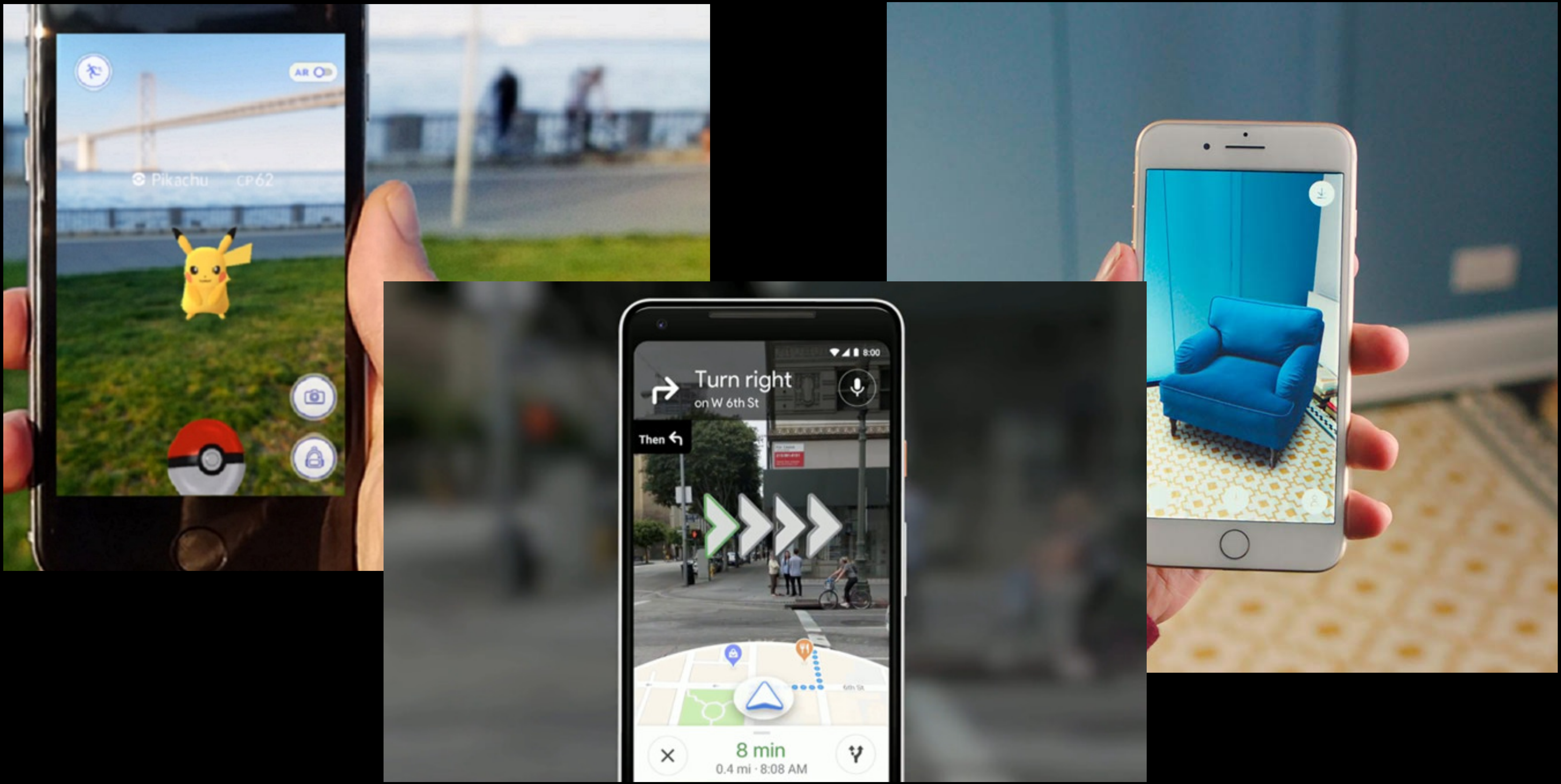
Location Based AR

(with React Native and friends)

Augmented reality (AR) apps are super cool!


AR
Pikachu CP62
8:00
Turn right
on W 6th St
Then
6th St
8 min
0.4 mi · 8:08 AM

But a lot of augmented reality apps are contrived.

The most promising AR apps *are contextual.*

The most important context?

Your location.

It seems simple…

Your phone has a GPS receiver.

Your phone has a compass.

Math exists.

Do we even need an AR system?

Who am I?

Brandon Johnson
@brandon_mn on Twitter
https://brandon.mn

I am a **freelance software engineer** 👨🏼‍💻 who (mainly) builds **React Native apps** ⚛️, **AR experiences** 🌐 and the **systems** ✨ that power them.

I also run **JavaScriptMN**, **ServerlessMN**, and help out with **Mpls Jr Devs.**

Let’s get coffee ☕ sometime!

What if we wanted to place a signpost over the Spoonbridge and Cherry?

Minneapolis Spoonbridge and Cherry
WALKER
LG

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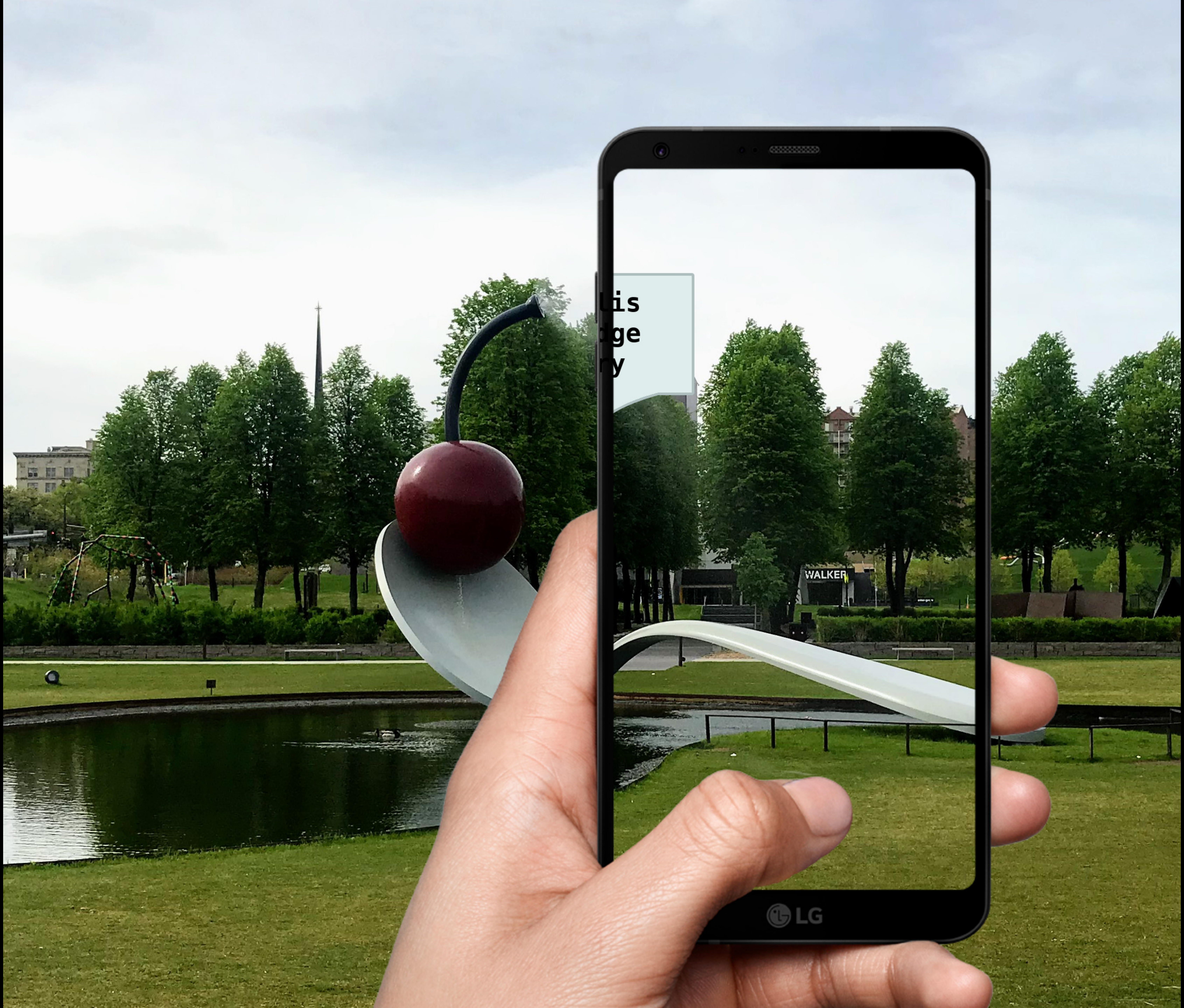
Minneapolis Spoonbridge and Cherry
WALKER
LG



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- The billboard should be located “at” the sculpture
- It should “face us” and follow us as we rotate
- It be “placed” so that you can tell what it is

it me!

