

Case Studies: Brütal Legend

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~50 unique unit types



~50 unique unit types



~50 unique unit types



Navigation



Navigation



Brawler vs Strategic AI Tactics



Brawler vs Strategic Perspective



The Team

- Anna Kipnis
- Chad Dawson
- Joe Virskus
- Kee Chi
- Nathan Martz

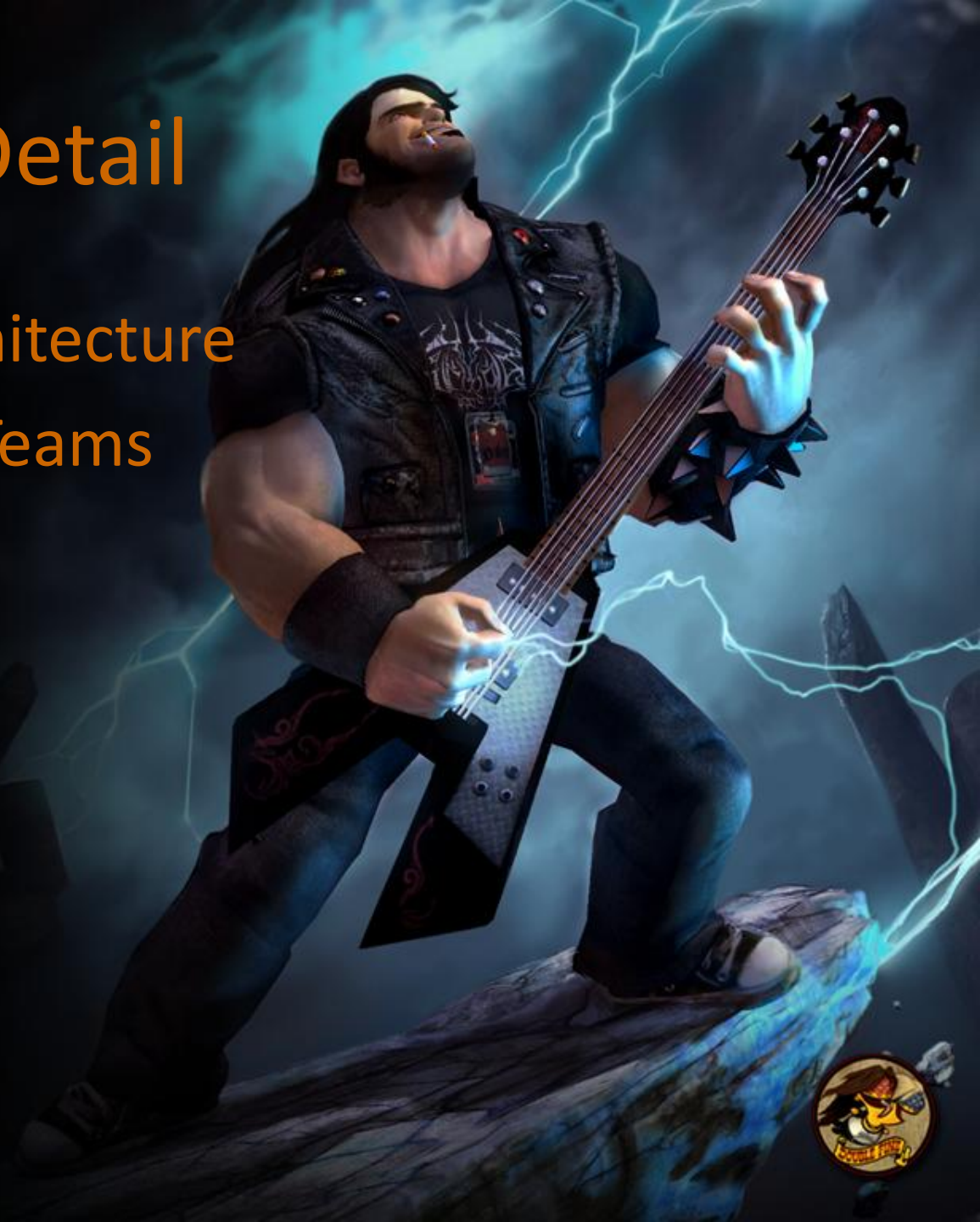


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~50 Units in Detail

- Component Architecture
- Unique Double Teams
- Avatar



AI Avatar

- Strategic decisions
- Combat decisions



AI Avatar – Strategic

1. Retreat if low health



AI Avatar – Strategic

1. Retreat if low health
2. Capture uncapped geysers



AI Avatar – Strategic

1. Retreat if low health
2. Capture uncapped geysers
3. Defend base



AI Avatar – Strategic

1. Retreat if low health
2. Capture uncapped geysers
3. Defend base
4. Join battles in progress



AI Avatar – Strategic

1. Retreat if low health
2. Capture uncapped geysers
3. Defend base
4. Join battles in progress
5. Help units under attack



AI Avatar – Strategic

1. Retreat if low health
2. Capture uncapped geysers
3. Defend base
4. Join battles in progress
5. Help units under attack
6. Hang out with largest army



