AI ARTIFICIAL INTELLIGENCE SUMMIT

Blending Autonomy and Control: Creating NPCs for *Tom Clancy's The Division*

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Overview – 1st Half

1. Game Overview
2. Combat NPC Overview
3. Design Philosophy
4. Archetypes
5. Factions
6. Challenge Scaling
7. Behavior Tree Structure

Combat NPC Overview

- 36 unique combat AI split into 11 archetypes
- 5 enemy factions and 1 friendly faction
- Detection system, threat system, scripted control, reaction to player Abilities, dynamic objective-handling, reactions to civilians and wildlife, idle activities
- Used in both systemic open world and linear, scripted story missions
- Behavior Tree architecture

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TOM CLANCY'S THE DIVISION

Design Philosophy

RPG AND Shooter

Strong Archetypes

Realistic Setting

Continual Challenge

RPG AND Shooter

- Allow player to play in different ways and use various roles
- Combine skills and synergize with other players
- Incorporate typical RPG systems such as Aggro and Crowd Control
- Incentivize pre-combat setup and tactical play
- Reward player skill (twitch)

Realistic Setting

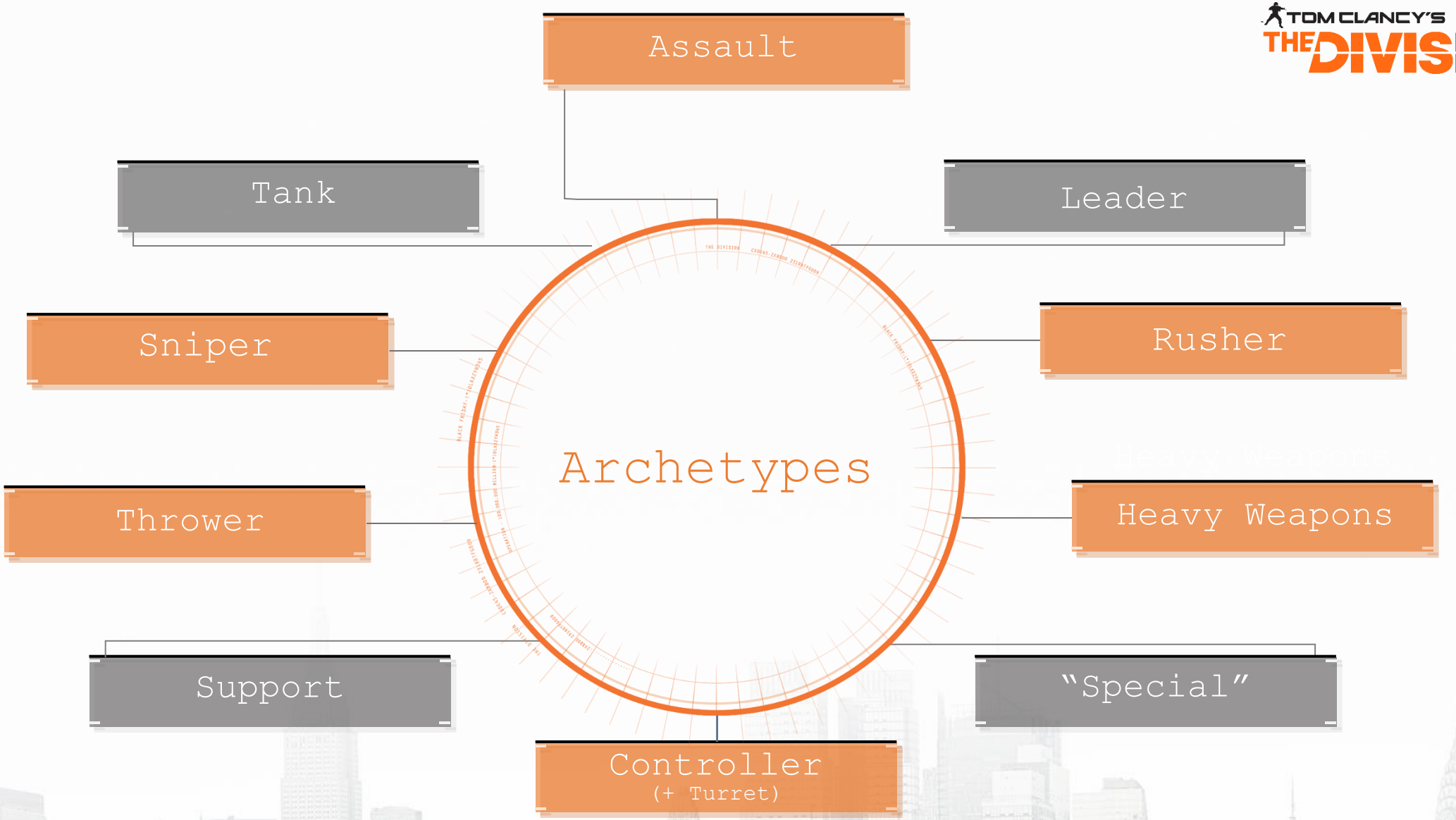
- Tom Clancy brand demands “realism”
- No magic or (too) sci-fi tech
- Open world allows player to go anywhere at any time
- Fun is still paramount (fun > “intelligence”)

Strong Archetypes

- Various roles that pose different challenges to the player
- Encourage the player to utilize different tactics based on the enemy archetype composition
- Create clear archetypes through obvious signs and feedback to the player
- Enemy synergies create interesting combat puzzles for the player

Continual Challenge

- Introduce new concepts and gameplay to the player over time
- Add or evolve concepts after player mastery
- Rollout more advanced variants of and new NPC archetypes throughout game
- Provide choice of multiple difficulty levels for Missions: Normal, Hard, Challenging


Assault
Tank
Leader
Sniper
Rusher
Archetypes
Thrower
Heavy Weapons
Support
"Special"
Controller
(+ Turret)

Archetype Challenges

Target Prioritization

Forces player to deal with an immediate threat

Target Ordering

Challenges the player to determine an optimal path for defeating enemies

Repositioning

Forcibly moves the player from one location to another (reactive)

Positioning

Encourages the player to move to new, often flanking, locations (proactive)

Minimize Exposure

Penalizes the player from being exposed too long

Endurance

Requires the player to spend a great deal of time before defeating the enemy

Archetype Synergies

	Assault	Rusher	Sniper	Thrower	Controller /Mech	Heavy Weapons	Tank	Leader	Support
Assault		None	None	None	None	None	None	Strong	None
Rusher	None		Strong	Standard	Standard	Strong	Standard	None	None
Sniper	None	Strong		Strong	None	None	Strong	Standard	None
Thrower	None	Standard	Strong		Strong	Standard	Standard	None	None
Controller/Mech	None	Standard	None	Strong		None	Standard	Standard	Standard
Heavy Weapons	None	Strong	None	Standard	None		Standard	Standard	Strong
Tank	None	Standard	Strong	Standard	Standard	Standard		None	Strong
Leader	Strong	None	Standard	None	Standard	Standard	None		None
Support	None	None	None	None	Standard	Strong	Strong	None	

Assault

- Basic shooting and use of covers
- Provides standard “depth” of battlefield
- Synergy with all archetypes
- Grunt role within fireteam

Challenges basic accuracy, timing, positioning

Rusher

- Runs directly towards the target
- Extra-deadly when within close range
- Forces the player to defeat the NPC before they are too close

Challenges target prioritization, repositioning

Sniper

- Long-range
- Very accurate
- Punishes player if exposed too long
- High damage on single target

Challenges minimize exposure

Thrower

- Throws grenades or other dangerous AoE items
- Forces the player out of their current position (usually cover)

Challenges repositioning

Controller

- Fights through a proxy (e.g. Turret)
- Repairs Turret if damaged
- Linked to Turret