A “head’s-up display”
isn’t good enough.

And on the web, right now, that’s the best we can do.

How do we add *depth*?

How can we *smooth over* bad location and heading data?

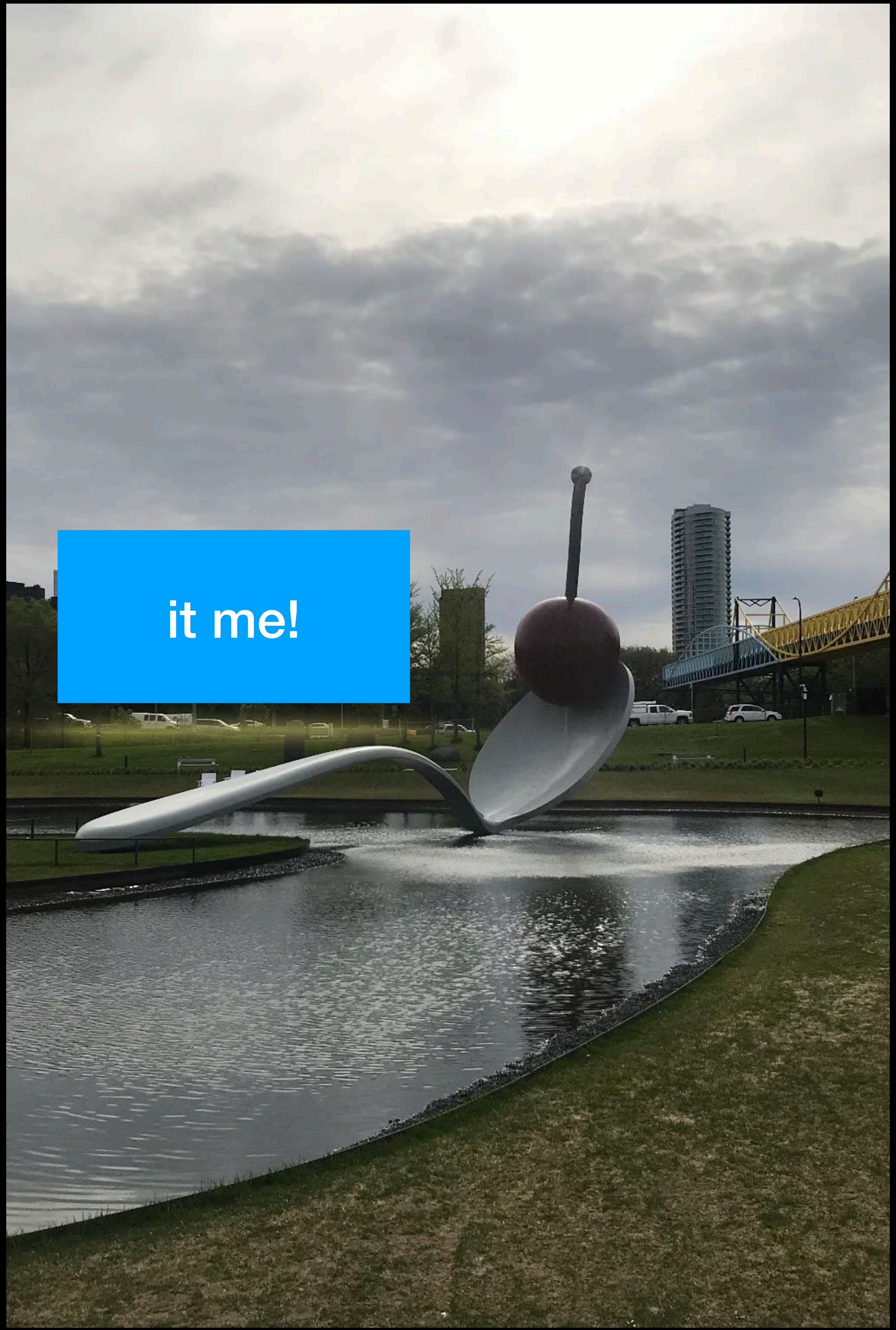
visual inertial odometry

ARKit and ARCore

- Your device’s *visual inertial odometry* implementation
- Uses accelerometers to measure the phone’s movement in your hand
- Uses the camera image + some fancy math (+ lasers, if you’re lucky enough to have lasers) to detect surfaces
- No matter which framework you use, ARKit and ARCore are used under-the-hood

it me!

it me!



it me!

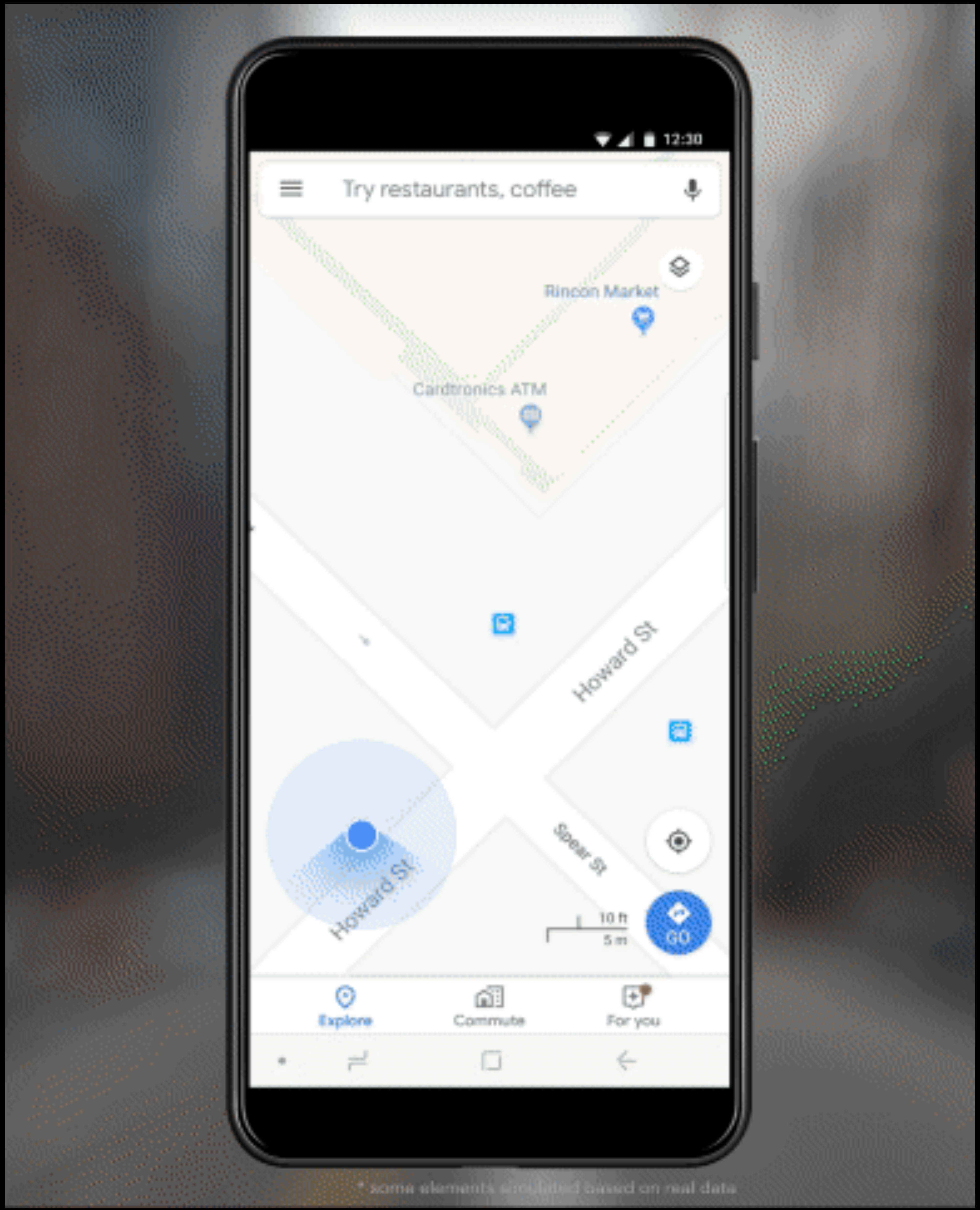
It seems simple…

Your phone has a GPS receiver.

Your phone has a compass.

Math exists.

But Location Based AR is still extremely difficult to get right.


12:30
Try restaurants, coffee
Rincon Market
Cardtronics ATM
Howard St
Howard St
Spear St
10 ft
5 m
GO
Explore
Commute
For you
* some elements simulated based on real data

WHAT GOOGLE’S DOING

- Smoothing over inconsistent GPS and compass readings is a hard problem
- Google’s masking the calibration process with a cool AR experience
- The rest of us don’t have access to the same tools, because we’re not masssive companies
- But we’ve got our own tricks up our sleeves!

