

Making delightful tools

for sustainable (small-team) development



ISA
(mw)

6 years @microsoft
VS debugger team

started murder engine 3
years ago

full time on coldblood <3

I LOVE tools!

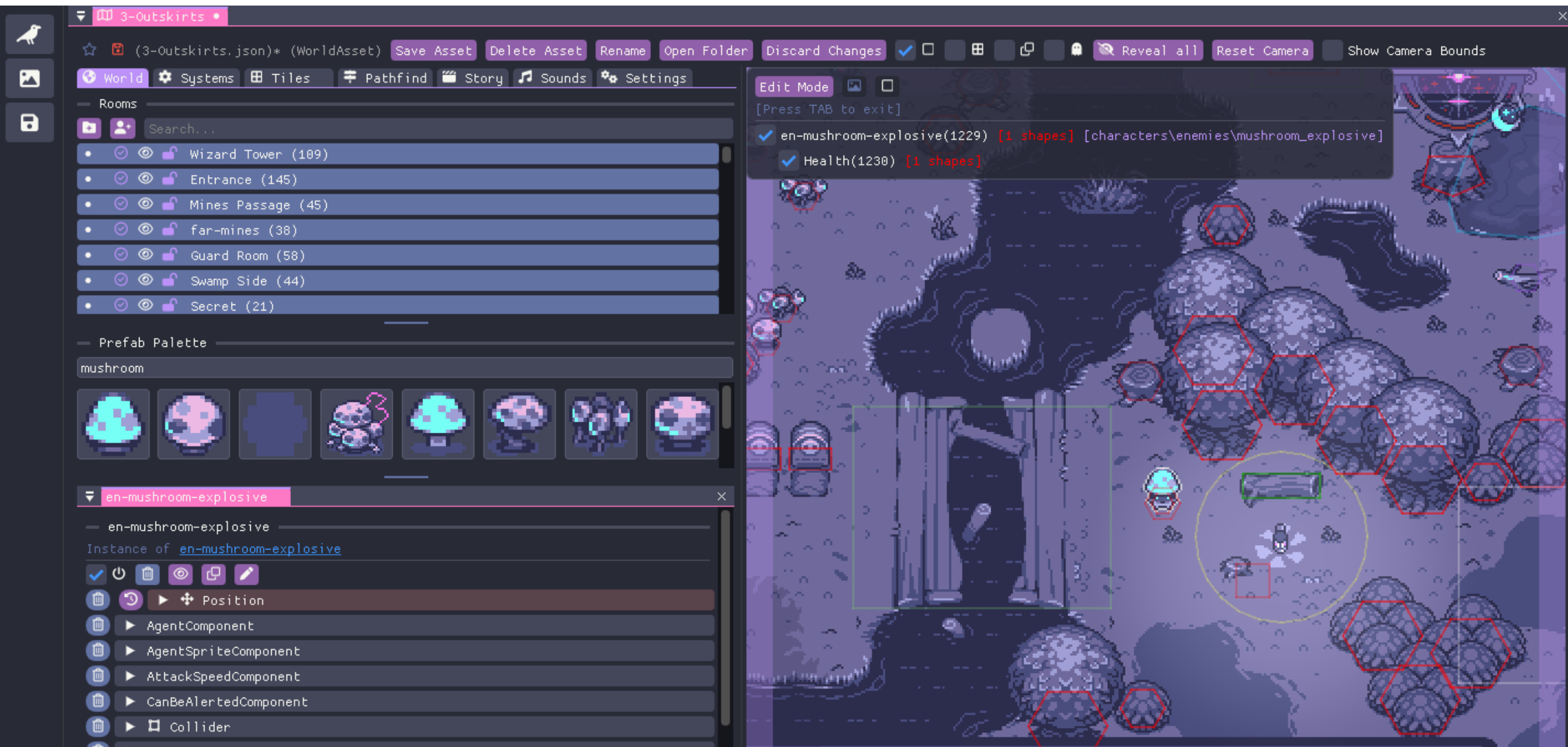
inc.





- ★ most of these tips apply to a small team (less than 8 people)
- ★ **HOWEVER** I also learned them as a senior engineer in Visual Studio (100+ people team)
- ★ based on my **own** experience and what has helped us so far!

i'm **not** here to convince you to do your own engine



★ my goal is to cover how to make tools...

- tailored for the team,
- delightful and fun to work with,
- with a data-oriented mindset,



...and balance between tools, engine and gameplay development with 9 tips!

*1 The game always
comes first*

★ start with whatever **unblocks** you and build from there!



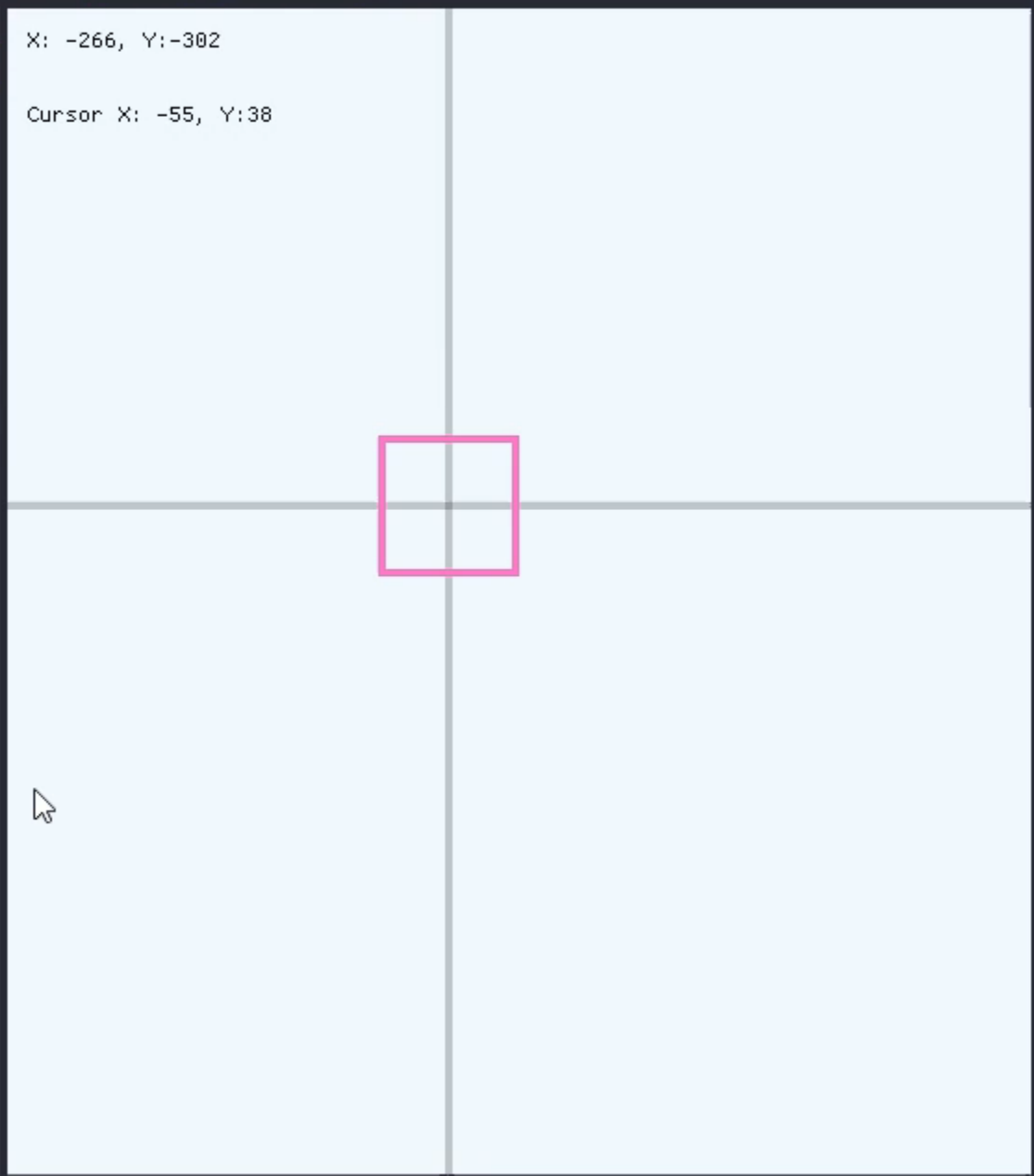
- Assets Atlas
- Dungeons
- Inventory
- Themes
- Tilesets
- Generated
- Entities
- World
- Player Info
- Editor Settings
- Game Settings

Dungeon/Level 1

(dungeon\level 1.json) (WorldAsset) Save Asset Delete Asset Rename Open Folder

World Systems

- New entity
- Core/Camera Instance
- Managers/Dungeon Generator Instance



2-Village

(2-Village.json) (WorldAsset) Save Asset Delete Asset Rename Open Folder Discard Changes [checkbox] [grid] [copy] [lock] [magnifying glass] Reveal all Reset Camera Show Camera

World [gear] Syst... [grid] Tiles [list] Path... [calendar] Story [music] Soun... [gears] Sett...

- Rooms
- Sheeps (1)
 - Sea (5)
 - Room 15 (52)
 - Room 4 (123)
 - props\bathtub (1)
 - Util/Scene Transition (1)
 - Object\Doors\Door-helena (1)

Prefab Palette

Filter...

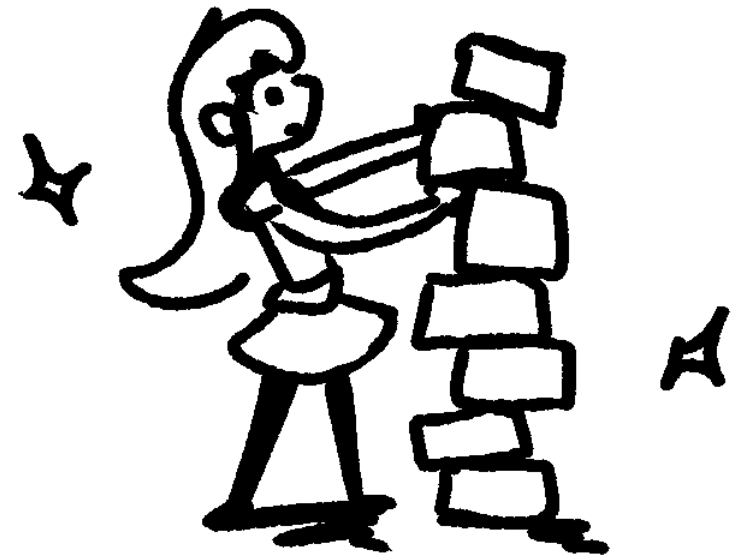




think of it as "little gifts" for your future-self
it can be an extremely rewarding experience!

✿ instead of comparing yourself to others, compare yourself with your own progress

I MADE IT
THIS FAR...



AND I DESERVE
TO KEEP GOING

★ do use other engines and see what you like about them
↳

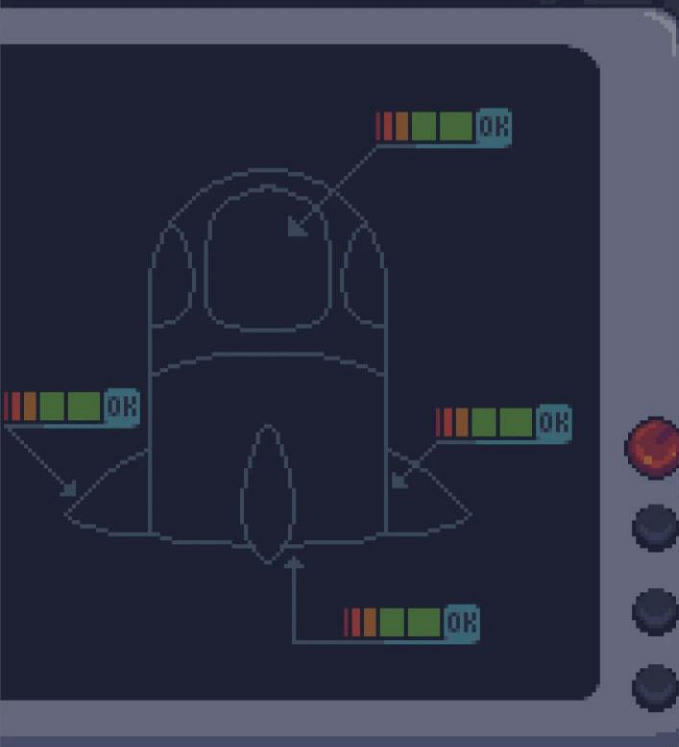
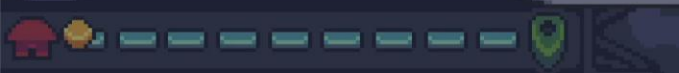
2 Stick to your goals



★ first goal: use our engine in a game jam



Alright, time to hit the road.

