

# TOWAR ***strike***

COMS W4172 / 3D User Interfaces & Augmented Reality  
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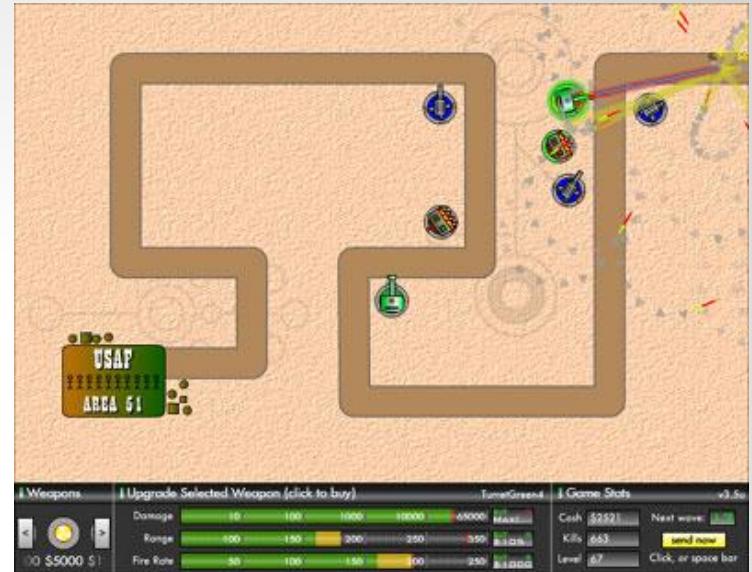
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# Tower Defense Games

Enemies come in waves and attempt to cross a map or follow a path to a goal

Player must stop them by building towers to damage and destroy them

Each new wave of enemies gets progressively more difficult to defeat



Onslaught 2



Fieldrunners

# Tower Defense Games

Towers cost cash to build and upgrade, which is earned by destroying enemies

Different types of towers exist, which have different abilities

The name of the game is survival, and strategy is based on choice and positioning of towers



Bloons TD5



Plants vs. Zombies

# **Project Goals:**

Create an enhanced, 3D version of the traditional tower defense game in an AR environment with added features

Incorporate the four facets of 3D interaction (selection, manipulation, travel and wayfinding) through AR affordances

Enable the player to be an active participant in defeating the enemies

# Result: TowAR Strike



# What is *TowAR Strike*?

*TowAR Strike* takes the genre in a new direction by allowing the player to directly participate in the destruction of enemies and explore the map for hidden items

By enhancing traditional game dynamics to incorporate 3D elements such as varying elevation and controllable pitch/yaw, *TowAR Strike* offers an added dimension of egocentric engagement to the traditionally exocentric 2D tower defense game

# Game environment

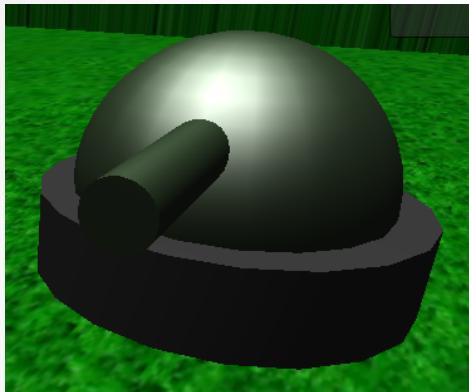


- Enemies spawn at the blue gate and make their way along the branching dirt paths to the red gate
- Towers can be built on the grass, at varying elevations

# Four types of towers

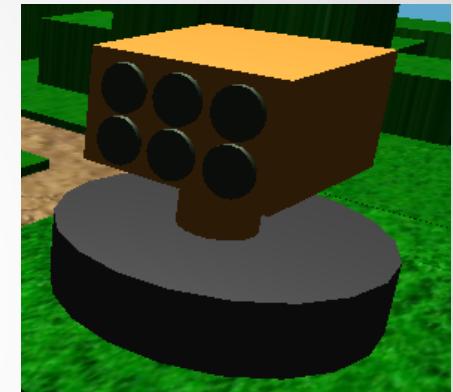
## CANNON

Fires fast cannonballs in rapid succession!



## LAUNCHER

Fires homing rockets!



## RADIATOR

Sends out waves of deadly radiation!

