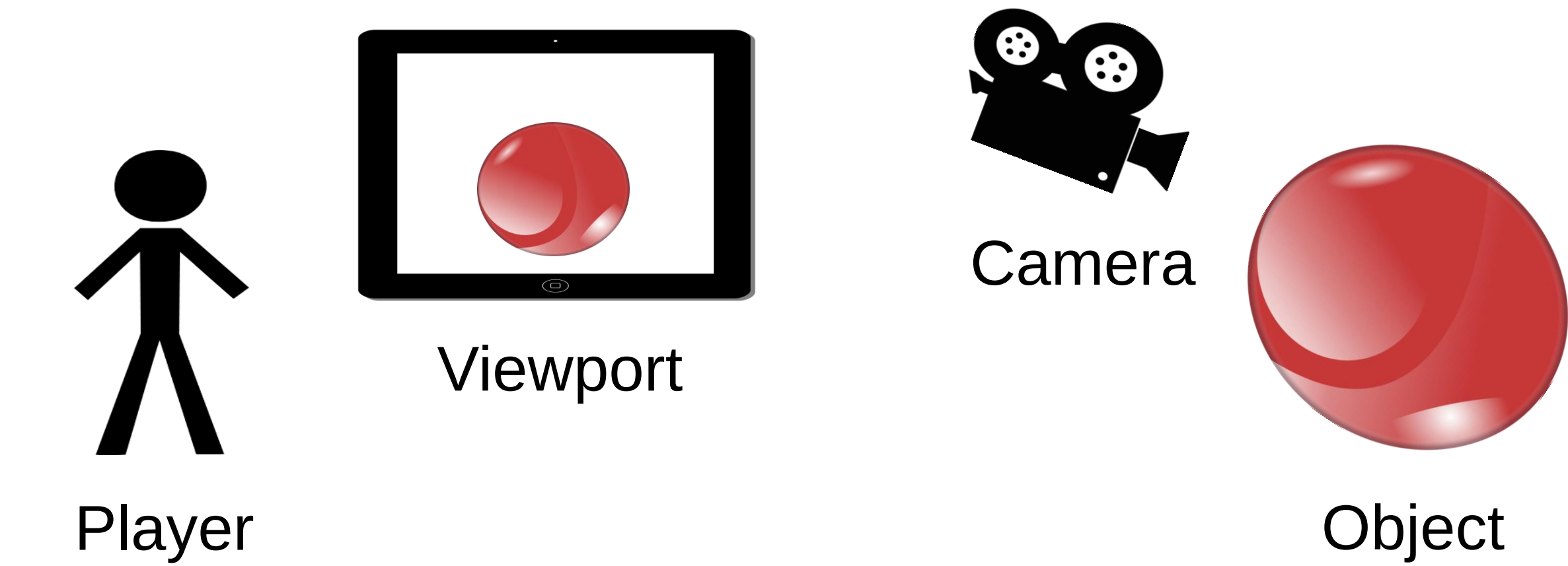


Spectator Techniques for Distributed Collaboration in Virtual Reality

Katherine Hsiao[†] Robert Silverberg[‡] Sinhwa Kang^{*} David M. Krum^{*}
[†]khsiao@ucsc.edu, [‡]rhs31@miami.edu, ^{*}{kang, krum}@ict.usc.edu

