Microsoft Research

# Microsoft Research Asia
# Faculty Summit 2012

# Designing Motion Gestures for Enhancing Kinect-based Interaction Effectiveness

PI: Xiangshi Ren
Members: Ryo Mizobata, Huawei Tu
School of Information,
Center for human-computer interaction,
Kochi University of Technology



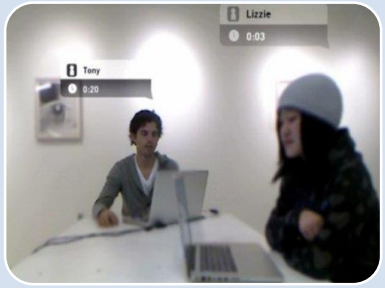
Microsoft Research Asia
Faculty Summit 2012

# Kinect

*Source: Microsoft Inc.*

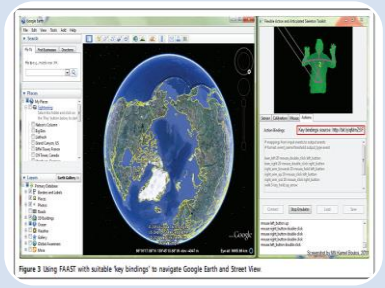
*Source: Microsoft Inc.*

Game Development




*Source: MIT Media Lab.*

Video Conferencing System



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

Map Navigation

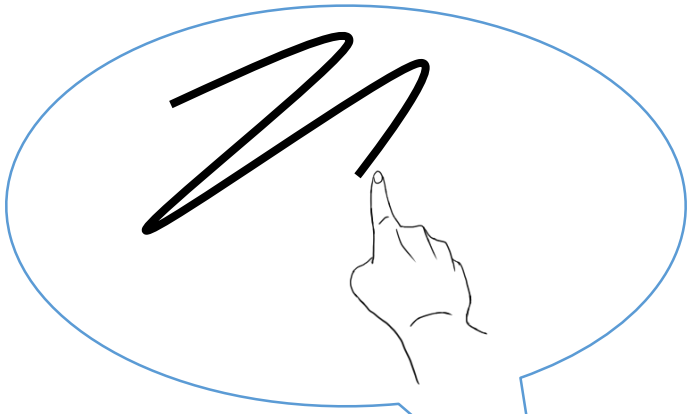
# General Purpose

- 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.

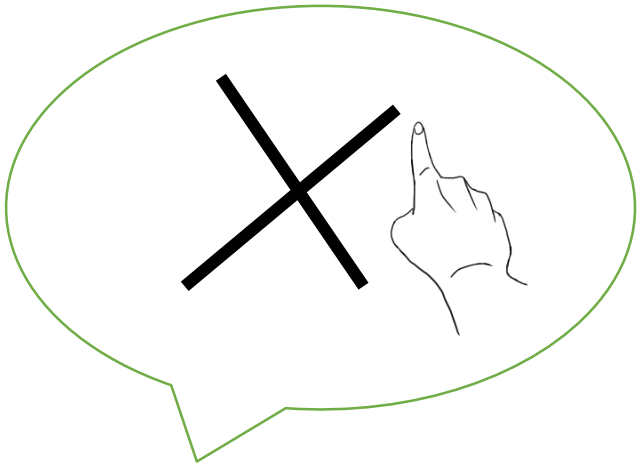
Report two studies about
User Defined Motion Gestures

Do designers really understand the needs of users?

