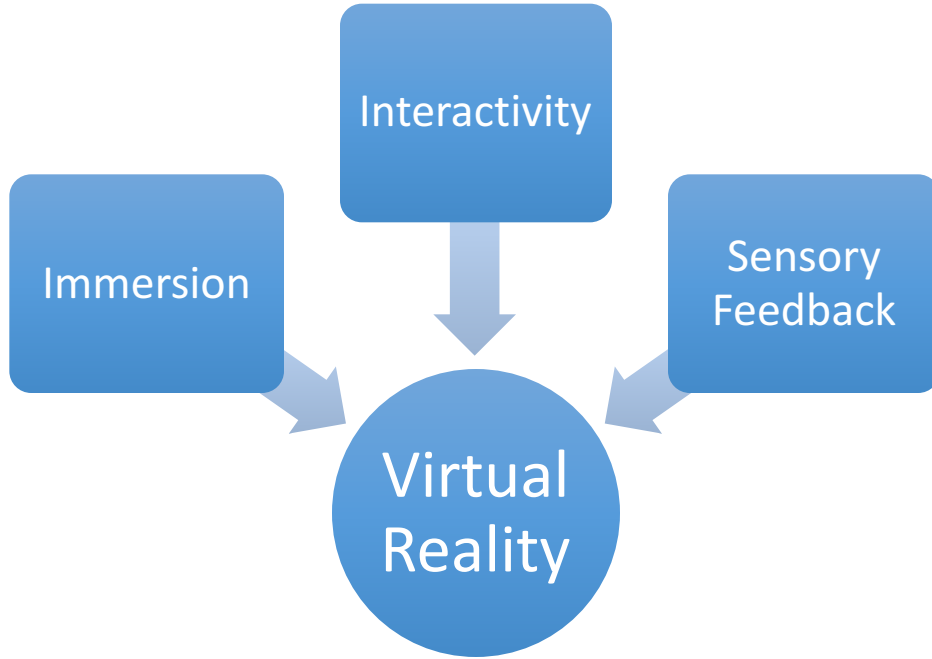# Ethics Emerging: the Story of Privacy and Security Perceptions in Virtual Reality
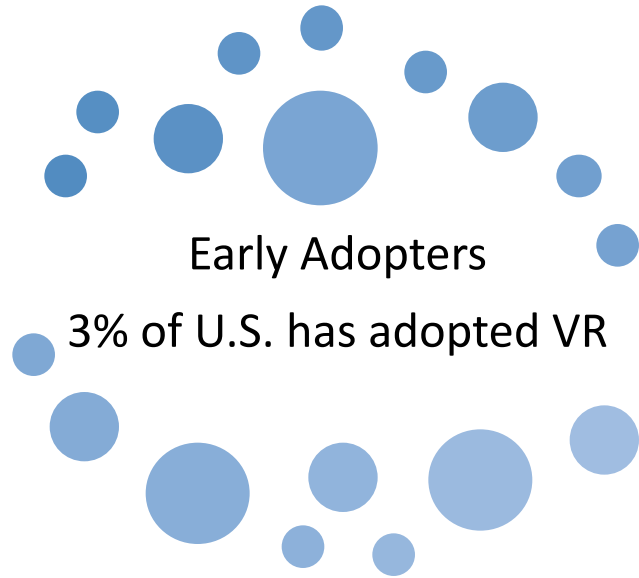
Devon Adams, **Alseny Bah**, Catherine Barwulor, Nureli Musabay, Kadeem Pitkin and Elissa M. Redmiles

