UNIVERSITY OF CAPE TOWN
Department of Computer Science

Proposal for evaluating the effectiveness of semaphoric-tangible and virtual reality interfaces for a previsualisation activity

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PREVIZ
2015

Animation process

storyboard → **production**

Animation process

storyboard → production

Animation process

storyboard → previz → production

Previsualization

A low-fidelity (rough) animation used to plan:

- scene arrangement
- camera angles
- timing

Previsualization

User defines a sequence of **keyframes**.

The system **interpolates** the keyframes to generate a rough animation.

Task analysis

- Model placement
- Camera placement
- Keyframe CRUD (create/read/update/delete)
- Timeline navigation

Users

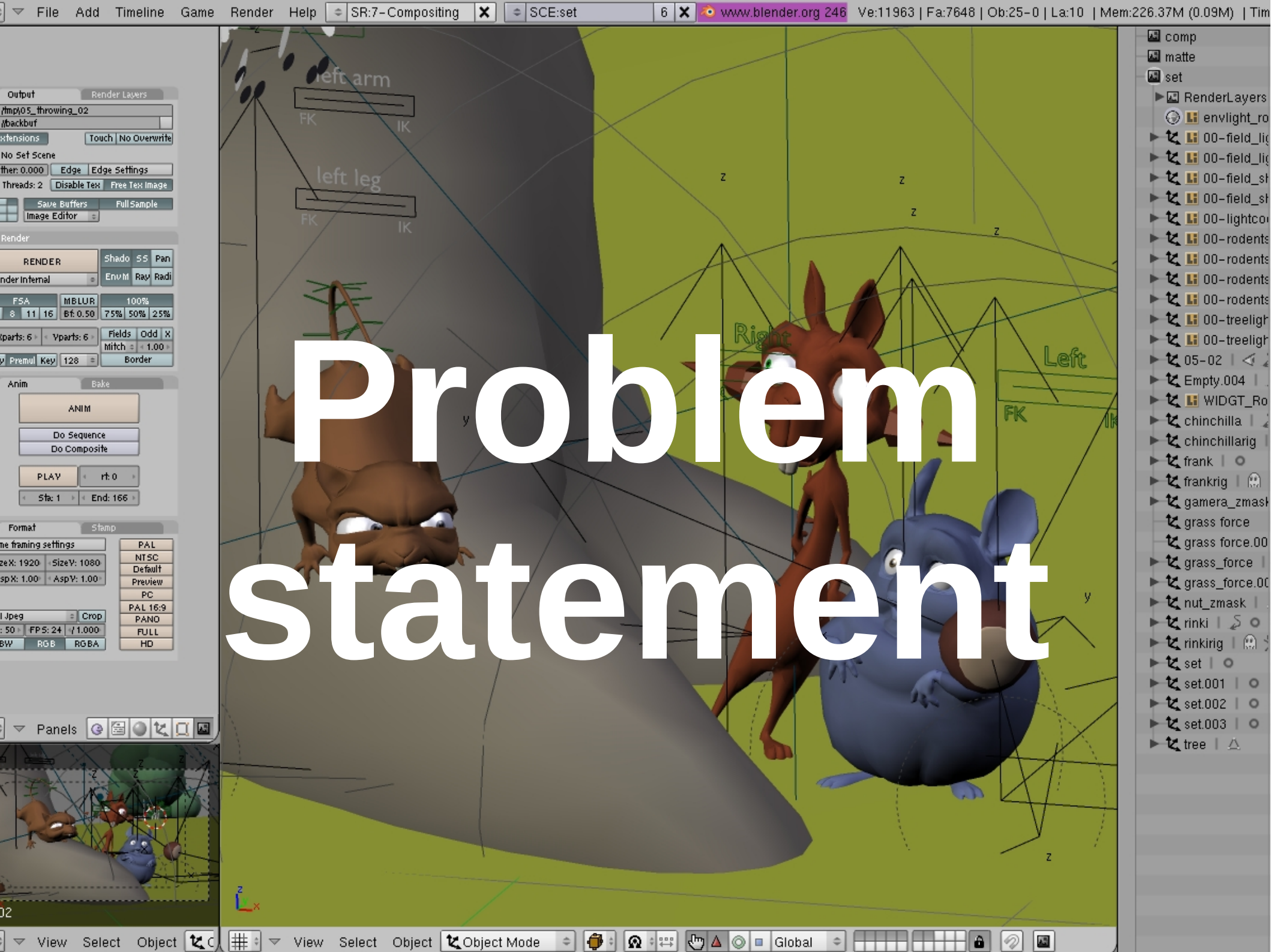
Existing

- Trained animators

Potential

- Directors
- Producers
- Casual users

(No training in traditional WIMP-based software.)


File Add Timeline Game Render Help
SR:7-Compositing
SCE:set
www.blender.org 246
Ve:11963 | Fa:7648 | Ob:25-0 | La:10 | Mem:226.37M (0.09M)
Output
Render Layers
RENDER
Anim
Bake
ANIM
Do Sequence
Do Composite
PLAY
Format
Stamp
left arm
left leg
FK
IK
Right
Left
comp
matte
set
RenderLayers
Problem statement
View Select Object
Object Mode
Global

Problem statement

Traditional animation software:

- requires **training**
- **constrained** to deskbound mouse and keyboard interactions

Is there an alternative?

