

Small Team, Huge Game, and Lua

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UNKNOWNWORLDS
ENTERTAINMENT

About Natural Selection 2

- UWE formed in Oct. 2006 in San Francisco, CA
- Core team of 9 with several others around the world
- NS2 is a sequel to a modification of the game Half Life
- Custom game engine

Two very unique teams



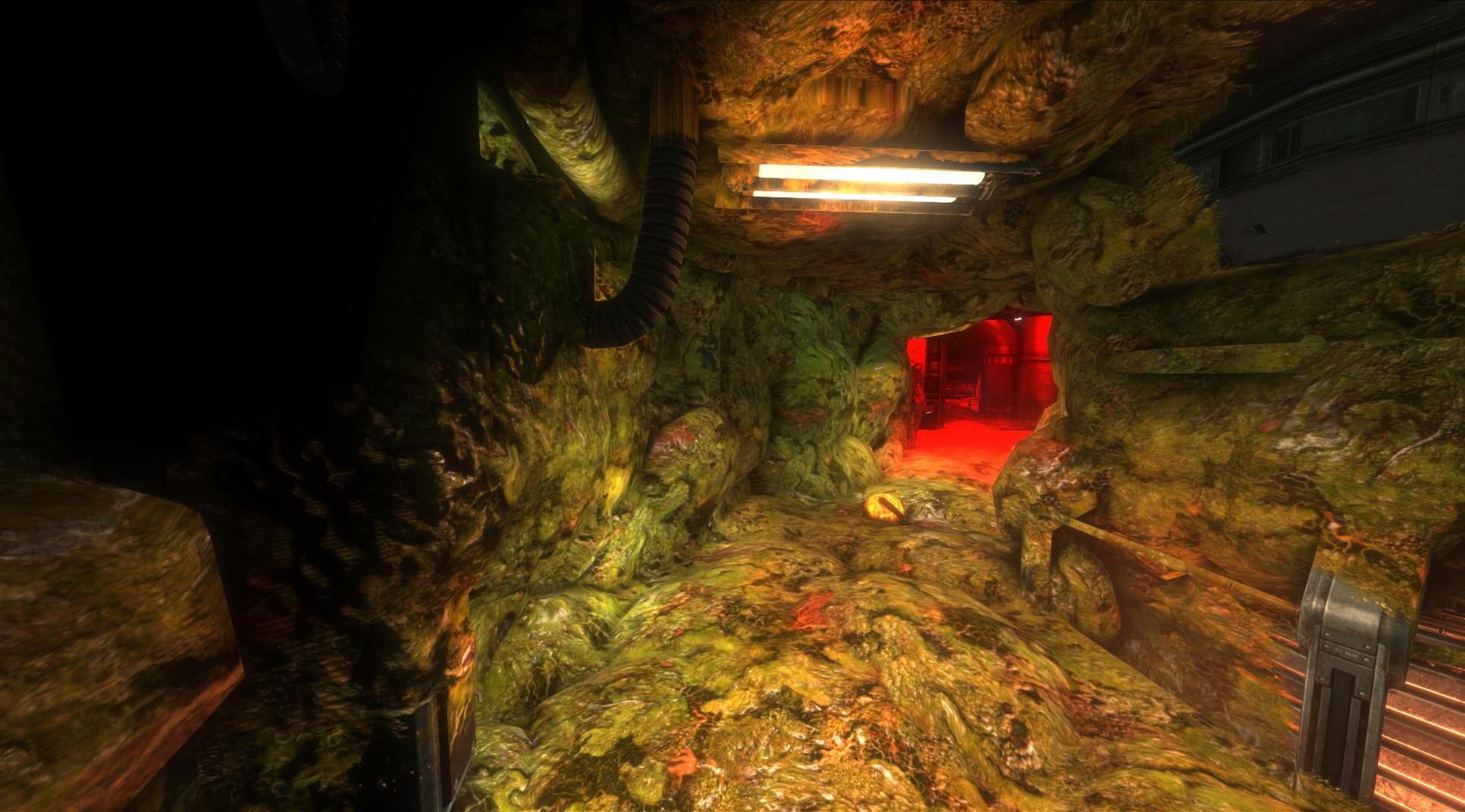
Online multiplayer



Hybrid first person shooter/real time strategy



Dynamic Environments



Released Halloween 2012

All Games > Action Games > Natural Selection 2

Natural Selection 2

[Community Hub](#)



Natural Selection 2 is an immersive, multiplayer shooter that pits aliens against humans in a strategic and action-packed struggle for survival. It seamlessly combines shooter and RTS/strategy gameplay. Key Features: Two Unique Sides: Whether you play as one of the elite marine Frontiersmen or the vicious alien Kharaa, you must use...