AI Avatar – Combat

1. Rock Solo
2. Double Team
3. Melee and guitar attacks



Double Teams



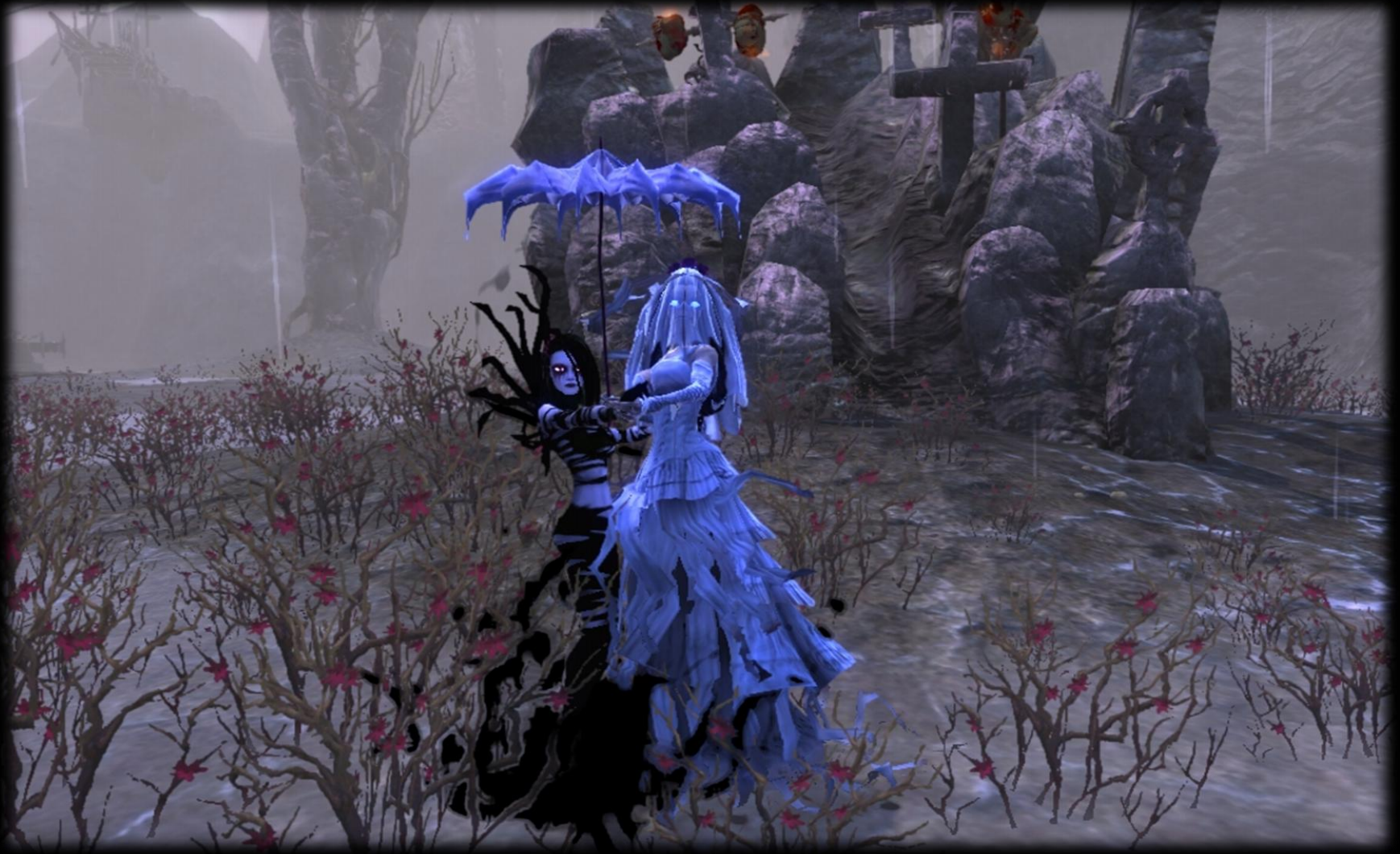
Double Teams



Double Teams



Double Teams



Double Teams



Double Teams

- How to use them
- When to use them



Double Teams

```

// AI Coop evaluation functions

class CoopEvalHelper : public RTTIObject
{
    DECLARE_RTTI_CLASS(CoopEvalHelper, RTTIObject);
    DECLARE_ATTRIBUTES();
public:
    CoopEvalHelper() : m_fAITargetSearchRadius(20.f), m_fPriority(0.5f) {}

    virtual float Eval(const CoCoop* pOwner, const Entity* pActivator, const Entity* pDesiredTarget) const = 0;
    virtual CoopEvalHelper* Clone() const = 0;

    // useful for several coops including headbangers and metal beast
    Entity* GetEnemyNearCenterOfAreaAroundAI(const CoControllerAI* pCoAI) const;
    Entity* GetEnemyAtMinDistanceAway(const CoControllerAI* pCoAI, float fMinDistance) const;

    float GetPriority() const { return m_fPriority; }

protected:
    CoopEvalHelper(const CoopEvalHelper* pEval)
    {
        m_fAITargetSearchRadius = pEval->m_fAITargetSearchRadius;
    }

    float m_fAITargetSearchRadius;
    float m_fPriority;
};
```

Double Teams

```
float CoopEvalManyTargets::Eval(const CoCoop* pOwner, const Entity* pActivator, const Entity* pDesiredTarget) const
{
    // pEntity best be an AI
    CoControllerAI* pCoAI = pActivator->GetComponent<CoControllerAI>();
    if (pCoAI != NULL)
    {
        // look at the memory of this ai, find that we have a decent number of enemies nearby
        uint fNumEnemiesInRange = 0;
        tBuddha.CountUnitsAroundAI(pCoAI, m_searchRange, &fNumEnemiesInRange);

        return Min(fNumEnemiesInRange * m_enemyCountWeightFactor, 1.f);
    }

    return 0.f;
}
```

Beast:

CoopEval=CoopEvalManyTargets

{

AITargetSearchRadius=35;

Priority=0.7;

};

Double Teams

```
float CoopEvalHighValueTarget::Eval(const CoCoop* pOwner, const Entity* pActivator, const Entity* pDesiredTarget) const
{
    if (pDesiredTarget != NULL && m_bestValueRatio > EPSILON)
    {
        // otherwise we want to do a value assessment where we compare the target's worth to my own
        // um. i don't have a good value function so i'm doing something kooky for now
        const CoPhysics* pCoPhysics = pOwner->GetSibling<CoPhysics>();
        const CoPhysics* pCoTargetPhysics = pDesiredTarget->GetComponent<CoPhysics>();
        if (pCoPhysics && pCoTargetPhysics)
        {
            const Box3 BoundingBox = pCoPhysics->GetAABBLocal();
            const Box3 targetBoundingBox = pCoTargetPhysics->GetAABBLocal();

            if (BoundingBox.GetExtent().y > EPSILON)
            {
                return Min(targetBoundingBox.GetExtent().y / (m_bestValueRatio*BoundingBox.GetExtent().y), 1.0f);
            }
        }
    }

    return 0.f;
}
```

HairHead:

CoopEval=CoopEvalHighValueTarget

{

BestValueRatio=1.5;

};

AI Avatar

- CoopEvalDistance
- CoopEvalMegastage
- SoloEvalHelper





Questions?



