



THE HONG KONG
UNIVERSITY OF SCIENCE
AND TECHNOLOGY

DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

A Live Storytelling Virtual Reality System with Programmable Cartoon-style Emotion Embodiment

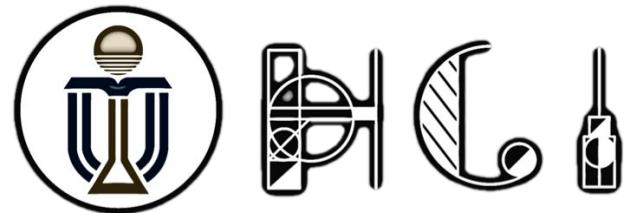
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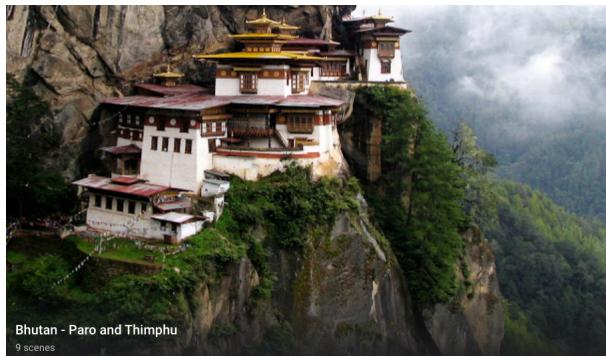


A Motivative Example



National Museum of the American Indian

Google VR Tour: Affordable VR Experiences



<https://arvr.google.com/tourcreator>

Engaging Experience with a Humorous Docent



How to Bring it into Virtual Space?

- Emotion embodiment
 - Expensive motion tracking
 - Delicate performing



Cartoon Animation and Comics

- Motivated by artists' practice



Goro Fujita
@gorosart

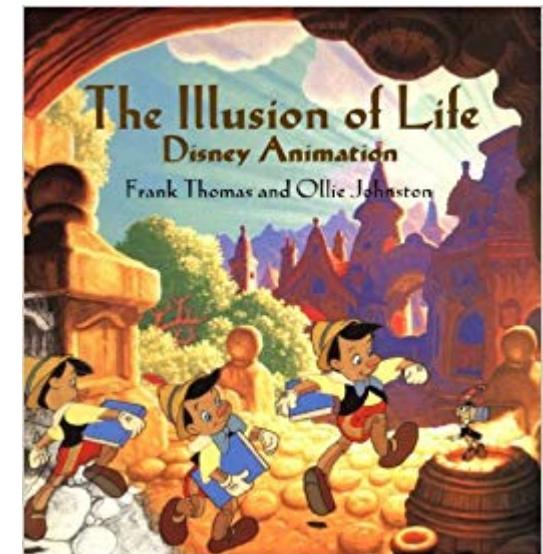
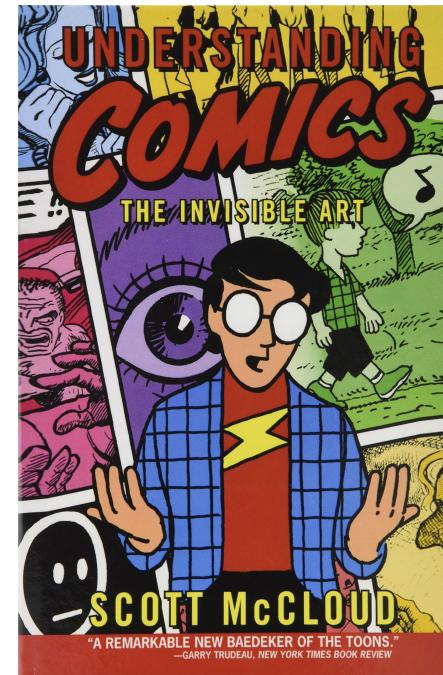
I'm now convinced that VR comics will be a thing! :D
Took a dragon ball page and made a #VR #Quill version
of it. Check it out in VR in #FacebookSpaces!

[翻译推文](#)

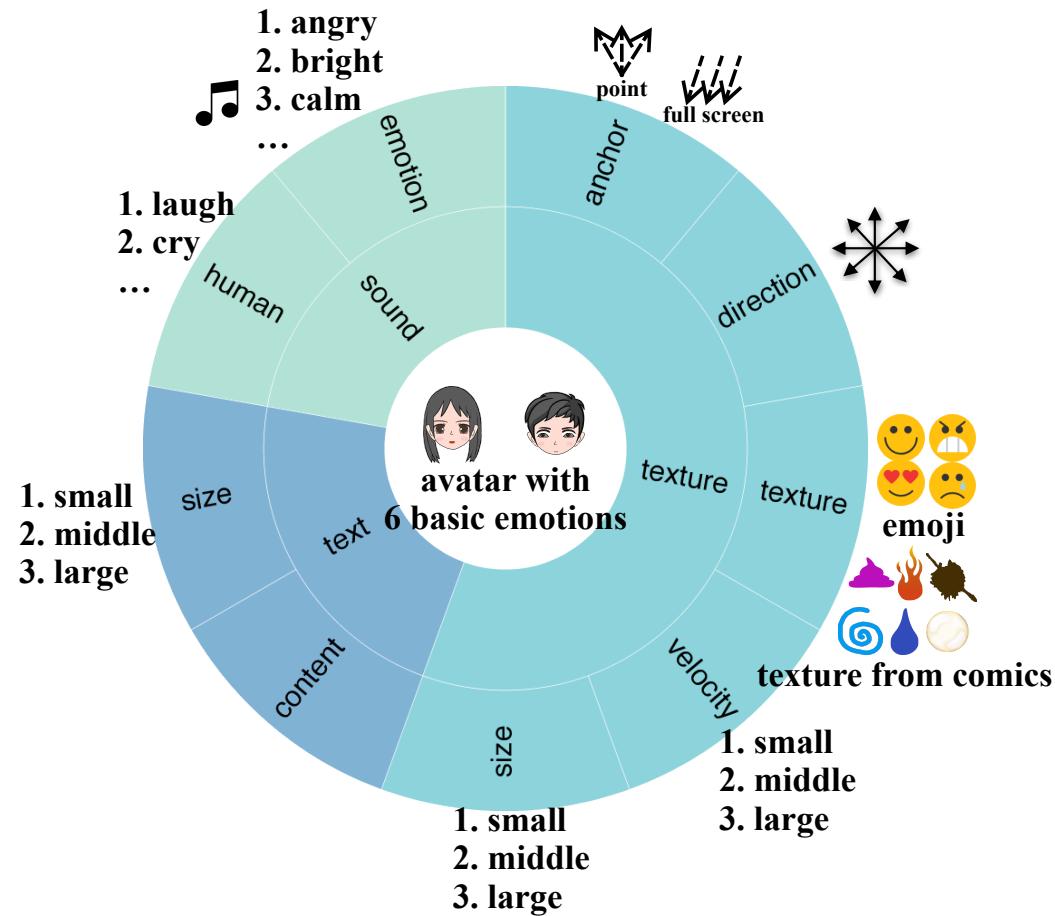


Cartoon Animation and Comics

- Design requirements from common methods in comics (McCloud, 1993) and cartoon (Thomas & Johnston & Thomas., 1995)
 - Clearly defined emotional state
 - Iconic abstraction of emotional meanings
 - Use multi-modalities to express an emotion