Genre: Action, Strategy, Indie

Release Date: Oct 30, 2012



[View all 10 screenshots](#)



[Watch all 2 trailers](#)



Engine written in C++



Gameplay written entirely in Lua

The screenshot displays the ns2 - Decoda development environment. The interface includes a menu bar (File, Edit, Project, Debug, SCC, Tools, Window, Help), a Project Explorer on the left, a main code editor, and an Output window at the bottom.

Project Explorer: Lists various Lua files, including Notifications.lua, NS2ConsoleCommands_Client.lua, NS2ConsoleCommands_Server.lua, NS2Gamerules.lua, NS2Utility.lua, NS2Utility_Server.lua, NutrientMist.lua, ObjectiveInfo.lua, Observatory.lua, ObstacleMixin.lua, Onos.lua, Onos_Client.lua, Onos_Server.lua, OptionsDialog.lua, Order.lua, OrderSelfMixin.lua, OrdersMixin.lua, OverheadMoveMixin.lua, OverheadSpectatorMode.lua, OwnerMixin.lua, Parasite.lua, ParasiteMixin.lua, ParticleEffect.lua, PathingMixin.lua, PathingUtility.lua, PhaseGate.lua, Pheromone.lua, PhysicsGroups.lua, and PickupableMixin.lua.

Player.lua Code:

```
function Player:GetGravityAllowed()

    // No gravity when on ladders or on the ground.
    return not self:GetIsOnLadder() and not self:GetIsOnGround()

end

function Player:GetMoveDirection(moveVelocity)

    if self:GetIsOnLadder() then
        return GetNormalizedVector(moveVelocity)
    end

    local up = Vector(0, 1, 0)
    local right = GetNormalizedVector(moveVelocity):CrossProduct(up)
    local moveDirection = up:CrossProduct(right)
    moveDirection:Normalize()

    return moveDirection

end

function Player:OnUseTarget(target)
end

function Player:OnUseEnd()
end

function Player:EndUse(deltaTime)

    if not self:GetIsUsing() then
        return
    end
end
```

Search Results: Find all "Weldable"

- ARC.lua:31: Script.Load("lua/WeldableMixin.lua")
- ARC.lua:155: InitMixin(self, WeldableMixin)
- Armory.lua:26: Script.Load("lua/WeldableMixin.lua")
- Armory.lua:157: InitMixin(self, WeldableMixin)
- ArmsLab.lua:27: Script.Load("lua/WeldableMixin.lua")
- ArmsLab.lua:124: InitMixin(self, WeldableMixin)
- CommandStation.lua:16: Script.Load("lua/WeldableMixin.lua")
- CommandStation.lua:68: InitMixin(self, WeldableMixin)
- Door.lua:18: Script.Load("lua/WeldableMixin.lua")

Output: (Empty)

Status Bar: Ln 1192 Col 49

Lua source shipped with the game

The screenshot shows a Windows Explorer window with the address bar set to `Steam > steamapps > common > natural selection 2 > ns2 > lua`. The search bar contains `Search lua`. The window title is `Organize`. The left sidebar shows the navigation pane with `Local Disk (C:)` selected. The main pane displays a list of 492 items, which are all Lua files. The list is sorted by name and includes columns for Name, Date modified, Type, and Size.

