions. Within the context of applied perception, he and his colleagues have studied the critical movement parameters of cyclists that observers use to predict the intention of cyclists in traffic. Another aspect of action and intention recognition concerns the communicative (social) nature of human gestures. Current research findings from his group have revealed the categorical distinctions that observers tend to make when viewing social and non-social human gestures presented as point-light displays. A further newly started application of these findings is within the area of human-robot interaction and the development of artificial systems that can recognize human actions and intentions using kinematic information. Dr. Hemeren has been a reviewer for Accident Analysis and Prevention, Journal of Safety Research, IEEE Transactions on Cognitive and Developmental Systems and Topics in Cognitive Science among others.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Lissa Holloway-Attaway has studied Theatre Performance (BFA Honours, York University, Canada) and Literature and Digital Media (MA/PHD, University of Georgia, USA). Her research explores the intersections of storytelling and media development across a number of forms and types, including traditional literature, electronic literature, digital games, social media, and interactive digital art. Currently she is an Associate Professor in Media Arts, Aesthetics, and Narration and the leader for the Media, Technology and Culture Research Group at the University of Skövde in Sweden. She also serves as the Research Director for the DONNA Group, an organization at the University of Skövde working with students, politicians, cultural institutions, and game developers to support inclusive game development practices. She is a digital media researcher and practitioner and teaches within the computer games development programs at the undergraduate and graduate levels. She also supervises PhD research in the School of Informatics within the subject area "Media, Aesthetics, and Narration". Her creative and critical media work and research has been exhibited, performed, and published in a number of International venues. Her current research is focused on emergent media forms (AR/VR), experimental narrative, digital cultural heritage, game-based interaction, environmental humanities, and the feminist posthumanities.

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SPEAKER BIOGRAPHIES

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Vasiliki Kondyli is a research assistant within the DesignSpace Group at the University of Bremen, Germany (www.design-space.org). Her research work is developing in the interface of environmental psychology, spatial cognition, and design computing. In this context, she focusing on the results of behavioural empirical studies in order to establish design precedents that contribute to Evidence-Based Design and promote a people-centred parametric design discourse.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Dr Lee is a senior research fellow in the School of Art, Architecture and Design at the University of South Australia and a conjoint senior lecturer at the University of Newcastle. Dr Lee has made a significant contribution towards architectural and design research in three main areas: design cognition, planning and design analysis, and design computing. His recent cognitive research, design and language, has an impact on breaking down the barriers to achieving efficient and sustainable interactions between people in design teams, particularly those in the Asia-Pacific region. As an expert in the field of architectural and design computing, Dr Lee was invited to become a visiting academic at the University of Newcastle in 2011. His international contribution has been recognised as: Associate editor for a special edition of Architectural Science Review; Reviewer for many international journals and conferences; International reviewer for national grants.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Research in the Levin lab is focused on the interface between concepts and visual perception. To this end, we have been exploring the concepts associated with a variety of object categories, and the knowledge that drives visual selection during scene and event perception. Some of our research explores how knowledge and other basic cognitive constraints affect scene and event perception. For example, we are currently exploring how people perceive the sequence of natural visual events, and how they represent space while viewing films. In a related line of research, we are exploring adults' and childrens' concepts about agency, and testing how these concepts affect event perception, human-computer interaction, and learning from agent-based tutoring systems. This line of research represents an interdisciplinary collaboration with our lab, Meg Saylor's lab (Cognitive Development), and labs in engineering (Julie Adams and Gautam Biswas), and has recently been supported by a grant from the NSF. In another current project, we are collaborating with the McCandliss lab to explore how natural events shape reasoning about number and theory of mind. To do this, we have created a narrative film depicting these sorts of events and have collected fMRI data from children while they view this film. Currently, the lab includes Lewis Baker (grad student), and Chris Jaeger (graduate student). Grad student alumni include Bonnie Angelone, Melissa Beck, Jonathan Herberg, Stephen Killingsworth, Yukari Takarae, Alex Varakin, and Joe Wayand. I received by BA from Reed College in 1990, and my Ph.D. at Cornell University in 1997, then moved to a faculty position Kent State University. Starting in 2003, I have been here at Vanderbilt where I am Professor of Psychology in the Peabody's department of Psychology and Human Development.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Kay O'Halloran has an academic background in mathematics, education, and linguistics and her research is interdisciplinary in nature, bridging the humanities, social sciences and sciences. Her research field is multimodal discourse analysis, involving the study of the interaction of language with other resources (e.g. images, sound, gesture, movement, 3-D objects and space) in texts, interactions and events. She has established and worked with multidisciplinary research teams to develop and make widely available new digital tools and techniques for multimodal analysis of different media (e.g. text, images and videos). Her latest research involves the development of computational approaches for the analysis of big datasets to study the relations between meaning, discourse, context and culture. Kay O'Halloran was the founding Director of the Multimodal Analysis Lab in the Interactive & Digital Media Institute at the National University of Singapore and she is currently Professor of Multimodal Analysis at Curtin University in Perth, Western Australia.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Juval Portugali is Professor of Human Geography at the Department of Geography and Human Environment, Tel Aviv University. He is the Head of the Environmental Simulation Laboratory (ESLab) and of the Environment, Society and Planning Graduate Program of Tel Aviv University. Juval Portugali received his BA degree from the Hebrew University of Jerusalem, did his MA studies at the Technion Haifa, and received a London University PhD from The London School of Economics and Political sciences.

