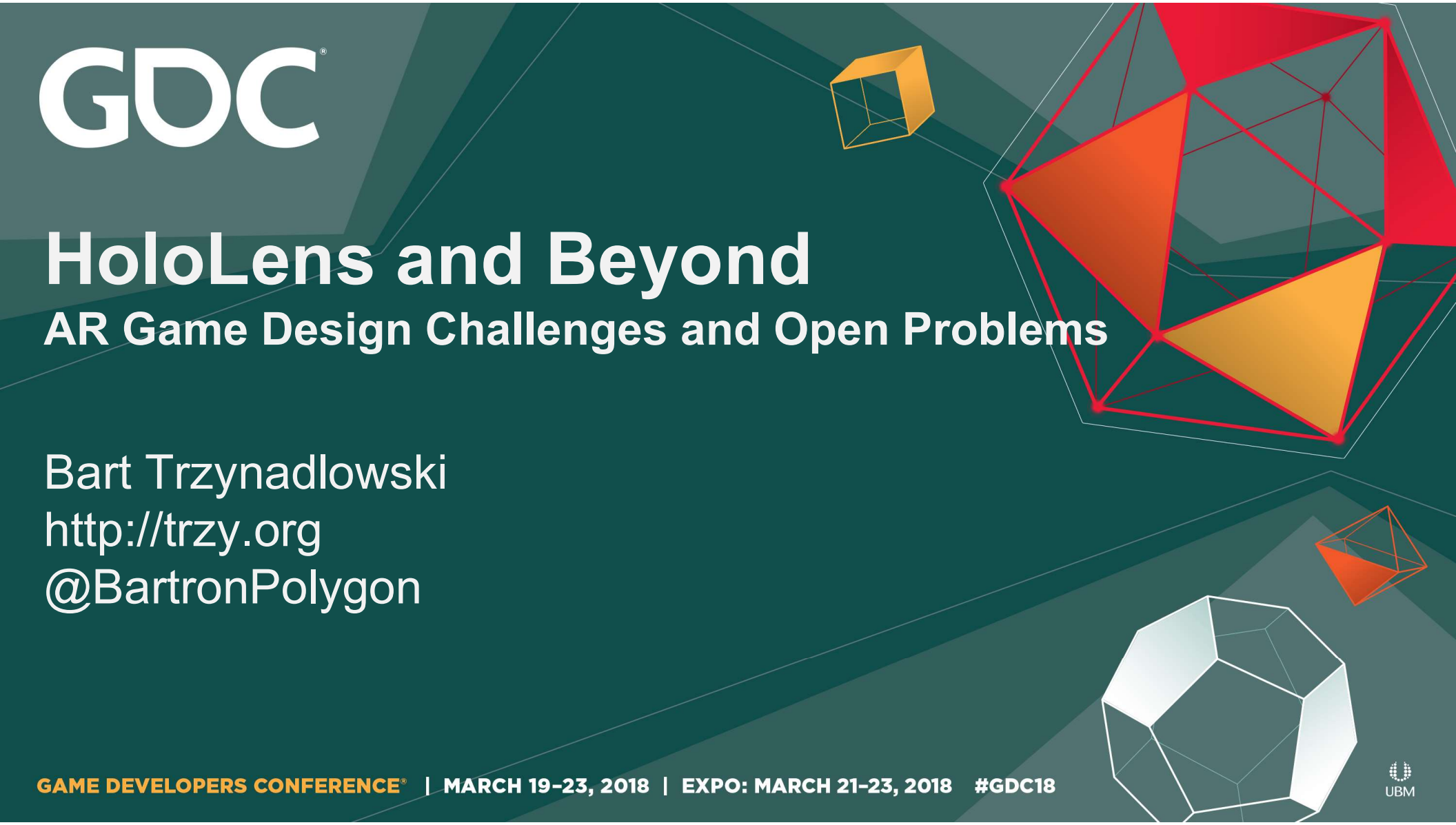
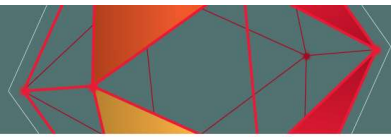
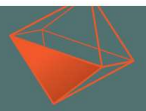

GDC
HoloLens and Beyond
AR Game Design Challenges and Open Problems
Bart Trzynadlowski
http://trzy.org
@BartronPolygon
GAME DEVELOPERS CONFERENCE® | MARCH 19-23, 2018 | EXPO: MARCH 21-23, 2018 #GDC18
UBM



Who Am I?

Bart Trzynadlowski

- http://trzy.org
- @BartronPolygon
- youtube.com/BartTrzynadlowski



Augmented Reality

Headsets

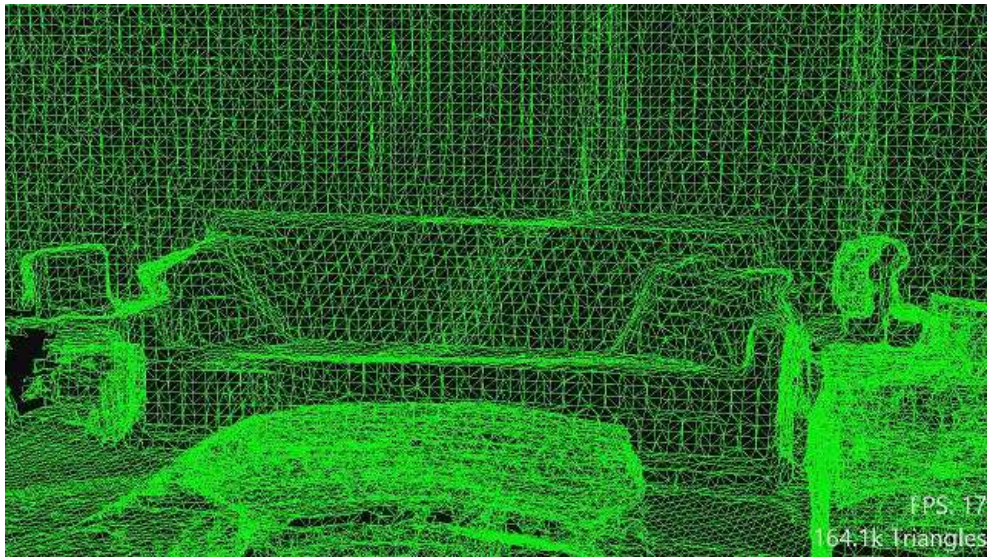
Mobile

HoloLens Capabilities

- Self-contained computer

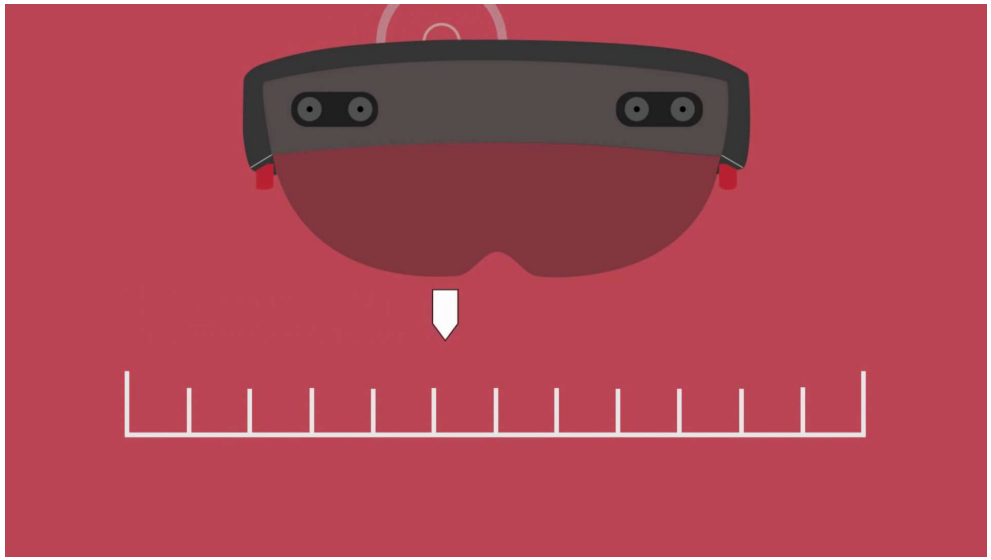
HoloLens Capabilities

- Self-contained computer
- Depth camera
  - Spatial mapping
  - Limited gesture support



HoloLens Capabilities

- Self-contained computer
- Depth camera
  - Spatial mapping
  - Limited gesture support
- Spatial audio
- Voice recognition



H.E.A.T.

