Co-Design in HYVE-3D

Representational Ecosystem, Design Conversations and Knowledge Construction Activities

Tomás Dorta¹, Emmanuel Beaudry Marchand², Hadas Sopher³
¹,²Hybridlab, University of Montreal ³Technion, Israel Institute of Technology
¹,²{tomas.dorta|emmanuel.beaudry.marchand}@umontreal.ca³hadassfr@campus.technion.ac.il

The aim of this workshop is to introduce participants to the co-design approach using a Social VR system (without headsets): Hyve-3D (Hybrid Virtual Environment 3D). The system affords simultaneous multi-user co-design (local and remote) using 3D sketches (exportable as vectors) and imported 3D textured geometries, photogrammetry models and point-clouds. Participants will be trained to use the suitable representational ecosystem and the verbal protocols specific for co-design as a particular kind of collaborative design where each will be simultaneously ideating ad-hoc projects instead of cooperating (where individual designs are put together in a later stage).

INTRODUCTION

Objectives
The goal of this workshop is to initiate participants coming from different backgrounds to the approach of co-design in a multidisciplinary and collaborative context.

The idea is to prepare the participants to actively support co-design activities through the appropriate Representational Ecosystem (Dorta et al. 2016a; Dorta & Kinayoglu, 2014) including traditional tools as physical models and freehand sketches combined to digital hybrid immersive techniques via Hyve-3D (Hybrid Virtual Environment 3D)(Dorta et al. 2016b). The workshop will utilize the “Knowledge Construction Activities” (KCAs) model to assess the representation’s effectiveness for early ideation processes (Sopher et al. 2017).

During the workshop, all the participants of the given project will use the Design Conversations technique (Dorta et al. 2011): the verbal protocols of this particular kind of collaborative design. This will allow them to gain awareness of the emergence of collective creative ideas, therefore learning the co-creative steps underlying better performance of the co-design process.

Scope
Participants will engage collaboratively to propose creative and innovative solutions, all while being immersed in a life-size photogrammetric representation of the project’s context (pointcloud or textured mesh). These ad-hoc projects will be realized in immersion, locally and remotely, through interconnected Hyve-3D systems (internationally). The participants will experience the way design decisions emerge and evolve upon and throughout different representations, while able to methodically construct and analyse coming situatd design processes. The workshop’s final outcomes will be available for presentation with the goal to further discuss during the conference.

Hyve-3D is a multiuser Social VR system allowing
3D sketch creation and high interactive fidelity with 3D models inside a hybrid immersive virtual environment (Dorta et al. 2016b; 2015; 2014). The innovative visualization technique uses a non-intrusive anamorphic image projected on a spherical concave screen. This open fabric screen permits enough space in order to accept many people at once ensuring the needed communication among users.

In addition, the 3D cursor technology of Hyve-3D facilitates local and remote collaboration. Using a handheld tablet, users interact with the virtual environment by moving the device and using well-known multi-touch gestures. Every user has a dedicated 3D cursor, enabling for an intuitive navigation (Fig. 1) and graphical expression (Fig. 2) within the virtual environment via the 3D track pad.

Users will be able to go back and forth from the vectors (.dxf) of their 3D sketches to the CAD software of their choice, detailing their projects and importing them back into Hyve-3D (wavefront .obj textured files) for further co-design work.

WORKSHOP SCHEDULE

Day 1
Part 1. Co-design rationale sessions in groups (up to 4 groups of 2-3 participants) learning about the representational ecosystem with traditional tools, the various elements of design conversations and the KCA assessment model.

Part 2. Hyve-3D: Introduction and training sessions followed by co-design in immersion.

Day 2

Part 2. Refinement of concepts in CAD/photogrammetric models and export/import into Hyve-3D for iterative co-design cycles.

Part 3. Interconnection with Montreal jury (and potentially other international collaborators) for final revisions and open-access presentations.

