

Mixed Reality Racing Fuses Deeper AR Experience with Physical Gameplay

Dan Doptis
Game Director – Velan Studios

Virtual Reality



HALF-LIFE
ALYX



Augmented Reality



MARIOKART
LIVE
HOME CIRCUIT

Mixed Reality



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Mobile



Design Challenges

Camera Management

Content Stability

FOV

Wearables



State of AR



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What if the camera is remote?

- Kart is the Avatar
- Freedom of Movement
- Toy Scale

**MARIOKART
LIVE
HOME CIRCUIT™**



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How it Works

“Game play Feel”
and ease of driving



**Throttle &
Analog Steering**
(Steering Model)

Precision Control of
Kart via software

Camera Sensor
(Low Latency Video for CV)



IMU
(Motion Model)

Understand how the
kart moves

Kart State



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Blurring the Line

Real

World

Physical Interaction
(Example: C



Digital Interactions
(Example: Boost)



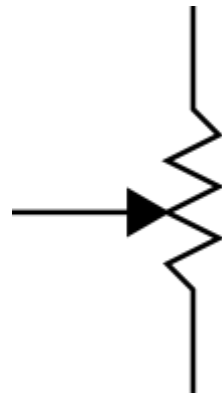
Control Conditioning



RC Car Control Pipeline



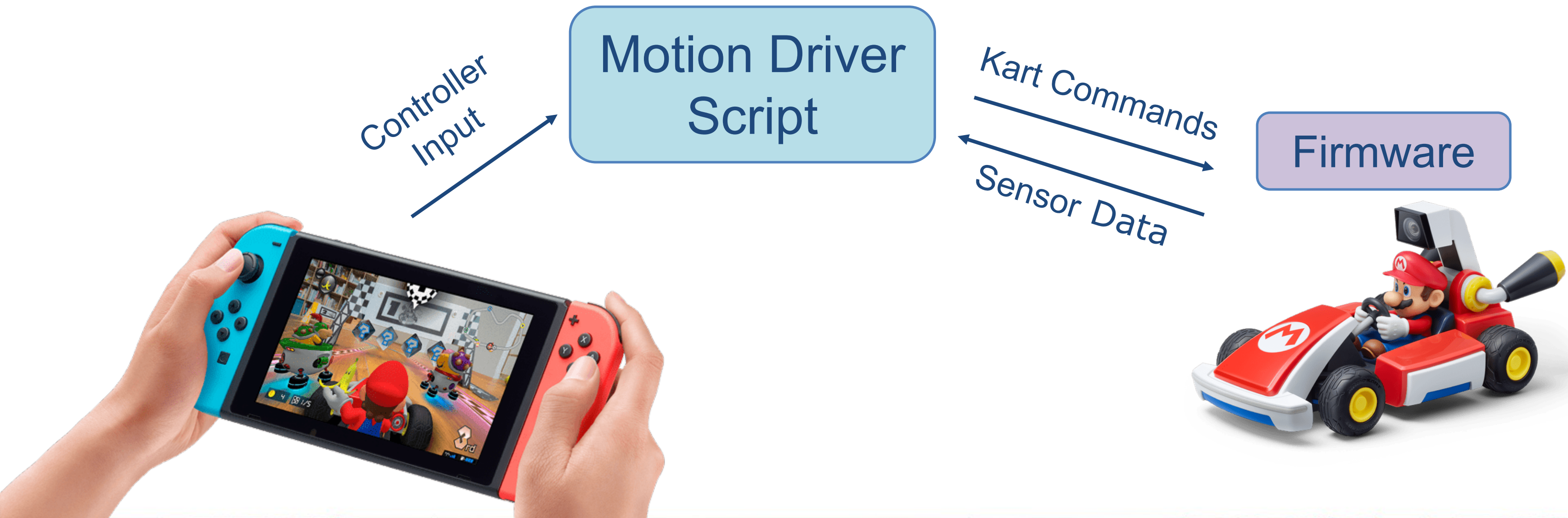
Potentiometer



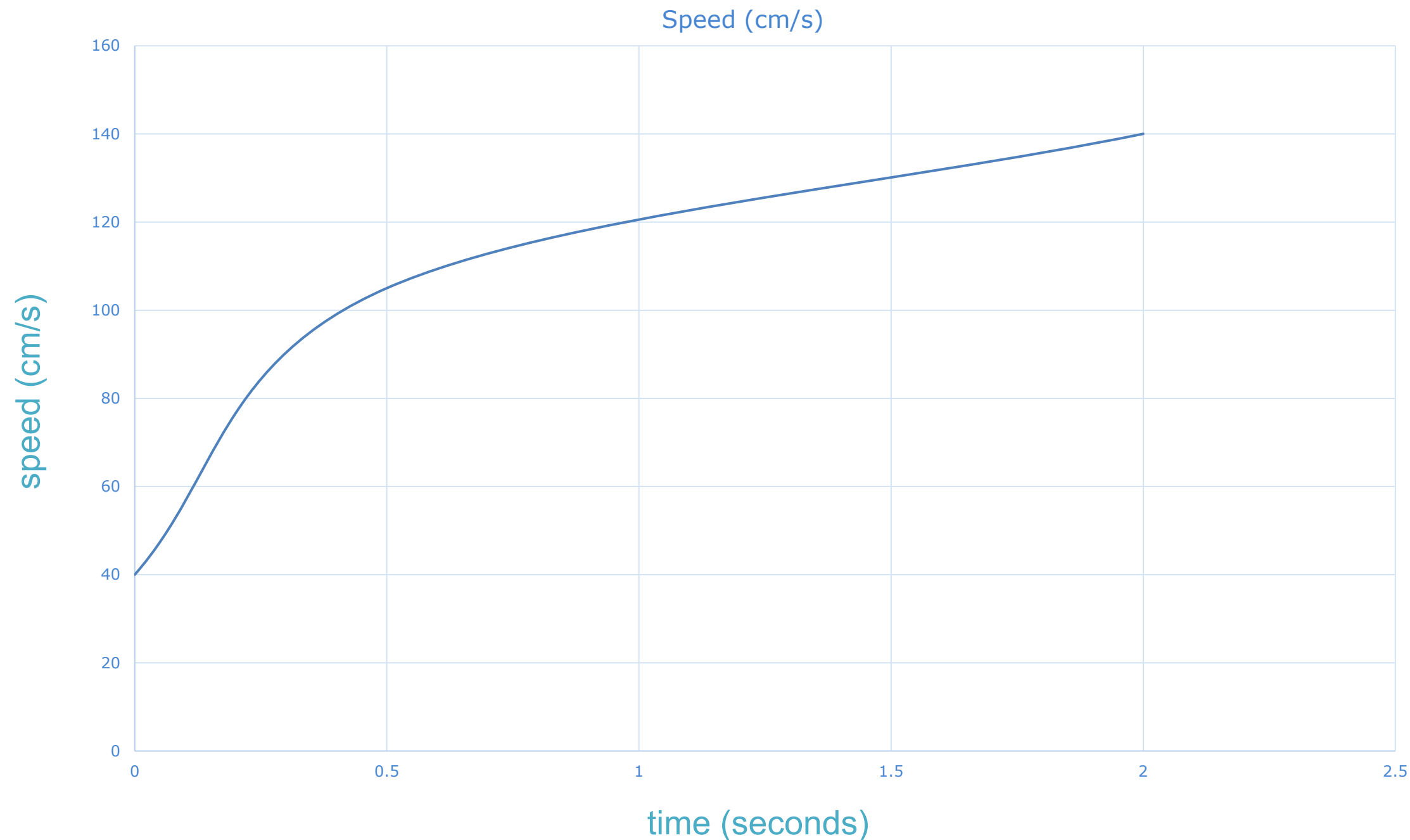
Motor Voltage



MK Live Control Pipeline



Input Curves - Acceleration



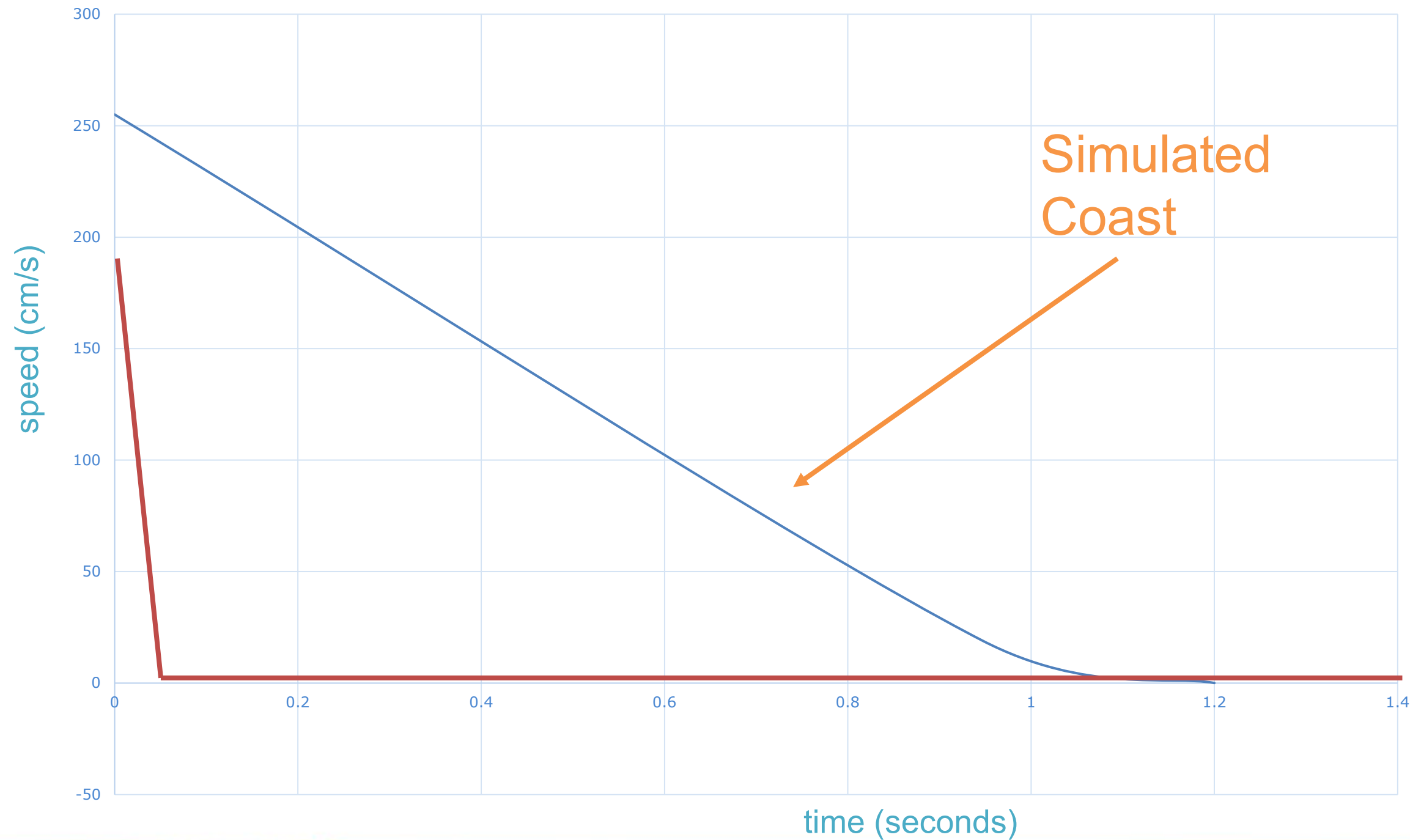
- Increased Realism
- Increased Controllability



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Input Curves - Deceleration



- Increased sense of momentum

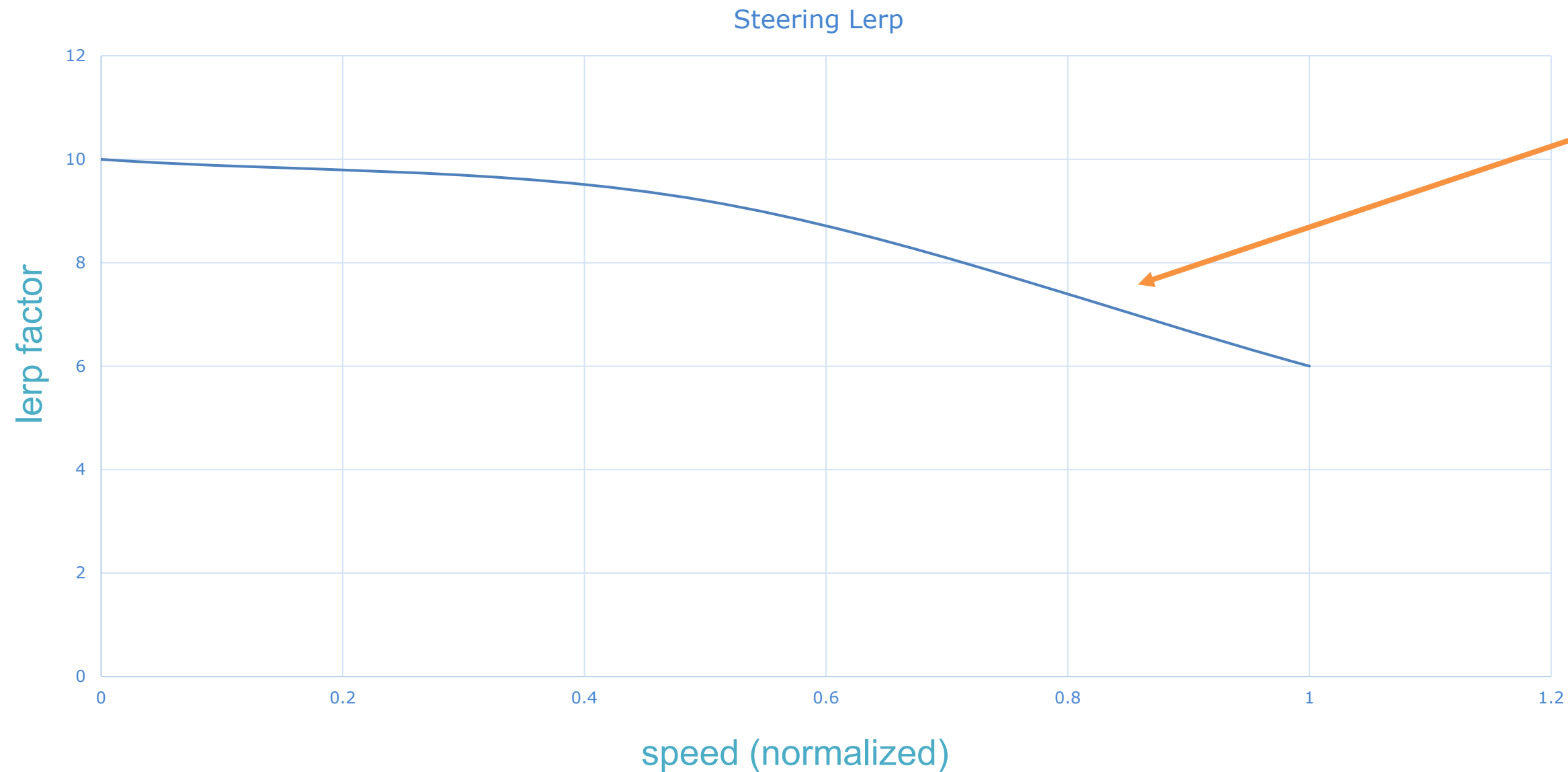
Brake



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Input Curves – Steering



Reduce
Overshoot

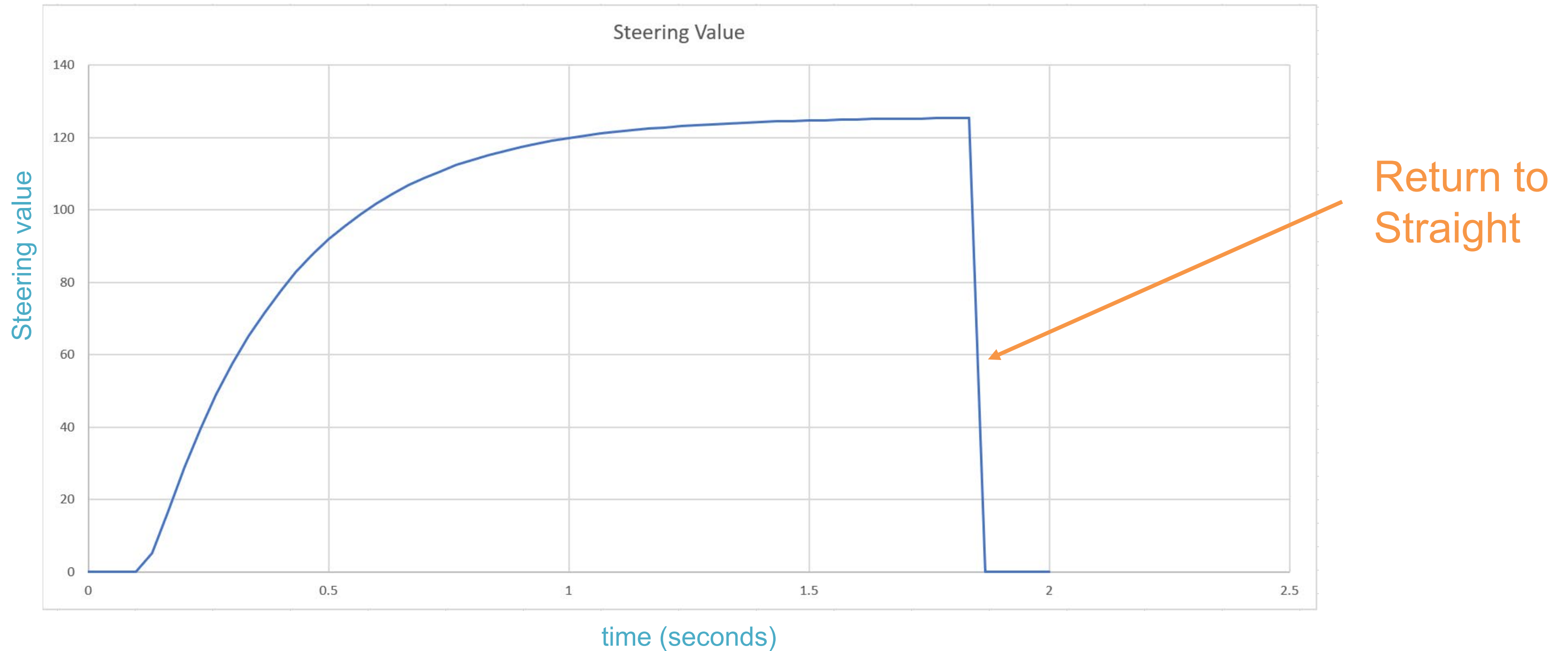
- Increased controllability at higher speeds



