



Sketching in virtual reality for rapid and situated idea generation

**myDESIGNLAB**

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## Background

### WHY 3D Modeling tool needed?

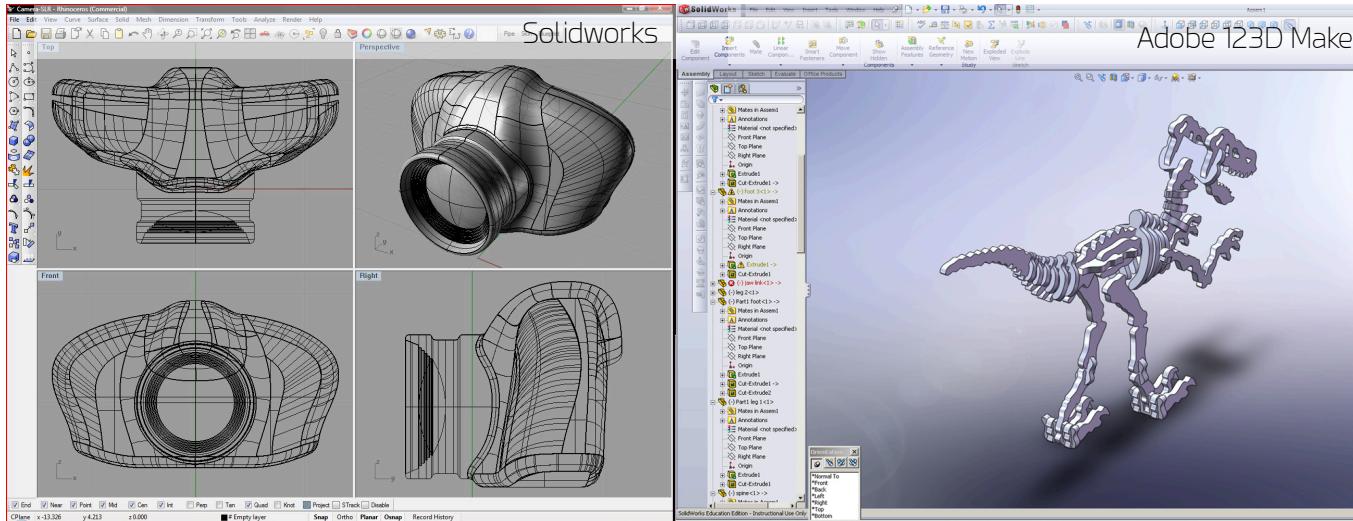
Advent of Digital Fabrication age is letting users to design their own products  
Users are invited to the design process thanks to various machines



## Background

## WHY 3D Modeling tool needed?

Most of the functions in current 3D Modeling tools are difficult for novice users

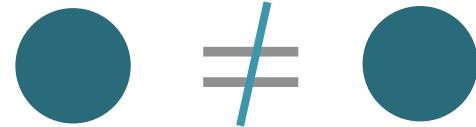


- Difficult to deal with various measures (Phi , mm, m etc)
- Less knowledge in 3D structures
- Difficult terminologies ( Extrude, Boolean Union, Translate ..etc)