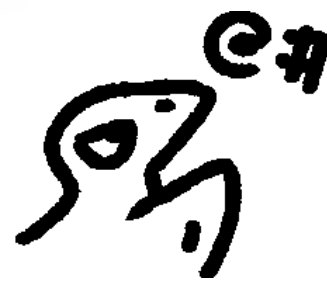


Results

Final results

Overall:	1 st (4.667 average from 50 ratings)
Fun:	9 th (4.469 average from 50 ratings)
Innovation:	5 th (4.573 average from 50 ratings)
Theme:	1 st (4.771 average from 50 ratings)
Graphics:	1 st (4.917 average from 50 ratings)
Audio:	7 th (4.585 average from 49 ratings)
Humor:	7 th (4.649 average from 49 ratings)

Game jam game of the month



Source: [GitHub Game Bytes – June 2023](#)



★ new goal: ship a commercial game

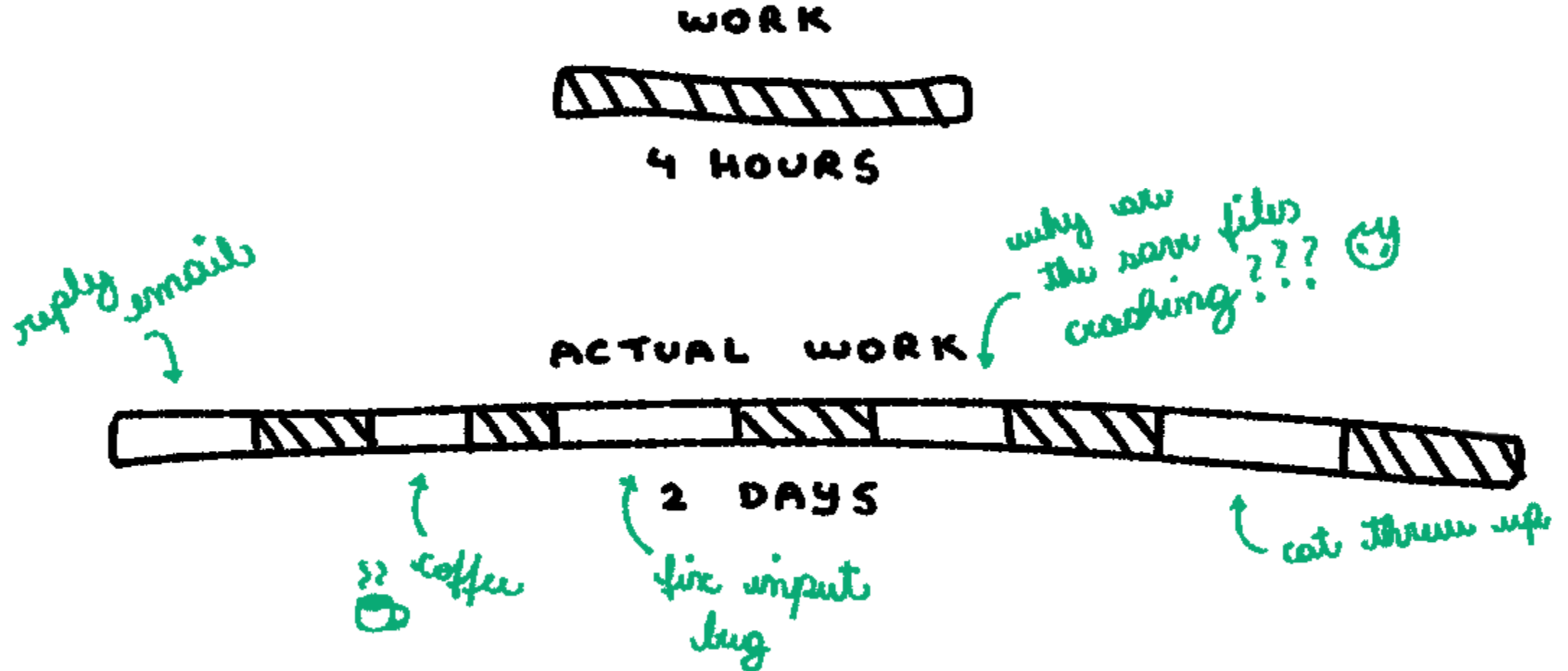
- ★ your **time** is your most valuable resource
- ★ goals can help you choose what to prioritize



★ get good at estimating feature costs!

→ make mistakes

→ accept that you WILL context switch. A lot.



examples

refactoring my serialization from reflection to source generation

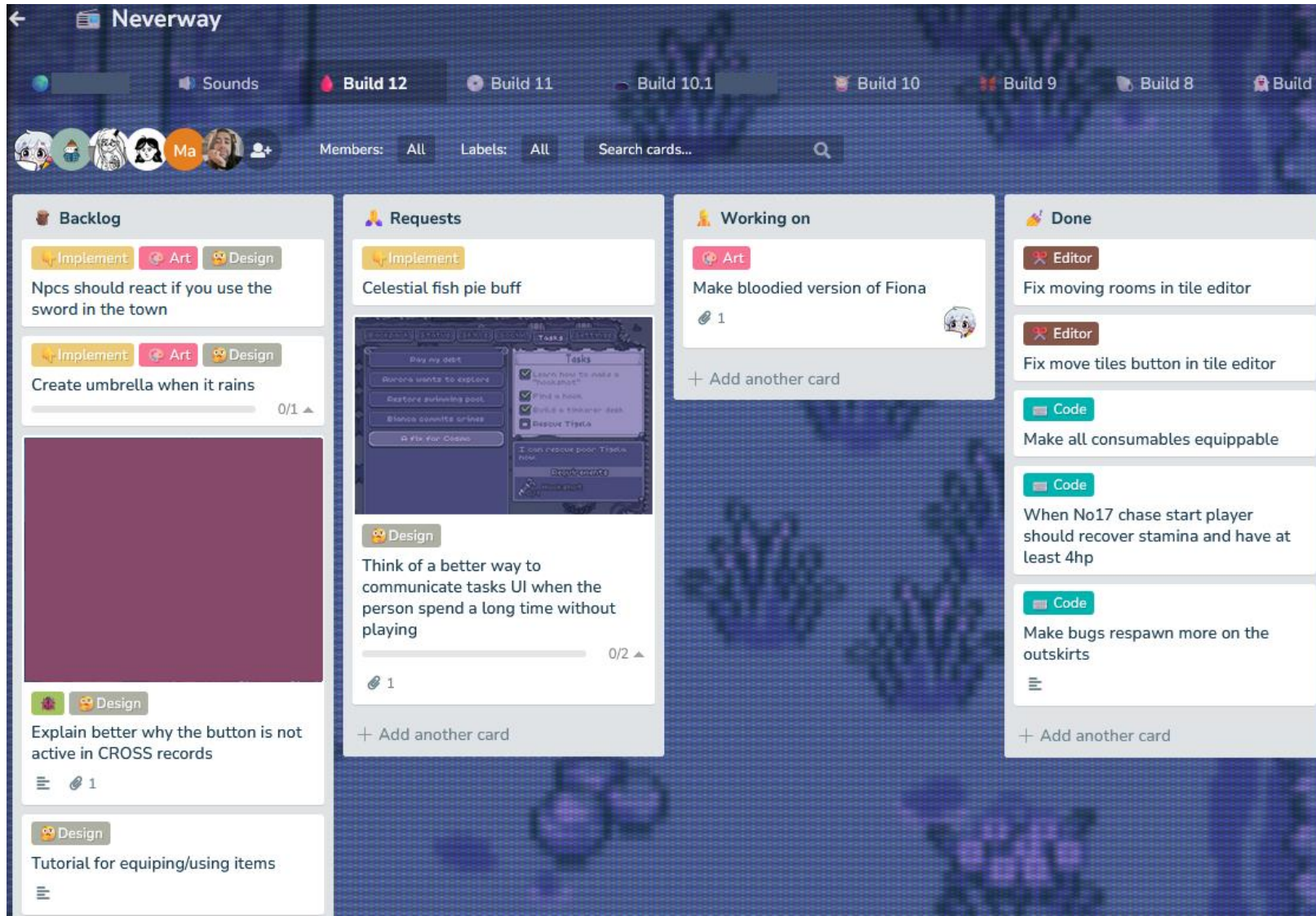
"that's hard" (bad)

"probably a month" (better)

15 days (actual work)

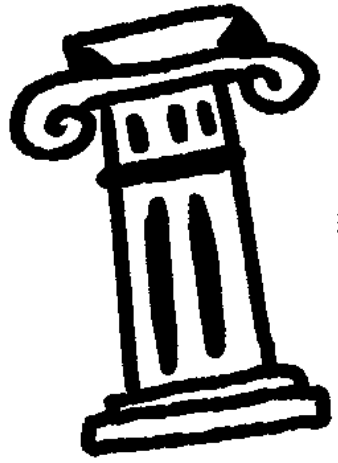
- + 1 week prototyping
- + 3 days implementing
- + 5 days fixing edge cases I missed
- + maybe add some weeks fixing edge cases here and there while working on the game again

- 🦋 keep a balance between planning vs. just doing stuff
- we have a backlog of tasks and “shop around” every cycle



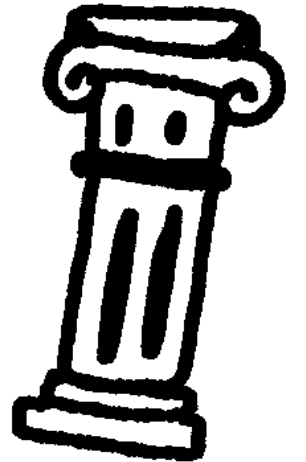
but how do you know if you're on the right path?



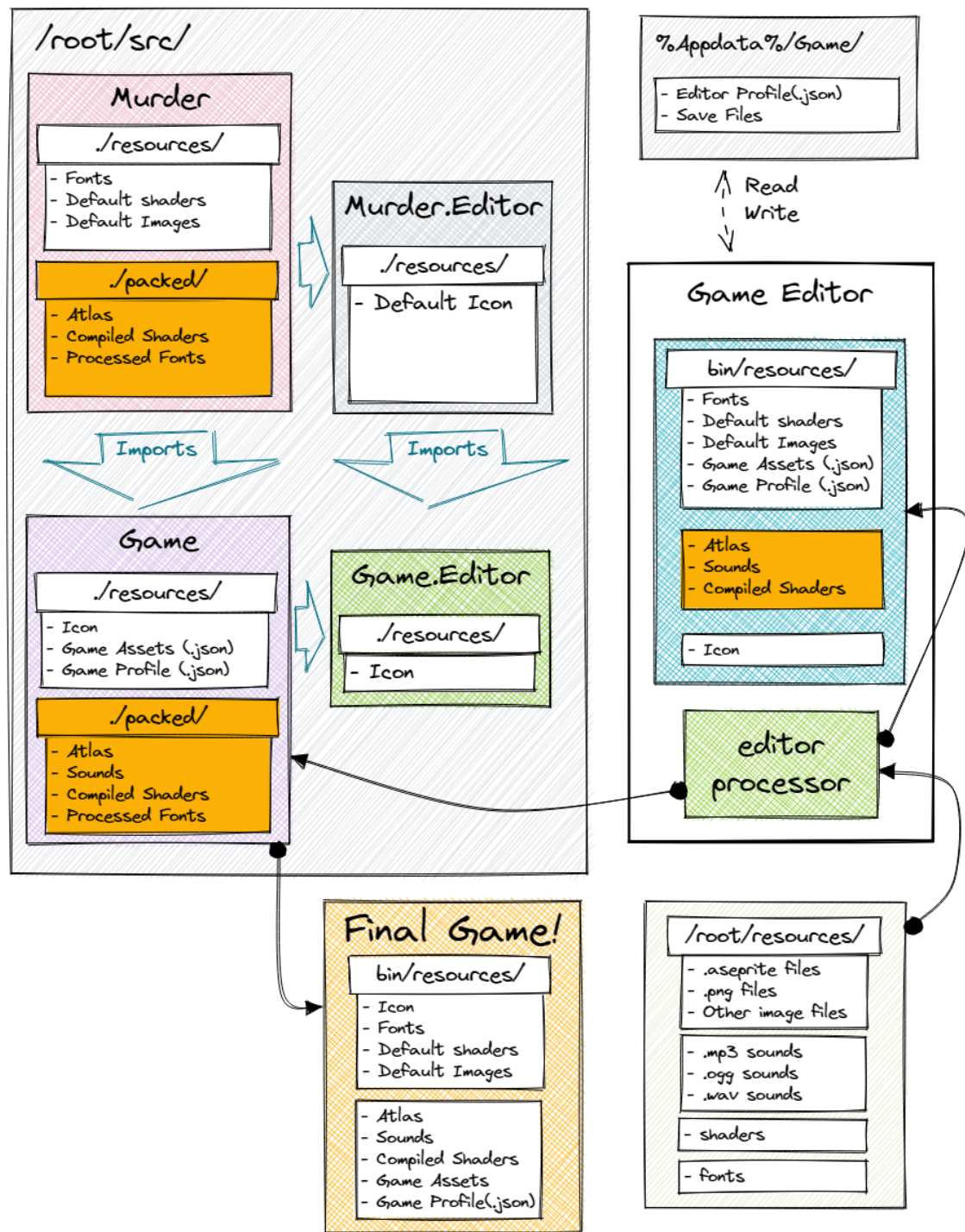


PILLARS

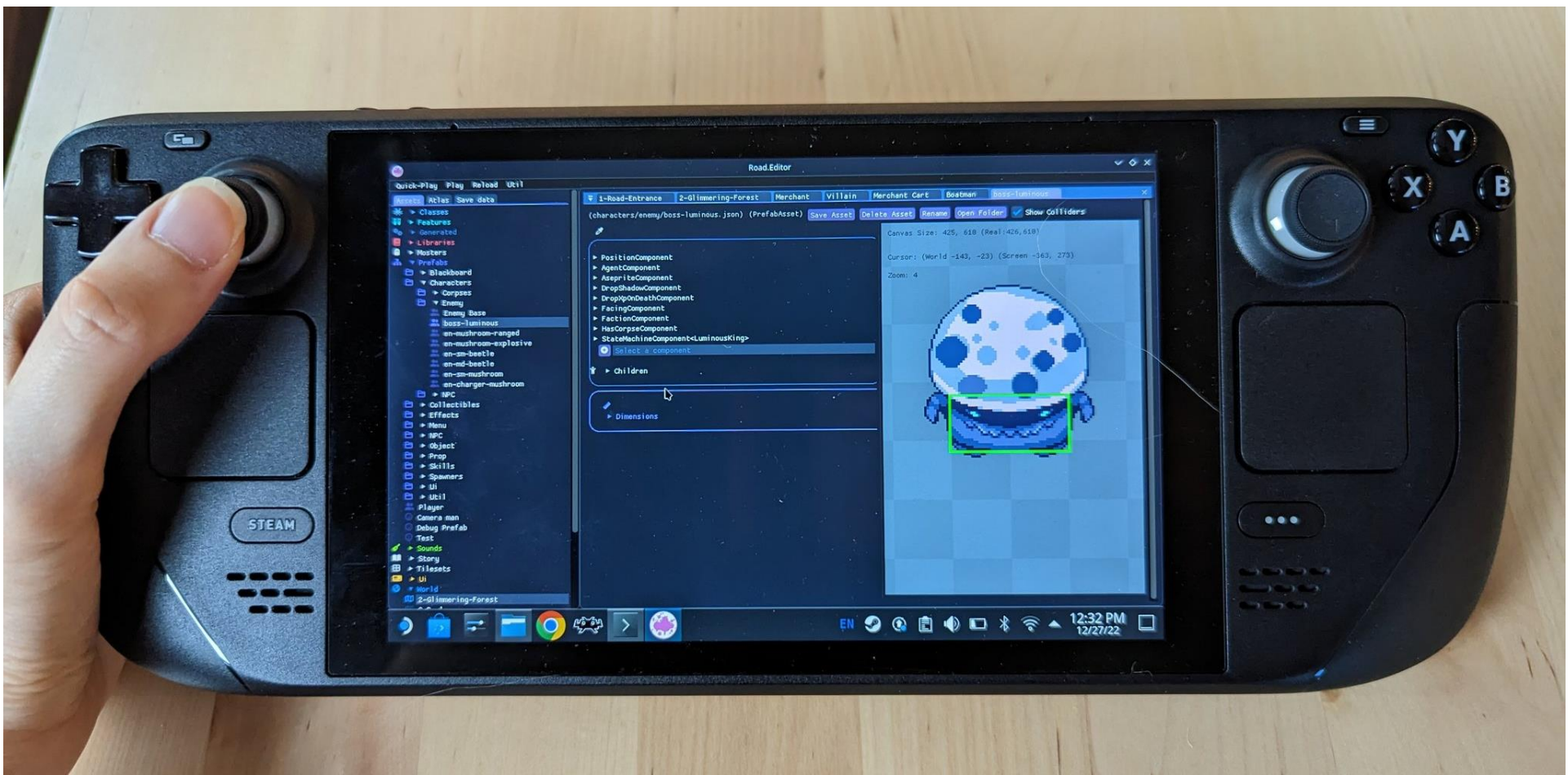
- ★ "one click setup" regardless of OS or device
- ★ programming first with full control of how projects are built
- ★ prioritize our team's strengths