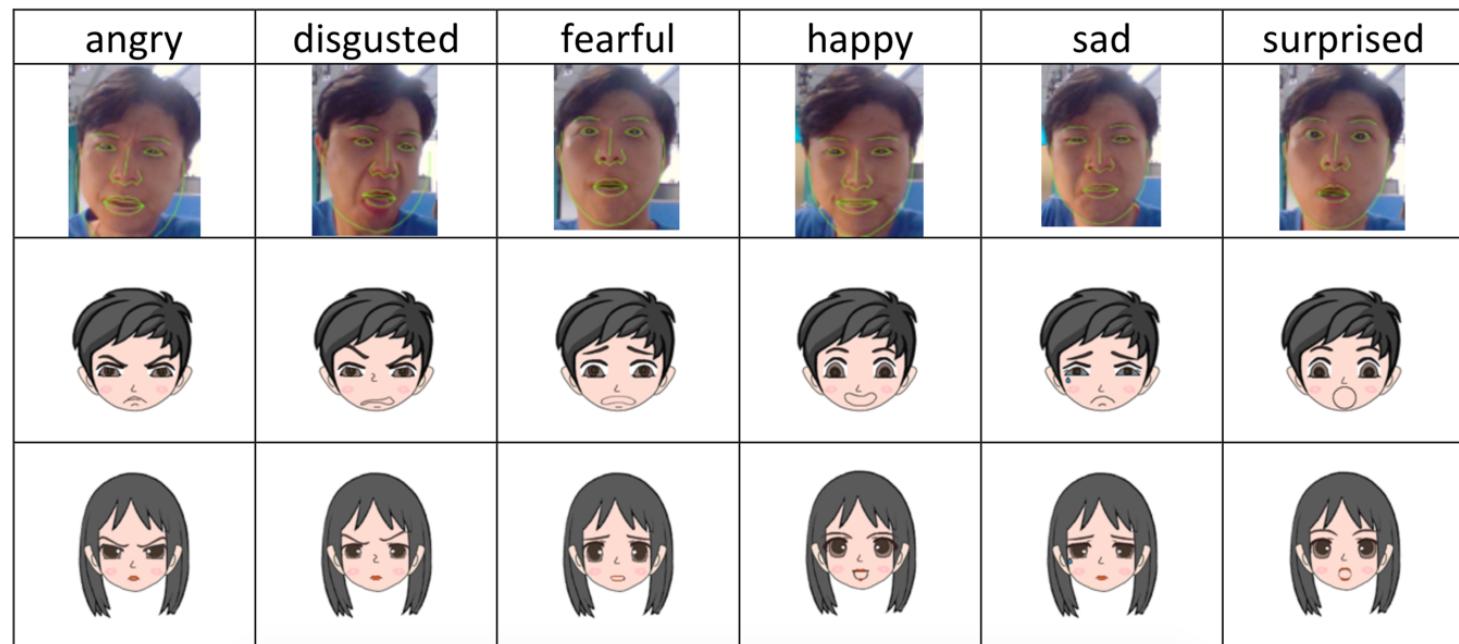
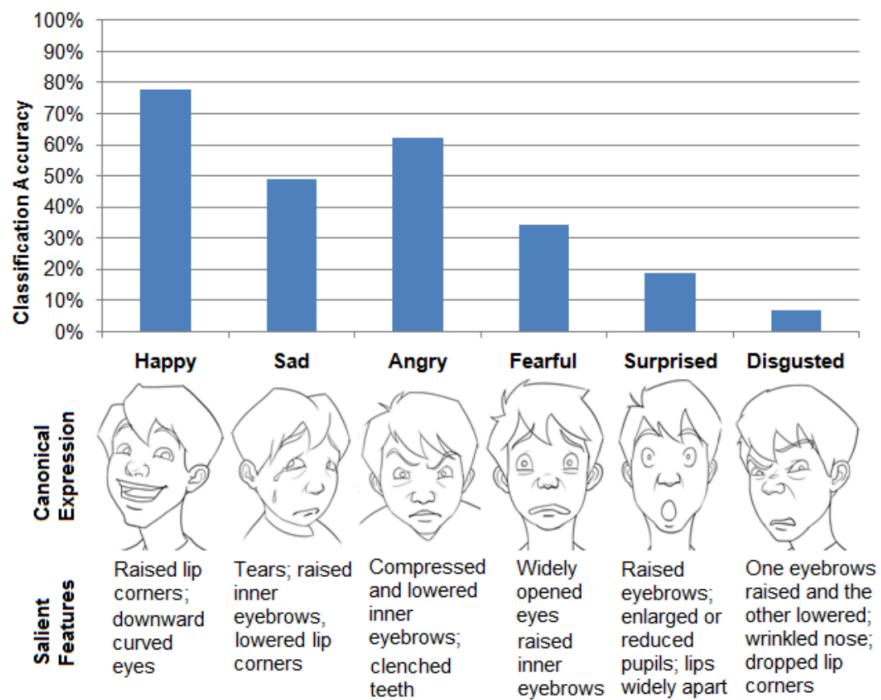
Cartoon Animation and Comics



Cartoon Animation and Comics

- Facial expression of avatar

➤ Ekman's six basic emotions (features summarized from Ma et al., 2012)