CHOOSE YOUR FIGHTER:

- **Game Engines:**
  Unity, Unreal (both cross-platform)

- **Low-Level Graphics Libraries:**
  SceneKit (iOS), OpenGL for Android

- **Plugins for Hybrid Mobile Apps:**
  react-native-arkit
  Viro for React Native

Your 3D framework offers…

- A way to represent text, images, or objects in 3D
- A way to place things at an `(x, y, z)` coordinate in space
- A way to rotate things on each axis

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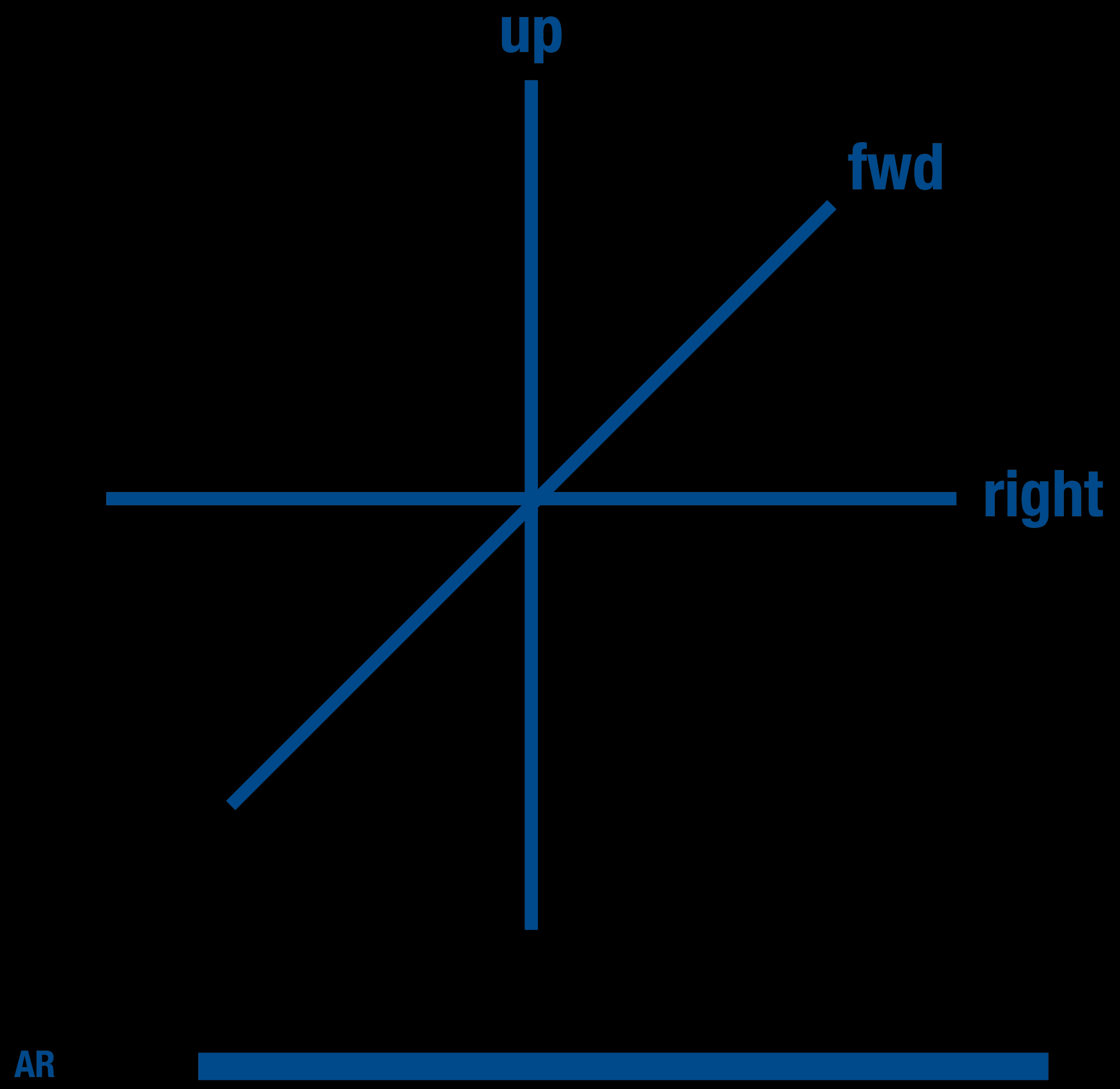

up
fwd
right
AR

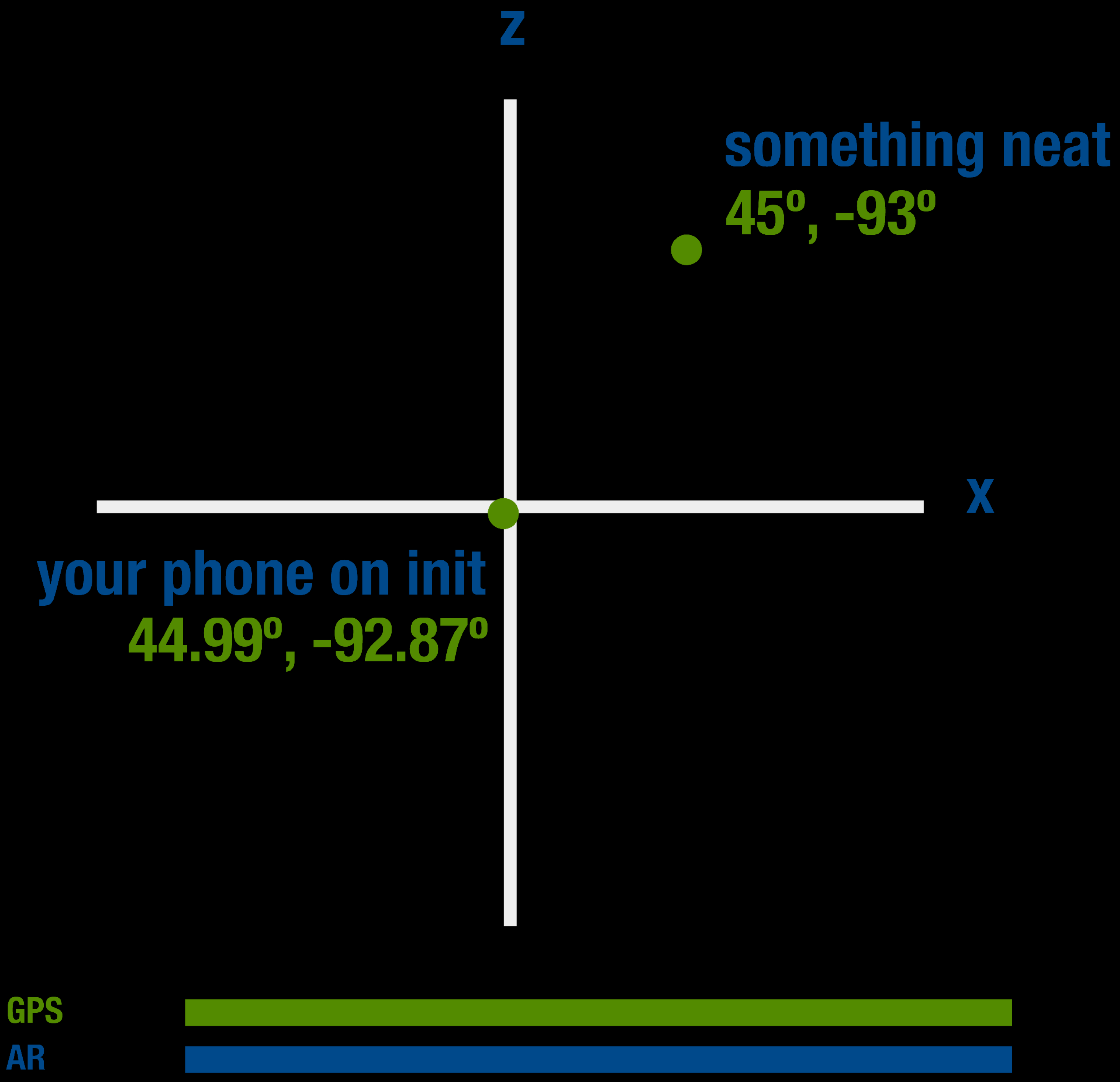
You’ll need to:

- **Get position data from your phone’s GPS receiver and find a way to use it in the 3D world**
- **Get compass heading data from your phone’s compass and find a way to use that to rotate the 3D world**
- **Determine when to listen to your phone’s GPS and compass, and when to listen to the AR system for position information**

Problems to Solve

Compass
GPS
AR

GPS: Where am I?



