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# Understanding the potential of virtual environments for improving C2 performance

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# Understanding the potential of virtual environments for improving C2 performance

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16<sup>th</sup> International Command & Control Research & Technology Symposium

- Background
- Can VE improve performance?
- Initial experiment and analysis
- Aspects of VE leading to improved performance
- Current experimental approach
- Next steps



# Background

- ELICIT: multiplayer online game
  - Counterterrorism intelligence domain
  - Like game *Clue*: ID fictitious terrorist plots
- Used for C2 experimentation
  - Examine org forms, learning, trust, culture, others
  - Very thin, textual interface
- Interested in extending into immersive VE



# What is a Virtual Environment?

- Customizable platform for interaction
- Synchronous and persistent network
- People are represented as avatars
- Flexibility of usage

# Virtual environment "Second Life"





# Design elements to support Neutral Valence

- Interior space only free from natural world complexities
- Subtle texturing of spaces
- Constant ambient lighting
- Narrow range of environmental stimuli

# Neutral space prototype





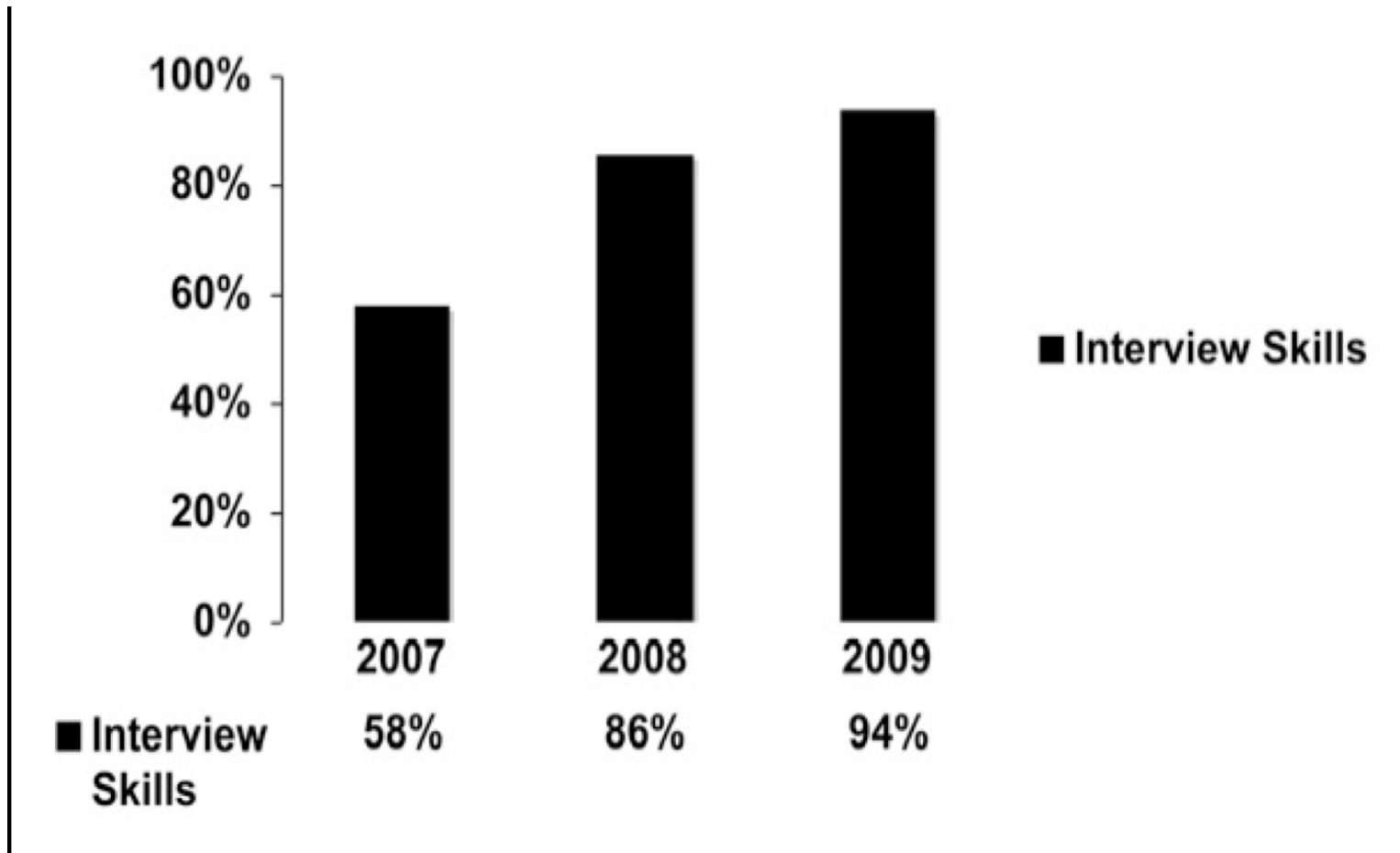
# Can VE improve C2 performance?