Designer's mental model



User's mental model

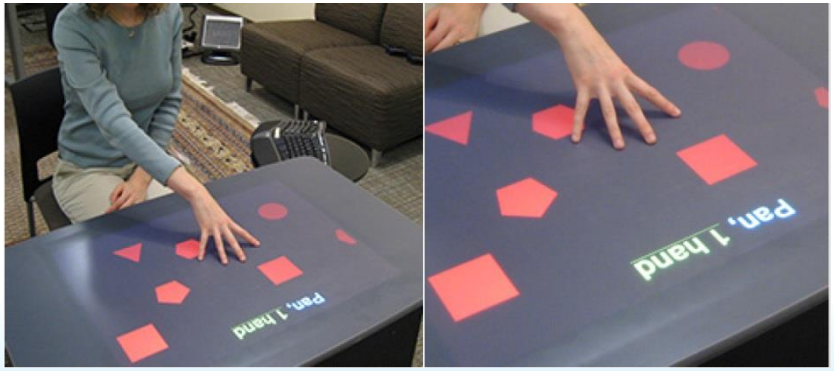


Designers

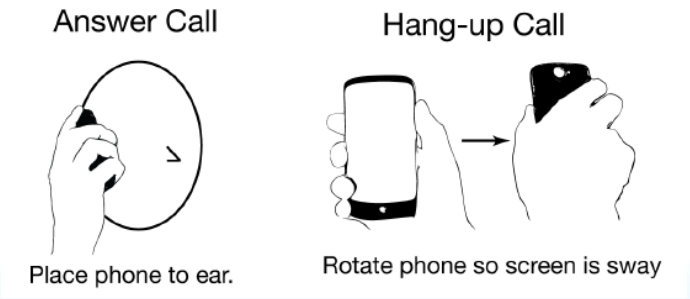

Users

# Related work

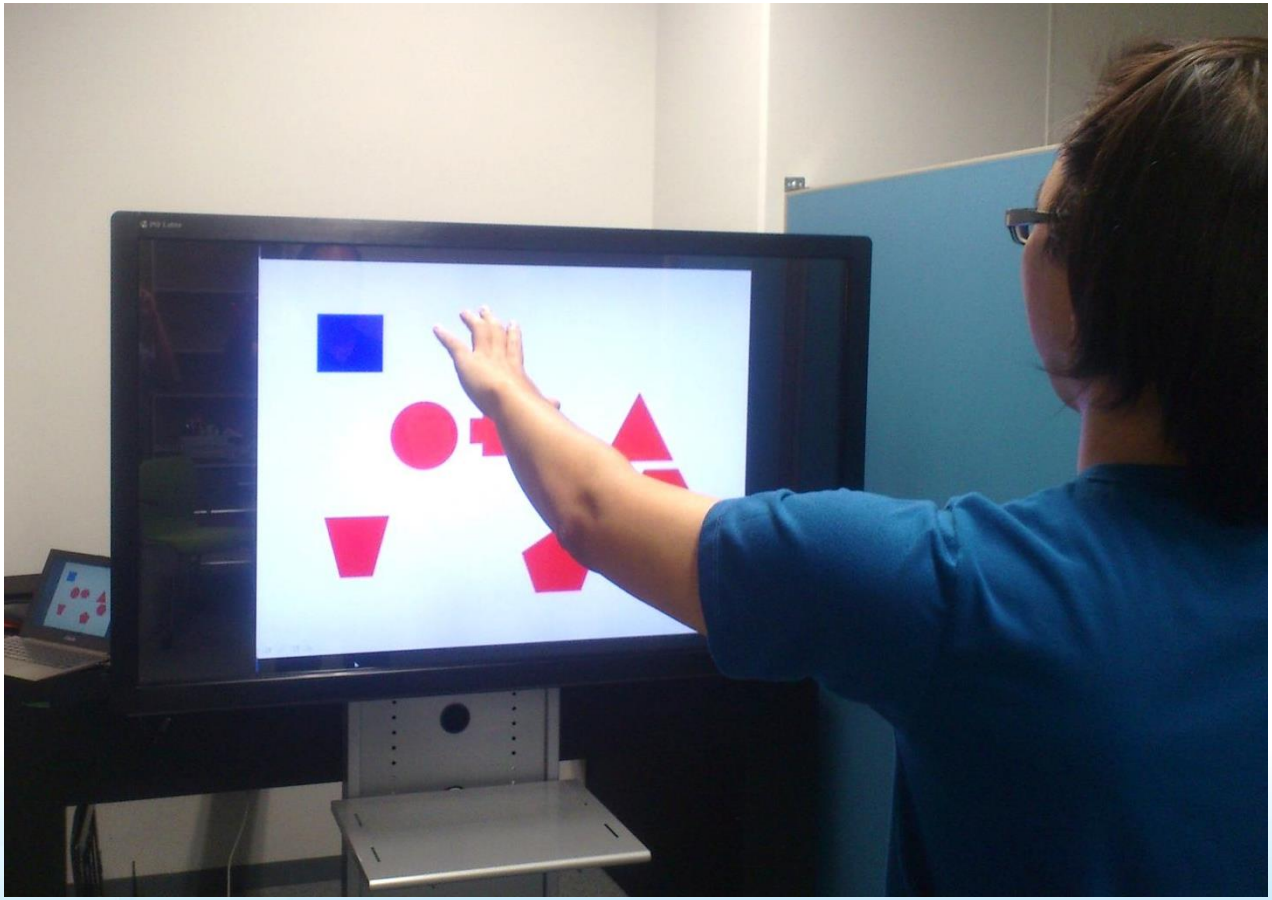
- Wobbrock et al. (2009): User-defined gestures for surface computing, *Proc. of CHI 2009*, pp. 1083 - 1093.




