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Designing Motion Gestures for Enhancing Kinect-based Interaction Effectiveness

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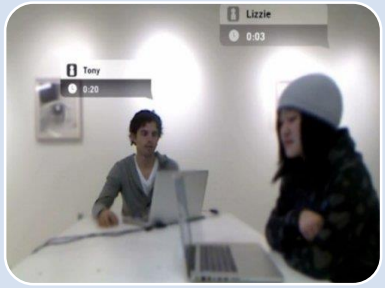
Microsoft Research Asia
Faculty Summit 2012

Kinect

Source: Microsoft Inc.

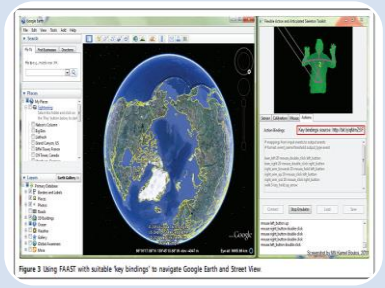
Source: Microsoft Inc.

Game Development



Source: MIT Media Lab.

Video Conferencing System



Source: Boulos, M. et al. IJHG, 2011.

Map Navigation

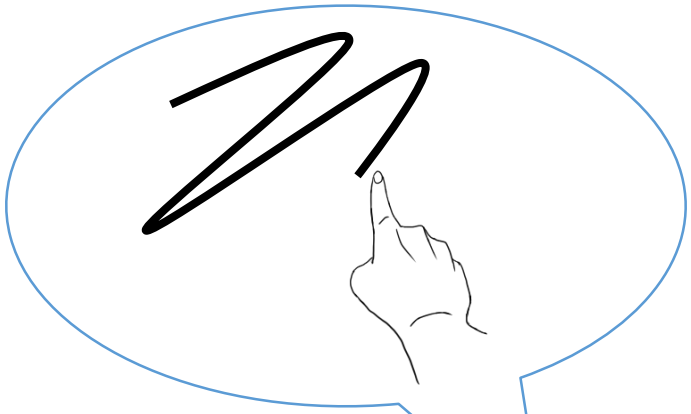
General Purpose

- Enhance the effectiveness of Kinect-based interaction.
- Provide insight into the design of Kinect-based user interfaces.
- Expand the design space of Kinect-based interaction.

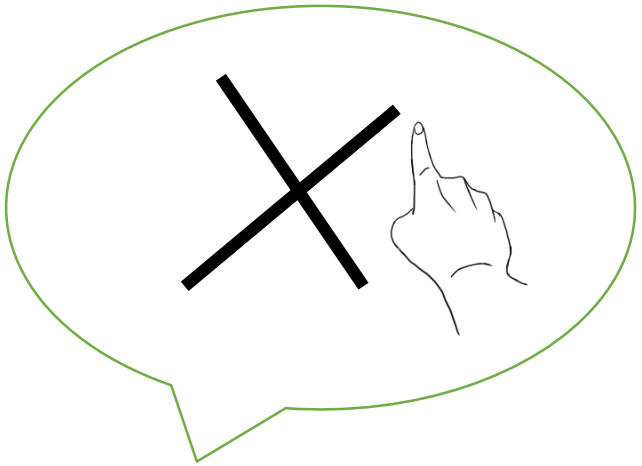
Report two studies about
User Defined Motion Gestures

Do designers really understand the needs of users?