Introduction

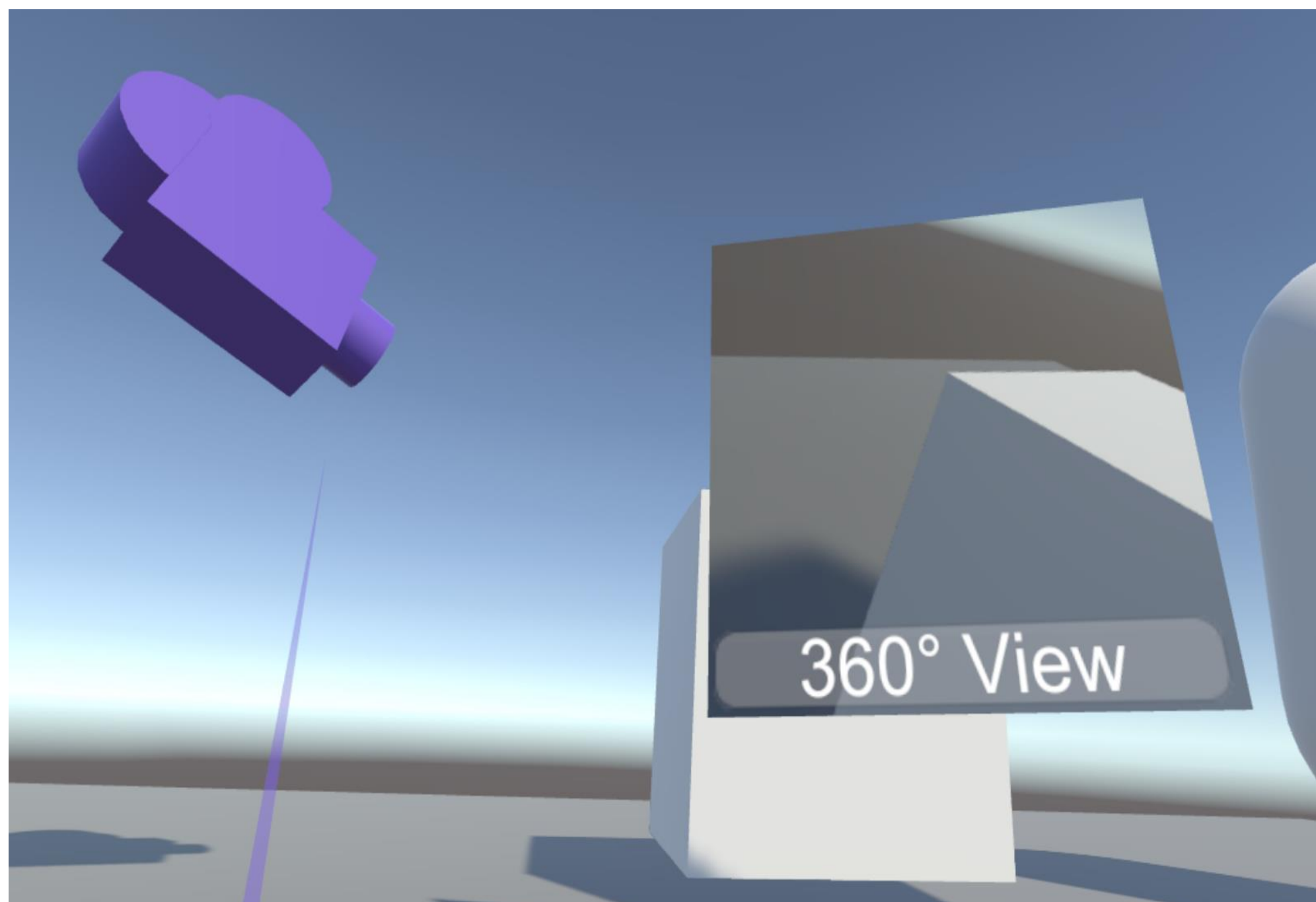
As more practical applications of Virtual Reality (VR) involve collaboration with others, 3D interactions must be designed with teamwork in mind. An interaction technique that has not been thoroughly explored in a collaborative environment is **viewport manipulation** which would allow **spectating** of other players independent of your location.



