Remote Augmented Reality Collaboration Application: A Study on Cues and Behavioural Dimension

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Presentation Outline

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Introduction

- AR technology has been used as enabling technology for collaboration activities especially in remote workspace.
- However, most research in collaboration and remote collaboration are focuses using VR technology.
- Traditional remote collaboration methods have mainly focused on adding 2D visual cues providing guidance on physical tasks.
- Which only limits the information to be search, viewed or processed by local user and remote expert.

Objective of the study

This study is intended to investigate the behavioral dimension of collaboration (collaborator’s behavior) and cues involved between local and remote user for physical task

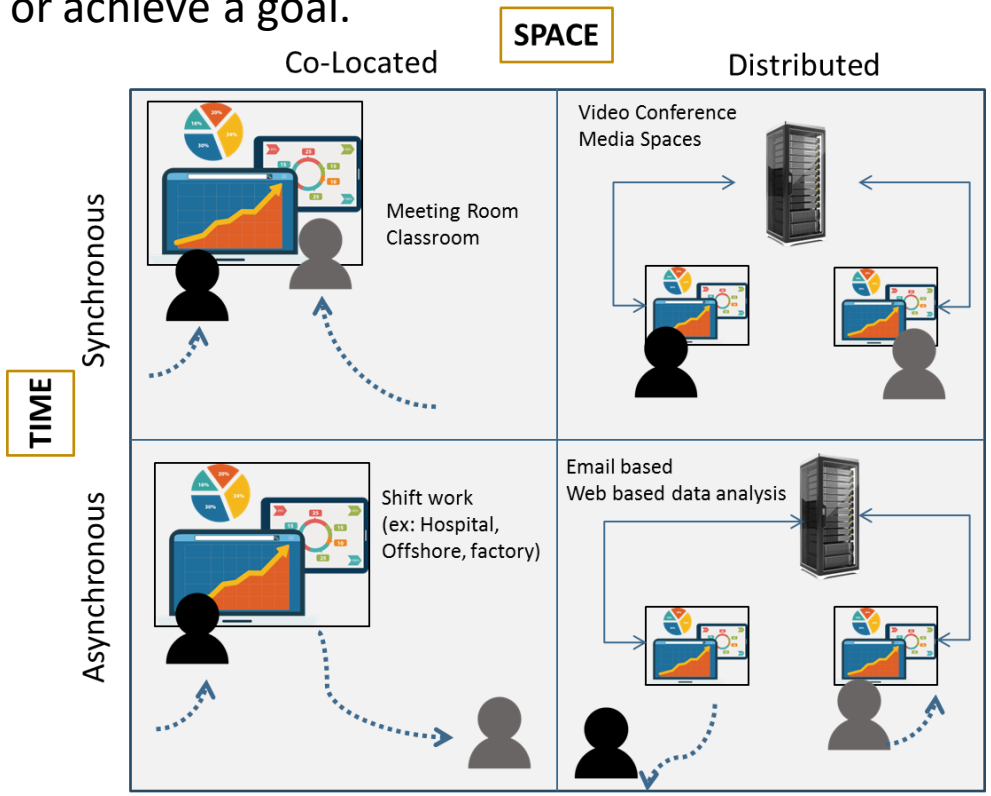
Related Work

Collaboration Theory

In general, collaboration is the process of two or more people or organizations working together to complete a task or achieve a goal.

Types of Collaboration:

- ❑ Face-to face collaboration
- ❑ Conversation
- ❑ Remote Collaboration
- ❑ Text base communication
- ❑ Groupworking