# Canadian border simulation



# Border simulation results



# Initial experiment



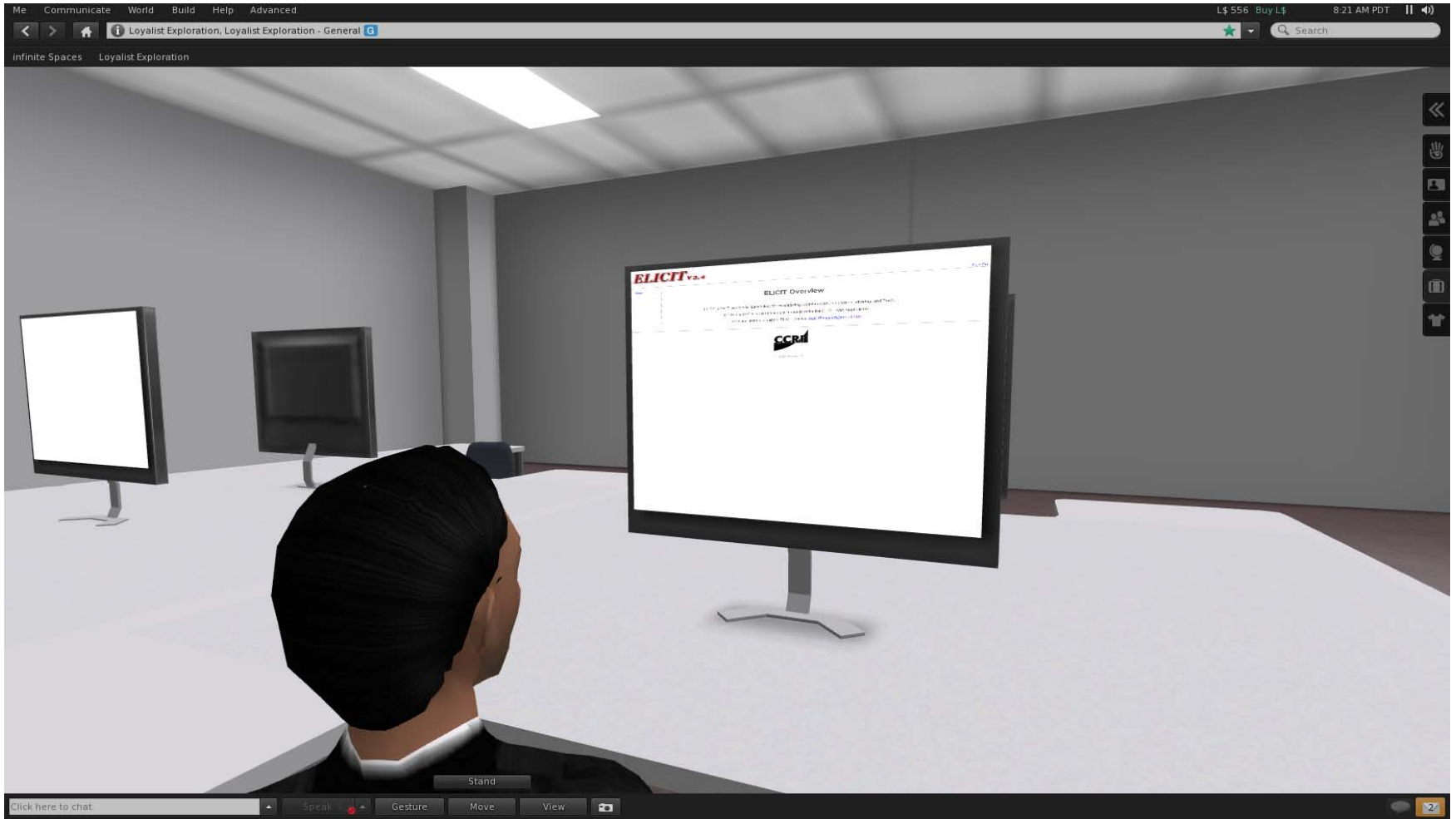


# Hybrid Room

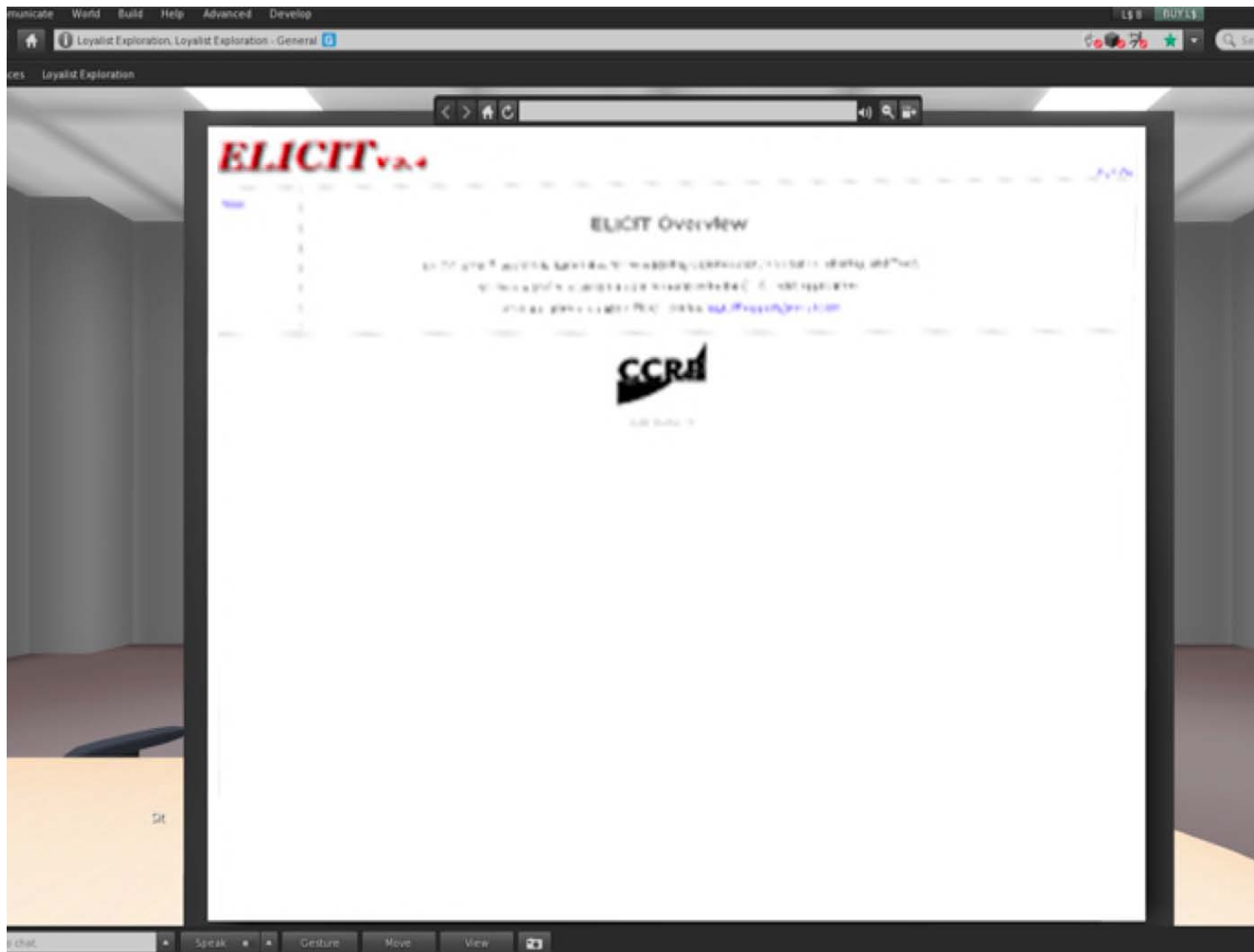




# Second Life Viewer 2.0



# Participant perspective



# ELICIT results FTF vs. CM

Variable	Mean	N	Standard Deviation	Standard Error
ID Time CM (in seconds)	2685	14	219	58
ID Time FTF (in seconds)	<b>2554</b>	14	279	74
Who Score CM	.140	14	.363	.097
Who Score FTF	<b>.790</b>	14	.426	.114
What Score CM	.321	14	.249	.066
What Score FTF	<b>.536</b>	14	.365	.098
Where Score CM	.570	14	.514	.137
Where Score FTF	<b>.790</b>	14	.426	.114
When Score CM	.262	14	.297	.079
When Score FTF	<b>.333</b>	14	.320	.086
Identify Composite CM	.324	14	.206	.055
Identify Composite FTF	<b>.610</b>	14	.327	.087