On the AI Strategy for KILLZONE 2's Bots



Alex Champandard – AiGameDev.com

Remco Straatman – Guerrilla

Tim Verweij – Guerrilla

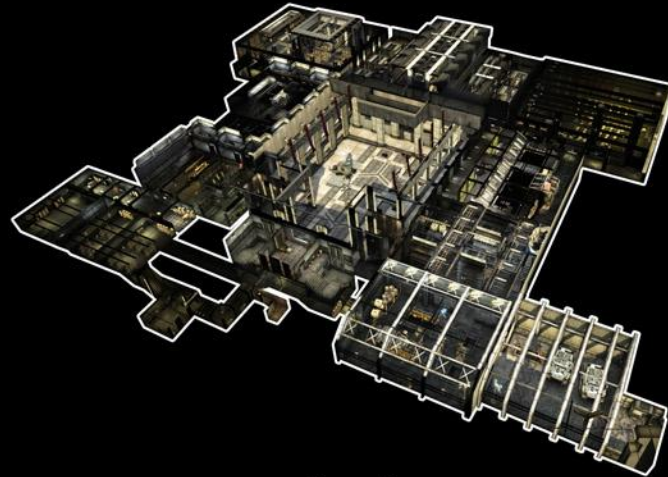
Gameplay





THE CHALLENGE

Maps



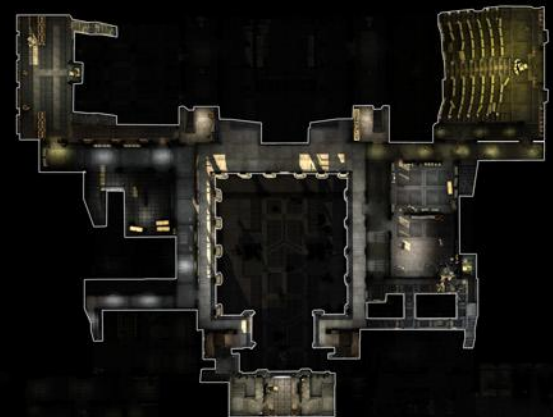
Basement



Ground



1st





Game Modes



- Search and Retrieve
- Capture and Hold
- Assassination
- Body Count
- Search and Destroy

Badges



Weapons





THE SOLUTION

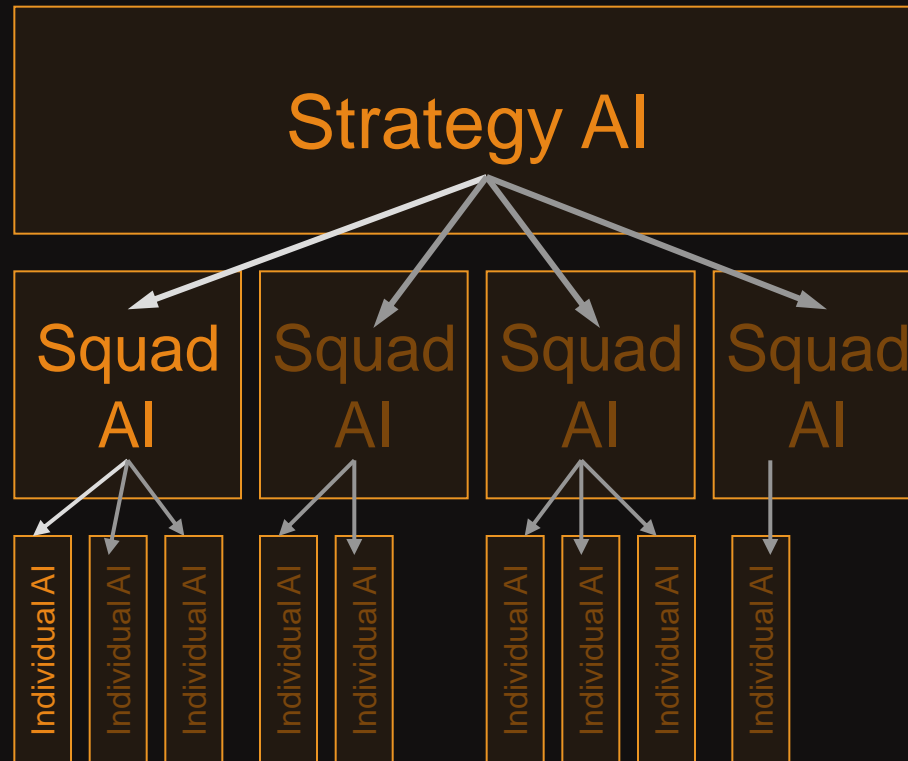
Take Away



Strategy is more than the sum of its parts.



Architecture





Killzone 2 Multiplayer Bots

R. Straatman, T. Verweij.

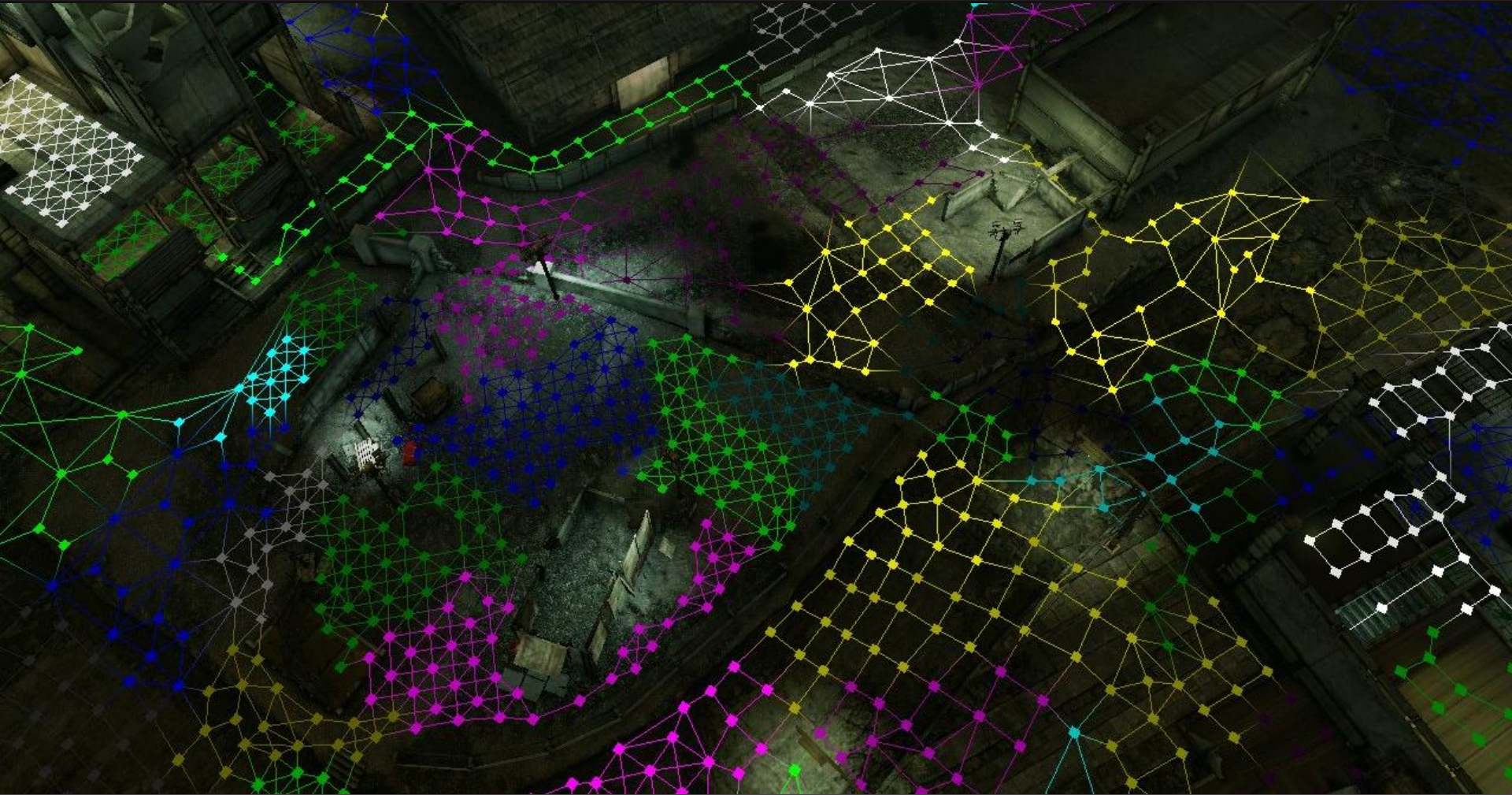
Paris Game AI Conference, 2009.