- 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

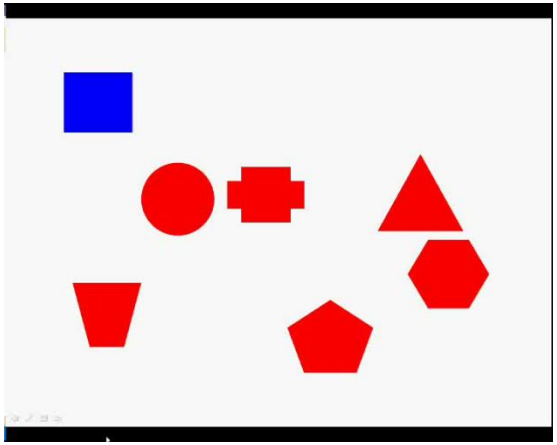


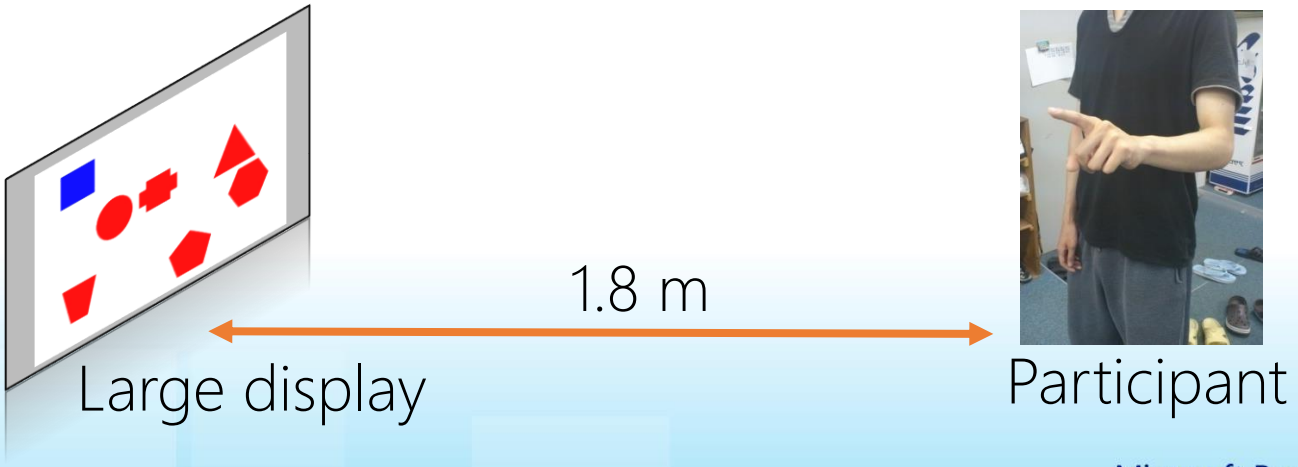
A scene of our experiments

# 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<br>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

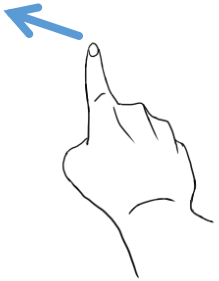
$$\mathrm{AS} = \sum_{P_i} \left(\frac{P_i}{P_r}\right)^2$$

  - e.g. *Object Selection* command

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

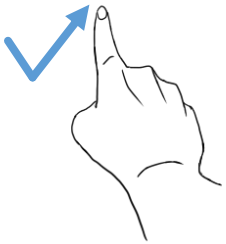
The higher score is better.

*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.