Background

Designing in real world space

Perceptional Space

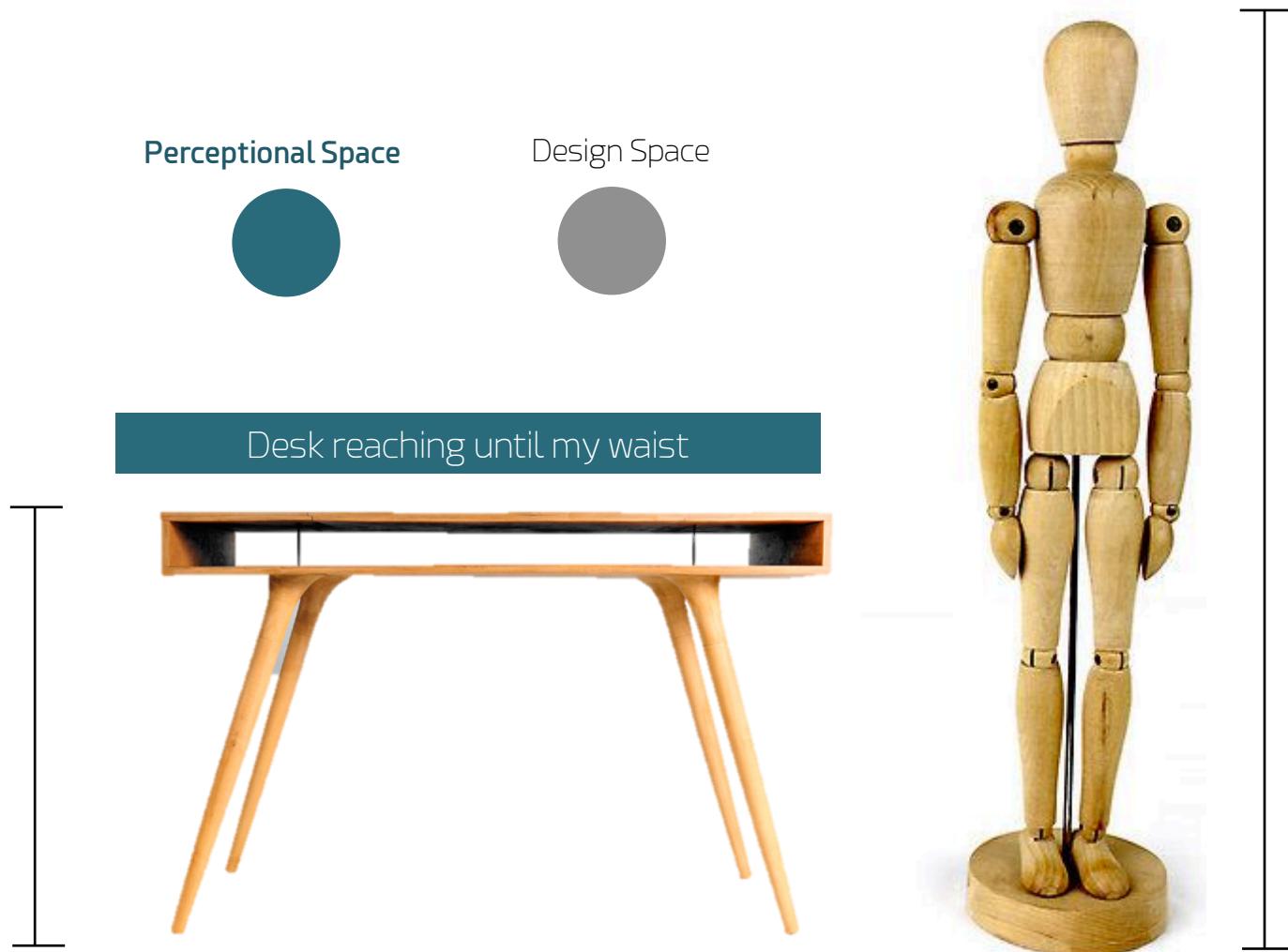


Design Space



Background

Designing in real world space



Background

Designing in real world space

Perceptional Space



Design Space



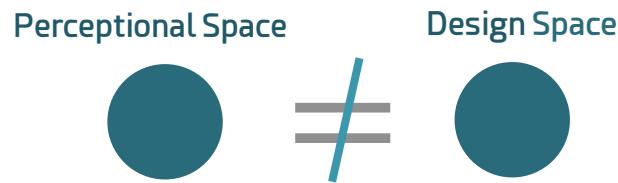
Desk Size 1500mm x 800mm x 600mm



Background

Designing in real world space

Proposed system try to solve  
"Discrepancy" existing between "perception space" and "designing space"



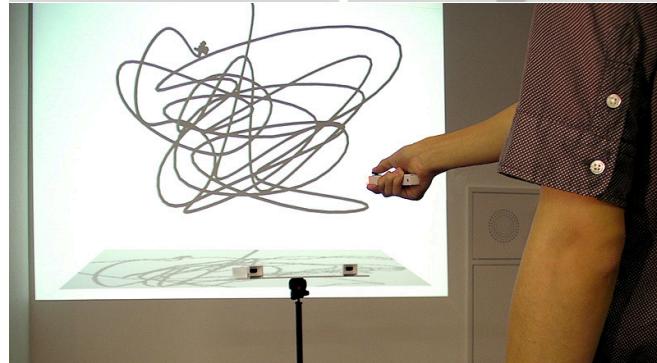
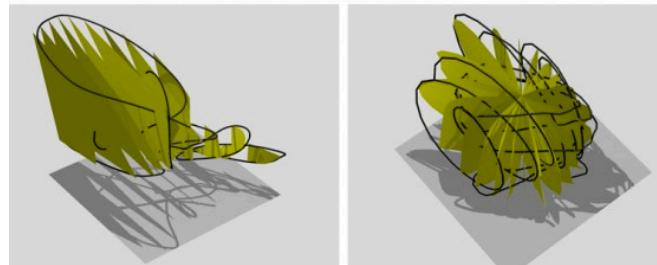
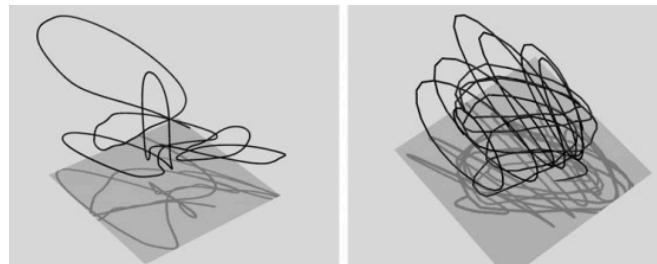
## Related Works

### Sketch-based modeling in 3D Space



FRONT, 2006

Motion capture system generates 3D objects.  
No visual feedback

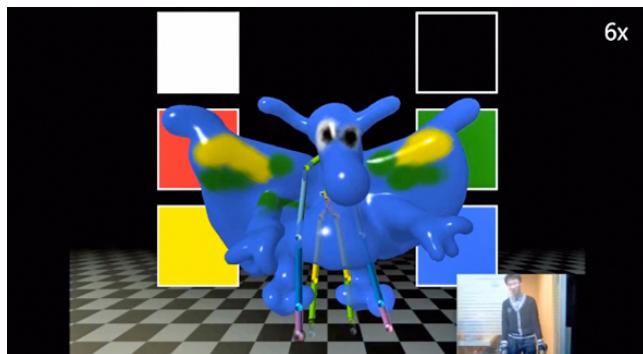
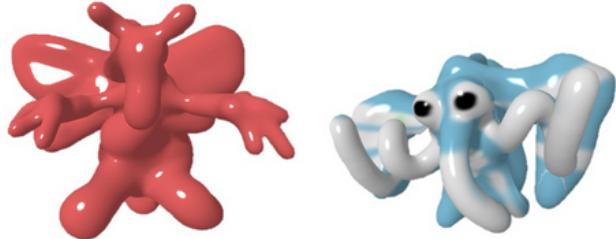


Spatial Sketch, University of Tokyo 2010

Drawing in 3D space, 2D visual feedback.  
Difficulty in matching 3D with 2D feedback.