Cartoon Animation and Comics

- Auxiliary multimodal display

➤ Texture

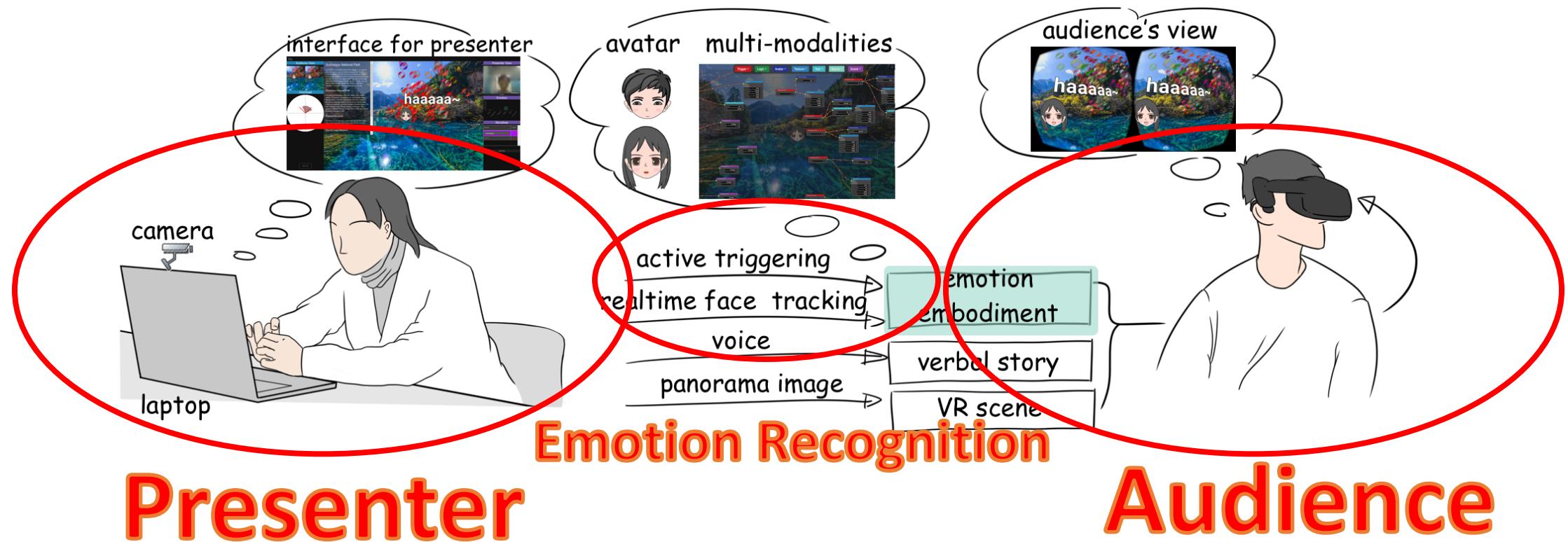
➤ Text

➤ Sound

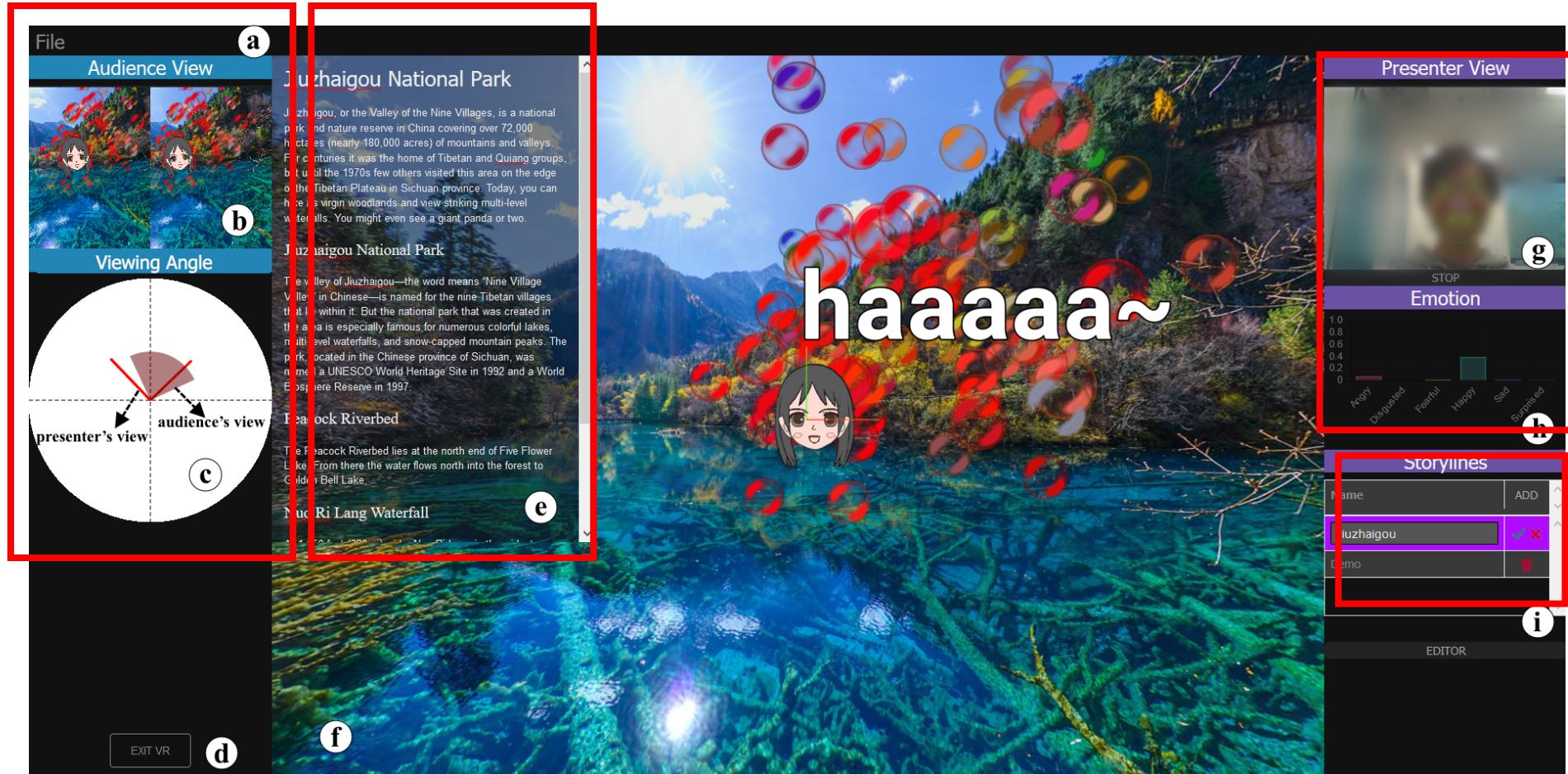


Tracks	Genre	Mood	Instrument	Duration	Attribution	Search music	Filter
▶ Because For Everything There Is Someone NEW	3:56	pATCHES			Ambient Dark		Download
▶ Cicada Killer NEW	2:06	Coyote Hearing			Cinematic Dark		Download
▶ The End NEW	2:54	Coyote Hearing			Cinematic Dramatic		Download
▶ Lulu Is the Cat I Like Best NEW	3:59	pATCHES			Ambient Inspirational		Download
▶ Ripe NEW	2:07	LATASHÁ			Hip Hop & Rap Funky		Download
▶ Candelabra NEW	2:18	LATASHÁ			Hip Hop & Rap Dramatic		Download
▶ Castille Soap NEW	3:13	LATASHÁ			Hip Hop & Rap Happy		Download
▶ Sunshower NEW	2:13	LATASHÁ			Hip Hop & Rap Calm		Download