Internal Architecture



Waypoint Network



Strategic Graph





Area Clustering Algorithms



Automated Terrain Analysis

William van der Sterren

AiGameDev.com Masterclass, 2009.

Manual Annotations

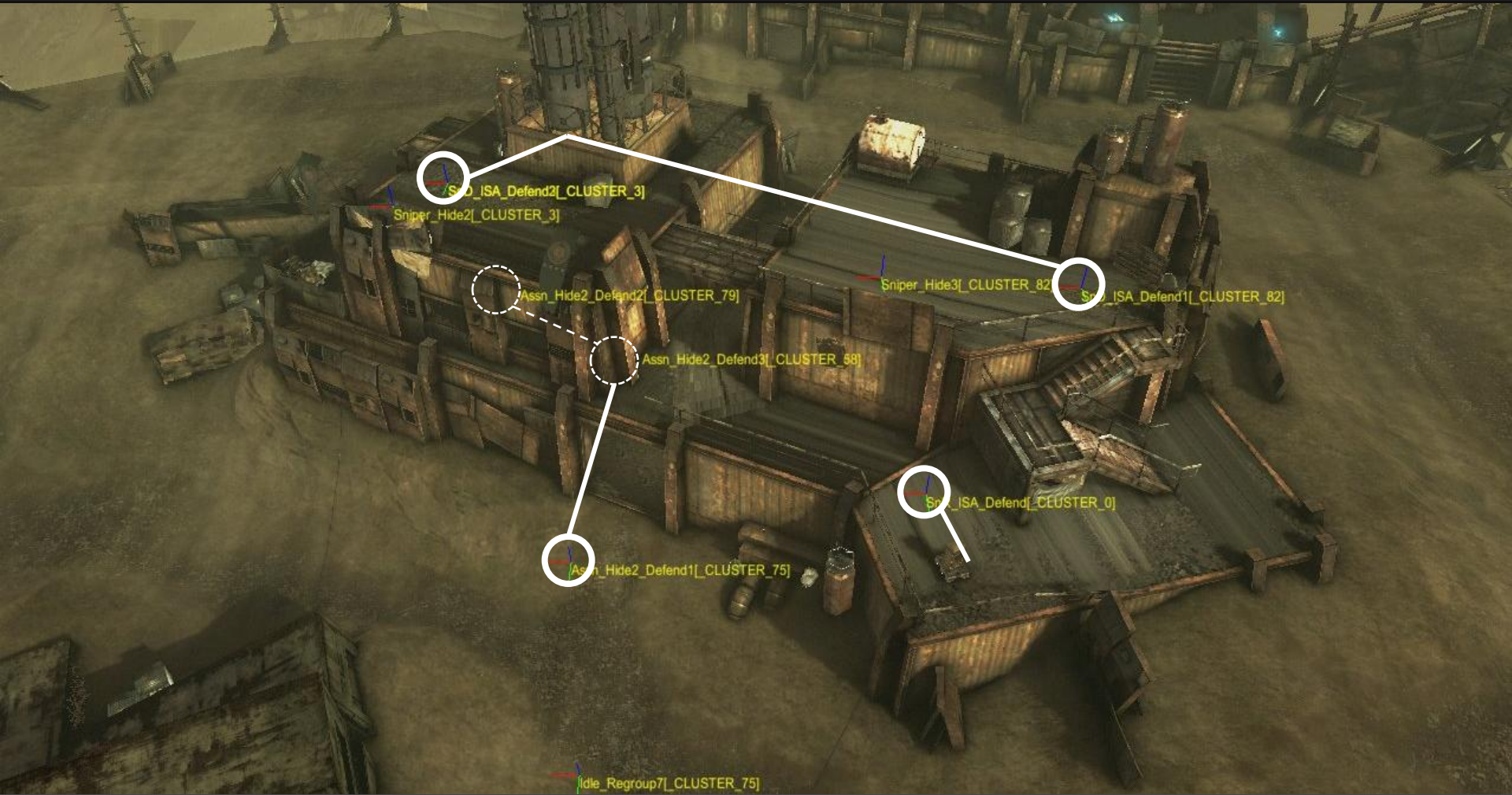


Regroup Locations





Mission-Specific Defense



Sniping Locations





Terrain Analysis



Procedural Combat Tactics

Remco Straatman, William van der Sterren, Arjen Beij.
Game Developers Conference, 2005.



Terrain Analysis & Reasoning

Kevin Dill, Sergio Garces, William van der Sterren, Paul Tozour.
AiGameDev.com Special Report, 2008.

Influence Map



Strategic Pathfinding



Strategic Pathfinding



Strategic Pathfinding



Strategic Pathfinding





Strategic Pathfinding



Realistic Autonomous Navigation in Dynamic Environments

Alex J. Champandard

Masters Research Thesis, University of Edinburgh, 2002.



Squad Assignment





Objective Assignment





Squad / Objective Assignment



Building a Better Battle: The Halo 3 AI Objectives System

Damian Isla

Game Developers Conference, 2008.