examples



examples



3 Never crash



DOOM  
@DOOM



you control the buttons you press

2:24 PM · Oct 24, 2019

 64

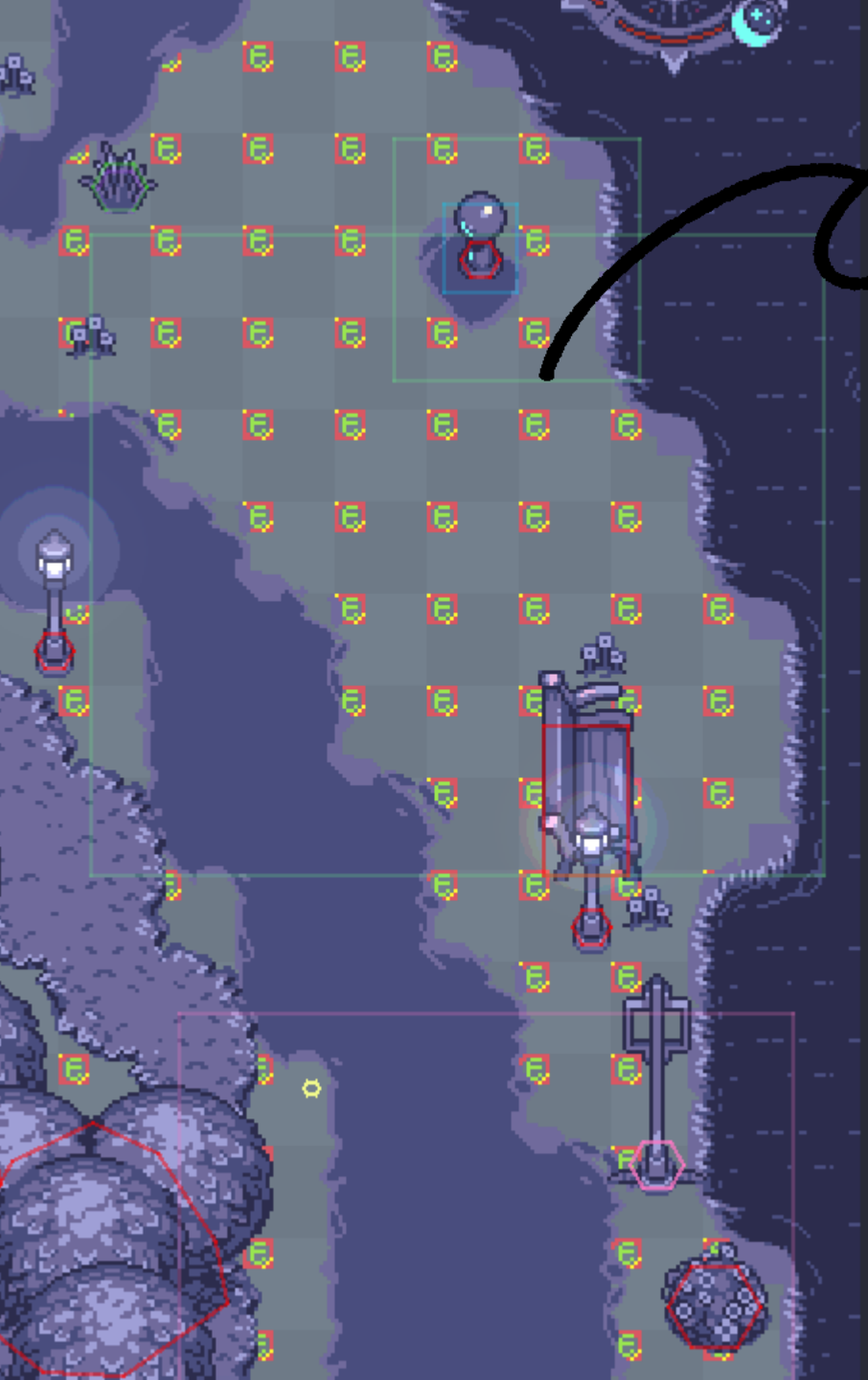
 1.3K

 7.1K

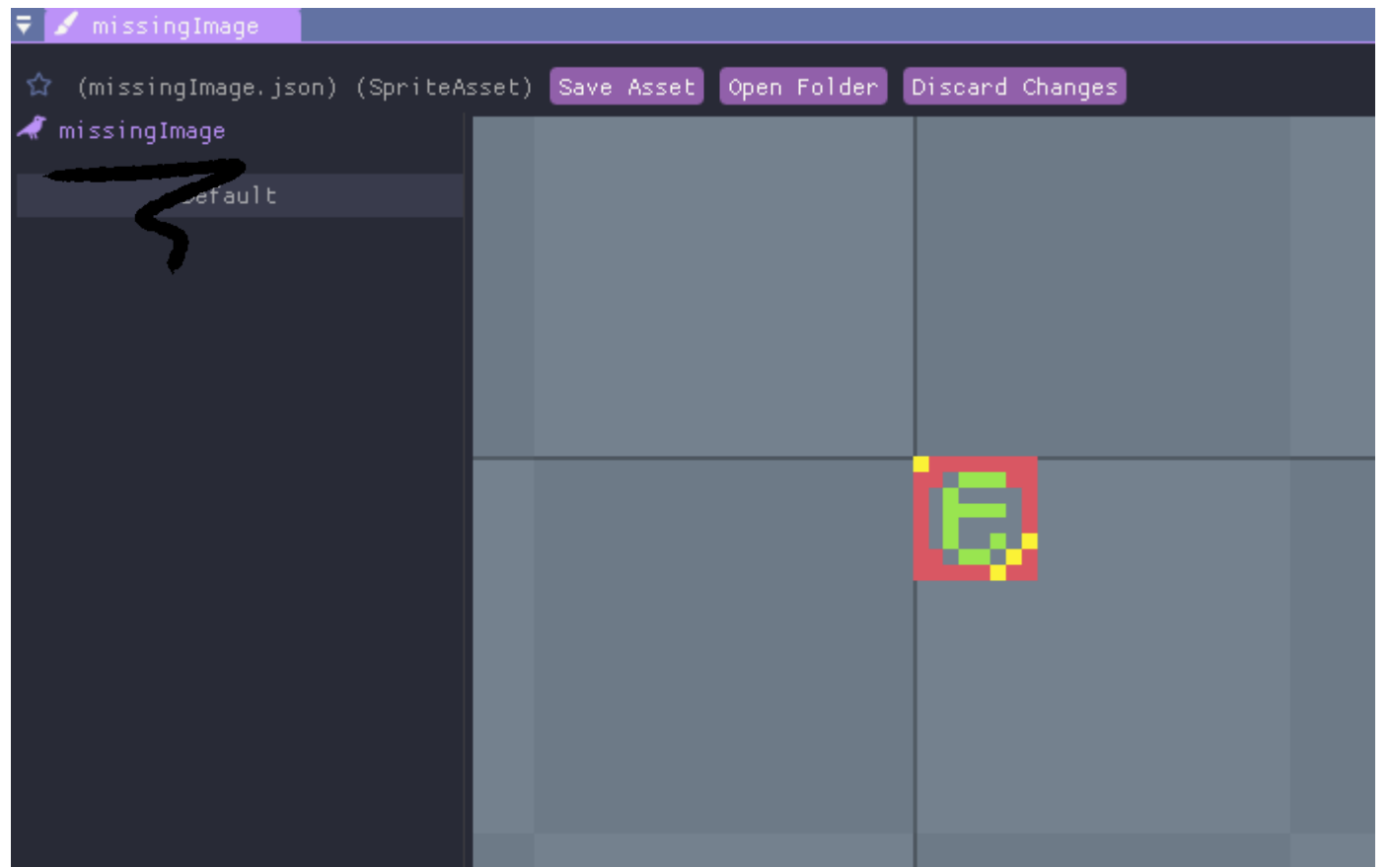
 675



make. it. deterministic.



examples



examples

★ logs!!!

```
[22:36:13] ⏪ Starting 'Loading Scene Content'
```

```
[22:36:13] PostProcessEntities (line 247): Tried to reference an entity with guid '814d6e96-f079-4a71-8b40-9eb35f1e7a95' that is not available in world.
```

```
[22:36:13] ⏪ Completed 'Loading Scene Content' in 0.101 s.
```

```
[22:36:13] Updating player passives.
```

```
[22:36:13] Loaded texture [Color] (1203x1203) > fonts/beaver
```

```
[22:36:26] Arrive (line 64): Unable to find Train target.
```

```
help
```

examples

★ Debug.Assert

```
internal bool Tick(float dt)
{
    Debug.Assert(World is not null && Entity is not null, "Why are we ticking before starting first?");
}
```

99+ references

```
public static void Warning(string msg,
    [CallerMemberName] string memberName = "",
    [CallerLineNumber] int lineNumber = 0) => GetOrCreateInstance().LogWarningImpl(msg, memberName, lineNumber);
```

99+ references

```
public static void Error(
    string msg,
    [CallerMemberName] string memberName = "",
    [CallerLineNumber] int lineNumber = 0) => GetOrCreateInstance().LogErrorImpl(msg, memberName, lineNumber);
```

(👁️) treat for C# devs)

examples

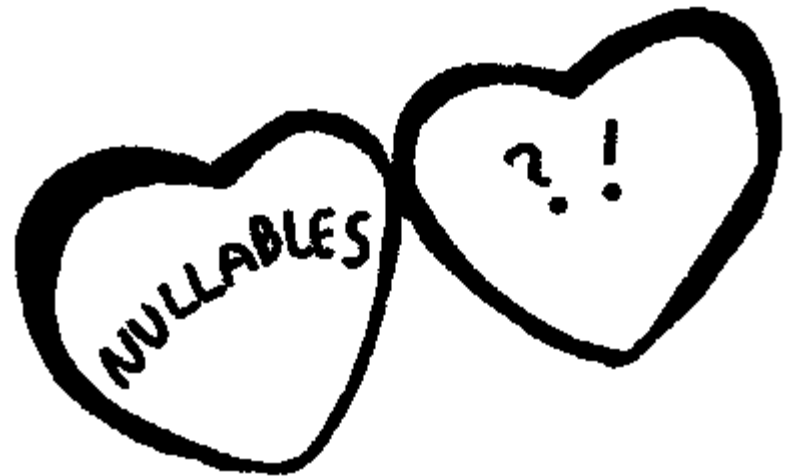
★ compile-time warnings

```
} _sceneLoader.LoadContent();
```

(field) `SceneLoader?` `Game._sceneLoader`
Initialized in `Game.LoadContent()`.
`'_sceneLoader'` may be null here.
[CS8602](#): Dereference of a possibly null reference.



```
} _sceneLoader?.LoadContent();
```



examples

★ leverage your **own** diagnostic analysis tools

0 references

```
internal class FrictionSystem : IFixedUpdateSystem
```

```
{
```

2 references

```
public void FixedUpdate(Context context)
```

```
{
```

```
    foreach (var e in context.Entities)
```

```
    {
```

```
        var velocity = e.GetVelocity();
```

```
        var friction = e.GetFriction();
```

```
    }
```

```
        e.ReplaceComponent(new VelocityComponent(velocity.Velocity * (1 - friction.Amount)));
```

```
    }
```

```
}
```

examples

- support sending diagnostic data to our server
- REALLY helpful for cross platform

status:open

Reported 3 (3) **Under consideration** 3 (3)

Item ID	Assignee	Title	Due Date	Priority
#195	Pedro Medeiros	Kiwolh: Khaluah	4d 4d	P0
#196	Pedro Medeiros	Kiwolh: Khaluah	4d 4d	P0
#197	Pedro Medeiros	Hajith: Calibre	3d 3d	P0
#194	Pedro Medeiros	Aurora didn't invite to party	5d 5d	P0
#198	Pedro Medeiros	Aurora problems	2d 2d	P0
#199	Pedro Medeiros	Bianca inside your home	2d 2d	P0

Source: [kanboard](#)