Name	Date modified	Type	Size
Onos.lua	10/28/2012 8:05 PM	LUA File	17 KB
Onos_Client.lua	9/6/2012 8:57 PM	LUA File	4 KB
Onos_Server.lua	6/1/2012 12:33 AM	LUA File	1 KB
OptionsDialog.lua	11/1/2012 7:22 PM	LUA File	8 KB
Order.lua	10/11/2012 9:09 PM	LUA File	8 KB
OrderSelfMixin.lua	11/14/2012 6:57 PM	LUA File	10 KB
OrdersMixin.lua	10/28/2012 8:05 PM	LUA File	20 KB
OverheadSpectatorMode.lua	10/28/2012 8:05 PM	LUA File	3 KB
OwnerMixin.lua	5/17/2012 8:36 PM	LUA File	4 KB
ParasiteMixin.lua	10/25/2012 8:31 PM	LUA File	6 KB
PathingMixin.lua	5/17/2012 8:35 PM	LUA File	13 KB
PathingUtility.lua	11/1/2012 7:23 PM	LUA File	11 KB
PhaseGate.lua	10/25/2012 8:31 PM	LUA File	13 KB
Pheromone.lua	9/18/2012 8:28 PM	LUA File	7 KB
PhysicsGroups.lua	11/1/2012 7:22 PM	LUA File	6 KB
PickupableMixin.lua	8/28/2012 7:42 PM	LUA File	3 KB
PickupableWeaponMixin.lua	9/6/2012 8:58 PM	LUA File	2 KB
Player.lua	11/1/2012 7:22 PM	LUA File	87 KB
Player_Client.lua	11/14/2012 6:57 PM	LUA File	108 KB
Player_Rumble.lua	9/6/2012 8:57 PM	LUA File	8 KB
Player_Server.lua	11/1/2012 7:22 PM	LUA File	22 KB
PlayerEffects.lua	11/14/2012 6:57 PM	LUA File	21 KB
PlayingTeam.lua	10/28/2012 8:05 PM	LUA File	28 KB
PointGiverMixin.lua	6/26/2012 11:45 PM	LUA File	3 KB
PowerConsumerMixin.lua	9/30/2012 3:42 PM	LUA File	5 KB
PowerMixin.lua	5/17/2012 8:35 PM	LUA File	5 KB
PowerPack.lua	8/28/2012 7:42 PM	LUA File	6 KB
PowerPoint.lua	10/25/2012 8:31 PM	LUA File	25 KB
PowerPoint_Client.lua	9/30/2012 3:42 PM	LUA File	7 KB

492 items

Overview

- Lua integration within the game engine
- OOP without the hierarchy
- Script errors
- Open development

Hooking into the engine

- Two ways the game code is notified of engine events
- Global events
- Entity events

Global events

```
local function OnClientDisconnected(reason)
    Shared.Message("You were disconnected: " .. reason)
end
```

```
Event.Hook("ClientDisconnected", OnClientDisconnected)
```

```
Event.Hook("Console_hello_world",
function() Shared.Message("Hello Lua Workshop!") end)
```

Entity events

First, what is an entity?

- Persistent networked object
- Server -> Clients
- Prediction
- Lag compensation
- Container for physics, graphics, etc
- Queryable

Player, Structure, Door, Weapon, Health pack, etc

Entity events

- From engine to specific entity
- Automatically networked

Player:OnInitialized()

Player:OnDestroy()

Player:OnProcessMove(move)

Cool picture break



OOP without the hierarchy

Traditional Hierarchy

Entity

Actor

BlendedActor

ScriptActor

LiveScriptActor

Structure

Hive

Armory

AdvancedArmory

Player

Marine

JetpackMarine

Alien

Skulk

Fade

Gorge

Problems with the hierarchy

Where to add new functionality?

CloakedActor

LiveScriptActor

Structure

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Armory

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Problems with the hierarchy

Where to add new functionality?

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CloakedActor?

Structure

CloakedActor?

Hive

Armory

CloakedActor?

Player

CloakedActor?

Alien

Problems with the hierarchy

Overrides lead to bugs:

```
function Marine:OnKill()  
    Player.OnKill(self)  
    self:RemovePoints(10)  
end
```

Problems with the hierarchy

Overrides lead to bugs:

```
function Marine:OnKill()  
    -- The Marine sometimes respawns very fast!  
    if self:CheckForQuickRespawn() then  
        self:RespawnQuick()  
    else  
        Player.OnKill(self)  
        self:RemovePoints(10)  
    end  
end  
end
```

OOP without the hierarchy

Traditional Hierarchy

Entity

Actor

BlendedActor

ScriptActor

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Structure

Hive

Armory

AdvancedArmory

Player

Marine

JetpackMarine

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The Overly Responsible LiveScriptActor

- Being alive, health, and armor

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team
- Energy

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team
- Energy
- Construction

The Overly Responsible LiveScriptActor

- Being alive, health, and armor
- Game effects (on fire, cloaked, etc)
- Scoring
- Team
- Energy
- Construction
- Using
- Orders
- Power
- Researching
- Stunning
- Upgrading

Cool picture break



Mixins

- Where to add new functionality?
- Overrides

What is a Mixin?