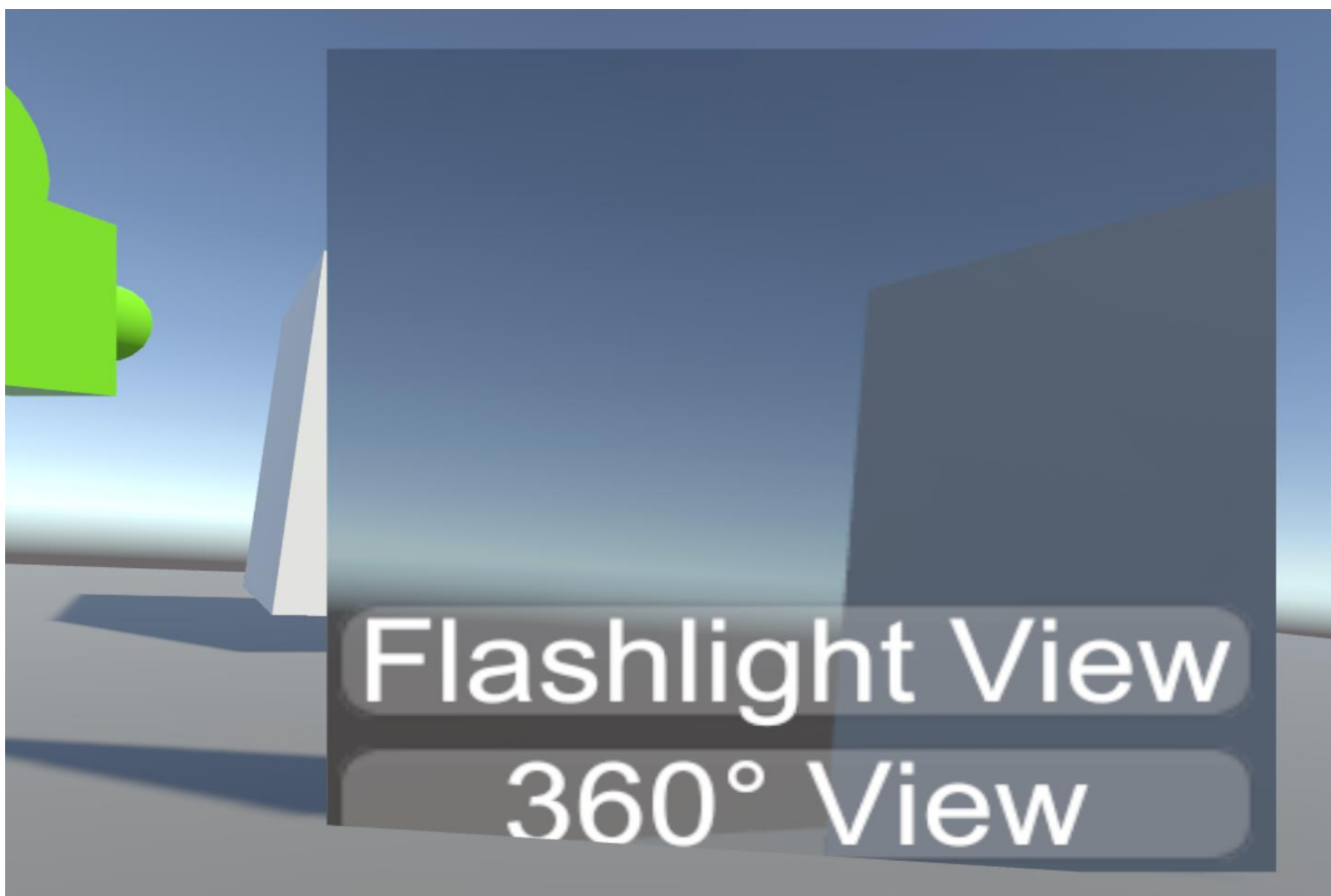
[Figure 1: Illustration of what each terminology means]