Turret

- Shoots at exposed enemies
- Low accuracy, but high RoF
- Can be repaired by Controller

Challenges target ordering, positioning

Heavy Weapons

- Suppresses the player with high RoF
- Long time between reloads
- Forces the player to avoid exposure

Challenges minimize exposure

Tank

- Heavy NPC that takes a lot of damage
- Generally have high damage output
- Long reload times provide combat opportunity for player
- Weak point exploitation encouraged in order to defeat NPC

Challenges minimize exposure, positioning, endurance

Leader

- Affects behavior of nearby NPCs
- Nearby NPCs become very aggressive

Challenges target ordering, repositioning

Support

- Assists teammates by healing them during combat
- Generally defensive in combat

Challenges target ordering, positioning

"Special"

- NPCs without strong archetype association
- Used only in end-game

Challenges various

Factions

- Rioters
- Last Man Battalion
- Cleaners
- Last Man Battalion (Tier 2)
- Rikers
- Joint Task Force

Rioters

- Earliest faction player will encounter
- Present introductory challenge to the player
- Build strong archetype associations
- Disorganized
- Unskilled
- Low tech

Cleaners

- Second faction player will encounter
- Present slightly more advanced challenge to the player
- Introduce first Controller, Turret, and Tank archetypes to the player
- Organized
- Efficient
- Low tech (though higher tech than Rioters)

Rikers

- Third faction the player will encounter
- Present more advanced challenge to the player
- Ruthless and careless (animation)
- Semi-coordinated
- Medium tech

Last Man Battalion

- Fourth faction player will encounter
- Provide advanced challenge
- Very organized and tactical
- Modern/high tech
- Skilled

Last Man Battalion (Tier 2)

- Fifth and final faction player will encounter
- Intended primarily for end-game
- Provide the most advanced and difficult challenge to the player
- Blending between archetypes (e.g. Thrower and Assault or Controller and Support)
- Advanced reactions to player skills and actions
- Very organized
- High tech
- Highly skilled

Joint Task Force

- Friendly faction
- Basic in-combat behaviors
- Force player to do most of the work in combat
- Cheerleaders for the player throughout the game in both combat and out of combat
- Basic interactions with player out of combat

NPC Challenge Tiers

Faction Tiers

Easy

- Rioters
- Cleaners
- Rikers
- Last Man Battalion
- Last Man Battalion (Tier 2)

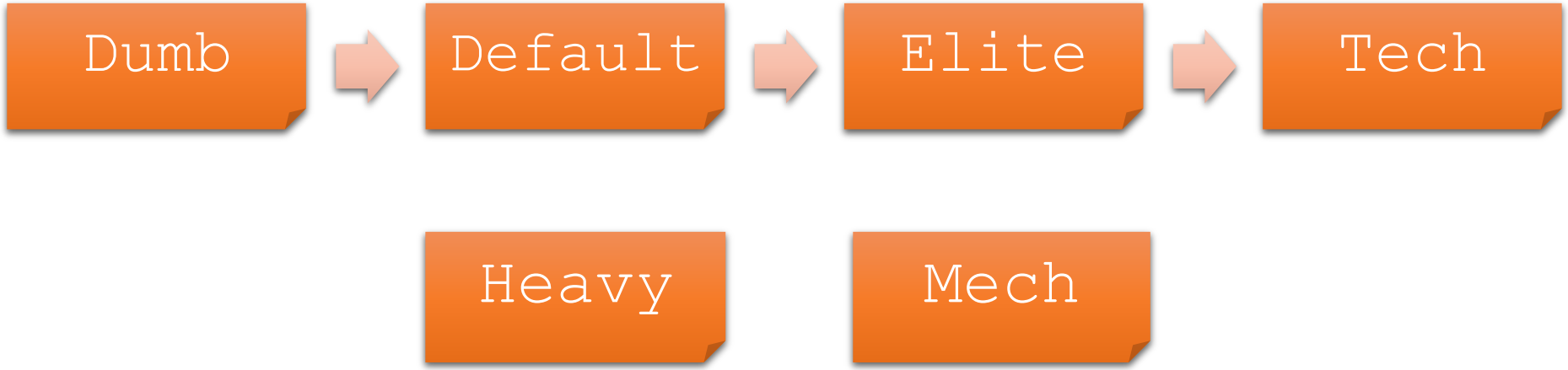
Difficult

IMPROVED

Reaction to Player Skills/Actions
Movement Speed/Style
Group Behavior
Cover Usage
Skill Usage
Stagger Resistance
Suppression Resistance
Health
Damage
Accuracy

Reaction to Player Abilities/Actions

- Different profiles to determine reaction to each player Ability (and some actions)
- Profile changes based on Faction tier and NPC role (e.g. Normal, Veteran, Elite, Named)



Dumb Profile

- Used exclusively by the Rioters
- Allows player to be a bit less careful and skilled with their Abilities and actions

Default Profile

- Used by majority of NPCs
- Reacts to Abilities and actions, but does not counter them effectively

Elite Profile

- Used by Elite role and Last Man Battalion (Tier 2) NPCs
- Counters some player Abilities and actions

Tech Profile

- Used by Agents and some Bosses
- Counters (hacks) many of the player's Abilities and actions

Heavy Profile

- Used exclusively by Tank archetypes
- Ignores some player Abilities and actions, and counters others in a unique way

Turret Profile

- Used exclusively by Turrets
- Ignores player actions, but counters some player Abilities in a unique way

Movement Speed/Style

- Only modified strafe speed of NPCs and rush speed of Rusher archetypes
- Some “panicked” movement styles were swapped with more “composed” movement styles
- Two different overall cover movement styles:
  - Mixed Movement – NPC sprints to a location, then strafes while shooting to cover
  - Full Strafe – NPC strafes while shooting to cover

Group Behavior

- Two major groups:
  - Disorganized – NPCs do not provide cover fire for each other or coordinate movement
  - Organized – NPCs provide cover fire for each other, coordinate their movement, and actively attempt to swarm/surround the player