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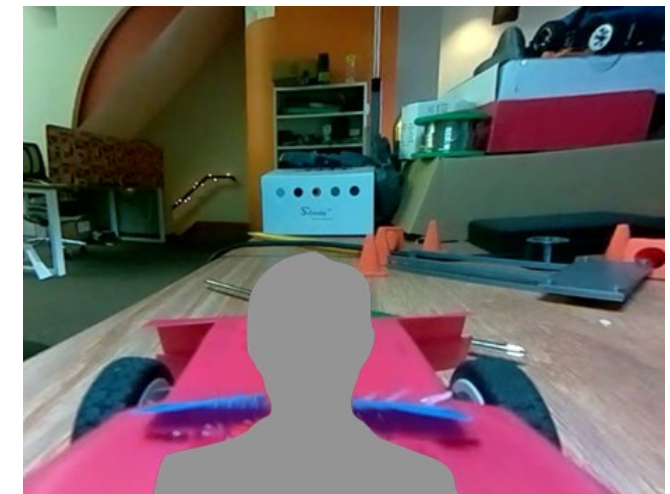
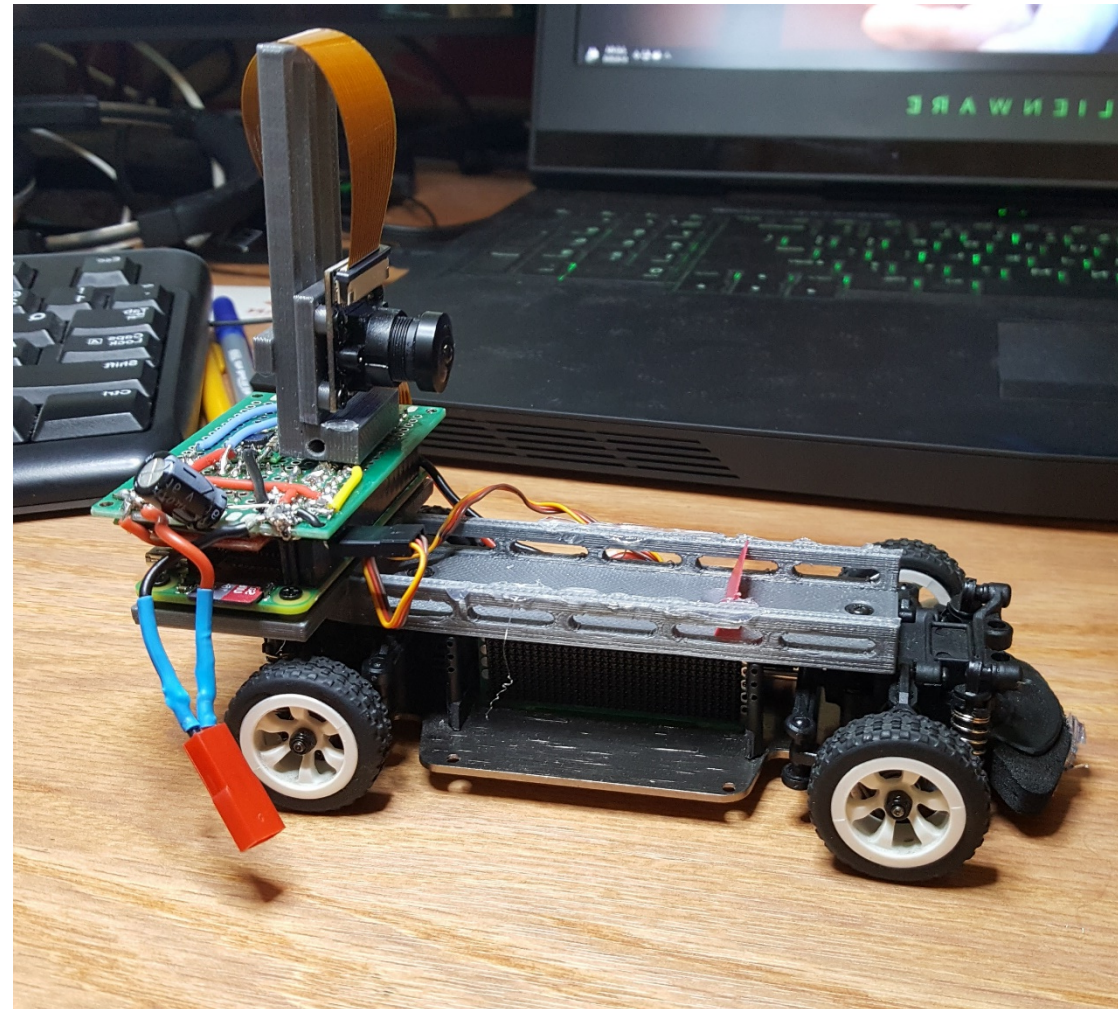
Steering Output Example



