Polishing

Jaanus Jaggo
Polishing

“Getting a system from 90 percent to 100 percent. That last 10 percent takes just as long as the first 90.” Alpha Protocol’s lead programmer Frank Kowalowski

Polishing includes:

● Game balancing
● Improving visuals
● Improving sounds
● Optimizing
● Adding little details
Achieving Polish

A team achieves polish by:

- Allocating time for polishing.
- Understanding its quality bar.
- Playing the game over and over.

"I wish we had more time to polish the game before release", says Kingdom Come: Deliverance exec producer

When should you polish your game?

**Too Early** - slows down development - time spent on *insignificant details*.

**Too Late** - you should not ship a broken product.

**Just Right** - plan time before and after shipping a product

use player feedback

https://gedd.ski/post/polish/
When should you polish your game?

Polish is not a one-time deal.

Game development is an iterative process.

The game dev loop:
1. Choose a set of features
2. Prototype and test
3. Build it quickly
4. Polish it up
5. Ship it
6. Get user feedback and polish more

https://gedd.ski/post/polish/
When should you polish your game?

Polish is not a one-time deal.

Game development is an iterative process.

Our schedule:

September | October | November | December | January

Milestone 1 | Milestone 2 | Milestone 3

https://gedd.ski/post/polish/
Gameplay polishing

- Create a good core gameplay loop.
- If the game is not fun with just basic shapes, it probably will never be.
- Do not move on, until you are satisfied with it.

Story of Tetris: [https://www.youtube.com/watch?v=_fQtxKmgJC8&t=1273s](https://www.youtube.com/watch?v=_fQtxKmgJC8&t=1273s)
Hooks, Tutorials, Rewards

First 10 minutes of gameplay

The new Player Experience: https://www.youtube.com/watch?v=-fWX6v0NTvl
Hooks

Gameplay

Visuals

Story
Good tutorial

Rule 1: Less text → Tutorial should feel like gameplay

Plants vs Zombies (GDC 2012):

Maximum of eight word at any given moment!
Good tutorial

Rule 2: Reinforce Learning Through Play

Once you reach the Gruz Mother you already know how to wake her up!

https://www.youtube.com/watch?v=vWiDS8SUvds
Good tutorial

**Rule 4:** Use visuals to guide the player

- Shoots peas
- Explodes
- Eats zombies
Good tutorial

Rule 2: invisible tutorial

Pick up that can!

Used to solve puzzles, kill enemies etc.

Half-Life 2’s Invisible Tutorial: https://www.youtube.com/watch?v=MMggqenxuZc
Playtest your tutorial

If some players are getting stuck, it is YOUR FAULT

Something obvious for you might not be so obvious for everyone

Struggle with tutorial: https://www.youtube.com/watch?v=WuSiKpreGIg
Examples of tutorials

Papers Please

http://papersplea.se/
Examples of tutorials

Super Mario first level

You will always hit the powerup block to avoid the enemy!
Examples of tutorials

Cut the Rope
Examples of tutorials

https://kotaku.com/tips-for-playing-the-witness-1755531140
Examples of tutorials

Inspiration from:

- Portal
- Stanley Parable

“The Button” - Ludum Dare game
Making the fingers happy

Multiple default controls
Controls remapping

https://gamedevelopment.tutsplus.com/articles/5-important-ways-to-add-polish-to-your-game--gamedev-7642
Save / Load game

Ways of saving a game:

- Automatic save
- Manual save
- Only meta game saved

Players want to know when the game is saved
Save / Load game

1. Make your object classes serializable
2. Make a Game class containing game state
3. Save your Game class to a file

Unity tutorial:
Smooth transitions
Smooth transitions

Smooth UI and gameobject transitions give fluid game feel.

Example:
http://gfycat.com/ImmenseHalfItalianbrownbear

Unity functions:

- Mathf.Lerp(min, max t)
- Mathf.SmoothStep(min, max, t)

https://www.leadwerks.com/community/blogs/entry/1466-polishing-games/
Add ambiance

Make sure there is always something moving or happening on the screen.

- Torches
- Clouds
- Wind (animated flags)
- Leaves flying
- Grass
- People walking
- Ambience sound
- Light changing

https://www.reddit.com/r/PS4/comments/5warjy/gif_horizon_zero_dawn_is_one_of_the_best_looking/
Add ambiance
Add particles

Orbital Craft - Jaanus Jaggo
Add particles

Custom particle editor - Jaanus Jaggo
Color grading

The House On Pine Street

Color In Storytelling: https://www.youtube.com/watch?v=aXgFcNUWqX0
Color grading

Miniature city - Jaanus Jaggo
Balancing

Goal of balancing: avoid broken gameplay
When you’re designing a game you want to create positive experiences. When gameplay is not providing positive experiences, your game is broken.

Balancing requires testing!
Enrico Fermi solution for precise answer:
● 1 expert
vs
● average of 100 random people

Balancing

The power curve

Extra Credits: Hearthstone power creep [https://www.youtube.com/watch?v=M3b3hDvRjJA](https://www.youtube.com/watch?v=M3b3hDvRjJA)

Strictly better cards
Balancing

Accept that you are never going to get the balance right on your first attempt!