Designer's mental model



User's mental model

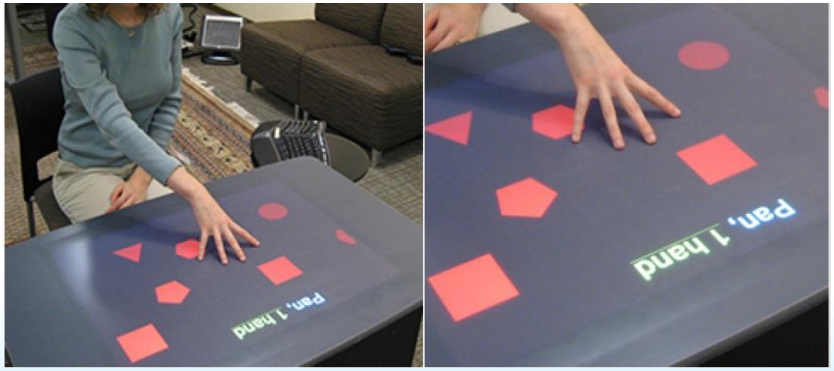


Designers

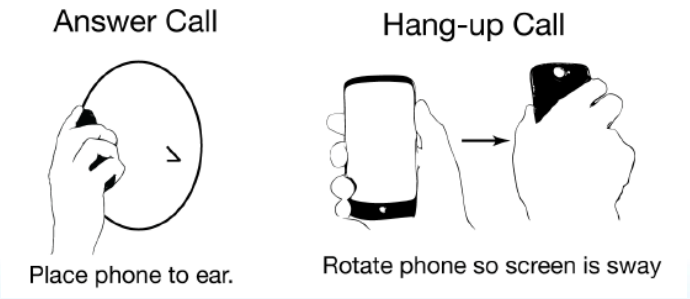
Users

Related work

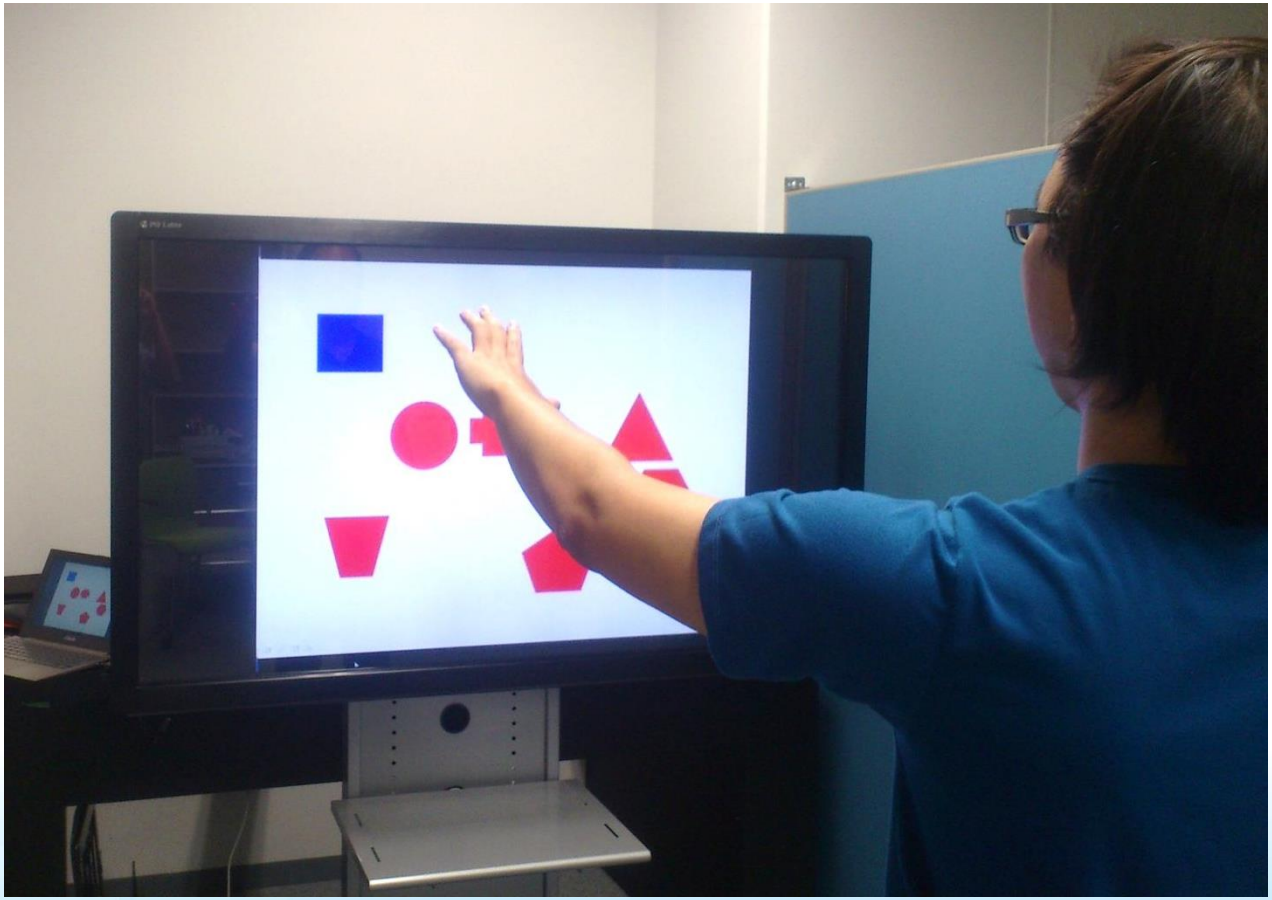
- Wobbrock et al. (2009): User-defined gestures for surface computing, *Proc. of CHI 2009*, pp. 1083 - 1093.