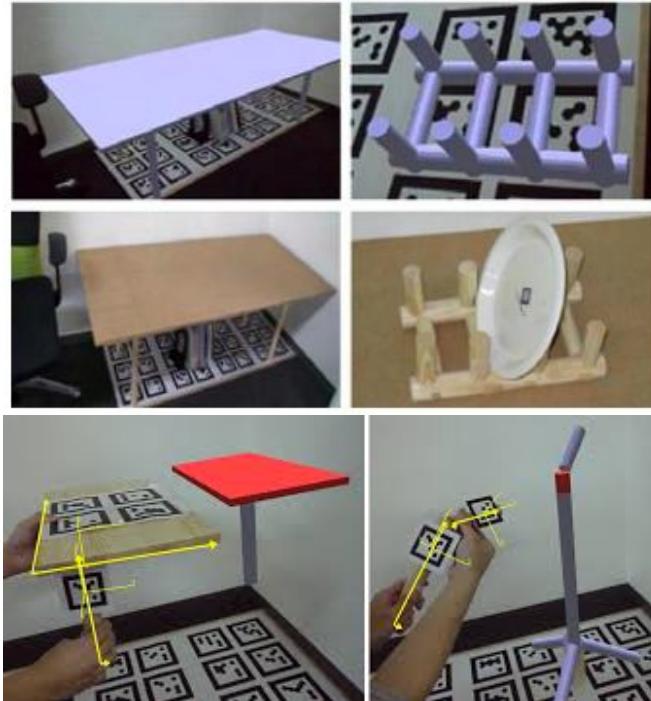
## Related Works

### Situated Modeling



BodyAvatar, Microsoft Asia, TEI 2013

Copy and reference human-body gesture  
of the user to generate avatar.  
Gesture Gloves



Situated Modeling, TEI 2012

Copy existing objects to quickly design 3D  
object in the space.  
Foot pedal input

Related Works

BodyAvatar



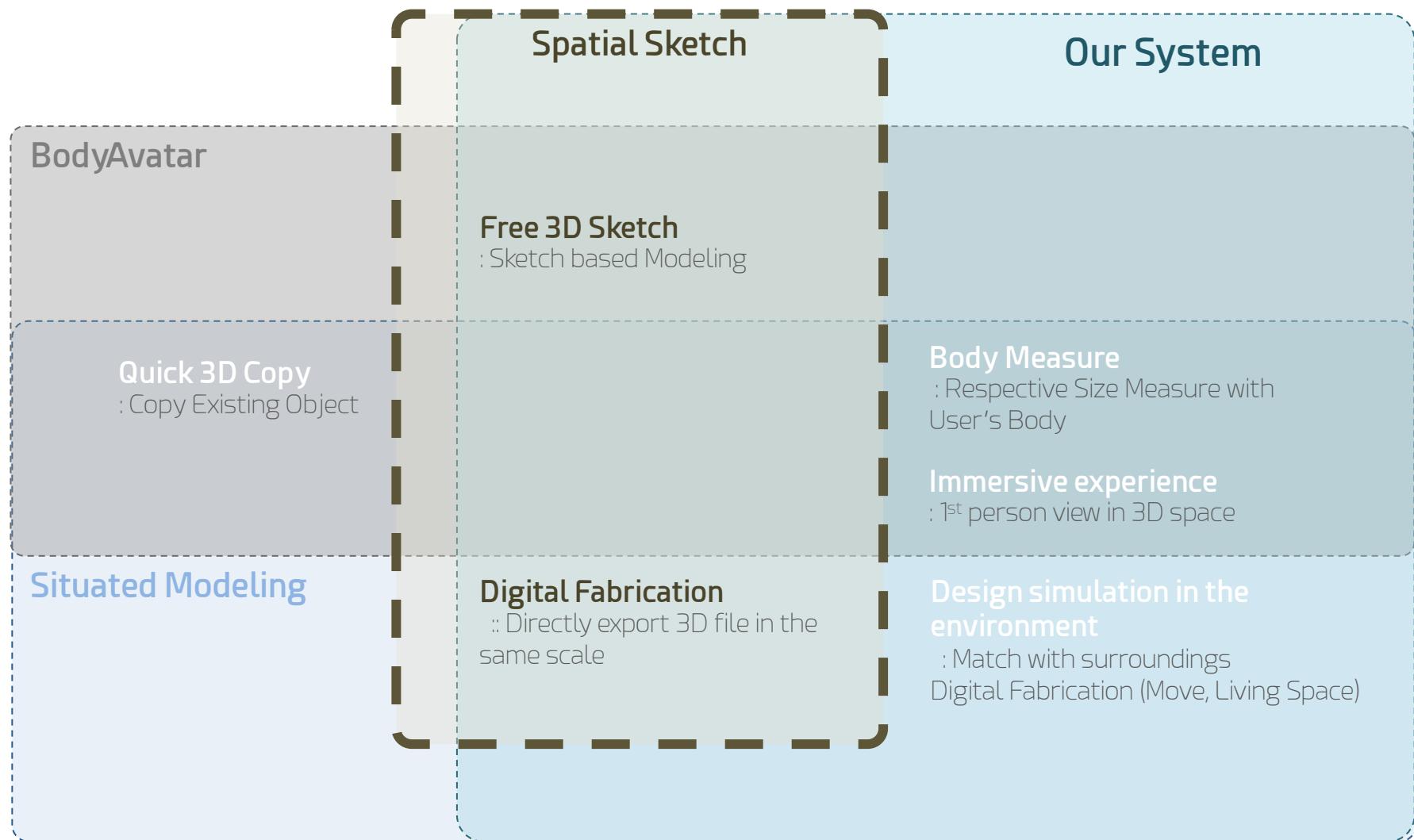
VR based 3D sketch system

Comparison with existing technology

Spatial Sketch		Our System
BodyAvatar	Free 3D Sketch : Sketch based Modeling	
Quick 3D Copy : Copy Existing Object		<b>Body Measure</b> : Respective Size Measure with User's Body  <b>Immersive experience</b> : 1 <sup>st</sup> person view in 3D space
<b>Situated Modeling</b>		<b>Digital Fabrication</b> :: Directly export 3D file in the same scale  <b>Design simulation in the environment</b> : Match with surroundings Digital Fabrication (Move, Living Space)