Implementation

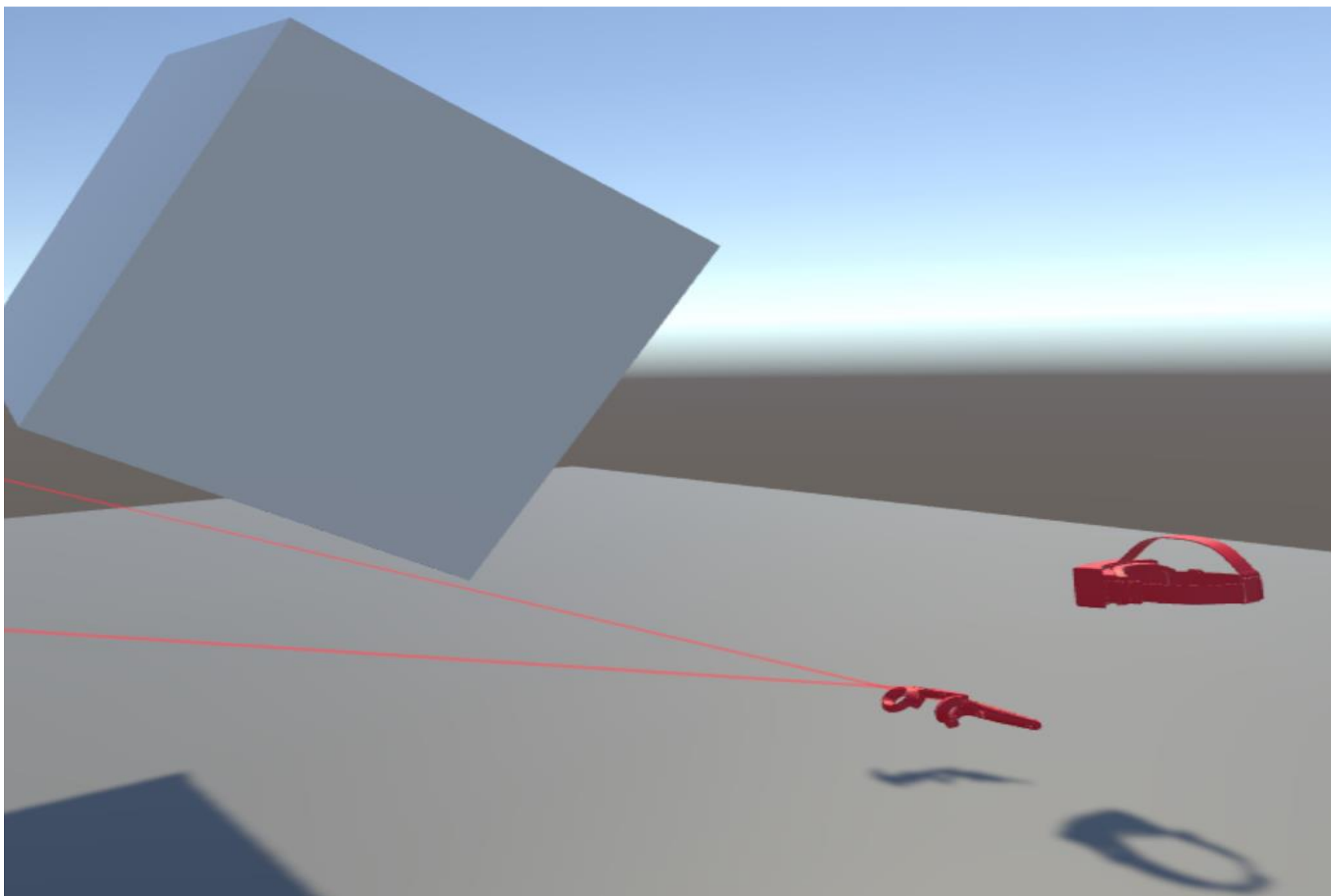
Using an HTC Vive, the three techniques have been implemented:



[Figure 2: *Regular camera/viewport Mode*. The viewport and camera is manipulated with the same system as regular objects]