Immersion

Interactivity

Sensory Feedback

Virtual Reality

Early Adopters
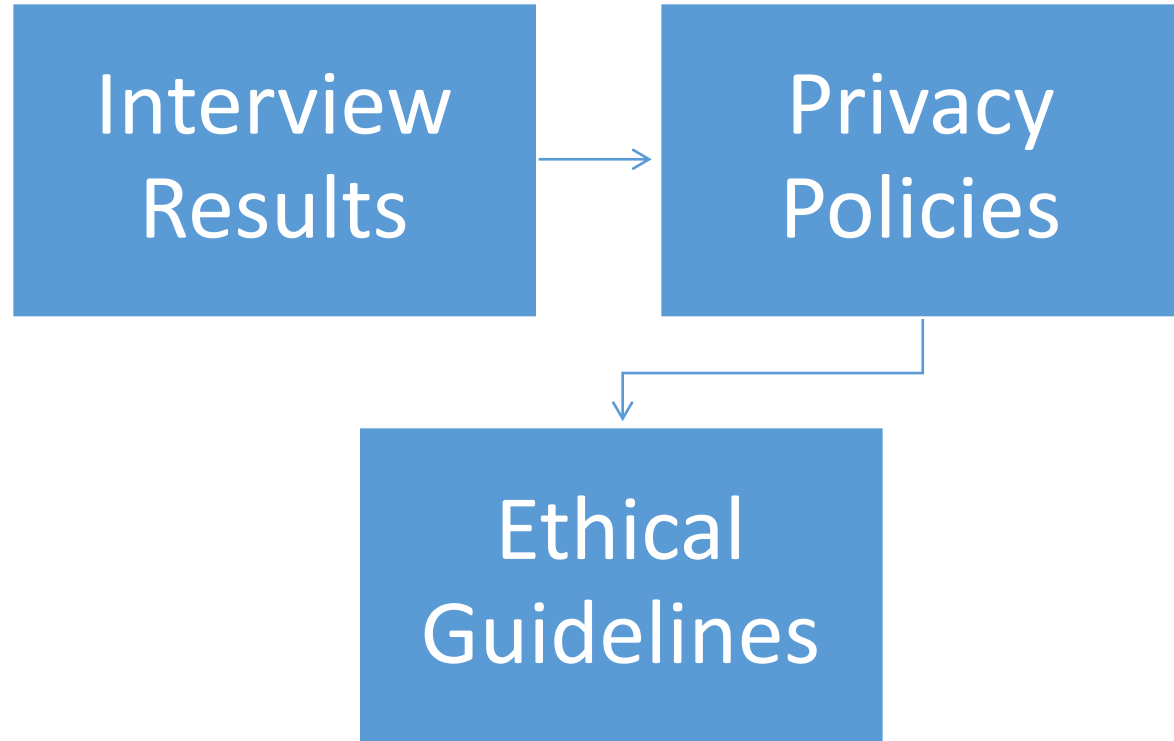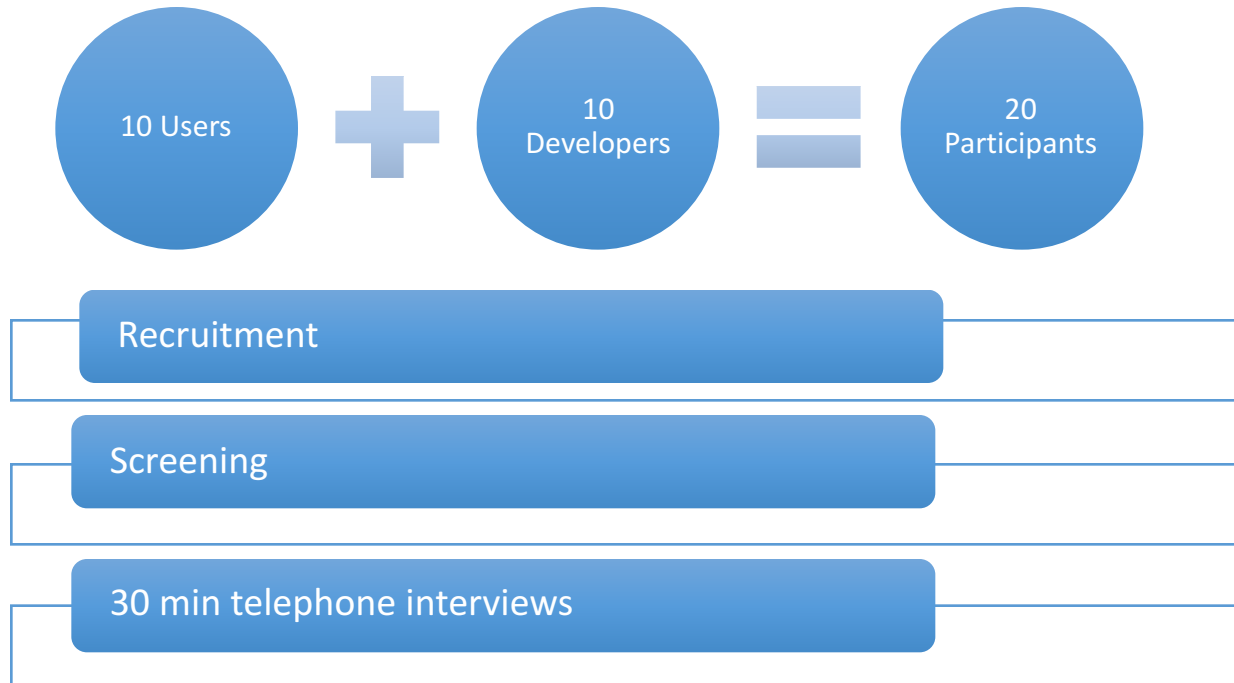
3% of U.S. has adopted VR