- A piece of functionality
- "Attaches" itself to an object
- Is NOT organized within a hierarchy

LiveMixin

```
LiveMixin = { type = "Live" }
```

```
function LiveMixin:__initmixin()  
    self.health = 100  
end
```

```
function LiveMixin:TakeDamage(amt)  
    self.health = self.health - amt  
end
```

```
function LiveMixin:Heal(amt)  
    self.health = self.health + amt  
end
```

Adding mixins to an object

```
local player = Server.CreateEntity("Player")
```

```
InitMixin(player, LiveMixin)
```

```
player:TakeDamage(50)
```

```
player:Heal(10)
```

Behind the scenes

```
function InitMixin(entity, mixin)

    for name, func in pairs(mixin) do
        entity[name] = func
    end

end
```

How to handle overrides

```
local CloakableMixin = { type = "Cloak" }
```

```
-- Uncloak when taking damage.
```

```
function CloakableMixin:TakeDamage()
```

```
    self:Uncloak()
```

```
end
```

How to handle overrides

```
local CloakableMixin = { type = "Cloak" }
```

```
-- Uncloak when taking damage.
```

```
function CloakableMixin:TakeDamage()
```

```
    self:Uncloak()
```

```
end
```

```
function LiveMixin:TakeDamage()
```

How to handle overrides

- Only call the first function attached?
- Require explicit calls to specific mixins?
- Call all the functions attached?

How to handle overrides

- Only call the first function attached?
- Require explicit calls to specific mixins?
- **Call all the functions attached.**

Behind the scenes

```
function InitMixin(entity, mixin)

  for name, func in pairs(mixin) do
    if entity[name] == nil then
      entity[name] = func
    else
      AddFunctionToCallerList(entity, name, func, mixin)
    end
  end
end

end
```

How to handle overrides

```
local player = Server.CreateEntity("Player")
```

```
InitMixin(player, LiveMixin)
```

```
InitMixin(player, CloakableMixin)
```

```
player:Cloak()
```

```
player:TakeDamage(50)
```

```
assert(not player:GetIsCloaked())
```

Cool picture break



Querying for mixins

```
function Bomb:Explode()
```

```
    local nearbyEnts = GetNearbyEnts(10)
```

```
    for i = 1, #nearbyEnts do
```

```
        nearbyEnts[i]:TakeDamage(25)
```

```
    end
```

```
end
```

Querying for mixins

```
function Bomb:Explode()
```

```
    local nearbyEnts = GetNearbyEnts(10)
```

```
    for i = 1, #nearbyEnts do
```

```
        nearbyEnts[i]:TakeDamage(25)
```

```
    end
```

```
end
```

Querying for mixins

```
function Bomb:Explode()
```

```
    local nearbyEnts = GetNearbyEnts(10, "Live")
```

```
    for i = 1, #nearbyEnts do
```

```
        nearbyEnts[i]:TakeDamage(25)
```

```
    end
```

```
end
```

