

Creating complex AI behaviour in Stellaris through Data Driven Design

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Much credit to Martin Anward, co AI programmer (currently Game Director)

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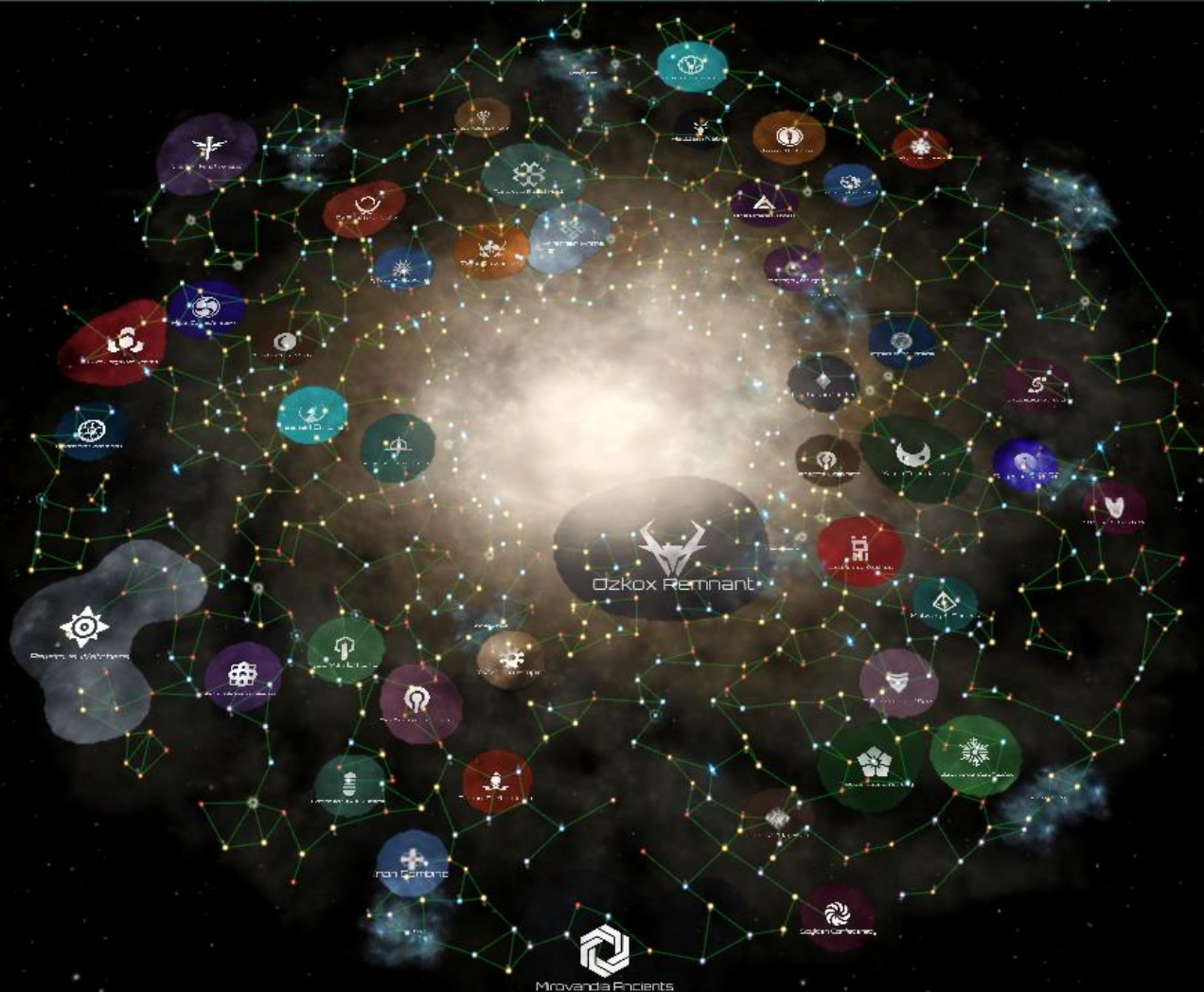
Agenda

- About Stellaris
- Why data driven design in Stellaris?
- How we apply it
- Challenges
- Summary





STELLARIS





PROVISIONAL

Why data driven design?