What VR Looks
Like in 5 years

Research Questions

- What are users' privacy and security concerns with VR?
- How are developers thinking about addressing security and privacy concerns?
- How are users coping with security and privacy issues?

Outline

Interview Results → Privacy Policies → Ethical Guidelines

Interview Study

10 Users + 10 Developers = 20 Participants

Recruitment

Screening

30 min telephone interviews

Interview Protocol

| Open Ended Questions	VR Background	What made you decide to buy / use a VR headset?
	Information Sources	How did you learn to develop for VR?
	Concerns	Do you foresee any privacy or security concerns with your product or with VR in general?
	Data Collection	Do you think your VR system collects information about you? What information?

Participant Demographics

Security Concerns

Security

"Not There Yet"

Sensors Data Sniffing
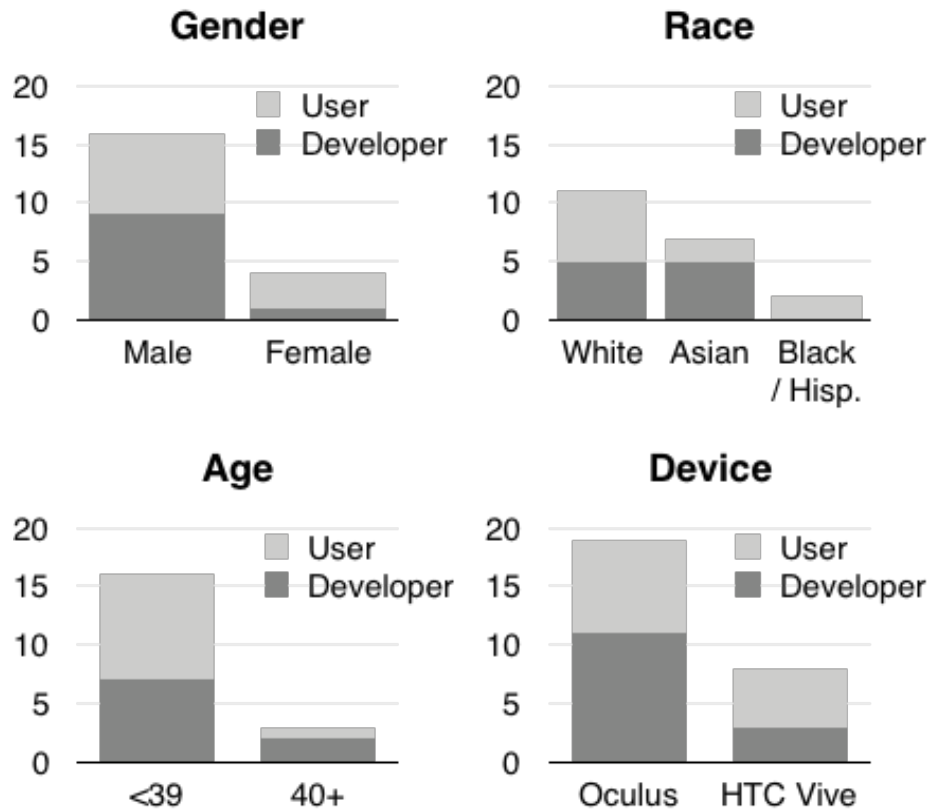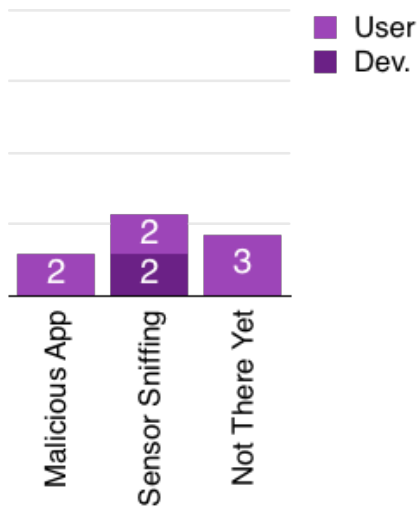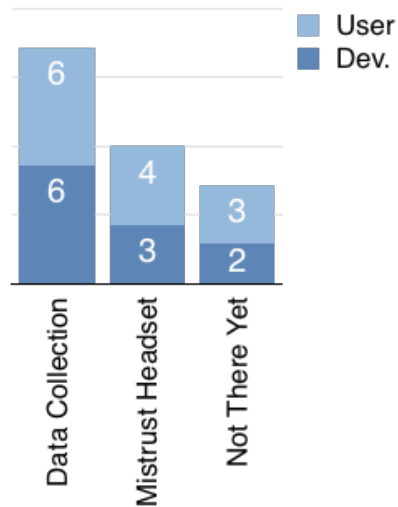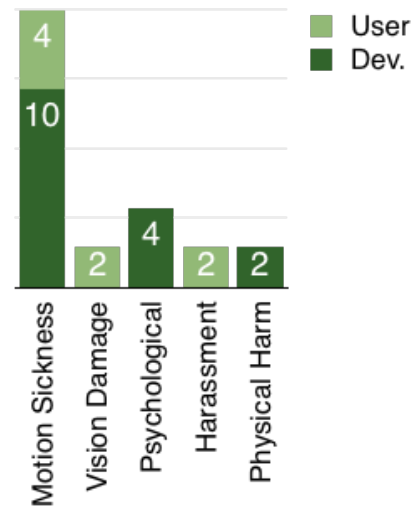
Malicious Applications
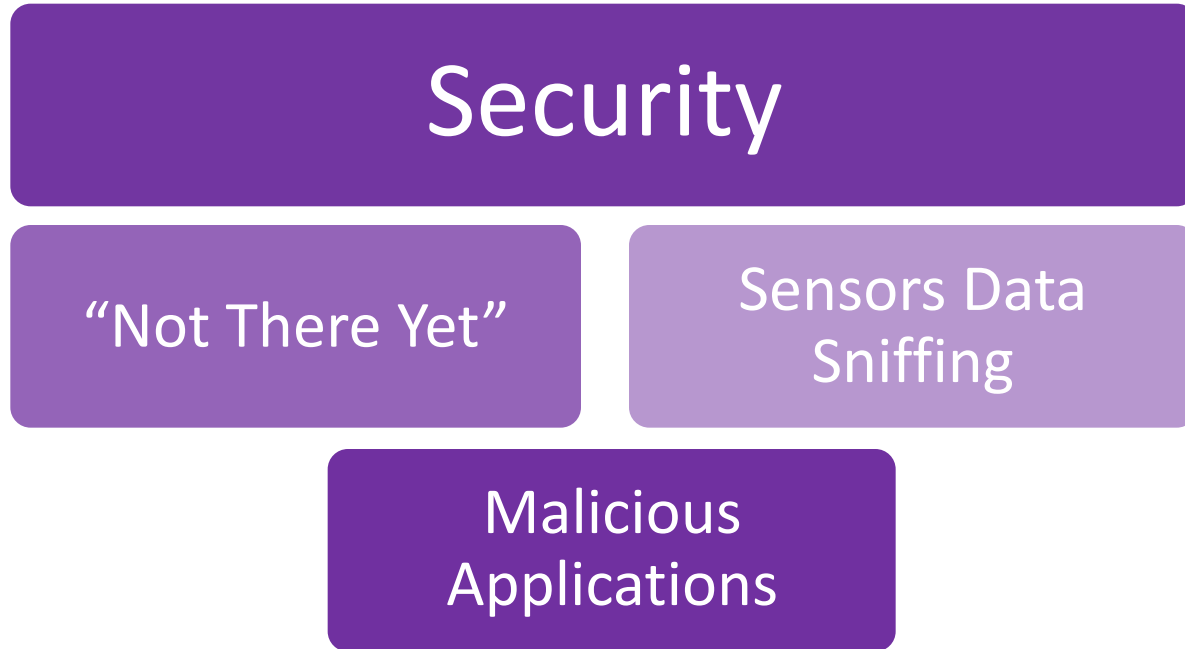
Few Security Concerns Mentioned

