



Helping It All Emerge

Managing Crowd AI In Watch Dogs 2

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Who Am I?



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UBISOFT®

Before:



THE SECRET WORLD

AGE OF
CONAN
UNCHAINED



Intr0ducti0n



Why Emergence?

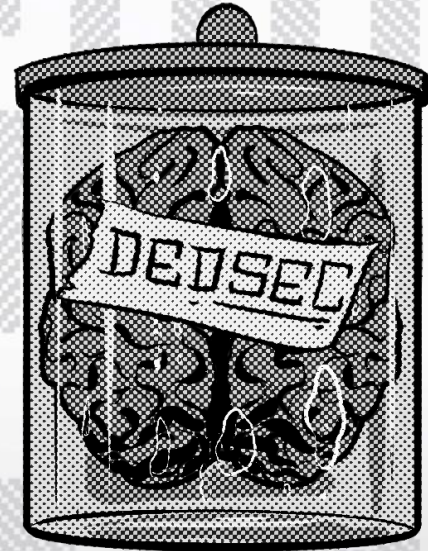


- Illusion of intelligence
- Interesting to watch and interact with
- Create a toy sandbox



What Is This About?

- Crowd AI Systems
- The Journey
- What's Next?



Some Context On WD

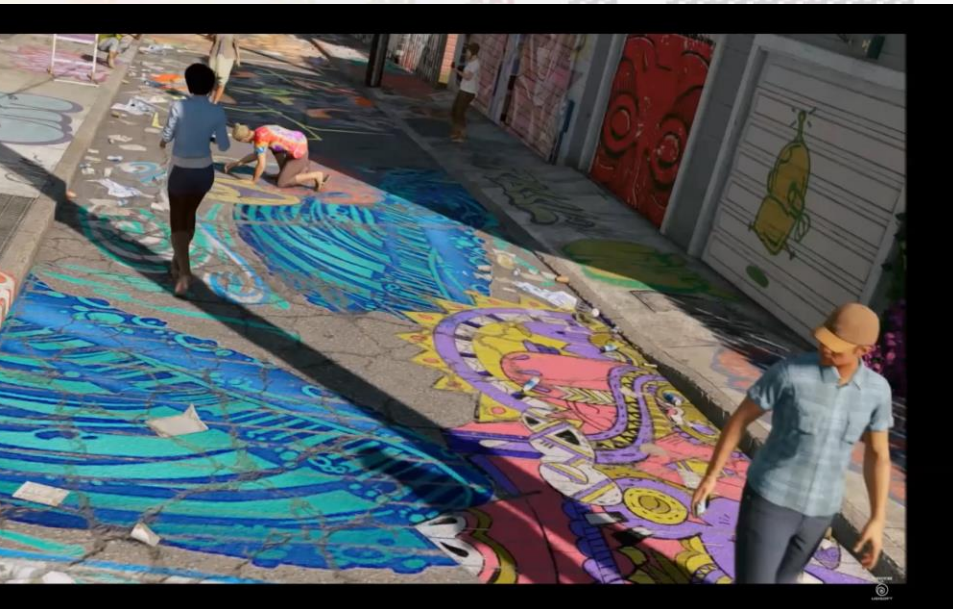


Call 911!



WZ 2

Some Context On WD2



- Vibrant and believable San Fran
- Hack into humanity
- Non-player centric world



Anecdote Factory



- Countless Anecdotes
- Avoid repetition and scripted feeling
- Surprise the player



Anecdote Factory



We know how it starts...
...never how it ends!

-Patrick Plourde, 2015



Anecdote Factory

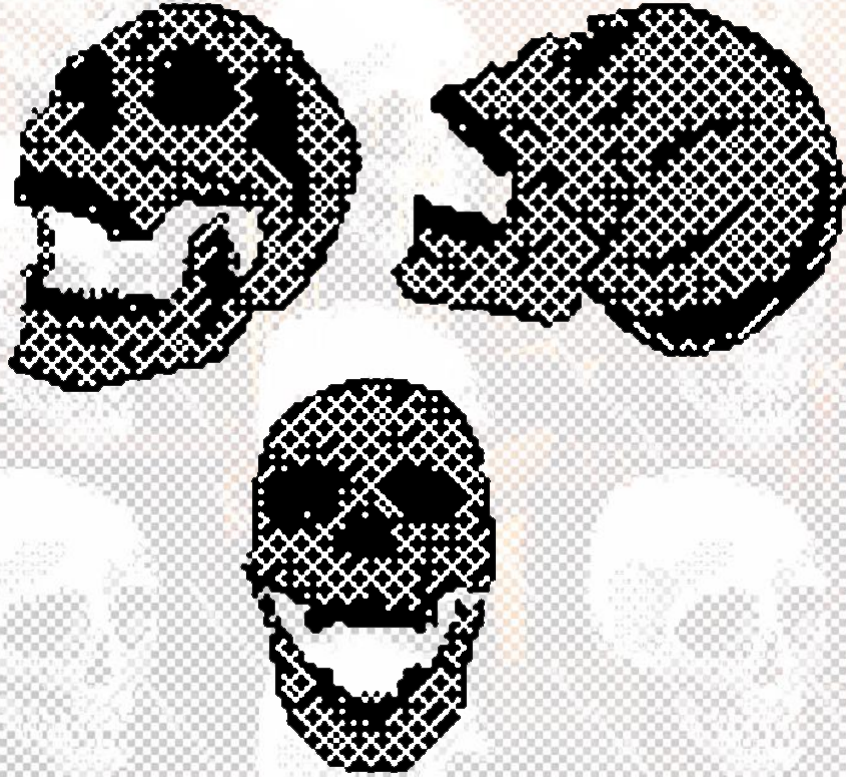


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Cr0wd AI Syst3ms



Crowd AI Systems



3 Systems

- Attractors
- Dynamic Attractors
- Reaction System



Crowd AI Systems



Attractors

- Spawned Activities
- Based on a Game Object
- Placed manually in the world



Crowd AI Systems



Dynamic Attractors

- Using same tech as attractors
- Spawned everywhere through an Event Manager
- Greetings, crimes, etc.