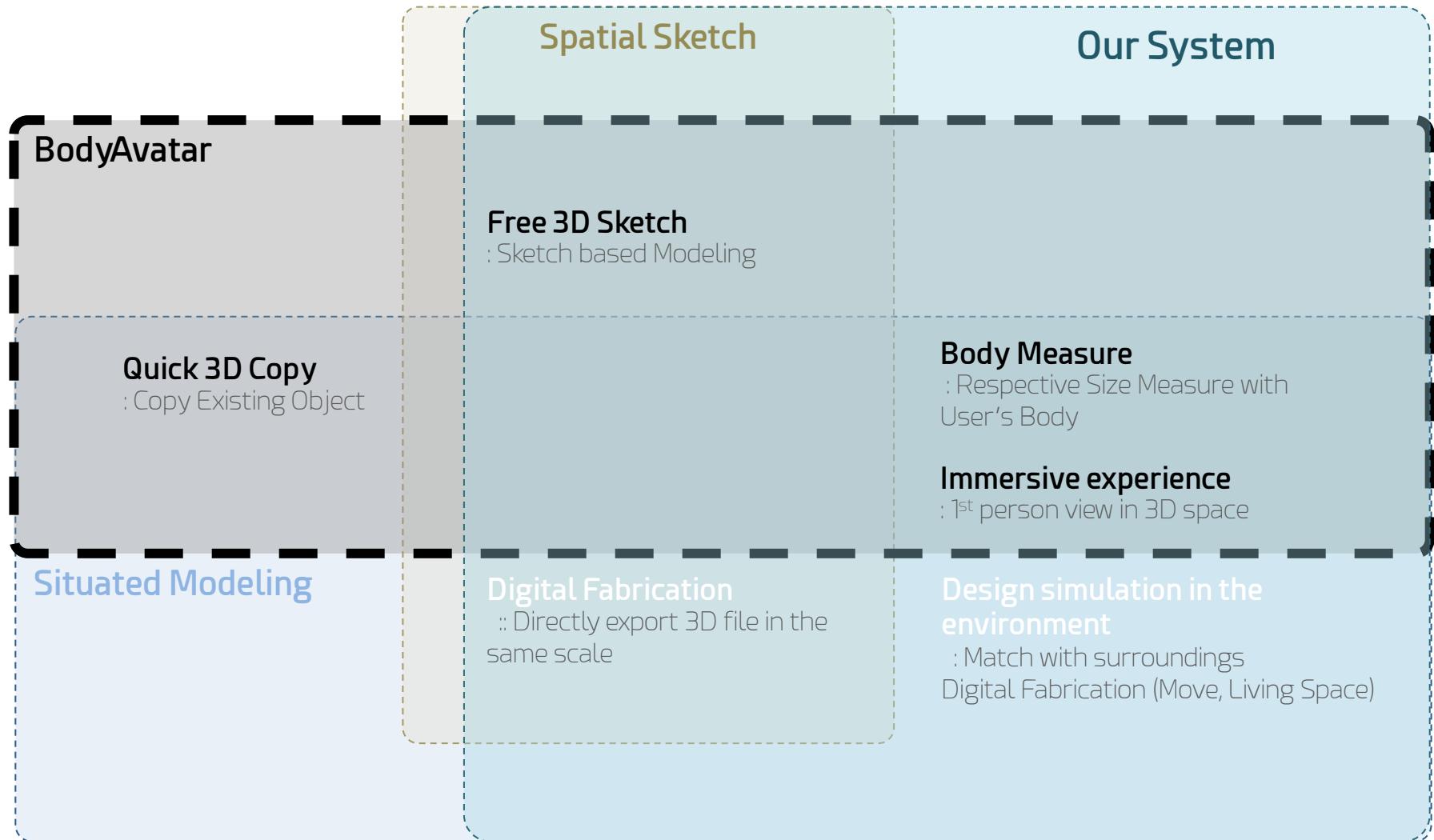
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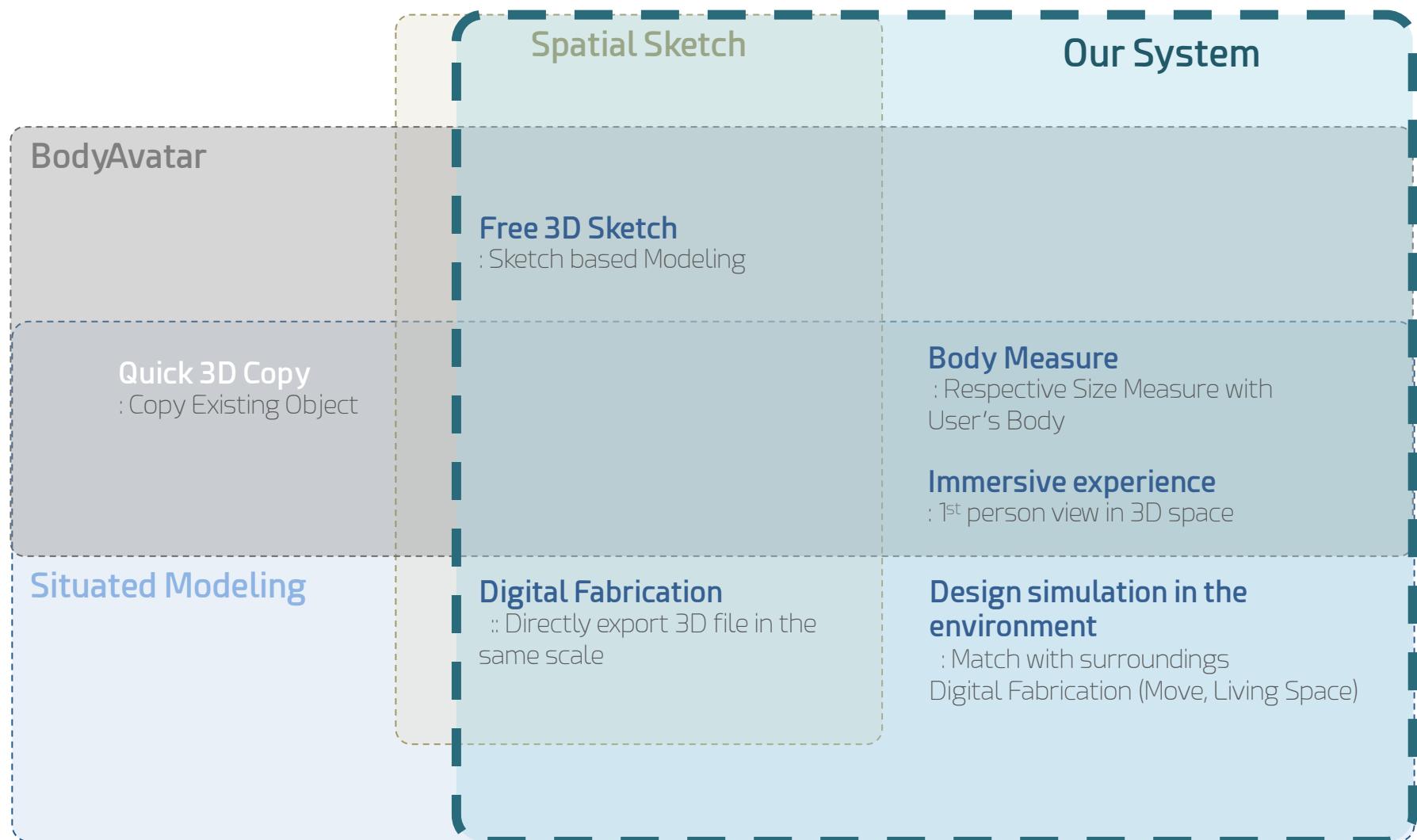