## Aspects of VE leading to improved performance

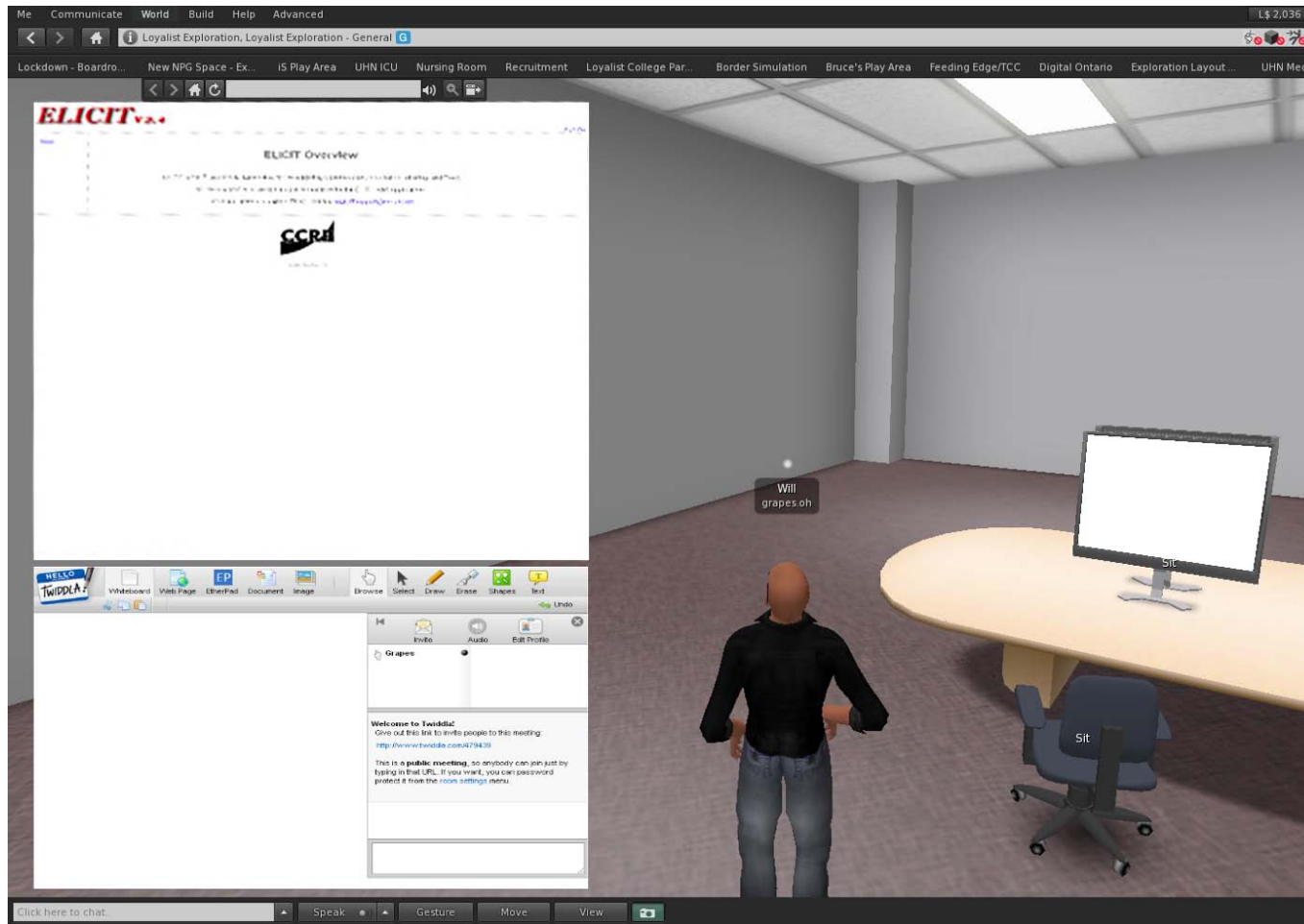
- Participant centered experience
- Contextually situated learning
- Fully utilize VE style of interactions
- Identification of self with avatar
- Sense of being in environment (presence)
- Sense of sharing environment with others (co-presence)



# Current experimental approach

- Seeks to harmonize native attributes of virtual environments that lead to enhanced performance by augmenting user interface and allowing for a broader range of interactions than the initial experiment.

# ELICIT in HUD



# 'Paper' clue version of ELICIT



The screenshot shows a virtual world interface with a menu on the left and a 3D environment on the right. The menu is titled "Clue #1" through "Clue #7" and includes icons for an envelope, magnifying glass, pushpin, people, and a question mark. A "Select Who Receives Clue" panel is overlaid on the menu, showing a grid of 16 numbered buttons (1-16). Buttons 4 and 9 are highlighted in green. The 3D environment shows a character in a black shirt and blue jeans standing in a room with a large yellow table, a computer monitor, and several blue chairs. A chat window is visible at the bottom of the interface.

**Clue #1**  
**Clue #2**  
**Clue #3**  
**Clue #4**  
**Clue #5**  
**Clue #6**  
**Clue #7**

**Select Who Receives Clue**

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16

Will grapes oh

Sit

Sit

Sit

Click here to chat

Speak

Gesture

Move

View

# Next steps

- Proceed with experimentation with ELICIT game-play through HUD
- Enhanced experimentation using 'paper clue' version of ELICIT in both F2F and CM
- Explore potentialities of integrated abELICIT within virtual environment