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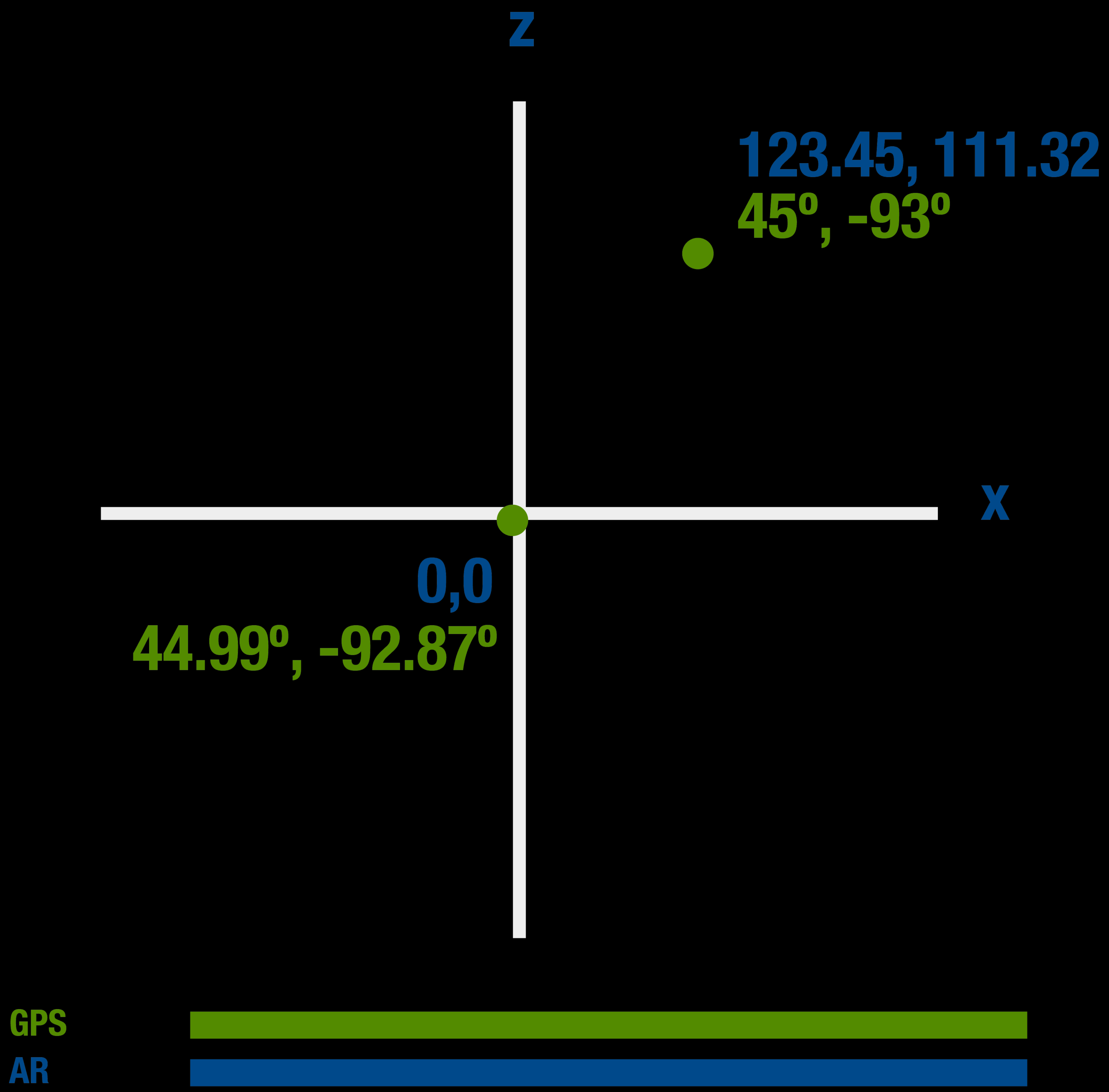


