# Contextual information exchange over virtual worlds

Bram Knaapen and Jun Hu
Eindhoven University of Technology

## Introduction: A design case

The non face-to-face communication of social and emotional experiences between people now happens through phone or other media like e-mail, IM (instant messaging), webcam (e.g. Skype) and other virtual communities such as Second Life. In the communication these experiences the context it has happened in pays an important role. Neither the technology nor our way of describing it enables us to communicate this context, in such a way that it can be "experienced" by the others, you can only imagine.

We first show a design case that tries to tackle this issue. The design concept proposes a system that is able to communicate the context of a remote (virtual) user so that the receiving (virtual) person is able to "feel" as if he/she is there without the translation steps. Often these steps are required when describing an experience. This concept enables a seamless transition between a real and virtual worlds leading to interesting scenarios.

A modular system of connectable triangles is designed (Fig 1). These triangles can be mounted to the wall in a pattern that can be a creation of the user, or a design by the designer. The resulting pattern generates a real-time abstract and artistic representation of a remote visual context. Essentially the receiving person is presented with a selection of the visual impressions the remote user/avatar experiences in the real/virtual environment. These visual impressions are captured by a device that is worn by the remote user in the real world or an avatar in the virtual world. The captured visual information is analyzed, processed, filtered and finally projected onto an abstract representation, then transmitted and projected through the system of triangles. The projection of the remote context should reside in the periphery of the attention of the receiving user to transfer the rough visual experience, but also when attention is paid, to give the receiving user an interesting and artistic visual experience of the remote context.

To get a sense of what the other person either in a real or virtual world experiences the receiving user should be in contact with the remote visual context and thus the system for a considerable time. Therefore this system is meant as a continuous and always-on real-time connection between two people or avatars. The triangles can be installed on any often-visited location (work, living room, kitchen, hallway, etc.). The modular character of the system allows for easy configuration on any place with some vacant space on the wall.

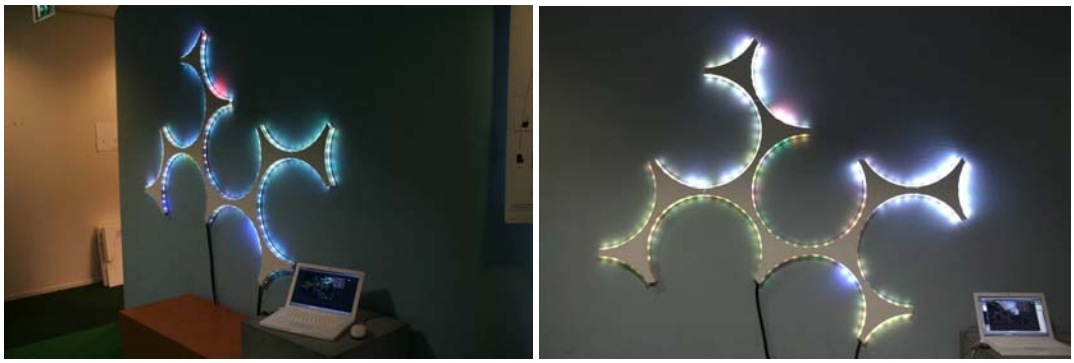

Fig 1. Two different remote visual contexts projected through the system.

# Requirements

### Part I: Architecture

There are four different settings possible.

1. Sender (Virtual Avatar) – Receiver (Real)

   The display is installed in a real world, e.g. living room. The displayed visual context is based on the content sensed by a virtual camera sensing the visual context of the Avatar inside the virtual world. In this case traces of the life of the virtual avatar are displayed inside the real world. This may result in a situation where when the user is not logged into the virtual world he's still able to follow the life of his avatar and the context within the virtual world.