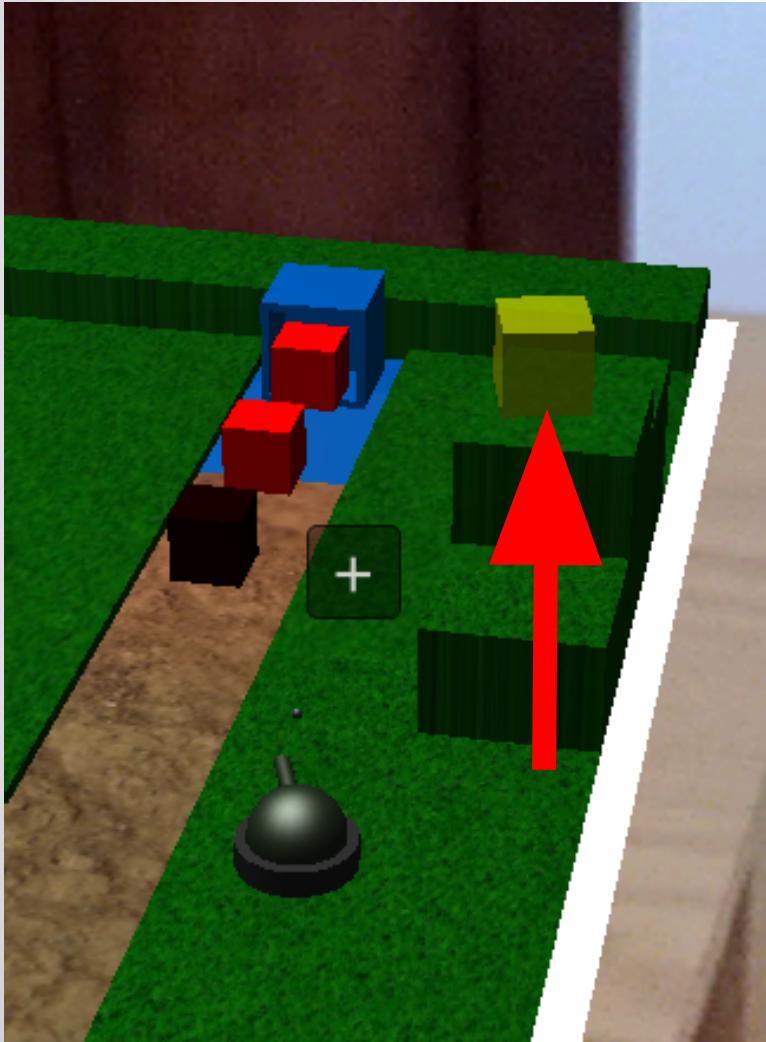


## MOUNTED TURRET

Shoots rapidfire bullets, and is controlled directly by the player!



# Item Crates



These “mystery boxes” spawn randomly during a wave

May contain additional cash or a trap, which will cost you lives

To open a crate and reveal its contents, you must shoot it using a player-controlled mounted turret

They exist only for a limited period of time!

# **DEMO**

(please excuse any lag)

# Demo video



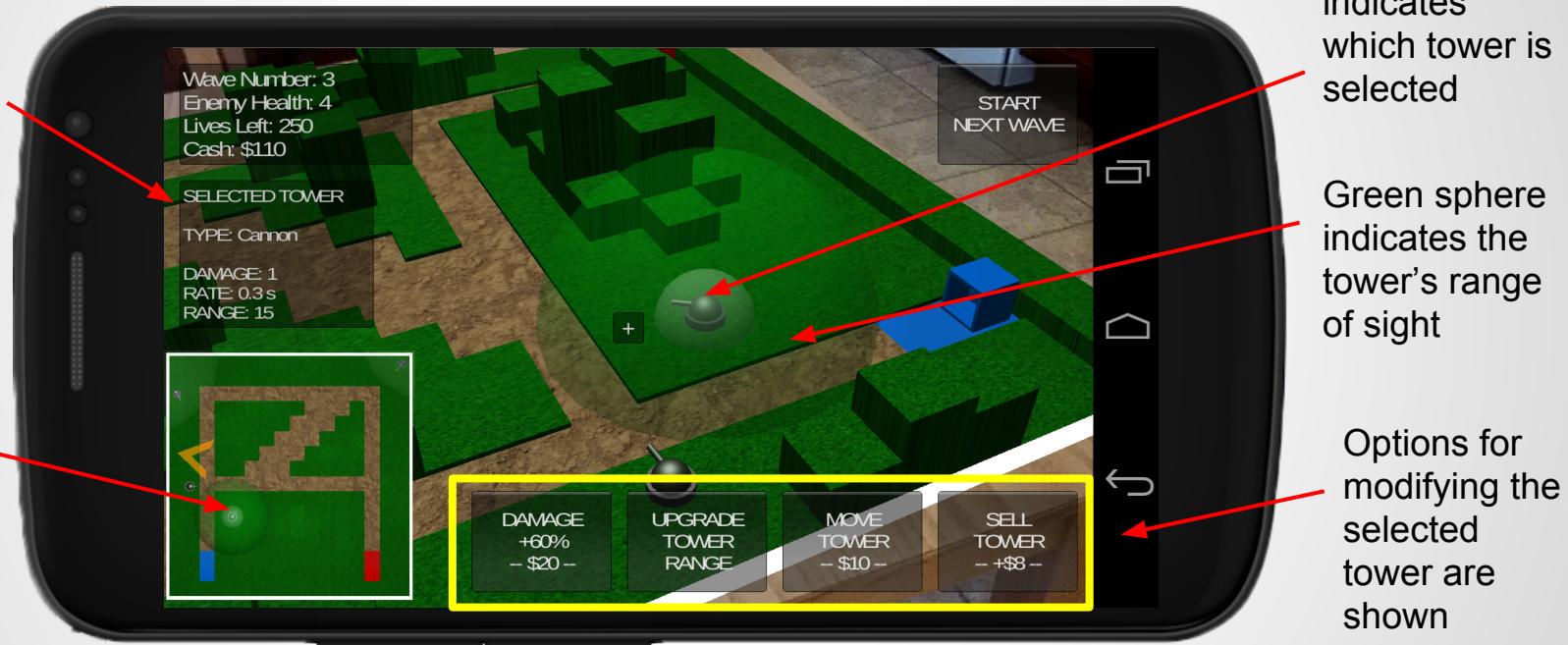
<https://www.youtube.com/watch?v=WzWt2ylvmhk>