4 Make it delightful

FUN

★ you're spending all your time here, make it enjoyable





ASSETS

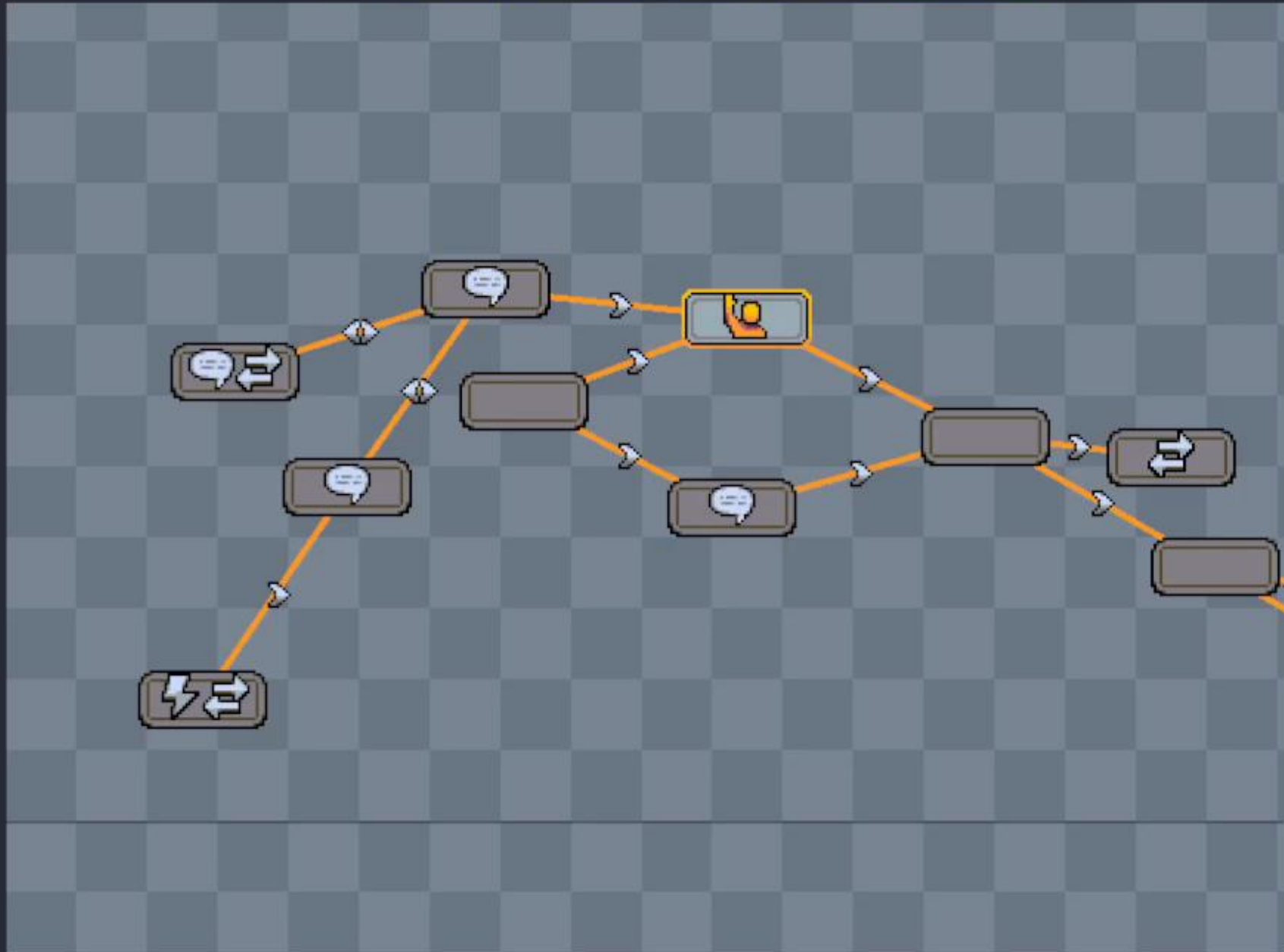
Search...



- ▶ Buffs
- ▶ Chest
- ▶ Features
- ▶ Fonts
- ▶ Game Modes
- ▶ Generated
- ▶ Global Events
- ▶ Libraries
- ▶ Localization
- ▶ Map
- ▶ Masters
- ▶ Npcs
- ▶ Particles
- ▶ Prefabs
- ▶ Skills
- ▶ World
- Editor Settings
- Game Profile
- Create new...

Getting everything ready...





Owner:

Portrait:

- Encounter
- OfferCard
- NoThanks
- YesThanks
- BoughtCard
- Chitchat

[No lines]



(World_Test.json)* (WorldAsset) Save Asset Delete Asset Rename Open Folder Discard Changes Show Colliders Show Grid Show Reflection Reset Camera Show Camera Bounds

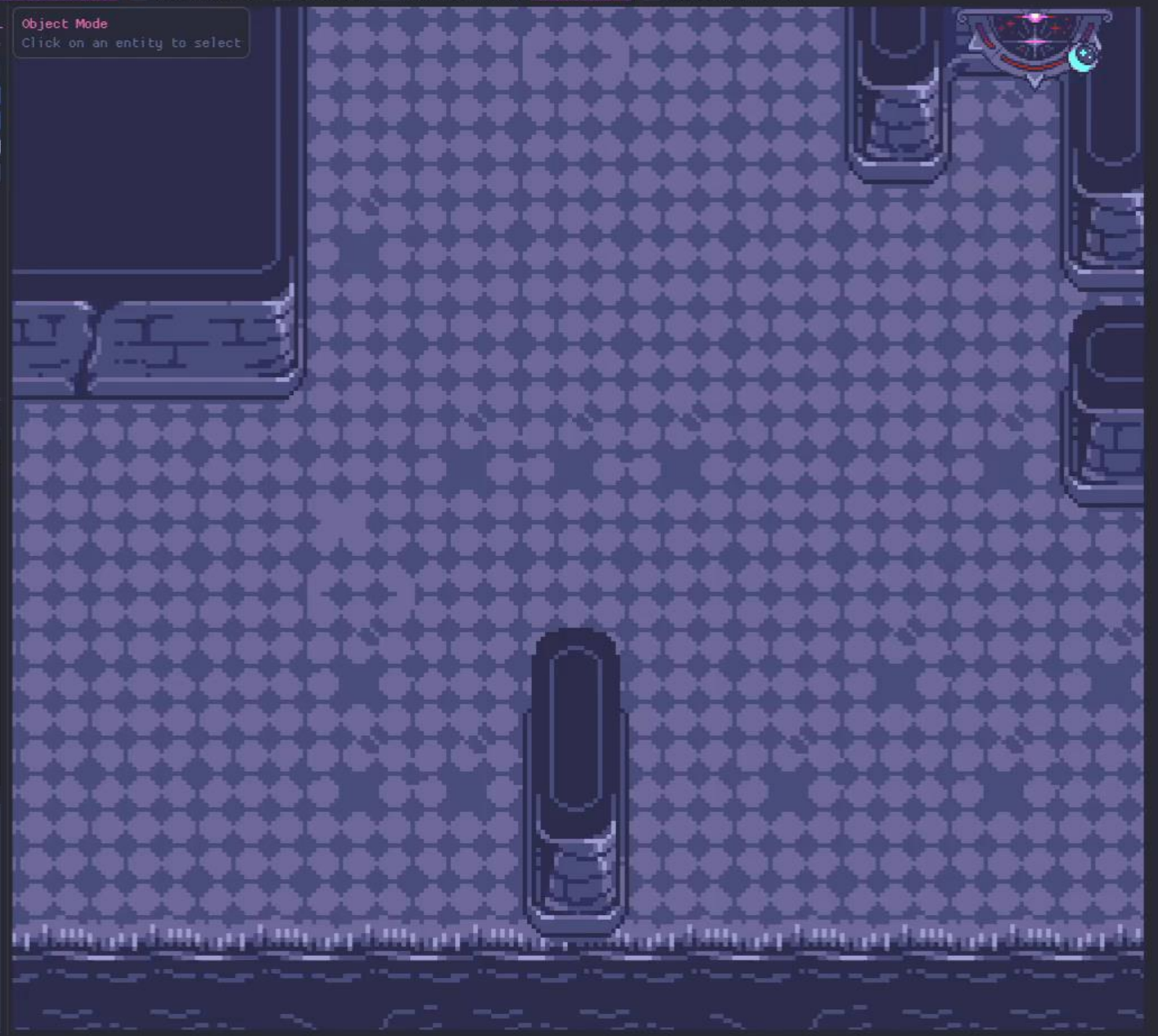
World Systems Tiles Pathfind Story Sounds Settings

- Rooms
- Search...
 - Empty (1)
 - Sounds (8)
 - Room (4)
- Other Entities
- Camera man
 - Tileset
 - Pathfind Grid Entity

Prefab Palette



Object Mode
Click on an entity to select



(props\metro_door.json) (SpriteAsset) Save Asset Open Folder Discard Changes

- props\metro_door
- close
- closed
- open
- opened



Timeline for "open" | 1 event | current frame: 3 (0.40s) | 2.2s

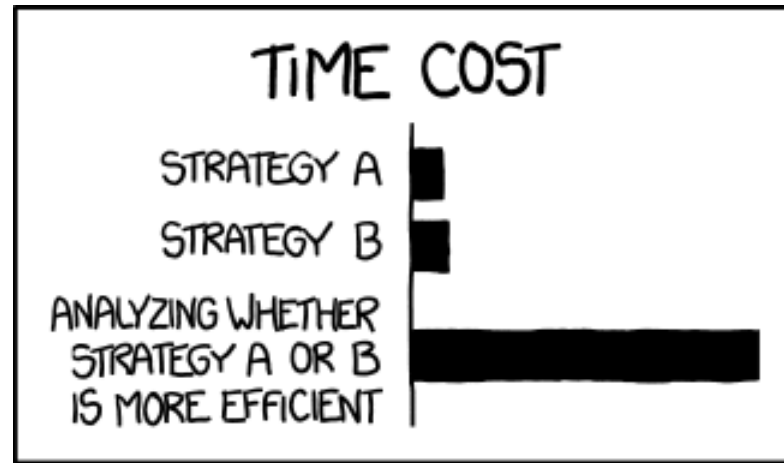
Messages
13 open_passage Add sound to test

Show Murder Engine is not focused.



5 *Only do it once it's
a bottleneck*

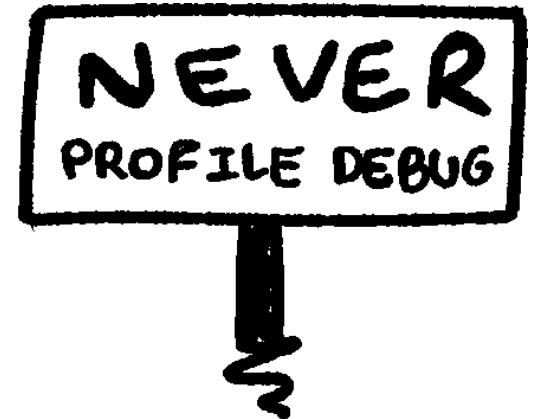
★ do not overthink performance. use a profiler! the fix is almost always very boring!



THE REASON I AM SO INEFFICIENT

Source: [xkcd](#)

BTW

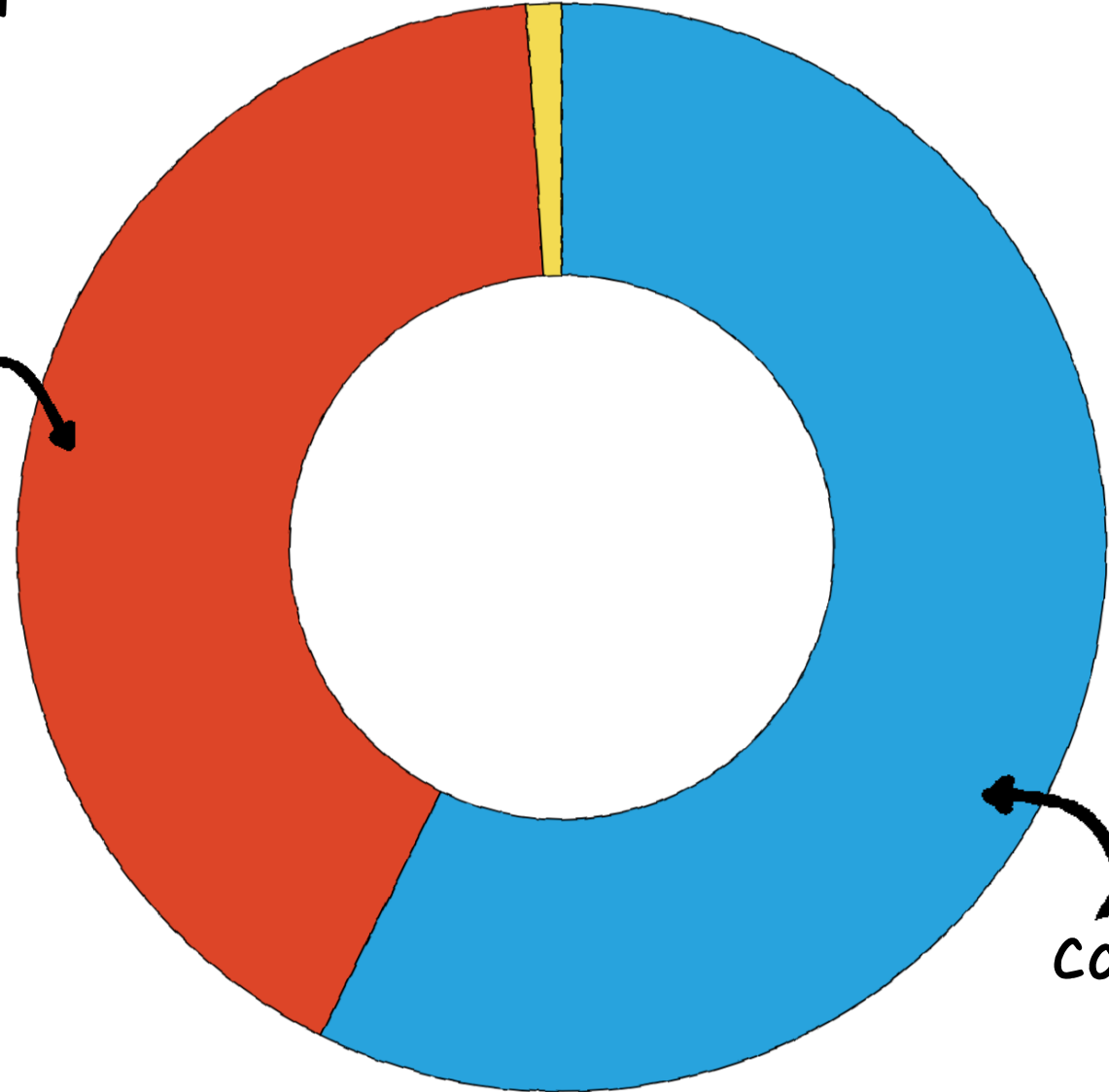


time spent fixing perf

refactor the entire thing



can we just not call that?



cache

examples

★ Perfview!!!!