Crowd AI Systems

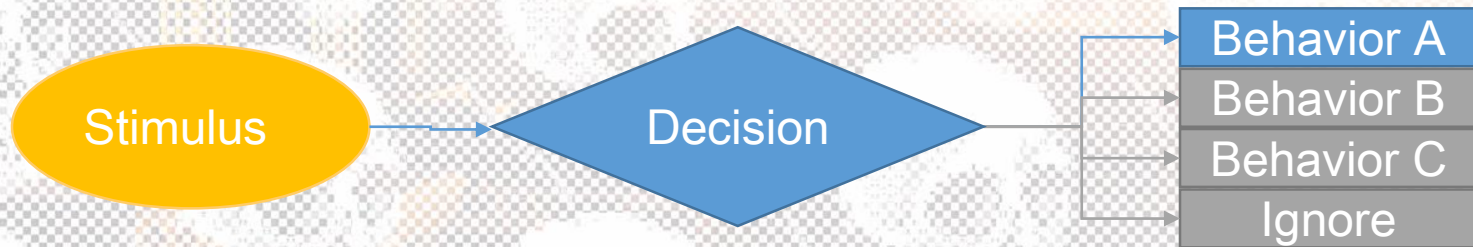


Reaction System

- Uses a stimuli based system
- Emergent chain reactions
- Completely systemic

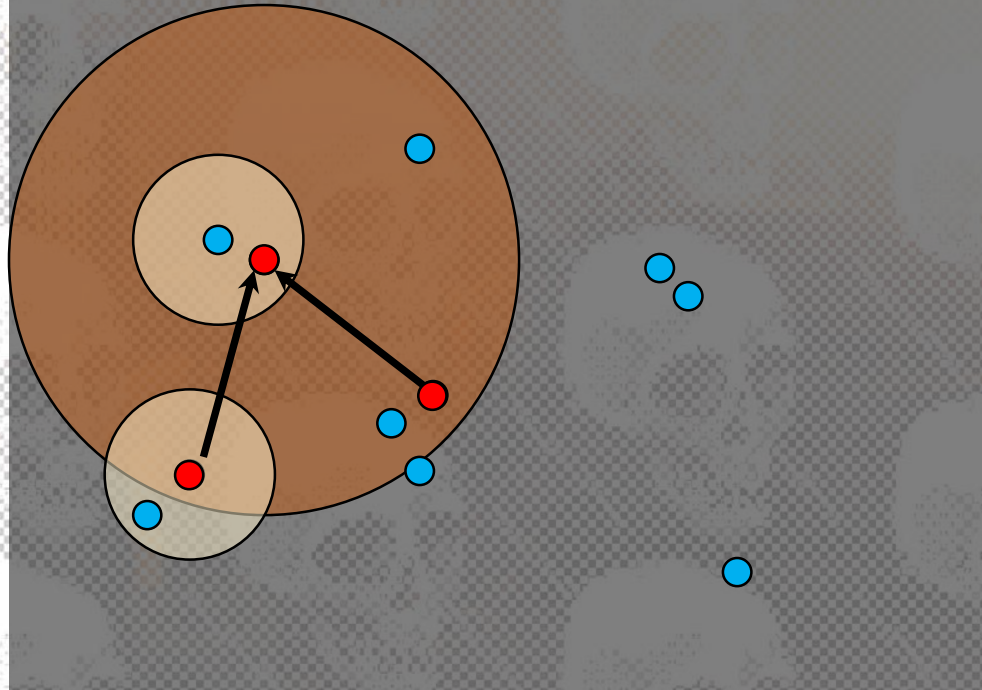


General Flow



Crowd AI Systems

Stims Propagation



Reaction System

Logic Rules

Criteria

Behavior	Incident	Emitter	Target
Walking	Insult		
Walking	Insult		Friend
Walking	Insult	Enemy	Friend

Behavior

Ignore	Observe	Fight	Flee
70%	20%		10%
	45%	50%	5%
		100%	



Reaction System

Logic Rules

Criteria

Behavior	Incident	Emitter	Target
Walking	Insult		
Walking	Insult		Friend
Walking	Insult	Enemy	Friend