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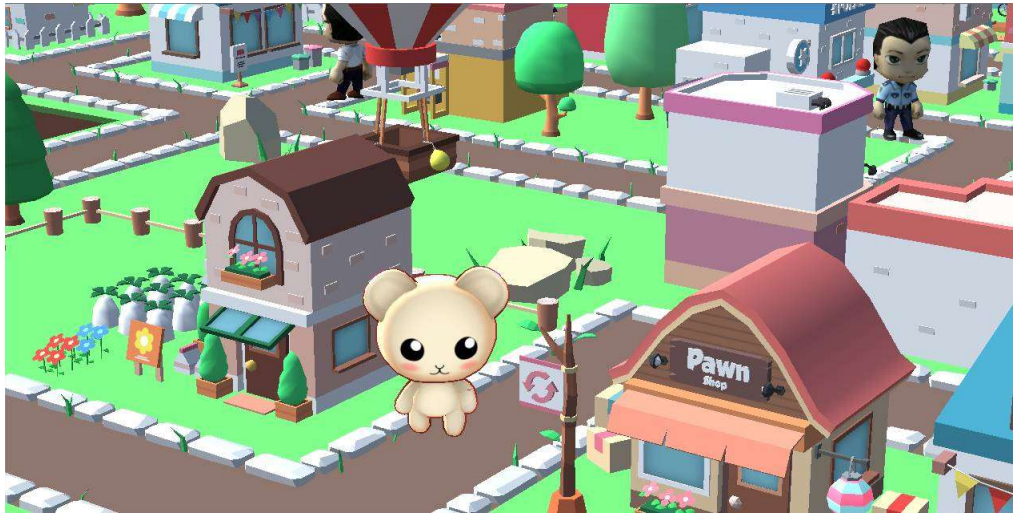
DOKO DESU KA



Vocabulary

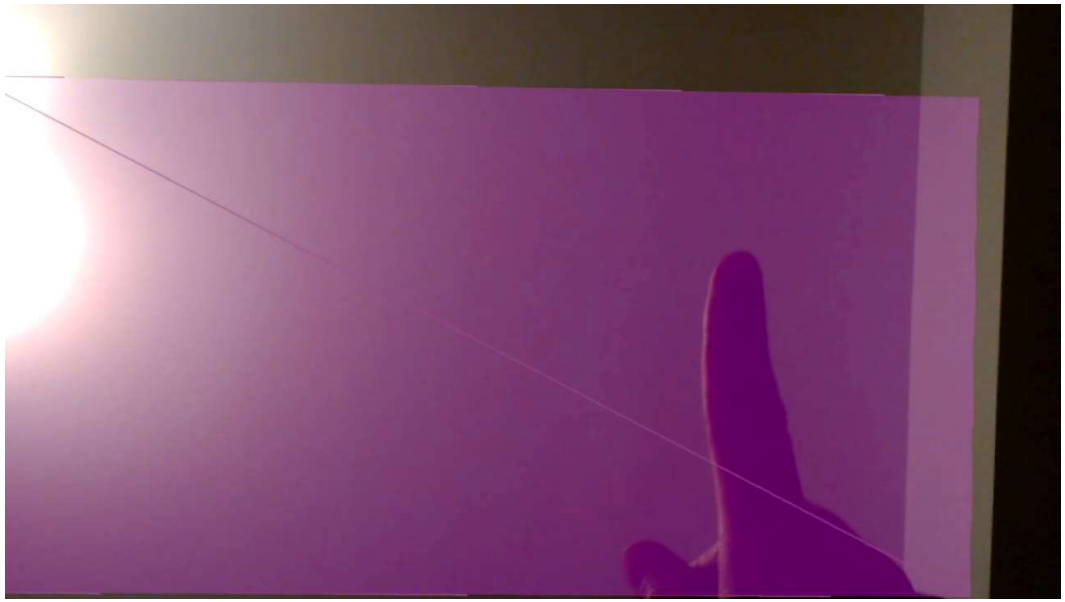
Massugu itte	Go straight
Modotte	Go back
Hidari ni itte	Go left
Hidari ni magatte	Turn left
Migi ni itte	Go right
Migi ni magatte	Turn right