Collecting data over a user specified interval

This dialog give displays options for collecting ETW profile data. The only required field the 'Command' field and this is only necessary when using the 'Run' command.

If you wish to analyze on another machine use the Zip option when collecting data. See [Collecting ETW Profile Data](#), for more.

Focus process:

Data File: ...

Current Dir:

Zip: Circular MB: Merge: Thread Time: Mark Text: Mark

Status:

Advanced Options

Name <input <="" th="" type="button" value="?"/> <th>Inc % <input <="" th="" type="button" value="?"/> <th>Inc <input <="" th="" type="button" value="?"/> <th>Inc Ct <input <="" th="" type="button" value="?"/> </th></th></th>	Inc % <input <="" th="" type="button" value="?"/> <th>Inc <input <="" th="" type="button" value="?"/> <th>Inc Ct <input <="" th="" type="button" value="?"/> </th></th>	Inc <input <="" th="" type="button" value="?"/> <th>Inc Ct <input <="" th="" type="button" value="?"/> </th>	Inc Ct <input <="" th="" type="button" value="?"/>
<input checked="" type="checkbox"/> ROOT	100.0	339,781.6	90,246
+ <input checked="" type="checkbox"/> Process64 Road.Editor (48700) Args:	100.0	339,781.6	90,246
+ <input checked="" type="checkbox"/> (Non-Activities)	100.0	339,781.6	90,246
+ <input checked="" type="checkbox"/> Threads	100.0	339,781.6	90,246
+ <input checked="" type="checkbox"/> Thread (11004) CPU=5078ms	1.9	6,491.1	19,777
+ <input checked="" type="checkbox"/> ntdll!	1.6	5,538.2	16,371
+ <input checked="" type="checkbox"/> kernel32!	1.6	5,538.2	16,371
+ <input checked="" type="checkbox"/> road.editor!	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> hostfxr!	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> hostpolicy!	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> coreclr!	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> Road.Editor!Road.Editor.Program.Main()	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> FNA!Microsoft.Xna.Framework.Game.Run()	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> FNA!Microsoft.Xna.Framework.Game.RunLoop()	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> FNA!Microsoft.Xna.Framework.Game.Tick()	1.6	5,538.2	16,369
+ <input checked="" type="checkbox"/> Murder.Editor!Murder.Editor.Architect.Update(class Microsoft.Xna.Framework.GameTime)	0.8	2,805.1	9,393
+ <input checked="" type="checkbox"/> Murder!Murder.Game.Update(class Microsoft.Xna.Framework.GameTime)	0.5	1,653.9	3,723
+ <input checked="" type="checkbox"/> Murder!Murder.Game.UpdateImpl(class Microsoft.Xna.Framework.GameTime)	0.5	1,653.9	3,722
+ <input checked="" type="checkbox"/> Murder!Murder.Game.UpdateInputAndScene()	0.4	1,522.1	3,569
+ <input checked="" type="checkbox"/> Murder!Murder.Core.Scene.Update()	0.4	1,428.7	3,092
+ <input checked="" type="checkbox"/> Murder!Murder.Core.Scene.Start()	0.3	1,154.1	2,612
+ <input checked="" type="checkbox"/> Bang!Bang.World.Start()	0.3	1,149.0	2,595
+ <input checked="" type="checkbox"/> Bang!Bang.World.NotifyReactiveSystems()	0.3	903.8	2,166
+ <input checked="" type="checkbox"/> Murder!Murder.Systems.Physics.TriggerPhysicsSystem.OnAdded(class Bang.World,value class System.Collections.Immutable.ImmutableArray`1<class Bang.Entities.Entity>)	0.2	529.3	1,449
+ <input checked="" type="checkbox"/> Murder!Murder.Systems.Physics.TriggerPhysicsSystem.CheckCollisions(class Bang.World,value class System.Collections.Immutable.ImmutableArray`1<class Bang.Entities.Entity>)	0.2	528.3	1,448
+ <input checked="" type="checkbox"/> Murder!Murder.Services.PhysicsServices.CollidesWith(class Bang.Entities.Entity,class Bang.Entities.Entity)	0.1	432.4	1,256
+ <input checked="" type="checkbox"/> Murder!Murder.Services.PhysicsServices.CollidesWith(class Murder.Core.Geometry.IShape,value class Murder.Core.Geometry.Point,class Murder.Core.Geometry.IShape,valu	0.1	302.5	856

▼ Systems Input 2D Batches

Update (1.81)	Name	Time (ms Peak)	(ms Entities)
FixedUpdate (2.37)	✓ DemoVersionAndFpsSystem	0.00	0.01 0
Reactive (2.61)	✓ SpriteFlashCleanupSystem	0.00	0.00 0
Pre-Render (2.25)	✓ IgnoreUntilSystem	0.00	0.00 0
Render (8.05)	✓ RoadDestroyAtTimeSystem	0.00	0.00 0
GuiRender (0.44)	✓ AttackedByCleanupSystem	0.00	0.00 0
Startup (200.51)	✓ IgnoreTriggerUntilSystem	0.00	0.00 0
	✓ FullscreenShortcutListener	0.00	0.00 0
	✓ PlaytimeTrackerSystem	0.00	0.01 0
	✓ TweenSystem	0.00	0.01 0
	✓ DestroyAtTimeSystem	0.00	0.00 0
	✓ PlayerInputSystem	0.03	0.17 1
	✓ PlayerHealthSystem	0.00	0.01 1
	✓ PlayerEquipChangeBufferSystem	0.00	0.00 0
	✓ AgentMoverSystem	0.03	0.06 4
	✓ AnimationOnPauseSystem	0.00	0.00 0
	✓ SpawnerSystem	0.00	0.00 0
	✓ InvulnerabilitySystem	0.00	0.00 0
	✓ SpawnBurstSystem	0.00	0.00 0
	✓ ShovelSystem	0.01	0.02 1
	✓ DestroyOnLightSystem	0.00	0.00 0
	StateMachineOnPauseSystem	0.00	0.00 0
	✓ RoadStateMachineSystem	0.05	0.12 34
	✓ RoadAgentStateMachineSystem	0.01	0.53 7
	✓ DialogueUiSystem	0.00	0.00 0
	✓ ChoiceUiSystem	0.00	0.00 0
	✓ HudSwordDialogueSystem	0.00	0.00 3042
	✓ InventorySelectorSystem	0.01	0.02 1
	SkipCutsceneSystem	0.00	0.00 0
	✓ ParticleRendererSystem	0.05	0.41 1

(1513)
(1675)
(2693)



▼ Insights

Overview Settings Details

— Performance

FPS: 89

Update: 00.00 (00.00)

Render: 00.00 (00.00)

Entities: 2949

— Window Scale

1x 2x 3x 4x

— Time

Time Scale

1.000 Reset

Not Paused

Now: 564.2

Now(Unscaled): 565.5



optimization also applies to your workflow!

- ★ differentiate “nice to have” and “must have”
- ★ as a rule, we only automate tools after hitting it at least 3 times
- ★ or whenever we notice we didn't add something cool to the game because it was too bureaucratic

examples

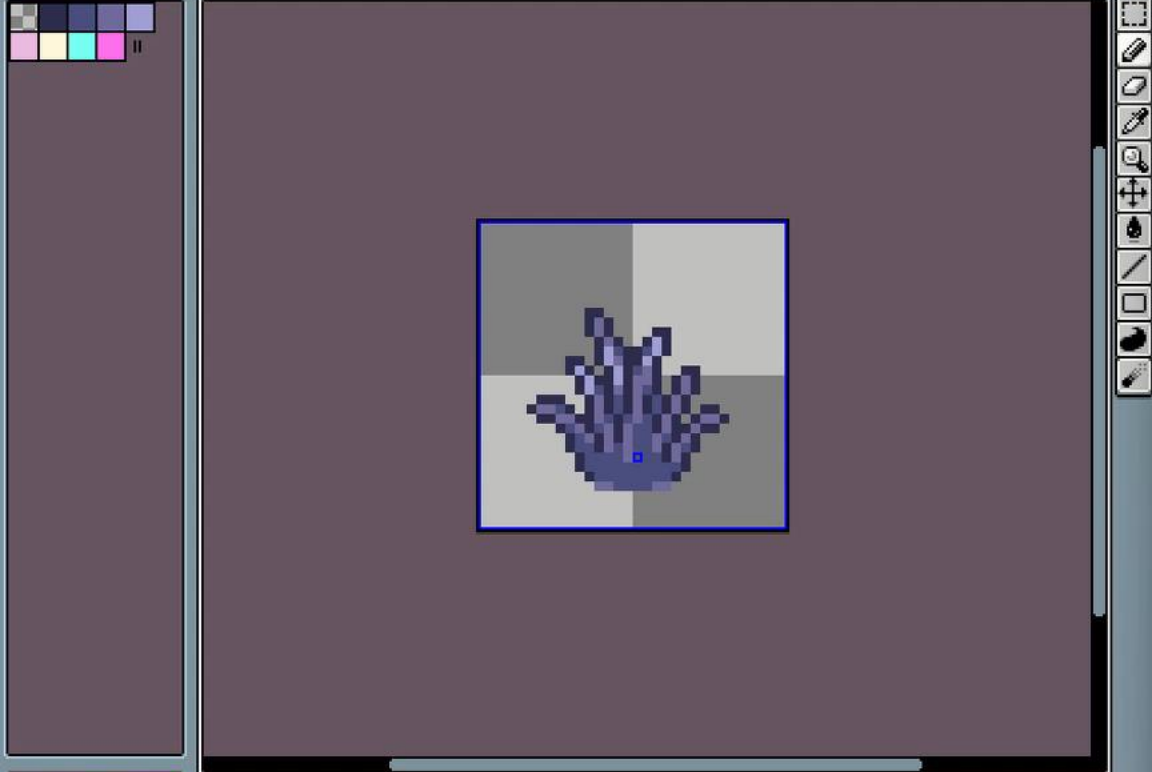
sprite hot reload

 BEFORE 

- must rebuild the whole game
- wait 2 minutes to see changes

  *now* 

- fast! Quick!
- can see right away how it looks in the game
- more time to try new ideas!



Timeline and animation controls:

Timeline: full, harvest, disturb, cut, emp

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Layer 2																						
Layer 1																						
Layer 3																						

Color picker: #000000

- Rooms
- Shipyard (176)
 - 8_fg_leaves (2)
 - roofs (2)
 - Room 6 (188)
 - Sea (5)
 - Cursed_Weapon (6)
 - Left expansion (41)
 - collision_blocks (1)
 - Room 4 (123)
 - Village (799)
 - Room 15 (36)

Prefab Palette

Filter...



examples

load saves by dropping zip files

 BEFORE 

- would procrastinate to debug repro

 
NOW 


- super quick repro
- fix a lot more bugs faster
- kinda fun

examples

ctrl-z

 BEFORE 

- had to discard changes in the whole file
- save a lot T_T

  now 

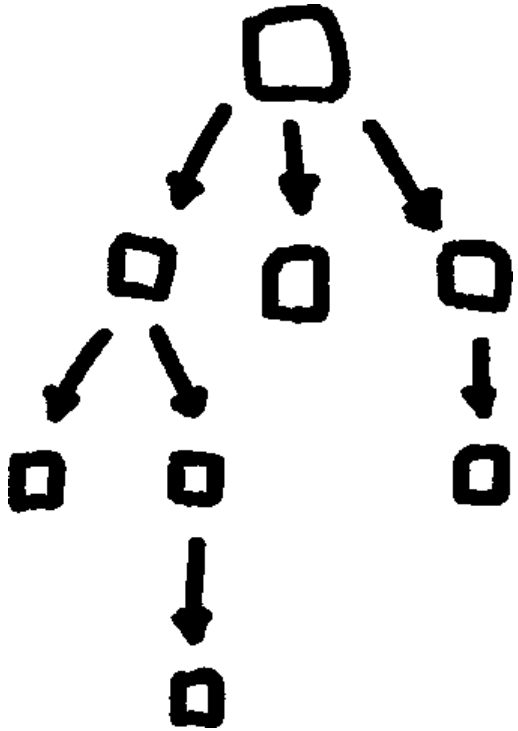
- can quickly iterate over undo operations
- be more creative when designing maps

(...it took me 2 years to implement this one)

6 *Scale horizontally*

what it means to scale horizontally

- ★ build modular code
- ★ usually takes longer to start, but helps you finish whatever you're doing

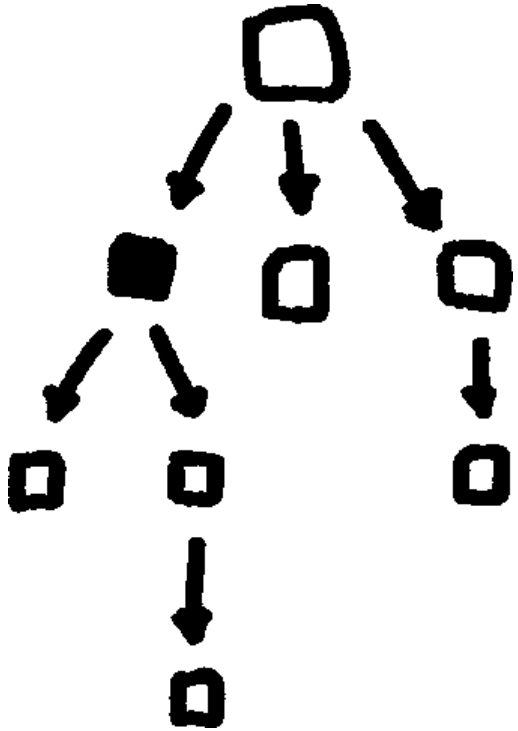


vs



what it means to scale horizontally

- ★ build modular code
- ★ usually takes longer to start, but helps you **finish** whatever you're doing