z

123.45, 111.32

45º, -93º

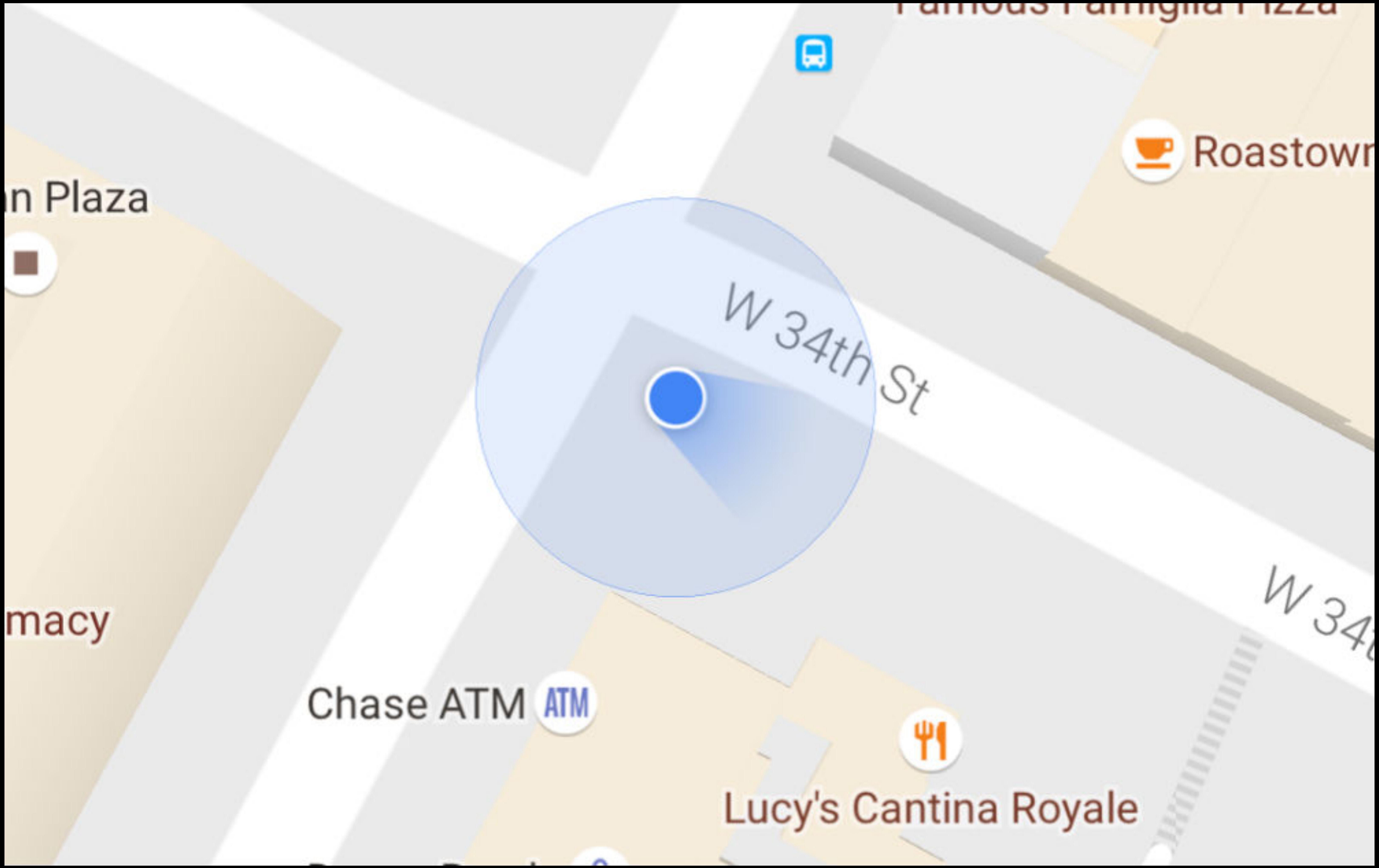
x

0,0

44.99º, -92.87º

GPS

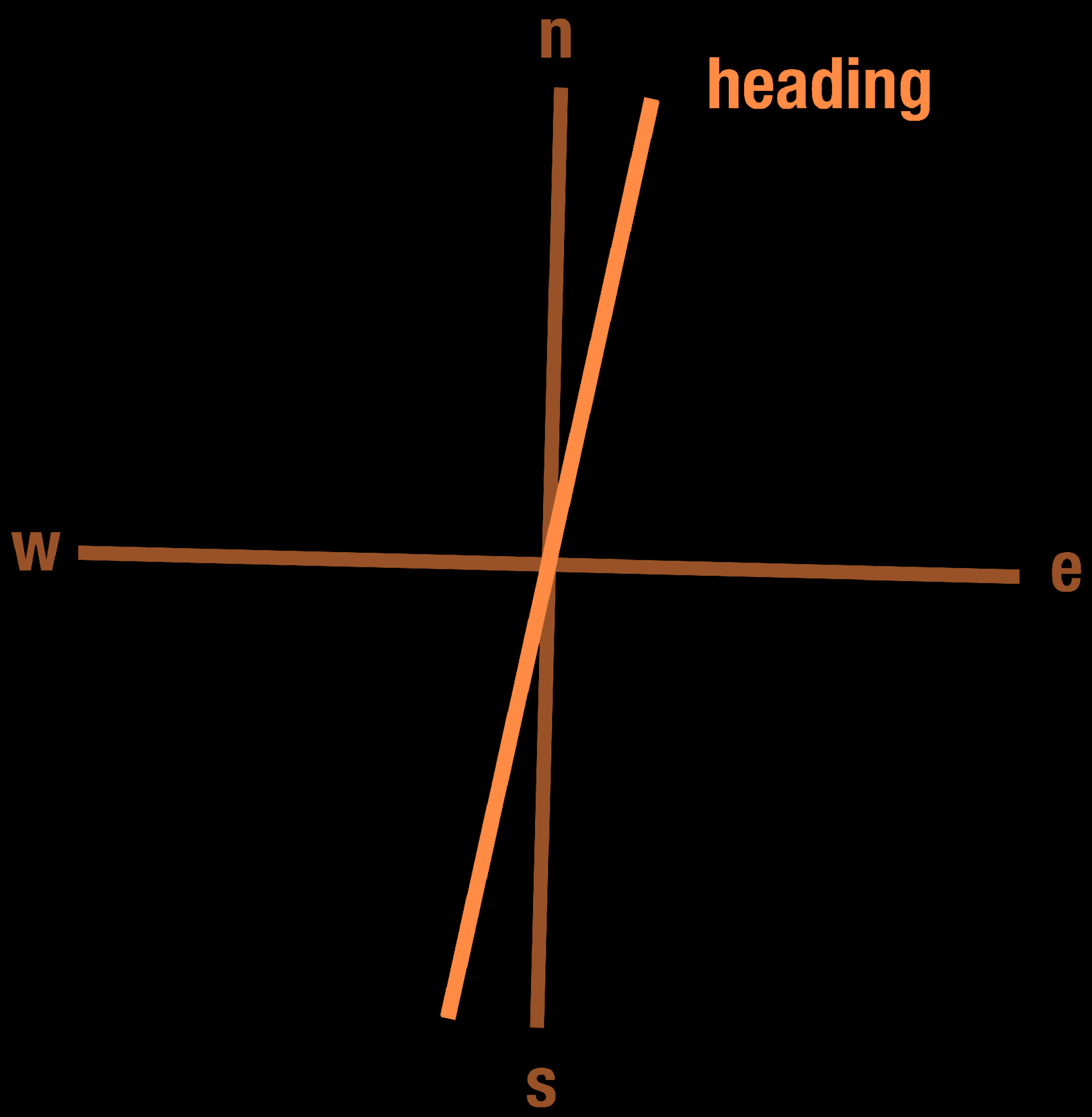
AR


Famous Famiglia Pizza
Roastown
n Plaza
W 34th St
macy
W 34t
Chase ATM
ATM
Lucy's Cantina Royale

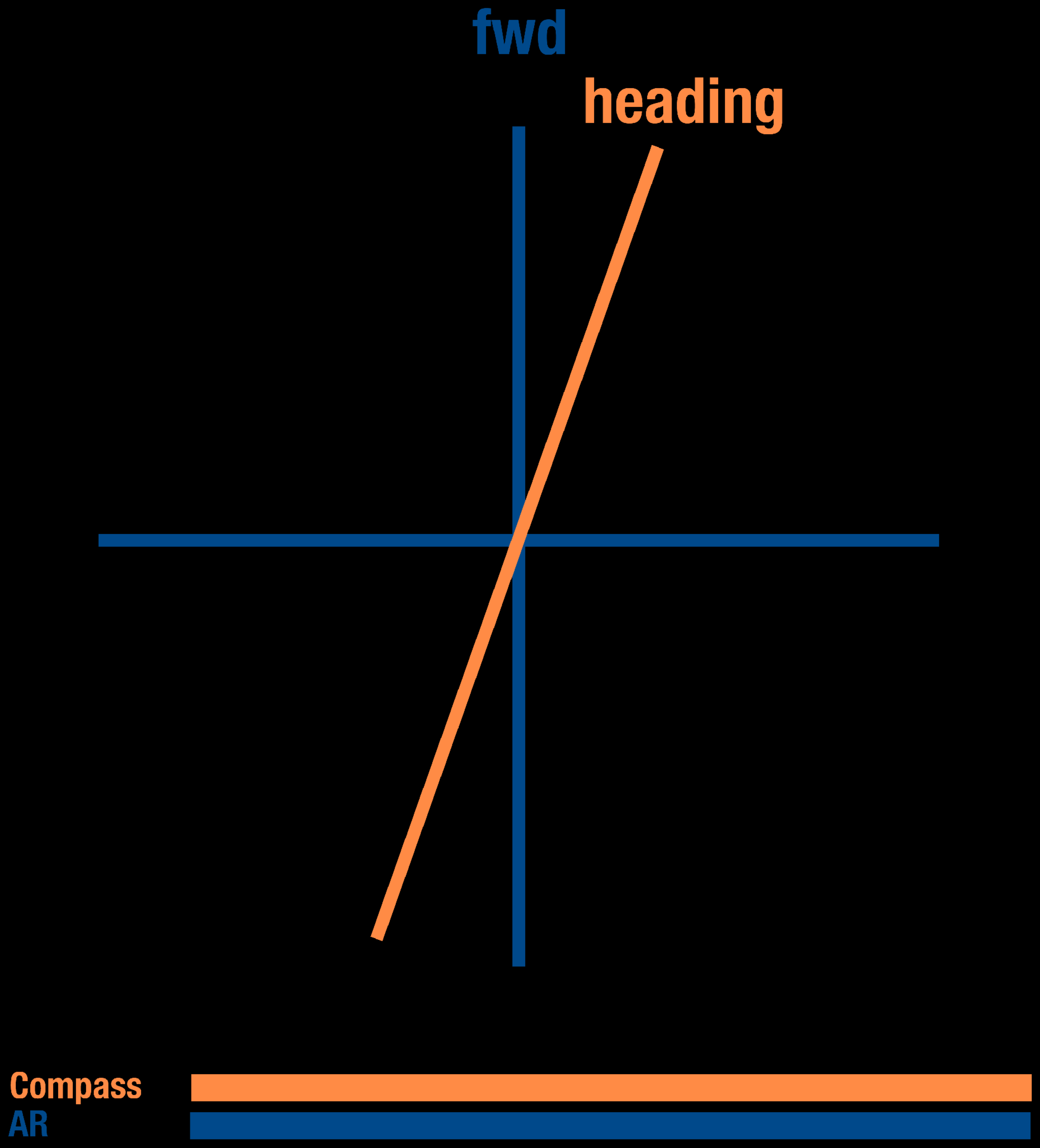
Decide what “good” GPS means for you.

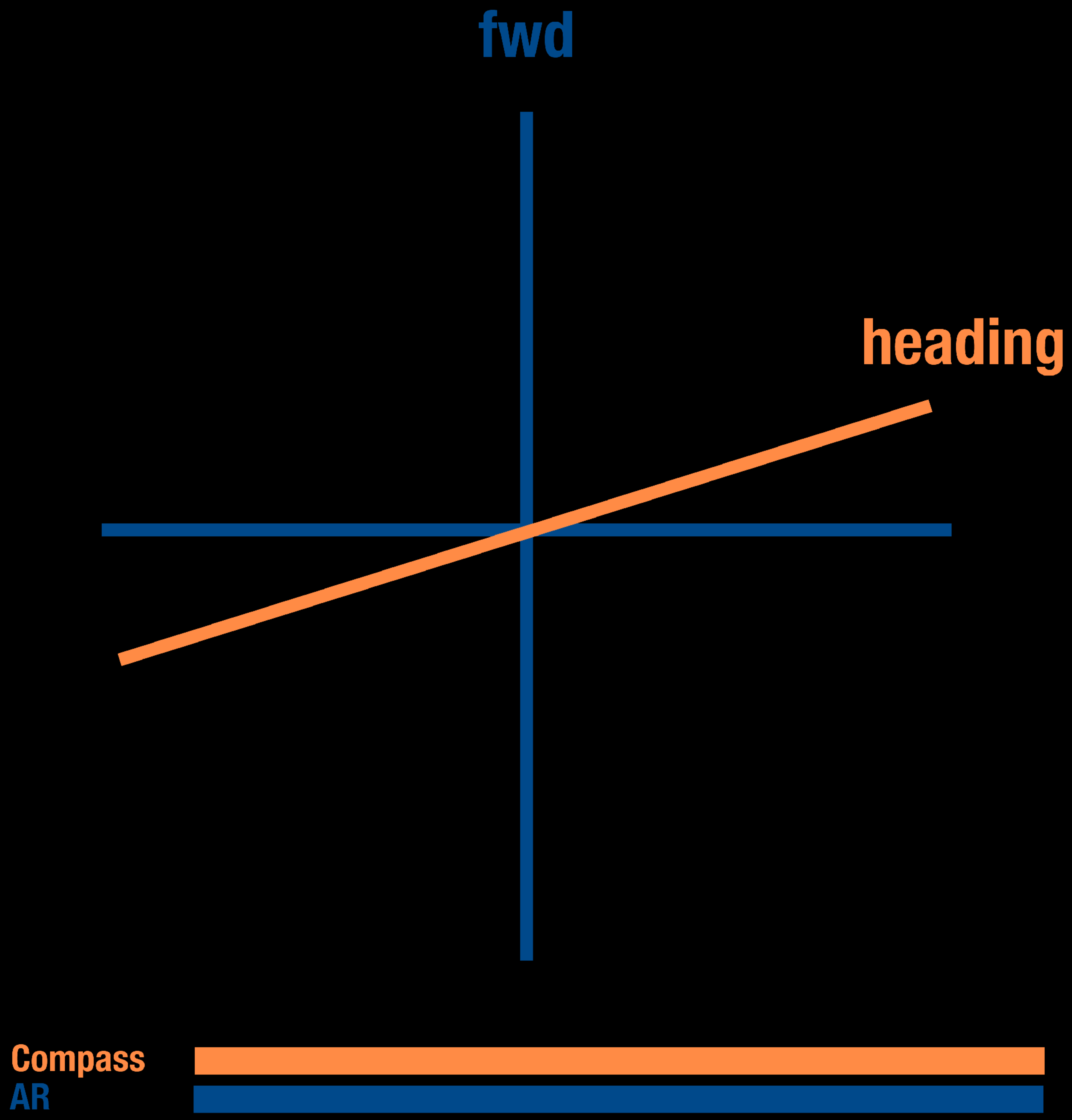
Compass: What am I looking at?