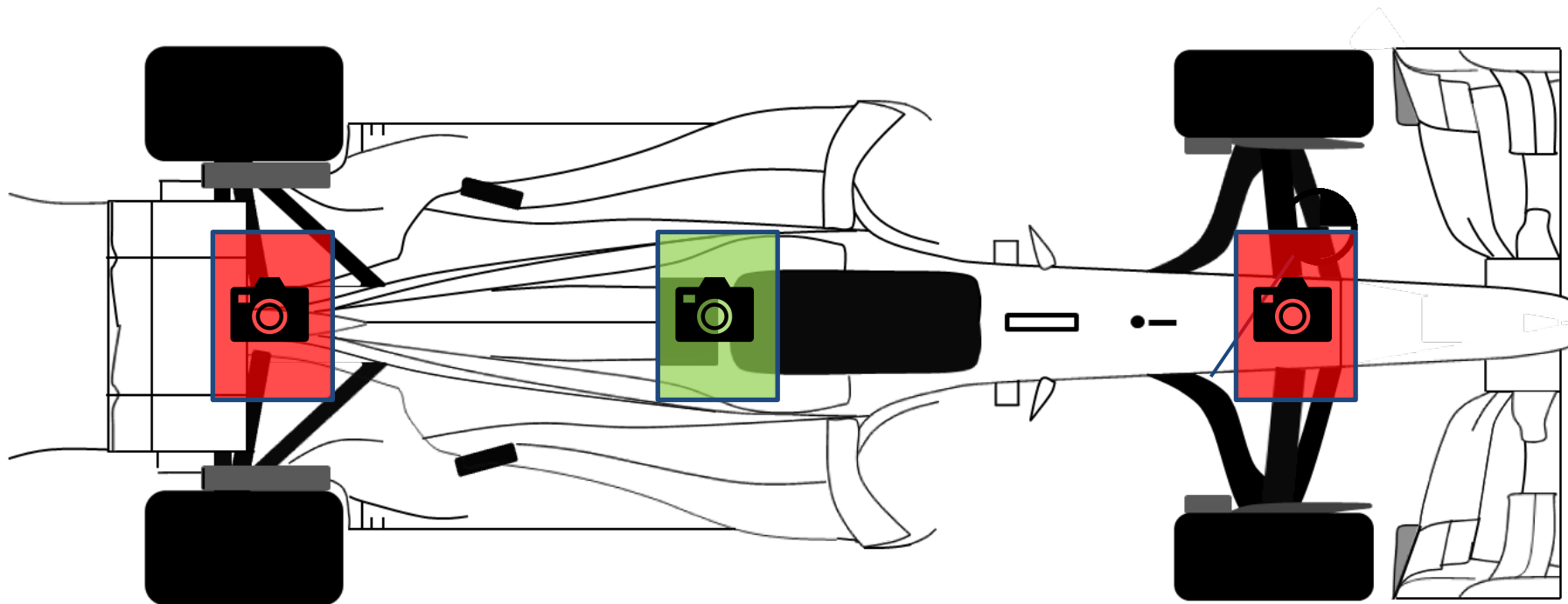
Digital View



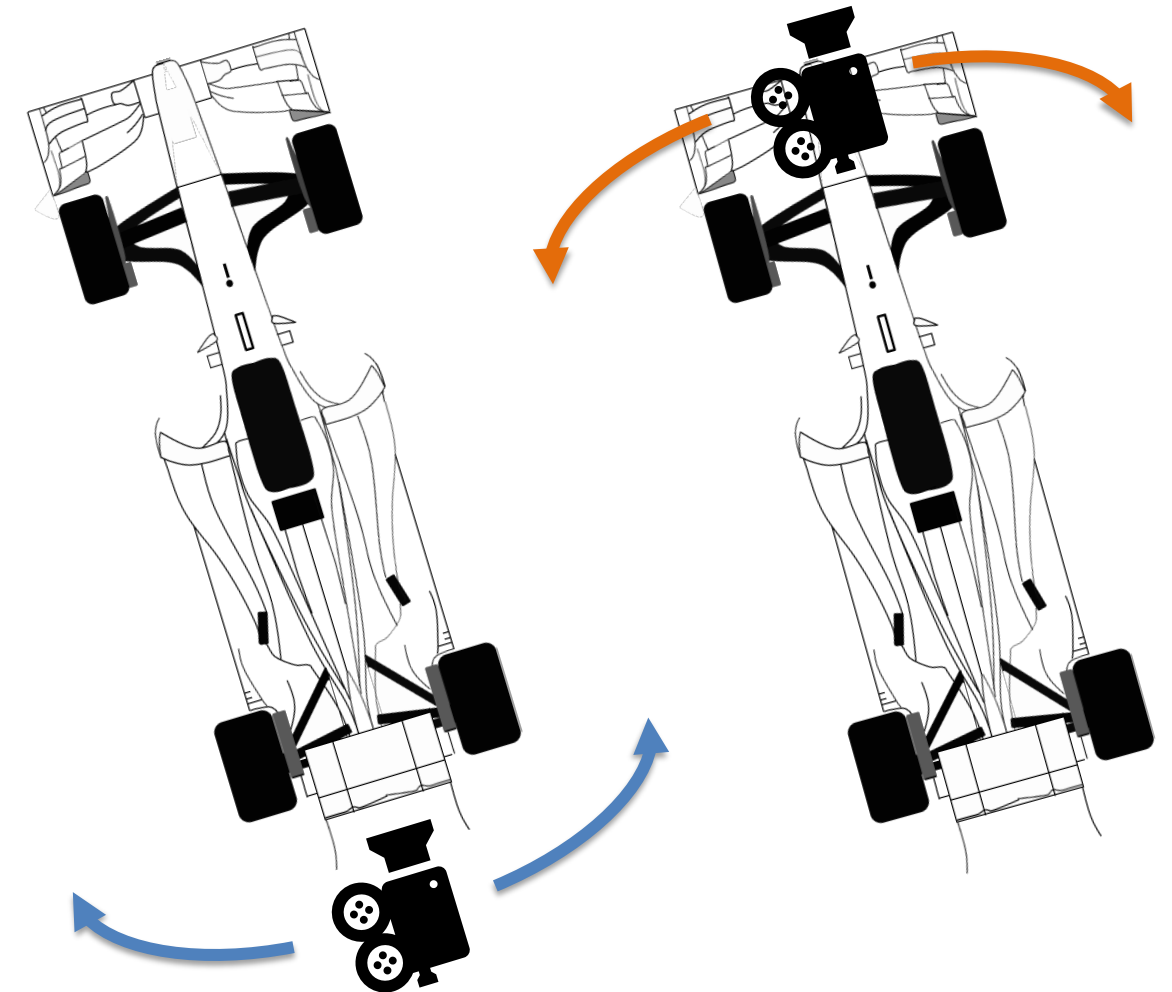
Position of Camera



Position of Camera



 Camera Sensor



Physical to Digital Interaction

Gas Gauge
(Battery)

Wheel
Rotation

Driver Reactions
(Crashes / Bumps)

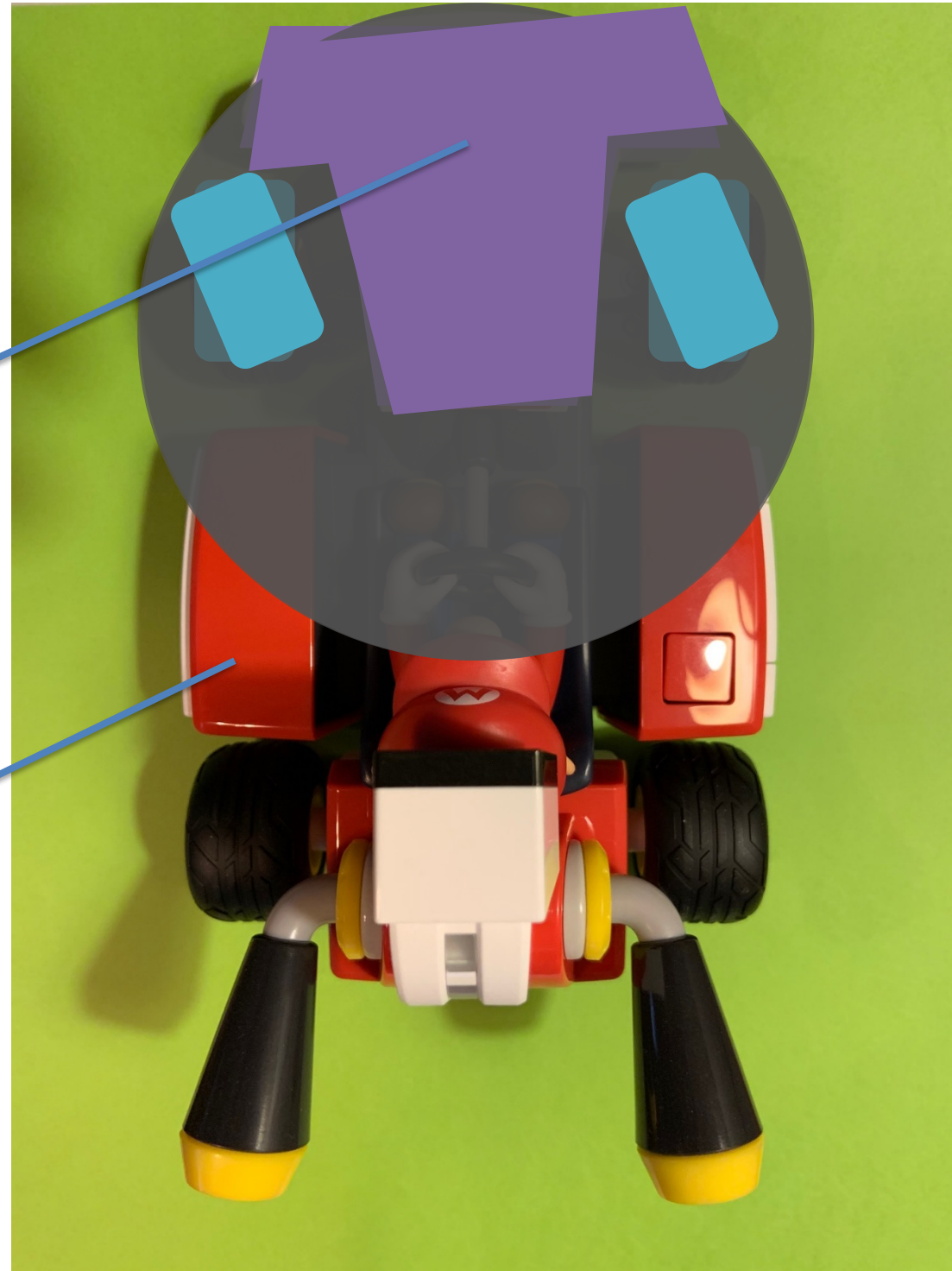
Speed



Drift



Physical Kart



Augmenting the World



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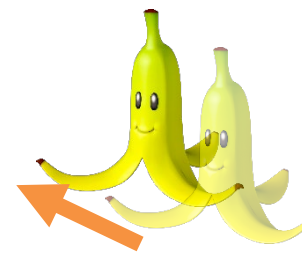
Augmenting the World