   Scenario:
   *John is a busy guy. He spends most of his day in his office. In his spare time John likes to be in Second Life with his avatar, Rick. Although he'd like to, John cannot be at two places at once. The display system installed in his real physical world and in his virtual world enables him to keep in touch with either world. This enables John to be connected with his virtual world despite he's not actively in it. It also enables Rick to be connected with John's world when inside the Virtual world.*

2. Real (Parallel world) – Context (virtual) – Receiver (Real) Sender

   The display is installed in the real world, e.g. living-room. The displayed visual context is based on the media available in the virtual world at the current position and orientation of the real remote person. In this case the virtual world acts as a parallel world based on the positioning information gathered in the real world. The traces of the life of a real person are displayed in the real world through a parallel virtual world. This may result in a situation where the receiving user gets information about the remote real user but that it's not possible to estimate the trustworthiness of the information since it is based up on media that has been recorded earlier which may result in a different visual context compared to the real visual context at the real remote location.

Scenario:
*Tom and Mary have been married for 10 years. Last September Mary had a big promotion but that required her to travel a lot. Whereas Tom and Mary spent a lot of time together before they now spend a lot of time apart from each other. To supplement this lack of time together they both have this system installed in their living room. Through this system they are able to experience the same visual contextual impressions the other person experiences during the day. This gives them a feel of being connected. And it enables them to empathize, like before. However Mary doesn't like the feeling carrying a camera around that films everything all the time. Therefore the projected visual context of Mary at Tom's place is based on a Camera inside a virtual world based on the location and orientation information gathered by Mary's phone.*

3. Sender (Real) − Receiver (Virtual)

A virtual version of the display is installed inside the virtual world. The displayed visual context is based on the visual context of the user in the real world. In this case traces of the real life of the user are displayed inside the virtual world. This can give other virtual users an idea of the real person behind an avatar.

Scenario:
*John is a busy guy. He spends most of his day in his office. In his spare time John likes to be in Second Life with his avatar, Rick. Although he'd like to, John cannot be at two places at once. The display system installed in his real physical world and in his virtual world enables him to keep in touch with either world. This enables John to be connected with his virtual world despite he's not actively in it. It also enables Rick to be connected with Johns world when inside the Virtual world.*

4. Sender (Virtual) − Receiver (Virtual)

A virtual version of the display is installed in the virtual world. The displayed visual context is based on the visual context of another remote virtual user. In this case traces of the life of the virtual avatar are displayed inside the (same) virtual world.

Mixed cases

The situations described in the cases can be mixed. When you encounter the system it's not immediately evident if the feed is from a real of virtual world. There is a seamless transition between the virtual and real world.

**Part II: Interfaces between virtual worlds**

MPEG-V should be able to provide the communication between virtual worlds to exchange contextual information. In this document we mentioned visual context on location and orientation information from sensors in the real or virtual world. Contextual information from other modality can also be used and combined, based on other sensory input.

A format for contextual information exchange is needed; possibly for this an ontology of is needed. Contextual information needs to be encoded and decoded for transmission, and encrypted if necessary.

**Part III: Interfaces between virtual worlds and physical world.**

1. MPEG-V will have to support a format to exchange real-time position & orientation information, and other information collected from possible sensory input in the real world.
2. MPEG-V will have to allow for capturing contextual information (in our example, visual impressions captured by a (virtual) camera) from virtual and real worlds based on the sensory input (see 1).
3. MPEG-V will have to support the real-time exchange of the contextual information captured.

**System overview (based on the scenarios):**

Input

Case 1, 2 & 4: Real-time streaming of raw contextual data (e.g. video) from the point of view of the virtual person in the virtual world

Case 2: Real-time streaming of raw contextual data (e.g. video) from the point of view of the real person in the real world

Case 2: Real-time streaming of the sensory input from the real world (e.g. position and orientation sensor data).

Processing

All cases: Processing of the contextual data into an abstract representation of the context (e.g. visual impressions)

Case 2: Creation of virtual sensors in virtual world that are connected or related to the sensors in the real world (e.g. a virtual camera based on the positional and orientation data). This camera will retrieve its "vision" based up on the content within the virtual world. This visual information is a supplement or a replacement of the real vision the remote person has.

Output

Case 1&2: The abstract representation of the context is presented into the real world.

Cate 3&4: The abstract representation of the context is presented into the virtual world.