All the usual reasons for data driven design:

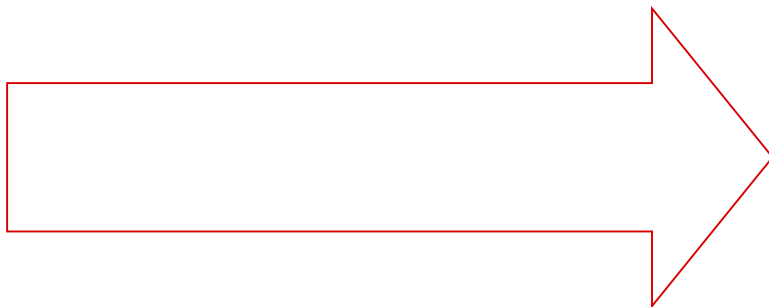
- Separate logic from data
- Exposing data for scripters and designers
- Control the flow/state changes through input data
- Modularity

Etc...



We make content heavy games

Armies
Buildings
Diplomatic Actions
Edicts
Ethos
Governments
Factions
Fleet movement
Leaders
Planets
Policies
Populations
Resources
Sectors
Ship components
Ship designs
Ships
Spaceports
Spaceport modules
Special projects
Species
Technologies
Traits
War demands



Behaviours



Paradox Game Pillars - Replayability



Replayable

You're basically never "done" with the game. System driven games with challenging sandbox environments make for unique game sessions each time you play.