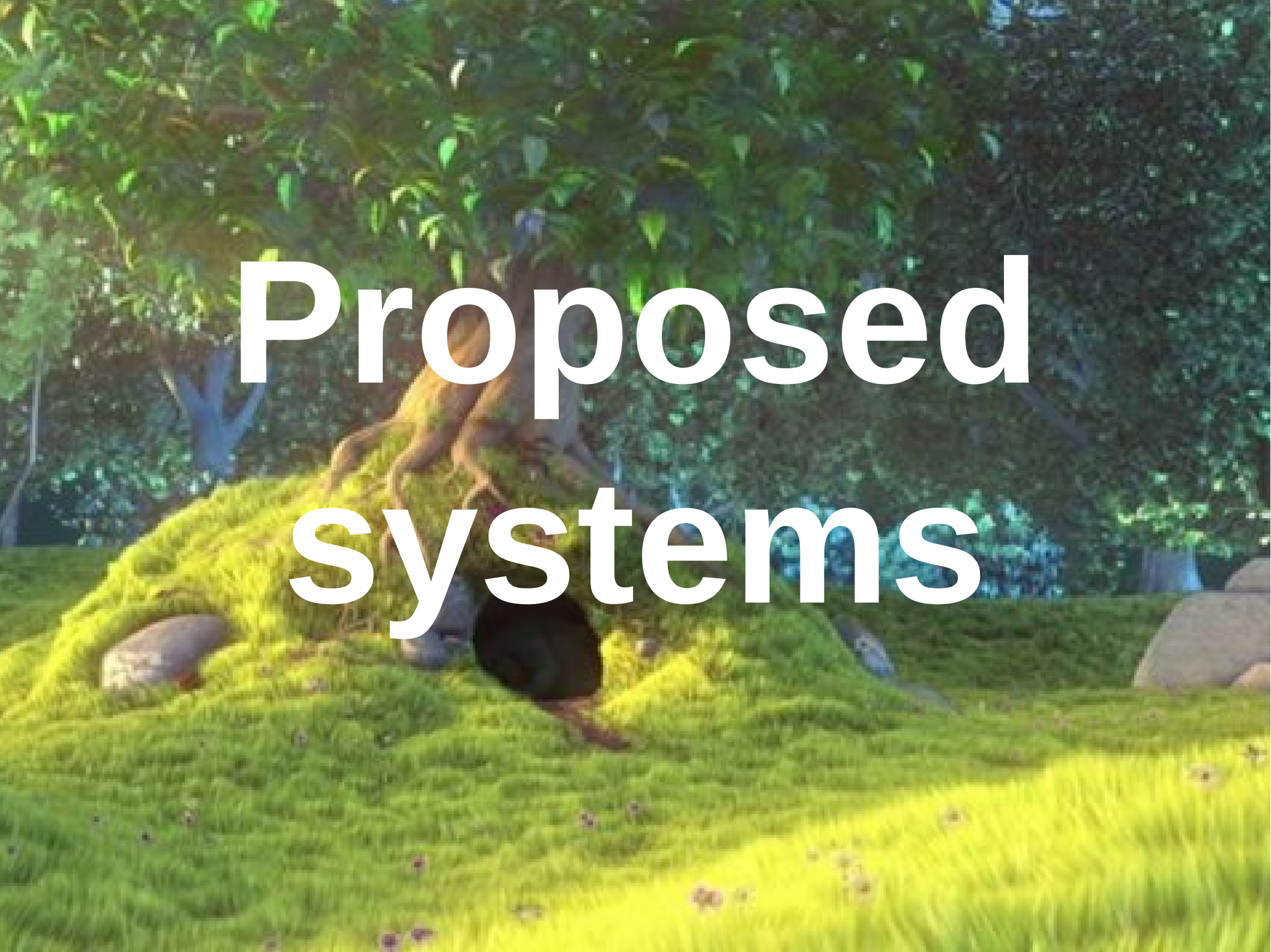
Proposed alternatives

Virtual reality (VR)

- places user in 3D virtual environment
- immersive and natural interactions

Tangible user interface (TUI)

- user manipulates data by manipulating physical object


Proposed
systems

Virtual reality

- User wears a **head-mounted display**
  - Oculus Rift DK2
- User **immersed** in the virtual scene
- Manipulates scene using input device
  - Input device undecided

Related work

- Large amounts of research into 3DUIs with VR
- 3DUIs are **efficient and natural**
  - Headmounted displays [Butterworth et al. 1992]
  - CAVE-based [Hughes et al. 2013, Ponto et al. 2013]

Related work

Problems identified

- Focused on 3D modelling task
- Trained participants
- Text/numeric data capture is difficult
  - alleviated by combined 2D/3D input [Wang and Lindeman 2014]

Tabletop system

- **3D printed models** and model camera
- Models placed on tabletop
- **Vision sensor** registers positions
- User controls system with **semaphores**
- Simple GUI displays results

Related work

- Multimodal interfaces **free the user** to focus on the operational task [Oviatt et al. 2004]
- Tangible interfaces are **easy to learn and use** (and well-researched) [Ishii 2008]
- Semaphoric modality is **complementary** [Jacob 2007]

Comparison

- Base WIMP system
- Compare alternate systems to base system

Stretch goal

- Compare alternate systems to one another


Experiments

Research questions

Hypothesis 1

Each interface will generate **fewer user errors** than the WIMP interface.

Hypothesis 2

Users will report that each interface is **more usable** than, and preferable to, the WIMP interface.

Hypothesis 3

All subtasks will take **more time** with an alternate interface compared to a WIMP interface.

Evaluation

Preliminary evaluation (completed)

- confirms user acceptance

Iterative user-centred development

- 3 development cycles
- First cycle: Heuristic evaluation by 3-5 HCI experts
- Remainder: Evaluation by industry experts