THE RESULTS

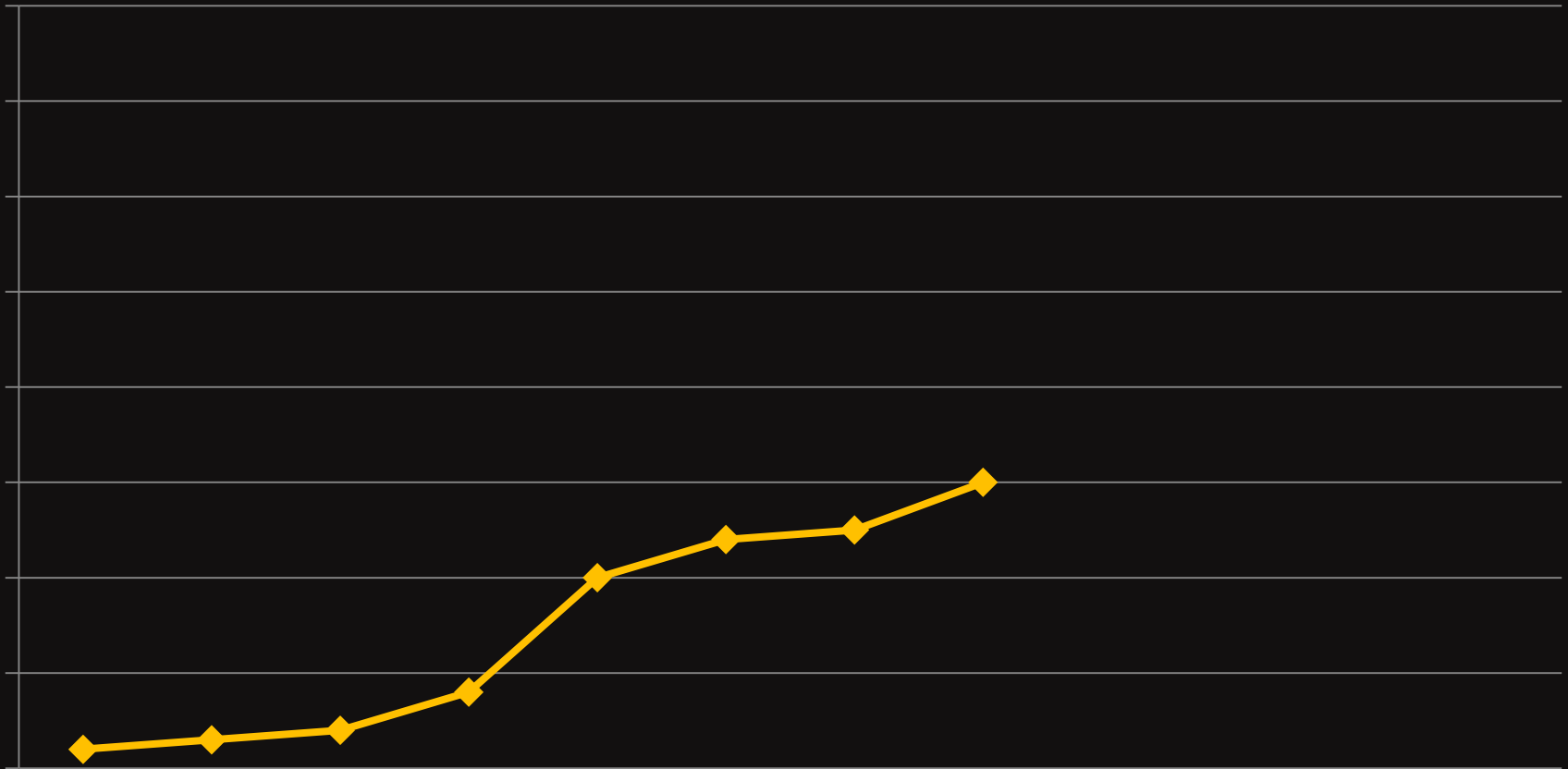
Reception



Don't listen to anything he says; he's biased.