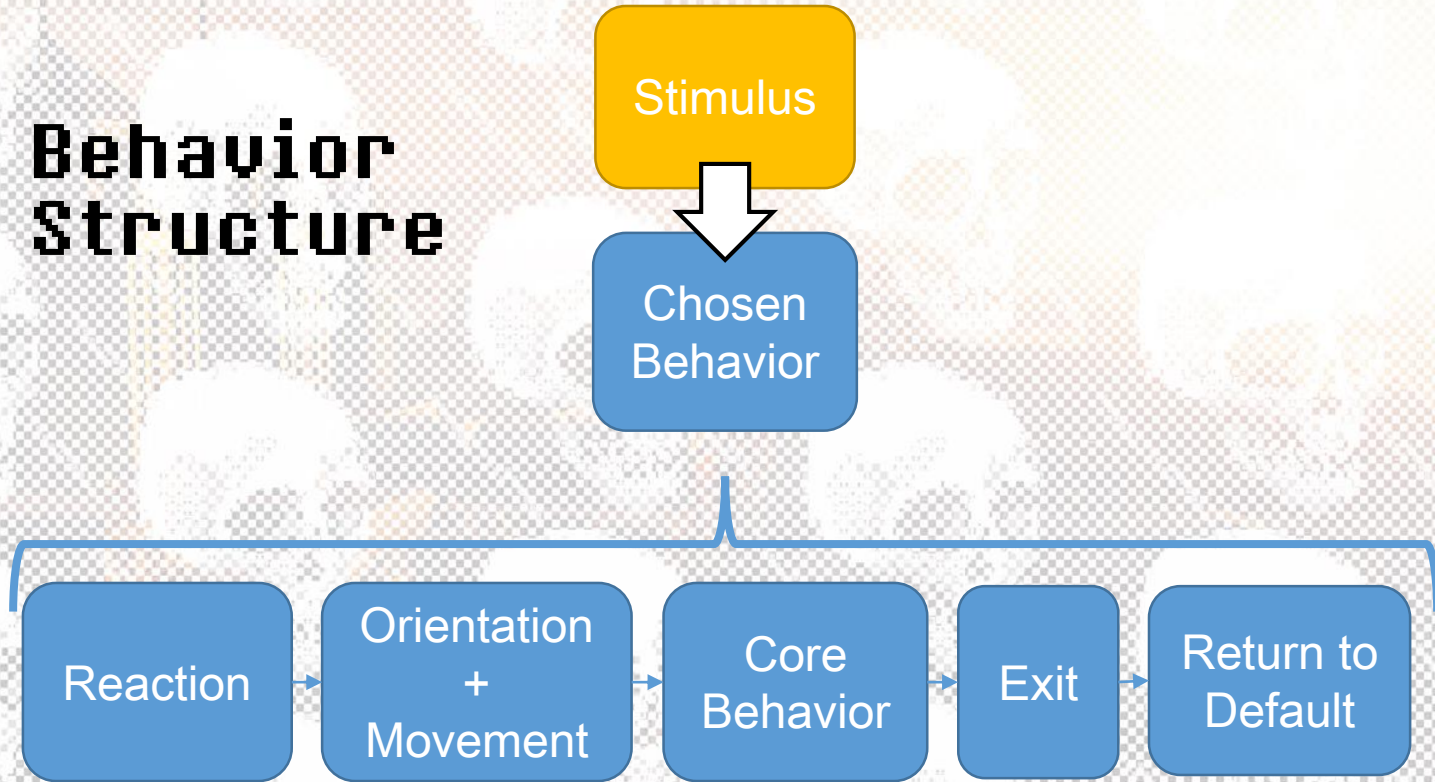
Behavior

Ignore	Observe	Fight	Flee
70%	20%		10%
	45%	50%	5%
		100%	

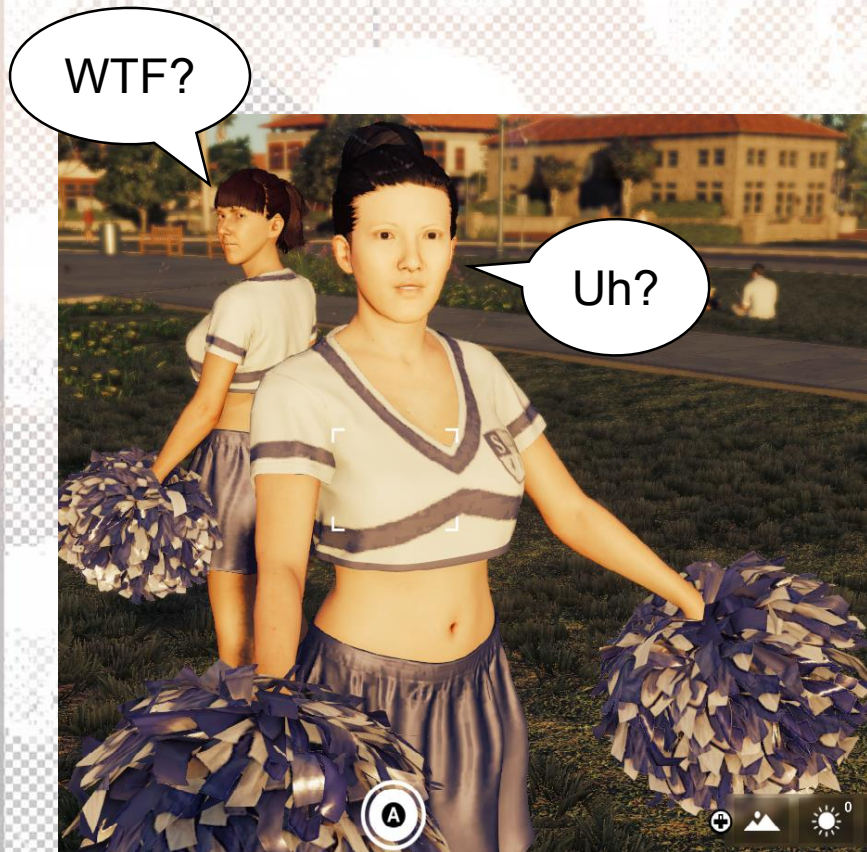


Reaction System

Behavior Structure



Reaction System

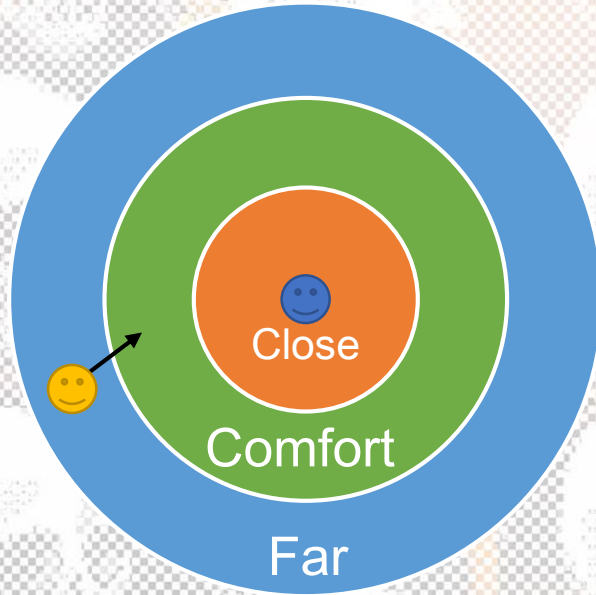


Reaction

- Short
- Stance transition, turn around or simple look-at
- Generic bark or onomatopoeia