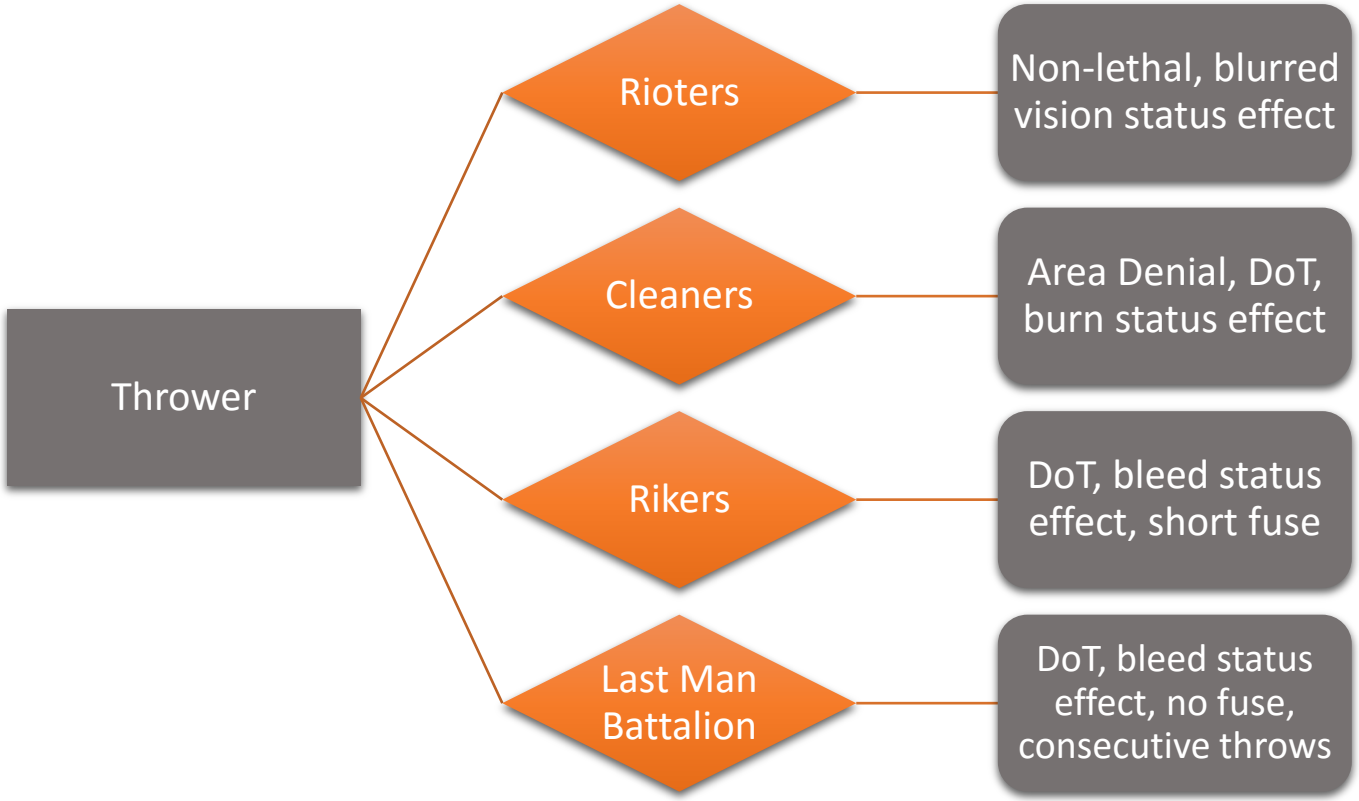
Cover Usage

- Two major groups:
  - Inconsistent – NPCs have a chance to move to a non-cover position and only move from it if they're directly being shot at
  - Consistent – NPCs always attempt to stay in cover; if they are outside of cover too long, they aggressively attempt to move to cover

Skill Usage

- Frequency of Skill usage (grenades, turrets, etc.) altered
- Modified range, speed of deployment, and cooldown of Skills
- Swapped out entire Skills depending on desired challenge

Example: Skill Evolution



Health/Stagger Resistance/ Damage/Accuracy

- Health, Damage, Stagger Resistance, Suppression Resistance, and Accuracy increased in small amounts per faction tier
- Stat increases kept to minimum and behaviors mostly used instead

Other Difficulty Modifiers

NPC Roles

Normal

- Default role of NPCs

Veteran

- Improved weapons
- Armor added
- Improved aiming

Elite

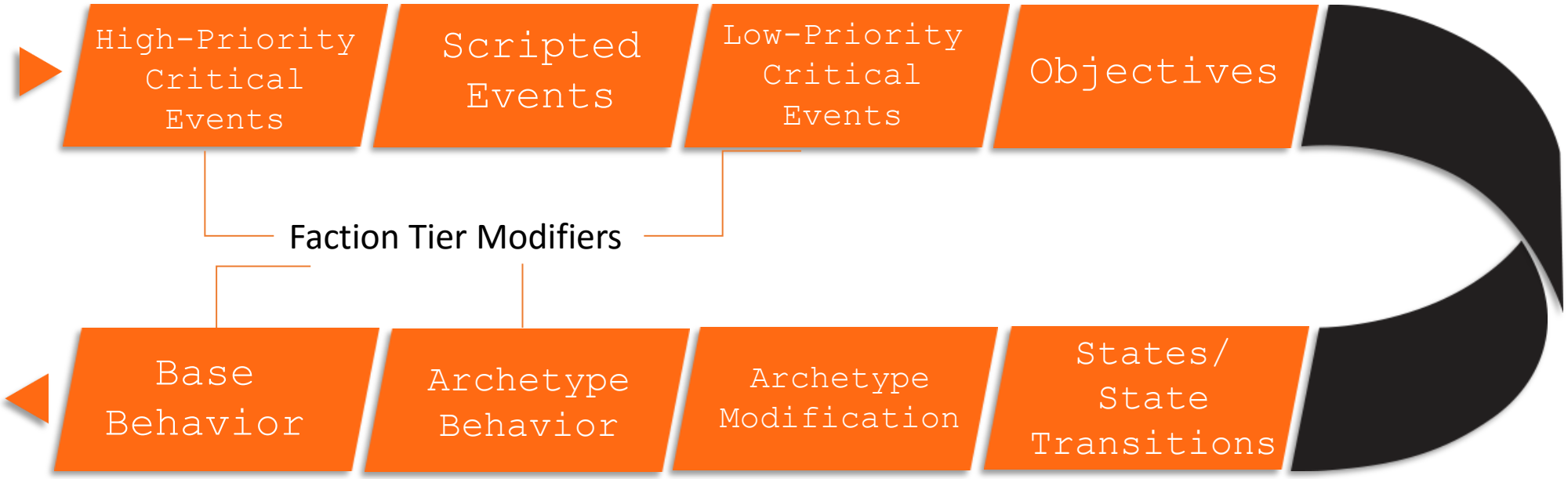
- Improved weapons
- Special ammo types
- Laser sights (cosmetic)
- Skill modifications
- Improved player ability reactions
- Additional Armor
- Improved aiming

Named

- Boss NPCs
- Unique weapons and weapon mods
- Additional Armor
- Improved aiming