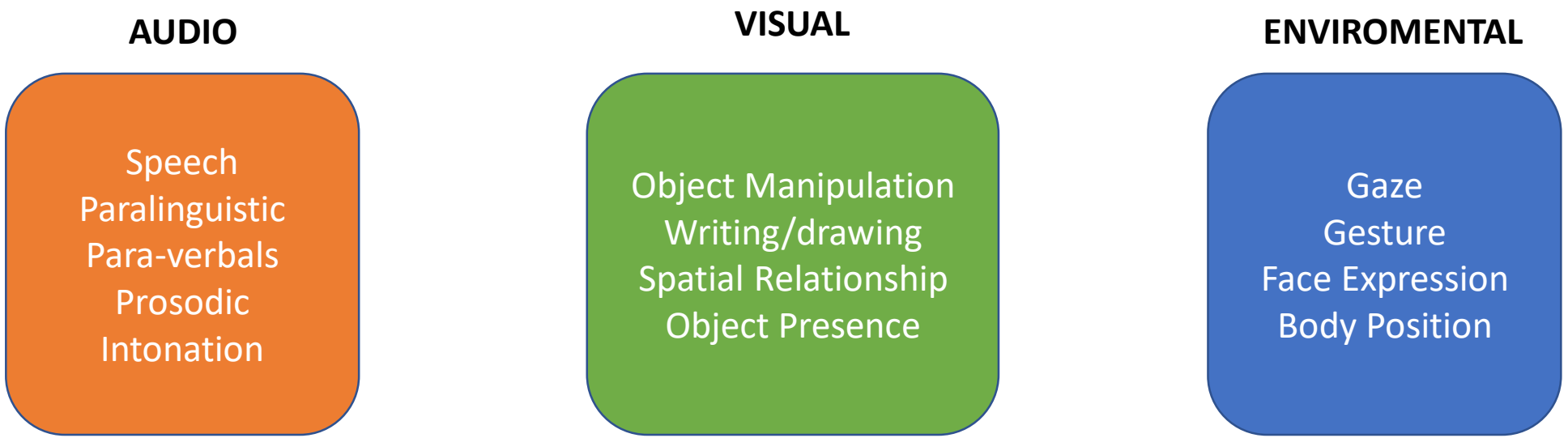
Goal : To create common understanding

Haller, Billinghurst and Thomas (2007)
Yamaguchi et. al (2009)

Related Work

Communication Cues

- Goal: To create common understanding
- Need to have communication cues to transfer meaningful information

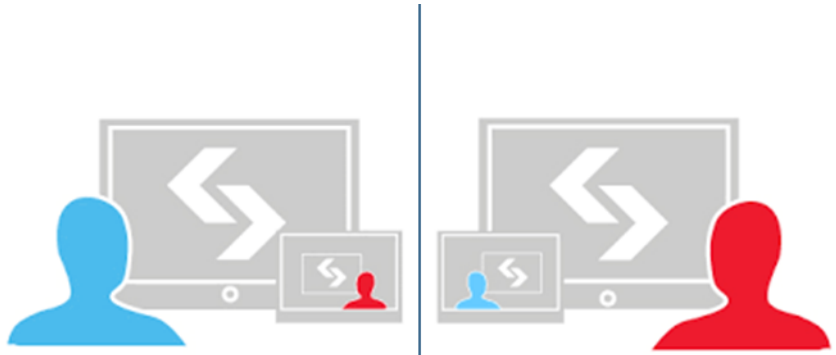


Related Work

Remote Collaboration

- Can be defined as a process that can be used to eliminate limitations of geographic location and developing cooperation between the members of the teams regardless of their location in this world.

- Involves distributed location either in synchronous or asynchronous.



Billinghurst and Thomas (2011)

Related Work

Augmented Reality (AR)

- AR technology has been used and proved to be useful in many sectors such as maintenance and training
- Due to ability of AR that can *(Lee et al., 2009)*:
  - Support seamless interaction between real and virtual environment
  - The ability to enhance reality create interfaces that go beyond being there
  - The presence of spatial cues for remote collaboration
  - Support of a tangible interface metaphor for object manipulation in physical task
  - The ability of transition smoothly between reality and virtuality

create a unique collaborative experience *(Sun et al., 2011)*

Related Work

Physical Task

- Physical task is referred to those who are involved in working together to perform actions on concrete object in 3D world.