Triple tapping:

- Intentionally overshoot the target (card cost 100 mana)
- Correct it on the other direction (card cost 60 mana)
- Now find the right value in between (card cost 85 mana)

At one point you will need excel sheets

Simply assigning values and tweaking them would take too much time!

RPG: Balancing = creating sense of progression

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Ground Forge spreadsheet for balancing **monster health** and **player equipment**
Diagrams for game items

Ground Forge diagram for balancing item crafting
Perfect imbalance

Unbalanced design creates balanced play.

Part of the fun is to figure out what works the best!

https://www.youtube.com/watch?v=e31OSVZF77w
Balancing

Asymmetric games - harder to balance, but more fun

Symmetric factions

Asymmetric factions
Design safeguards

No matter how good you are at balancing, players will find exploits!

In Powergrid, players bid for power plants and resources.

In Hearthstone more powerful cards depend on randomness.

Polish is when “You take a game from ‘this is functional’ to ‘this is art.’”

Dragon Age lead designer Mike Laidlaw

http://www.midsummergames.com/author/erik/
Lecture task

1. Write an example of a polishing detail (something small) in a video game that has a great effect to the game feel.
2. Add a picture

Example: In game “Journey” the player has this long scarf that is flapping in the wind. And it also shows the progression by getting longer over time.
Game optimization

"Good optimization means that the game works at the same framerate across a wide range of hardware specs, including low-end configurations."

**SYSTEM REQUIREMENTS**

**MINIMUM:**
- Requires a 64-bit processor and operating system
- OS: 64-bit Windows 7, Windows 8.1, Windows 10
- Processor: Intel Core i5-4430 / AMD FX-6300
- Memory: 8 GB RAM
- Graphics: NVIDIA GeForce GTX 960 2GB / AMD Radeon R7 370 2GB
- DirectX: Version 11
- Network: Broadband Internet connection
- Storage: 30 GB available space

**RECOMMENDED:**
- Requires a 64-bit processor and operating system
- OS: 64-bit Windows 7, Windows 8.1, Windows 10
- Processor: Intel Core i5-6600k / AMD Ryzen 5 1600
- Memory: 16 GB RAM
- Graphics: NVIDIA GeForce GTX 1060 3GB / AMD Radeon RX 580 4GB
- DirectX: Version 11
- Network: Broadband Internet connection
- Storage: 30 GB available space
## Game optimization

### Steam hardware survey 2019

[Image of a table showing video card performance data]

[Link to survey: https://store.steampowered.com/hwsurvey/videocard/]

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**ALL VIDEO CARDS**

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Game optimization

“Premature optimization is the root of all evil”
instead be extremely effective at
getting things done

Most code is
not
performance-sensitive

Jonathan Blow, the creator of Braid and The Witness:
https://www.youtube.com/watch?v=JjDsP5n2kSM&index=12&list=PL_5CVXzMqD7ZTRdf9B4allwX47ZuWw7Og
Game optimization

Three things to optimize:

- Optimize for speed
- Optimize for space (memory, disk space)
- Years of my life per program implementation

https://imgur.com/gallery/RtfHa
Unity profiler

60FPS ~ 16ms in total
Ways to improve Unity performance

CPU:

- Object **cashing** and **pooling**
- Optimize code in **update loop**
- Reduce the number of **updated game objects**
- Reduce the number of active **RigidBodies**

GPU:

- Make objects **static** (bake lights and occlusion)
- Enable **Static** and **Dynamic batching**
- Reuse **materials** and **textures**
- Reduce the number of **post-processing effects**
- Use **LOD meshes** for larger scenes

[Link](https://www.cgcookie.com/articles/maximizing-your-unity-games-performance)
More demanding graphics effects

Dynamic shadows

Post processing effects
Ways to improve Unity performance

Object pooling

```csharp
public class ObjectPool : MonoBehaviour {

    public GameObject bullet;
    public int pooledAmount = 20;
    private List<GameObject> bullets;

    // Use this for initialization
    void Start () {
        bullets = new List<GameObject> ();
        for (int i = 0; i < pooledAmount; i++) {
            GameObject obj = Instantiate (bullet) as GameObject;
            obj.SetActive (false);
            bullets.Add (obj);
        }
        InvokeRepeating ("Fire", .05f, .05f);
    }

    void Fire () {
        for (int i = 0; i < bullets.Count; i++) {
            if (!bullets [i].activeInHierarchy) {
                bullets [i].transform.position = transform.position;
                bullets [i].transform.rotation = transform.rotation;
                bullets [i].SetActive (true);
                break;
            }
        }
    }
}
```

https://www.cgcookie.com/articles/maximizing-your-unity-games-performance
Garbage collection spikes

Your project likely creates object every frame:
- Eliminate temporary lists
- Replace classes with structs
- Restructure your code
The art of screenshake

https://www.youtube.com/watch?v=AJdEqssNZ-U&t=9s
NEXT WEEK - milestone 1 presentation

Milestone 1
- **Wiki page**: Description, UI Mockups, Screenshots, Build
- Game Loop implementation
- Win and Lose conditions
- Presentation

Presentation (5 minutes):

Don’t make slides, instead **show the game**. Cover following things:

- Remind us about your **game idea**
- **Demo your game** (live or recorded)
- Tell about **what went well** and **what went wrong**
- What are you going to **change** compared to your original idea