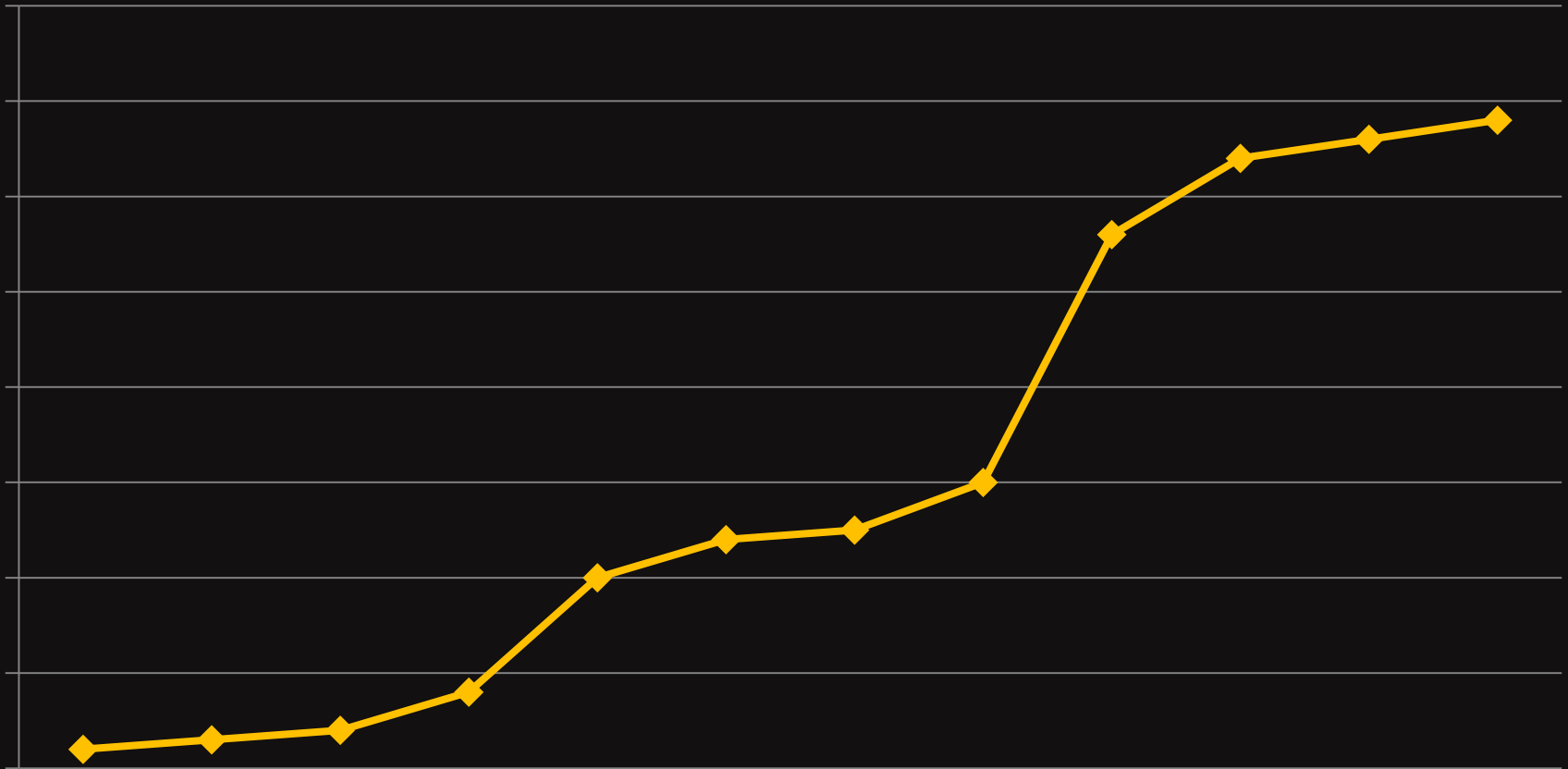


Analysis





Embracing Special Cases



Explosive Ambush



Turret Wall





Modern Combat AI

Less "Expert System" and more "Creative AI."

- Gameplay data-mining.
- Optimization algorithms.

Embracing Special Cases

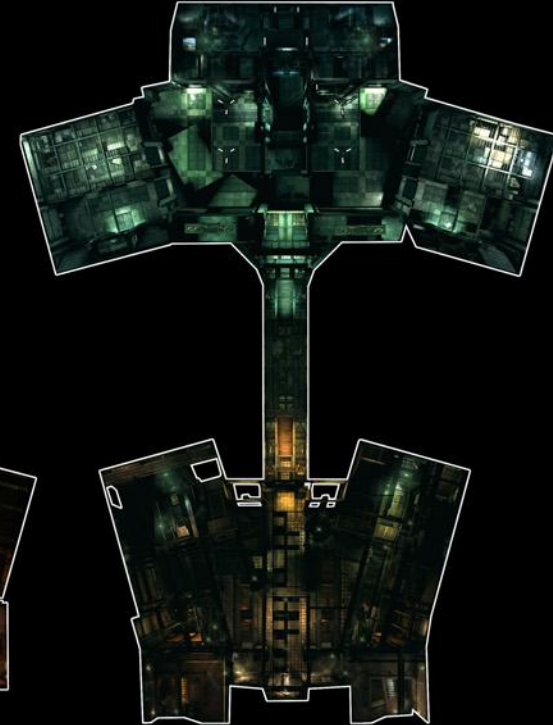


Interiors

Ground Floor

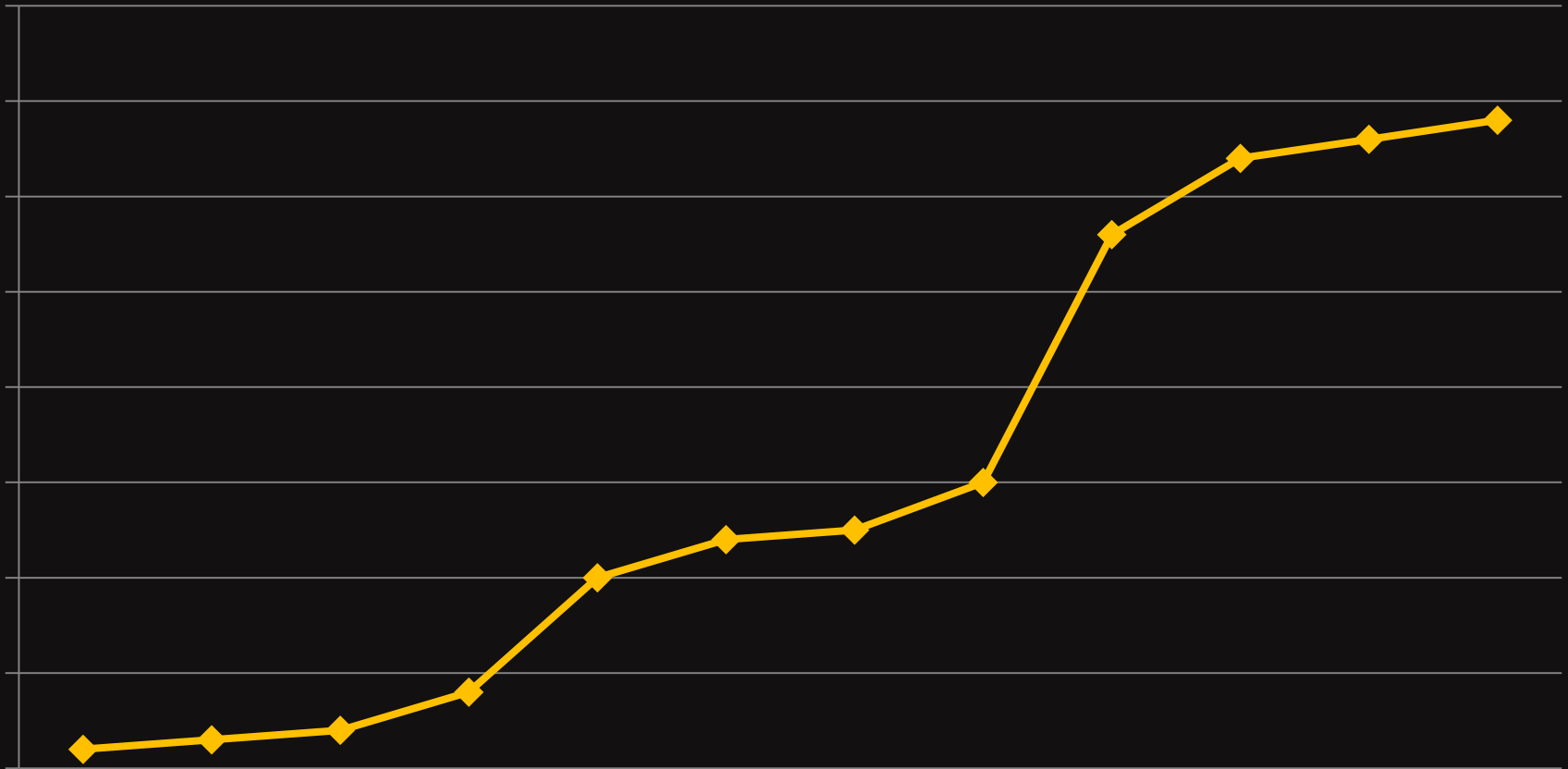


1st Floor





What's Next?