1. Alpha



Augmenting the World

1. Alpha
- 2. Floating**
- 3. Ambient Motion**



Augmenting the World

1. Alpha
2. Floating
3. Ambient Motion
4. **Drop Shadow**



Augmenting the World

1. Alpha
2. Floating
3. Ambient Motion
4. Drop Shadow
- 5. Contrasting Colors**



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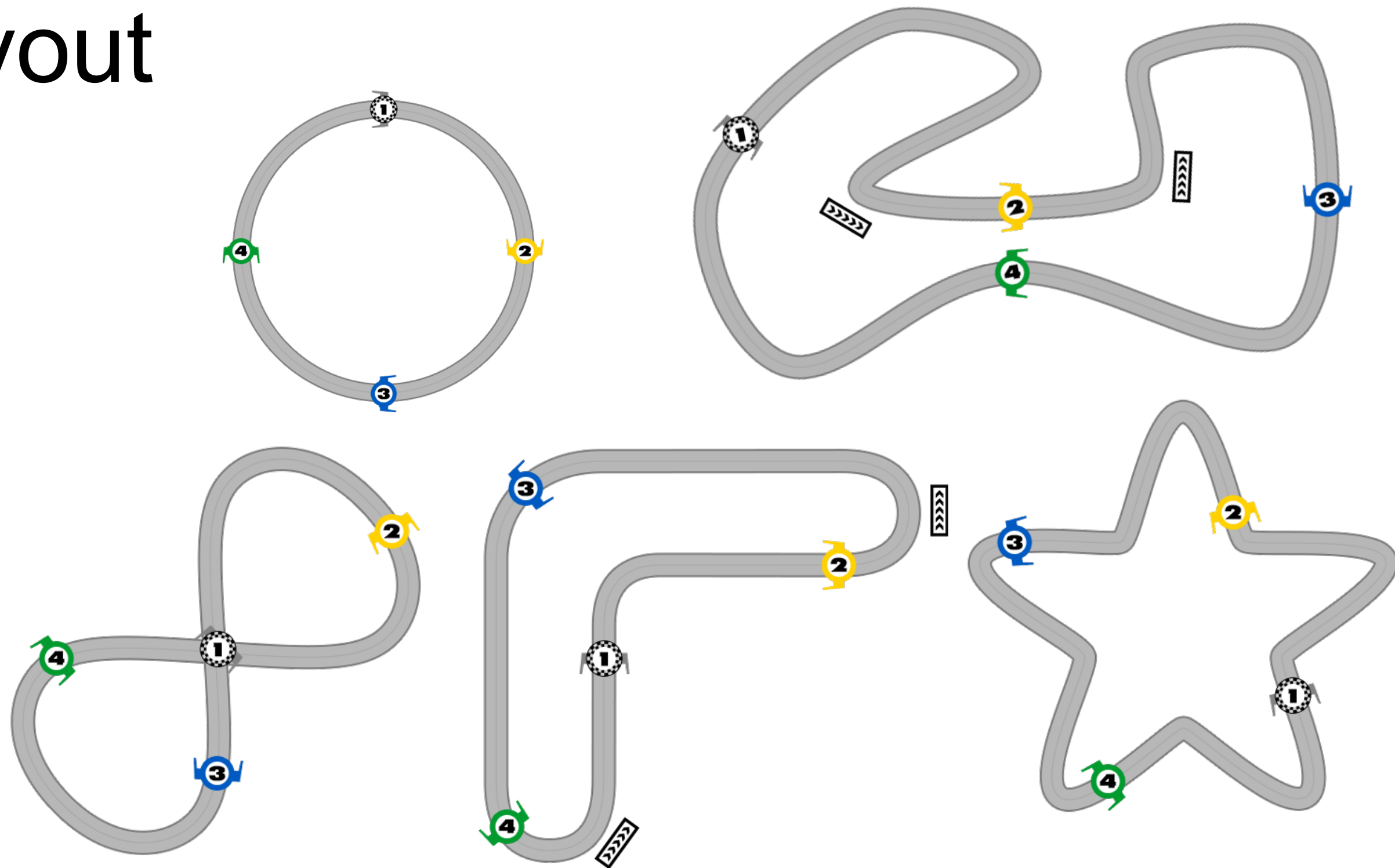
Density Based Content Spawning



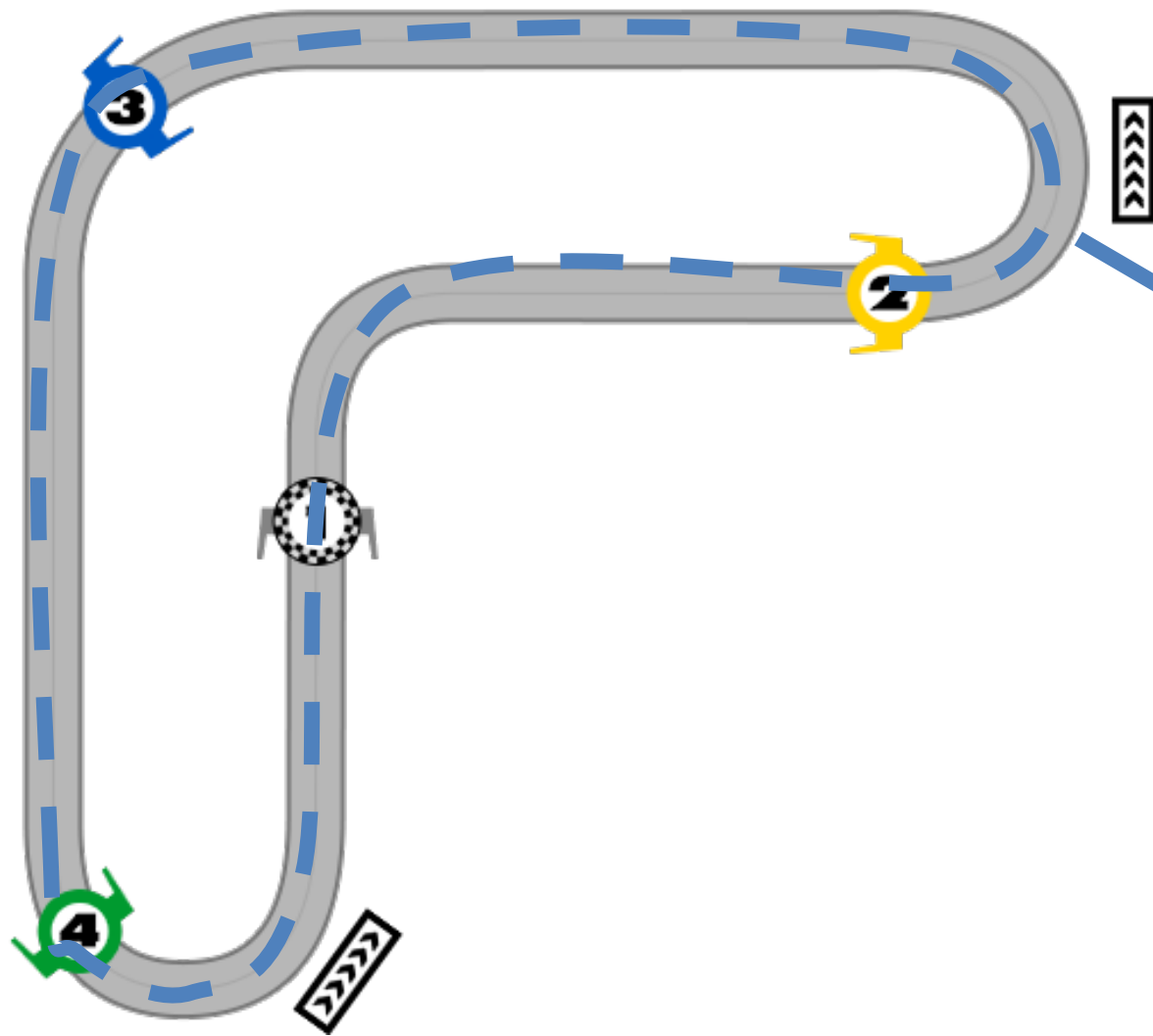
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Course Layout

