Corgo in Wonderland

CS 174C W24 Final Demo

made by a team of dog lovers:
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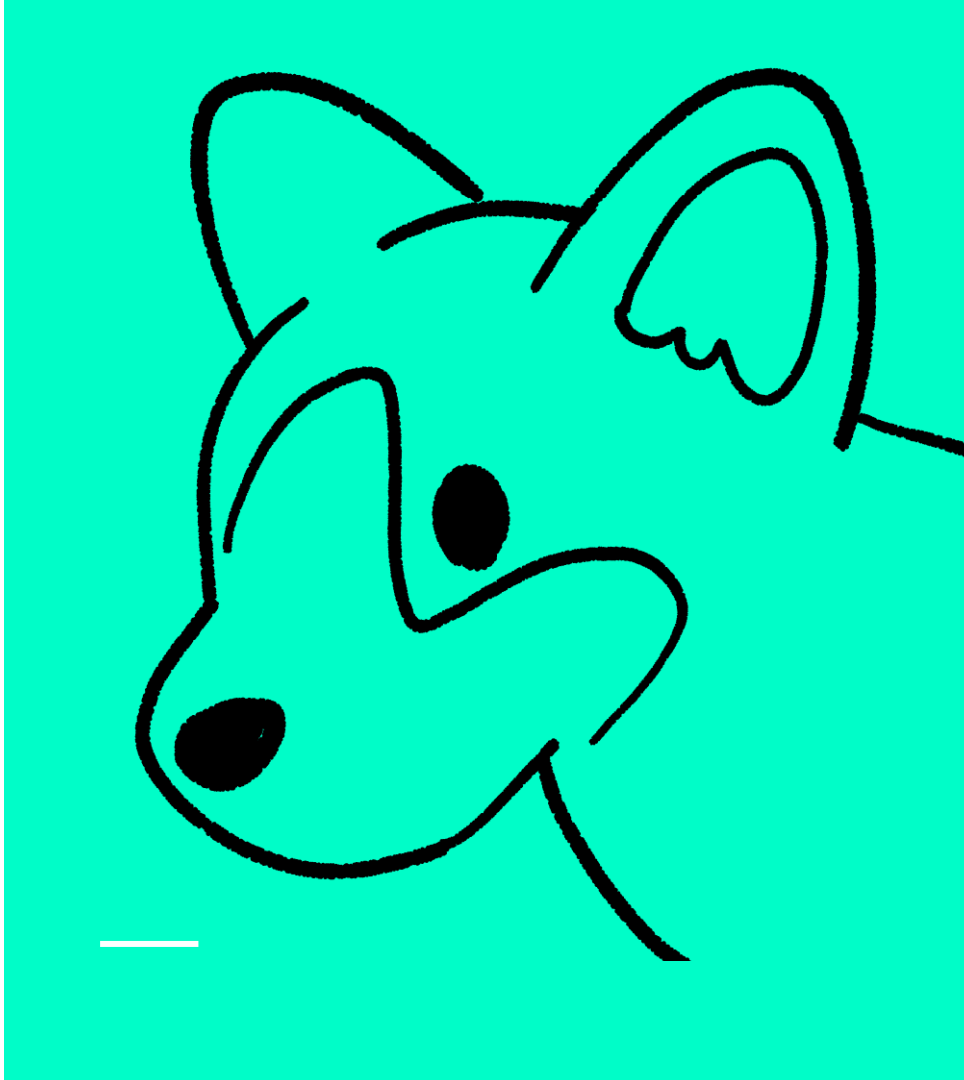
Explore a surreal world with Corgo!