Behavior Tree Structure

Decision-Making Prioritization



NPC Behaviors

Combat Encounters

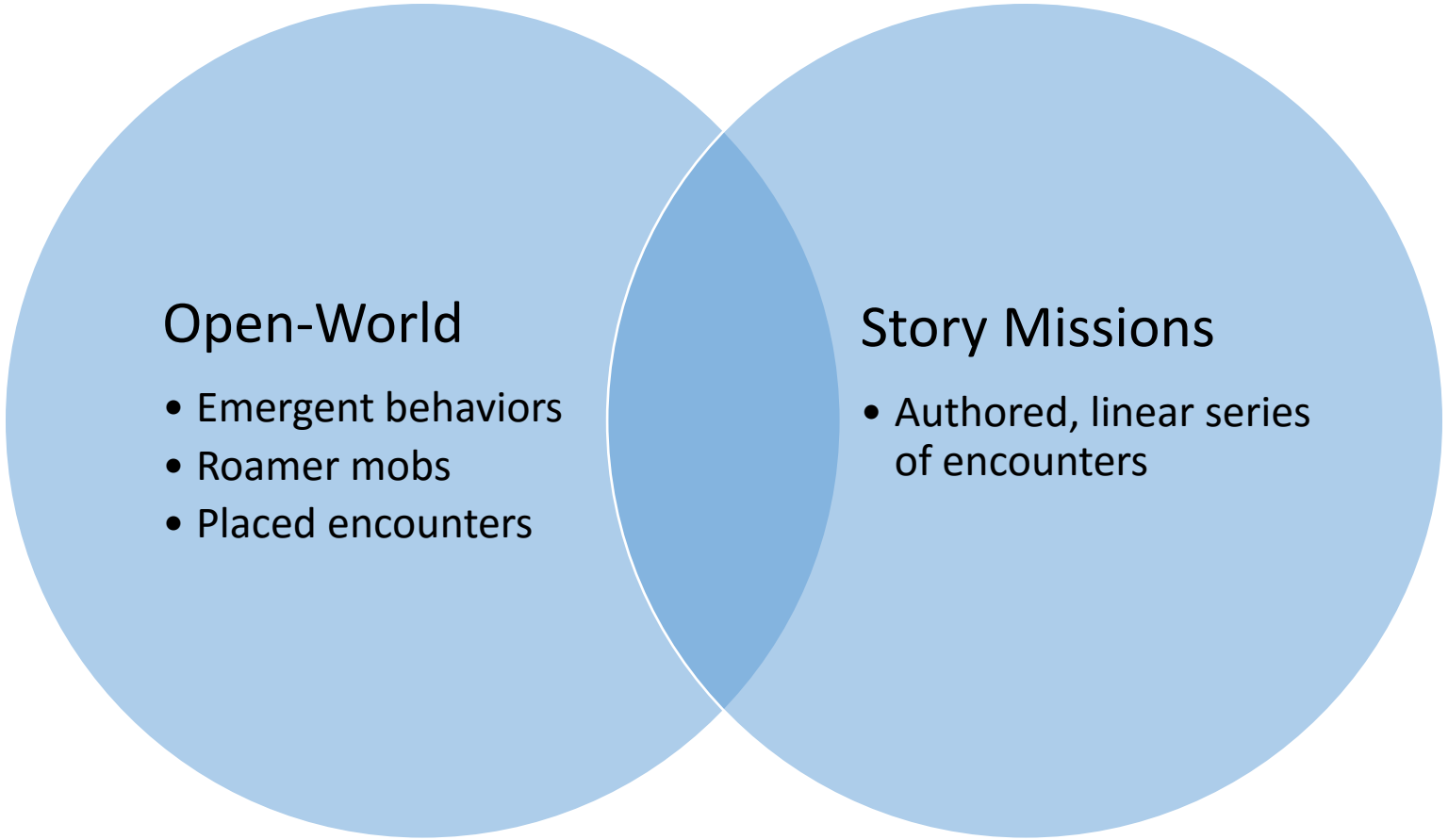
Behavior Systems

- Sensory/Detection
- Positioning
- Threat

Giving Control to Level Designers

Cross Discipline Teams

Combat Encounters



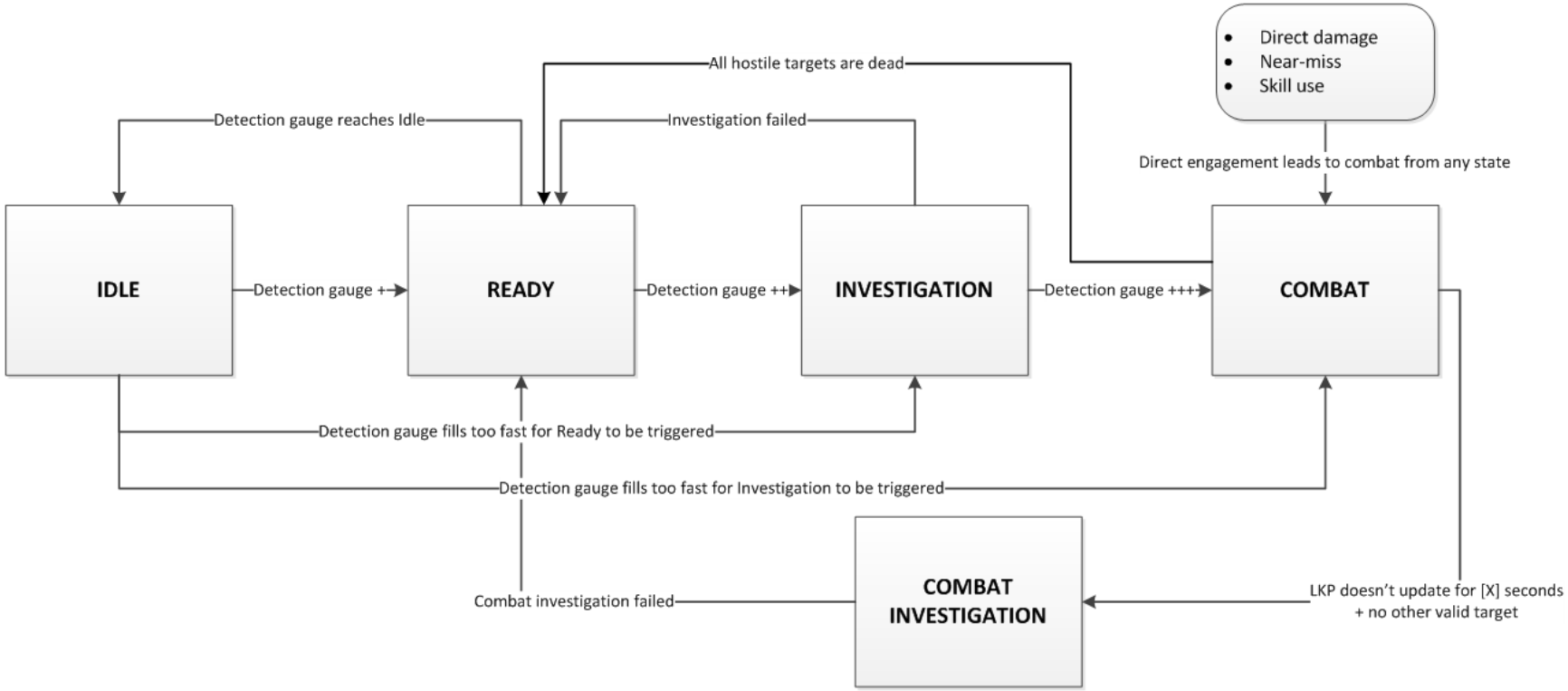
Player Investigation Phase

Allow the player to:

- Scope out combat area
- Identify high priority targets
- Synchronize with Coop players
- Set up initial combat range

Detection System

Idle
Ready
Investigation
Combat
Combat Investigation



Alertness Level

Underlying the detection system is the alertness level

- Affected by audio and visual stimuli.
- Escalation plans differ by archetype and faction.

Visual Stimuli

Vision Cones

- Forward + periphery cones
- Instant combat cones
- 360 close awareness
- Defined per Archetype
- Combat and non-combat cones
- Aiming and Non-aiming
- Modified based on weather

We also modify the line of sight tests when a player is in low cover out of combat to allow players to stay hidden more easily.

Audio Stimuli

Audio Events

- Sound Type
- Radius

Sound Type limits the highest alert level that can be triggered

Interesting sounds can only trigger Ready

Suspicious sounds can trigger Investigation but not Combat

Threatening sounds can trigger Combat

Sound	Type	Radius
Walking	Suspicious	5
Parkour	Suspicious	10
Skill Use (quiet)	Suspicious	15
Skill Use (loud)	Suspicious	35
Pistol	Threatening	40
Assault Rifle	Threatening	40
Explosion (small)	Threatening	25
Explosion (large)	Threatening	50

Last Known Positions

Allow players to exploit the NPC Detection System as a gameplay mechanic.