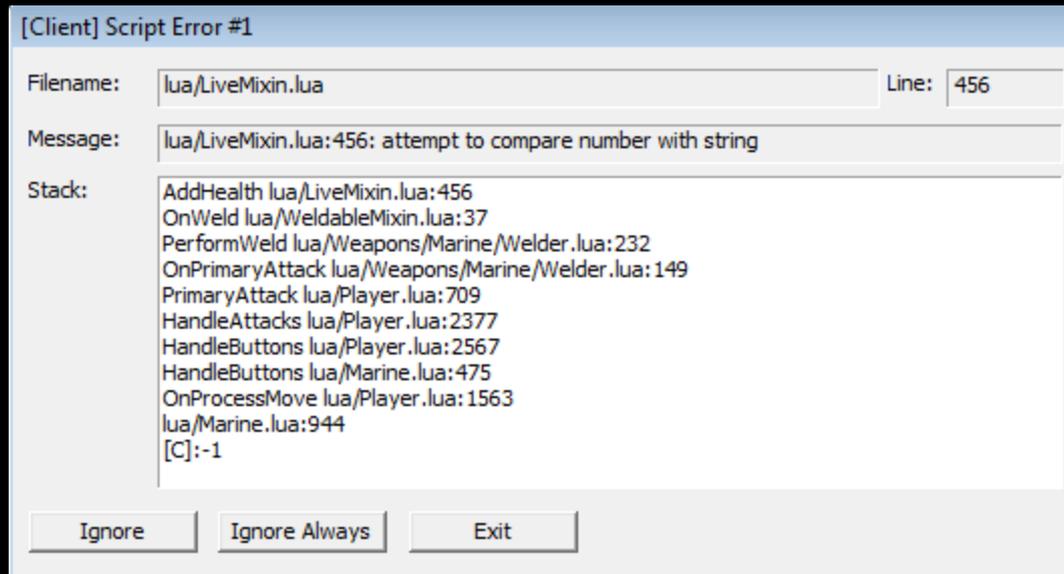
109 Mixins in NS2

- PowerSourceMixin
- ModelMixin
- FireMixin
- FreeLookMoveMixin
- FollowMoveMixin
- OrdersMixin
- PathingMixin
- PickupableMixin
- PointGiverMixin
- ...

Script Errors

- Line number
- Call stack
- State
- Automatic collection

Script Errors



Script Errors

The screenshot shows a 'Log Viewer' window with a menu bar containing 'File' and 'Help'. The main area is divided into four panels: 'Errors', 'Call Stack', 'Locals', and 'Evaluate'.

Errors: A list of error messages. The first error is highlighted in blue: '#1: lua/LiveMixin.lua:456: attempt to compare number with string'.

Call Stack: A list of function calls leading to the error. The top call is highlighted in blue: 'AddHealth lua/LiveMixin.lua:456'. Other calls include 'OnWeld lua/WeldableMixin.lua:38', 'PerformWeld lua/Weapons/Marine/Welder.lua:232', 'OnPrimaryAttack lua/Weapons/Marine/Welder.lua:149', 'PrimaryAttack lua/Player.lua:709', 'HandleAttacks lua/Player.lua:2377', 'HandleButtons lua/Player.lua:2567', 'HandleButtons lua/Marine.lua:475', 'OnProcessMove lua/Player.lua:1563', 'lua/Marine.lua:944', and '[C]:-1'.

Locals: A tree view showing local variables for the current function. The 'self' table is expanded, showing various attributes. The 'health' attribute is highlighted in blue and has the value '10'.

Evaluate: Two empty text boxes for evaluating expressions.

Log Viewer

File Help

Errors:

```
#1: lua/LiveMixin.lua:456: attempt to compare number with string
```

Call Stack:

```
AddHealth lua/LiveMixin.lua:456
OnWeld lua/WeldableMixin.lua:38
PerformWeld lua/Weapons/Marine/Welder.lua:232
OnPrimaryAttack lua/Weapons/Marine/Welder.lua:149
PrimaryAttack lua/Player.lua:709
HandleAttacks lua/Player.lua:2377
HandleButtons lua/Player.lua:2567
HandleButtons lua/Marine.lua:475
OnProcessMove lua/Player.lua:1563
lua/Marine.lua:944
[C]:-1
```

Locals:

```
self
├── recentHealthChanged = 0
├── visibleClient = 0
├── timeLastHealed = 0
├── sighted = 0
├── researchProgress = 0
├── researchingId = 1
├── alive = 1
├── vortexed = 0
├── underConstruction = 0
├── teamNumber = 1
├── techId = 76
└── health = "10"
```

Evaluate:

Script Errors

```
function WeldableMixin:OnWeld()  
    self:AddHealth("10")  
end
```