System for Supporting Emotion Embodiment

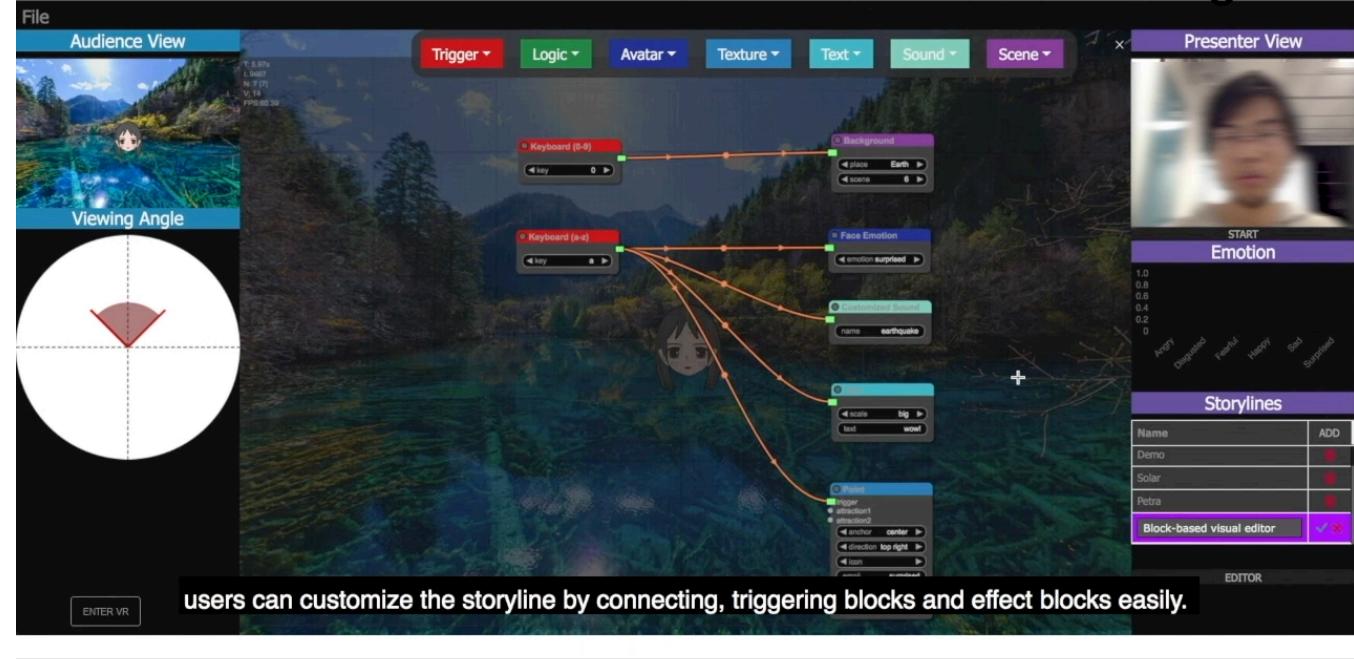


Interface for Presenter



Visual Programming

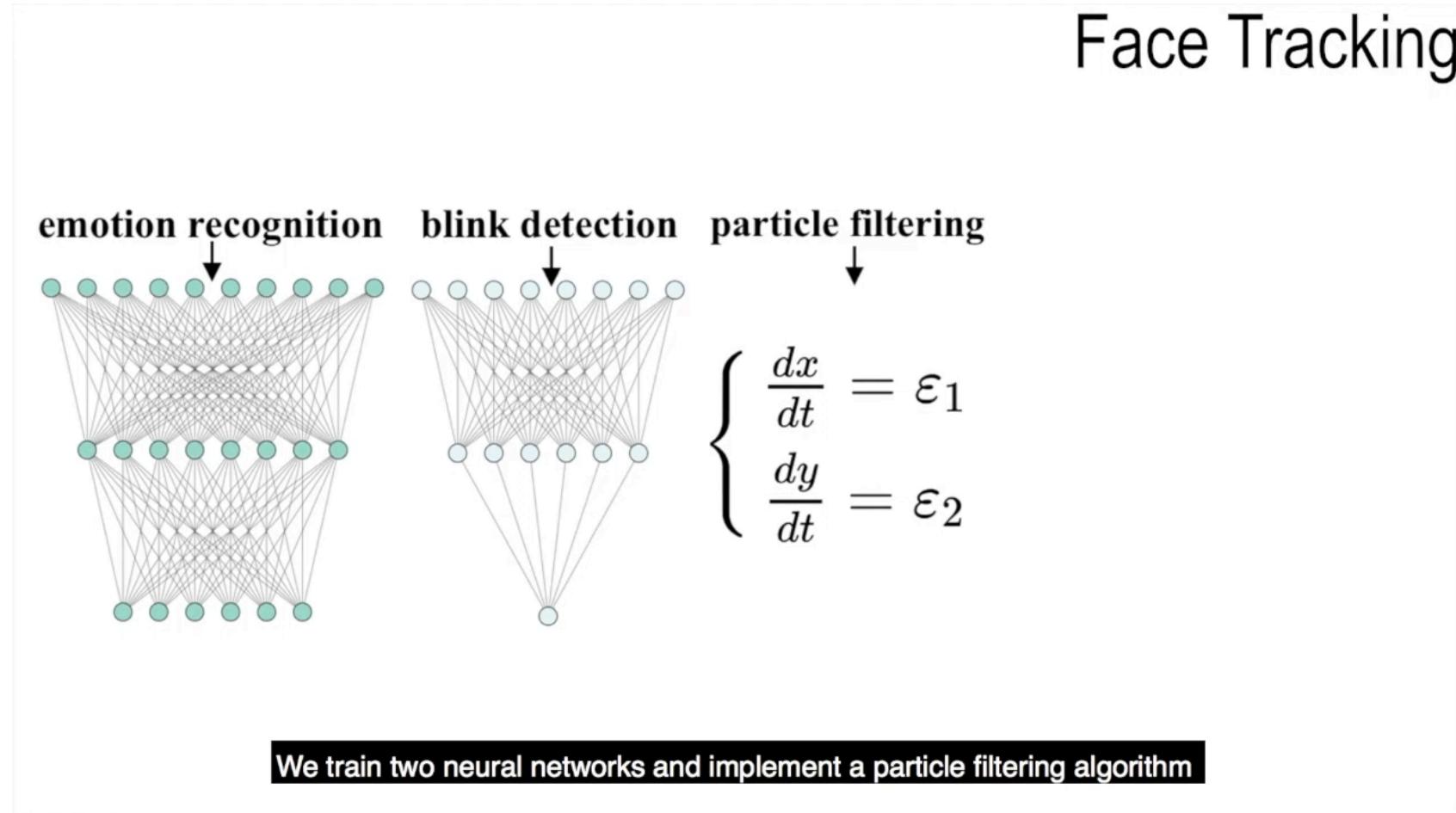
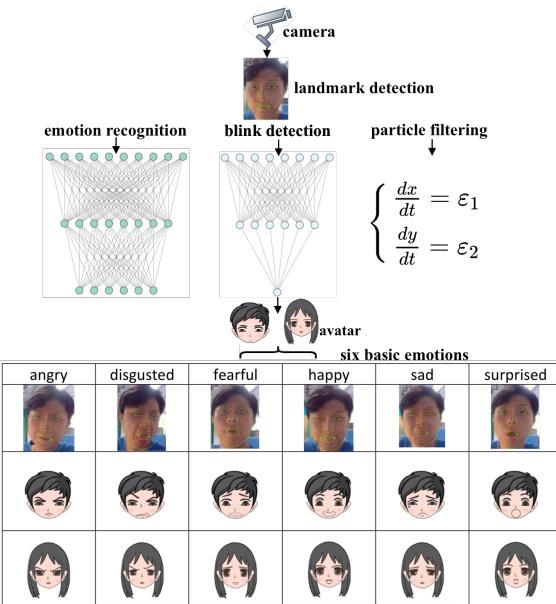
Blocked-based Visual Editing Tool