- Ruiz et al. (2011). User-defined motion gestures for mobile computing, *Proc. of CHI 2011*, pp. 197-206.



Little study has been done on 3D motion gestures in hands free

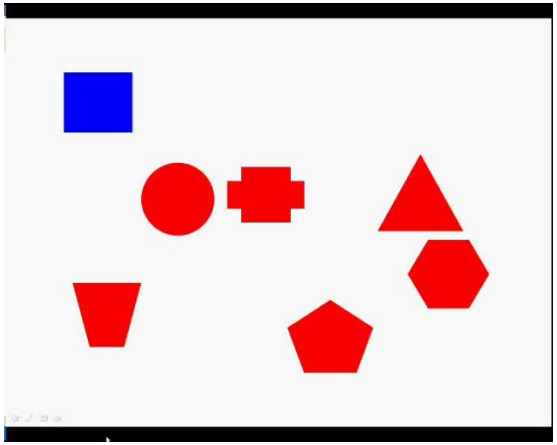


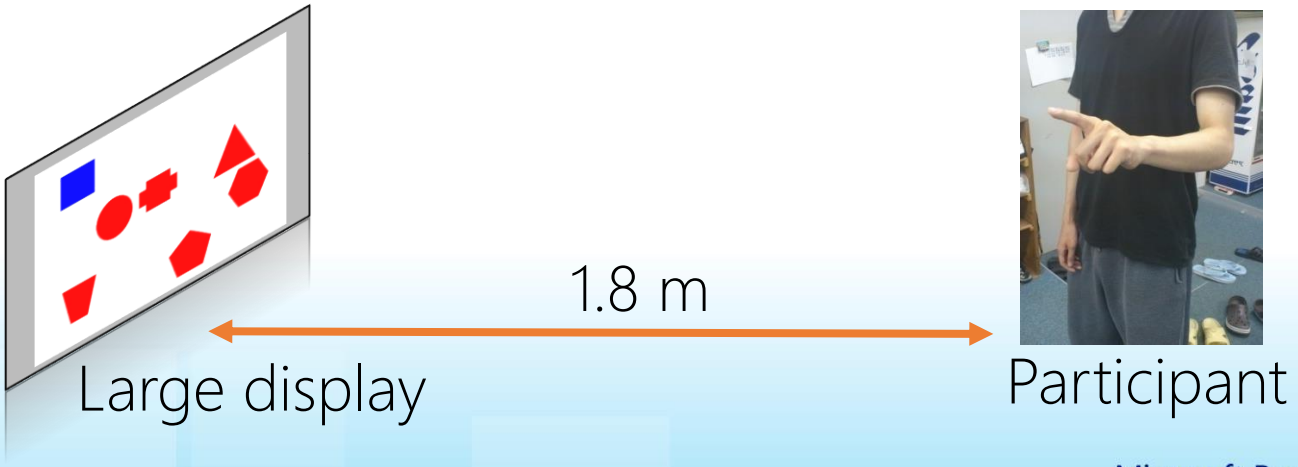
A scene of our experiments

STUDY 1: User-defined Motion Gesture Design

Experiment: Task and Procedure

- Step 1: Demo display
  (the effect of a command)
  - e.g. *Move* command
- Step 2: Define a gesture
  - e. g.





