Siggraph Asia 2012

Paul Bourke

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Reebok
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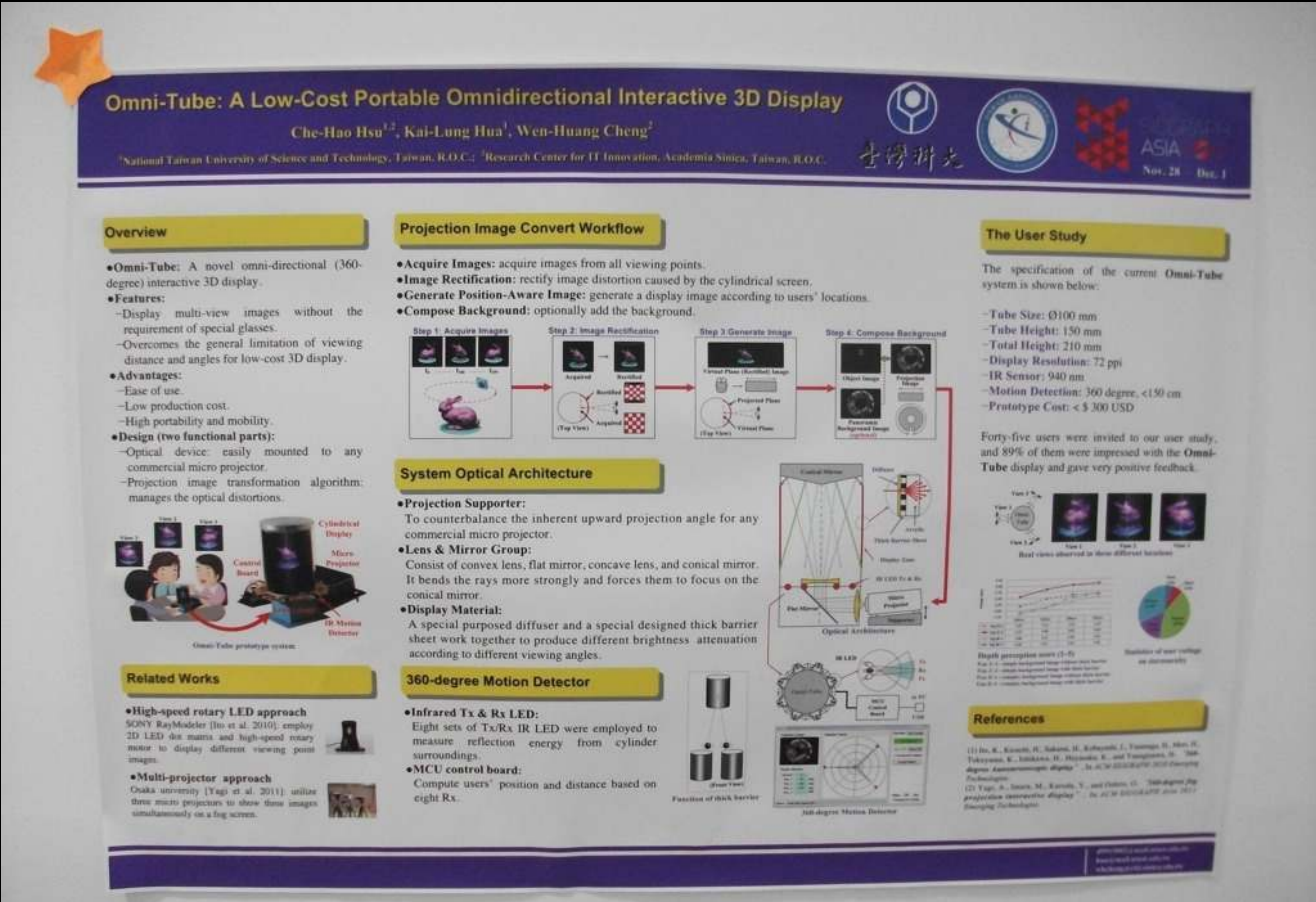
Poster