EXPANSIONS



Sword of Islam



Legacy of Rome



Sunset Invasion



The Republic



The Old Gods



Sons of Abraham



Rajas of India



Charlemagne



Way of Life



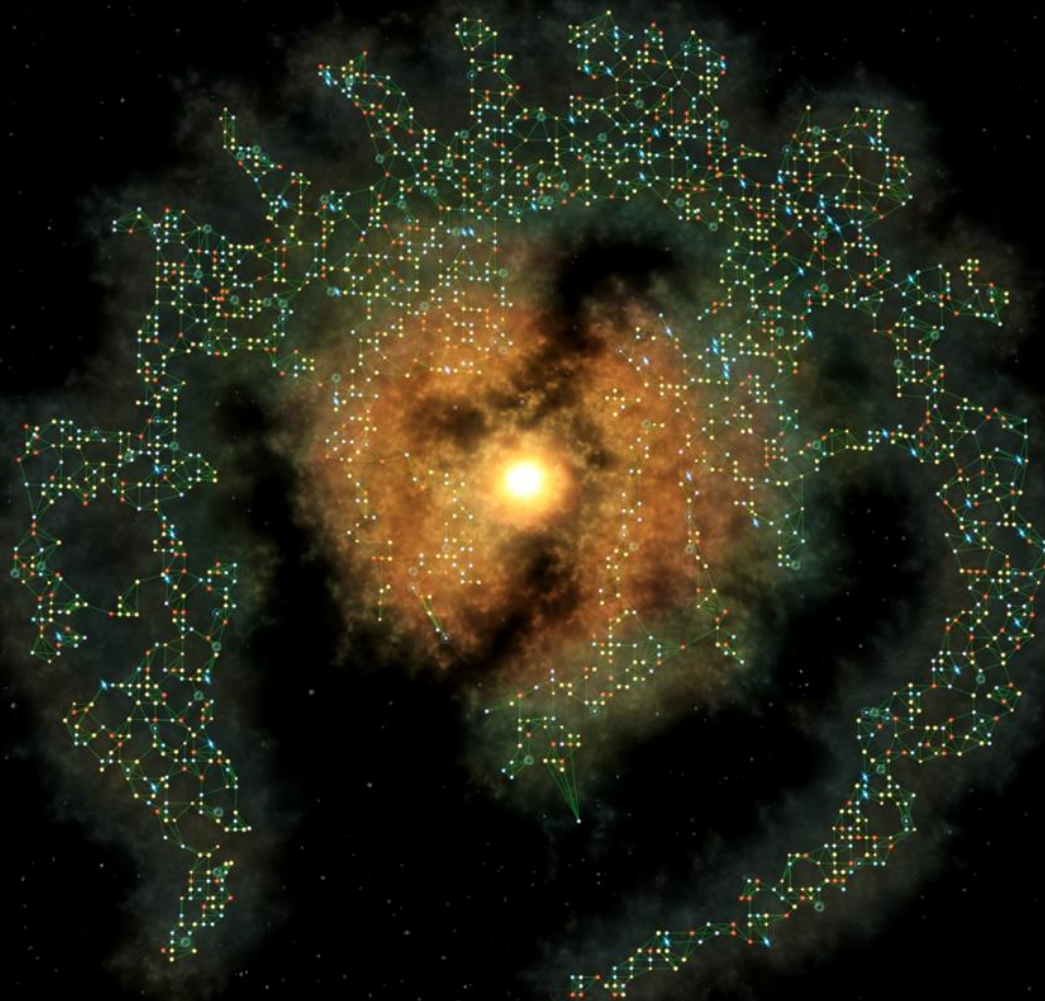
Horse Lords



Conclave



The Reaper's Due





Tools - maximizing resources

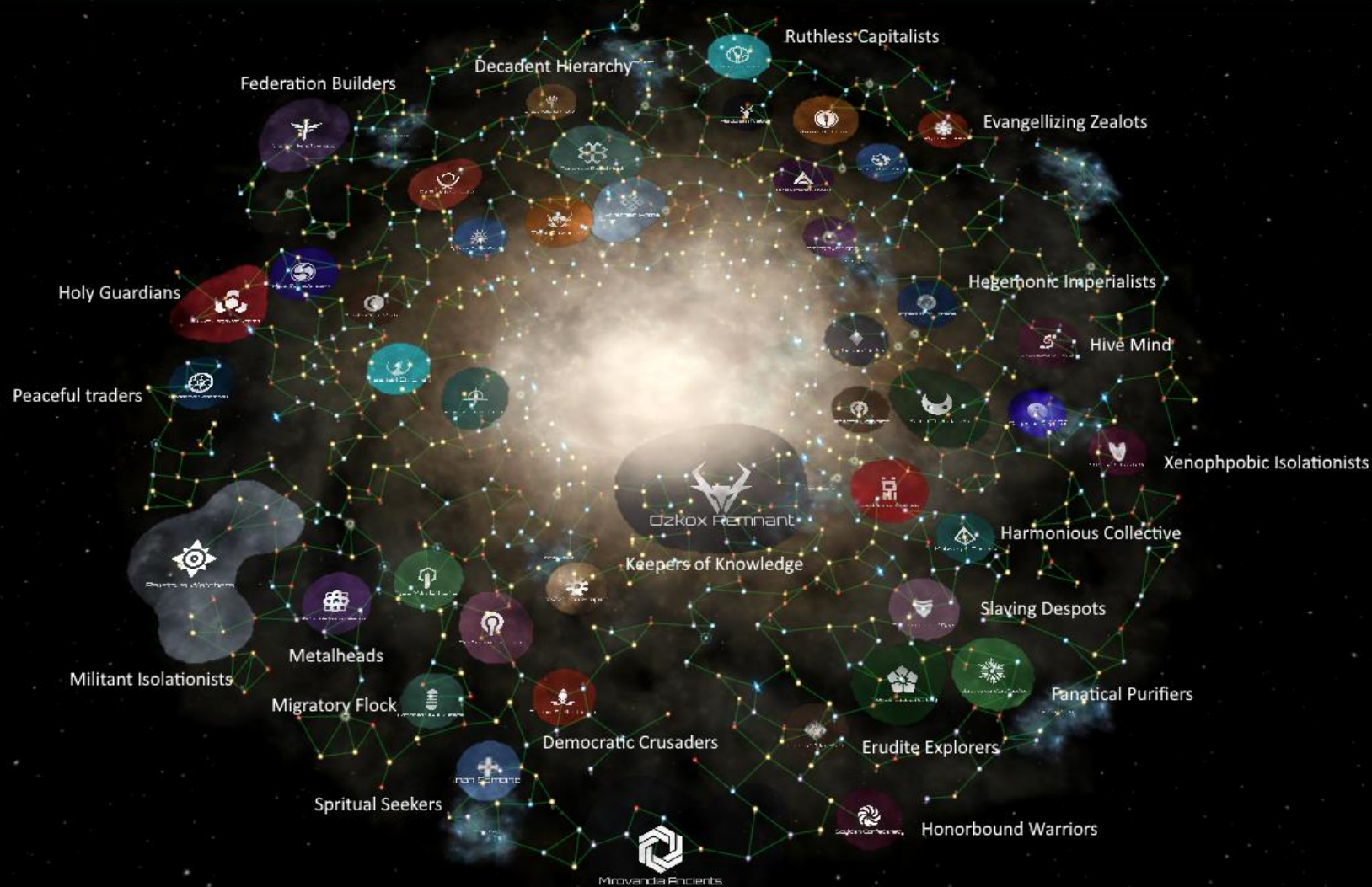
TRIGGERS		SCRIPTED WEIGHTS	
DESC	Check if a certain state is active. Use the trigger to eliminate options in a list or to modify a scripted weight.	Set a certain weight on a database object.	Select an option for the AI using the highest weight, fraction calculations, or weighted randomization.
EXAMPLE	<p>HasEthicTrigger:</p> <p><i>Returns true if country scope has the specified ethic.</i></p> <pre>ai_allow = { has_ethic = militarist }</pre>	<pre>building_military_academy = { ai_weight = { base = 10 modifier = { factor = 2 has_ethic = militarist } } }</pre>	<p>Options A, B, C Weights 5, 5, 10 Total weight = 20 Chance = 25%, 25%, 50%</p>



