EMBODIED VISUO-LOCOMOTIVE EXPERIENCE ANALYSIS

Immersive Reality Based Summarisation of Experiments in Environment-Behaviour Studies

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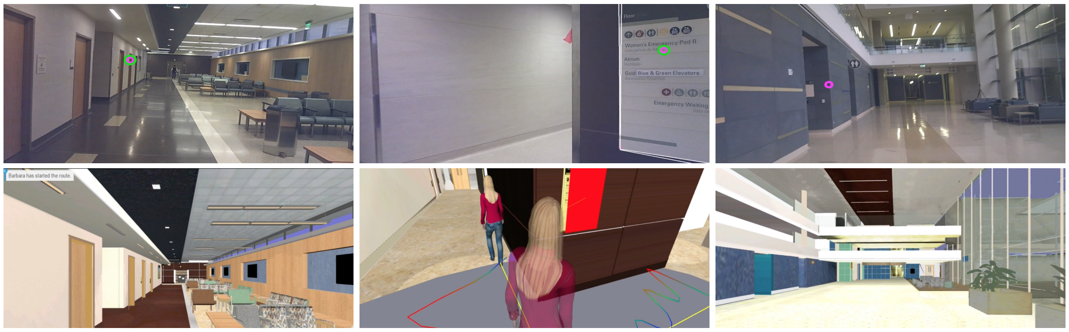

Figure 1: Immersive reality experience (computationally generated) based on multi-modal perceptual data and its high-level analysis; integrates fixation analysis from gaze data, automated signage extraction from video, and pre-designed 3D building models. (Site: New Parkland Hospital, Dallas)

EVIDENCE BASED DESIGN

Evidence-based design (EBD) for architecture involves the study of post-occupancy behaviour of building users with the aim to provide an empirical basis for improving building performance [Hamilton and Watkins 2009]. Within EBD, the high-level, qualitative analysis of the embodied visuo-locomotive experience of representative groups of building users (e.g., children, senior citizens, individuals facing physical challenges) constitutes a foundational approach for understanding the impact of architectural design decisions, and functional building performance from the viewpoint of areas such as environmental psychology, wayfinding research, human visual perception studies, spatial cognition, and the built environment [Bhatt and Schultz 2016].

MULTI-MODAL ANALYSIS OF WAYFINDING

The evidence-based analysis of people's embodied visuo-locomotive behaviour in large-scale built-up spaces, e.g., during a wayfinding task in an airport or hospital, encompasses the measurement and qualitative analysis of a range of aspects including people's visual perception, their decision-making procedures & intentions, the affordances of the environment, etc. Our approach is driven by the high-level semantic analysis of *multi-modal perceptial data* currently encompassing (M1–M4): **(M1)**. mobile eye-tracking data and corresponding visual perception analysis; **(M2)**. analysis of visual data from external cameras along the route and ego-centric camera (onboard the eye-tracker); **(M3)**. people-movement trajectories based on locomotive path taken by subjects, including other events (e.g., asking for help, looking around) that are recorded during the experiments by an experimenter using a mobile device; **(M4)**. morphological analysis of the structure and layout of the environment (e.g., topology, routes, isovists) computed from available 3D models of the building.

The computational "semantic analysis" and "perceptual sensemaking" of multi-modal visuo-locomotive data presents a typical "big data" challenge, and opportunities for technological research & development at the interface of Artificial Intelligence, Human-Computer Interaction, Spatial Cognition making inroads in an area of high societal impact [Bhatt et al. 2014; Bhatt and Schultz 2016].

GENERATING IMMERSIVE EXPERIENCES

We have developed a technological framework consisting of complementary tools that can generate virtual and immersive reality based *analytical summarisations* (Fig. 1) of large-scale multimodal data (i.e., M1–M4) concerning, for instance, wayfinding studies, signage perception as part of environment-behaviour studies. The integrated analysis of the embodied visuo-locomotive experience is externalised in an immersive reality setup at an individual and aggregate analytical level.[1]

CASE STUDY: THE NEW PARKLAND HOSPITAL, DALLAS We present the results from an experiment at the New Parkland Hospital, a new healthcare facility in Dallas, Texas (USA). Experiments include a total of 25 participants from the local community aged between between 28-83 years. Of particular interest here is a complex wayfinding task involving navigating from the emergency room to the pharmacy (approx. 15min walk). Indeed, the entire experimental dataset includes all the data sources enumerated in (M1–M4).

References

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[1] Immersion is implemented using a combination of the Vizard Virtual Reality Software and compatible HMDs thereof, e.g., Oculus Rift.

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