On the AI Strategy for Killzone 2's Bots



Alex Champandard – AiGameDev.com

Remco Straatman – Guerrilla

Tim Verweij – Guerrilla

DAWN OF WAR 2 AI POSTMORTEM



WARHAMMER
40,000
**DAWN
OF
WAR**



Chris Journey
Senior Programmer
Double Fine Productions

OVERVIEW

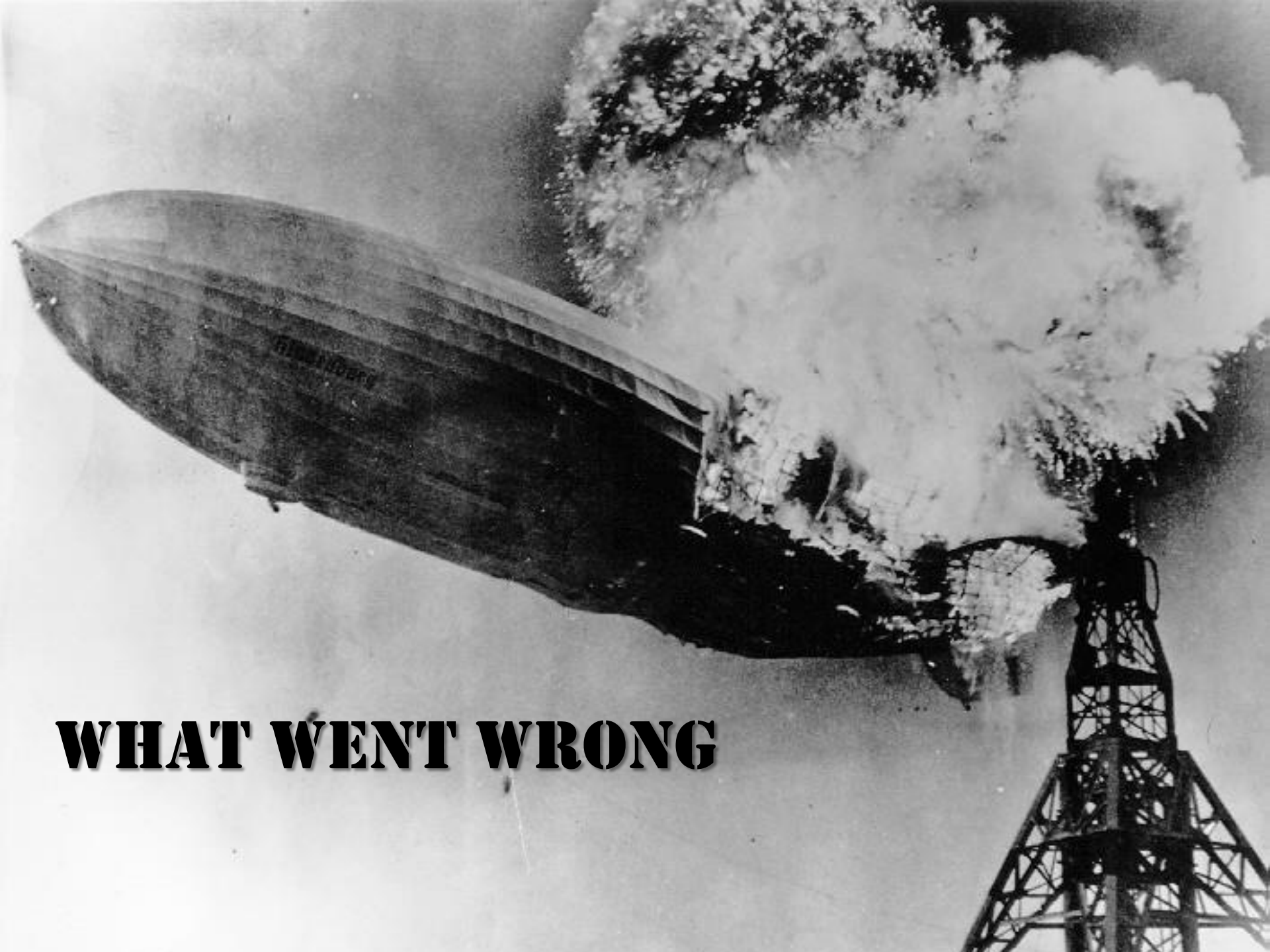


- What Went Wrong
- What Went Right
- Assorted Technical and Production Nuggets

GOALS FOR DAWN OF WAR 2

- Bringing Dawn of War into the Company of Heroes engine





WHAT WENT WRONG

WHAT WENT WRONG

- No Team Overlap



Company
of Heroes

25 Programmers

Dawn of
War 2

20 Programmers

1.5 Programmers



WHAT WENT WRONG



- No Team Overlap
- Results: Lots of rework and lost effort

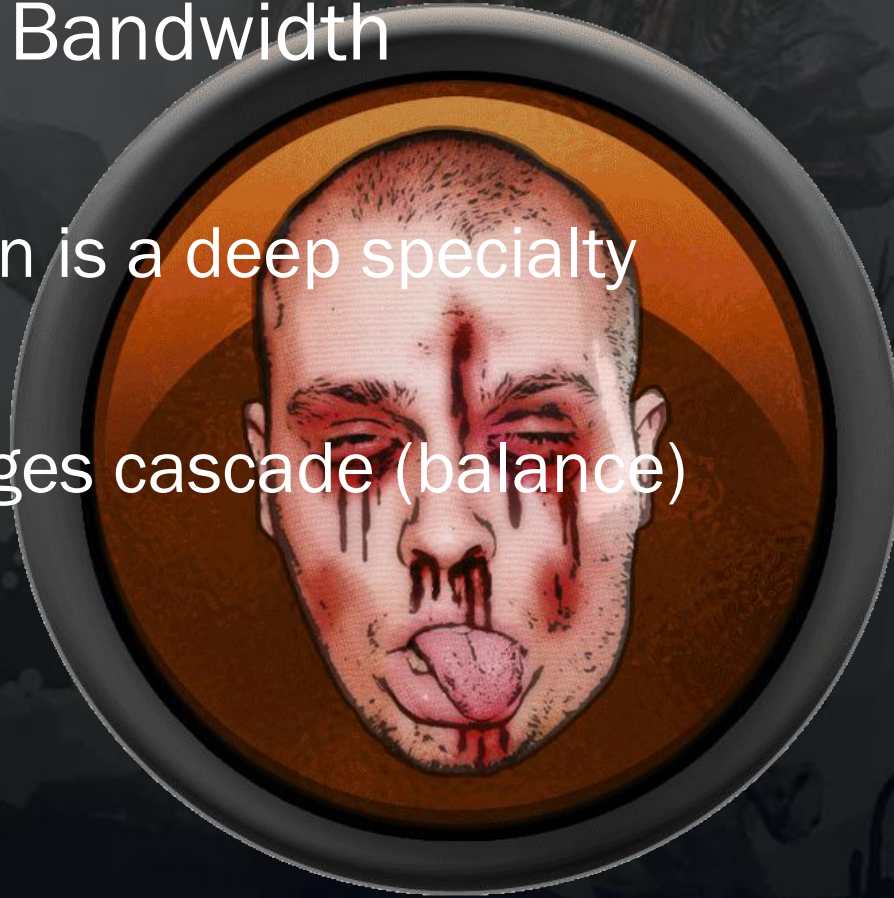
WHAT WENT WRONG

- Designer Bandwidth

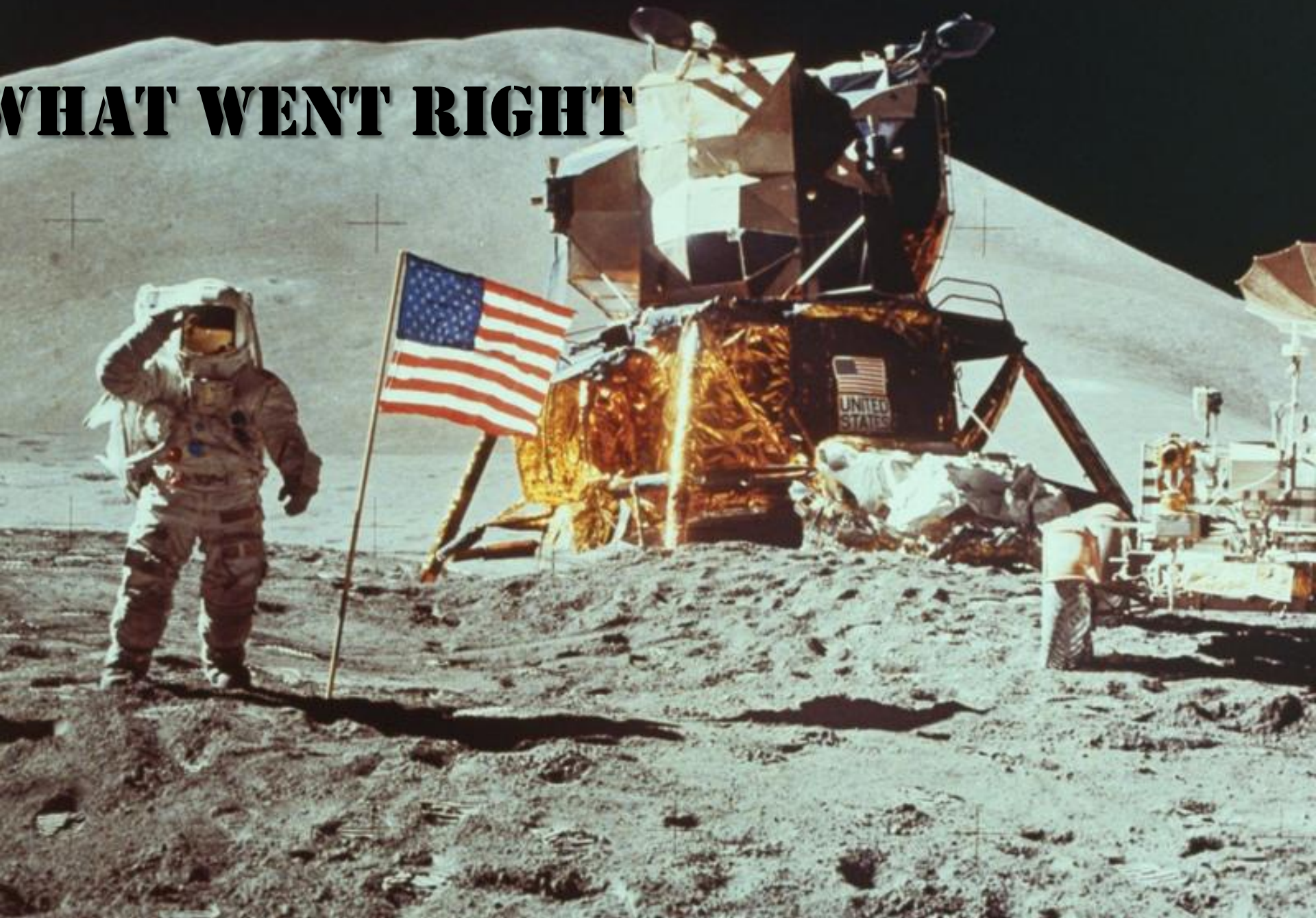


WHAT WENT WRONG

- Designer Bandwidth
 - AI design is a deep specialty
 - AI changes cascade (balance)



WHAT WENT RIGHT



WHAT WENT RIGHT

- AI Programmer/AI Designer pair
- Short iteration cycles



SEARCH BASED MELEE



TOUCHING



- Company of Heroes – no touching
- Dawn of War 2 – lots of touching
- No touching example

NO TOUCHING



TOUCHING



SEARCH BASED MELEE

- Tabletop solution
- Consider ring base in A^* search