Examples of data types and AI data processing in Stellaris

Data type	AI data processing
Policy	Policy with highest weight is activated
Technology	Random weight algorithm will select one of the valid options
Building	Allow trigger + score based on weight & wanted resource
Ships	Weights used as fractions for each ship size







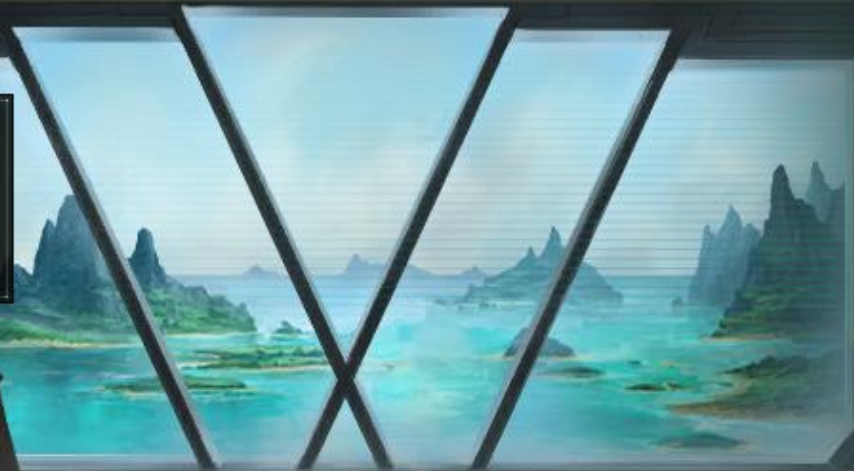
Larongo Serene Administration

Moral Democracy

Federation Builders

**Federation Builders**

Federation Builders consider all sentient life to have value, and will seek to form a strong Federation to protect themselves and others from expansionistic Empires.



May your nation always be at peace, Human friends.

GR-345



+119



Equivalent



Larongia



Declare War

Invite to Alliance



Demand Vassalization



Ask to be their Vassal



Offer Trade Deal

Recall Embassy

AI personalities



Honorbound Warriors
Evangelising Zealots
Erudite Explorers
Spiritual Seekers
Ruthless Capitalists
Peaceful Traders
Hegemonic Imperialists
Slaving Despots
Decadent Hierarchy
Democratic Crusaders
Harmonious Hierarchy
Federation Builders
Xenophobic Isolationists
Fanatic Purifiers
Hive mind
Migrating Flock
Metal Head
Fanatic Befrienders



Hegemonic Imperialists

```
behaviours = {
    slaver = yes
    purger = no
    robot_exploiter = yes
    conqueror = yes
    subjugator = yes
    liberator = no
    opportunist = yes
    uplifter = no
    dominator = no
    infiltrator = yes
    robot_liberator = no
    propagator = no
    multispecies = no
}
```