Triggering	
Keyboard	send a triggering signal by pressing 0-9, a-z, or A-Z
Mouse	send a triggering signal by pressing left or right mouse button
Counter	send a pre-set number of triggering signals
Facial Expression	send a triggering signal when the selected emotion is detected
Logic	
And	send a triggering signal when all inputs are triggered
Or	send a triggering signal when any input is triggered
Avatar	
Emotion	change the facial expression of the avatar
Position	change the position of the avatar
Role	change the role of the avatar, boy or girl
Reset	reset the position of the avatar to the center of the view
Texture	
Point	create a point texture
Full Screen	create a full screen texture
Attraction	create an attraction point to decorate the effects of a kinetic texture
Text	
Text	create a configurable text
Sound	
Human	configurate human sound
Customization	configurate emotion sound
Scene	
Background	change background image
Rotation	rotate the scene

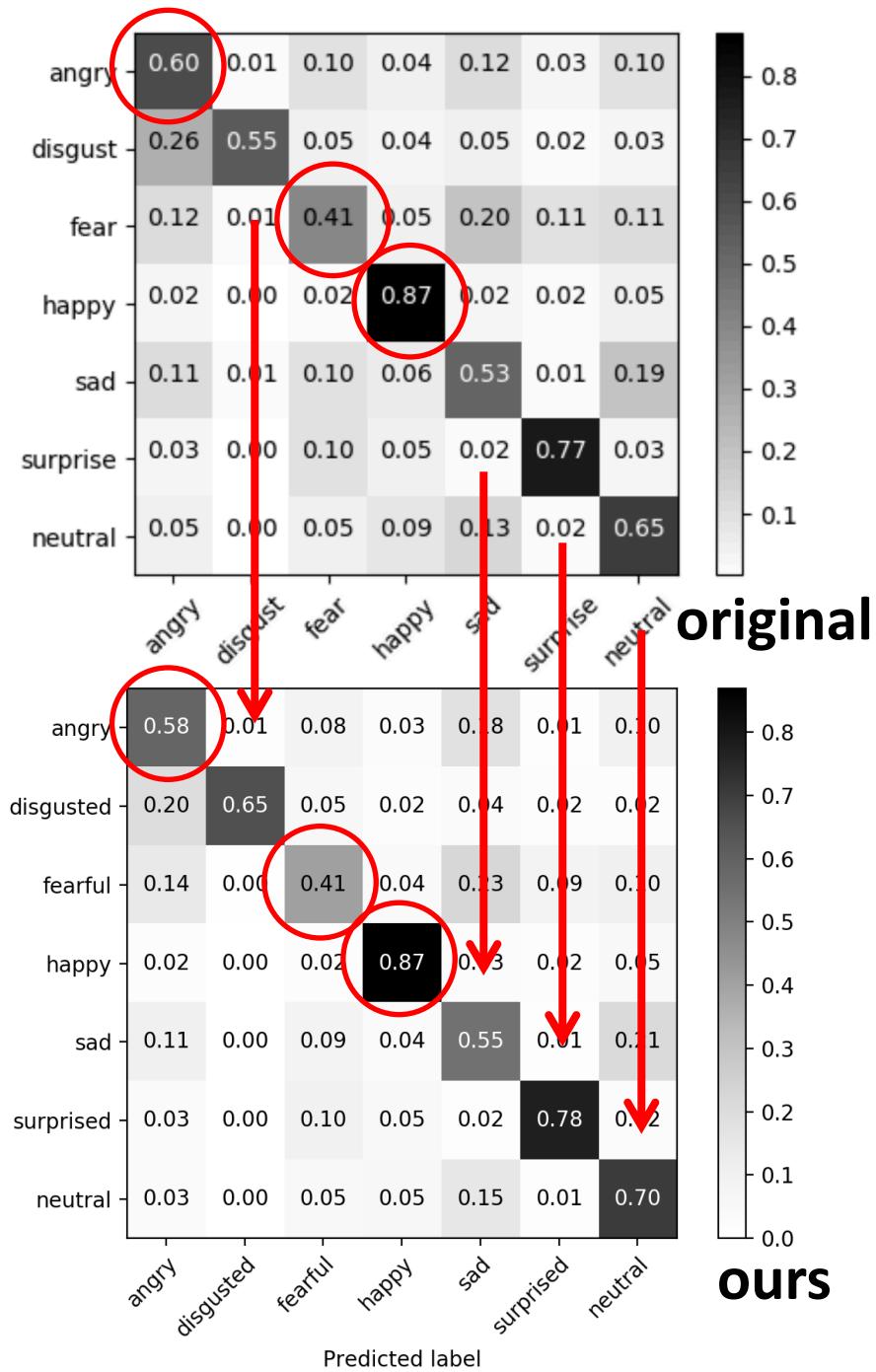
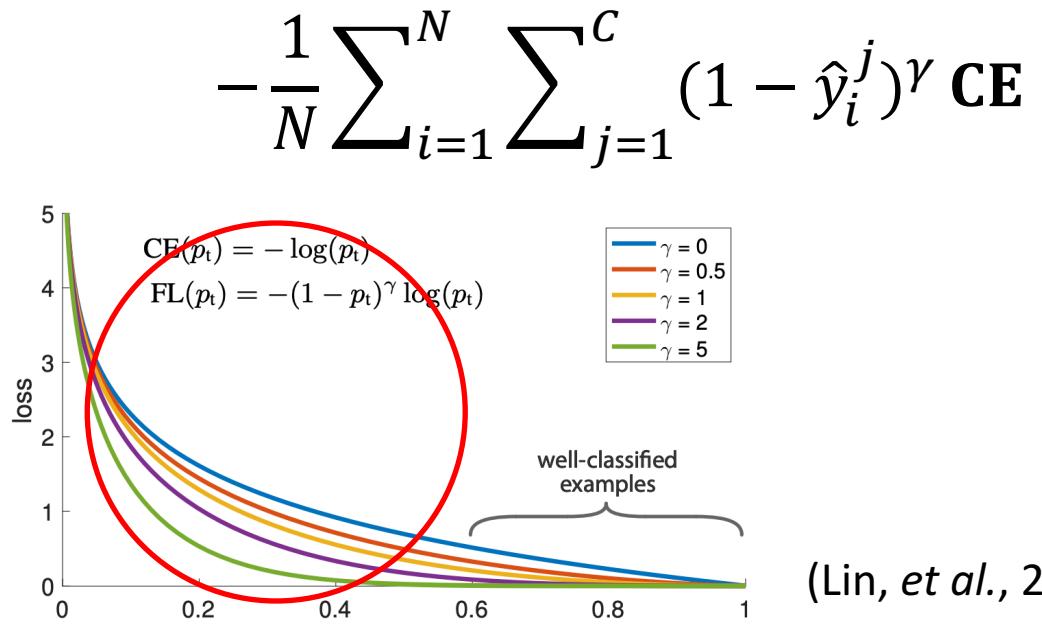
Face Tracking