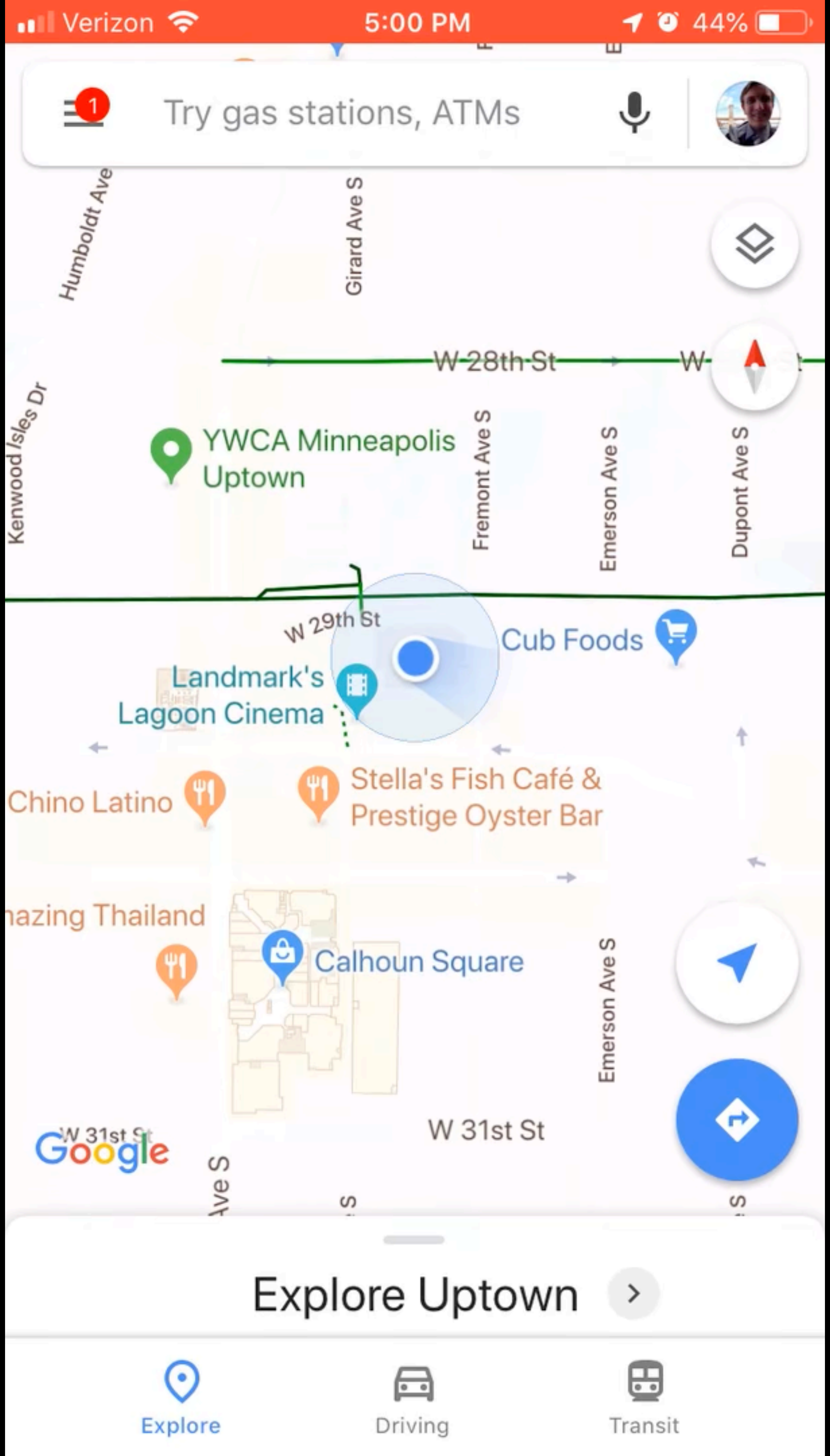
ARKit “solves” this with World Alignment: `GravityAndHeading`



Compass


fwd
heading
Compass
AR


fwd
heading
Compass
AR



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GravityAndHeading only takes the first compass reading.

Your first compass reading will be *abysmal.*

But if you track heading yourself, you can do just fine.

Math: What does it mean?

You’ll find yourself relearning a lot of math from a long time ago.

(and you might actually really enjoy it!)

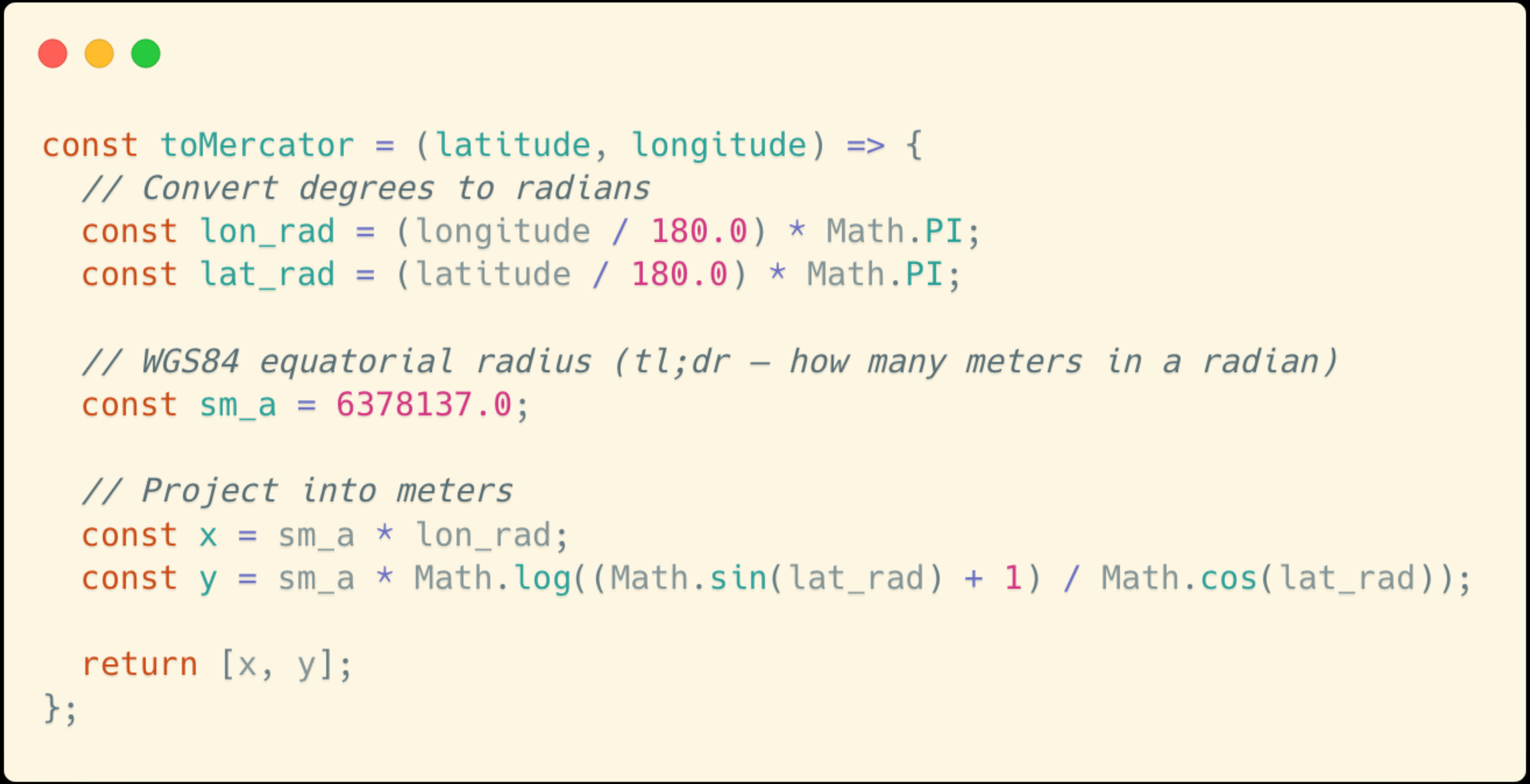
Position

latitude, longitude ⇒ x, y

RESEARCH FLAT EARTH (w/ mercator projection)