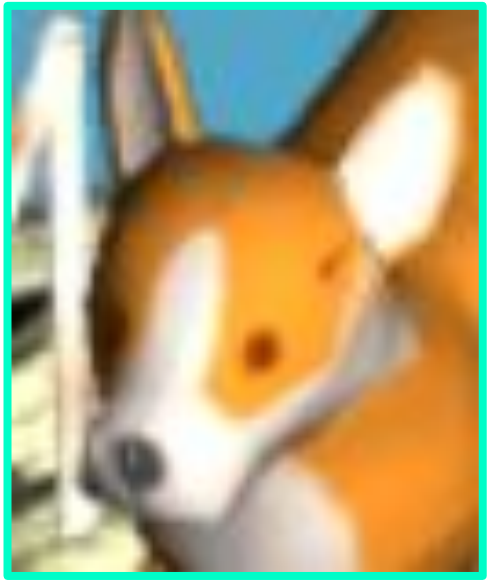
Travel plans:

- Making Corgo and friends
- Rickety Rope Bridge
- Frogs in Mushroomia
- Flower Dance
- The Underground

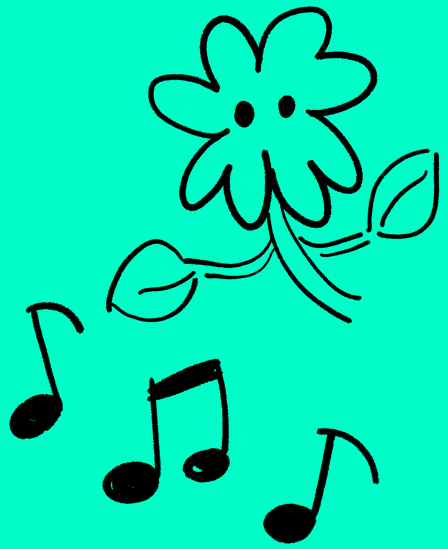


Features:

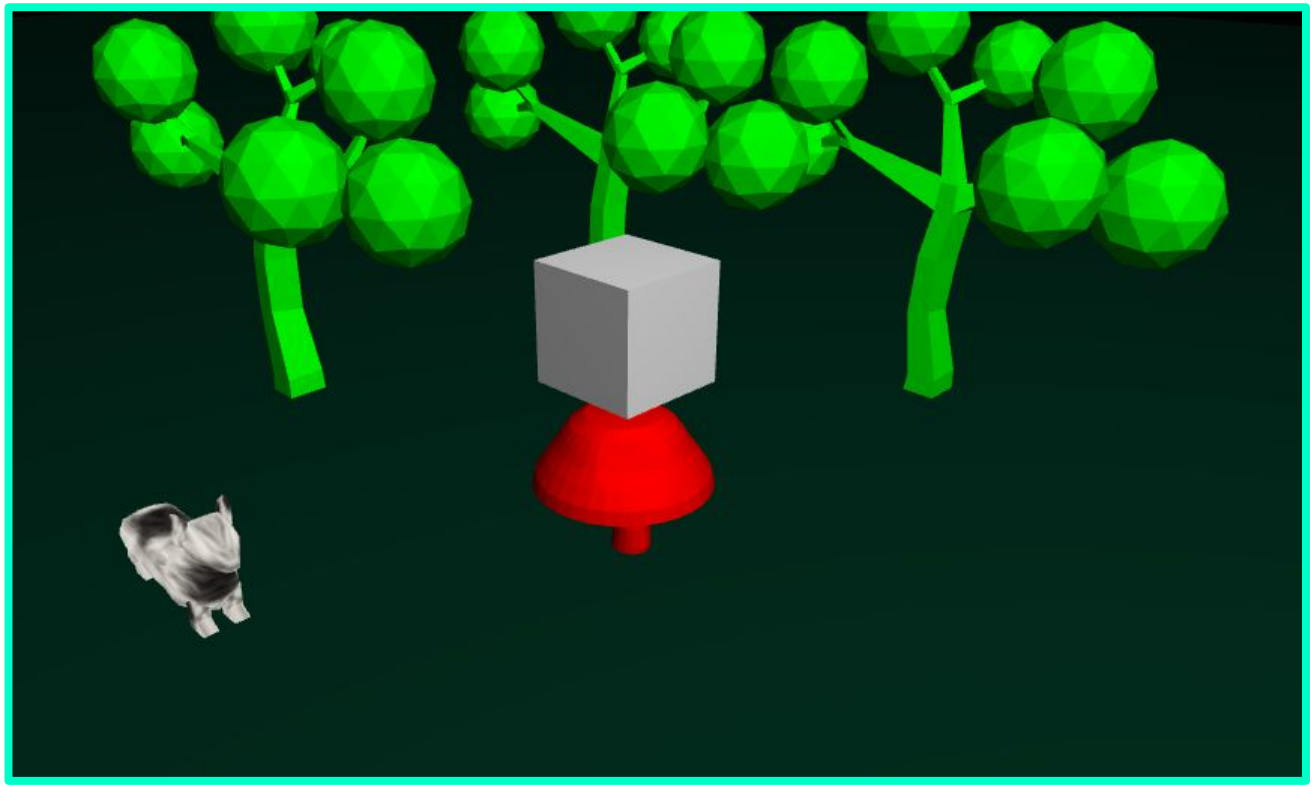
- Splines
- Forward and Inverse Kinematics
- Mass-Spring-Damper systems
- Symplectic integration
- Fluid Dynamics and Marching Cubes
- Physics - Position, Velocity, Acceleration
- Collision Detection
- Corgo (the most important future)