Omni-Tube: A Low-Cost Portable Omnidirectional Interactive 3D Display
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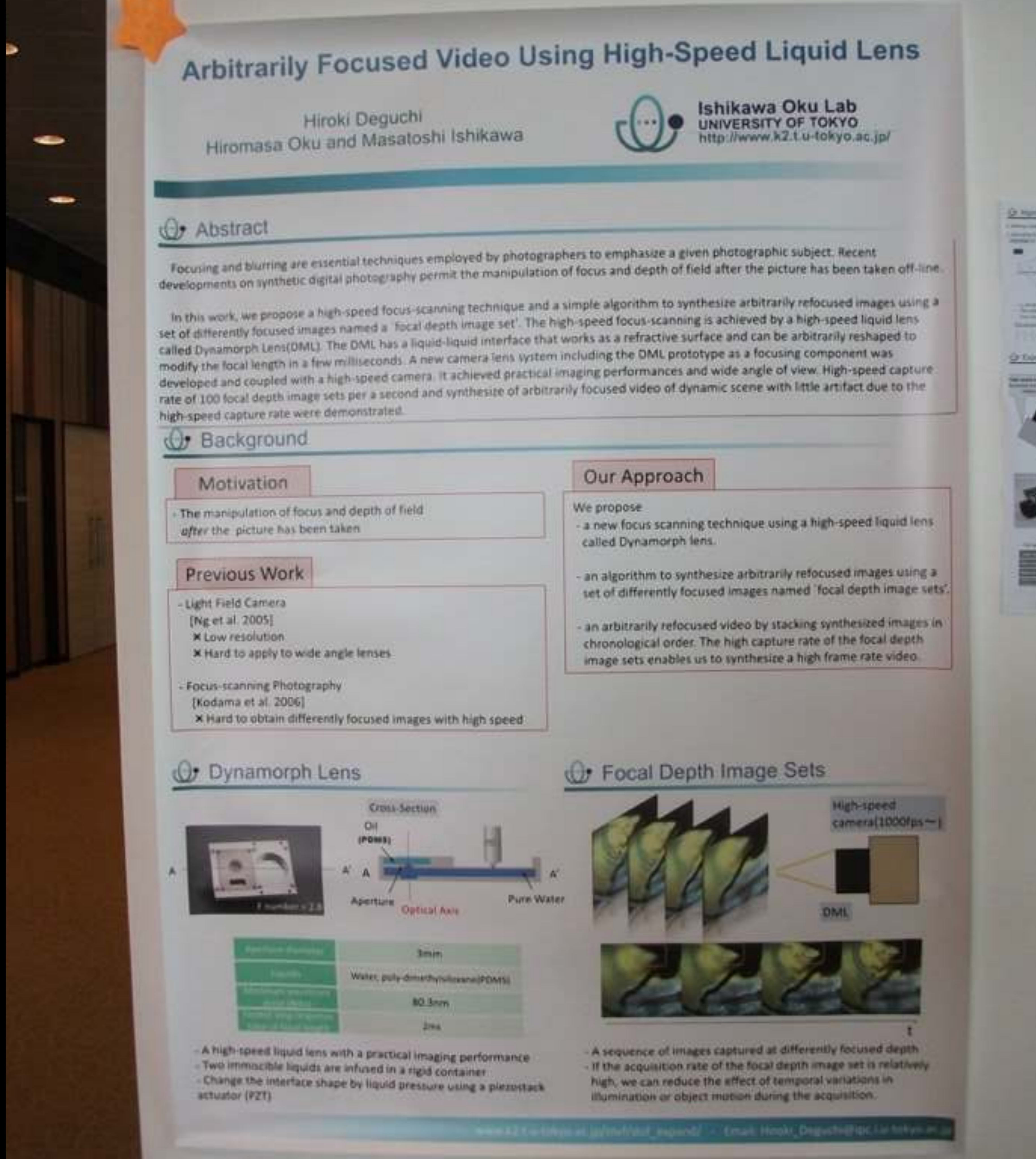
Overview
•Omni-Tube: A novel omni-directional (360-degree) interactive 3D display.
•Features:
-Display multi-view images without the requirement of special glasses.
-Overcomes the general limitation of viewing distance and angles for low-cost 3D display.
•Advantages:
-Ease of use.
-Low production cost.
-High portability and mobility.
•Design (two functional parts):
-Optical device: easily mounted to any commercial micro projector.
-Projection image transformation algorithm: manages the optical distortions.
Cylindrical Display
Micro Projector
Control Board
IR Motion Detector
Omni-Tube prototype system
Related Works
•High-speed rotary LED approach
•Multi-projector approach
Projection Image Convert Workflow
•Acquire Images: acquire images from all viewing points.
•Image Rectification: rectify image distortion caused by the cylindrical screen.
•Generate Position-Aware Image: generate a display image according to users' locations.
•Compose Background: optionally add the background.
Step 1: Acquire Images
Step 2: Image Rectification
Step 3 Generate Image
Step 4: Compose Background
System Optical Architecture
•Projection Supporter:
To counterbalance the inherent upward projection angle for any commercial micro projector.
•Lens & Mirror Group:
Consist of convex lens, flat mirror, concave lens, and conical mirror. It bends the rays more strongly and forces them to focus on the conical mirror.
•Display Material:
A special purposed diffuser and a special designed thick barrier sheet work together to produce different brightness attenuation according to different viewing angles.
Optical Architecture
360-degree Motion Detector
•Infrared Tx & Rx LED:
Eight sets of Tx/Rx IR LED were employed to measure reflection energy from cylinder surroundings.
•MCU control board:
Compute users' position and distance based on eight Rx.
The User Study
The specification of the current Omni-Tube system is shown below:
-Tube Size: Ø100 mm
-Tube Height: 150 mm
-Total Height: 210 mm
-Display Resolution: 72 ppi
-IR Sensor: 940 nm
-Motion Detection: 360 degree, <150 cm
-Prototype Cost: < $ 300 USD
Forty-five users were invited to our user study, and 89% of them were impressed with the Omni-Tube display and gave very positive feedback.
References