Constructional Task	Analytical Task
Those that involve collaboration building of a real object	Those that involve the analysis of objects in real world such as measurement and identification of properties
Example: measure a perimeter of a block or constructing or repairing a physical component.	Example: need an expert analysis on a situation such as a crime scene.

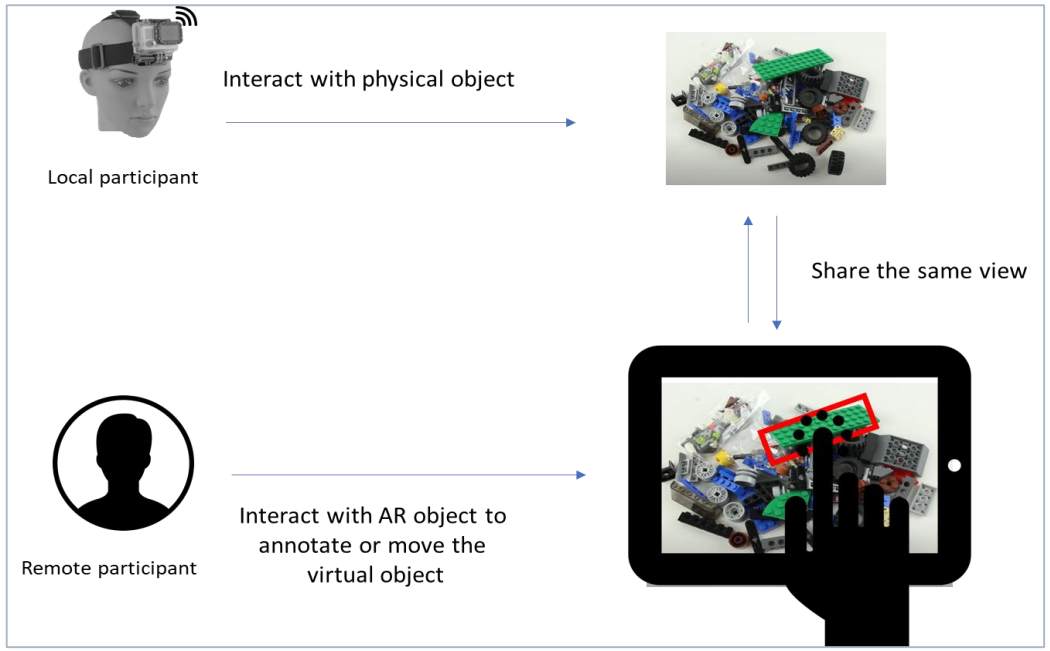
Neiva (2016)

Method

Participants: 12 volunteers (each in pairs)

Tools / device/ software :

1. LEGO vehicle
2. Instruction manual
3. Mini Camera
4. Mobile device
5. Earphone
6. Laptop



Study Design :

1. Constructional physical task – building a LEGO vehicle
2. Local participants had the LEGO pieces without instruction
3. Remote participants had the full instructions manual with schematic images
4. Video is recorded during study

Result

Scenario 1

- There is an active engagement between participants in order to complete the task given.
- Local participants constantly need to move their phone just to show the progress or ask for assistance
- Several cues are involved in this study: -
  - The classification of words and gestures had to be adapted by local and remote participants to identify parts and actions.
  - At the beginning of the collaboration process: notice both local and remote participants struggle to understand each other.
  - When local and remote participants established a common and shared classification of gestures and keywords for the identification of parts and actions, the collaboration process has become easier.

Result

Scenario 2

- A certain cues language was established by remote and local participants to specify the parts and positions
- It is observed that a good adaptation of the camera to the head of the local participant makes collaborations more intense and active
- Remote participants were more proactive in seeing the progress of the task throughout the experiment and they were able to give instruction at the same time

Conclusion

- In the behavioral dimension, evidence has shown that there are slight differences in hands-free and hand-held configurations for the performance of physical construction tasks.

- It was found that gestures and speech cues were involved. Furthermore, it is quite difficult to convey accurate information when only one mode is involved.

Thank you.