Last known photo of specimen C0RG-O



Making Corgo and friends

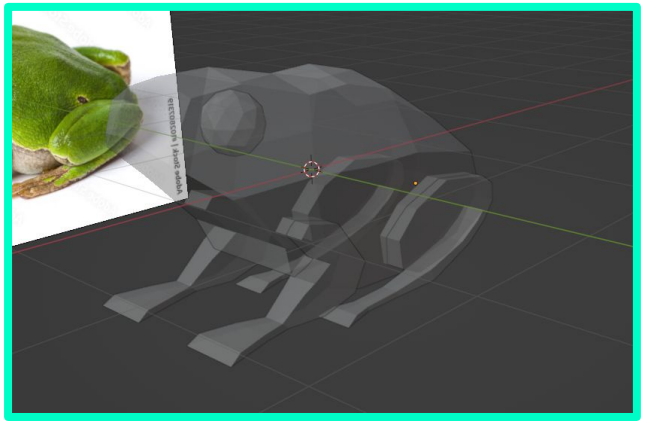


Last time, we saw Corgo in Wonderland like this... Let's see what's changed!

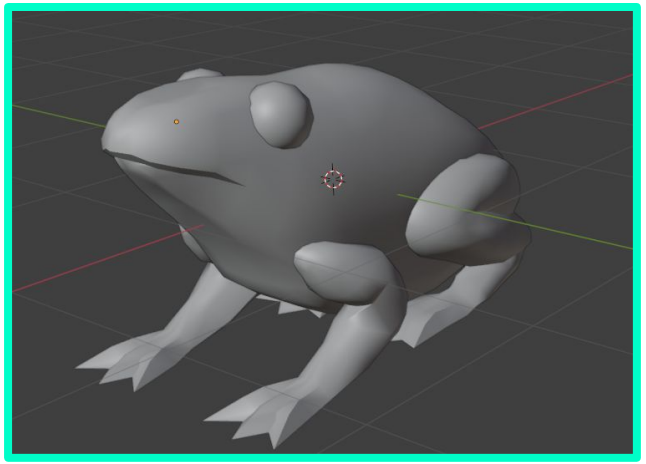
Blender-Tinygraphics Workflow

- Models were created in a 2-step process.
- First, initial, low-poly models.
- Then, refined the models into the final versions for use.
- Also, fixing issues with object importation for non-triangulated faces
- The rest of the models will be shown in the upcoming slides / demo