His research integrates complexity and self-organization theories, environmental-spatial cognition, urban dynamics and planning in modern and ancient periods. His publications include *Implicate Relations: Society and space in the Israeli-Palestinian conflict*, Kluwer 1993. *The Construction of Cognitive Maps*, Kluwer, 1996 (Ed.). *Self-Organization and the city*, Springer, 2000. *Complex Artificial Environments*. Springer Complexity Series, 2005 (Ed.). *Complexity, Cognition and the City*, Springer, Complexity Series 2011. *Complexity Theories of Cities Have Come of Age*, Springer, Complexity Series 2012 (Ed.), *Complexity, Cognition, Urban Planning and Design*, Springer, Complexity Series 2016 (Ed. With Egbert Stolk).

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SPEAKER BIOGRAPHIES

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Jakob Suchan is research assistant within the Human-Centred Cognitive Assistance Lab at the Department of Computer Science, University of Bremen. His research focusses on the integration of vision and KR from the viewpoint of computational cognitive systems where integrated (embodied) perception and interaction are involved.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

I am research associate in the Faculty of Linguistics and Literary Sciences at the University of Bremen. My area of research focuses on multimodal narratives in visual images, film and graphic media. I specialise in developing linguistics-informed methods for analysing formal and narrative structures, such as frameworks of cohesion, events structures, narrative space, characters' development and motivations in film, comics, graphic novels, interactive storytelling and video games. I have published journal articles and book chapters on applying these methods to addressing a wide variety of social, cultural and aesthetic issues such as complex film narratives, film genre comparison, authorship, persuasive functions in film and graphic novels, screen violence, cross media comparison, adaptation, multimedia literacy, etc.?

I have also led several interdisciplinary research projects combining the linguistics-based analysis and empirical methods such as eye-tracking experiments, automatic audio-visual detection in computer science, fMRI in neuroscience.

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SPEAKER BIOGRAPHIES

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BIOGRAPHY

Barbara Tversky studied cognitive psychology at the University of Michigan, where she focused on the then neglected topic of spatial memory and imagery. The work continued and expanded at the Hebrew University in Jerusalem and Stanford University to include categorization, memory, cognitive maps, spatial mental models, spatial language and memory, eyewitness testimony, biased visual and verbal memory, HCI, design, diagrammatic thinking, gesture, event perception and cognition, and creativity. She is currently Professor of Psychology at Columbia Teachers College and Professor Emerita of Psychology at Stanford. She has received awards for teaching and for a computer laboratory for teaching cognitive psychology, is a fellow of the American Academy of Arts and Sciences, the American Psychological Society, the Cognitive Science Society, and the Russell Sage Foundation, and was elected to the Society of Experimental Psychology. She has served on the governing boards of many professional organizations, on the editorial boards of many journals, and on the organizing committees of nearly 100 international interdisciplinary conferences. She has enjoyed collaborations with linguists, philosophers, computer scientists, neuroscientists, biologists, chemists, engineers, architects, designers, and artists.

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SYMPOSIUM ORGANISATION

DesignSpace

THE DESIGNSPACE GROUP

DesignSpace is a research and consultation group focussing on the development of cognitive technologies and educational discourse for people-centered spatial thinking and architecture design. DesignSpace research has developed cognitive assistive technologies for people-centred usability analysis and building performance evaluation at all phases of the architecture design process, including design conception, preliminary prototyping & iterative refinement, and evidence-based post-occupancy analysis with a specific focus on wayfinding, signage, and eye-tracking studies.

DesignSpace offers a range of solutions for the universal design paradigm guided execution of large-scale built-up environments; the team has a track-record in providing customised technological solutions for the healthcare and aviation sectors. DesignSpace also conducts case-study driven intensive seminars and accredited training workshops both in academic / non-profit as well as private contexts.

If you would like to obtain more information, or get involved, please send us an email at: info@design-space.org

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Cognitive Vision

COGNITIVE VISION

The Cognitive Vision research project addresses computational cognitive vision and human visual perception from the viewpoints of cognition, language, logic, and artificial intelligence. Currently, our emphasis is on the integration of vision and artificial intelligence from the viewpoints of perception, interaction, and control focusing on themes such as: Commonsense Scene Understanding, Explainable Visual Interpretation, Concept Learning and Inference from Visual Stimuli, Semantic Question-Answering with Image and Video, Visuo-Spatial Representation Learning, Visual Perception (e.g., involving eye-tracking), Embodied (Multimodal) Event Perception.

Basic research is driven by application areas where, for instance, the processing and deep semantic interpretation of (potentially large volumes of) highly dynamic visuo-spatial imagery is central.

If you would like to obtain more information, or get involved, please send us an email at: info@cognitive-vision.org

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MINDS. MOVEMENT. MOVING IMAGE / ICSC 2018. ROME, ITALY.

MINDS. MOVEMENT. MOVING IMAGE. consists of two symposia held as part of the 7th International Conference on Spatial Cognition (ICSC 2018). September 10-14, 2018; Rome (Italy) / Convener: Mehul Bhatt, www.icsc-rome.org. Speakers at the symposium include: *M. Bhatt* (University of Bremen, Germany and Örebro University, Sweden), *A.S. Devlin* (Connecticut College, United States), *V. Kondyli* (University of Bremen, Germany), *J. Lee* (University of South Australia, Australia), *J. Portugali* (Tel-Aviv University, Israel), *K. O'Halloran* (Curtin University, Australia), *L. Holloway-Attaway* (University of Skövde, Sweden), *D. Levin* (Vanderbilt University, United States), *J. Suchan* (University of Bremen, Germany), *C. Tseng* (University of Bremen, Germany), *B. Tversky* (Columbia Teachers College, and Stanford University, United States).