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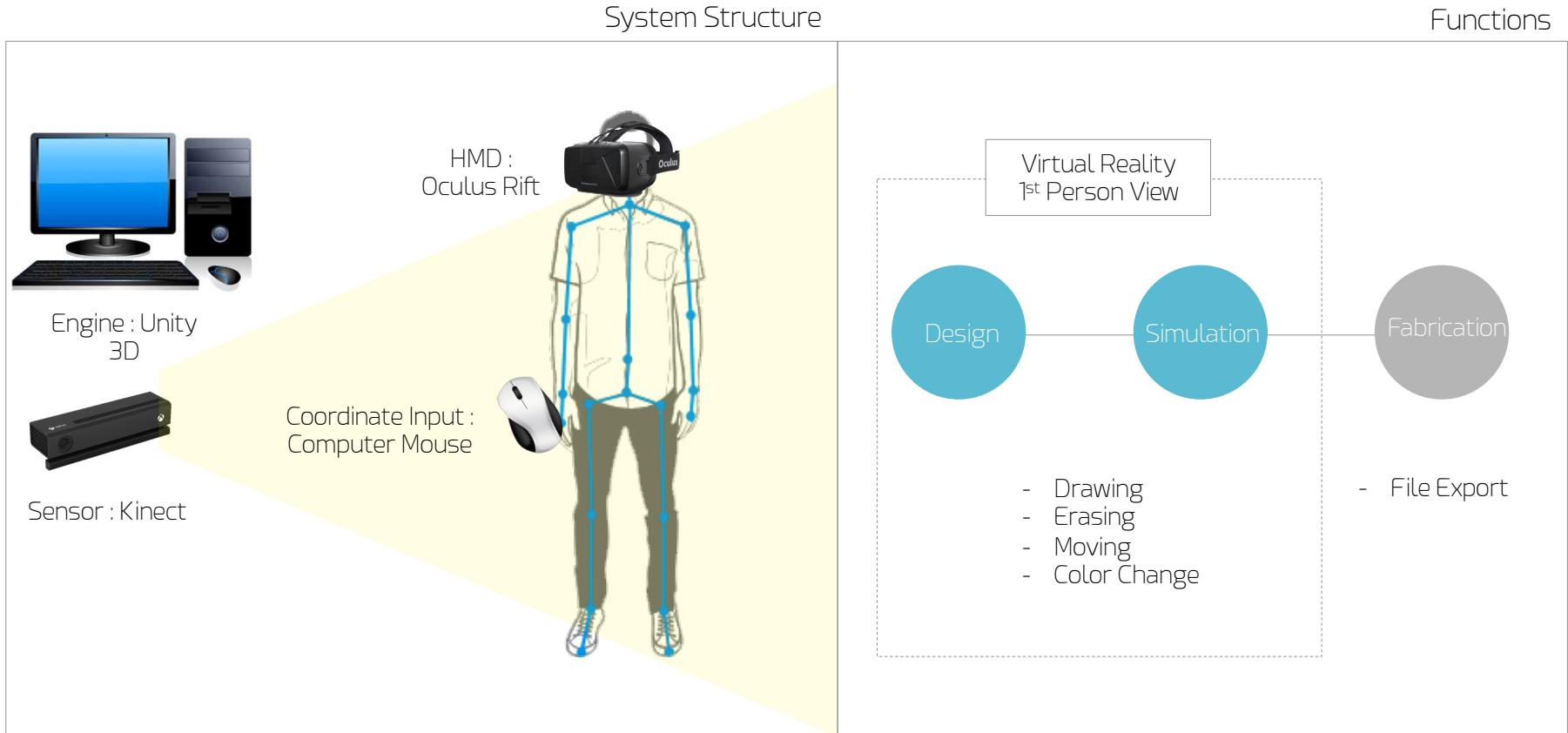
VR based 3D sketch system