Little mention among developers (d=2, u=4)

Developers mention an inclination to **pass responsibility** to others (d=2)
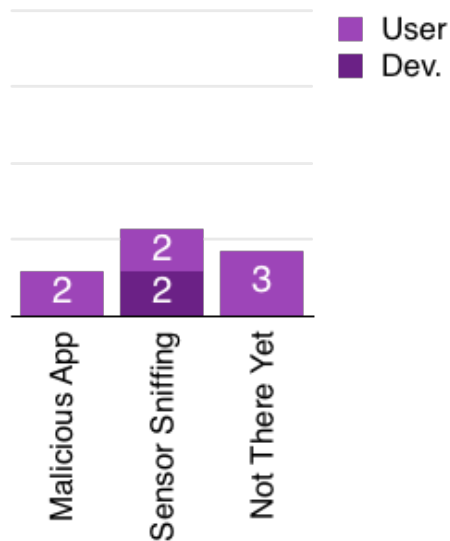
Use of cloud data storage "…means that we don't have to deal with securing information ourselves. It makes it their problem and not ours."

Privacy Concerns

Privacy

"Not There Yet"

Company Reputation Distrust

Data Collection

"Always On"

Camera (IR) Microphone

Greater Privacy Concerns

A majority of users (u=6, d=6) mentioned microphone and IR sensor data collection