Not a dog ->

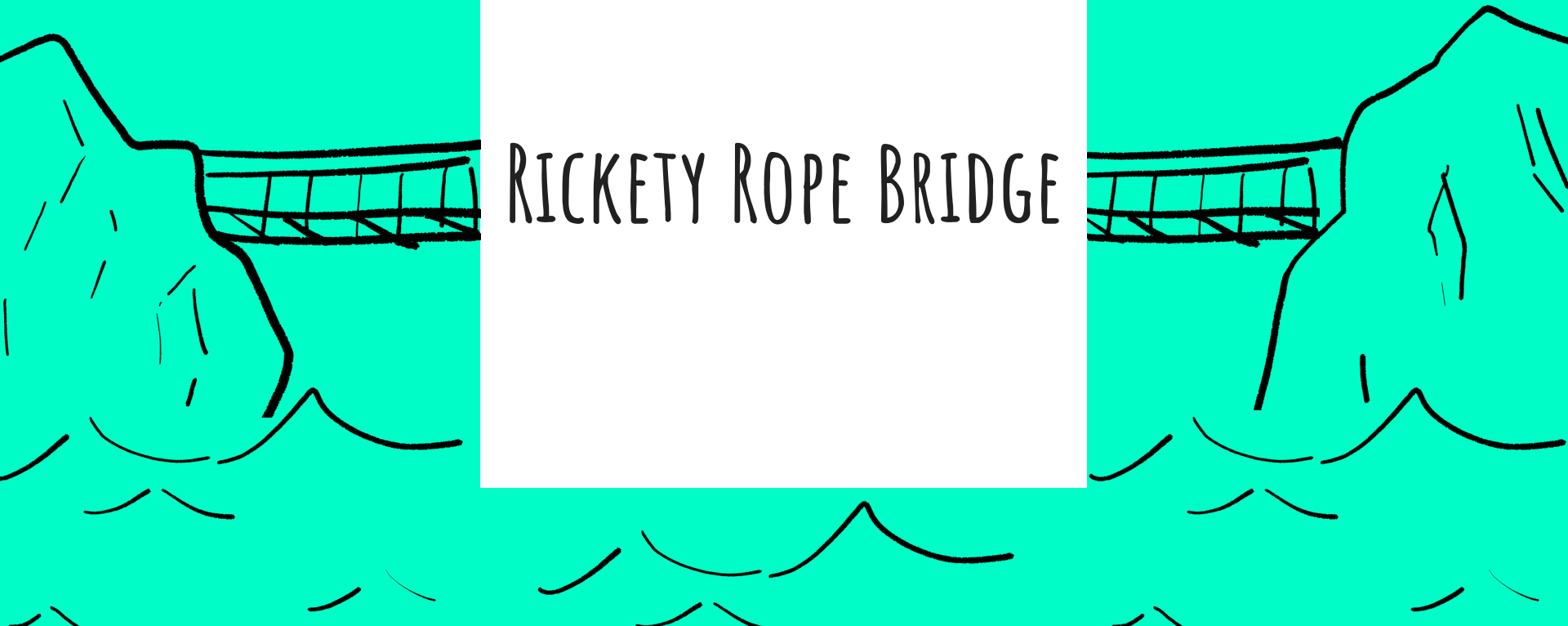


low-poly ~~forg~~ frog



Final ~~fronge~~ frog

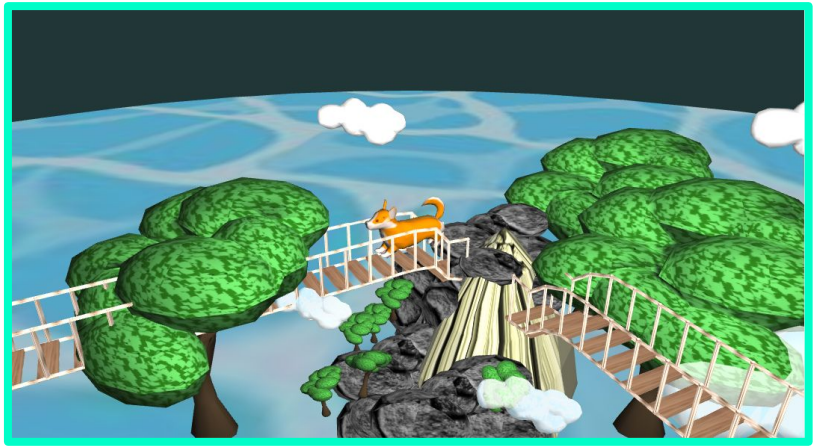
Rickety Rope Bridge

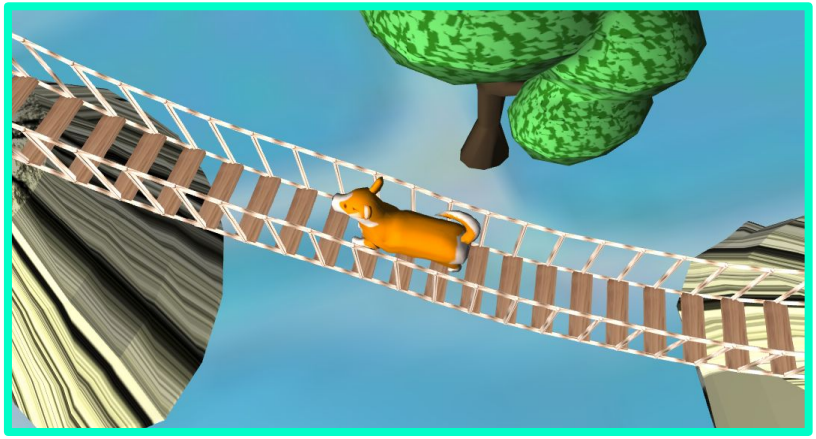


Rope bridge

$$\mathbf{f}_{ij}^{s} = k_{ij}^{s}(d_{ij} - l_{ij})\hat{\mathbf{d}}_{ij}; \quad \mathbf{f}_{ij}^{d} = -k_{ij}^{d}(\mathbf{v}_{ij} \cdot \hat{\mathbf{d}}_{ij})\hat{\mathbf{d}}_{ij}$$

- Uses a mass-spring-damper system
  - Ropes consist of particles connected by springs
    - Some particles' locations are perturbed slightly during their initial creation to make the movement of the bridge more interesting