Comparison with existing technology



# VR based 3D sketch system

## System Structure & Functions



VR based 3D sketch system

Functions

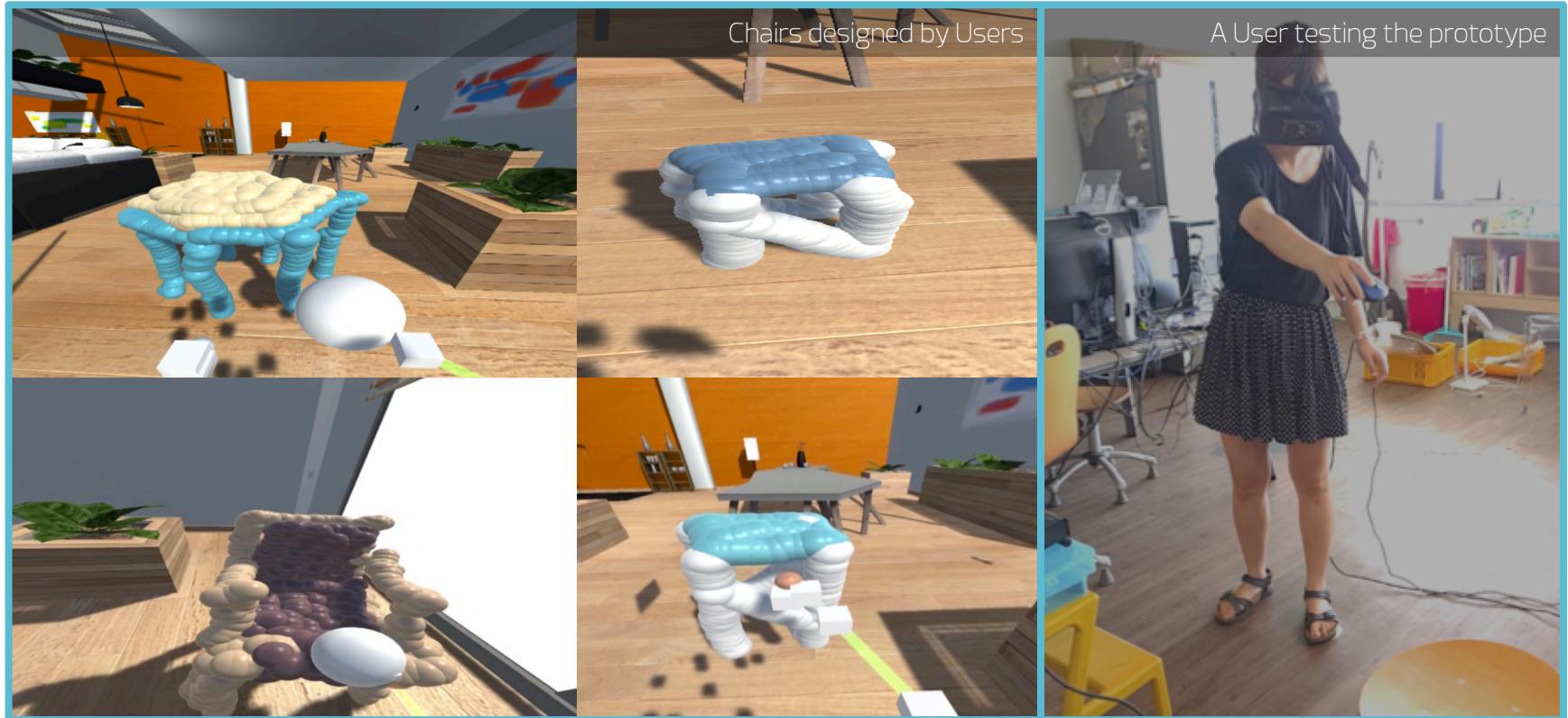


# VR based 3D sketch system

## User Discussion

User Test

Group Interview

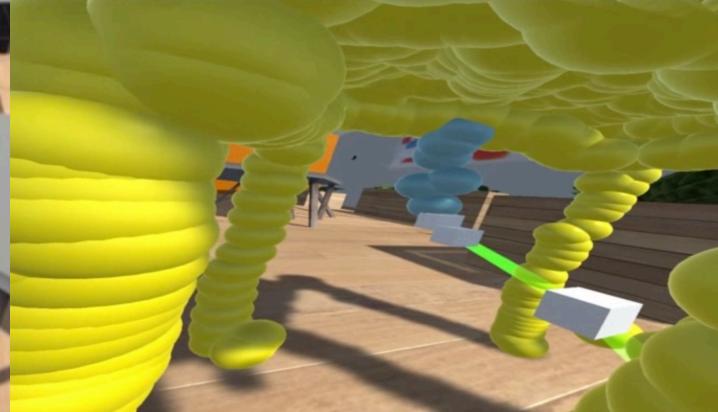
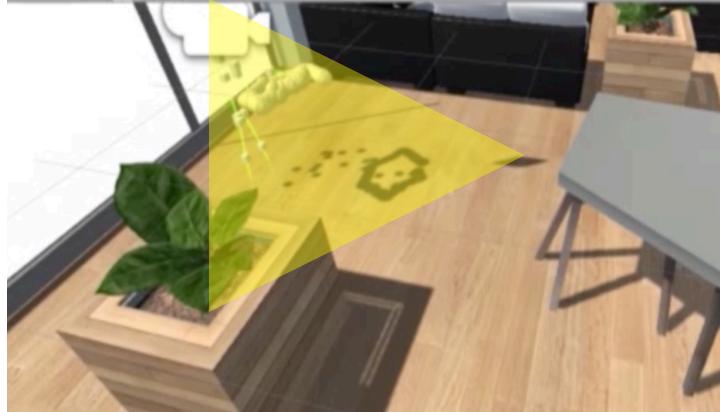
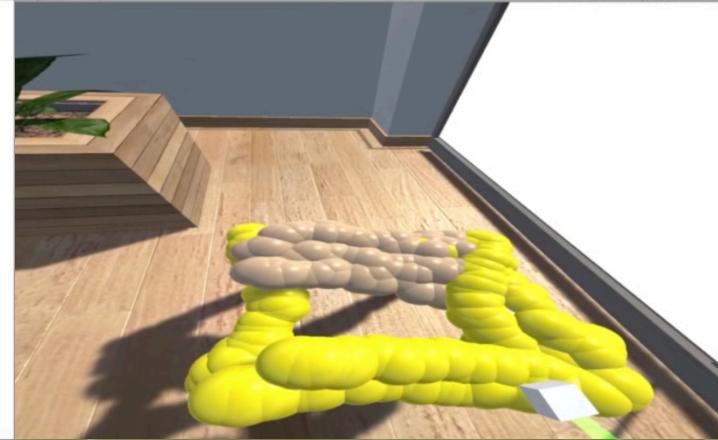
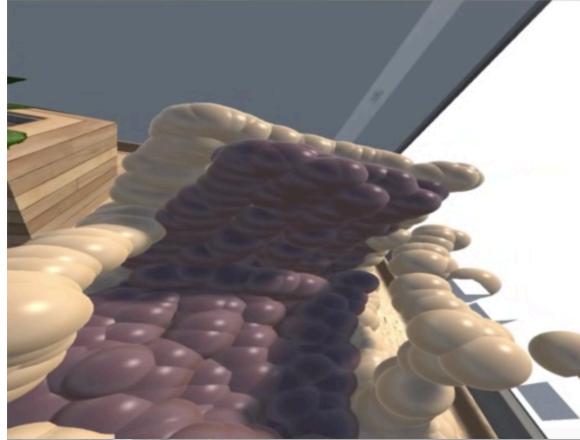