Poster



Arbitrarily Focused Video Using High-Speed Liquid Lens
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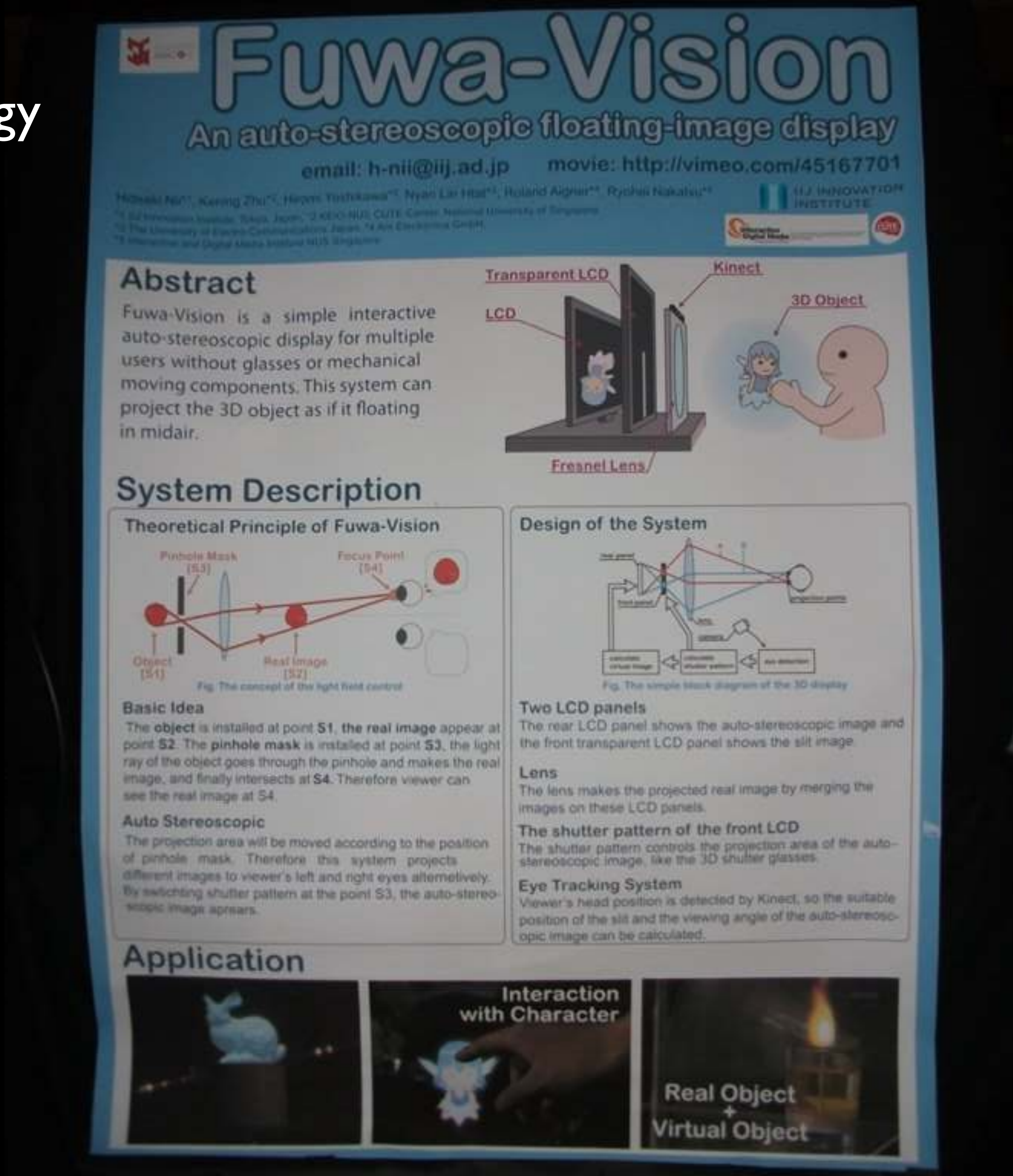
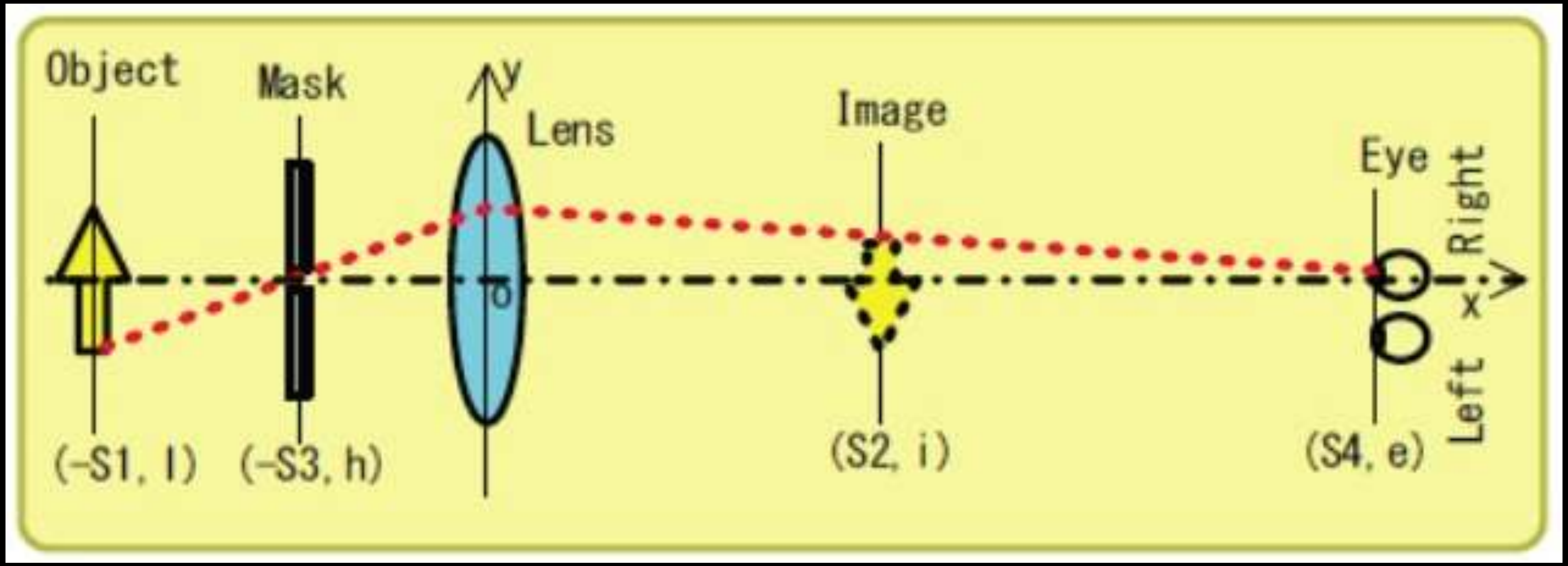
Abstract
Focusing and blurring are essential techniques employed by photographers to emphasize a given photographic subject. Recent developments on synthetic digital photography permit the manipulation of focus and depth of field after the picture has been taken off-line.
In this work, we propose a high-speed focus-scanning technique and a simple algorithm to synthesize arbitrarily refocused images using a set of differently focused images named a 'focal depth image set'. The high-speed focus-scanning is achieved by a high-speed liquid lens called Dynamorph Lens(DML). The DML has a liquid-liquid interface that works as a refractive surface and can be arbitrarily reshaped to modify the focal length in a few milliseconds. A new camera lens system including the DML prototype as a focusing component was developed and coupled with a high-speed camera. It achieved practical imaging performances and wide angle of view. High-speed capture rate of 100 focal depth image sets per a second and synthesize of arbitrarily focused video of dynamic scene with little artifact due to the high-speed capture rate were demonstrated.
Background
Motivation