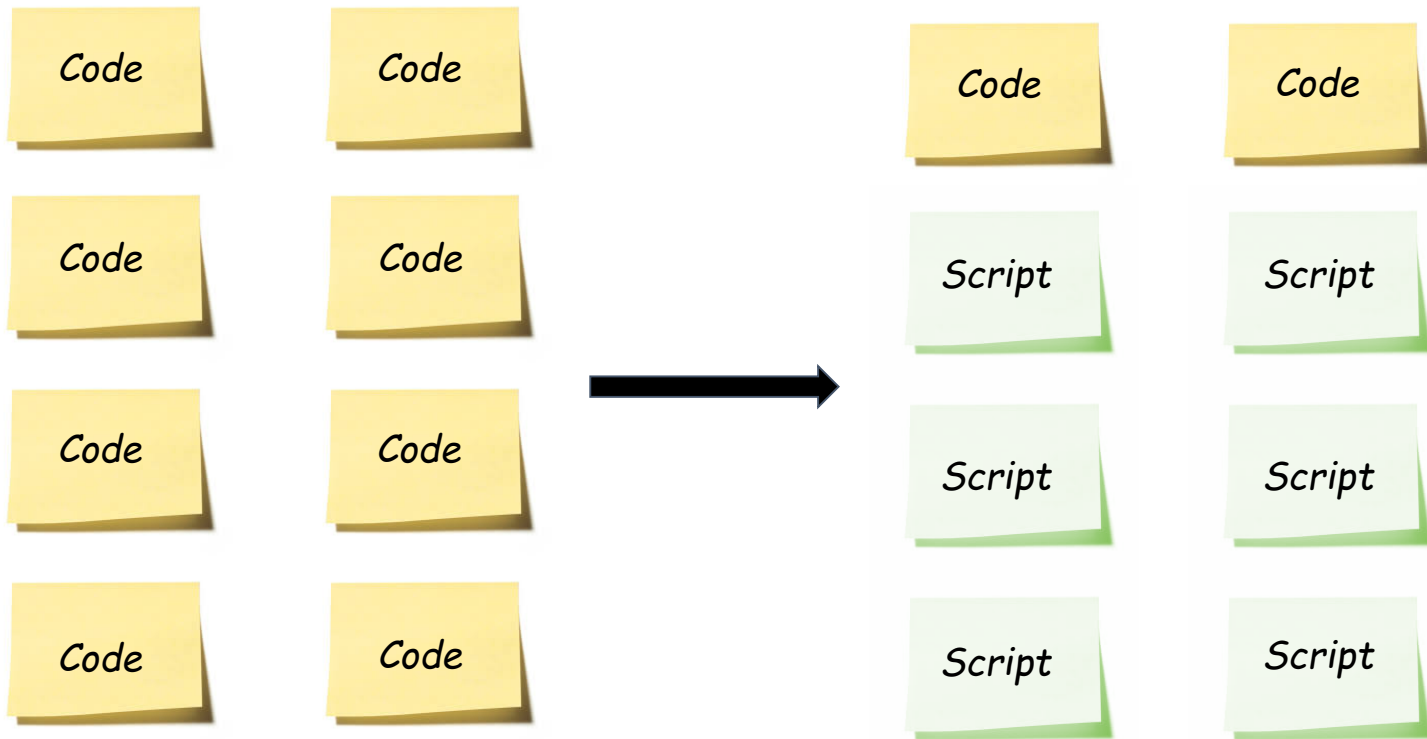


```
void CAIInteriorMinister::HandleAscensionPerks() const
{
    const CCountry* pCountry = GetCountry();
    const CArray< const CTraditionType* >& AscensionPerks = CAscensionPerkDatabase::GetInstance()->GetArray();

    ALLOCA( CFixedPoint, AscensionPerks.GetSize(), Weights );
    memset( Weights.GetPointer(), 0, Weights.GetBufferSizeInBytes() );

    for ( int32 i = 0, iSize = AscensionPerks.GetSize(); i < iSize; ++i )
    {
        const CTraditionType* pAP = AscensionPerks[ i ];
        if ( pAP->IsPotential( pCountry ) && pAP->CanActivate( pCountry ) )
        {
            Weights[pAP->GetIndex()] = pAP->CalcAIWeight( pCountry );
        }
    }

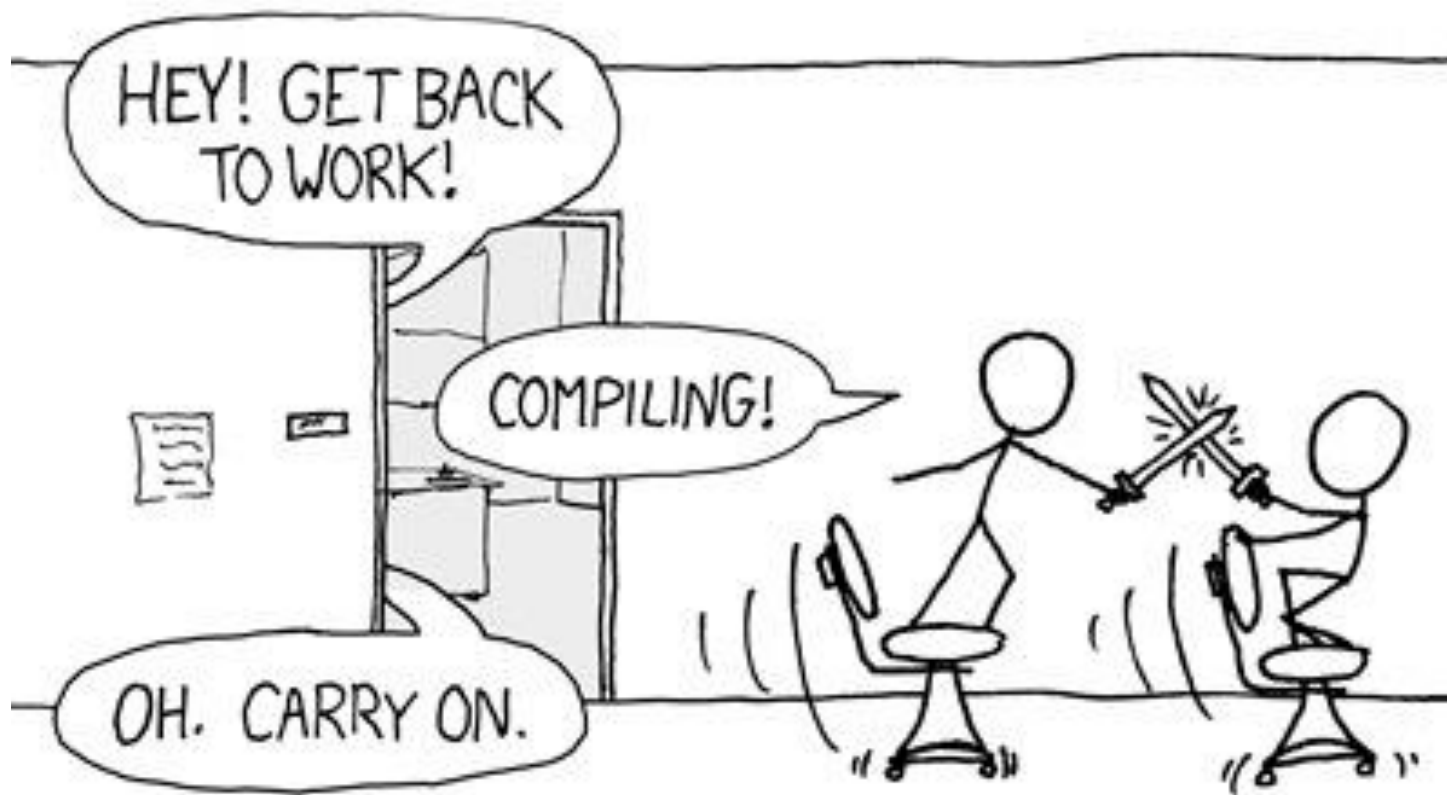
    int nRandom = GetWeightedRandom( AscensionPerks.GetSize(), Weights.GetPointer(), _pAICore->GetAIRand() );
    if ( nRandom >= 0 )
    {
        const CTraditionType* pAP = AscensionPerks[ nRandom ];
        CCountryActivateAscensionPerkCommand Command( pCountry, pAP );
        ASSERT( Command.IsValid() );
        if ( Command.IsValid() )
        {
            PostCommandToSession( Command.Clone() );
        }
    }
}
```