- Emotion recognition
- Blink detection
- Position tracking



Face Tracking

- Emotion recognition
 - FER2013 dataset
 - Multi-class focal loss (unbalanced training)



Face Tracking

- Blink detection
 - CEW blink detection dataset
 - VGG16
 - 96% accuracy
- Position tracking
 - Particle filtering

$$\begin{cases} \frac{dx}{dt} = \varepsilon_1 \\ \frac{dy}{dt} = \varepsilon_2 \end{cases}$$

User Evaluation

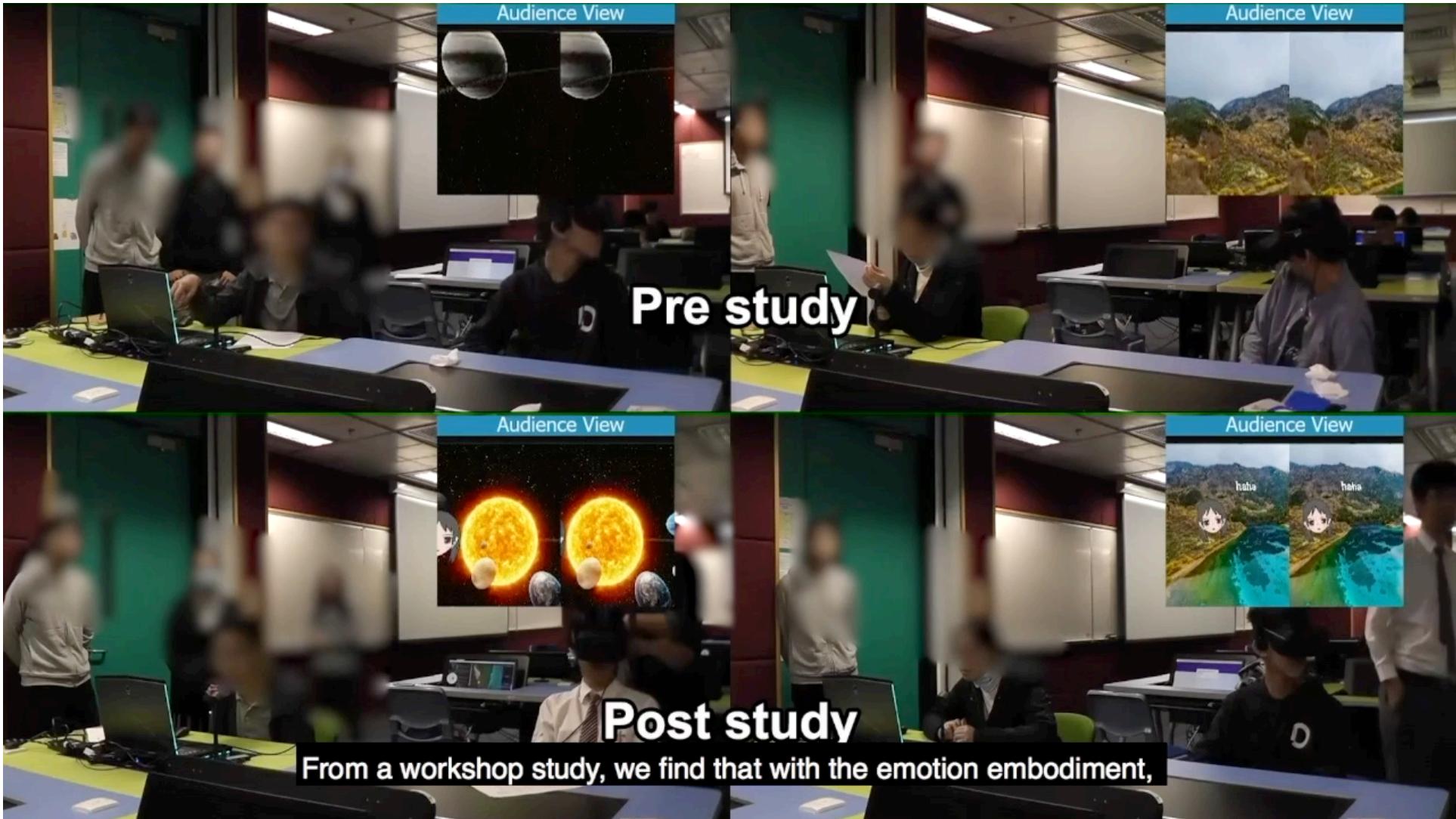
- Expert interview
- Workshop study

User Evaluation

- Expert interview
 - Semi-structured interviews with three experts
 - ✓ E.1: four years of live audio-visual performing experience
 - ✓ E.2: industrial visual designer for three years
 - ✓ E.3: cartoon making with graphics software for four years
 - Findings
 - ✓ Emotion expressing: "*In current live streaming platforms, people love to use emojis, or kaomojis, to directly express emotions. The movements of emojis can evoke audiences' emotional resonance easily.*"-E.1
 - ✓ Visual programming: "*I always use touch designer to pre-edit audio-visual effects before my performance. Compared to writing code manually, node programming (block-based visual programming) has a shorter development cycle, and is more convenient and flexible for people who are not coding experts. For example, when I construct some functions, I can easily modify previously edited modules by adding or removing blocks, and it would be a disaster if I have to modify it by typing lines and lines of code.*"-E.1
 - ✓ Face tracking: "*I will use the emotion recognition function. I think other people would too. We always like to try things with minimal mental efforts. Controlling things with facial expressions is a perfect example of that.*"-E.1

User Evaluation

- Workshop study
 - Workshop: *emotion embodiment for live storytelling in VR*
 - Participants
 - Five students (aged 16) and one teaching assistant (TA, aged 22) from a local secondary school
 - Procedure (pre-test and post-test study method)
 - Welcoming and introduction
 - Storytelling without emotion embodiment (pre-test)
 - Emotion embodiment training
 - Storytelling with emotion embodiment (post-test)