Script Errors

Top Reported Errors

1 Minute 5 Minutes 15 Minutes **1 Hour** 1 Day 1 Week 1 Month



87	bad argument #1 to '?' (string expected, got no value)	sandbox
73	lua/autorun/shared.lua:16: ')' expected near 'ply'	base
68	lua/effects/bodyshot/init.lua:17: ')' expected near 'physics'	sandbox
54	gamemodes/perp/gamemode/cl_vehicles.lua:98: attempt to call method 'InVehicle' (a nil value)	perp
51	...d cow's weapons/lua/effects/effect_mad_gunsmoke/init.lua:41: Tried to use a NULL entity!	darkrp
50	...d cow's weapons/lua/effects/effect_mad_gunsmoke/init.lua:22: Tried to use a NULL entity!	darkrp
45	gamemodes/perp/gamemode/cl_modules/radio.lua:15: Module not found!	base
42	lua/weapons/cse_base/shared.lua:19: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
42	lua/weapons/cse_base_as/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
42	lua/weapons/cse_base_bs/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_a/shared.lua:18: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_abs/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
41	lua/weapons/cse_base_s/shared.lua:16: bad argument #2 to 'CreateFont' (table expected, got number)	sandbox
39	LuaCmd:1: attempt to call method 'ChatPrint' (a nil value)	1942rp

Script Errors

Garry's Mod Errors

Top Errors

Details

error #1210070651 **base** 7,041 reports 1,625 reporters first seen 9 days ago

72
60
48
36
24
12
0

Nov 18th 15:00
errors: 51

Error

```
gamemodes/perp/gamemode/cl_modules/radio.lua:15: Module not found!
```

Call Stack

```
1. require - [C]:-1
2. unknown - gamemodes/perp/gamemode/cl_modules/radio.lua:15
3. include - [C]:-1
4. unknown - gamemodes/perp/gamemode/cl_init.lua:44
```

Open Development

- Bug fixes
- Optimizations
- Gameplay features

Open Development

Your location: [Translation](#) > [German](#)

Menu

- Arabic
- Chinese (Simplified)
- Chinese (Traditional)
- Croatian
- Czech
- Danish
- Dutch
- English (British)
- Finnish
- French
- German**
- Greek
- Hungarian
- Italian
- Japanese
- Korean
- Lithuanian
- Norwegian
- Polish
- Portuguese (Brazil)
- Portuguese (Portugal)
- Romanian

Filter

Delete filter

Options

Show all strings

Hide accepted strings

Download file

Strings to translate - **German**

ADRENALINE_SPUR_HINT ("More alien energy") [Use original text as translation]

"Zusätzliche Energie für Aliens" [1p. / approve / delete]

"Zusätzliche Alien Energie" [0p. / approve / delete]

"Zusätzliche Alienenergie" [0p. / approve / delete]

ADRENALINE_SPUR_TOOLTIP ("Gives aliens more energy") [Use original text as translation]

"Gibt Aliens zusätzliche Energie" [2p. / approve / delete]

ADRENALINE_TOOLTIP ("Double energy pool.") [Use original text as translation]

"Verdopplung des Energiepools." [2p. / approve / delete]

ADVANCED_ARMORY_HINT ("Flamethrowers, grenades") [Use original text as translation]

"Flammenwerfer, Granaten" [6p. / approve / delete]

"Flammenwerfer und Granaten" [-2p. / approve / delete]

"Flammen- und Granatwerfer" [-2p. / approve / delete]

ALIEN_ALERT_NEED_ENZYME ("Player requesting Enzyme Cloud") [Use original text as translation]

"Spieler fordert Enzymwolke an" [1p. / approve / delete]

ALIEN_ALERT_NEED_MIST ("Player requesting Nutrient Mist") [Use original text as translation]

"Spieler fordert Nährstoffwolke an" [0p. / approve / delete]

AMMO_PACK_TOOLTIP ("Ammo to fill any weapon") [Use original text as translation]

"Munition zum Befüllen jeglicher Waffen" [1p. / approve / delete]

"Munition zum Befüllen jeder Waffe" [-1p. / approve / delete]

ARC_HINT ("Commander artillery") [Use original text as translation]

"Commander Artillerie" [-1p. / approve / delete]

"Mobile Artillerie" [0p. / approve / delete]

"Commander-Artillerie" [0p. / approve / delete]

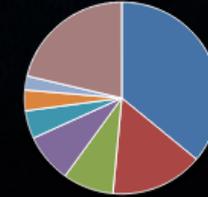
ARC_ROBOTICS_FACTORY_HINT ("Builds MACs and ARCs") [Use original text as translation]