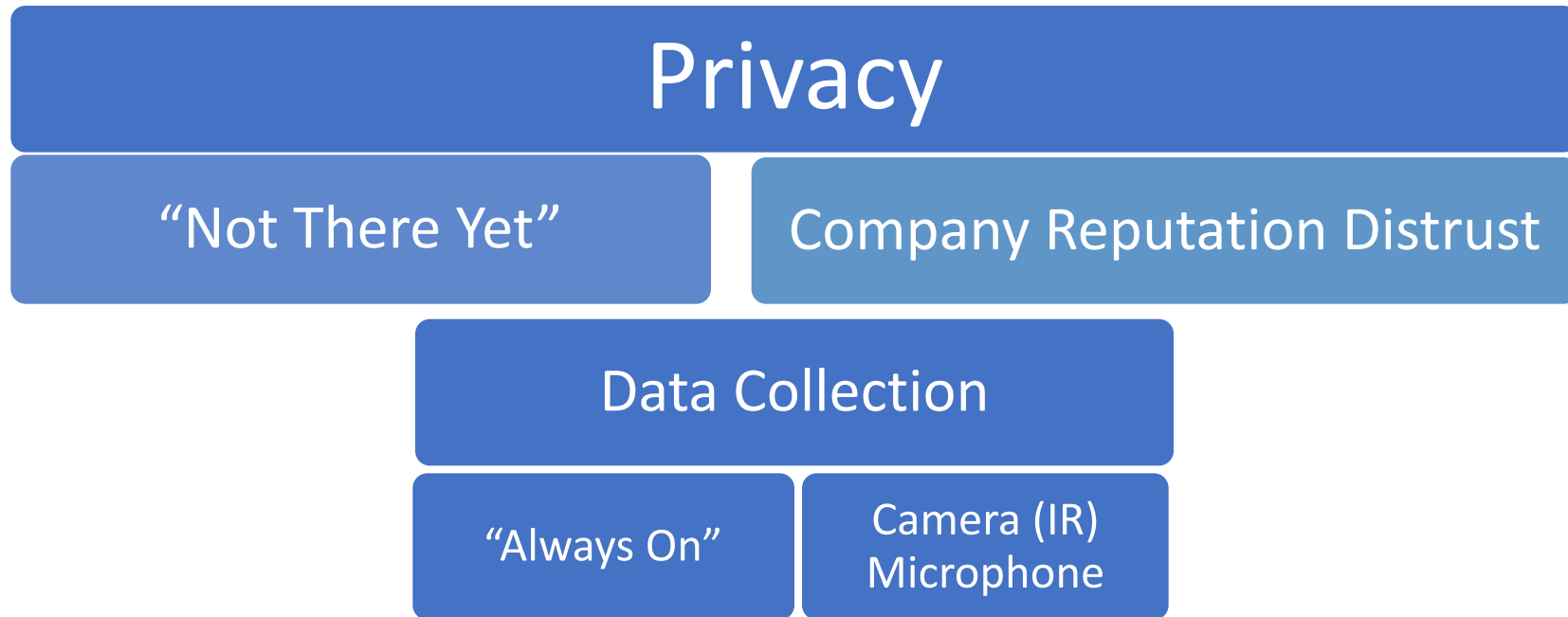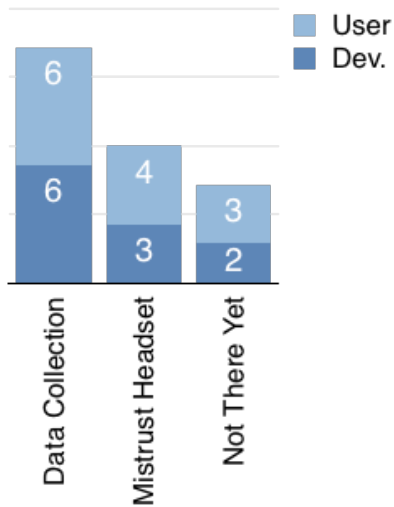*"The Rift actually has a microphone in it… [so I realized] oh crap people can hear me. I've [also] seen somebody post a picture of what the sensors actually picked up and it was a pretty clear view of the room."*

Privacy issues around the headset producer's reputation (u=4, d=3)

"Considering that Oculus Rift is owned by Facebook, I [am] concerned… you know Facebook has been in the news recently about just how much they picked up based on your habit, posting activities and things like that."

Image Captured from Oculus Sensors

Well-Being Concerns

Well-Being

| Motion Sickness | Psychological | Harassment | Vision Damage | Physical Harm |

Chart (horizontal bar):
- Motion Sickness: Dev. 10, User 4
- Vision Damage: 2 (User)
- Psychological: 4 (Dev.)
- Harassment: 2 (User)
- Physical Harm: 2 (Dev.)

Legend: Dev. / User

Psychological Well-Being Concerns

Developers mention concerns about the psychological well being of users

"VR is a very personal intimate situation and when you wear a VR headset… you really believe it, it's really immersive. So if someone harms you in VR, you will also feel that after taking off the headset."