https://youtu.be/gEjlVHh4bzI

Typical Game Flow

Scan

Typical Game Flow



Scan → Place

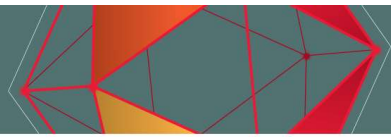
Typical Game Flow

Scan → Place → Play

Challenges in AR Game Design

Environment

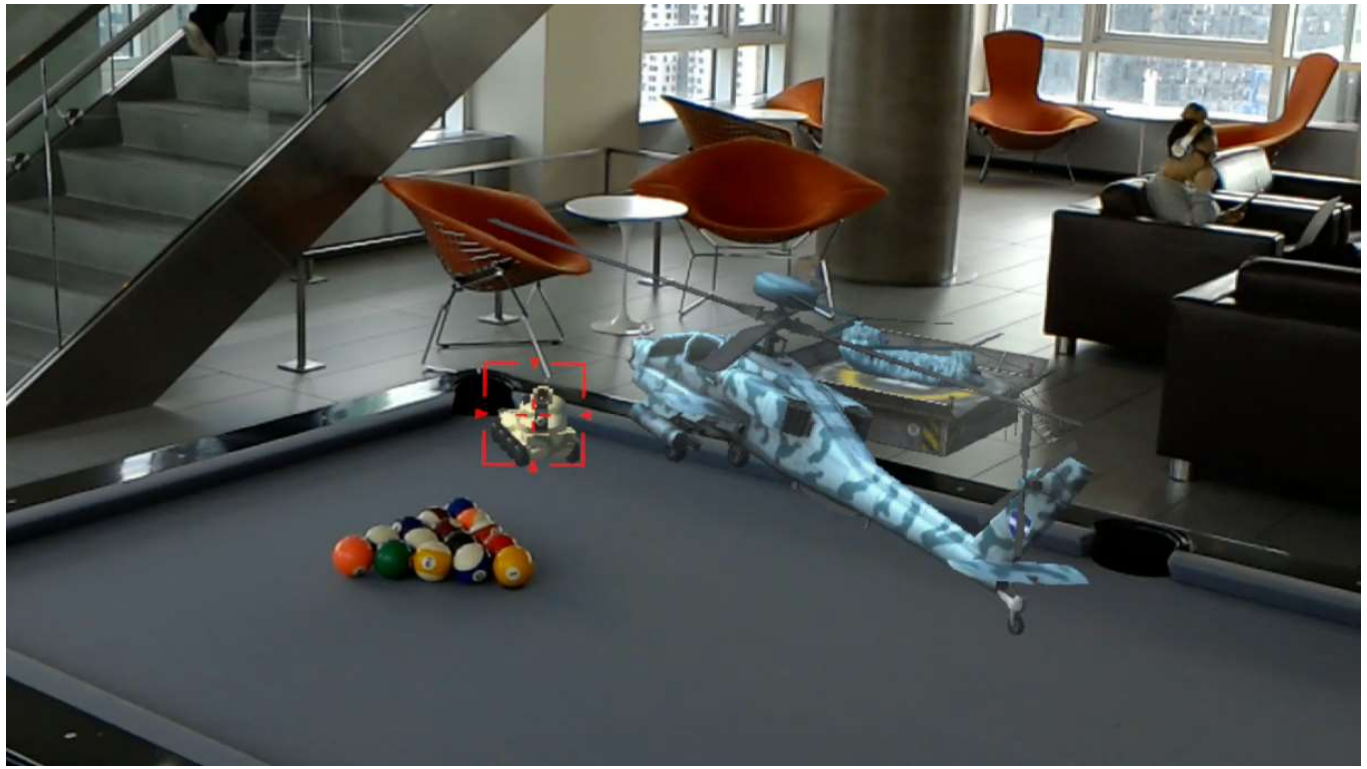
Players



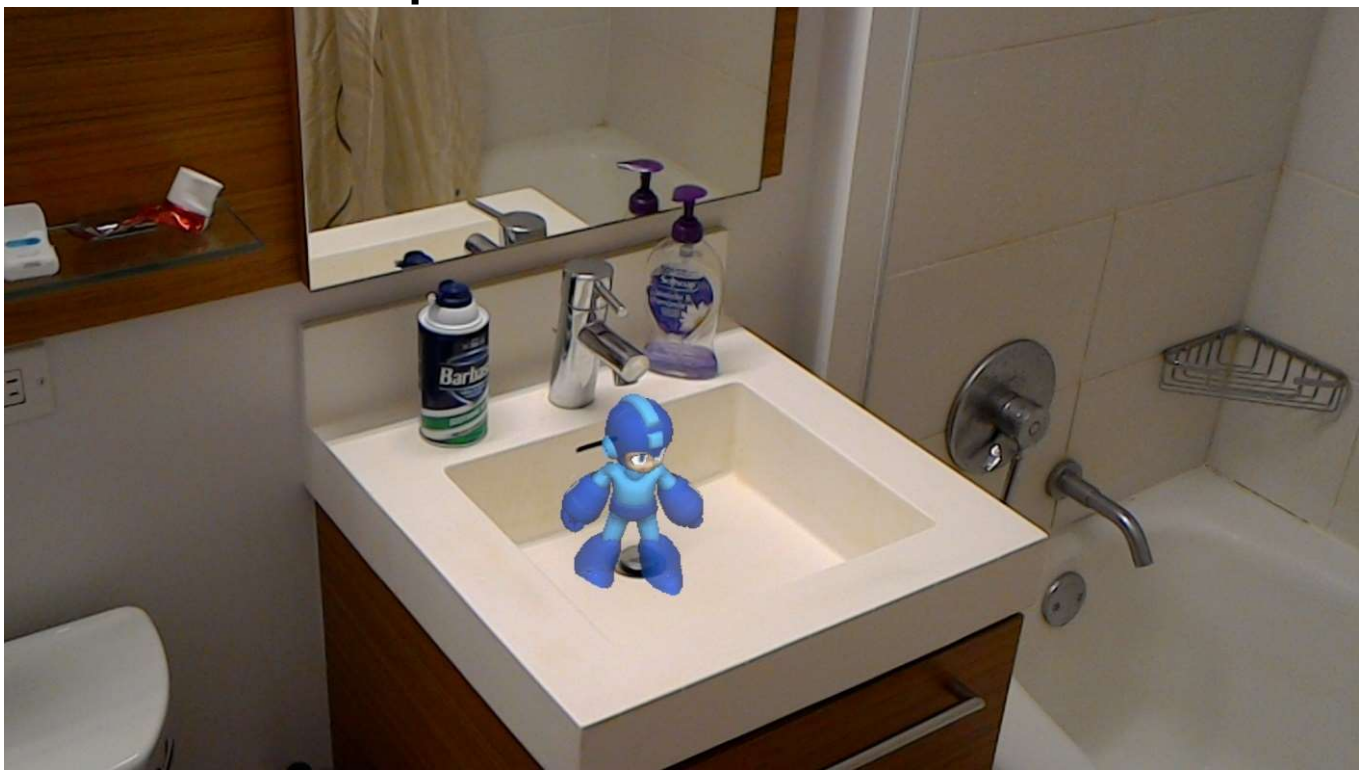
Environment is Unpredictable

Where will your game be played?

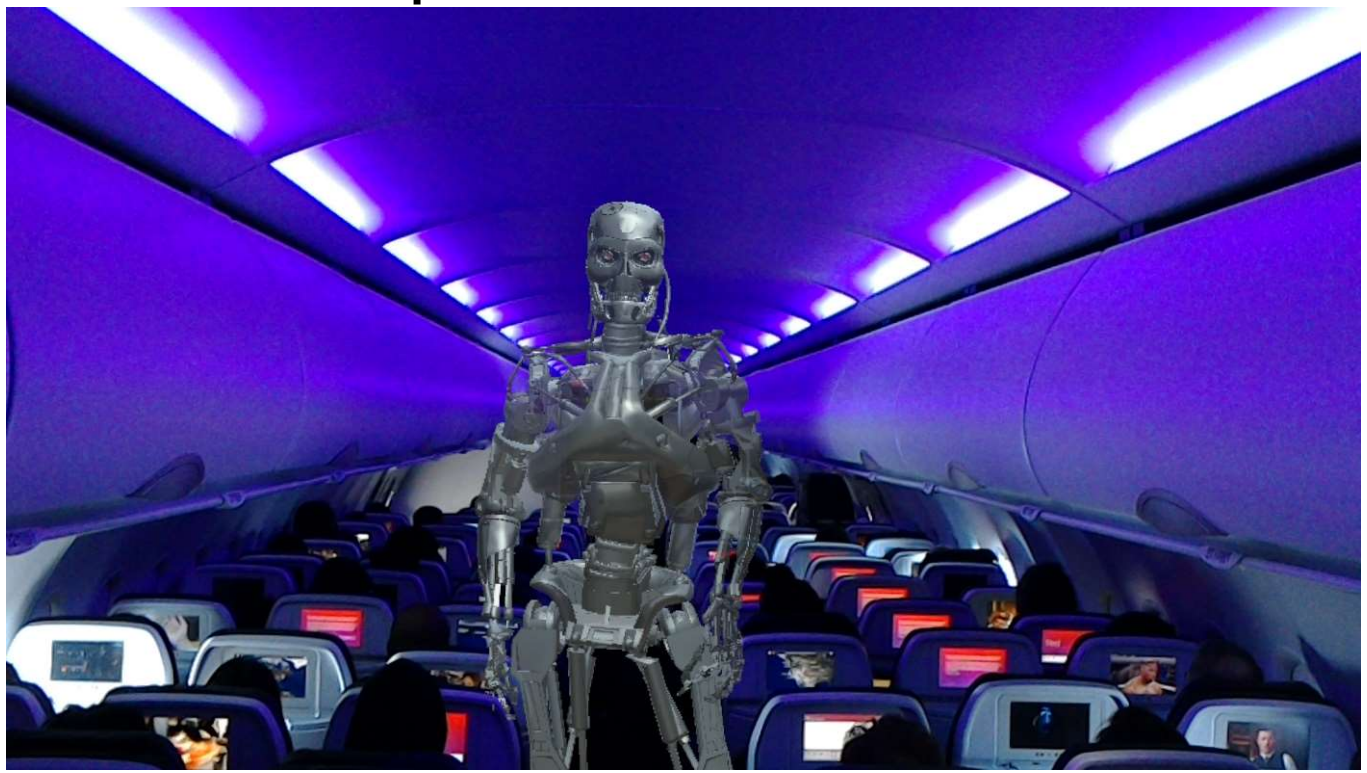
Environment is Unpredictable

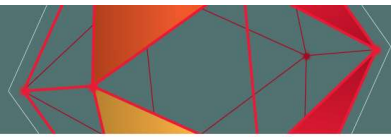


Environment is Unpredictable



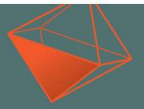
Environment is Unpredictable





Tech Challenge: Placement and Level Design

Topology vs. **Context**



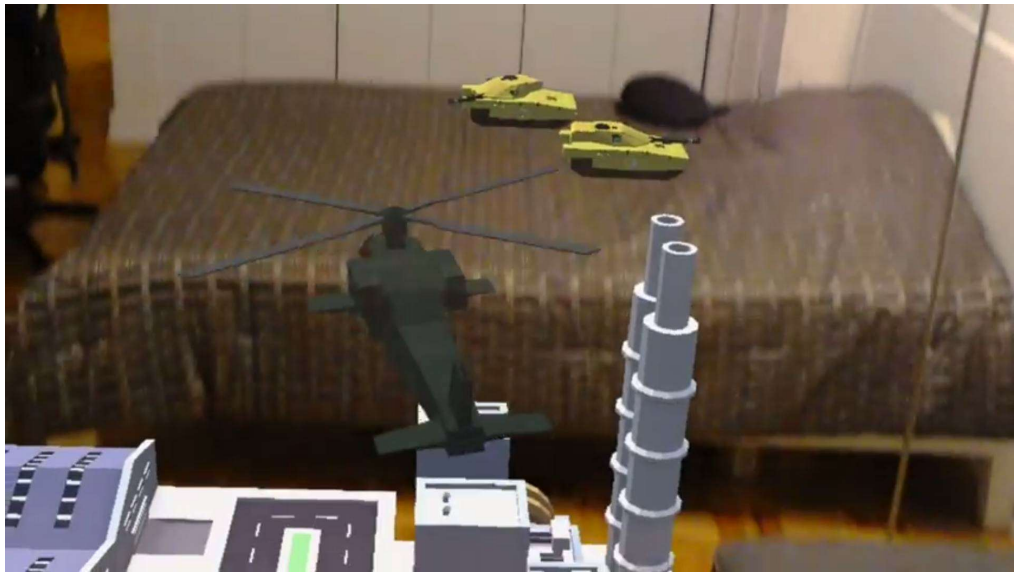
Tech Challenge: Placement and Level Design

Topology: Does the object physically fit here?