"Baute MACs und ARCs" [4p. / approve / delete]

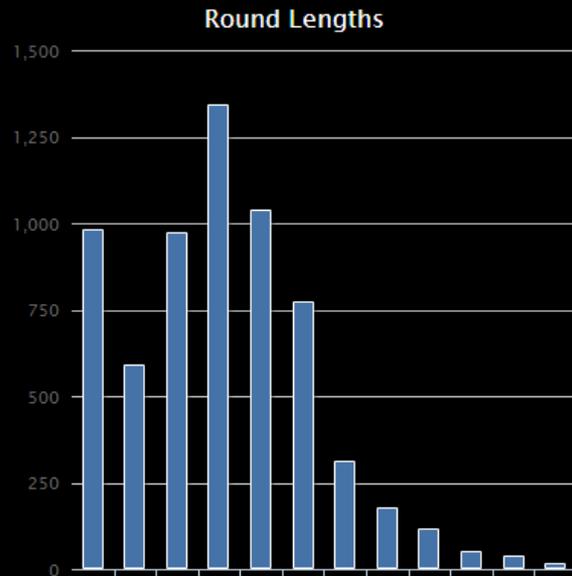
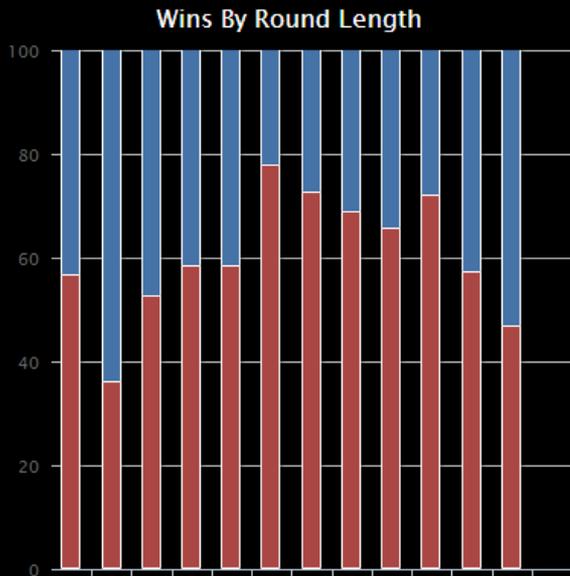
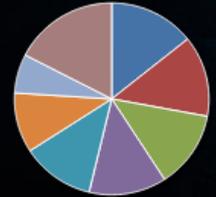
Open Development



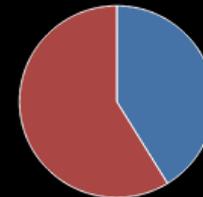
Player Nationalities



Maps



Wins



Open Development

ns2_co_stargate

★★★★☆
54 ratings



Created by:



Magneto

[View all shared files](#)

Usable in:



Open Development



e_X_w Shotgun
by aageon



Colonial Marines - Exo Sui...
by Nomad



COMPACT LMG



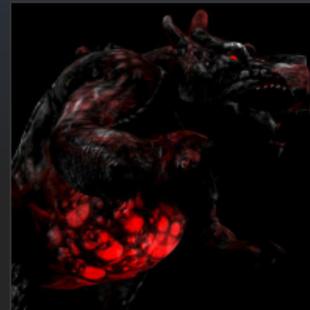
Compact LMG
by Ice



Custom Shotgun Mod
by Nick²



Hello Kitty Rifle
by NoFucksGiven.Jpg



Blood Gorge
by [CYNICAL_MASS]



Colonial Marines
by Nomad



Colonial Marines - Hands
by Nomad



J13 Elite Crosshairs
by Pizza Supreme

Open Development

Marine vs Marine

NATURAL SELECTION
MARINE vs MARINE



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unknownworlds.com/decoda



CARGO TRANSFER SOUTH



VV-90

IN PROGRESS

NATURAL SELECTION

LZ 8877

COMMANDER: MOTIG^
TEAM RES: 200



300

56 RESOURCES

TSE EXPORT
SERIAL NUMBER
PART NO.
DATE OF MANUFACTURE
WARRANTY