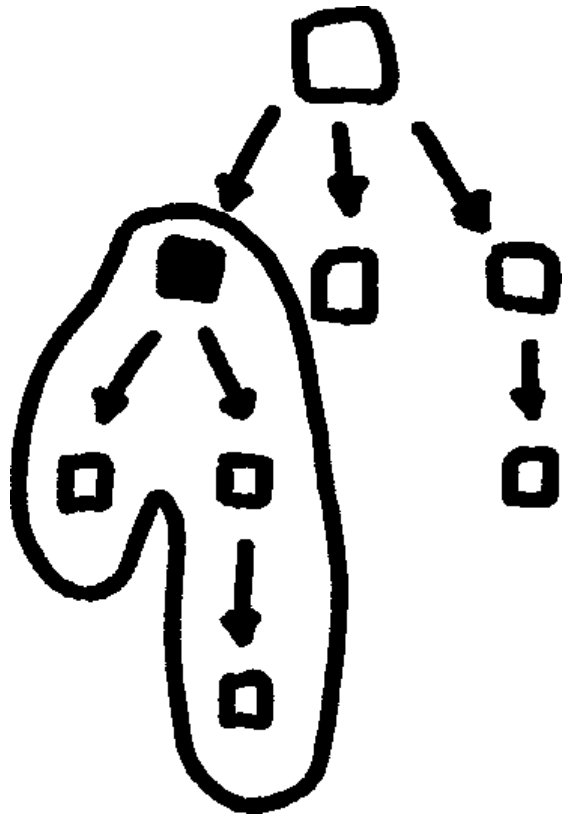


vs



what it means to scale horizontally

- ★ build modular code
- ★ usually takes longer to start, but helps you finish whatever you're doing



vs



★ generate code!

by **generating** code, you get a code that is...

★ Fast ★.

Clean

Safe

cheap

★ generate code!

examples

```
e.GetComponent<PositionComponent>();
```

vs

```
e.GetPosition();
```

examples

* source generation
for serialization!

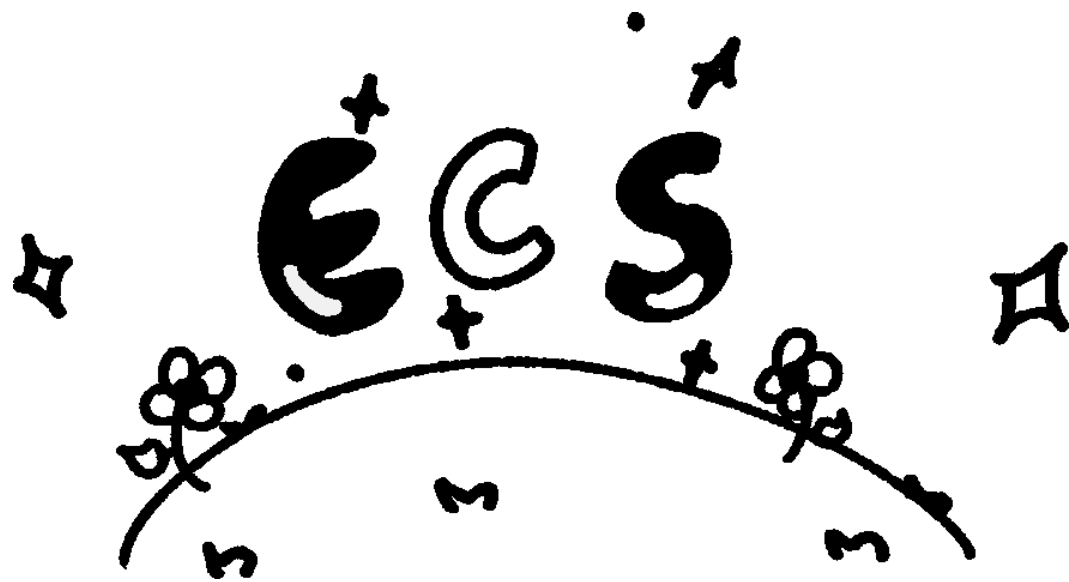
```
RoadSourceGe...s [generated] ↵ ×
This file was generated by 'Murder.Serializer.Generator' at 2024-09-11 3:55:47 PM and cannot be edited. [Rerun generator]
Murder.Serial

1 using System.Text.Json.Serialization;
2
3 namespace Murder.Serialization;
4
5 /// <summary>
6 /// Serialization context for all the types within Road. You may find
7 /// - Components
8 /// - State machines
9 /// - Interactions
10 /// - Game assets
11 ///
12 /// And any private fields that these types have.
13 /// </summary>
14 [JsonSerializable(typeof(Murder.Assets.GameAsset))]
15 [JsonSerializable(typeof(Bang.Components.IComponent))]
16 [JsonSerializable(typeof(Bang.Components.IMessage))]
17 [JsonSerializable(typeof(Bang.StateMachines.StateMachine))]
18 [JsonSerializable(typeof(Bang.StateMachines.IStateMachineComponent))]
19 [JsonSerializable(typeof(Bang.Interactions.IInteraction))]
20 [JsonSerializable(typeof(Bang.Interactions.IInteractiveComponent))]
21 [JsonSerializable(typeof(Road.Components.Agents.ActionComponent))]
22 [JsonSerializable(typeof(Road.Components.ActiveRoutineTrackerComponent))]
23 [JsonSerializable(typeof(Road.Components.AffectBuildingsComponent))]
24 [JsonSerializable(typeof(Road.Components.AiFollowerComponent))]
25 [JsonSerializable(typeof(Road.Components.AiMasterComponent))]
26 [JsonSerializable(typeof(Road.Components.AiRetreat))]
27 [JsonSerializable(typeof(Road.Components.AmbienceSoundInScreenComponent))]
28 [JsonSerializable(typeof(Road.Components.AnimatePlayerOnInteractionComponent))]
29 [JsonSerializable(typeof(Road.Components.Interactions.AnimationOverlaidComponent))]
```

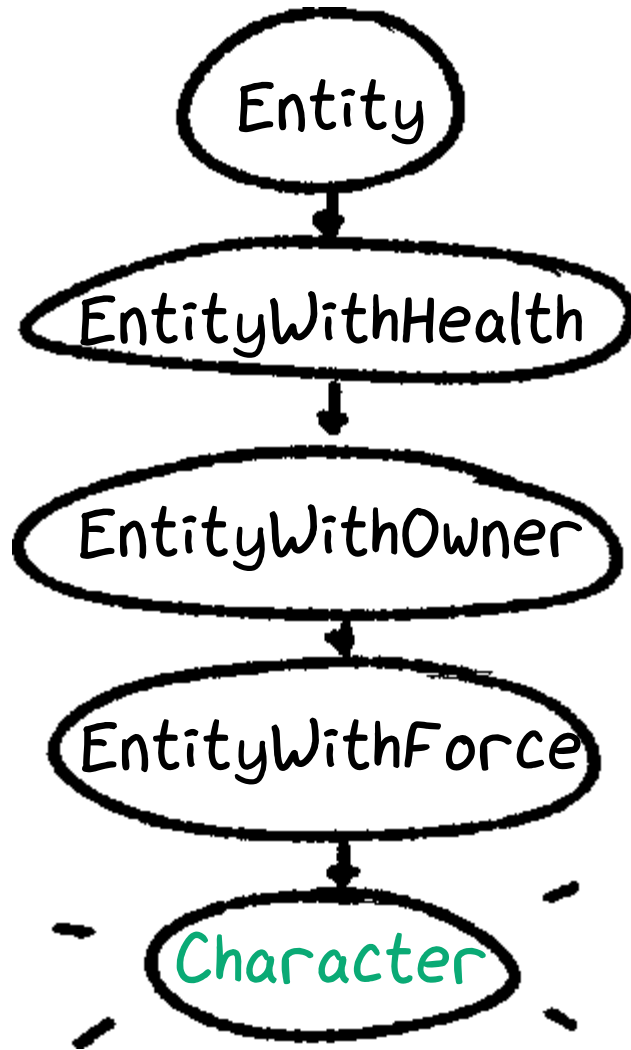
See [Adventures serializing absolutely everything in C#](#)



★ i'm biased

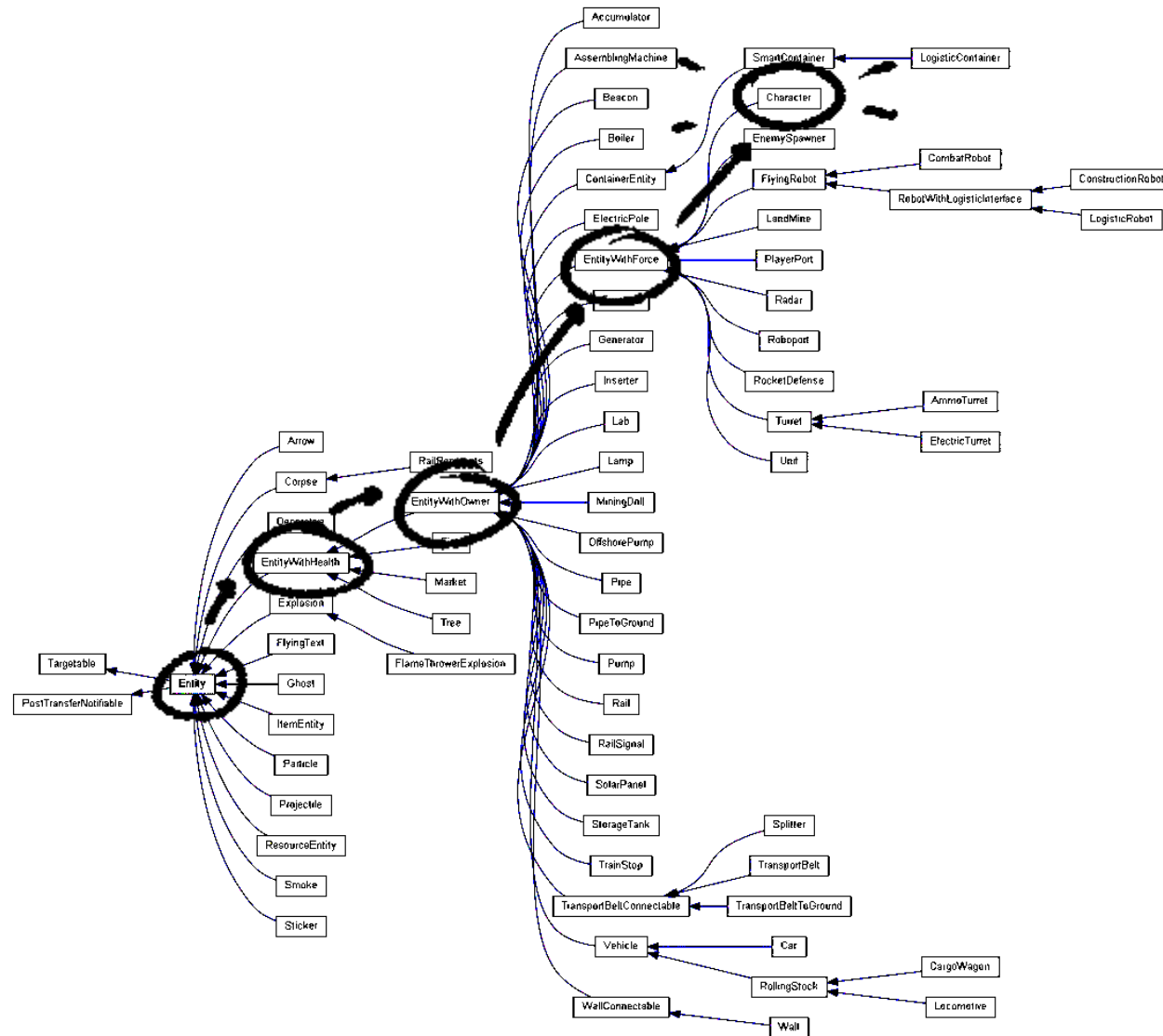


oop



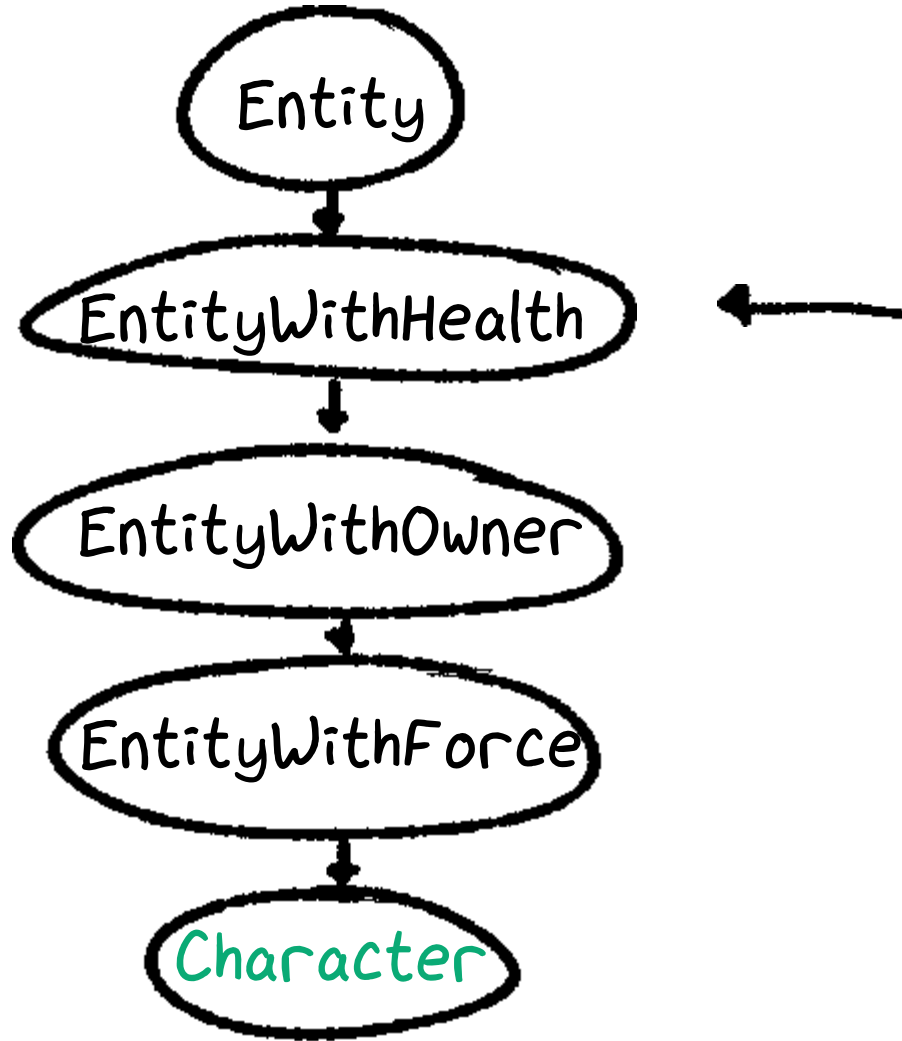
```
public class Character :  
    EntityWithForce  
{  
    private Sprite _sprite;  
    private Vector2 _position;  
  
    override void Update() { ... }  
    override void Draw() { ... }  
}
```