# VR based 3D sketch system

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# VR based 3D sketch system

## User Discussion



# VR based 3D sketch system

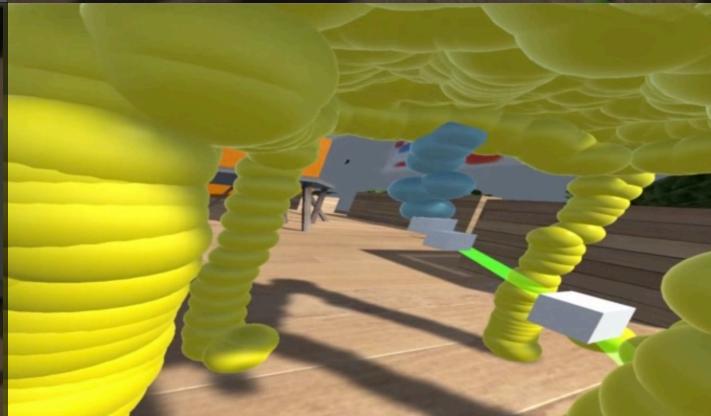
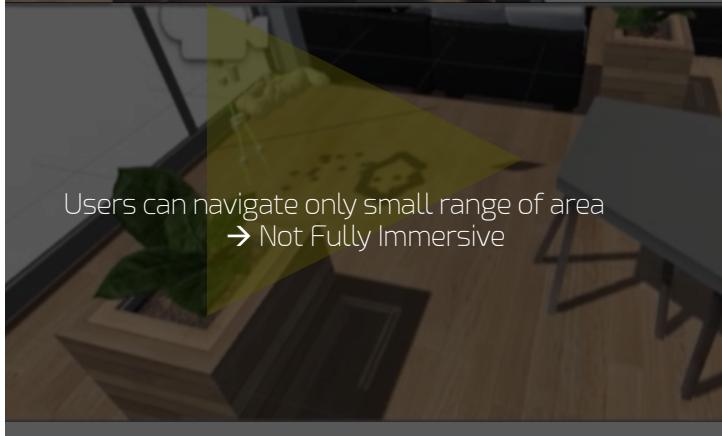
## User Discussion

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Difficulty In drawing flat structures (planes, lines)



# VR based 3D sketch system

## User Discussion

User Test

Group Interview



Difficulty In drawing flat structures (planes, lines)



Users can navigate only small range of area  
→ Not Fully Immersive



More functions are needed  
→ Rotation / Scaling

VR based 3D sketch system

## Discussion

### Possibility as a "Rapid designing tool"

Iterations of designing process with user & environment

### Add More Functions

Rotation , Copy similar objects , Scaling etc)

### Multi-user Scenario

Expand possibility as a collaborative designing tool

### Future Applicability

Idea generation tool between (Designers – nonDesigners)

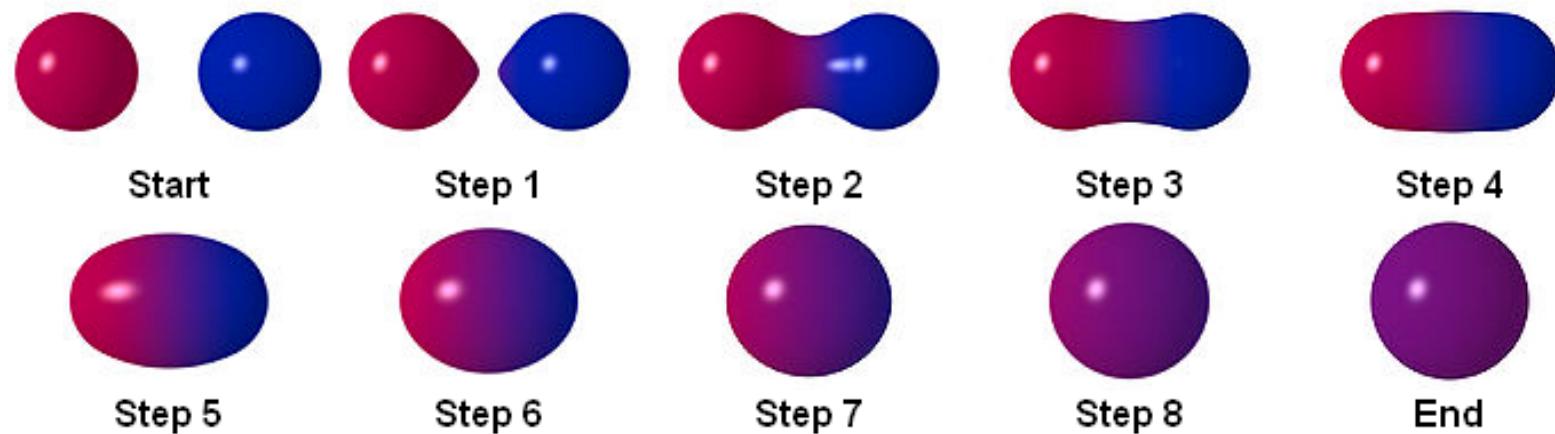


THANK YOU

Any Questions?