Experiment: Command Selection

All these commands are used in the WIMP interface Total 33 commands			
Clear All	Pan	Accept	Menu
Enlarge	Previous	Close Single	Open
Insert	Rotate	Cut	Paste
Maximize	Select Group	Delete	Pause
Minimize	Select Single	Delete Group	Play
Move	Shrink	Duplicate	Redo
Next	Zoom In	Duplicate Group	Reject
	Zoom Out	Help	Stop
		Lock	Undo

Performance Measure

- Agreement Score (AS)*
  - The extent of agreement of each command

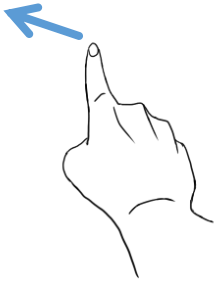
$$\mathrm{AS} = \sum_{P_i} \left(\frac{P_i}{P_r}\right)^2$$

  - e.g. *Object Selection* command

AS = $(6/10)^2+(4/10)^2 = 0.52$

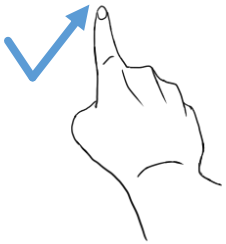
The higher score is better.

Click gesture



6 of 10 participants

Check gesture



4 of 10 participants

* Wobbrock, J.O., Aung, H.H., Rothrock, B. and Myers, B.A. (2005). Maximizing the guessability of symbolic input, *Ext. Abstracts CHI '05*, 1869-1872.

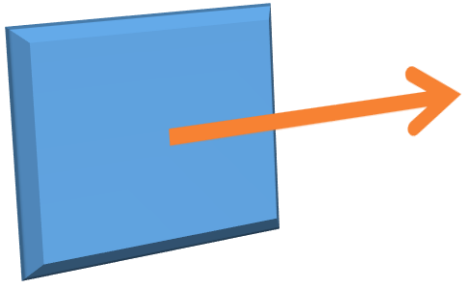
Experiment: Command Selection

Analogue Commands		Abstract Commands	
Clear All	Pan	Accept	Menu
Enlarge	Previous	Close Single	Open
Insert	Rotate	Cut	Paste
Maximize	Select Group	Delete	Pause
Minimize	Select Single	Delete Group	Play
Move	Shrink	Duplicate	Redo
Next	Zoom In	Duplicate Group	Reject
	Zoom Out	Help	Stop
		Lock	Undo

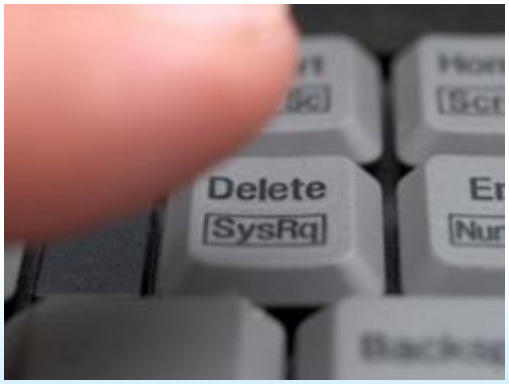
Total 33 commands

Analogue and Abstract

- Analogue Command
  - We can find the action in our daily life
  - Users can define easily
  - e.g. *Move*