examples

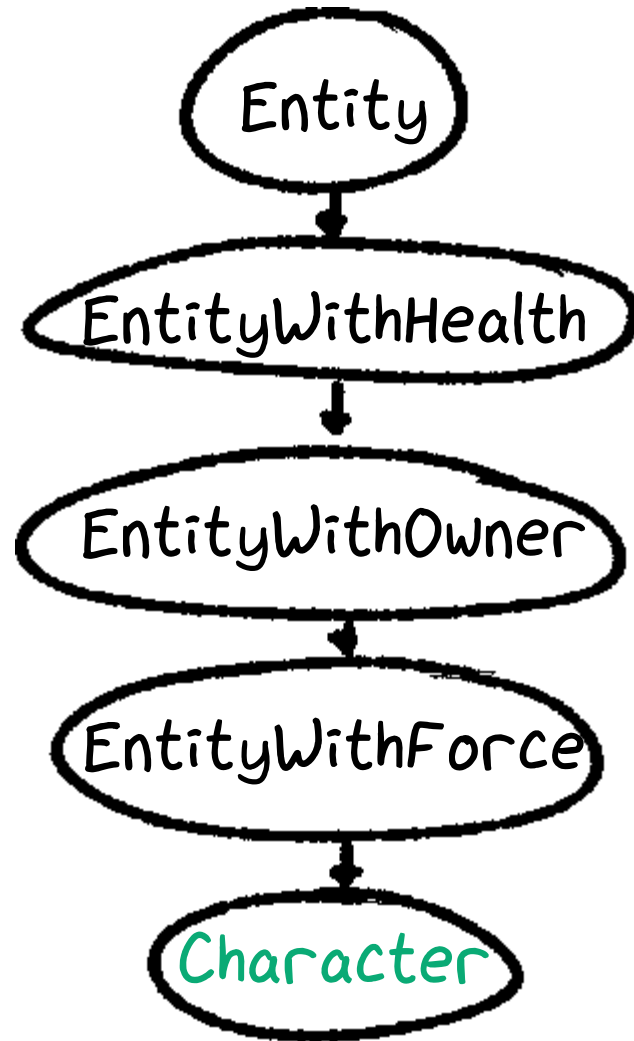


Source: [Factorio Friday Facts #18](#)

oop

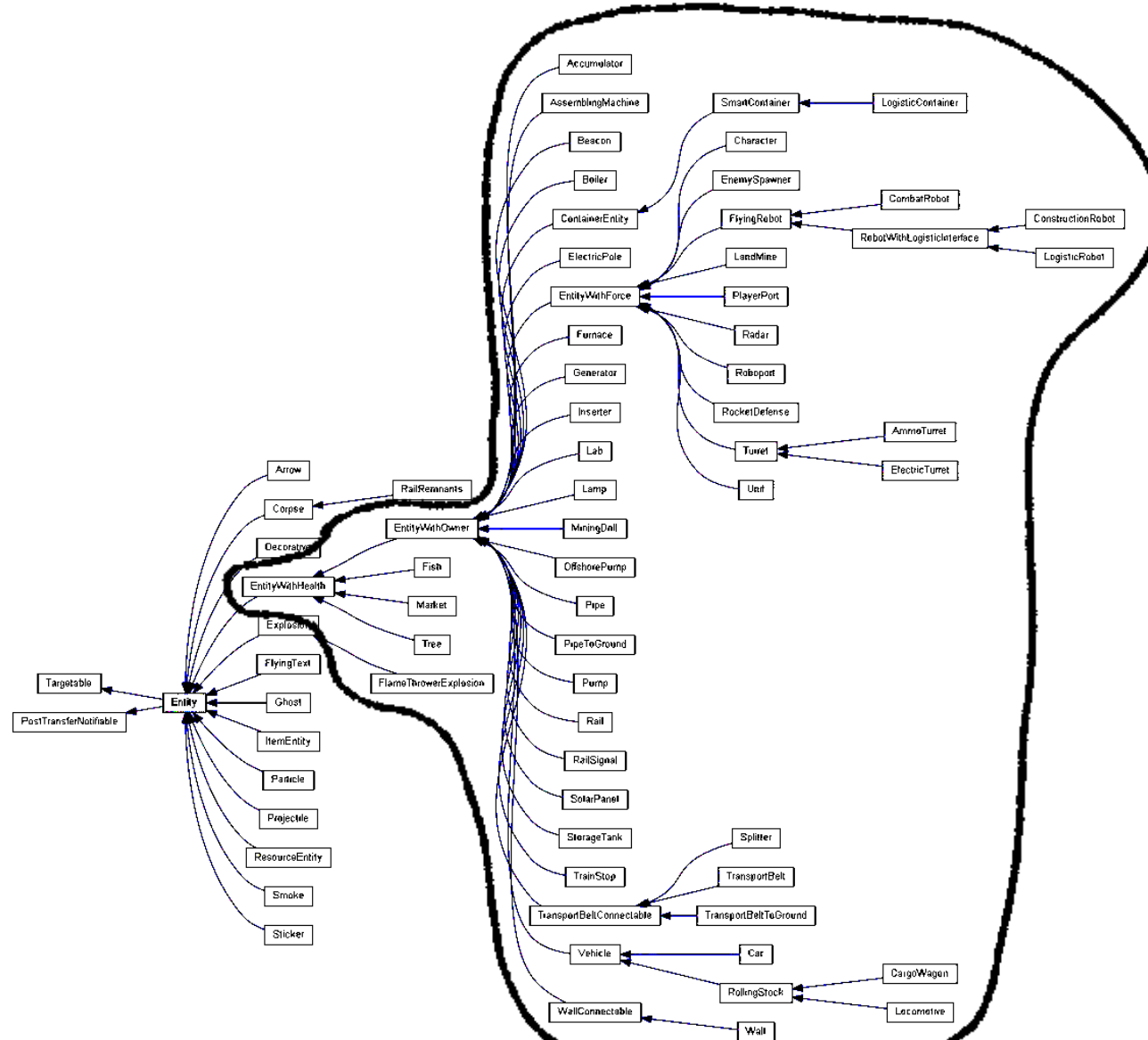


oop



} virtual void OnDamageReceived()

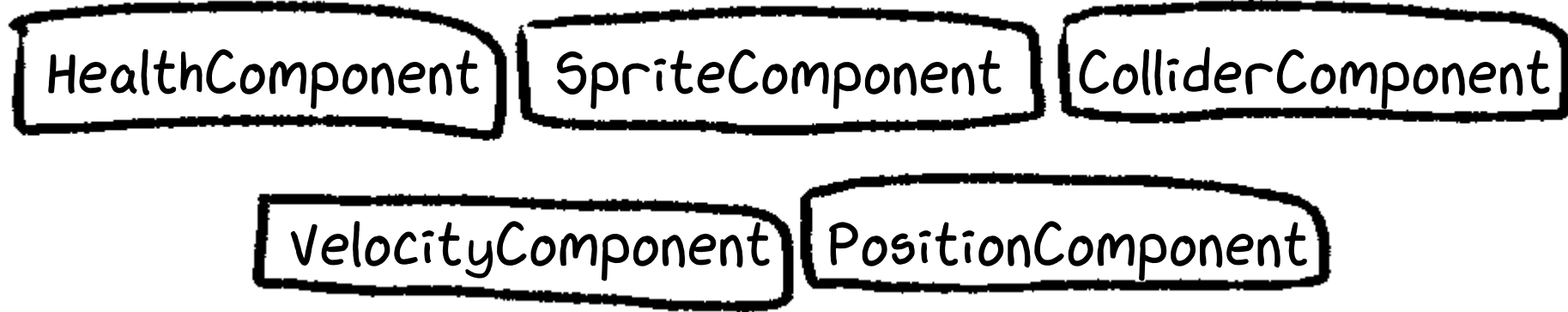
examples



Source: [Factorio Friday Facts #18](#)

ECS

Entity



```
public readonly struct PositionComponent  
{  
    public readonly Vector2 Vector;  
}
```

```
public readonly struct SpriteComponent  
{  
    public readonly Guid Sprite;  
    public readonly string Animation;  
}
```

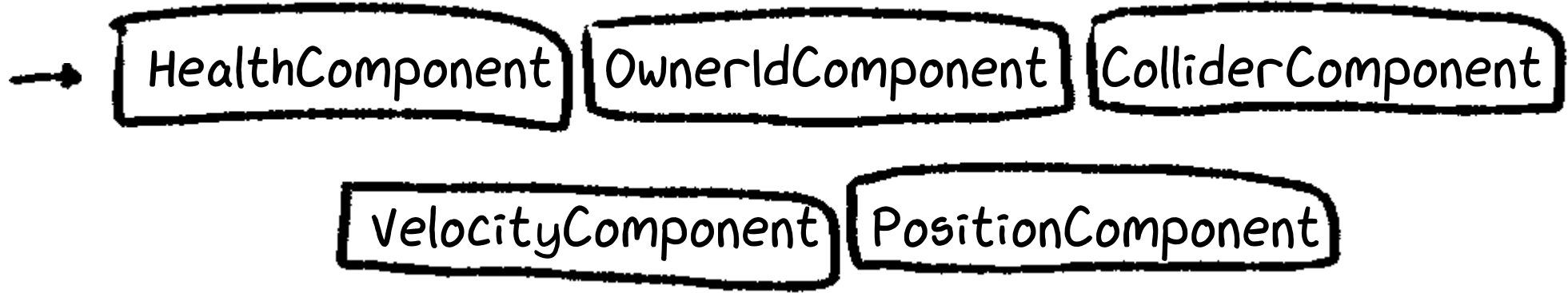
ECS

Entity

```
[Filter(typeof(PositionComponent), typeof(SpriteComponent))
public class RenderSprite : RenderSystem
{
    override void Draw(World world, Entity[] entities)
    {
        foreach (Entity e in entities)
        {
            Vector2 position = e.GetPosition().Vector;
            ...
        }
    }
}
```

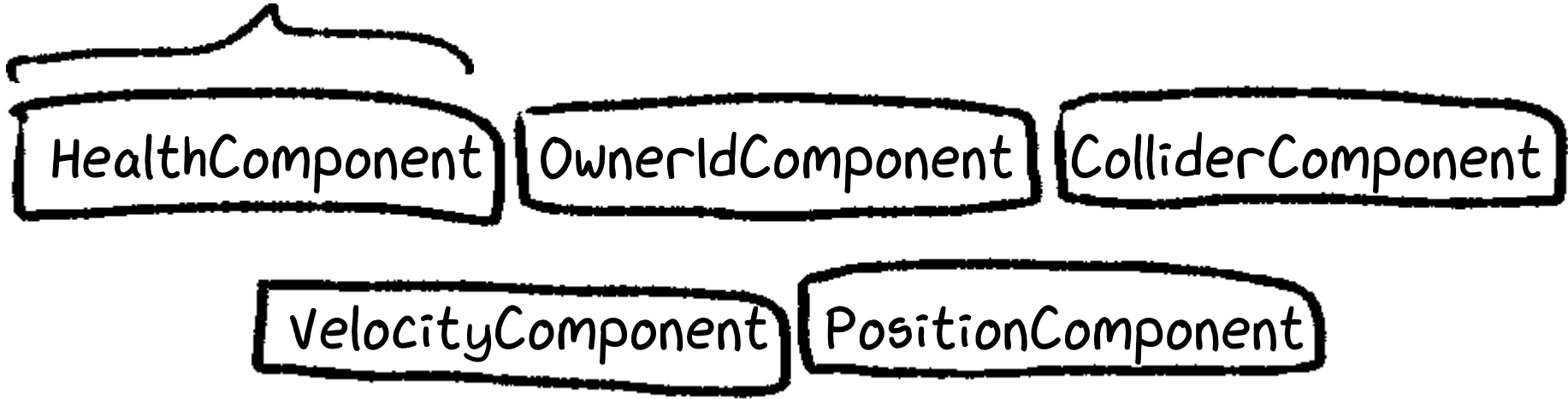
ECS

Entity



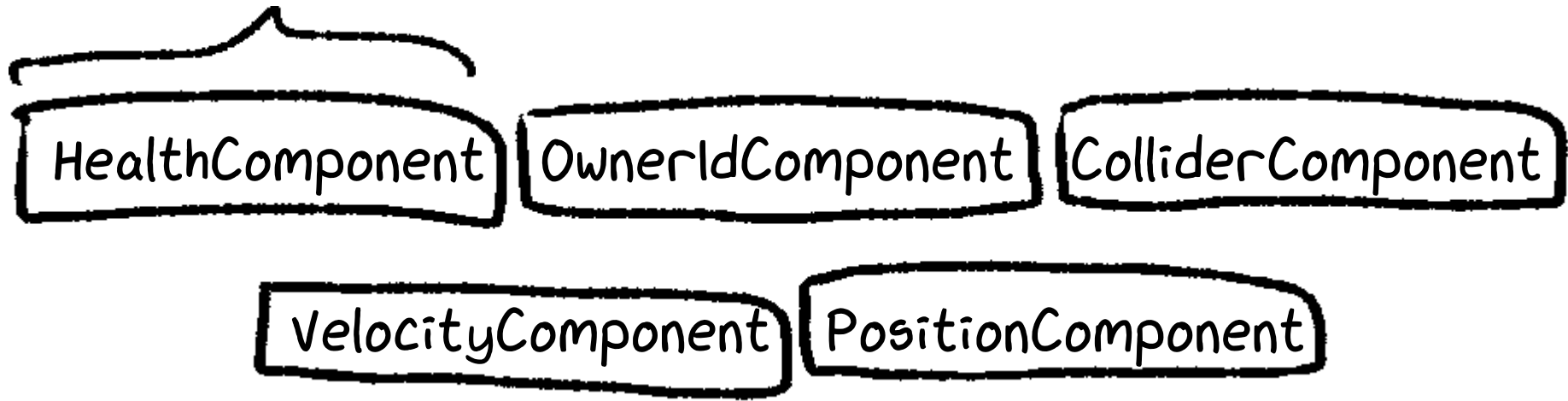
ECS

```
public readonly struct HealthComponent : IComponent
{
    public readonly int Health { get; init; }
    public readonly int MaxHealth { get; init; }
}
```