# Interaction design: selection

Done primarily via raycasting

Selected tower's stats are displayed on the left

Both spheres visible on mini-map to aid in precise visualization



White sphere indicates which tower is selected

Green sphere indicates the tower's range of sight

Options for modifying the selected tower are shown

- Select a tower by tapping it, deselect by tapping elsewhere
- Falls in line with player expectations for selection in similar 2D games, ended up still being the most comfortable approach for 3D

# Interaction design: selection

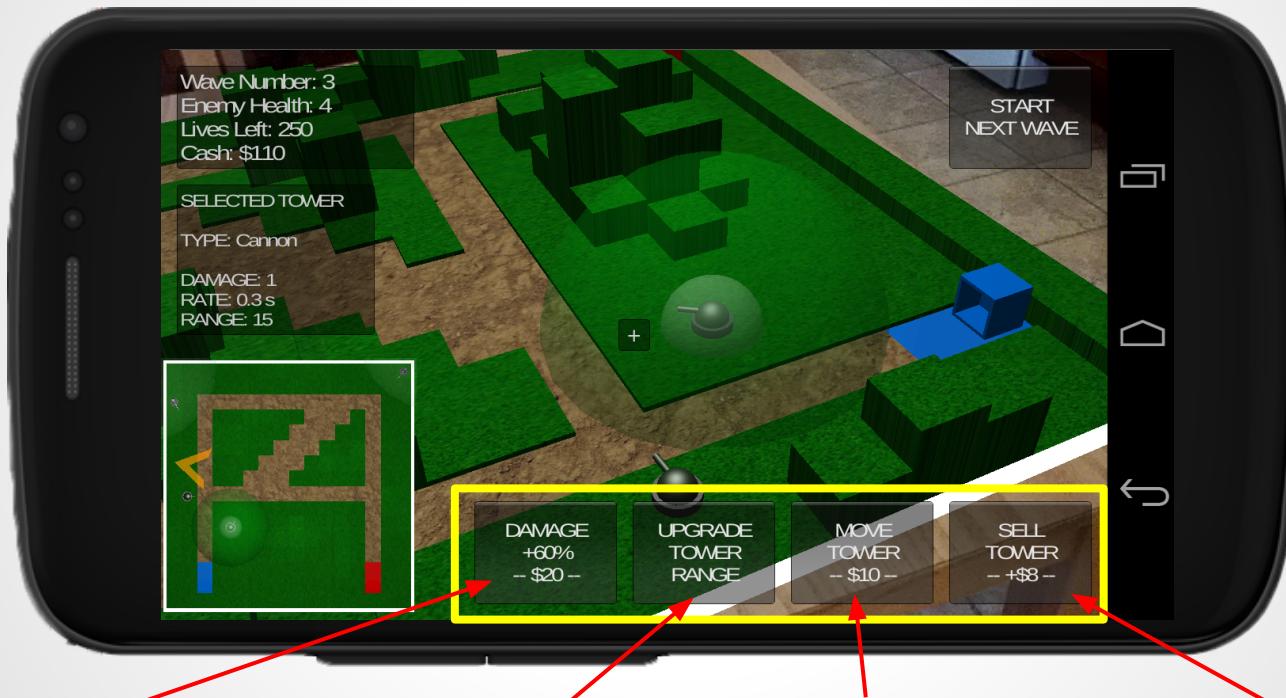
A more subtle form of selection by pointing: firing at enemies and item crates with the mounted turret