Reaction System

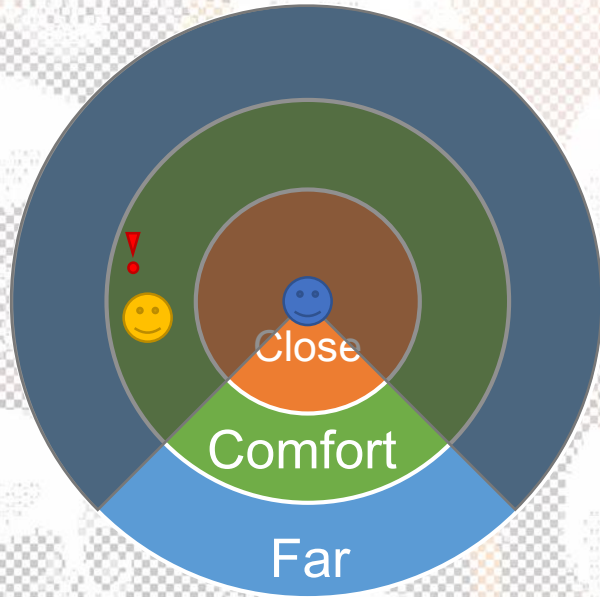


Movement & Orientation

- Proper distance
- Comfort Zone
- Angle restriction



Behavior structure

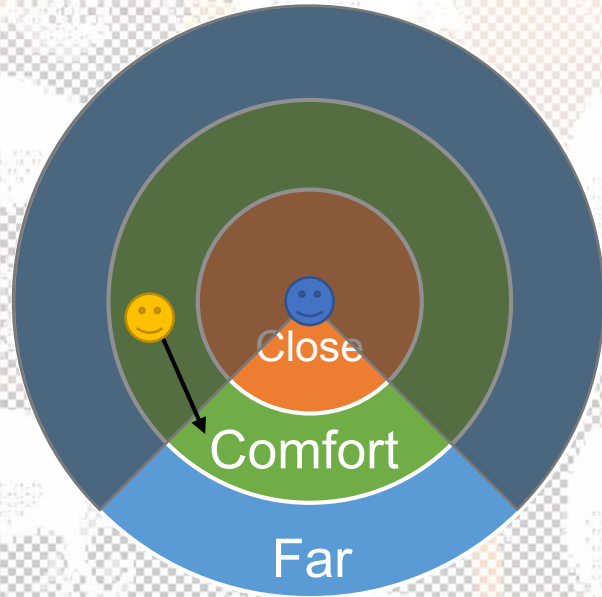


Movement & Orientation

- Proper distance
- Comfort Zone
- Angle restriction



Behavior structure



Movement & Orientation

- Proper distance
- Comfort Zone
- Angle restriction



Reaction System



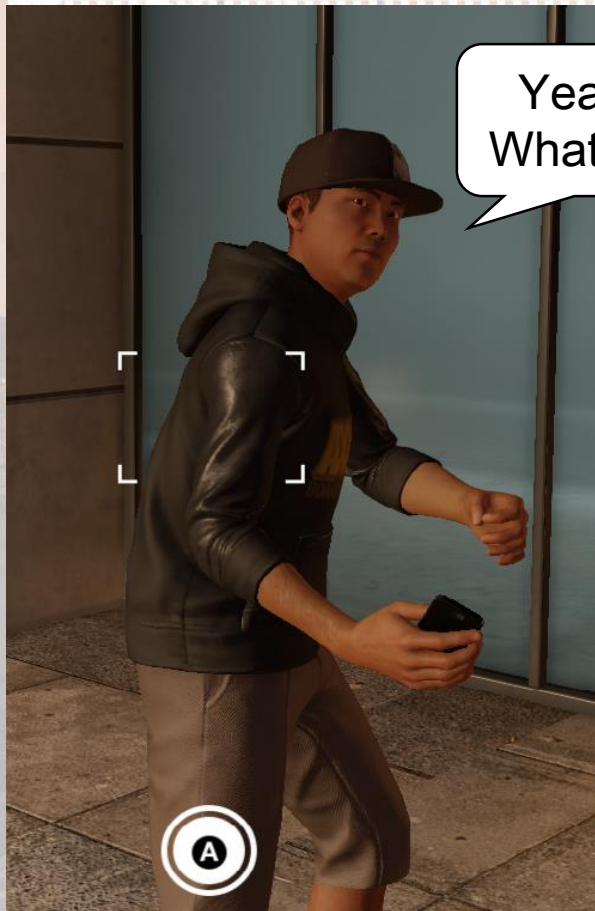
What are you
looking at?

Core Behavior

- Follow target or keeps position
- Display behavior for [X] sec / until target is gone



Reaction System



Exit

- Last bark to indicate transition
- Cooldown emotional state
- Return to previous state



Behavior structure

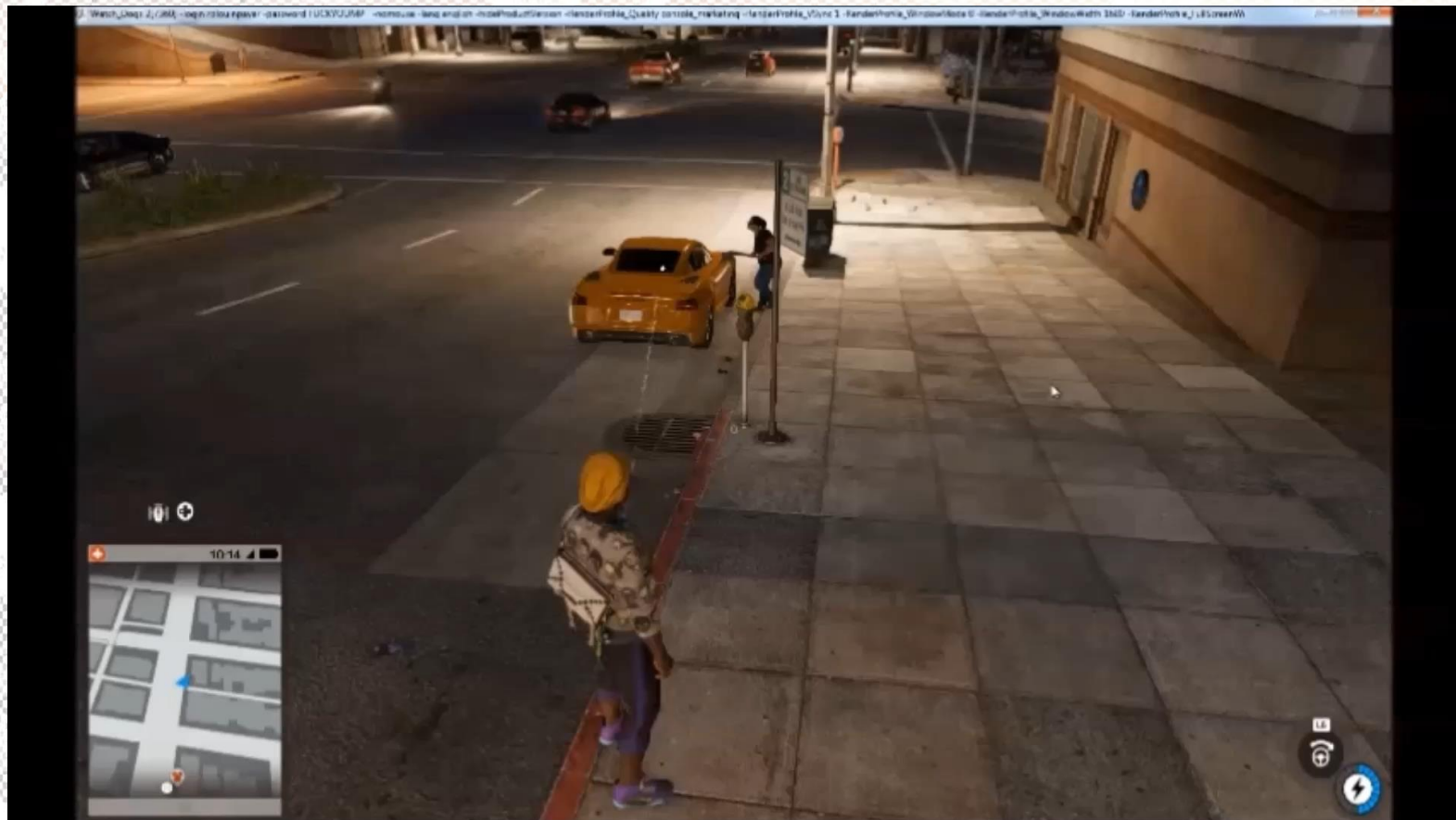


Back to default

- Attractor
- Emotional state



Reaction System



Th3 J0urn3y





Lessons Learned

1. Believable behaviors
2. Ratio, not randomness
3. Emotional continuity
4. Personalities
5. Player-Centrism
6. Self-stabilization mechanics
7. Missions needs



Coherence

Error 101: No coherence



Emergent Behavior:

A behavior which happened that was not predicted...