  - Planks are springs as well, with higher spring stiffness constants so their lengths do not noticeably change
    - This allows the bridge to sway naturally, as if in the wind
- Corgo moves along a Hermite spline whose control points are the locations of the planks
- The camera also moves along a spline and aims at Corgo's position





Frogs in Mushroomia

How does it work?

- The frog is a mass-spring-damper system that treats the top of the mushroom as the "ground"
- Camera changed at set time intervals
- Corgo’s position, velocity and acceleration are determined by a Hermite spline

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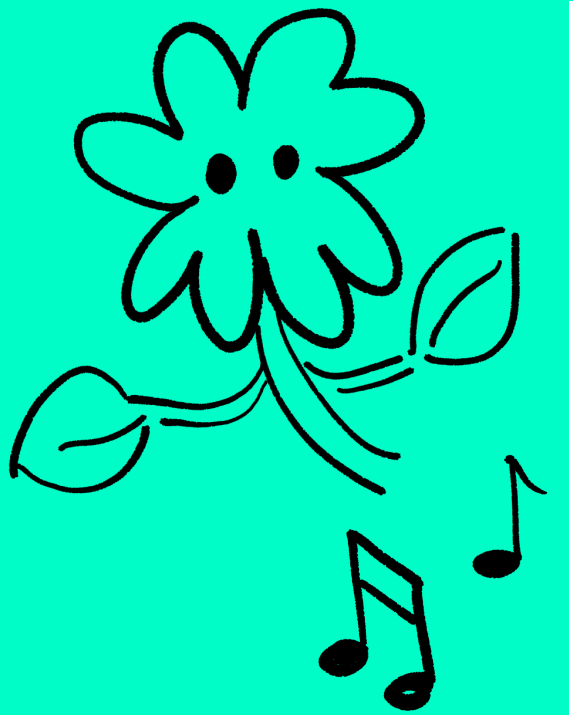