Context: Does the object *belong* here?

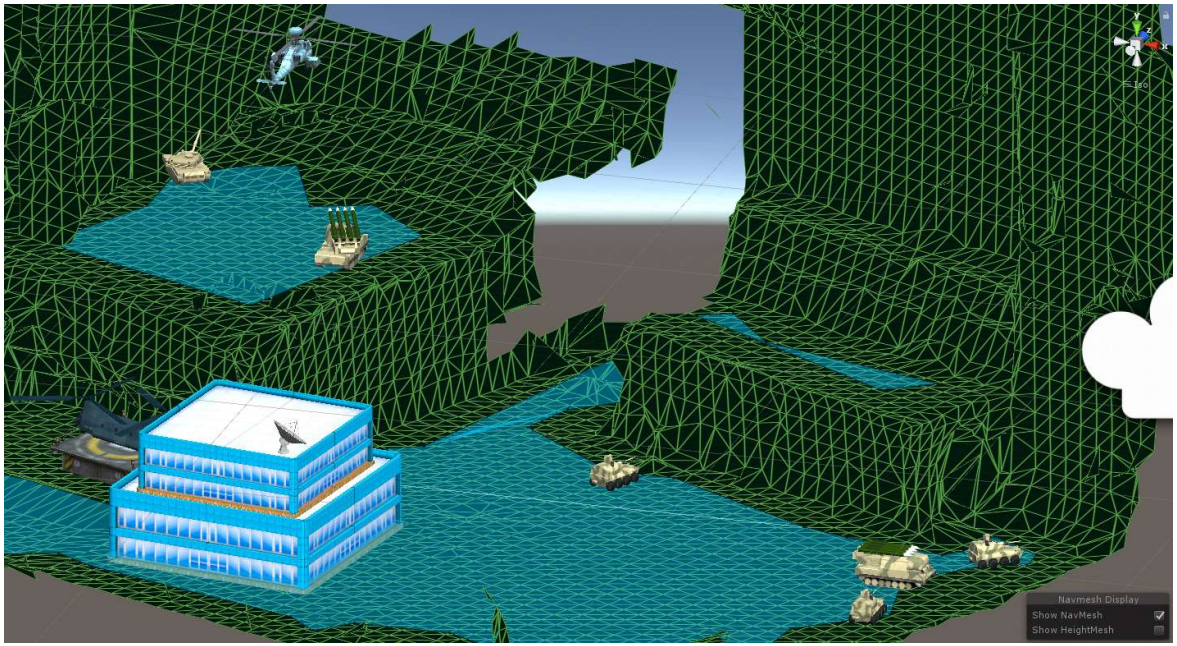
Design Challenge: Scale

Total control over world size and perspective.



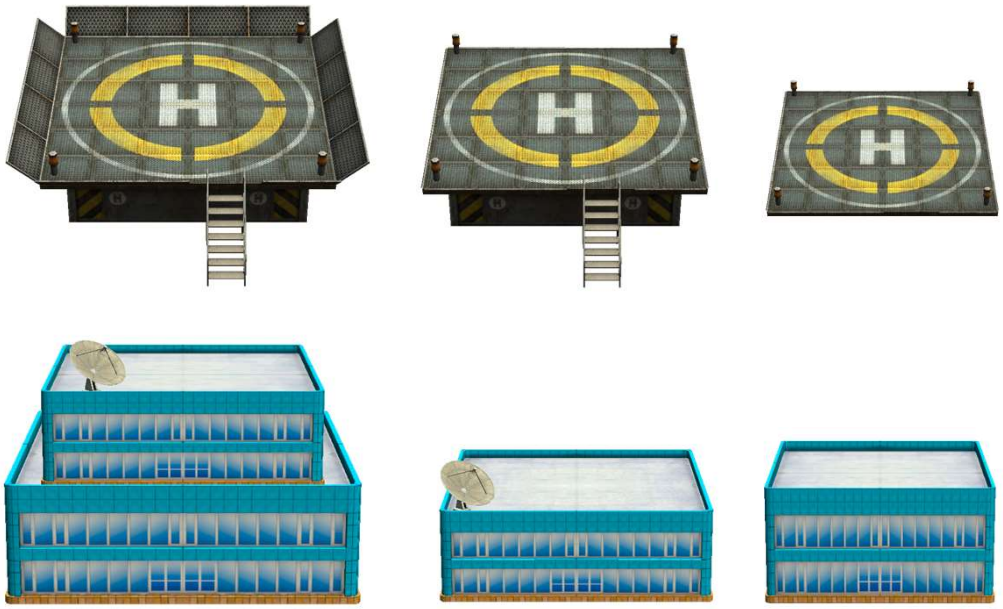
AR: No control over world size.

Placement in *H.E.A.T.*



►Desire maximum distance between structures

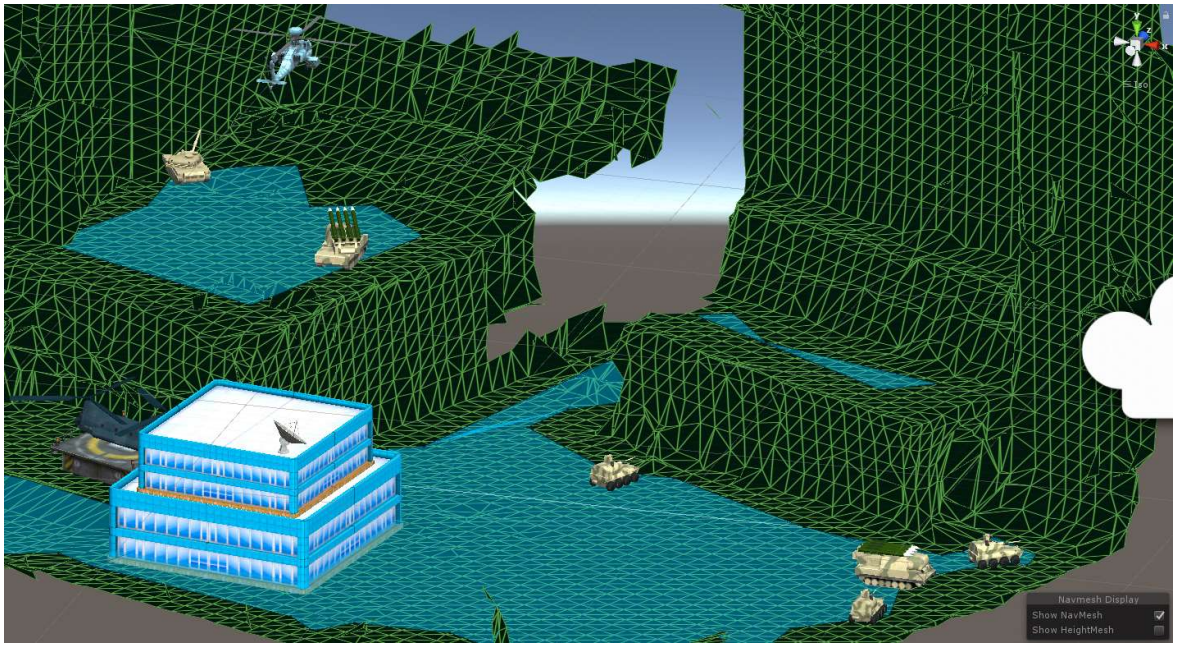
Placement in *H.E.A.T.*



►Desire maximum distance between structures

- Try multiple separation/size combinations

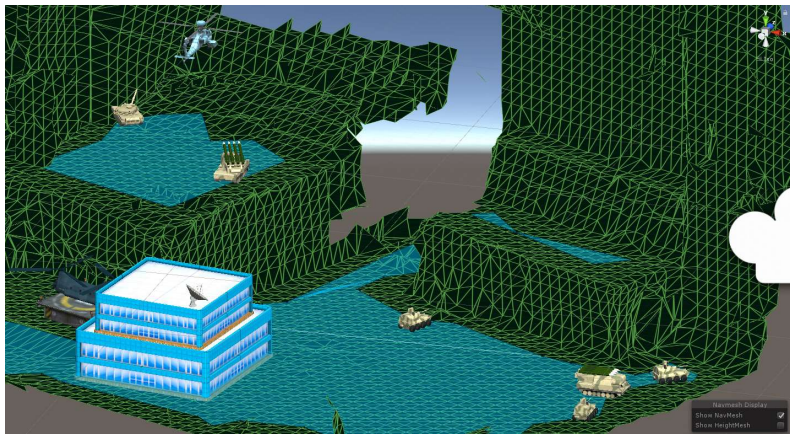
Placement in *H.E.A.T.*



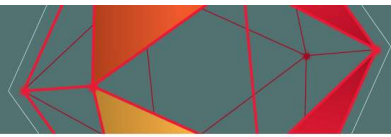
- ►Desire maximum distance between structures
  - Try multiple separation/size combinations
- ►Vehicles allocated between floor and platforms
  - Floor as fallback