Evaluation

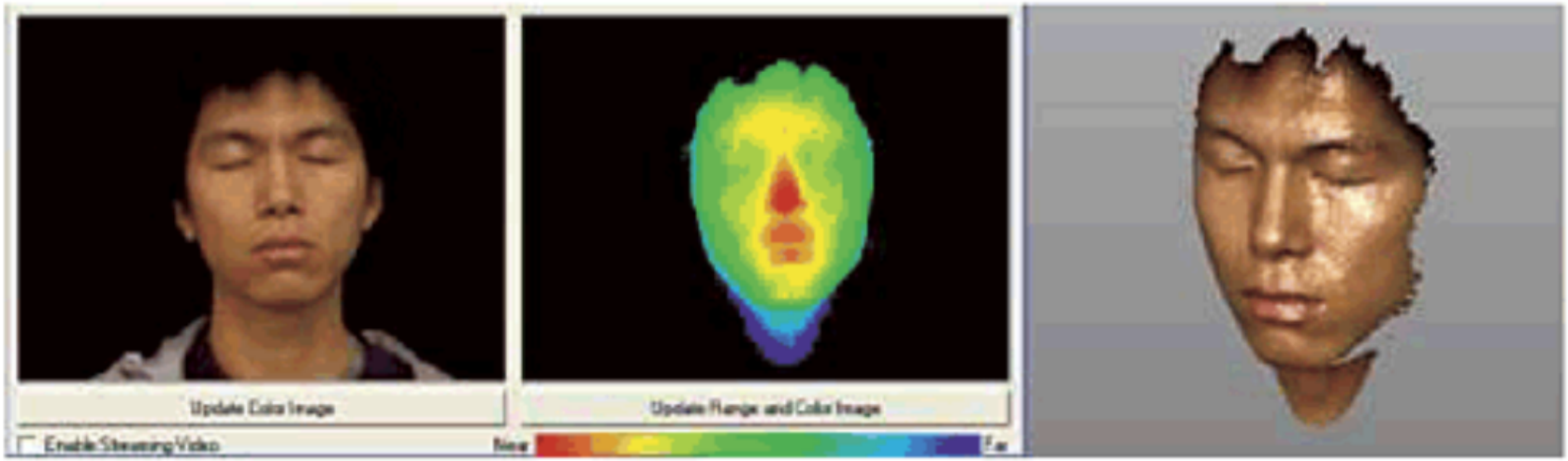
Final user evaluation

40 non-animators perform the same activity, made up of multiple animation subtasks.

We will be measuring:

- Time taken
- Error rate (undos)
- Usability
- Correctness of final animation

Vision subsystem



[Lu et al. 2007]

Vision subsystem

- High-fidelity, time-of-flight Kinect for Xbox One range sensor
- Surface-model registration
- Iterative closest point algorithm
  - Appropriate coarse registration
  - Time-of-flight noise model
  - Sensor-specific distortion map

Research questions

Hypothesis 1

At a range of 5–6m, the sensor will be able to correctly register a single 3D printed model.

Hypothesis 2

At the same range, the sensor will register multiple 3D printed models.

Hypothesis 3

At the same range, the sensor will re-register multiple 3D printed models after occlusion by a human subject.


Project
planning

Implementation strategy

- Initial design informed by **well-established research** areas
- Task analysis performed for paper prototype
- **Core functionality** implemented in base WIMP system
- **Iterative development cycle** for alternate systems

Development platform

Choices driven by **hardware compatibility** and **team knowledgebase**...

Development platform

Oculus

Myo

unity 5

Windows® 8

Challenges and risks

- Eskom
- Team coordination
- Code coordination
- Relatively new hardware and SDKs
  - Hardware requirements
- Appropriate assets
  - 3D, printable, compatible
  - Big Buck Bunny

Code ownership

reusable code, repeatable experiment, less paperwork

Ethical issues

- Low-risk experiments
- Simulation sickness (nausea)
  - informed consent

Project plan

- Base WIMP system
  - functionality baseline
- Rapid iterative development
- Emphasise feasibility milestone

Questions?

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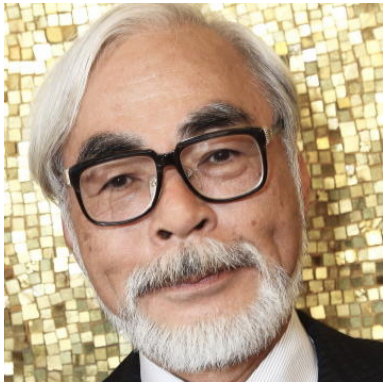
Peter Ramsey
Rise of the Guardians

Nina Paley
Sita Sings the Blues

You?

Jennifer Lee
Frozen



Hayao Miyazaki
Spirited Away

Participate in our experiment to find out!