- Only accept goal cells where rings exactly touch







SEARCH BASED MELEE

- Lots of benefits...
- Exact distance for animators
- Extra room between units to increase mobility of other unit



PROBLEM: GROUP OVERLAP

- Multiple units attacking a single target bump and overlap
- Fix: Enforce circular bases between units with the same target







PROBLEM: GROUP OVERLAP

- Decide whether to re-move based on current overlap and priority
- In A* search, only accept goal cells with no overlap
- Only perform fancier steps when near enough melee target to matter



SEARCH BASED MELEE



Ork Rugby



SEARCH BASED MELEE



WHAT WENT RIGHT

Defining Personality with AI



DEFINING PERSONALITY



- Dawn of War 2 units has fewer animations than Company of Heroes units
- Compensate for animation with AI
- Create new plan functionality for new unit capabilities

DEFINING PERSONALITY

Company of Heroes Squad Plan

Under Attack!

All Squad: Seek Cover Nearby (5m)

All Squad: Wait Few Seconds

Core: Advance 15m To Better Cover

Flanks: Advance 15m To Better Cover

DEFINING PERSONALITY



Move out!

00:08:28

simrate:10



00:29:40

simrate:10





DEFINING PERSONALITY



DAWN OF WAR 2 AI POSTMORTEM

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