WIRED   **Virtual Rape Is Traumatic, but Is It a Crime?**

Users felt those at psychological risk shouldn't use VR

"Some people might not be mentally developed enough to take something like that and not be messed up over it, you know?"

16

Developer Responsibility

"I think that it's on the developer to try and limit the user to being able to only experience what the developer was intending for them experience in the first place."

Developers feel **responsible** for users' well-being and privacy

Desire to use existing **norms** to ensure safety in VR

Permissions (d=4)
Privacy Policies (d=6)

Permissions

Four developers suggested permission requests

"identical to current privacy methodologies…

requesting permission from the end user ahead of time."

But, currently no such permissions on desktop VR

And design is hard

"if you want to [request] some information

from the player you cannot simply display it

on the screen because it is not there."

Privacy Policies

90 Oculus apps
(10%)

Have Privacy Policy

74
(82%)

Mention VR / VR Data
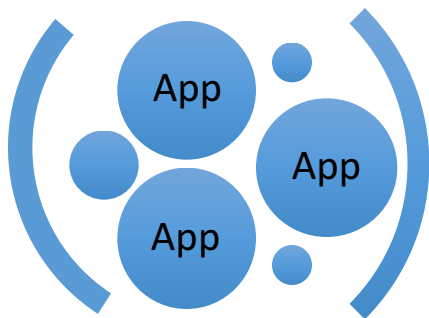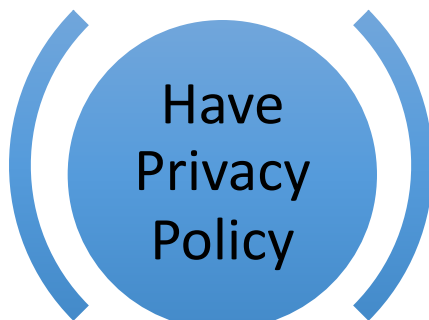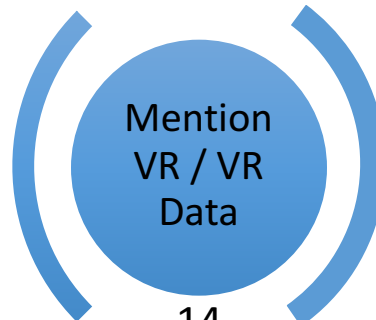
14
(19% of those w/ policies)

50 HTC Vive apps
10%

Have Privacy Policy

15
(30%)

Mention VR / VR Data
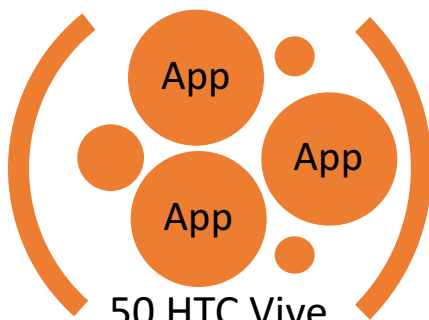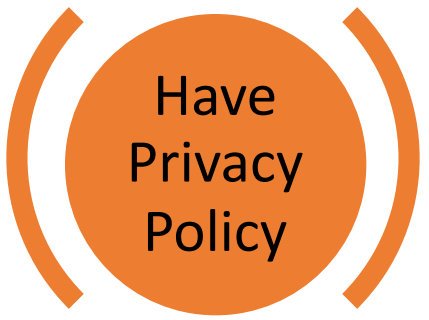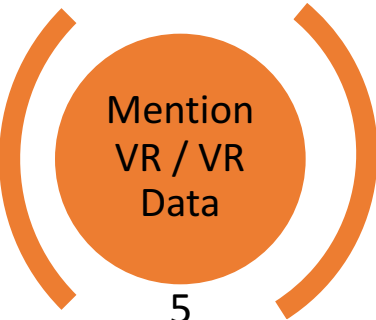
5
(33% of those w/ policies)

"there's a quite a big list of unknowns right now in terms of what's best etiquette for a user and what's gonna keep the user the most [safe], comfortable, and satisfied"

Code of Ethics Co-Design

Draft of guidelines

Invited developers to edit & add to guidelines

Trace ethnographic analysis of edits

Consensus reached on 10 principles for VR ethical development

Code of Ethics Co-Design

Standards for Ethical Development in VR

Do No Harm. We will ensure that the intensity of VR experiences is appropriate by thorough testing.