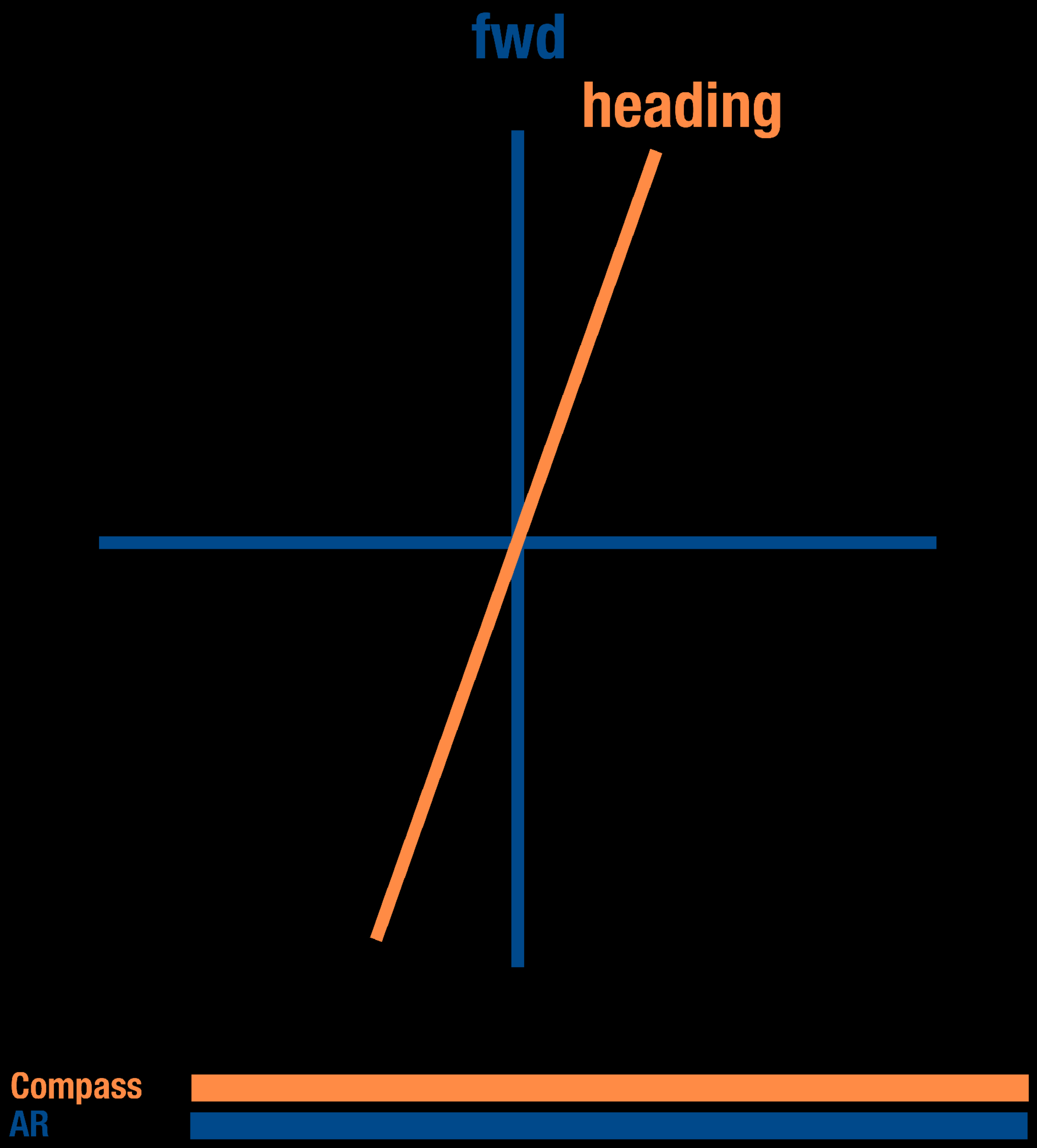
Grafonaut
youtu.be/CPQZ7NcQ6YQ
/u/aloofloofah

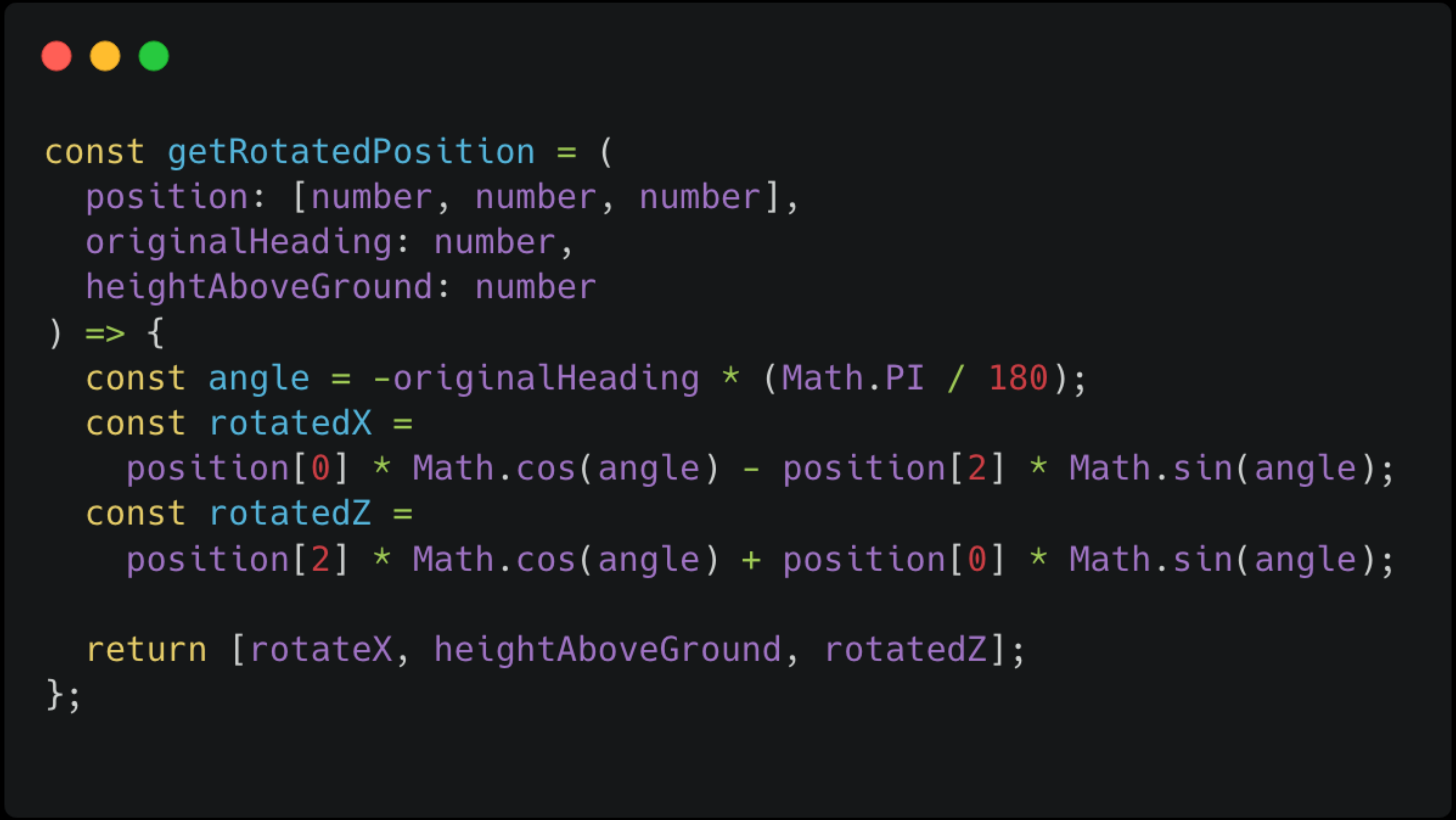
```
yarn add mercator?
```



```
const toMercator = (latitude, longitude) => {
  // Convert degrees to radians
  const lon_rad = (longitude / 180.0) * Math.PI;
  const lat_rad = (latitude / 180.0) * Math.PI;

  // WGS84 equatorial radius (tl;dr – how many meters in a radian)
  const sm_a = 6378137.0;

  // Project into meters
  const x = sm_a * lon_rad;
  const y = sm_a * Math.log((Math.sin(lat_rad) + 1) / Math.cos(lat_rad));

  return [x, y];
};
```