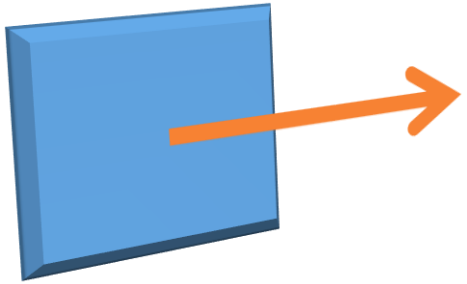
# Experiment: Command Selection

| 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 |

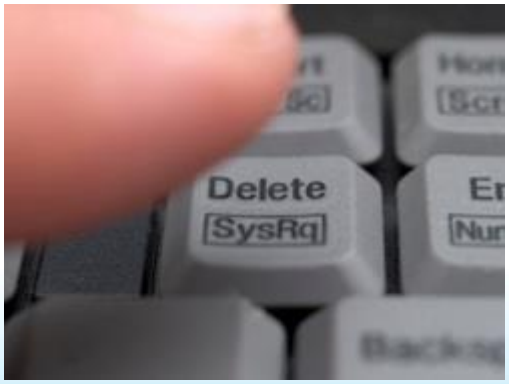
Total 33 commands

# Analogue and Abstract

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

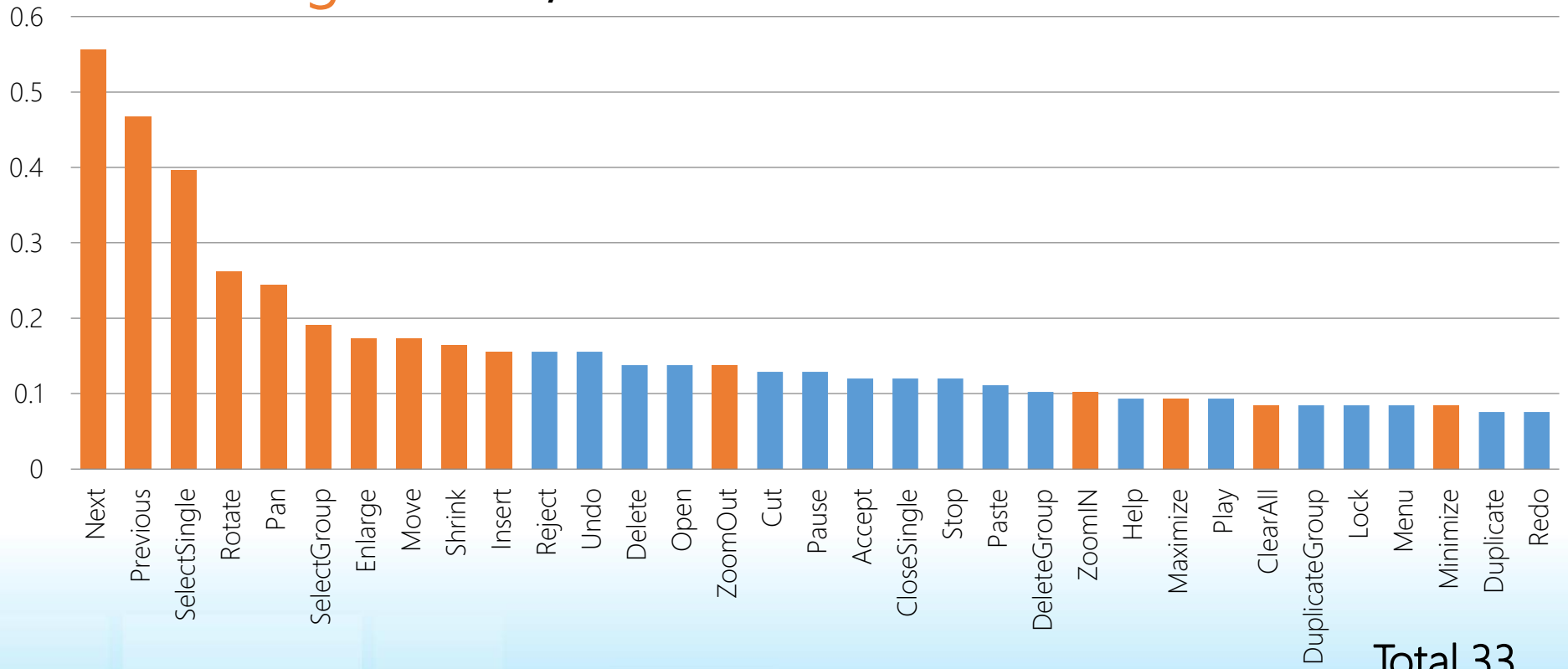


- Abstract Command
  - We can *not* find the action in our daily life
  - e.g. *Delete*