- The manipulation of focus and depth of field after the picture has been taken
Previous Work
- Light Field Camera [Ng et al. 2005]
× Low resolution
× Hard to apply to wide angle lenses
- Focus-scanning Photography [Kodama et al. 2006]
× Hard to obtain differently focused images with high speed
Our Approach
We propose
- a new focus scanning technique using a high-speed liquid lens called Dynamorph lens.
- an algorithm to synthesize arbitrarily refocused images using a set of differently focused images named 'focal depth image sets'.
- an arbitrarily refocused video by stacking synthesized images in chronological order. The high capture rate of the focal depth image sets enables us to synthesize a high frame rate video.
Dynamorph Lens
Cross-Section
Oil (PDMS)
A
A'
Aperture
Optical Axis
Pure Water
3mm
Water, poly-dimethylsiloxane(PDMS)
80.3mm
2ms
- A high-speed liquid lens with a practical imaging performance
- Two immiscible liquids are infused in a rigid container
- Change the interface shape by liquid pressure using a piezostack actuator (PZT)
Focal Depth Image Sets
High-speed camera(1000fps〜)
DML
t
- A sequence of images captured at differently focused depth
- If the acquisition rate of the focal depth image set is relatively high, we can reduce the effect of temporal variations in illumination or object motion during the acquisition.