- Players are hidden while repositioning along cover
- Low profile run when moving from cover to cover

NPCs remember the last position a hostile was seen

- *Aim At Position*
- *Navmesh Position*

Exploiting Detection

File Edit Layout New Window Settings Debug

Local build

Debug

History

Clear debug history

General Settings

- Agents in Debug Mode only
- Client only
- Phasing Settings
- NPC Only
- Players only
- Server only
- Agents in Combat only
- Current iteration
- Server Debug Distance
  - Infinite Debug Distance
- Debug Draw Identifier Labels
- Debug Text Background Opacity

Clear Recorded Checkboxes

Clear Visibility Checkboxes

Make Recorded Visible

Save Settings

1

Filter on Identifier

Save/Load Recordings

Save Recording

Contextual Properties

Game Entity Properties

UID	BF7AF8C856D323B0000040B1604C7983
Resource Name	N/A
Position x	182.855
y	5.78665
z	-659.206
AgentDebug	
Weapon	pon_assaultrifle_m4_default_soundvariation_3
NPCConfig	stem data/juice/ai/npc/lmb_commando.mnpc
Level	11
	Humanoid Default
In Combat	
	Melee attack

- Attributes
- Custom Visuals
- Behaviors

Game Debug History

45.80 45.90 46.00 46.10 46.20 46.30 46.40 46.50 46.60 46.70

Draw

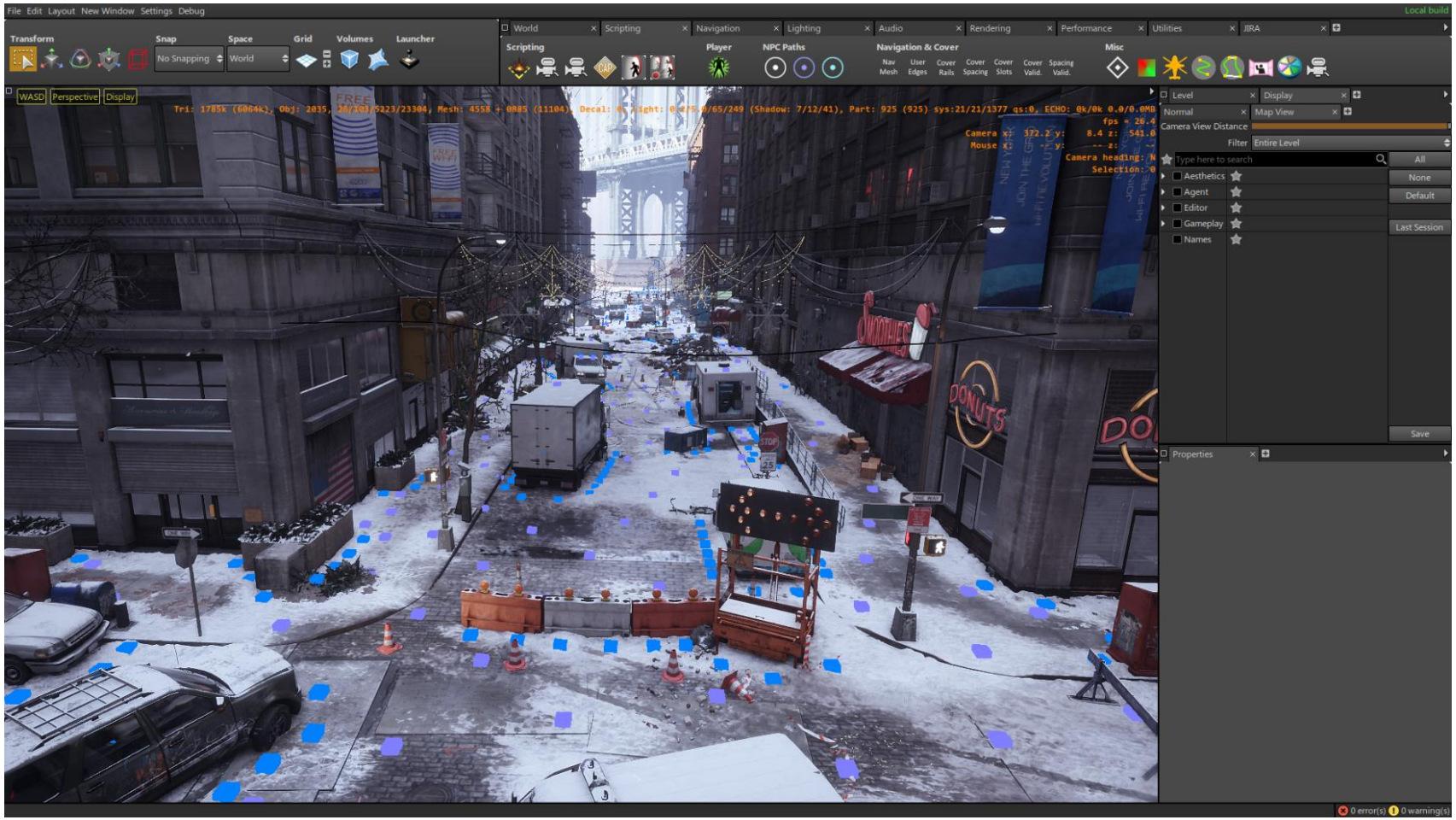
Behavior

Animation

Script

1 error(s) 0 warning(s)

Tactical Positions



Manhattan

6 square kilometers

800 000 cover positions

1 500 000 non-cover positions

Cover positions

- Cover facing direction
- Cover height
- Cover depth
- Corner or Non-corner

Non-cover positions

- 4m spacing
- Rotated grid

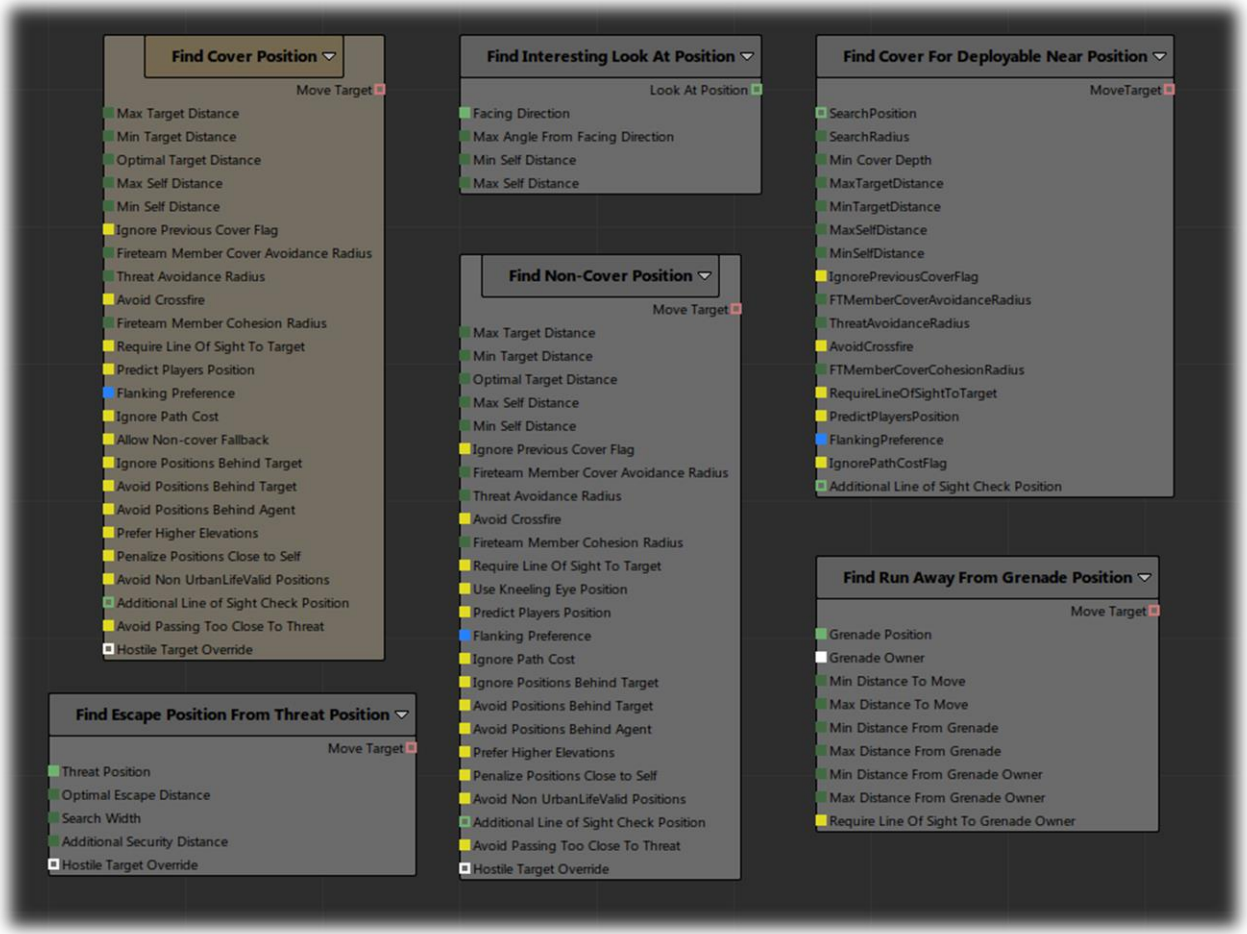
Position Scoring

Uses a single “Uber” position evaluator

- Many parameters to affect the evaluator
- Exposed to behavior through different nodes