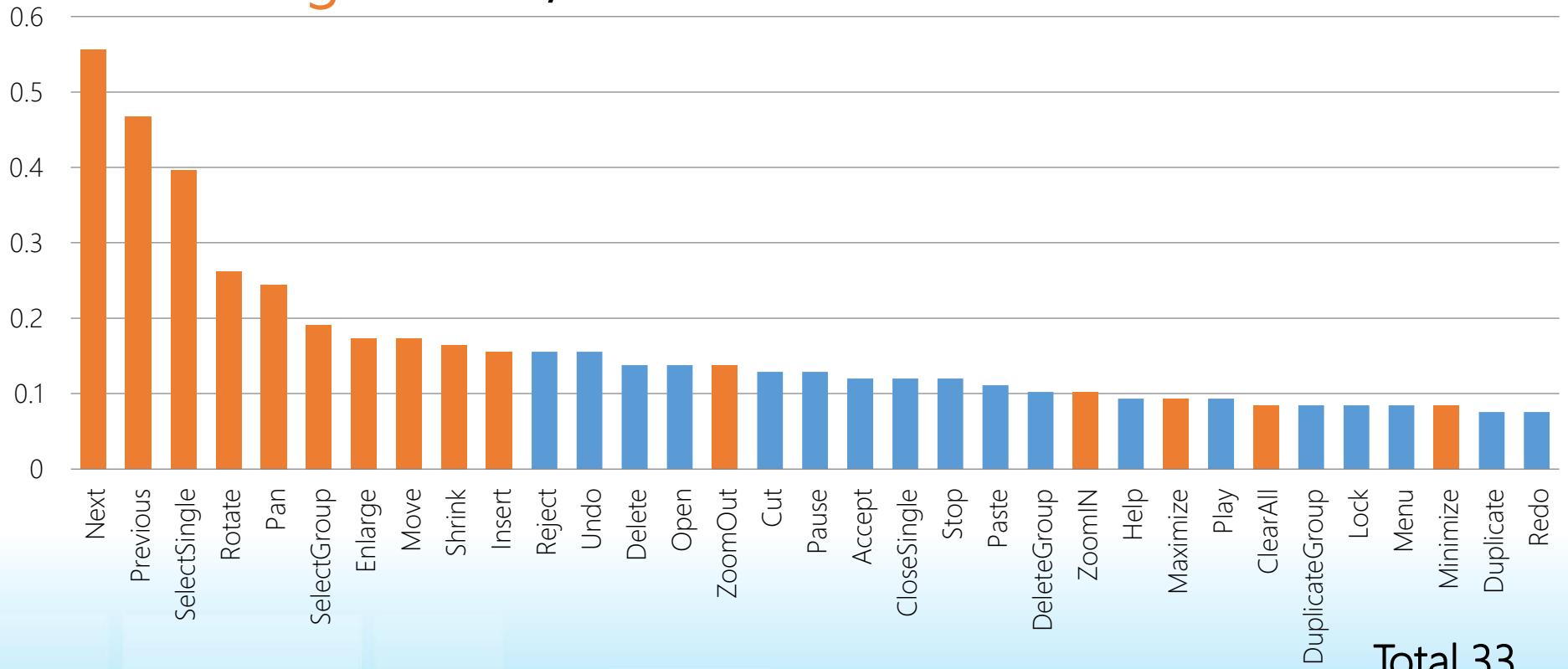


- Abstract Command
  - We can *not* find the action in our daily life
  - e.g. *Delete*



Results: Agreement scores

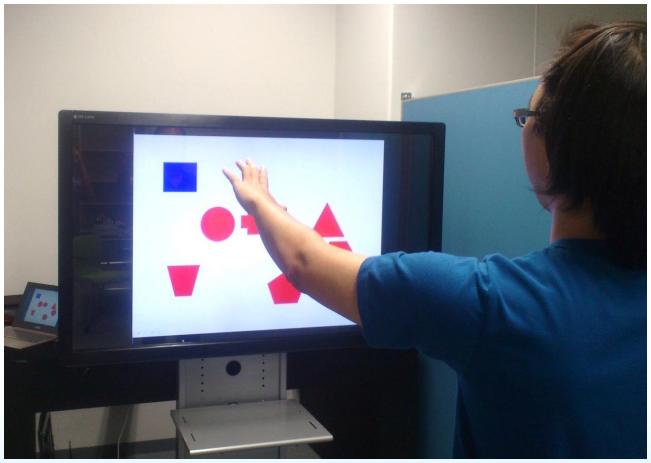
- Analogue: 0.23, Abstract: 0.11



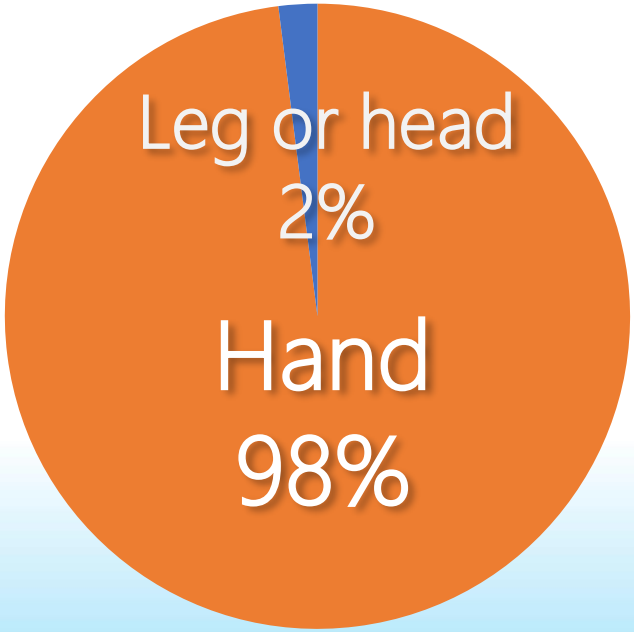
Total 33

Findings (1)

- Users preferred hand gestures only even when they had enough space to perform motion gestures.