Opportunity: Better Placement Solvers

- Better topology and constraint solvers needed. Currently:
  - Spatial Understanding (HoloLens)
  - NavMesh (Unity, Unreal)
  - Smart Terrain (Vuforia)
- Dynamic navigation planning
- Object recognition, segmentation
  - Generate interesting placements
  - Character interactions with environment

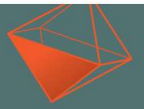


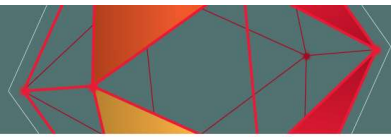
What Could We Do With Object Recognition?



Wish List for Next Placement Solver

- Enumerate surfaces and topographic features
  - Provide relevant metrics: surface area, height, shape/aspect ratio
- Segmentation of spaces into regions of interest
  - Cluttered/noisy areas vs. clean/open
- Volumes and empty spaces
  - Visibility (what other regions visible by player or game objects in given region)
- Multi-scale analysis
  - Schematic of room/region shape
- User-defined scoring for optimizer/solver?

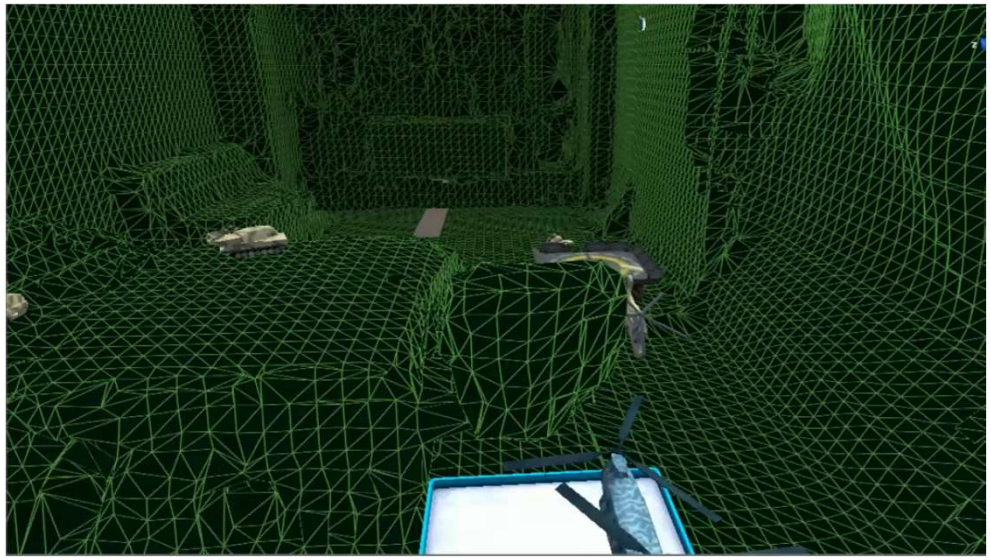




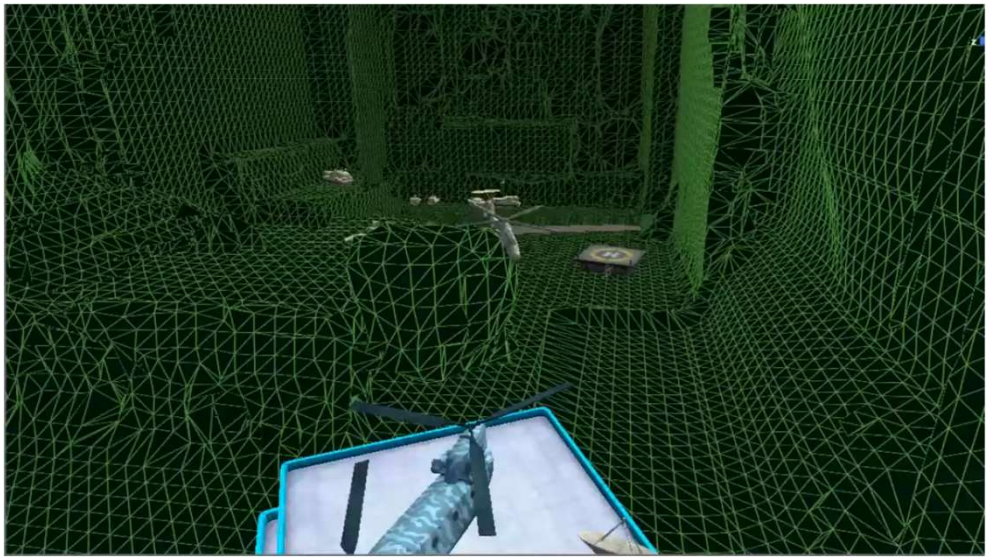
Navigating Empty Space

Navigating a helicopter through a cluttered room is tricky!

Navigating Empty Space

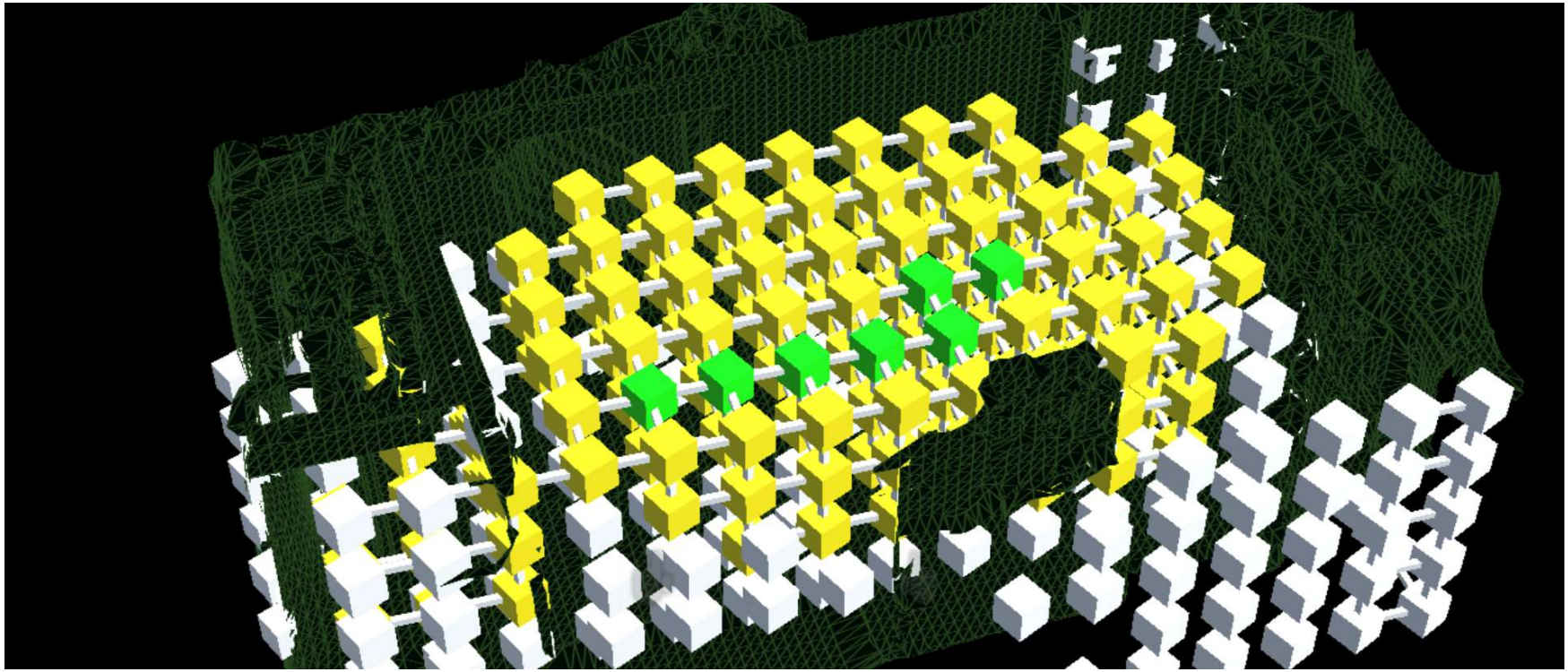


Raycasting + Heuristics



AirNav

Navigating Empty Space



Spawning Vehicles in *H.E.A.T.*

Intra-mission spawning:

- Hidden tunnels

Spawning Vehicles in *H.E.A.T.*

Intra-mission spawning:

- ▶Hidden tunnels
- ▶Overhead fly-overs
  - Spatial audio!