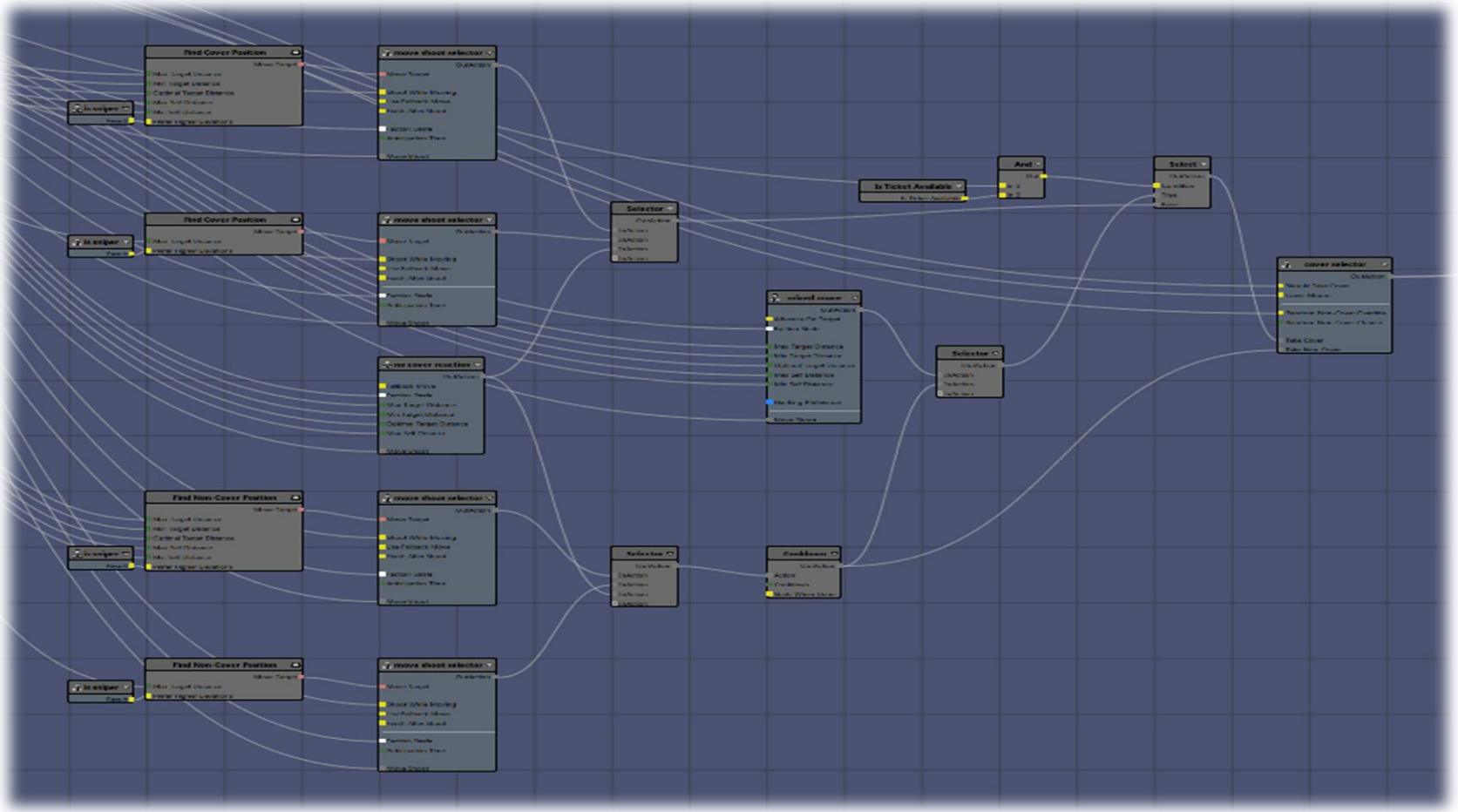
Parameters from behaviors and NPC configuration

- distance from search position
- travel distance
- min/max/optimal target distance
- cover versus non-cover
- flanks hostile target
- flanking by primary and secondary targets
- line of sight to target or another point
- fireteam separation and cohesion
- death stains
- navigation path passes too close to hostiles”