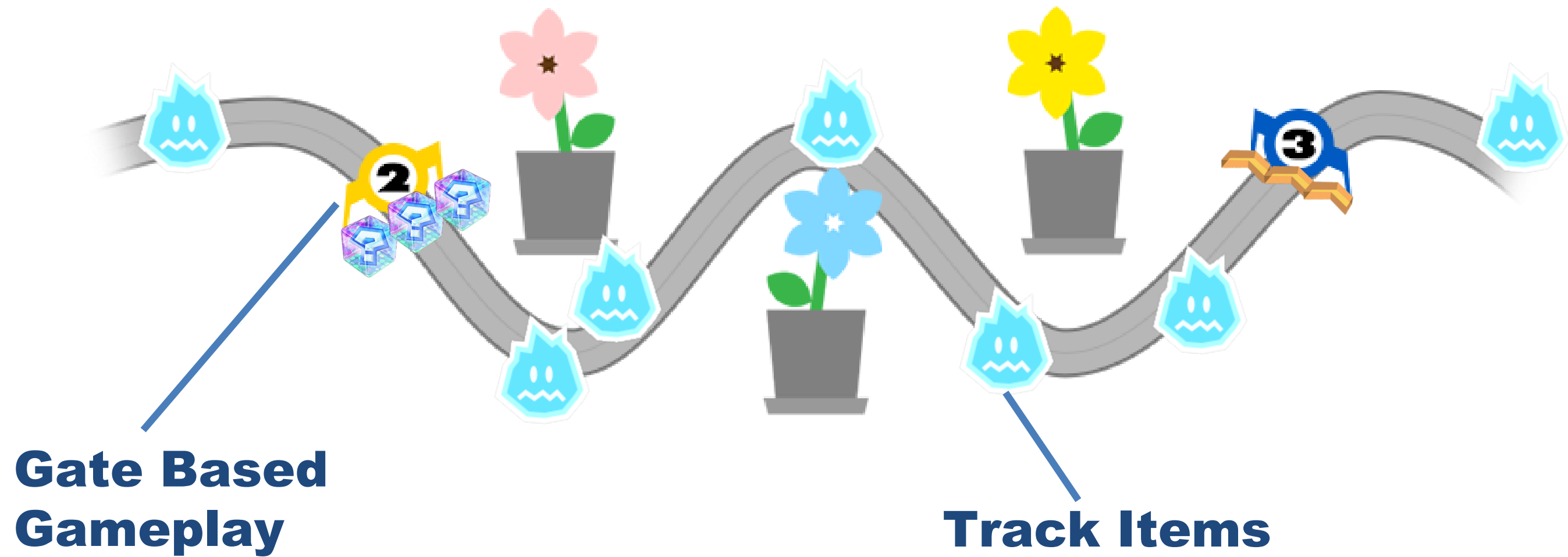


Course Size

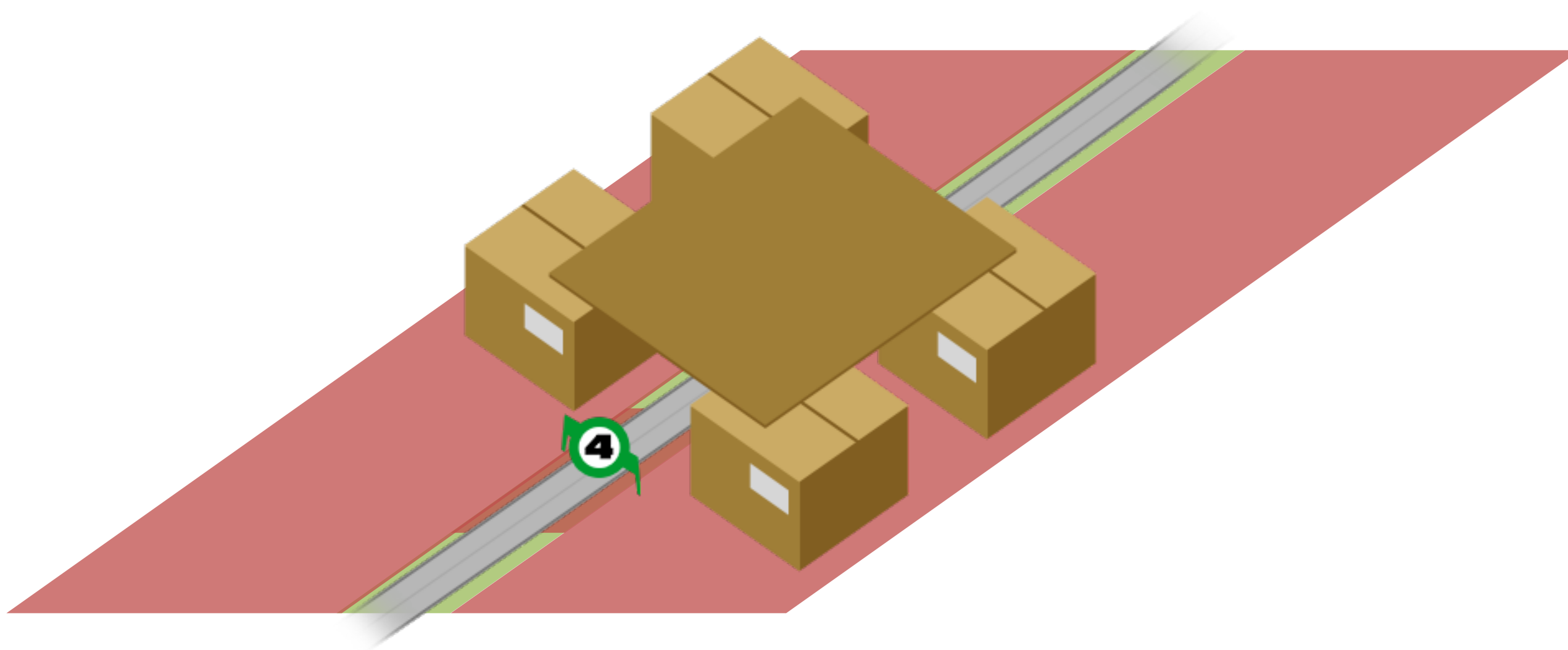


**Total Track
Length:
5m - 100m**

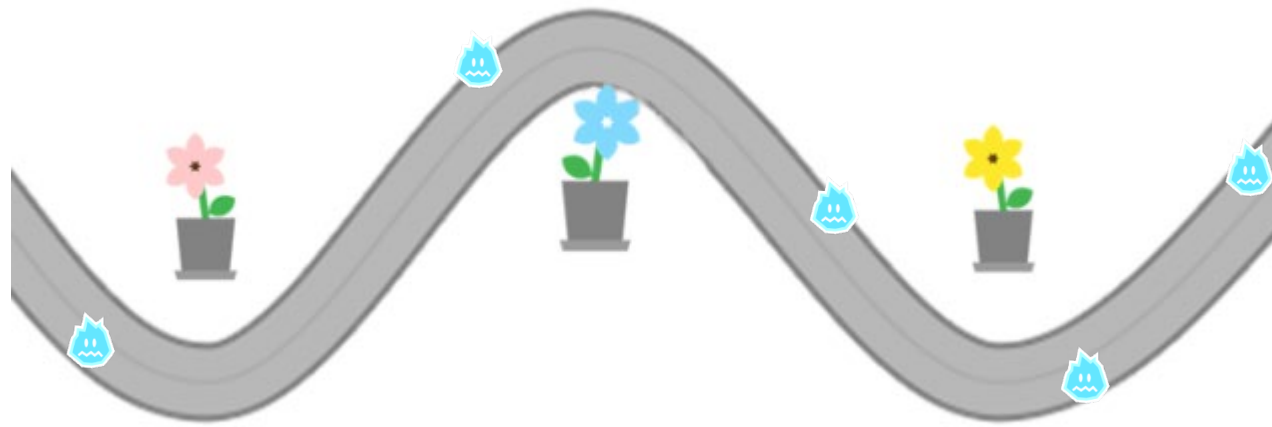
Track Items



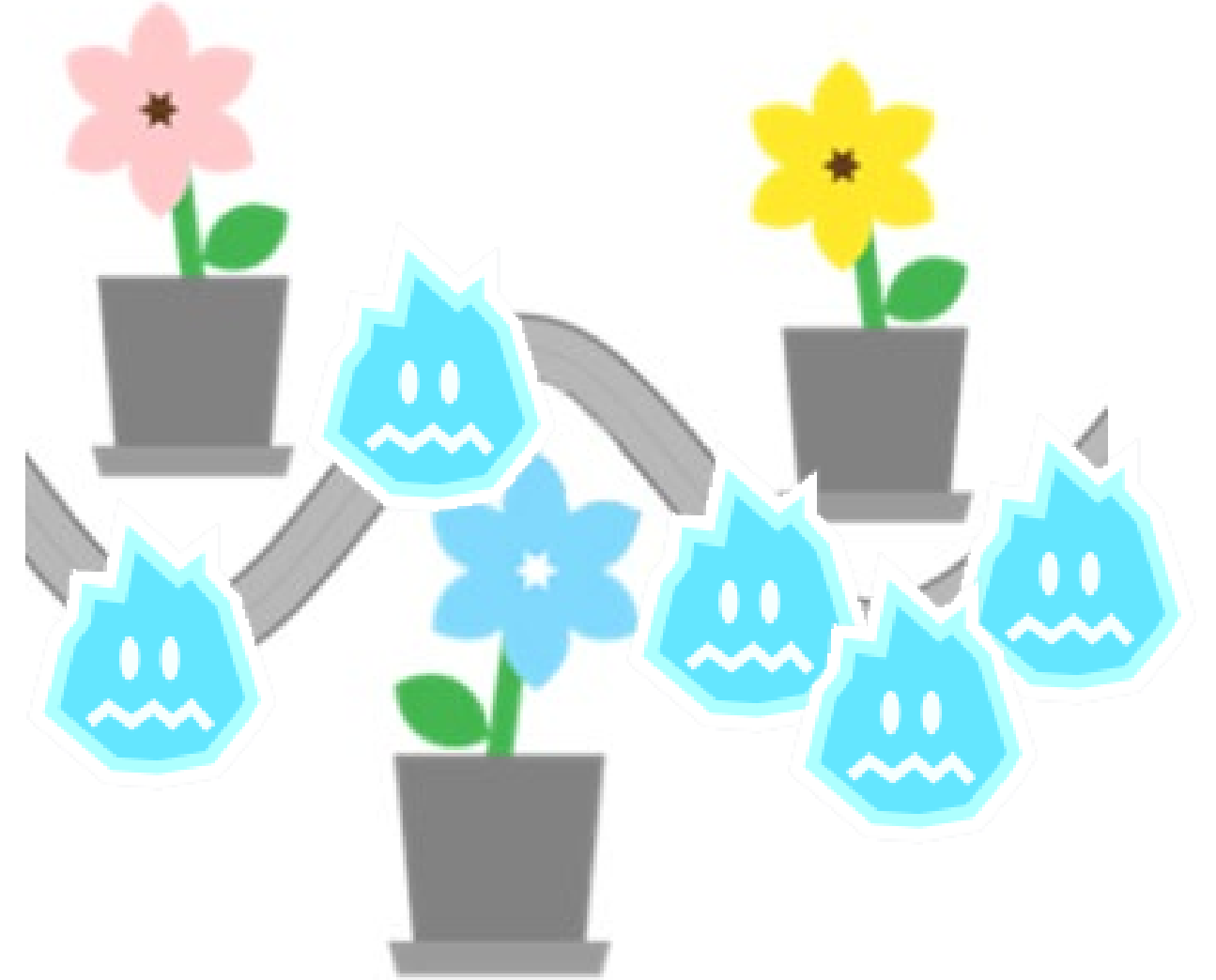
Safe Space



Fixed Quantity

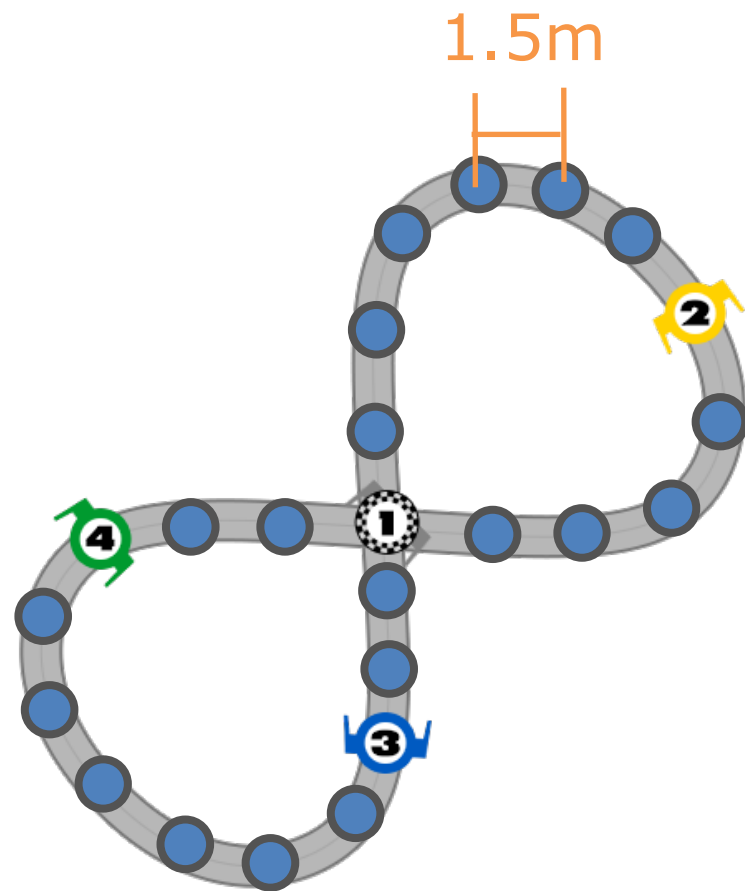


Large Track

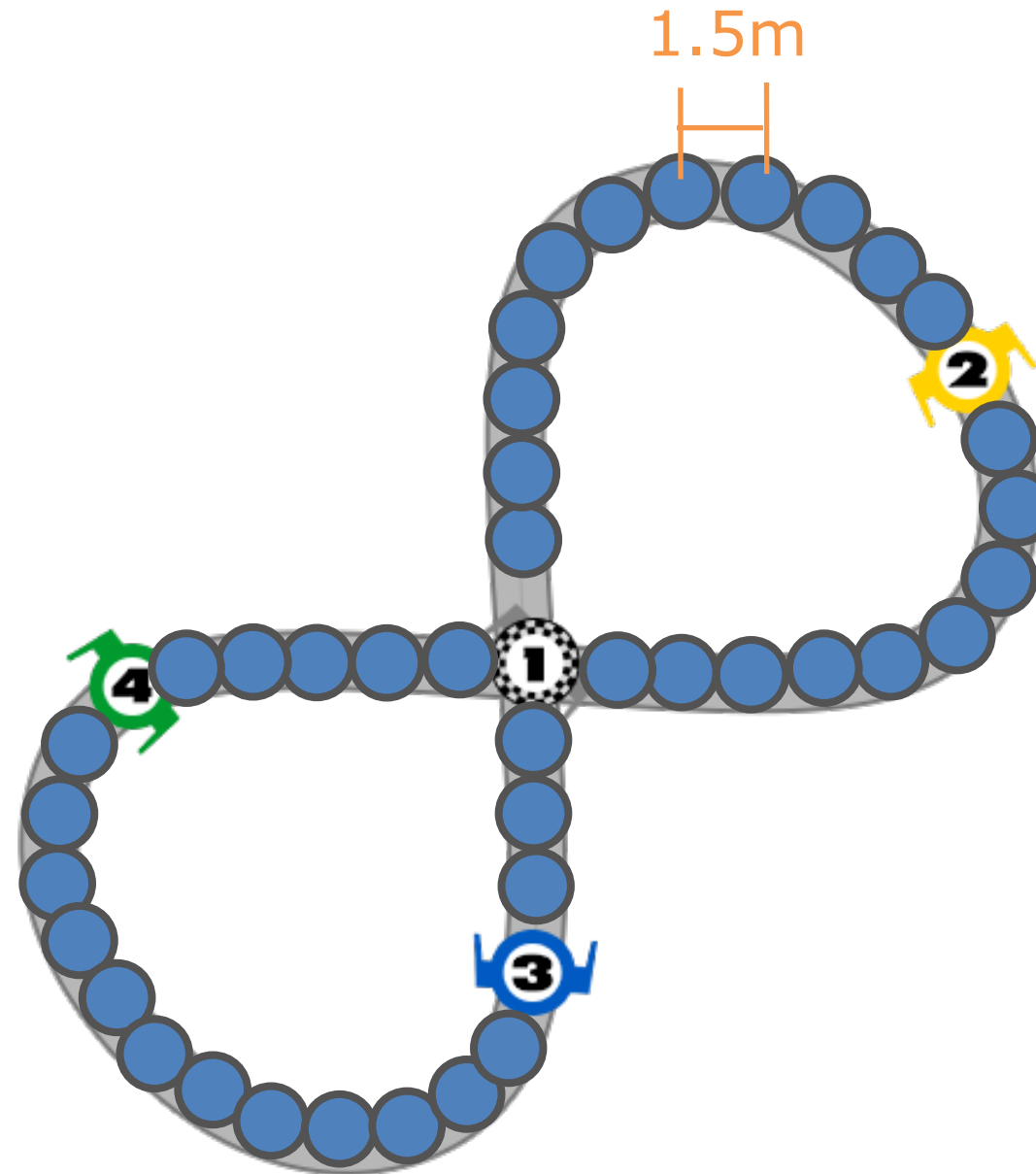


Small Track