PREREQUISITES

No particular skills or experience in design are essential as the proposed activity aims to foster the potential of a more open ideation process shared collaboratively by different multidisciplinary stakeholders engaged in actual projects using a representational ecosystem. Participants are encouraged to bring their personal laptops with any 3D modeler of their choice pre-installed, which can import .dxf files and export .obj geometries, and/or any photogrammetry software. Although participants should expect a photogrammetric pointcloud or mesh to be provided for the immersive co-design sessions, those already experienced with 3D scanning processes of the sort are welcome to bring their own files (textured .obj, .ply pointcloud or series of pictures) or equipment to document an environment of their choice.

SKILLS ACQUIRED BY PARTICIPANTS

After the workshop’s completion, participants should be comfortable in driving co-design activities that will benefit from a proper use of the various elements...
constituting the Representational Ecosystem, the Design Conversations as well as the fundamentals of the Knowledge Construction Activities model to assess the representation's effectiveness in ideation. First-hand experience of how these frames are put to use throughout the evolving ad-hoc projects should allow for a deepened understanding of the particularities encountered during the different phases of the collaborative design process. By also directly witnessing an assessment of the used representations’ effectiveness, participants are expected to develop a more critical approach regarding the tools they could come to employ in future design processes or research protocols.

**EXPECTED OUTCOMES**

The result of this workshop consists primarily of collaboratively elaborated immersive architectural concepts, represented through 3D sketches and 3D models, embedded inside a pointcloud or textured mesh photogrammetric representation of a given context. This way, participants’ solutions will be proposed and shared with a particular emphasis put on how they integrate within their expected environment. Sketches and models created throughout the activity will be available for participants to keep and explore in the future using any 3D modeler capable of reading 3D vector as .dxf files.

**BACKGROUND**

**Tomás Dorta**

Tomás Dorta has a background as a practitioner architect and designer. His research interests include the design process and co-design using new technologies and the development of new techniques and devices of design in the virtual realm. He obtained his Ph.D. (2001), studying the impact of virtual reality as a visualization tool into the design process. His research has been extensively funded by Canadian’s federal and provincial research grant institutes and published and presented in several international scientific conferences as well as scientific journals. As a design educator, Tomás Dorta joined the School of Design of University of Montreal in 2003 where he is now full professor. Tomás Dorta is the director of the Design research laboratory Hybridlab.

**Emmanuel Beaudry Marchand**

Emmanuel is currently a master’s student in the Design and Complexity program at the University of Montreal and is working under the direction of Tomás Dorta at Hybridlab. Emmanuel’s research focuses on immersive virtual environments and the perception of architectural and urban scenes transposed using accessible digital technologies for a contextualized ideation. Coming from a background in graphic design, his projects are driven by a deep interest for the implications of novel forms of mediatic documentation.

**Hadas Sopher**

Hadas is a PhD candidate at the faculty of Architecture and Town Planning, Technion, Israel, under the supervision of Yehuda E. Kalay. Hadas’s research proposes a framework to assess the impact of traditional and immersive learning environments on design processes of the architectural Studio. Hadas won the Guthweirth fellowship (2016) and the Jacobs fellowship (2017). The research is kindly supported by the European Research Council grant (FP7 ADG 340753).

**Past Work in relation to the workshop**

Tomas Dorta demonstrated their system Hyve-3D at the last event of SIGGRAPH in Los Angeles in 2015. Tomas Dorta launched Hyve-3D at SIGGRAPGH 2014 in Vancouver. He organized in collaboration with colleagues of the Victoria University of Wellington (NZ) a workshop about virtual heritage using Hyve-3D in CAADRIA 2016 conference at Melbourne. Hyve-3D has been selected as one of the best user interfaces of 2014 by Co.Design. Other mentions in the media include Bloomberg, Les Affaires, The Telegraph and so on.
REFERENCES
Dorta, T, Kinayoglu, G and Hoffmann, M 2015 ‘Hyve-3D and rethinking the “3D cursor”: unfolding a natural interaction model for remote and local co-design in VR’, *SIGGRAPH '15 Studio: Special Interest Group on Computer Graphics and Interactive Techniques Conference, Studio Proceedings*, Los Angeles, p. 43