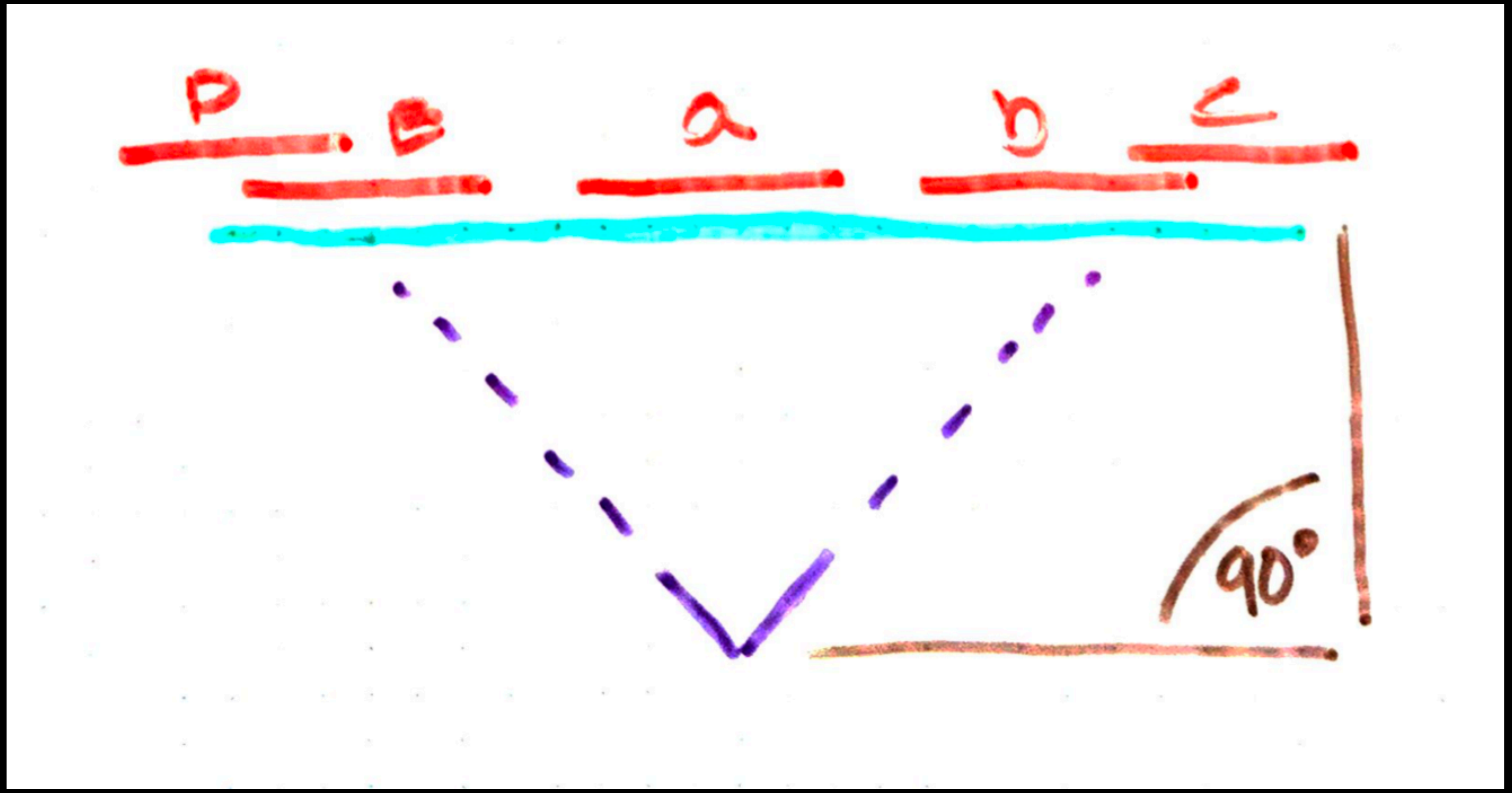
Orientation

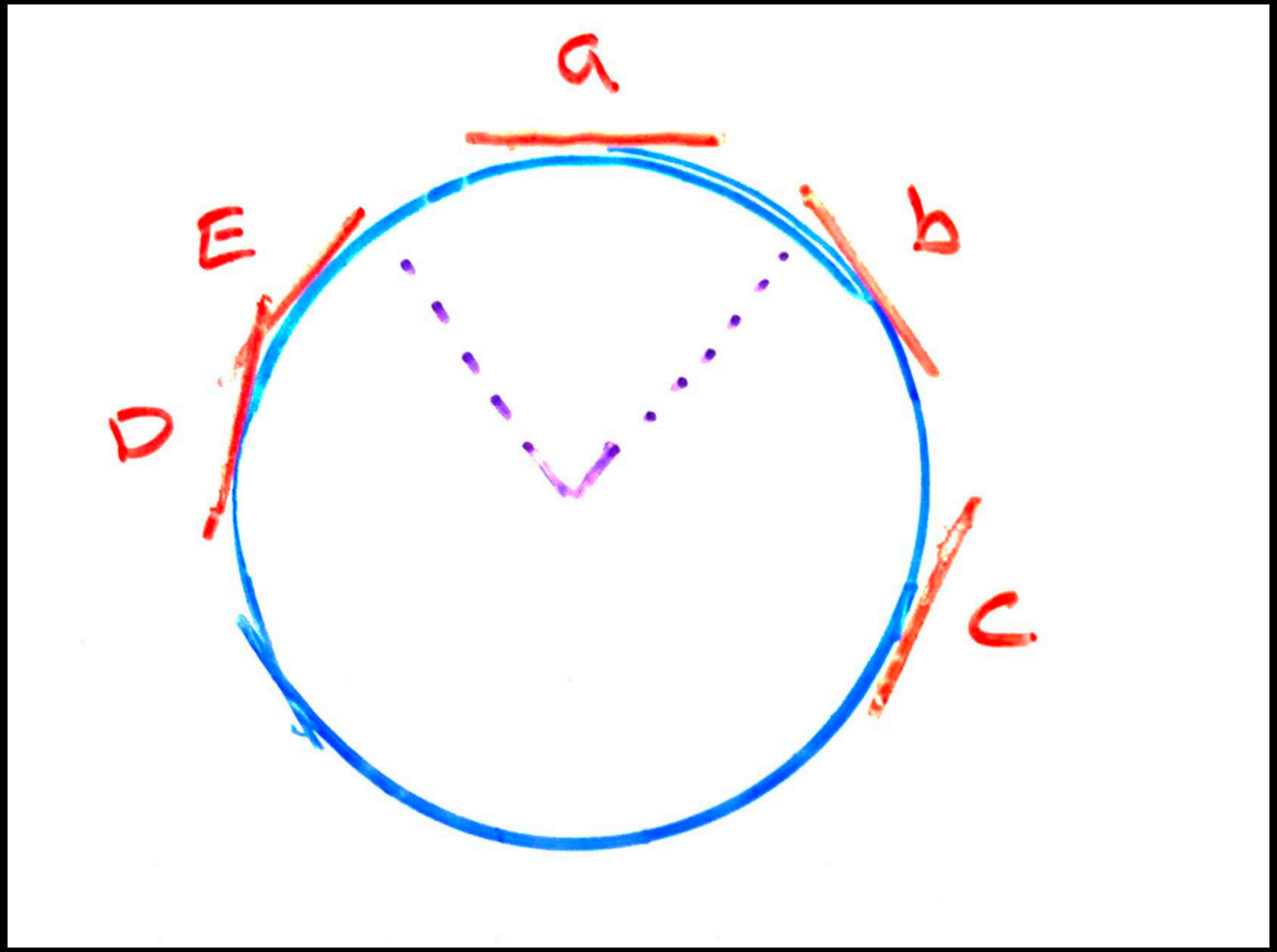

fwd
heading
Compass
AR



```
const getRotatedPosition = (
  position: [number, number, number],
  originalHeading: number,
  heightAboveGround: number
) => {
  const angle = -originalHeading * (Math.PI / 180);
  const rotatedX =
    position[0] * Math.cos(angle) - position[2] * Math.sin(angle);
  const rotatedZ =
    position[2] * Math.cos(angle) + position[0] * Math.sin(angle);

  return [rotateX, heightAboveGround, rotatedZ];
};
```

Placement





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Can you read it?
Do objects overlap?
Where is it facing?

Next Steps

- Viro Media: viromedia.com
- Snap Lens Studio: lensstudio.snapchat.com
- 6d.ai: 6d.ai
- Three.js: threejs.com

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