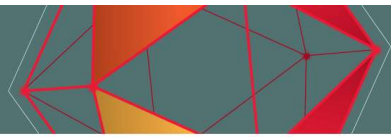
Design Challenge: Static Scenery

We lose a key reward mechanism…

Design Challenge: Static Scenery

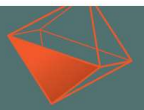
Welcome to the next level… unless you're in AR.

Solution: Empower the Player to Alter Reality



Solution: Empower the Player to Alter Reality

Idea: Level design/alteration as a game mechanic



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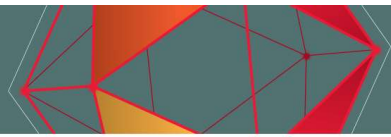
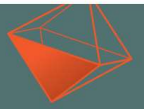
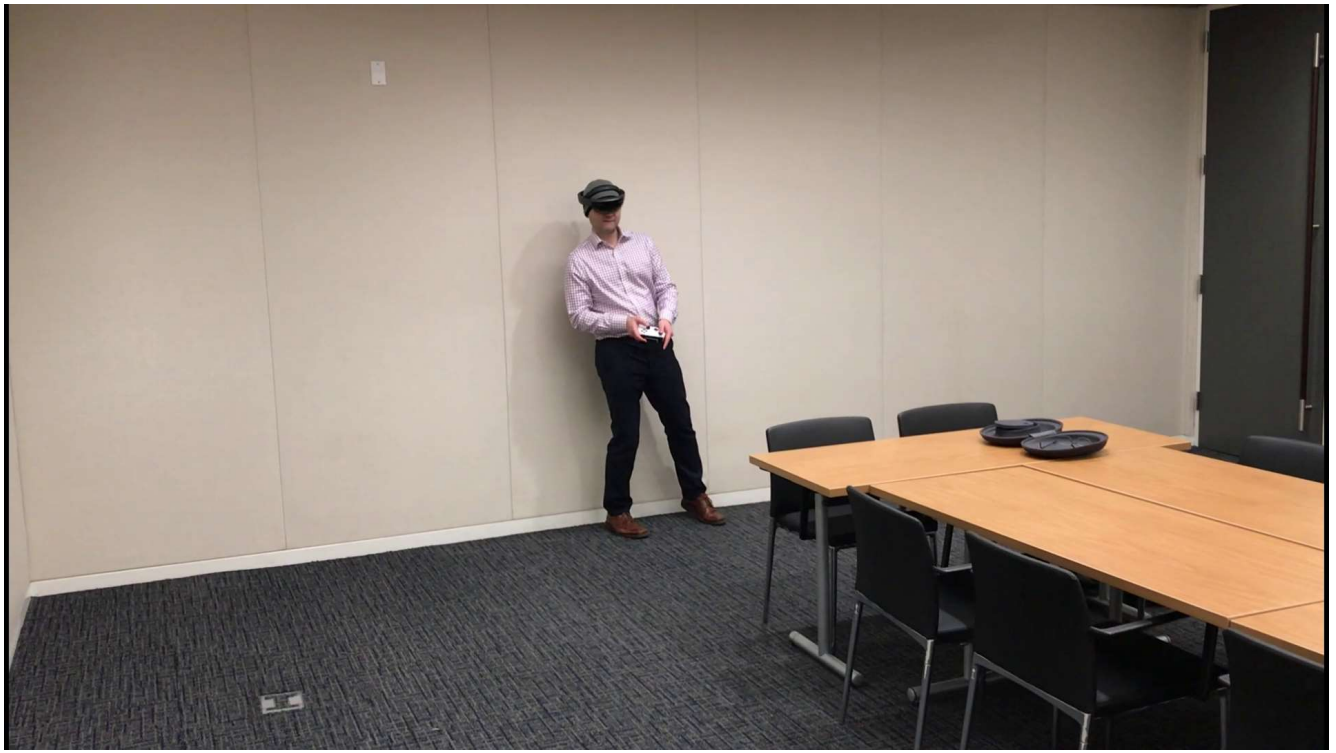


Design Challenge: Player Controls Camera

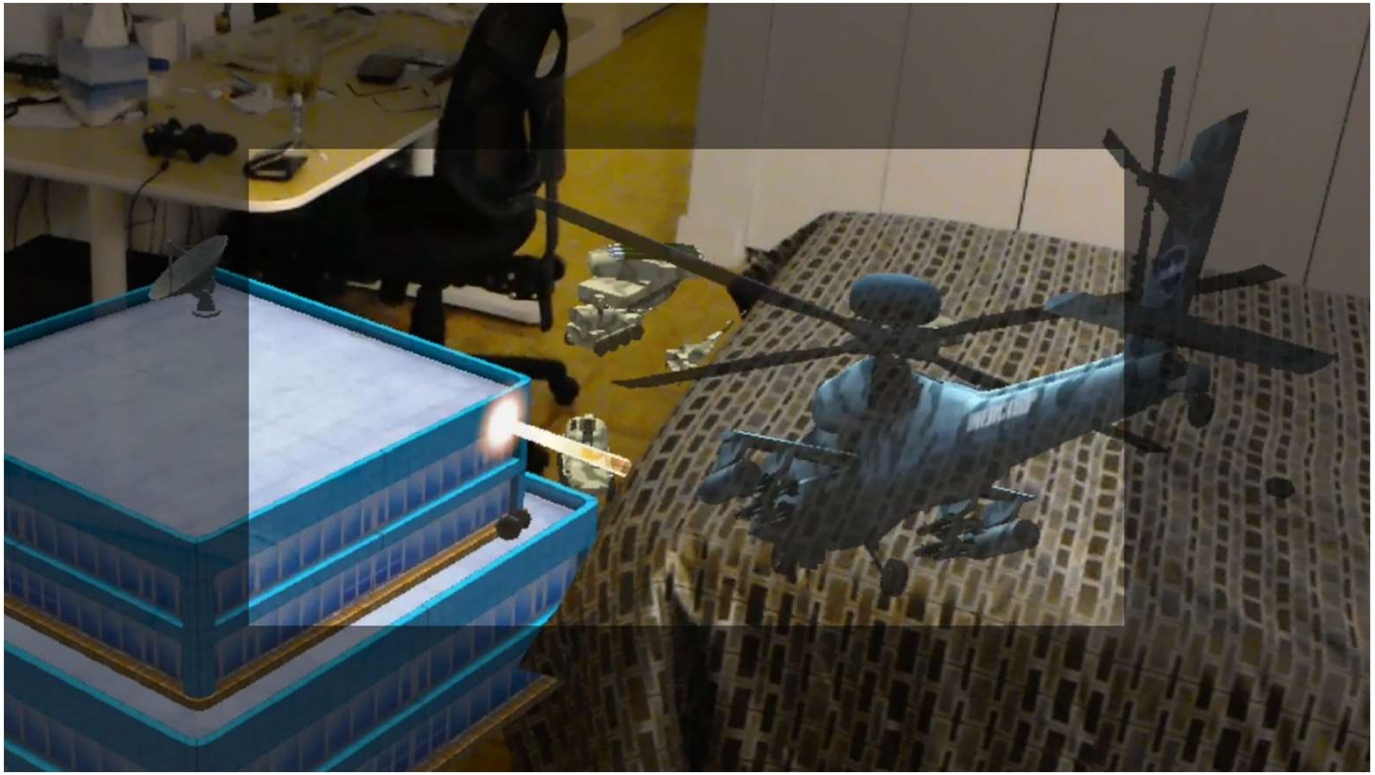
- Player's head is the camera
  - Cannot control player's gaze
- Unlike home VR, near-unlimited ability to walk around ("room scale")
- Narrative challenge
- Goodbye cinematic sequences?
  - Hard on AR headsets
  - Perfectly doable on mobile