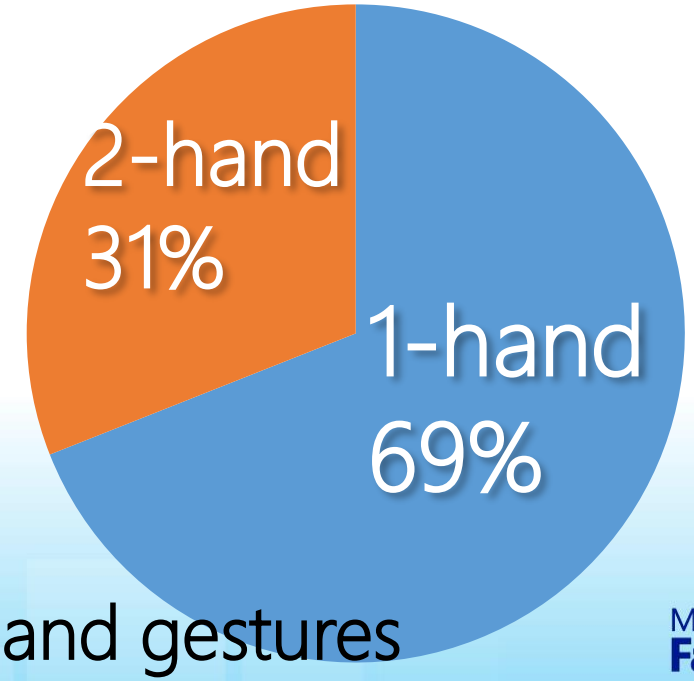


All gestures



Findings (2)

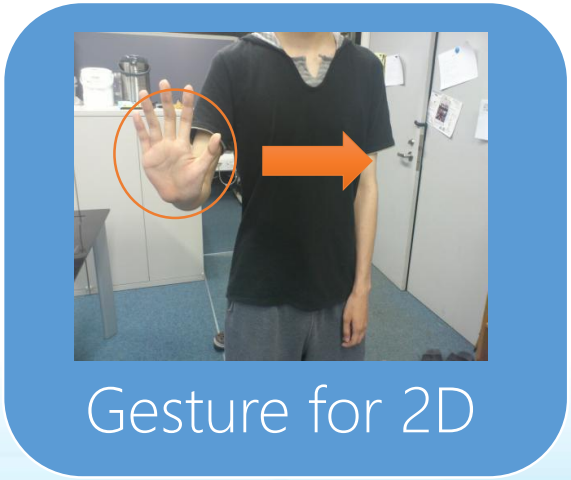
- Users preferred to use one hand, rather than two hands, to perform motion gestures.
- The hand gesture maybe considered the primary style for 3D motion gestures.



All hand gestures

Findings (3)

- 38% of new gestures were created in our study,
  - e.g. catching an object to move it
- New gestures should be considered when designing 3D motion gestures.



Category of Gestures

Gestures for both 2D and 3D (62%)		New gestures for 3D (38%)	
Next/Previous	Select Single/ Select Group	Move	Zoom In/ Zoom Out
Pan	Clear All	Enlarge/Shrink	Maximize/Minimize
Close Single	Delete/ Delete Group	Rotate	Insert
Paste	Undo/Redo	Cut	Duplicate/ Duplicate Group
Help	Menu	Open	Lock
	Play/Pause/Stop	Accept/Reject	

General Discussion

Discussion (1)

- We found that the Choice-based gesture method is better than the User-defined gesture method.

- The Choice-based gesture method can help participants to define gestures when participants can not come up with good gestures.
  - *Choose a better gesture*: Participants may choose better gestures from a gesture list than any they can think of themselves.
  - *Create a new gesture*: Participants may create new gestures which are based on a gesture list.

Discussion (2)

Study 1: User-defined

- Low agreement
- Difficult to define
- Effective for developing an initial set of gestures

Study 2: Choice-based

- High agreement
- Easy to define
- Effective for creating new gestures

Achievements

- We have presented Study 1 at APCHI 2012 *(10th Asia Pacific Conference on Computer Human Interaction, Matsue, Japan)*

  Mizobata, R., Tu, H. and Ren, X. (2012). User-defined Motion Gestures, in *Proceedings of APCHI 2012*, pp. 783-784.

  We won the Best Poster/Demonstration Award

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Thank you!

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