ECS

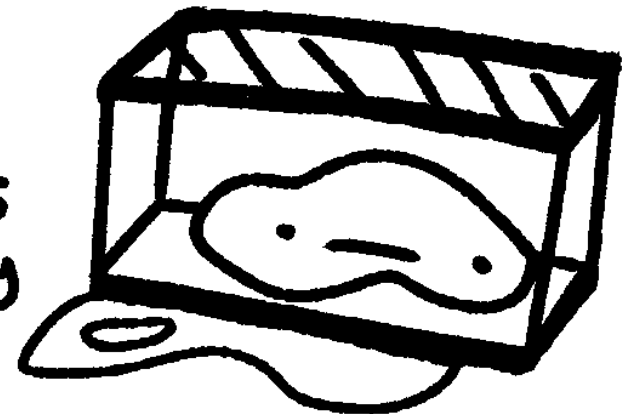
```
[Filter(typeof(HealthComponent))]  
public class DamageSystem : IMessengerSystem  
{  
    public void OnMessage(  
        World world,  
        Entity e,  
        DamageReceivedMessage message) { ... }  
}
```



- ★ all about flexibility: give yourself room to be creative
- ★ quarantine your weird code!



it leaks
memory



examples

CORE ENGINE: NEW DATA-ORIENTED GAME OBJECT MODEL

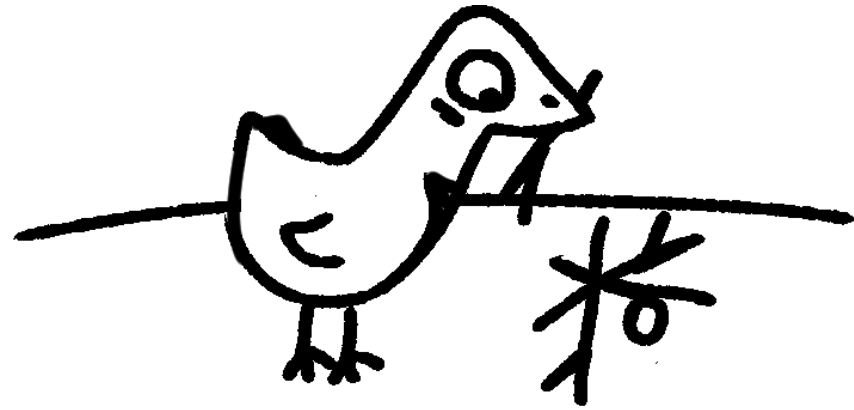
Northlight switched to a completely new data-oriented game object framework during the development of Alan Wake 2. The new entity component system (ECS) based model enables memory-efficient storage and makes parallel execution efficient and safe. This means that the engine can support a varying number of target hardware cores efficiently, enabling bigger, more dynamic and fuller worlds. ECS also played a supporting role for our tools development, simplifying the building of the new Scattering tool for mass-authoring vegetation - ECS allowed us to simply have a lot more entities without the need to invent any custom solution for scattering objects in the world.

The ECS framework also made it to our gameplay programmers' "favorite tech" list as it helped implement the Case Board - Saga's visual storyboard for gathering evidence. ECS meant that iteration was quick because adding new or modifying existing systems or game objects was easy, and performance gains were clear when saving and loading the Case Board.

Source: [How Northlight makes Alan Wake 2 shine](#)

7 *You don't have to
do everything
yourself*

★ remember your goals!



are you implementing it because it's fun or to prove you can do it?

if it's for fun...

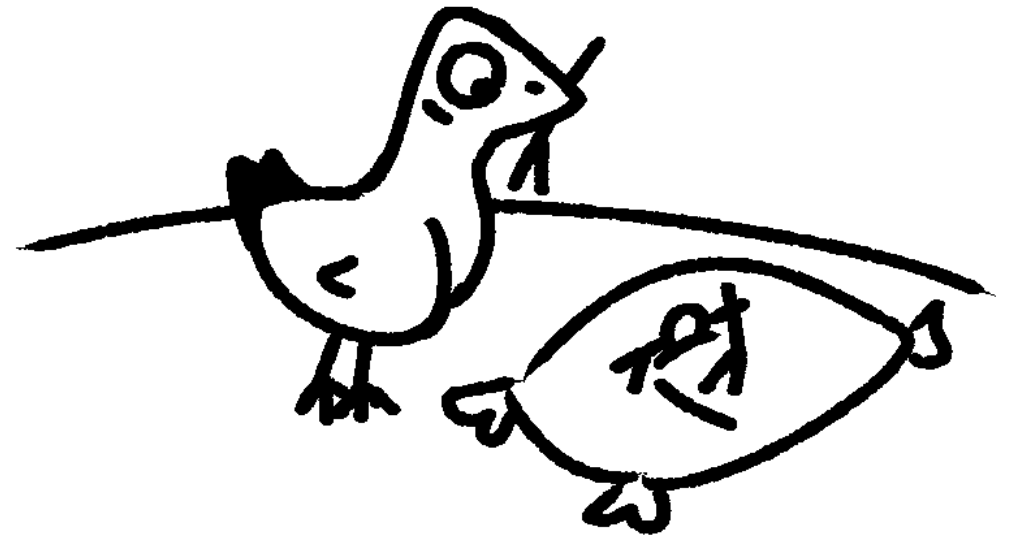
- can you afford the time?
- does it get you closer to your goal?

if it's to prove you can...

- was it proven before?
- is there anything unique that you can do?

is the learning valuable?

- ✦ make decisions by budgeting your time
- ✦ do consider the **trade-offs** when "offloading" the responsibility to a library



Runtime

ECS

PHYSICS

Assets

SERIALIZATION

LEVEL EDITOR

DIALOGUE

Graphics

RENDER

EDITOR UI

O.S.

SOUND

INPUT

Runtime

Entitas

Box2D

Assets

ODIN

LDtk

INKLE

Graphics

FNA

ImGui

O.S.

Fmod

SDL

Runtime

OURS

OURS

Assets

OURS

OURS

OURS

Graphics

FNA

ImGui

O.S.

Fmod

SDL

8 *Prototype,*

implement, refactor



- ✿ invest time studying the best industry approaches
- ✿ prototype in a hello world project!
(...or wherever is cheaper, really)

★ don't overthink the design, 90% of the time your idea might fail:

- not fun
- technical blocker



study industry approaches (can skip)



prototype and try it out. does it break everything? if so, does it simplify things?



decide to implement or not



implement!



???



fix edge cases (you will overlook something...), simplify and abstract



think of something else

examples

creating my custom dialogue language

1 week just **studying** several approaches: blackboards...



1 week asking around, using inkle, seeing what I like



2 weeks **implementing** the language

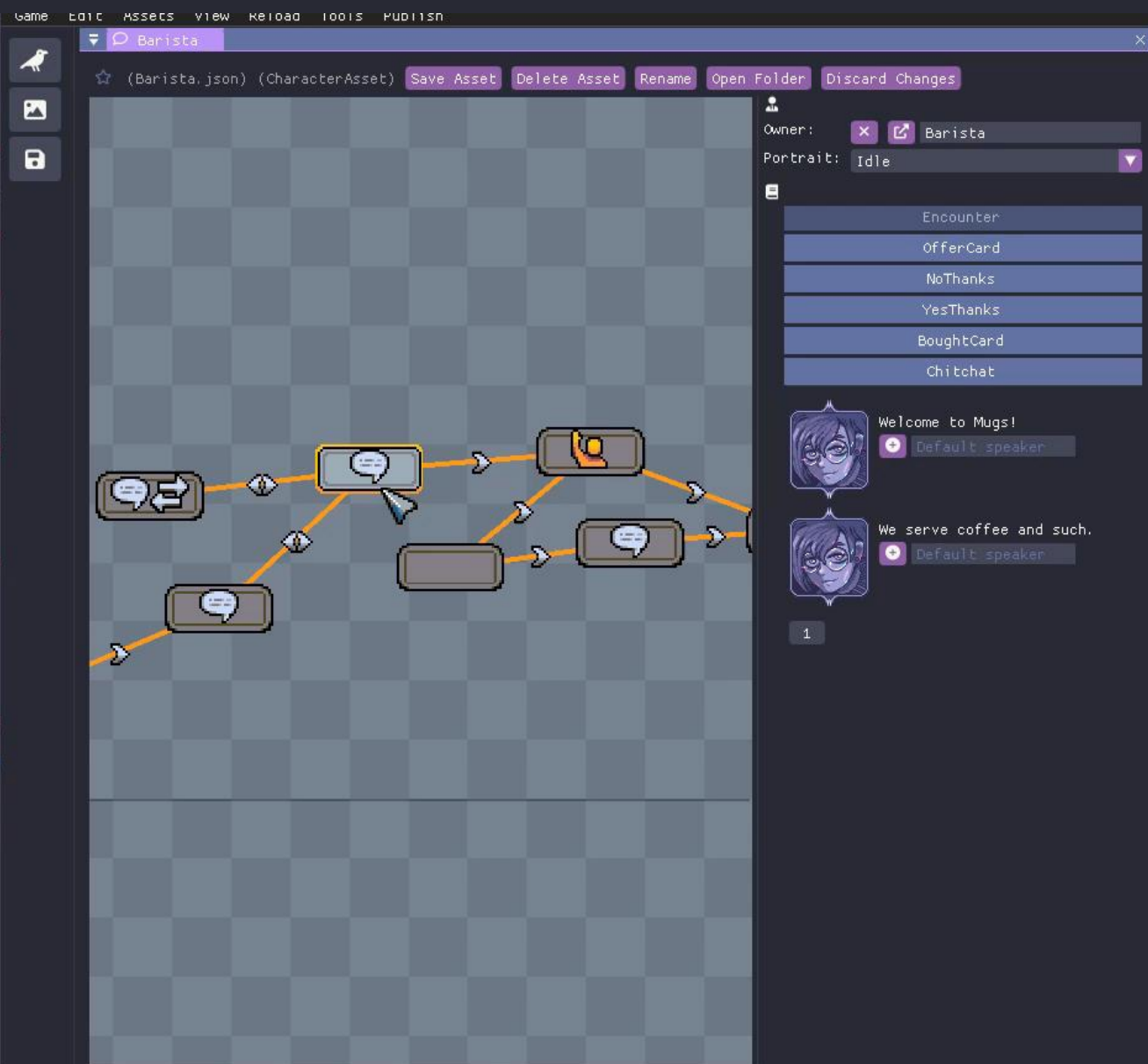


refine it forever

```

barista.gum
14 // i: when referencing icons
15 // {} for referencing variables
16 // // comments
17
18 =Encounter
19 @1 Welcome to Mugs!
20 We serve coffee and such.
21
22 (!HasMembershipCard)
23 If you buy a Mugs Membership Card, we offer free coffee refills.
24 It costs a total of 5 {i:TicketIcon}.
25
26 -> OfferCard
27
28 (...)
29 It seems that you already have a Mugs Membership Card!
30 Here is your free coffee refill.
31
32 [HasTalkedSinceEnteredShop=true]
33 [c:RefillCoffeeInteraction]
34
35 -> exit!
36
37 (!HasMembershipCard)
38 | @1 Changed your mind?
39 You can get a Mugs MembershipCard for 5 {i:TicketIcon}!
40
41 -> OfferCard
42
43 (...!IsCoffeeFull)
44 (HasTalkedSinceEnteredShop)
45 @random
46 + Good morning! Here's our special of the day.
47 + Hello there! Today's coffee has been pretty okay, don't get any high expect
48
49 (...)
50 @random
51 + More coffee?
52 ...
53 Who am I to judge. There you go!
54 + There you go.
55

```



9 *Trust yourself!*

- ✿ most people giving advice on the internet didn't ship a game
- ✿ even advice coming from experienced devs might not apply to you, so it's okay to disagree!
- ✿ selectively ignoring advice is how you innovate

✿ it's all about the journey!



RECAP

1. Game always comes first
2. Stick to your goals
3. Never crash
4. Make it delightful
5. Only do it once it's a bottleneck
6. Scale horizontally
7. Don't have to do everything yourself
8. Prototype, implement, refactor
9. Trust yourself!

Questions?

✉ SUBSCRIBE TO
THE NEWSLETTER!

★ coldbloodinc.studio

★ [@isadora.codes](https://twitter.com/isadora.codes)

★ github.com/isadorasophia/murder



↪
DOWNLOAD
SLIDES!