PSCR 2020² THE DIGITAL EXPERIENCE







Building VR for Public Safety Jack Lewis Chris Johnson, Jeff Karhoff





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NIST

PSCR2020



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User Interface and User Experience



Why Virtual Reality?

Virtual Reality is a technology that we can leverage in order to create safe and repeatable testing by simulating real world scenarios in VR and gathering metrics.



How are we using it?

Our current project is the VR Test Bed, which is a large scale open source VR project that can be leveraged by industry in order to test and rapidly prototype new user interfaces for first responders.

Speakers



Design Considerations for Firefighter Non-Playable Characters

Chris Johnson



Prop Creation for VR

Jeff Karhoff



Simulating Smoke in VR

Jack Lewis

Design Considerations for Firefighter "Buddy" NPCs

Chris Johnson, VR Game Designer



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WHAT IS AN NPC?



NPC stands for "Non-Playable Character." These are the other characters (besides the player) in the simulation that are controlled by artificial intelligence. In our scenario, there are two NPCs, who are both firefighters working with the player as part of a buddy

team

MASTERING IMMERSION



Participant immersion is key to creating a VR scenario that is engaging, and that will yield accurate test results. In our firefighting scenario, this means creating AI partners that act and feel like intelligent, responsive, cooperative members of your team.

THREE QUESTIONS DRIVING THE DESIGN



What actions are the NPCs capable of?

When will the NPCs perform these actions?

How will the player control the NPCs?



What actions are the NPCs capable of?

E* Switch on FFTaskTypeEnum								
—	Default Follow Player 🕞 🚽							
Selection	Pickup Victim 🕞 📥							
	Put Down Victim 🕨 🦯							
	Search Room 🕨 🗕							
	Sound Off 🕨 🦯							
	Wait 🕨 🦯							
	Null 🕨 🦯							



When will the NPCs perform these actions?





How will the player control the NPCs?



LESSON #1:

Command the group as a whole, NOT individuals



LESSON #2:

Make commands context sensitive to limit showing unnecessary information to players



LESSON #3:

Always let the player know what their buddies are currently doing



LESSON #4:

Give feedback that buddies have received the command



LESSON #5:

Also give feedback to show whether a command was a success or failure



CONCLUSIONS

#1 Only include actions which help achieve the overarching goal		Make sur relatable real li	# 2 Make sure actions are relatable to relevant real life actions		#3 Automatically perform as many actions as possible to reduce micromanaging		#4 Leave actions up to the player's command if they will influence the tactical situation	
	#5 ALWAYS strive to distill the command interface to be as simple as possible		Alw kno are	#6 Always let the player know what the NPCs are currently doing		#7 Always let the player know what actions they can command the NPCs to do		

THANK YOU







Prop Creation for VR Jeff Karhoff VR Developer & Digital Artist



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What is a Prop?

• A prop is an object that supports the scene but is not part of the level layout (environment) or character set.

Haptic Challenge Environment – Parking Garage S.W.A.T. Scenario

VR Content Considerations



Performance Considerations

- Polygon Count
- Texture Size
- Draw Calls

Visual Considerations

- Scale
- Missing Geometry
- Transparency

VR Content Considerations

"Fake Everything You Can"

- Parallax Occlusion
- Tessellation
- Pre-Built Lighting
- LOD's



Our Workflow



Prop Anatomy



Block Out



High Poly



Low Poly



Texturing



Final Asset - Unreal Engine



Final Asset - Unreal Engine



Final Asset - Unreal Engine



Thank You!



Simulating Smoke in VR Jack Lewis Lead VR Developer







POLICE

The Importance of Good Smoke

- Realism
 - Having the virtual simulation be realistic is required in order to effectively test User Interfaces in VR.
- Immersion
 - The more immersive the simulation is, the more accurate the user's response and actions will be.



Our First Attempt at Smoke



Firefighter Feedback

• The Good

- They liked that we thought about smoke and included it
- The smoke limited visibility the way it should

• The Bad

- The smoke did not feel like smoke
- The smoke was not dynamic
 - Did not darken over time
 - No texture to the smoke

Performance Issues

• The importance of framerate

- Our target framerate is 90 FPS for VR
- This system required tons of particles and each one has draw calls and an injection cost
- We had to lower the screen resolution to hit our FPS target
- The system caused numerous lighting bugs





The New Smoke System

Lit Show

Alpha Build Smoke (Video of new smoke)

How it Works



Gif's by Ryan Brucks



https://shaderbits.com/blog/authoring-pseudo-volume-textures



Performance Improvements

- 90 FPS!
 - The new system uses no particles and is now volume texture based



Limitations

• Hardware limitations

- Higher performance hits on lower end machines
- Hard to make it consistent between machines and headsets
- Not currently portable to standalone headsets such as Oculus Quest





What's Next

- Ray Marching
 - Simulates light rays going through volumes
- Vector Fields for Airflow
 - Using vector fields to describe the airflow of a building
- Particles for embers/ Ashes
 - Particles within the smoke that follow airflow