(a) (b) (c) (d)

Figure 1: *(a)One of synthesized images. (b),(c)and(d) are magnified views of synthesized image. (b)is a close-up of(a), focused on the ball. (c)is focused on the ant. (d)has a wide range of depth of field.*

Poster +
emerging technology



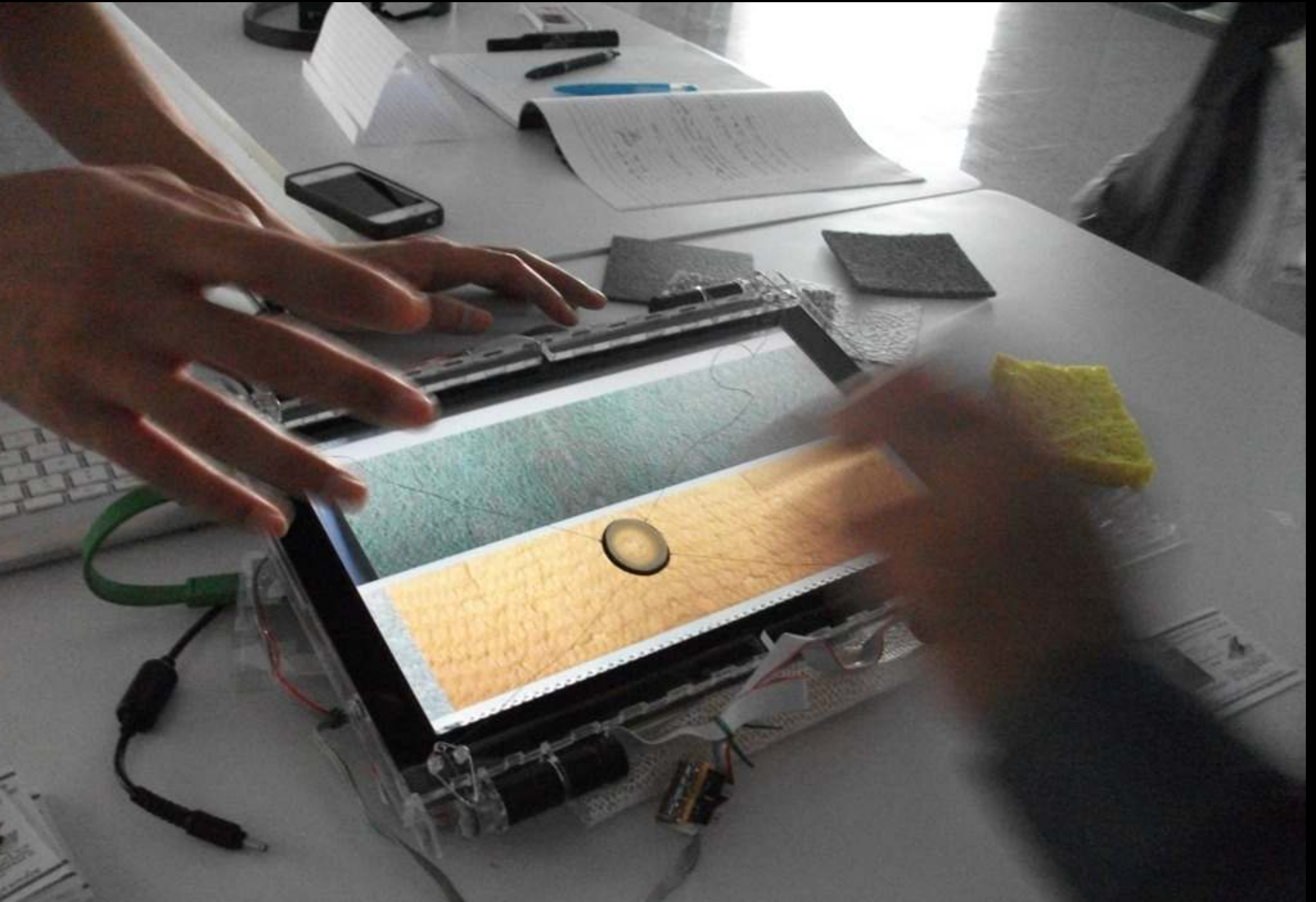


Object
Mask
y
Lens
Image
Eye
Right
Left
x
O
(-S1, l)
(-S3, h)
(S2, i)
(S4, e)

Poster +
Emerging technology


UAV

Emerging technology “theme”: touch



Papers: Video Enhanced Gigapixel Panoramas

- Add localised motion to gigapixel images.
- Video region may move across the image.
- Best of both worlds:
  - video has poor spatial resolution
  - gigapan images have poor temporal resolution.
- Key to the work is the video registration/blending, and their interactive viewer.