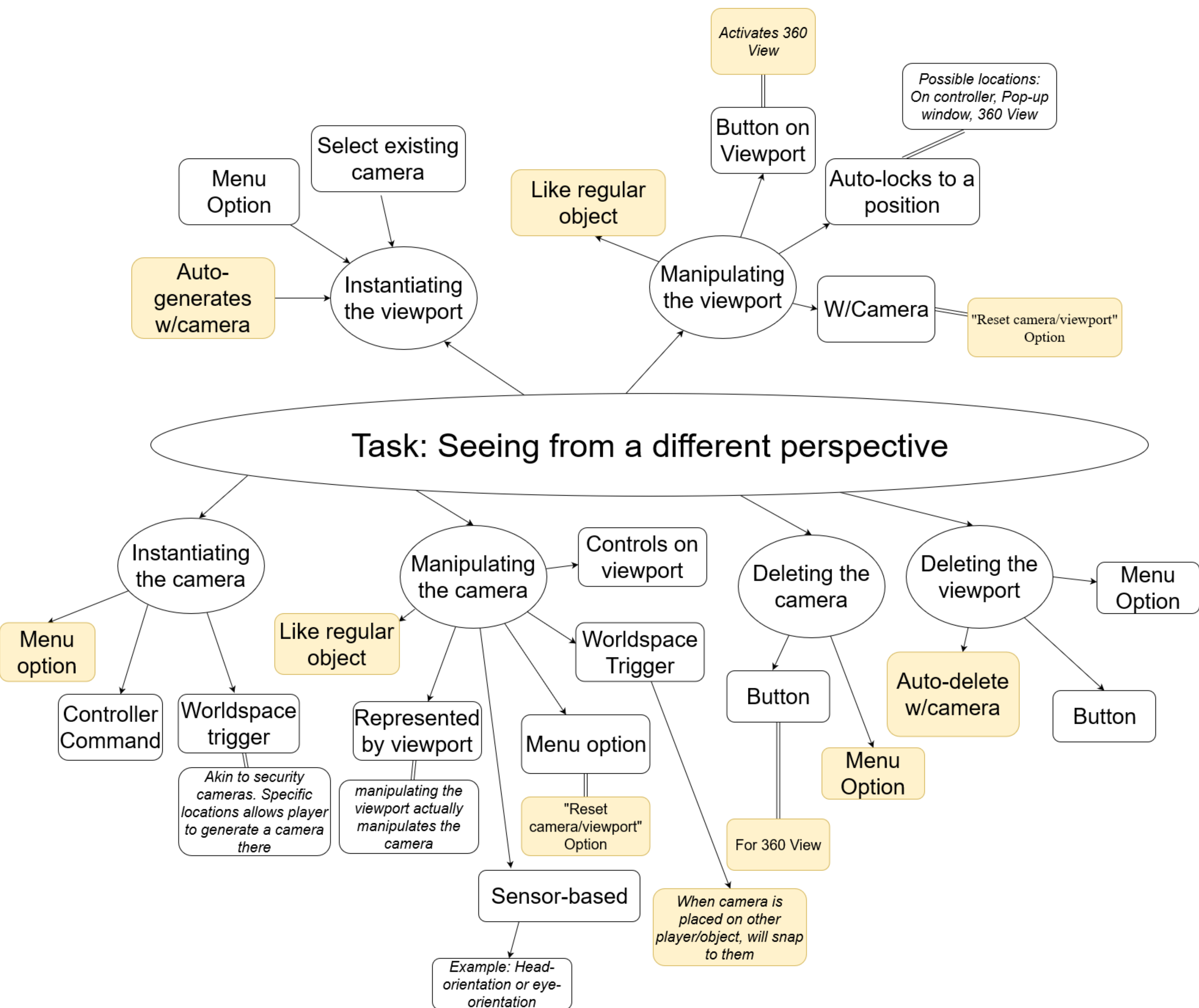
[Figure 3: *Flashlight Mode*. On viewport, camera orientation is manipulated by the user's head orientation.]



[Figure 4: *360 View Mode*. User has 360 view from camera's location. The user avatar is still action in this mode.]

Method

On this poster, spectating is defined as accessing a view of the environment from a viewpoint other than your own. This is done from defining a camera point and a viewport.



[Figure 5: A draft of a taxonomy tree for spectating as a 3D interaction technique. The yellow boxes are techniques that have been implemented for a prototype.]

Preliminary Feedback

- 3 users, all experienced with VR
- After familiarizing themselves with the control scheme, users completed a repetitious task for 2 minutes with each technique
- Users filled out the System Usability Scale (SUS)

Technique	Regular camera/ viewport	Flashlight	360 View
SUS Average Ratings	75.83	60.83	85

Discussion and Future Work

- Spectating via viewport manipulation has promise as a viable and useable 3D collaborative technique.
- This technique allows users to (1) see another user's perspective and/or (2) gain a third person perspective.
- This would allow users to follow along with another user's actions or keep track what the other user is doing.
- Future work includes implementing other spectating techniques and performing user testing in a collaborative setting.