The “Freeze”

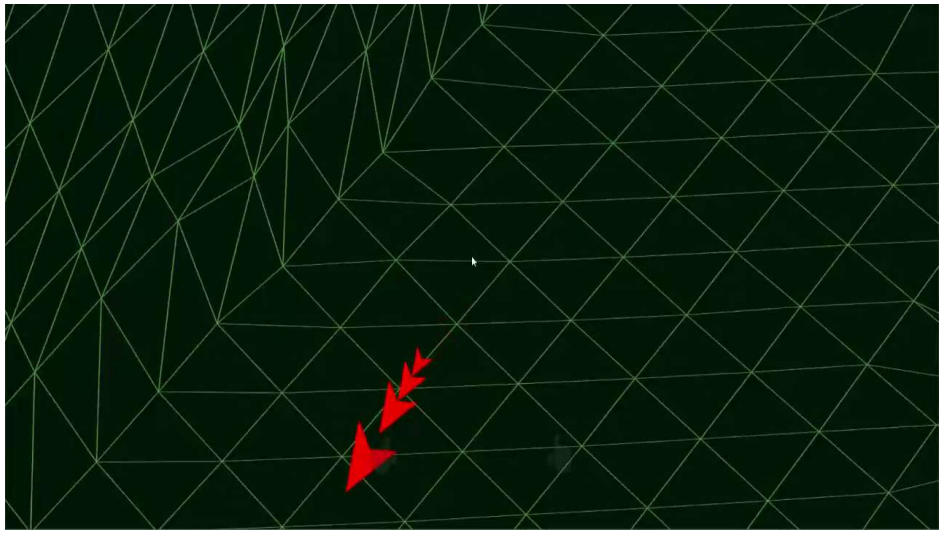


Limited FOV

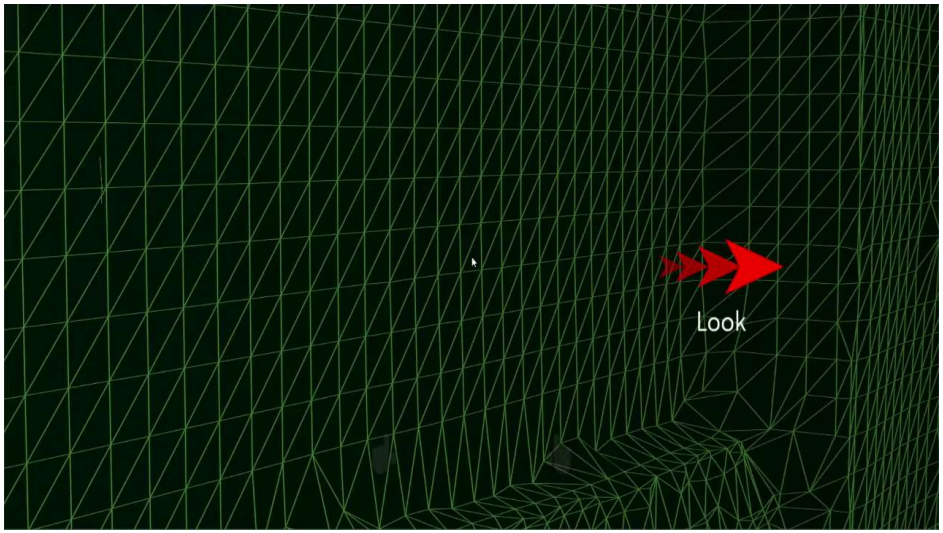


Guidance Arrows

Can be surprisingly ineffective if done wrong!



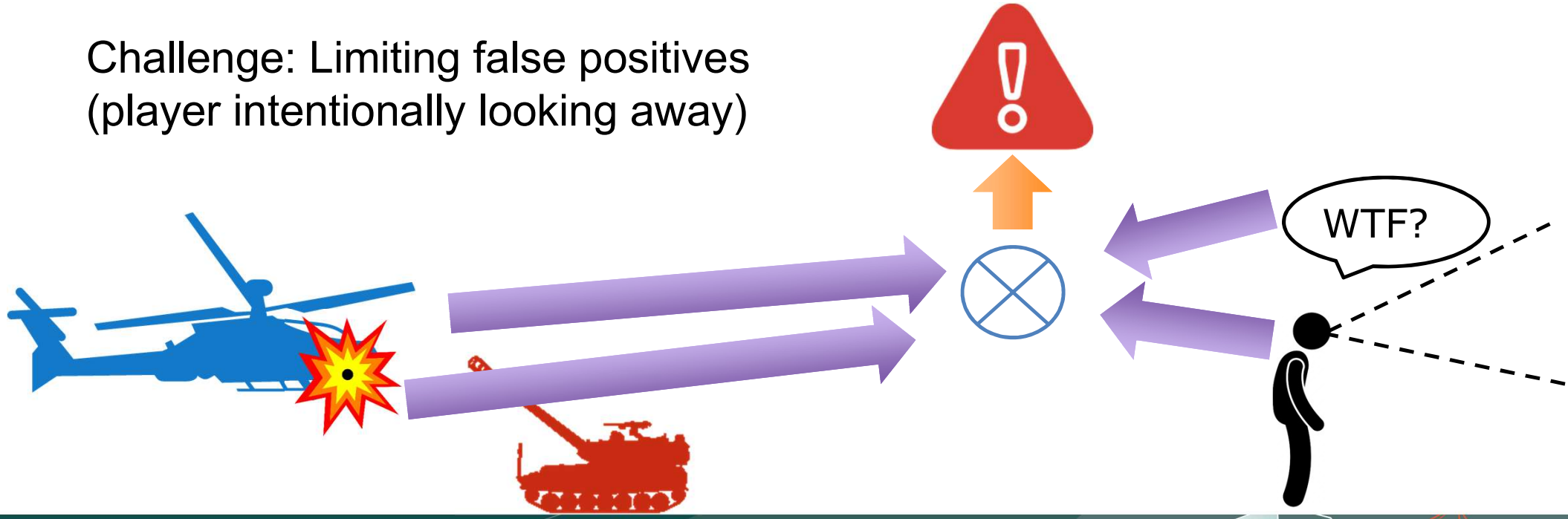
Original



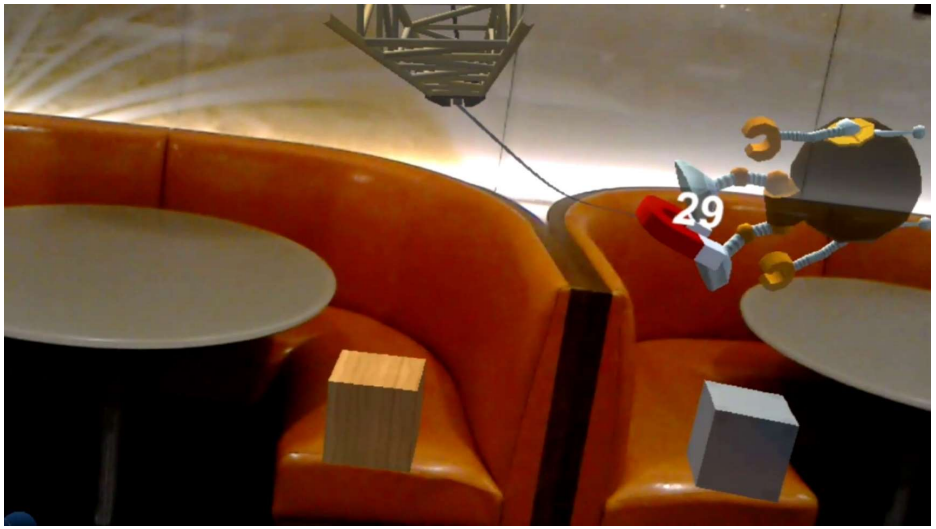
Improved

Seamless Confusion Detection?