- Enemies get darker as they take damage as an indication of successful hits
- Item crates disappear and a sound effect is played to confirm that it has been opened
- More on the functionality of the mounted turrets in the next section

# Interaction design: manipulation

Four ways to manipulate a tower



Pay for a 60% boost in damage power (just press the button and the stat will update on the left)

Pay to upgrade the tower's range of sight via scaling (covered in next slide)

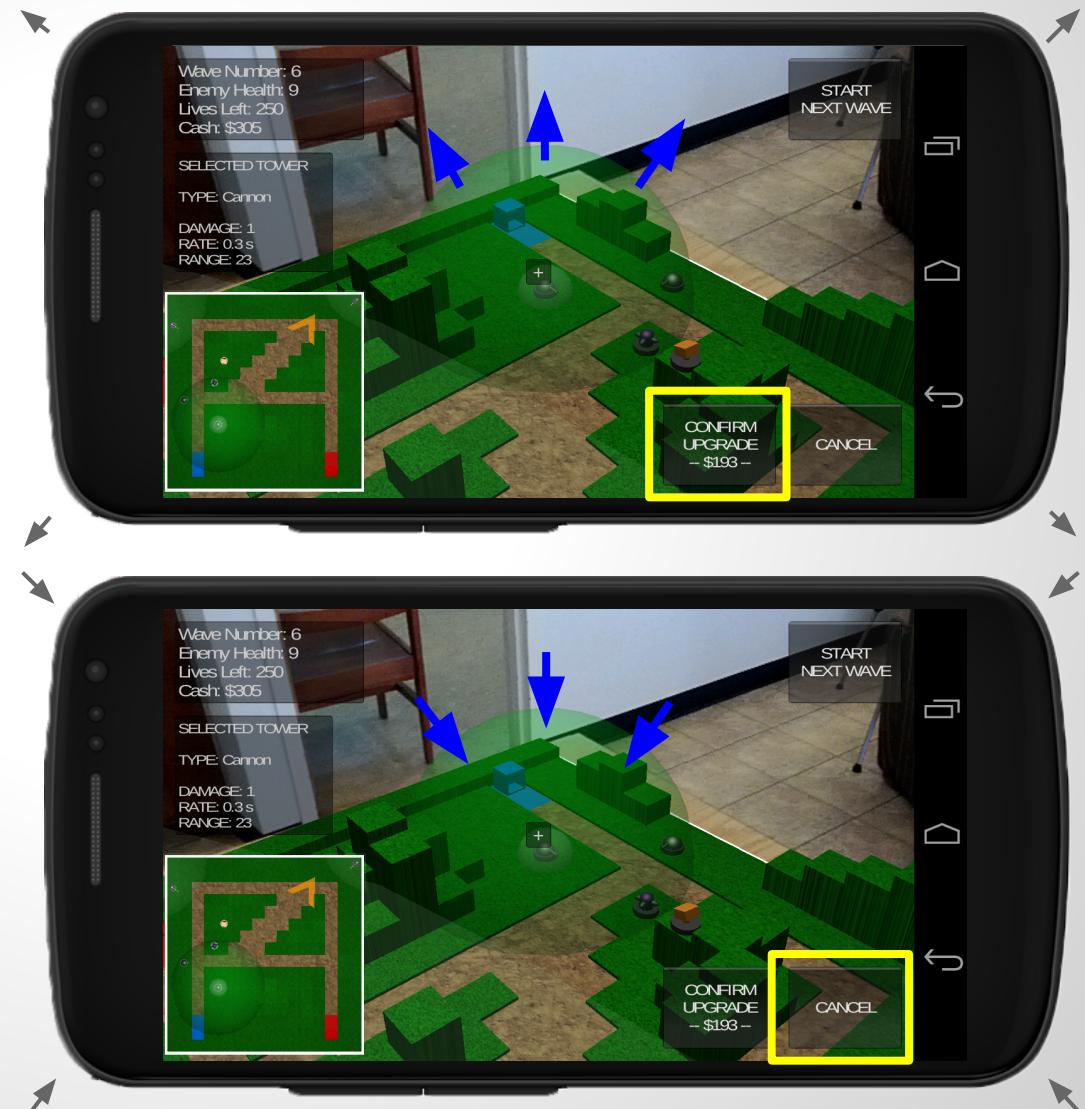
Pay to change the tower's position via translation by moving the device (covered in an upcoming slide)