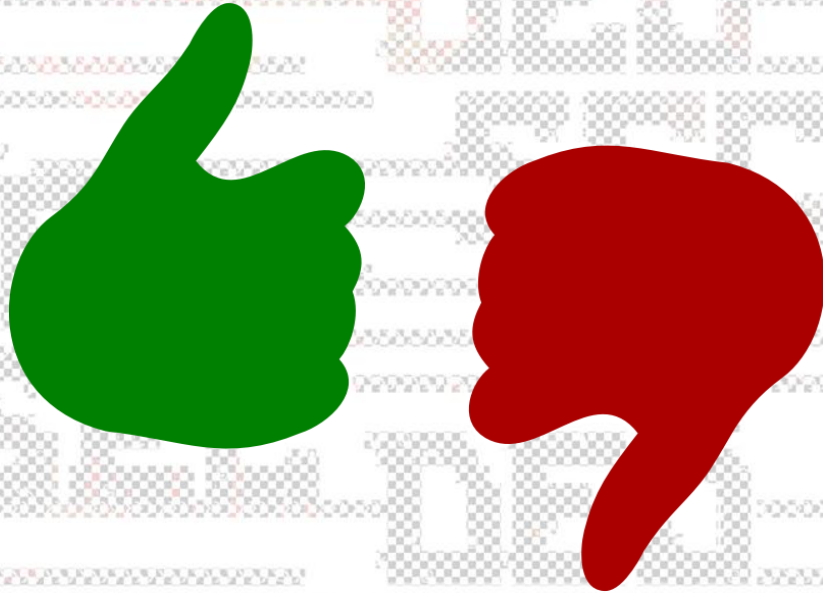
...but predictable.



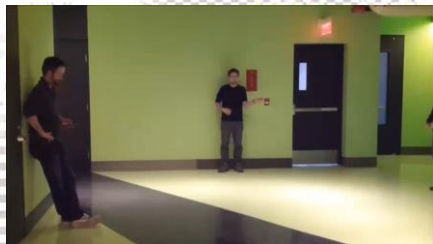
Coherence

Error 101: No coherence

Solution:



Coherence

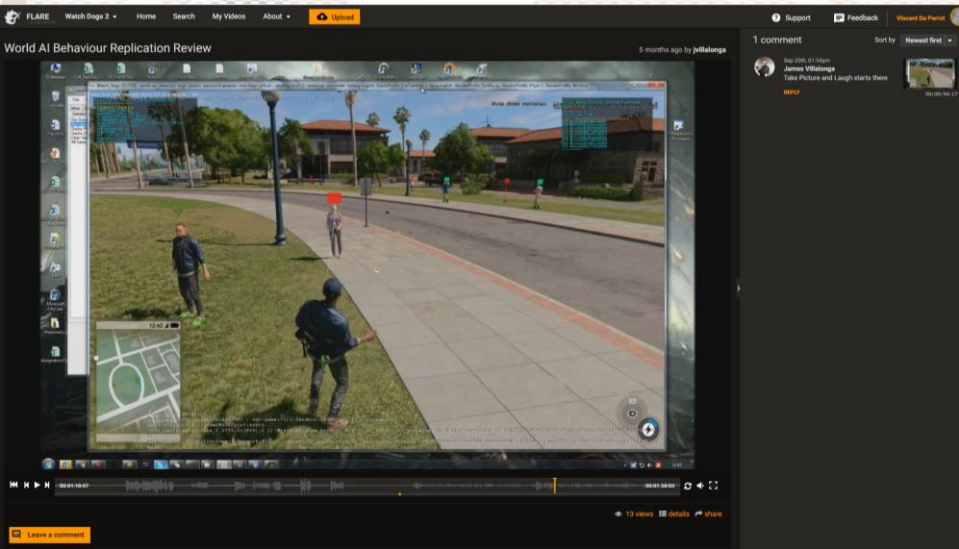


➡ Best take ➡

- Breakdown
 - Code
 - Animations
 - Barks



Coherence

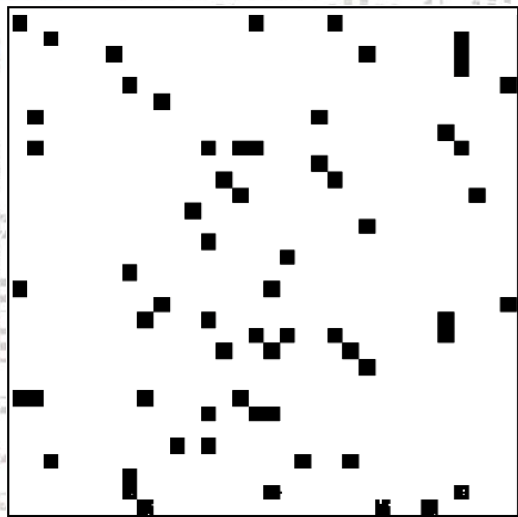


- /Flare
 - Video platform
 - In-progress features

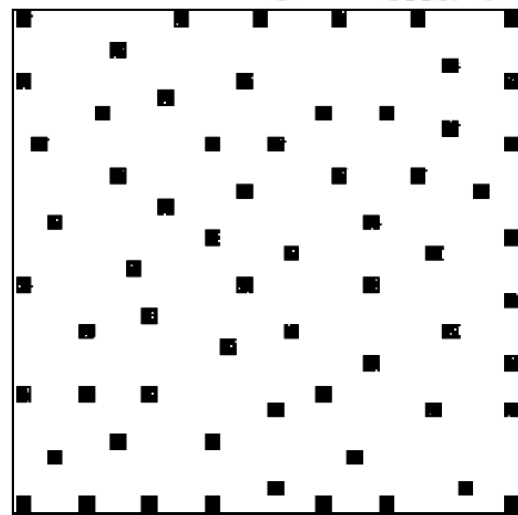


Control

Error 102: No control on the outcomes



Random Distribution



Homogeneous Distribution

Randomness < Pseudo-randomness



Emotional Continuity

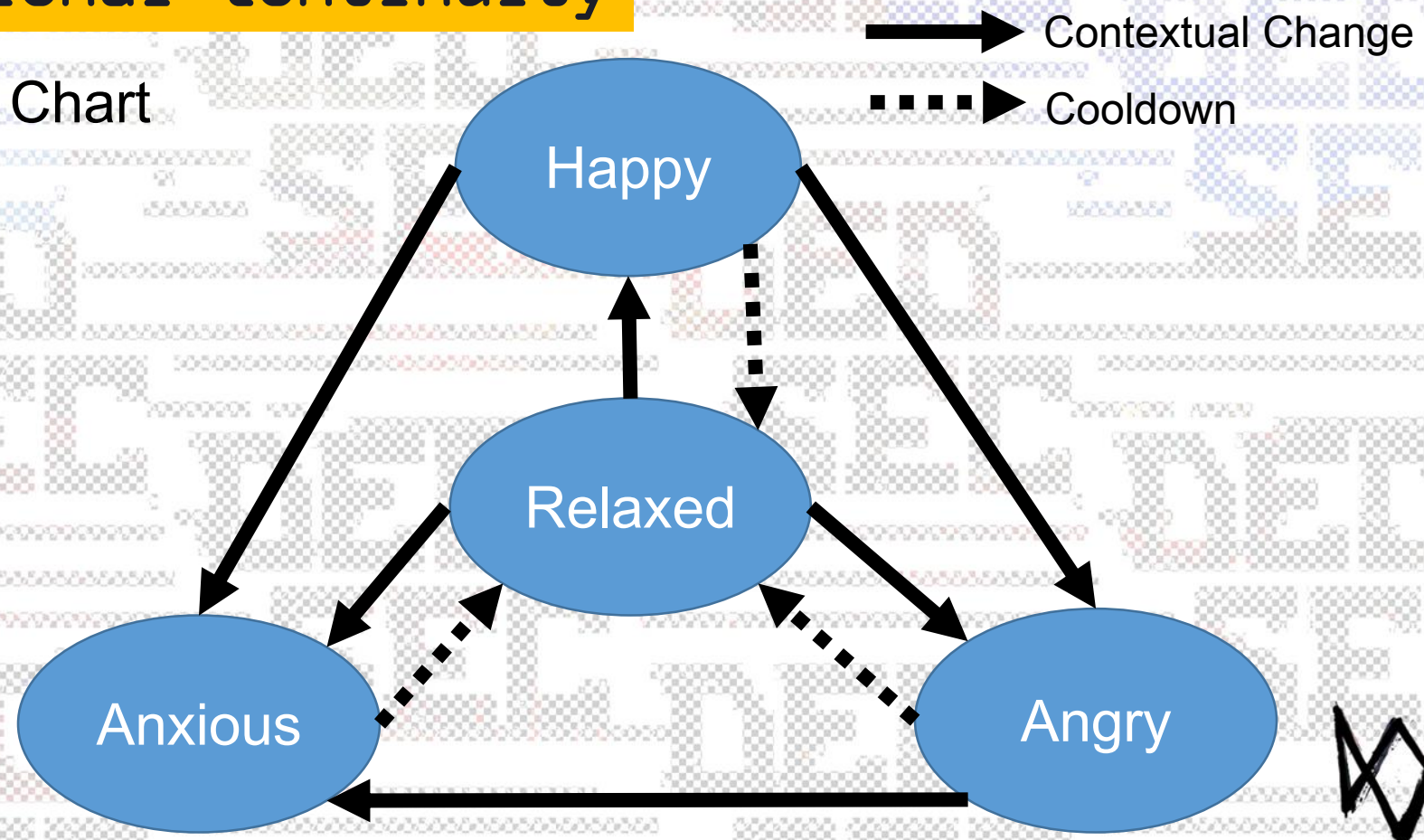
Error 103: NPCs are bipolar!

Solution:



Emotional Continuity

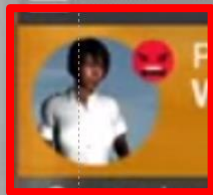
Mood Chart



Emotional Continuity



Emotional Continuity



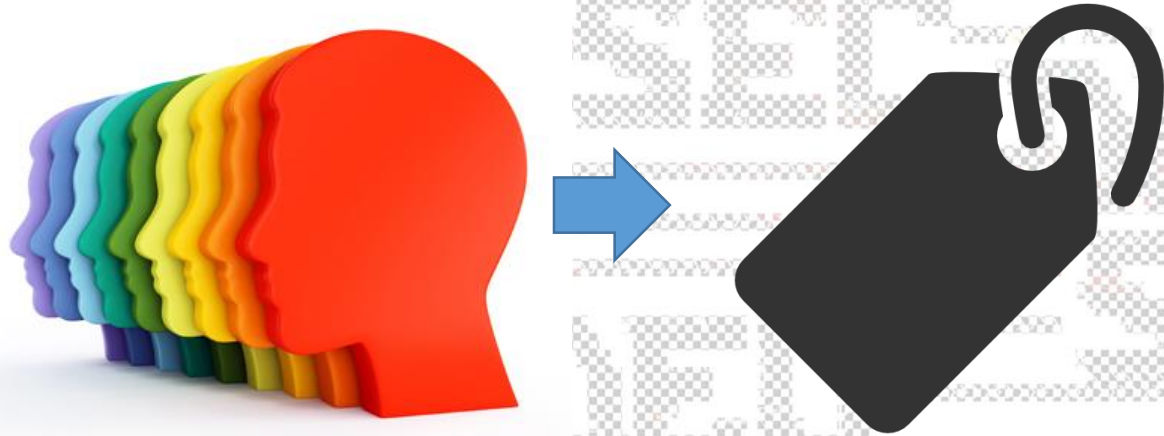
Patrice, Chloe
Writing an autobiography

Campaign Operations Supervisor
Income \$89,500

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Error 104: Not Enough Variety

Solution:

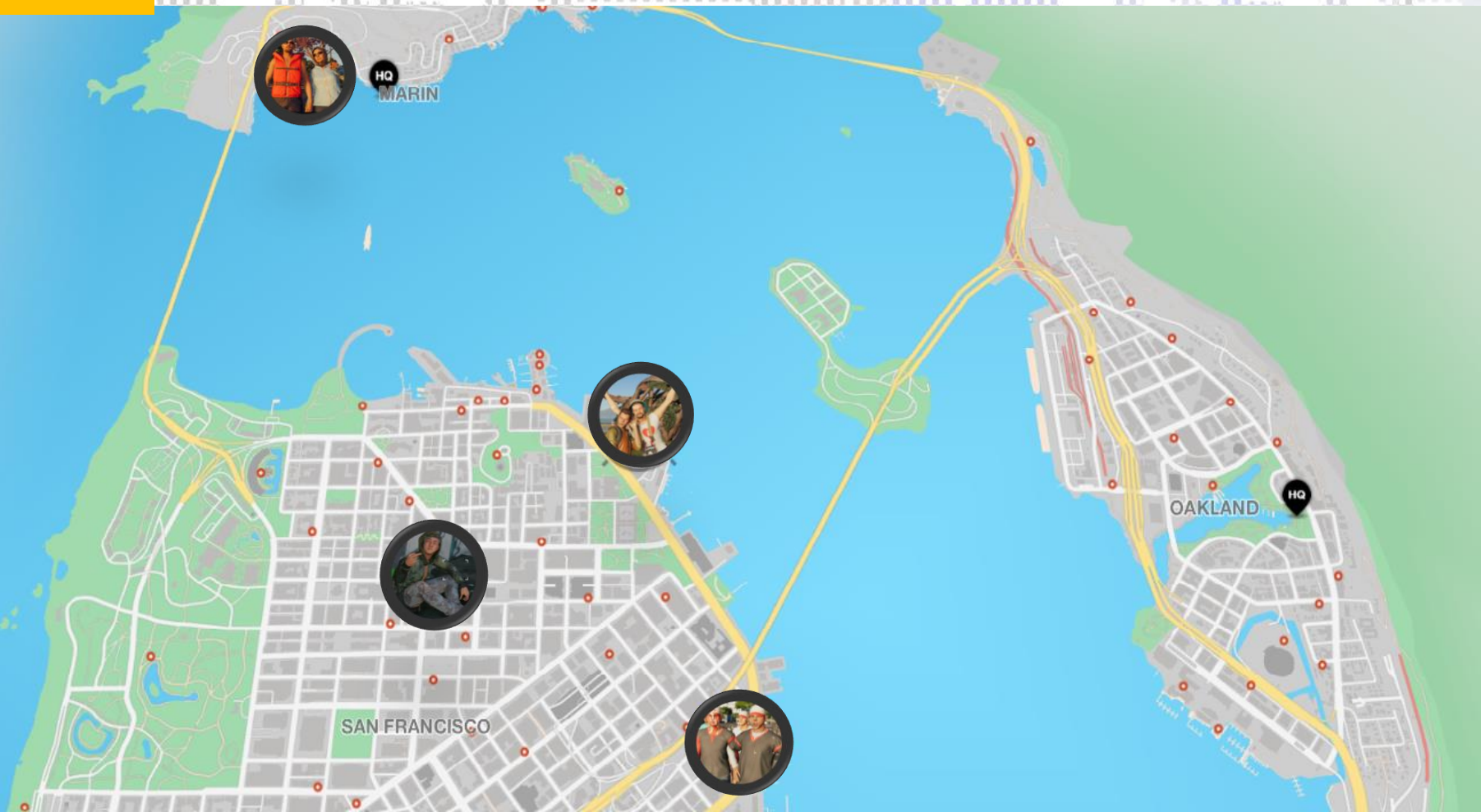


Flavor

X:\Watch_Dogs 2[9504] -world san_francisco -login rblouinpayer -password gobbledygook -nomouse -txtlang english -GameProfile_UseSubtitles 0 -lang english -hideProductVersion -RenderProfile_Quality pc -RenderProfile_VSync 1 -RenderProfile_WindowMode 0 -Rend



Flavor



Non-player centric

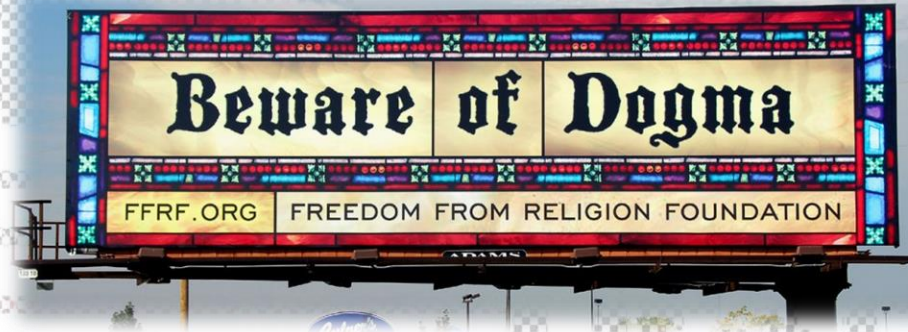
Error 105: Either too or not enough reactive to player



Non-player centric

Non-Player Centric:

Still has to be “Player-Proof”!



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Non-player centric



Provocative Agents

- Create stimuli to create reactions on bystanders
- City is living by itself!



Non-player centric



Non-player centric

Emotes



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System Stabilization

Error 106: The systems can degenerate quickly



System Stabilization

Error 106: The systems can degenerate quickly

Solution: They should be able to self-stabilize



Mission Needs

Error 107: No crowd AI in mission layouts

Solution: Answer the needs of Mission Designers



Mission Needs



Affiliated Civilians

- Player detection
- Warning and alert behaviors
- Special reactions
- Interior requirements





Production Tips

What do you need?



Ride The Chaos

The right team

1. Small dedicated team
2. Weekly reviews
3. Iterative process



The right production tools

1. Reaction Matrix
2. Managing
 - 750 logic rules
 - 200 animation rules
 - 220 audio rules
3. Power of combination and fuzzy logic



Ride The Chaos

reaction_rule_tool_macros_human.xlsm - Excel

Roxanne Blouin-Payer

	D	E	F	G	H	I	J	K	L	M	N	O	P
2													
3	SelfSpecialAgentType	SelfAgentCategory	SelfBehaviorModifier	SelfPersonality	SelfSpecialDemoCharacter	LocomotionType	CurrentVehicleType	IncidentType	IncidentIntensity	IncidentDetail	PerceivedType	SelfAgentState	SelfAgentStateLeader
7		Civilian		Any		OnFoot		PictureObstru				Busy	
8		Civilian		Any		OnFoot		PictureObstru				Busy	
9		Civilian		Any		OnFoot		VehicleStunt					
10		Civilian		Any		OnFoot		VehicleStunt				ObserveHap	
11		Civilian		Any		OnFoot		gDroneProxi				WanderAngry	
12		Civilian		Any		OnFoot		gDroneProxi				erveConfused	
13		Civilian		Any		OnFoot		gDroneProxi				erveConfused	
14		Civilian		Any		OnFoot		Silly				nfused, Obser	
15		Civilian		Any		OnFoot		Silly				nfused, Obser	