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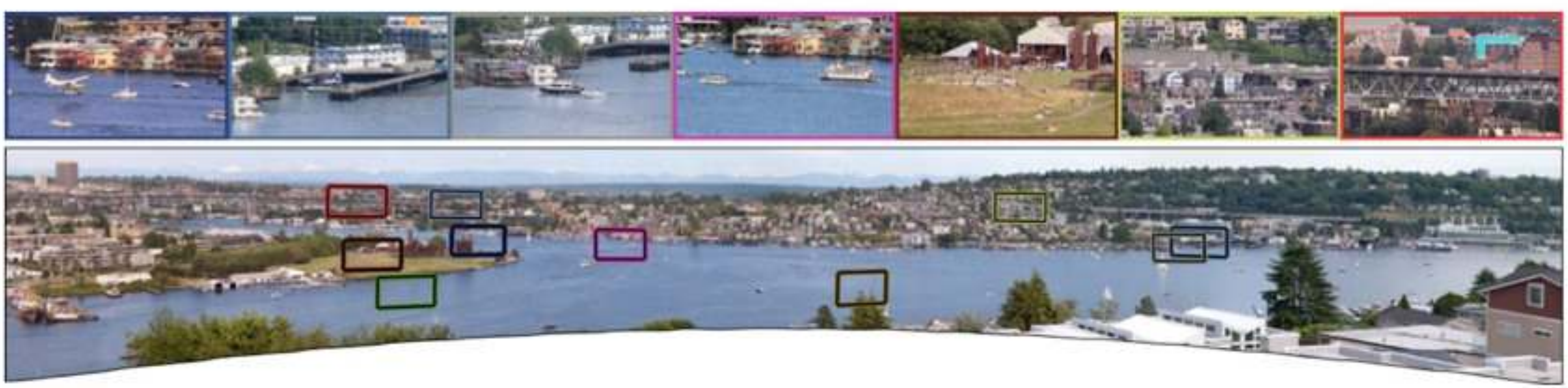

Figure 1: *A gigapixel image with integrated sparse video clips. Combining high-resolution images with embedded video (example frames in the top row) allows users to explore complex scenes in a new way.*


Canon 7D - 100 - 400mm Variable Zoom

Papers: Real or Fake? Human Judgments about Photographs and Computer-generated Images of Faces

- Determine factors that cause people to to perceive images as real or CG.
- Concentrated on faces
- Outcomes