Sell the tower to earn back cash (simply deletes the object)

# Interaction design: manipulation

## *Scaling* the range:

- Move the device backward or forward to scale up or down the range of the tower
- Tap the “confirm” button to pay the specified amount for the upgrade, which increases in real time as you scale up, and disables if you can’t afford it
- To the user, it will appear as though the sphere remains the same size on the screen while the rest of the scene gets larger and smaller, feels quite intuitive
- Tap “cancel” to abort the operation and return to the previous menu



# Interaction design: manipulation

***Translation:*** moving the towers

- While in the movement menu, the tower will simply follow your crosshair
- Tap “place tower” to confirm the new location and pay the associated price (the price of building that tower), or “cancel” to abort, which will undo all movement
- Using this pointing technique, towers can be placed at varying elevations with great ease



# Interaction design: manipulation

## **Rotation:** aiming the mounted turret

- Activate a mounted turret by moving the device into its *control zone*, a large area behind the turret denoted in the scene by a large translucent sphere
- When taking control of a mounted turret, the turret head rotates (pitch and yaw) to respond to the device's orientation, specifically the aim of the crosshair
- Decided on this approach over just mimicking the device's rotation because the latter made precise aiming difficult if the camera wasn't positioned exactly at the head of the turret

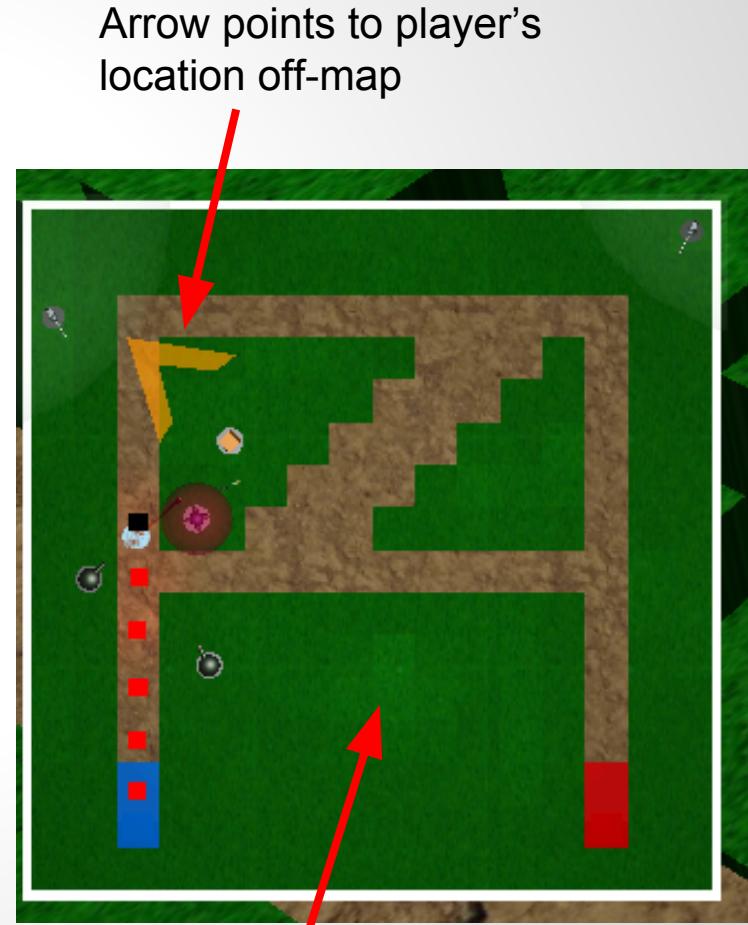
Turret will aim at whatever is under the crosshair



# Interaction design: wayfinding

There is the potential for things to be happening everywhere, so we need a quick way to make sense of it all:

- The **minimap**



Brighter regions denote  
higher elevation

# Interaction design: wayfinding

Wayfinding is incentivized by occlusion of objects

We see the  
crate on the  
minimap, but  
not in the main  
view!



# Interaction design: travel

- Almost anything the user can do in *TowAR Strike* will involve travel:
  - inspect the landscape, decide where to place towers
  - move into or out of mounted turrets
  - uncover bonuses in the environment
- More exploration = more integrated investigation experience



**And that, ladies and gentlemen, is  
*TowAR Strike*™**

**Questions?**