Stellaris Mod More galaxy sizes

"MY CODE'S COMPILING."





EVERY TIME MY GAME LAGS

SEARCH☒ Sessions ☐ Speakers**ALL SESSIONS****SPEAKERS****★ MY SCHEDULE****VIEW SESSIONS AS:****LIST****GRID**

Behavior is Brittle: Testing Game AI

Summit Speakers:

Sergio Ocio Barriaes | Lead AI Engineer, Hangar 13/2K

Dave Mark | President & Lead Designer, Intrinsic Algorithm LLC

Emil Johansen | Consultant: AI Specialist, Unity Expert, AngryAnt

Mike Lewis | Lead Gameplay Programmer, ArenaNet, LLC

Mike Robbins | Senior Software Engineer, Holospark LLC

Location: Room 2002, West Hall

Date: Monday, February 27

Time: 5:30pm - 6:30pm

Format: Session

Track:  AI Summit

Pass Type: GDC All Access, GDC All Access + VRDC, GDC Summits, Tutorials, & Bootcamps, GDC Summits, Tutorials, & Bootcamps + VRDC - **Get your pass now!**



Summary

Why use Data Driven AI for your games?

- Complex semi-unpredictable behavior
- Unique personalities
- Good for handling large amounts of input data and dependencies
- Mod friendly, scalable, modular
- Code is kept clean and simple



Questions?

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