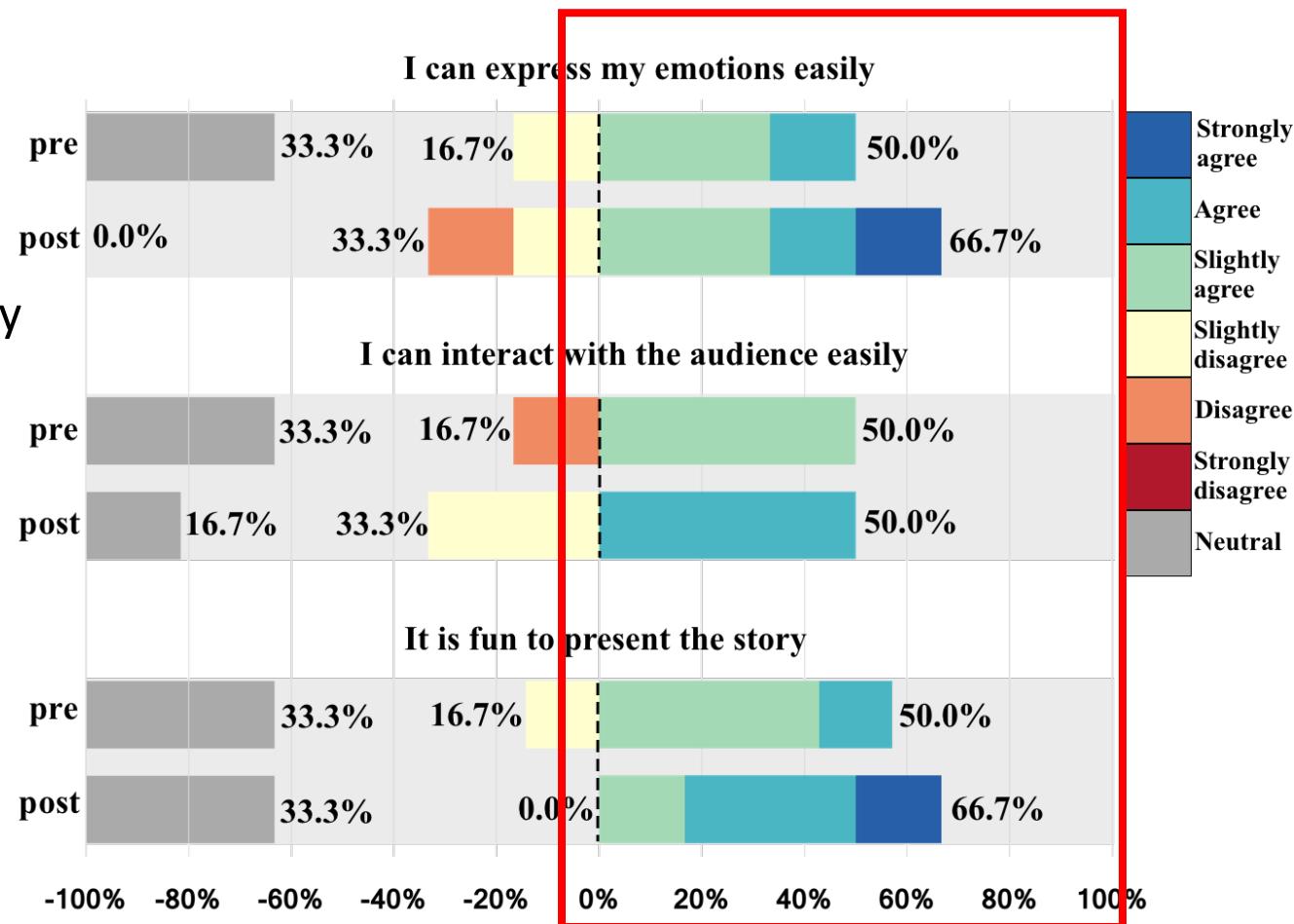


User Evaluation

- Workshop study

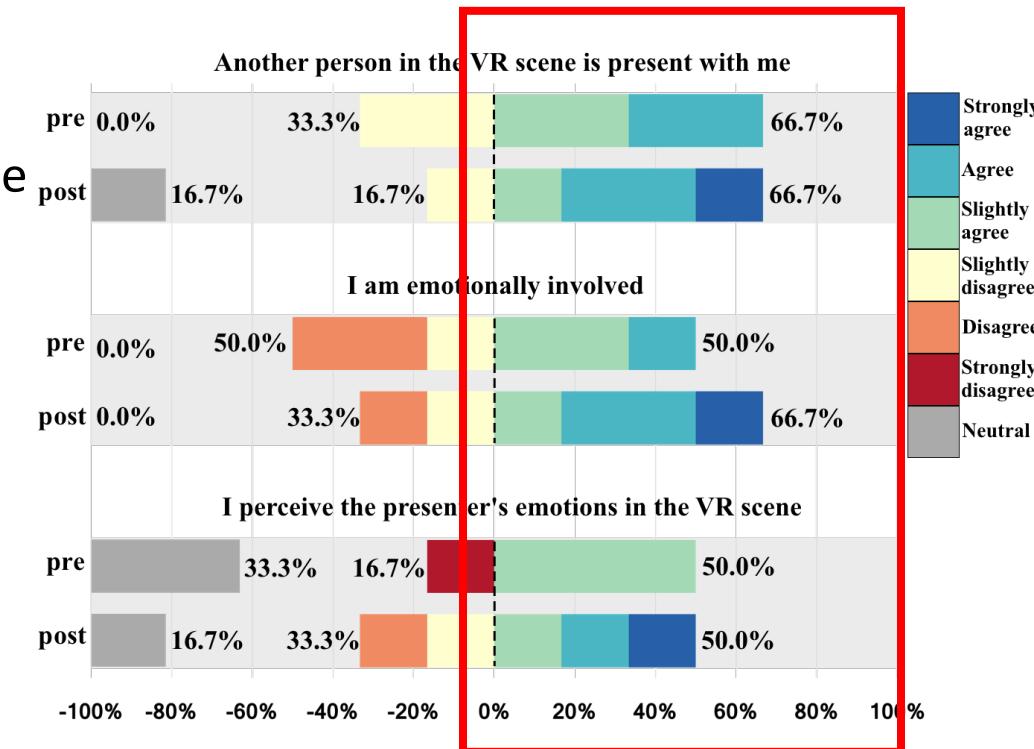
- Presenter

- ✓ I can express my emotions easily
 - ✓ I can interact with the audience easily
 - ✓ It is fun to present the story



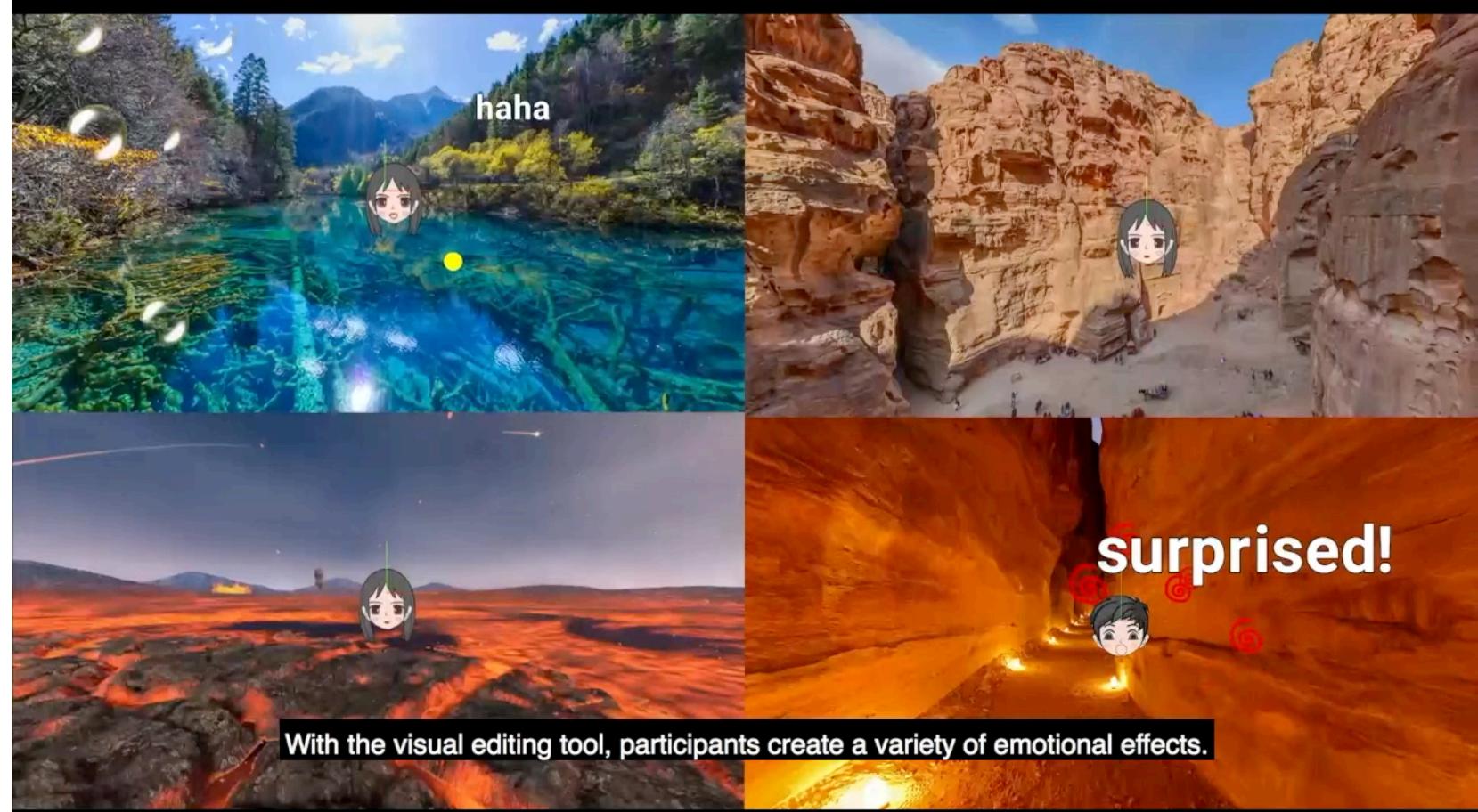
User Evaluation

- Workshop study
 - Audience
 - ✓ Another person in the VR is present with me
 - ✓ I am emotionally involved
 - ✓ I perceive the presenter's emotions in the VR scene



User Evaluation

- Workshop study
 - Participants' creation



Design Considerations (Social Interaction)

- Support emotional communication is important for social interaction in VR
 - Provide functions to allow users to import self-made assets
 - Users want to configure appearances of avatars themselves
- New functions like face tracking is usually welcomed by users, but we need a more robust solution
- Better human-AI collaboration solution is needed when algorithms are used to support social interaction

Limitations

Conclusion and Future Works

Thank You



source code & ppt

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