Density Based



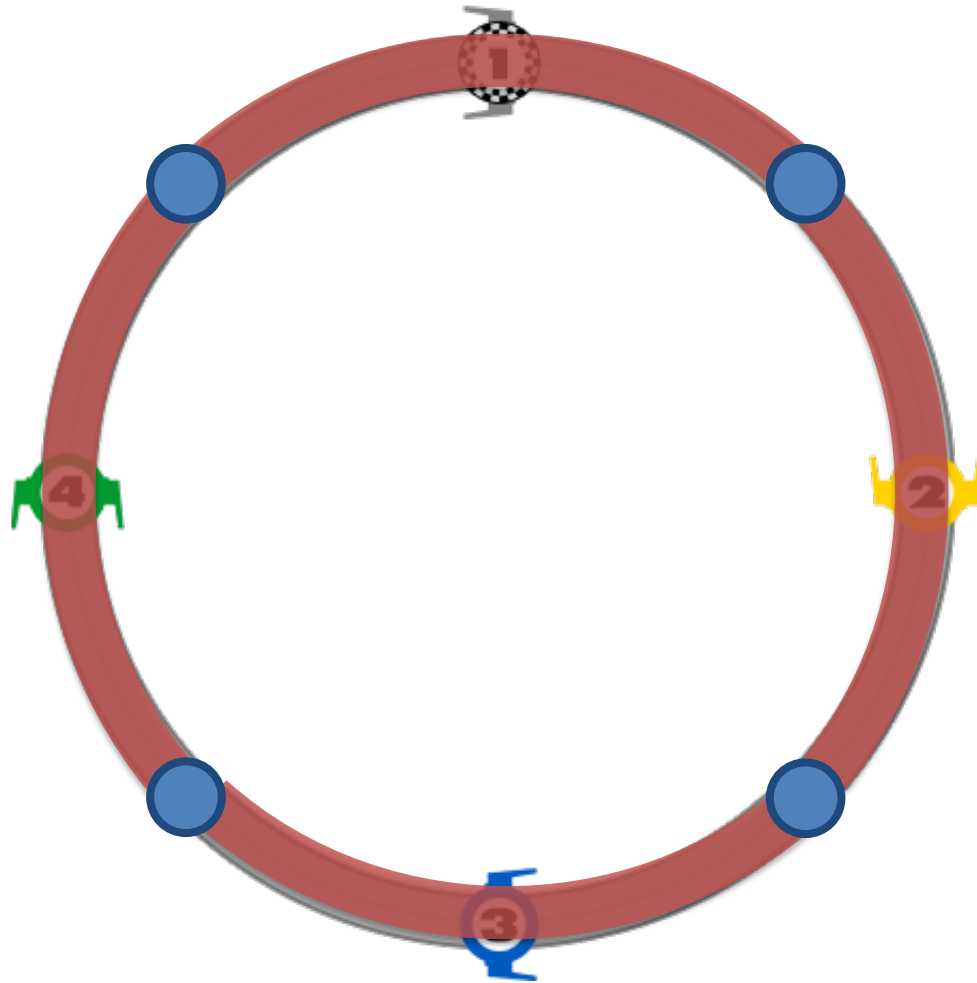
Average Size Track



Large Track

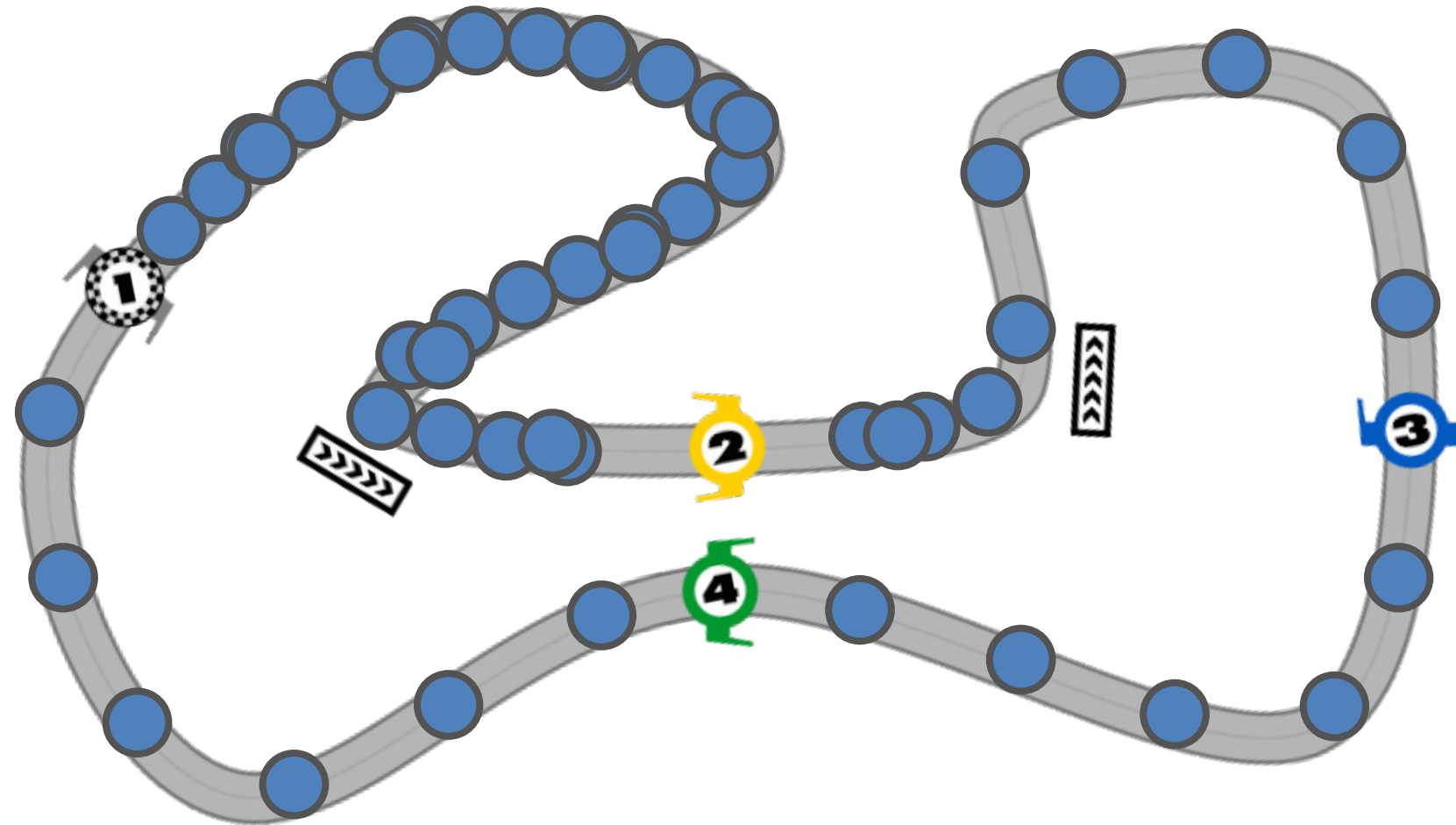
- Minimum distance from gate
- Minimum distance between items

Edge Cases



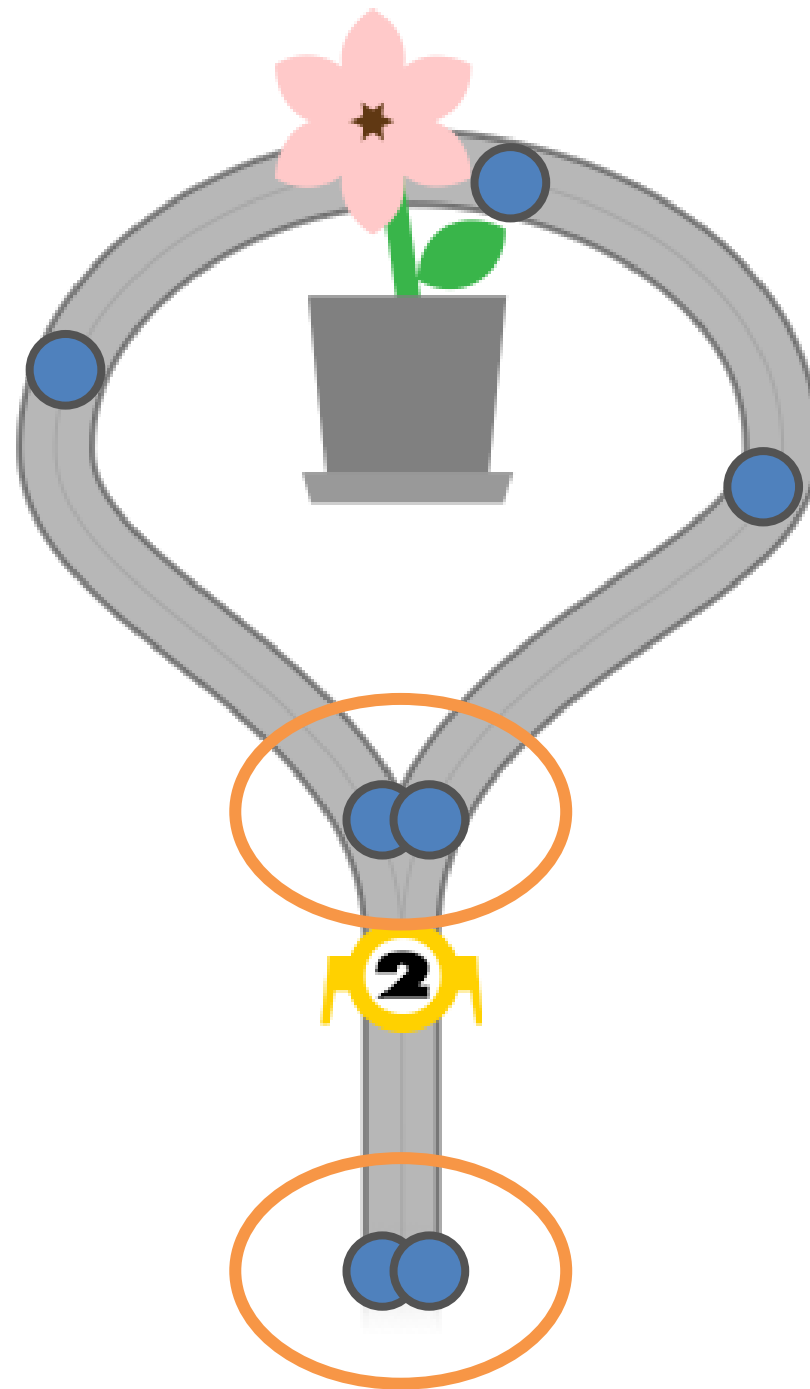
Tiny Track

Edge Cases



Very Large Track

Overlap





Final Thoughts



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Designing for Mixed Reality

- Ask yourself: Is the game stronger by being in the real world?
- Accept that you are no longer in total control.
- Leave time in the project to make it as robust as possible.
- Emphasize mechanics or features that bridge the real world to the physical and vice versa.

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www.velanstudios.com