  - help cognitive scientists discover the mechanisms that underlie judgements of realism
  - help CG artist create more realistic characters
  - improve computational models in image forensics
- “One key finding was that participants discriminated between photos and CG images best for original images, less well for grayscale images, and worst for reflectance images. This suggests that shading may be more important than colour for judgments about visual realism.“
- Also experts outperformed non-expert but only for greyscale images.

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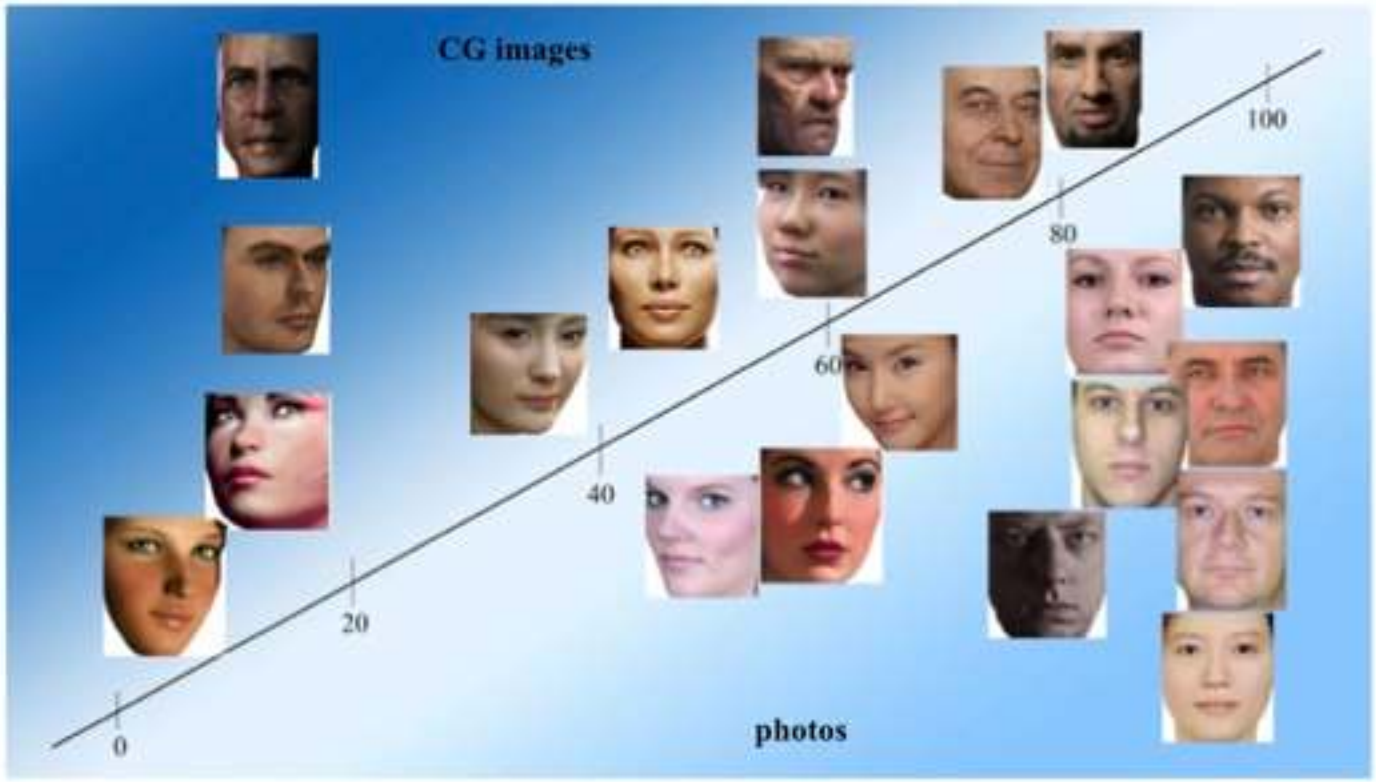