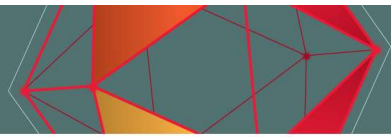
Challenge: Limiting false positives
(player intentionally looking away)



An AR-Native Idea: Player's Head As Input Device

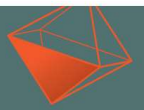


Yes, it looks as silly as you'd imagine!



Ergonomics in *Doko Desu Ka*

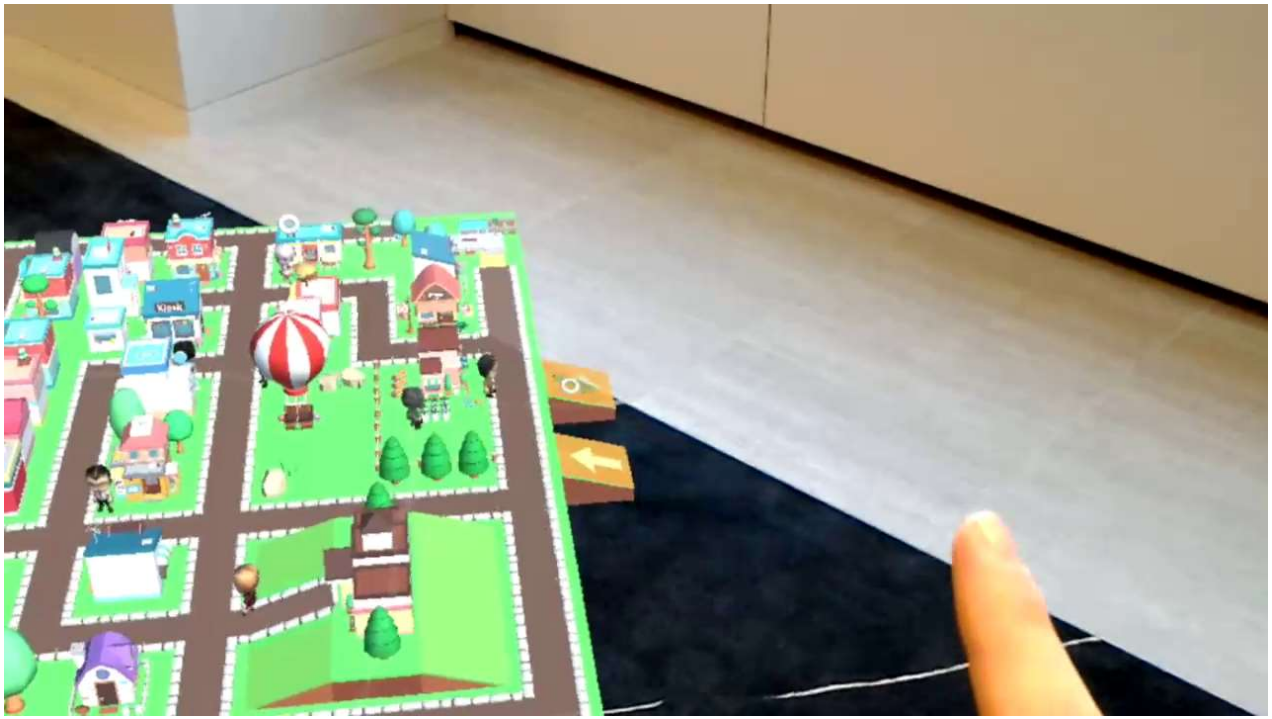
Looking down at the floor for extended period of times is uncomfortable!



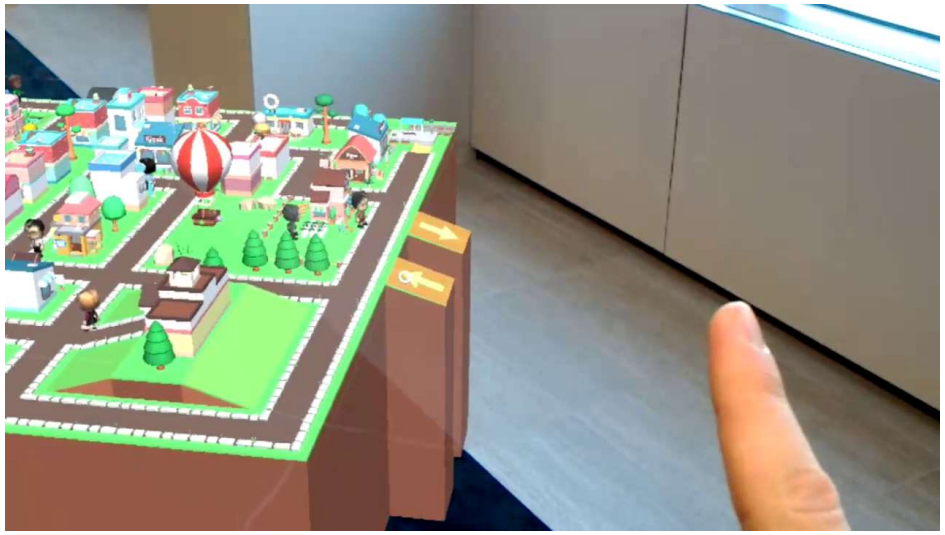
Ergonomics in *Doko Desu Ka*

If only all our necks were this strong!

Ergonomics in *Doko Desu Ka*



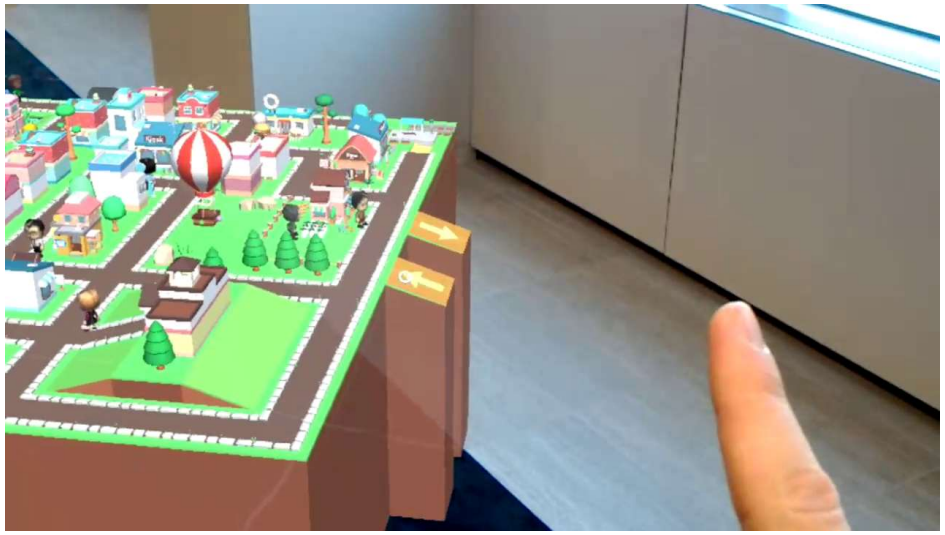
Physical Space and UI



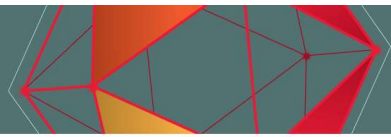
When possible, integrate UI onto 3D objects.

Map *physical* context to *mental* context.

Physical Space and UI

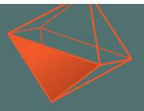


Key differentiator for AR vs. VR: room-scale experiences w/ persistent, localized objects.



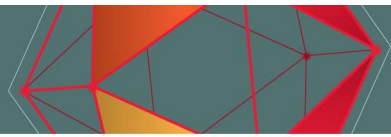
Summary: What Have I Learned?

- ►Keep casual audience in mind
  - Be attentive to struggles to adapt to this new experience
- ►Many existing game mechanics can be adapted…
- ►… but “AR-native” is the real key
- ►Make use of the environment
  - ‘Wow’ factor
  - AR native
- ►People enjoy creating and sharing – *changing* their reality feels like magic



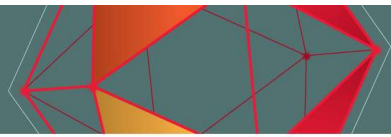
Much To Look Forward To!

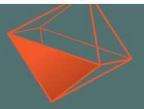
- Improved headsets!
- AR Cloud
  - Detailed mapping
  - Persistence
  - Shared experiences
  - World scale, location-based gaming



Gaming in 2021

https://youtu.be/400aS2-L7RM



Thank You!

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