Gameplay Animation Audio

PRÊT CALCULER

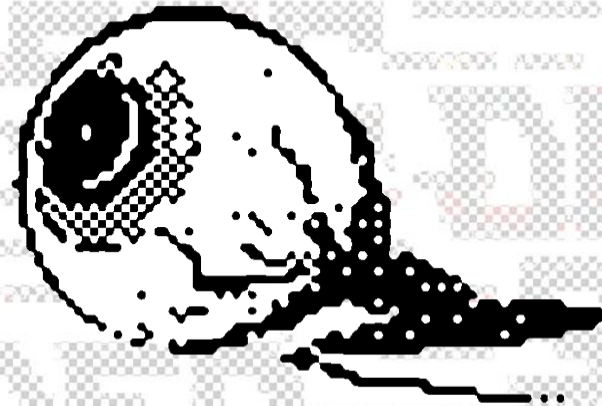
FR 11:59 2017-02-10

W2

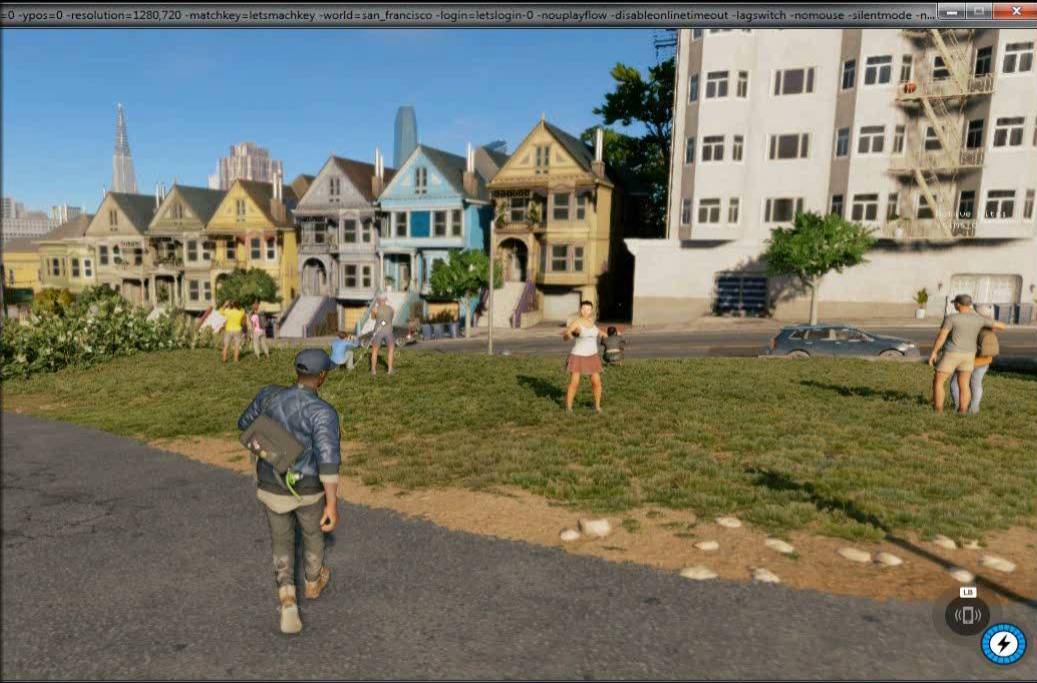
Ride The Chaos

The right debugging tools

1. Repro
2. Understand
3. Control



Ride The Chaos



[Dissect][wd2-temp-dissect-rel][03/11/2016 3:58:27 PM][v1.0.0.968908]
29636] Connected To: WatchDogs_r64 [PID: 29636]

Filter Tracks Show Tracks

Animation Events

Duration Events

SendPersistentStimEvent

StateManagerComponent - 0: Motion

CPlayerStandingMotionStateDef

Idle Start/ StartTraj Move Stop StartAni StartTraj Move

AllowsRepositioning

StateManagerComponent - 1: Action

Animation Missions Reactions Top View

AI Reactions Table HumanDefault Gameplay Only Matched

Breakpoint	Rule ID	Type	Input
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Captures Timeline

BreakpointKeyValue

Selected Entity: player.MainCharacter.PawnPlayer.Aiden2 (0xC90219AAAA49047C) 94.5 KBs/Frame

W2

Wh4t's N3xt?



Unsolved Issues

1. Behaviors requiring a dialogue
2. Rules Competition
3. Apply better the reaction system to combat AI



Results

1. 30% more playtime in open world
2. Creative videos
3. Positive reviews

“Watch Dogs 2 has a better open world than GTA V and Skyrim”

– Chris White, God Is A Geek

“Watch Dogs 2 will hack your open-world gaming expectations”

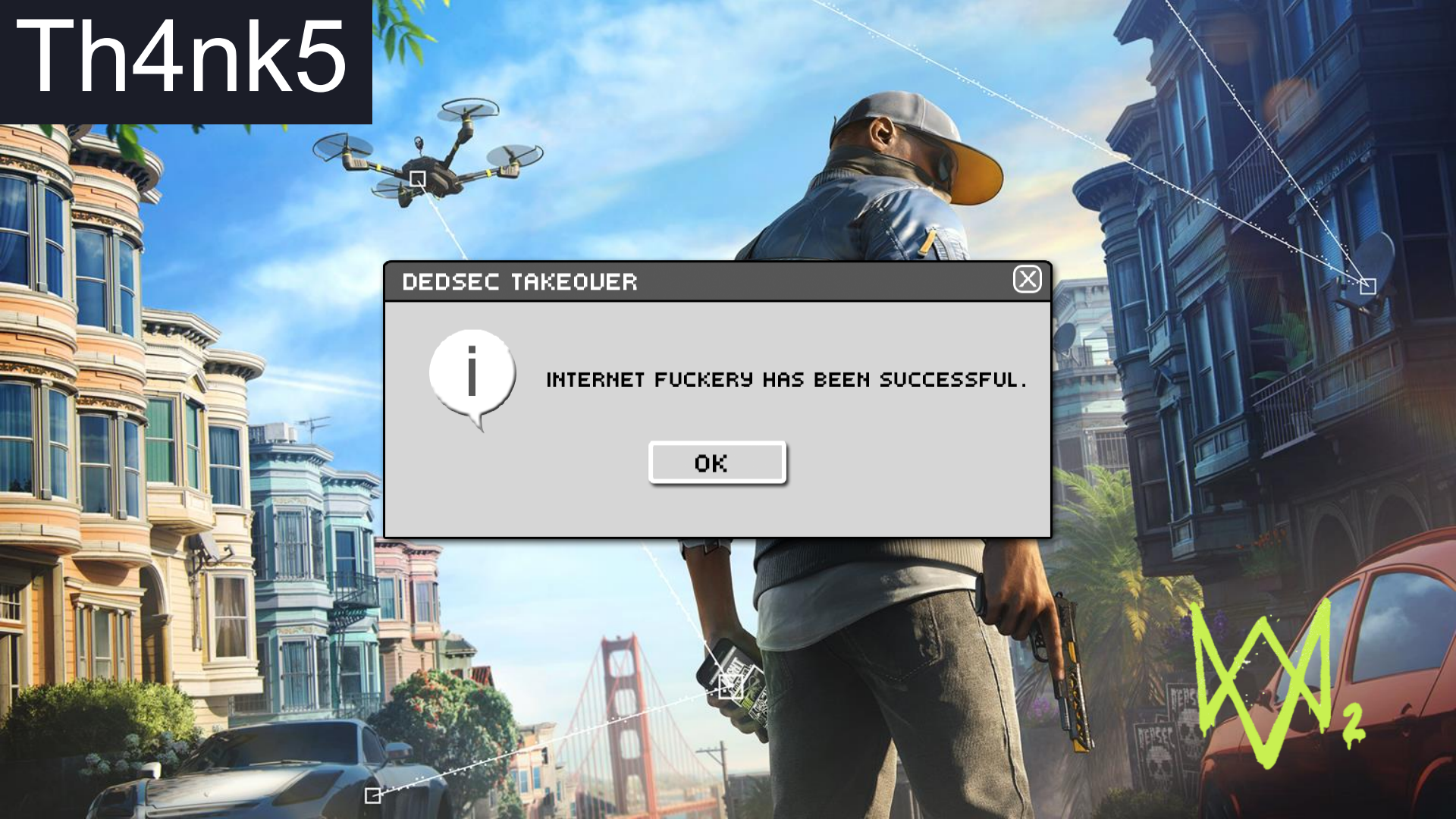
– Sam Machkovech, ArsTechnica

“Watch Dogs 2 NPCs are a constant source of joy”

– Gita Jackson, Kotaku



Th4nk5



DEDSEC TAKEOVER



INTERNET FUCKERY HAS BEEN SUCCESSFUL.

OK



MORE QUESTIONS? MEET ME ON THE UBISOFT LOUNGE

on

WEDNESDAY

from

11.00PM

to

12.00PM

WEST HALL, 2ND FLOOR

#UBIGDC