Flower Dance

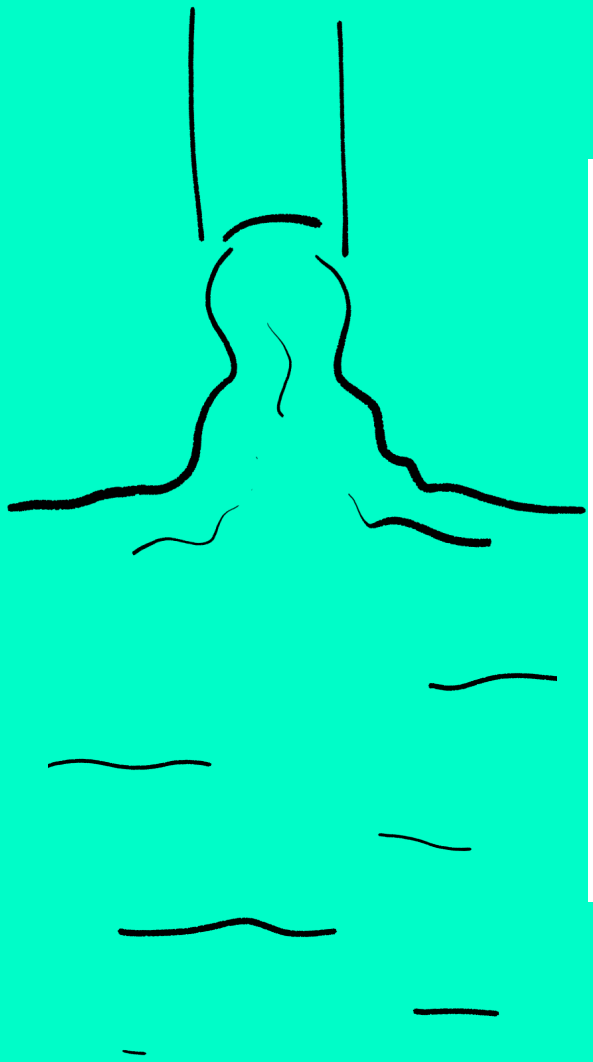
FLOWY

- Flowy's animation uses inverse kinematics.
- The head and both "arms" have associated splines that generate positions.
- These positions are fed to the IK system to create the animation.

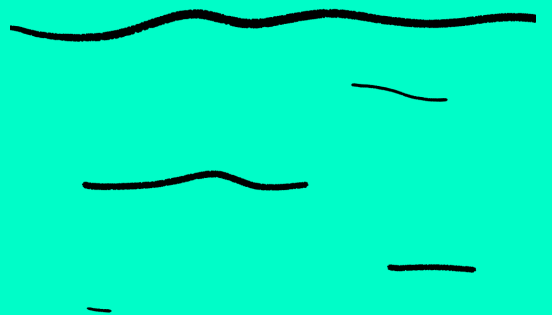
$$\dot{x} = J\dot{\theta}$$

CORGO

- Corgo's animation uses forward kinematics.
- Angles are calculated over time to adjust the tail and feet.



The Underground



Fluid Sim

$$\mathbf{g}_{ij}(t) = m_i m_j \left(\frac{\alpha}{(d_{ij} + \varepsilon)^a} - \frac{\beta}{d_{ij}^b} \right) \mathbf{d}_{ij}$$

- Marching cubes
  - Looked better than particles but trickier to implement
- Optimization trick: calculate fluid physics only just some particles each frame
  - Raise force of attraction to achieve identical look

See the DEMO for yourself!

WOOF! –