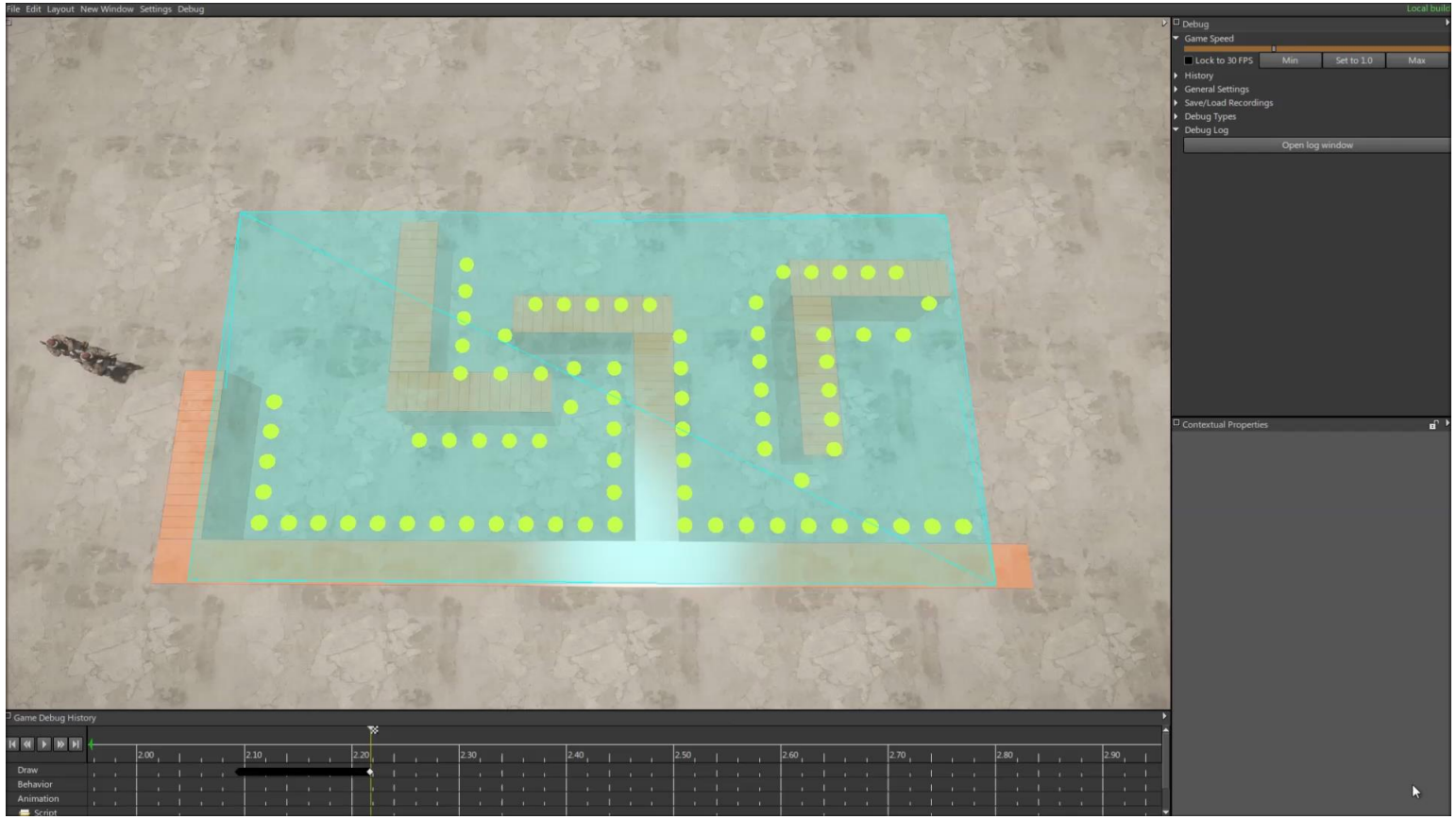


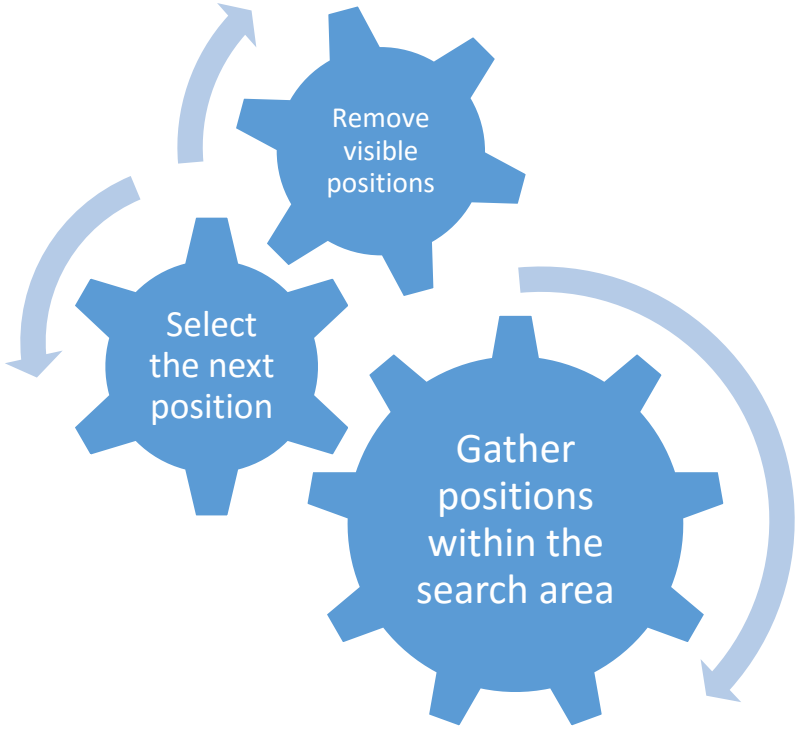
Successive Queries

- Cover position with an optimal range
- Non-cover position with line of sight
- Cover or non-cover position without line of sight



Investigation





Threat System

Base Threat

- enemy proximity
- enemy cover status
- enemy flanking status
- agent type (Player or NPC)
- is the enemy being targeted by allies

Action Threat

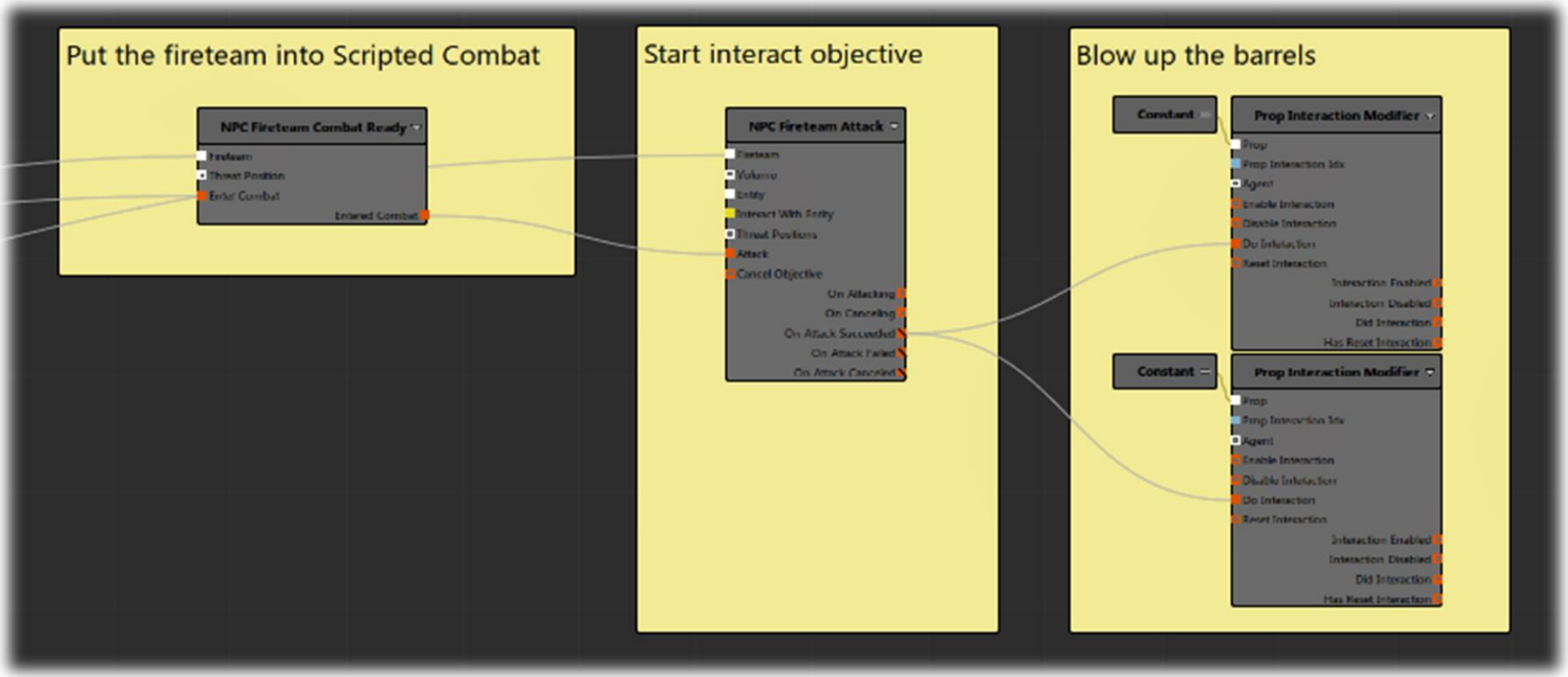
- firing weapons
- using skills
- damaging the NPC
- damaging the NPC's allies

Giving Control to Level Designers

Visual Scripting

Nodes can modify:

- Low Level Orders
- Alert Levels
- Positioning
- Threat System
- High Level Objectives



Low Level Orders

NPC Orders
Move to Position
Move to Agent
Take Cover
Follow Agent
Aim at Position
Shoot at Position
Use Skill

Used for control of a single NPC in a scripted encounter.

e.g. Putting a hostage behind cover.

NPC follow a player.

Implemented in behavior as critical events.

- Higher priority than core behaviors.
- Allows the NPC to respond to grenades or player skills.