# Results: Agreement scores

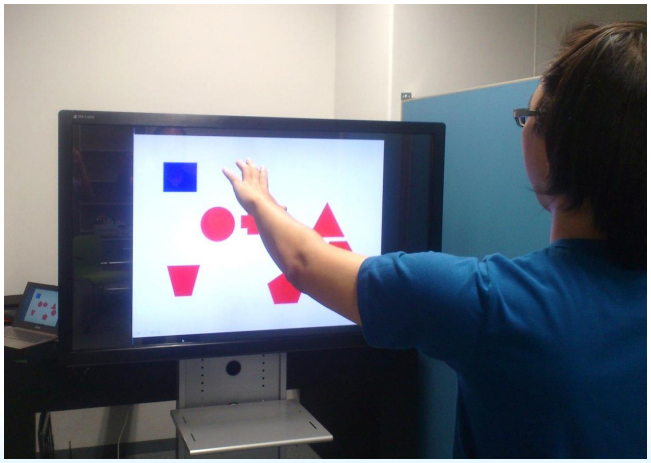
- Analogue: 0.23, Abstract: 0.11



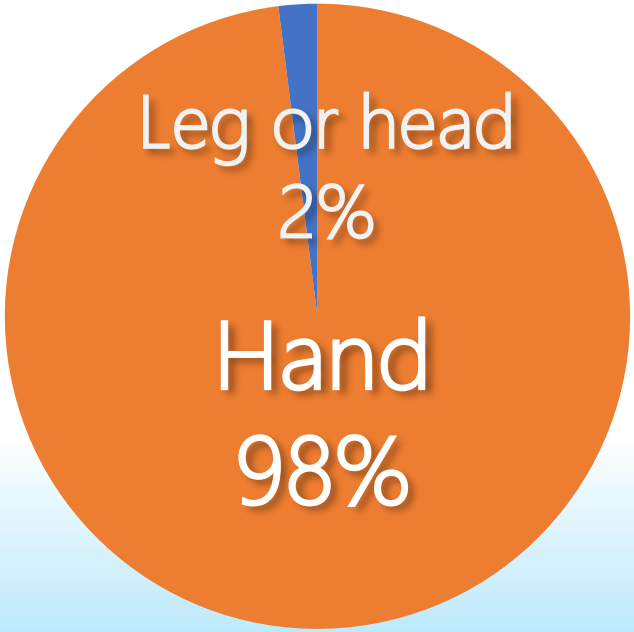

Total 33

# Findings (1)

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

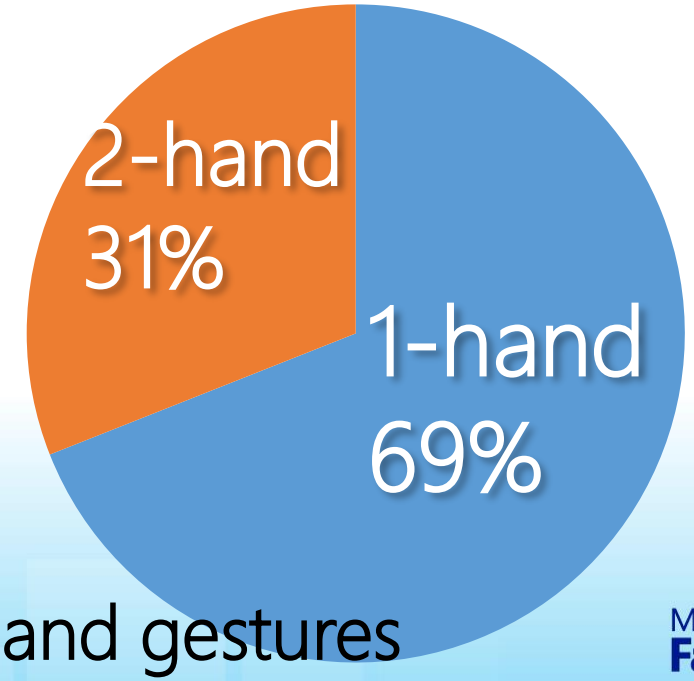


All gestures



# Findings (2)

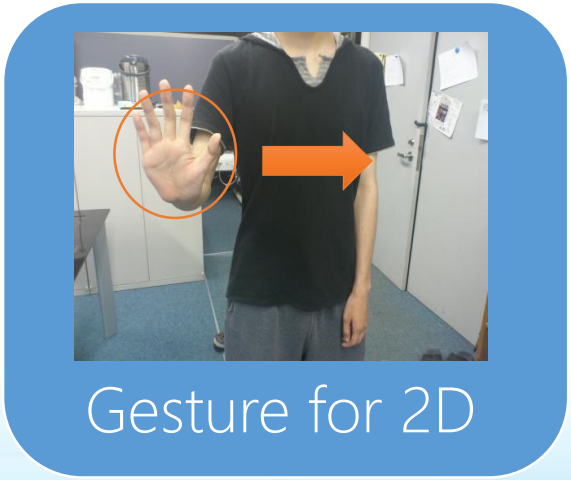
- Users preferred to use one hand, rather than two hands, to perform motion gestures.
- The hand gesture maybe considered the primary style for 3D motion gestures.




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*

Microsoft Research

# Thank you!

Microsoft Research Asia
Faculty Summit 2012