SecureProtect the Experience. We will use the best security protocols and protections of which we are aware to ensure that malicious actors cannot alter or harm a users' experience while they are in VR.

Be Transparent About Data Collection. We will ensure that our privacy policies specifically mention VR data and how that data will be used (and shared) and protected.

Ask for Permission. We will include permission requests, if at all possible, for sensitive data such as eye-tracking information, health or biometrical information, including movement-derived data, _____.

Keep the Nausea Away. We will test all products before release and do our best to reduce nausea among our users.

Diversity of Representation. We will work to ensure that a diverse array of avatars are available for use by users and that our representations of groups and characters does not perpetuate stereotypes.

Social Spaces. We will take extra care through privacy protections and clear and conspicuous community guidelinesmoderation affordances to ensure that cyberbullying and sexual harassment is kept to a minimum and social VR experiences are kept safe and inclusive. Projects involving children [or other vulnerable populations?] deserve special consideration.

Accessibility for All: Include options for those without standard vision, hearing, or movement to enable them to participate fullymeaningfully in experiences, for example through modular design that allows users to integrate additional software or hardware as needed. as long as it doesn't hurt the vision of the project, the idea of the project comes first

User-Centric User Design and Experience. Make good UX that is designed to be informative to end users.

Proactive Innovation: We will seek out and implement relevant methods by which to enhance, immerse and make seamless the experience in which we provide for our users. This includes the acknowledgement that we as an entity are inclusive of our ecosystem and not separate from it in relation to our end-users and act as a unifying body in collaboration and symbiosis for the best possible experience overall.
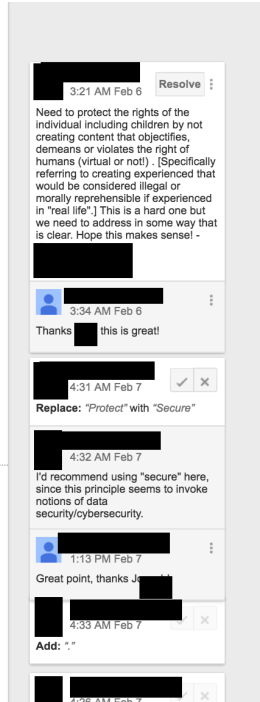
11 online communities

1053 Views

245 potential editors

19 contributors

7 sharers

40 contributions

10% edit rate equiv. to Wikipedia

Standards for Ethical Development in VR

Do No Harm. We will ensure that the intensity of VR experiences, and effects caused (e.g., seizure risk from flashing lights) is appropriate by thorough testing. Avoid creating content that objectifies, demeans or violates the rights of humans or animals (e.g., creating experiences considered illegal or morally reprehensible if experienced in "real life").

Secure the Experience. We will use the best security protocols and protections of which we are aware to ensure that malicious actors cannot alter or harm a users' experience while they are in VR.

Be Transparent About Data Collection. We will ensure that our privacy policies specifically mention VR data and how that data will be used (and shared) and protected.

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Proactive Innovation: We will seek out and implement new methods to enhance the immersive and seamless experience we provide to our users. We will not consider end-users as entirely separate: we will act in collaboration and symbiosis with them to achieve the best possible experience overall.

Summary

Three categories of concerns: Security, Privacy, Well-Being

Developers feel responsible for Privacy & Well-Being; Existing Practices May Not Work

Co-design with developers may be useful in other security & privacy areas

Future work: secure libraries for VR development, what does policing look like in a Virtual World, how does well-being fit in as a security / privacy topic

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