NPC Orders are Trouble

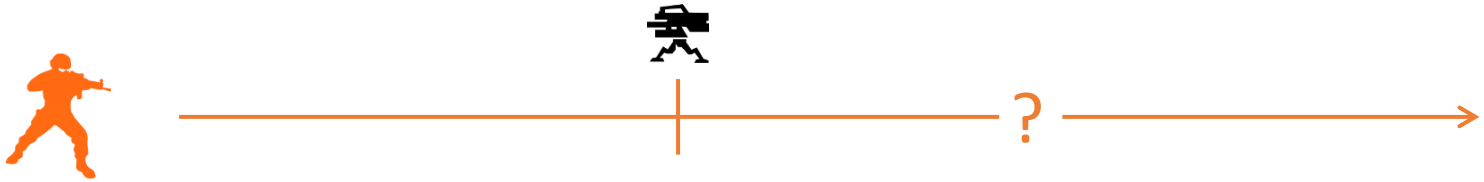
Orders skip the evaluation of the underlying systems

- Sensory and Detection
- Threat evaluation

Orders break NPC reactivity.

Orders don’t provide context for following behaviors.

- An example: A move order that is interrupted by combat



Low level orders force Level Designers to create AI!

Combat Positioning

Provide Level Designers with modifiers to the position system:

- NPC Zones
  - Only accept positions within the volume.
  - If NPCs are out of the zone, score positions closer to the zone higher.
- Tactical Position Modifier
  - Gives score bonus to positions close to the volume with maximum bonus for positions inside the volume.

Can limit both volume types to particular archetypes

  - Force snipers to stay in specific locations.

Scripted Alert Levels

Idle
Ready
Investigation
Combat
Combat Investigation
Scripted Investigation
Scripted Combat

Scripted Investigation

- Provides an area for the NPC to investigate.
- NPCs don't return to idle.

Scripted Combat

- Used without a hostile target.
- Level Designers can specify one or more threat directions.
- Skips initial combat behavior – combat reactions and barks.
- Won't transition to *Combat Investigation* or *Idle*.

High Level Objectives

NPC Objectives
Attack Volume
Attack Player/NPC
Destroy Prop
Defend Volume
Defend Player/NPC/Prop
Interact with Prop

Built on top of the underlying NPC systems.

- Modify detection, positioning and threat systems.

Primary behavior implemented as slightly lower priority than NPC Orders.

Throughout the behavior tree, NPC Objectives can provide additional context for behaviors, including animations and NPC barks.

Affect both in-combat and out-of-combat behaviors.

Interact with Prop

Positioning

- Increase the score of positions near the object.
- Further increase the score of positions between the object and hostile threats.

Threat

- Increase the threat value of hostiles near the object
- Further increase the threat value of any hostiles targeting NPCs interacting with the object.

Behaviors

- Move NPCs to the area if they are a long way away
- If there are no high value threats, move to the object and begin interaction.

Orders vs Systemic

We needed both!

In the open world, prefer systemic behaviors

- Handles unpredictable player movement

Low level orders work great in story missions

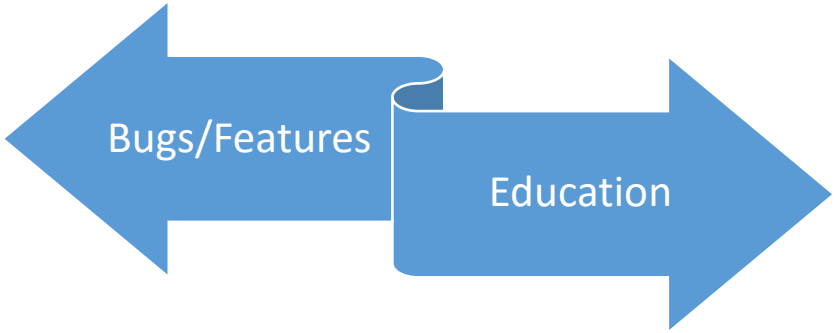
- Provides fine level control over agent positioning
- Better for scripted action sequences than animation sequences.

Players will find a way to break all NPC behaviors; and low level orders are more brittle.

Cross Discipline Teams

Communication

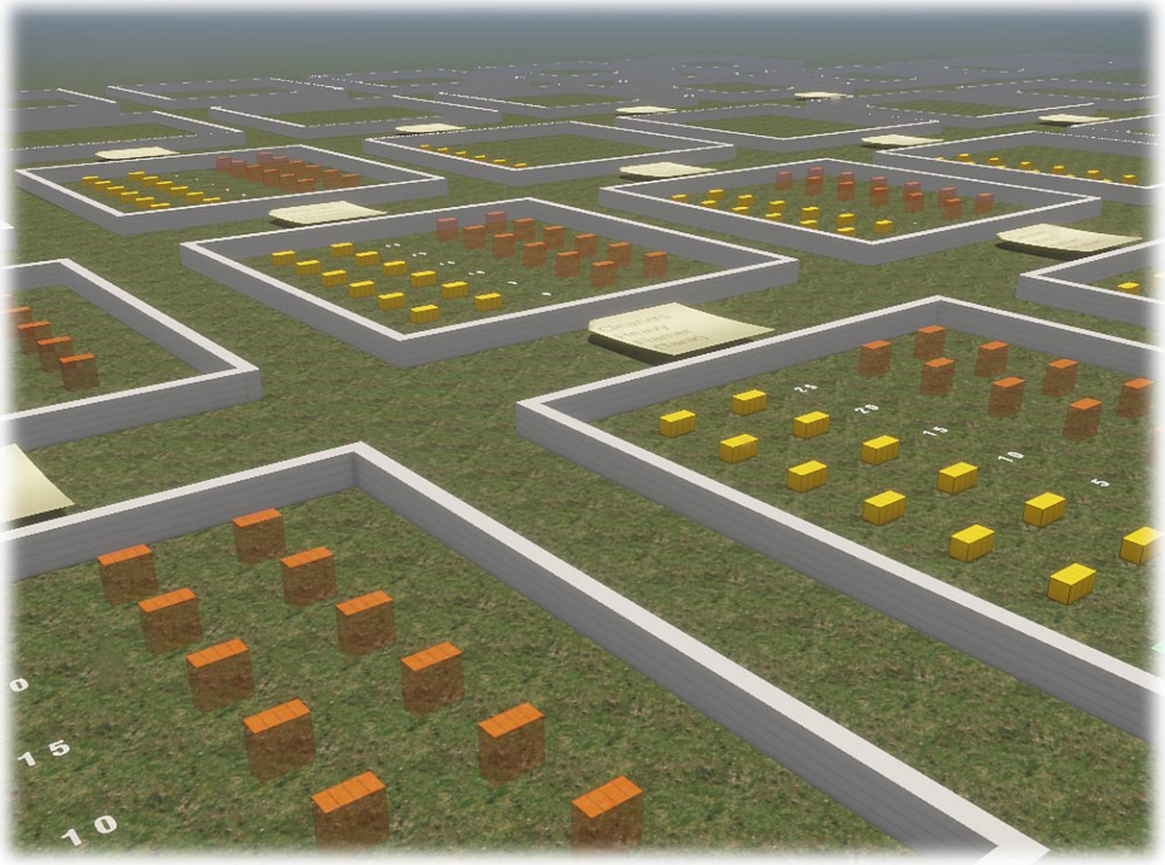
- Building two-way communication bridges.



- Wikis and email are insufficient.
- Cross Discipline task forces targeting specific elements of the game.
- Weekly sync meetings between Level Designers, NPC designers and AI programmers.
- Embedded a Level Designer within the NPC team.

Validation and Debugging Tools

- Validate as much as possible in the editor.
  e.g. Check that volumes contain enough tactical positions
- Test levels
  - Reproducing problems
  - Providing examples of intended use
- Expose your internal debug draw
  - Will be used by some Level Designers.
  - BT debugger was almost never used by Level Designers.



Conclusion

- NPC Faction and Archetype Design
- Behavior System Design
- **Cross Discipline Teams**

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