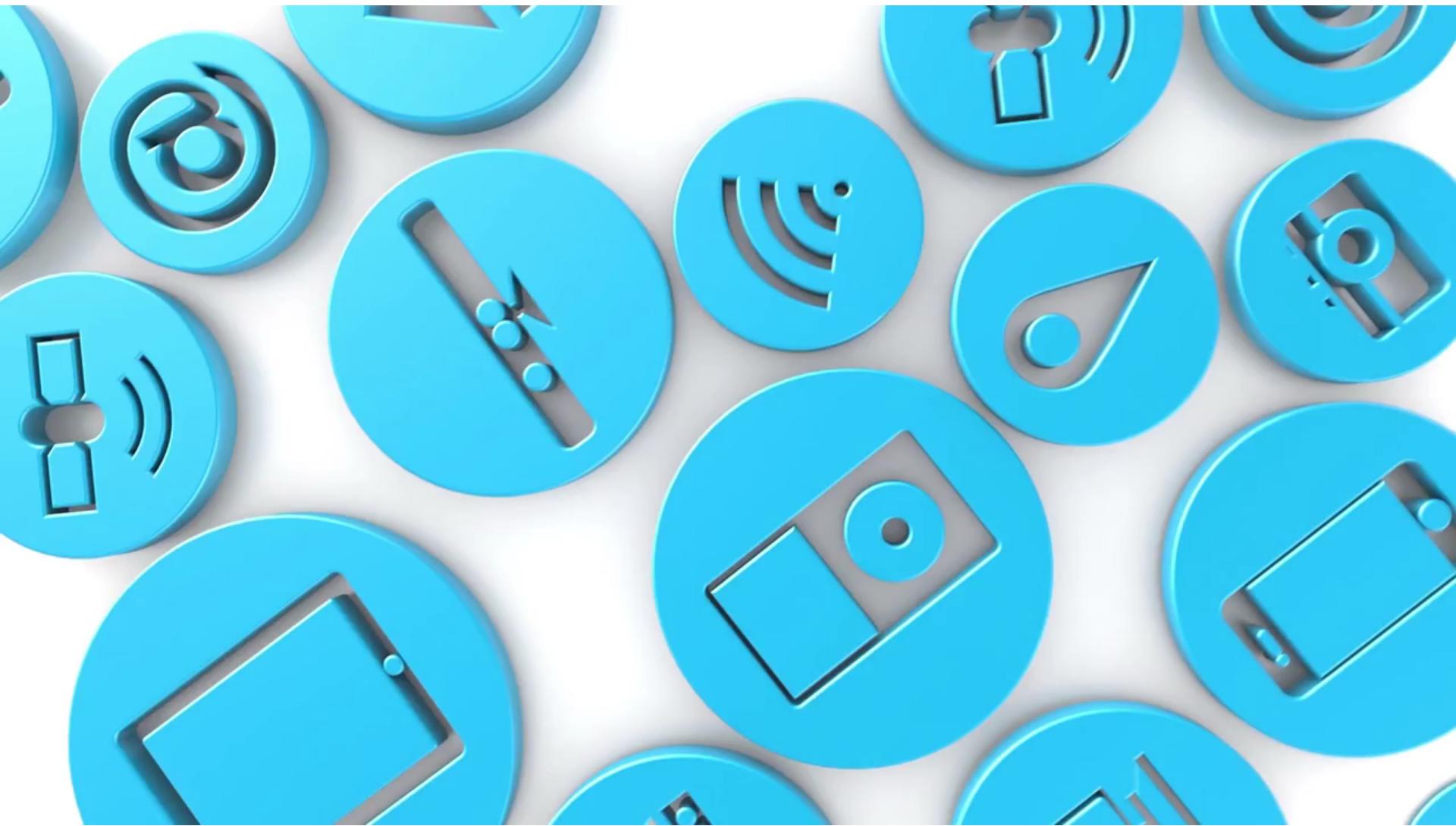
## APPENDIX

### Meta-ball



## APPENDIX

### Disney 3D Sketch



## APPENDIX

### Comparison with existing technology

FRONT	Body Avatar	Proposed System	Spatial Sketch	Situated Modeling
<p>Only Expertise can use : High sense in 3D modeling is needed (Imaginary space of the user)</p> <p>Concept Image and not yet implemented</p> <p><b>Body Measure</b> : Respective Size Measure with User's Body</p>	<p>Body Gesture with 3D Space, 2D Feedback</p> <p><b>Body Measure</b> : Respective Size Measure with User's Body</p> <p><b>Immersive experience</b> 3D sketching with both 1<sup>st</sup> person / 3<sup>rd</sup> person mode : Immersive</p>	<p>Various Furniture Design within 3D Space</p> <p><b>Body Measure</b> : Respective Size Measure with User's Body</p> <p><b>Immersive experience</b> : 1<sup>st</sup> person view</p> <p><b>Design simulation in the environment</b> : Match with surroundings Digital Fabrication</p> <p><b>Digital Fabrication</b> :: Directly export 3D file in the same scale</p>	<p>Discrepancy with dimensions : Design in 3D, feedback in 2D</p> <p>Scale mismatch</p>	<p>Quick 3D modeling : copying several primitive types</p> <p>Unnatural interaction : Use foot pedal as input</p> <p><b>Design simulation in the environment</b> : Designed in the real space with Augmented Reality</p>