Figure 1: *A psychophysical experiment explored factors underlying human judgments of visual realism for face images. The figure shows subjective realism score of 10 photo-realistic computer-generated (CG) images and 10 photos of faces. CG images are above the scale and photos below it. Overall, photos were judged to be more realistic than CG images.*




Our aim is to identify factors that influence visual realism for images of faces




Which of them are real? Which are fake?

Paper: Data driven finger motion synthesis for gesturing characters

- "In a controlled environment, we carefully captured and post-processed finger and body motions from multiple actors. To augment the body motions of virtual characters with plausible and detailed finger movements, our method selects finger motion segments from the resulting database taking into account the similarity of the arm motions and the smoothness of consecutive finger motions."
- "Our key observation is that plausible finger motions can be inferred from the wrist motion."

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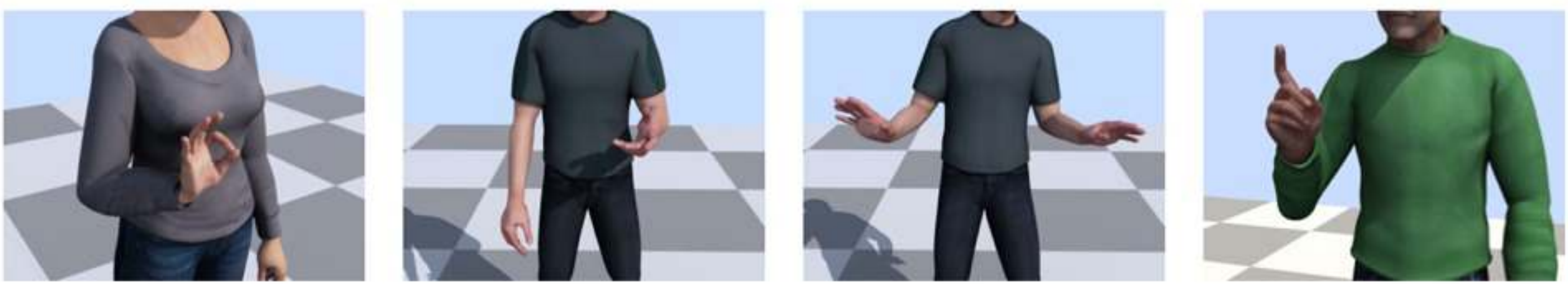

(a) (b) (c) (d)

Figure 1: *Animations with synthesized finger motions: (a) ok gesture, (b)-(c) extracts from a conversation, (d) attention gesture.*

Art + emerging technology

Siggraph Asia in Hong Kong in 2013

Tuesday November 19 - Friday November 22