Improving user experience with Apple Pencil

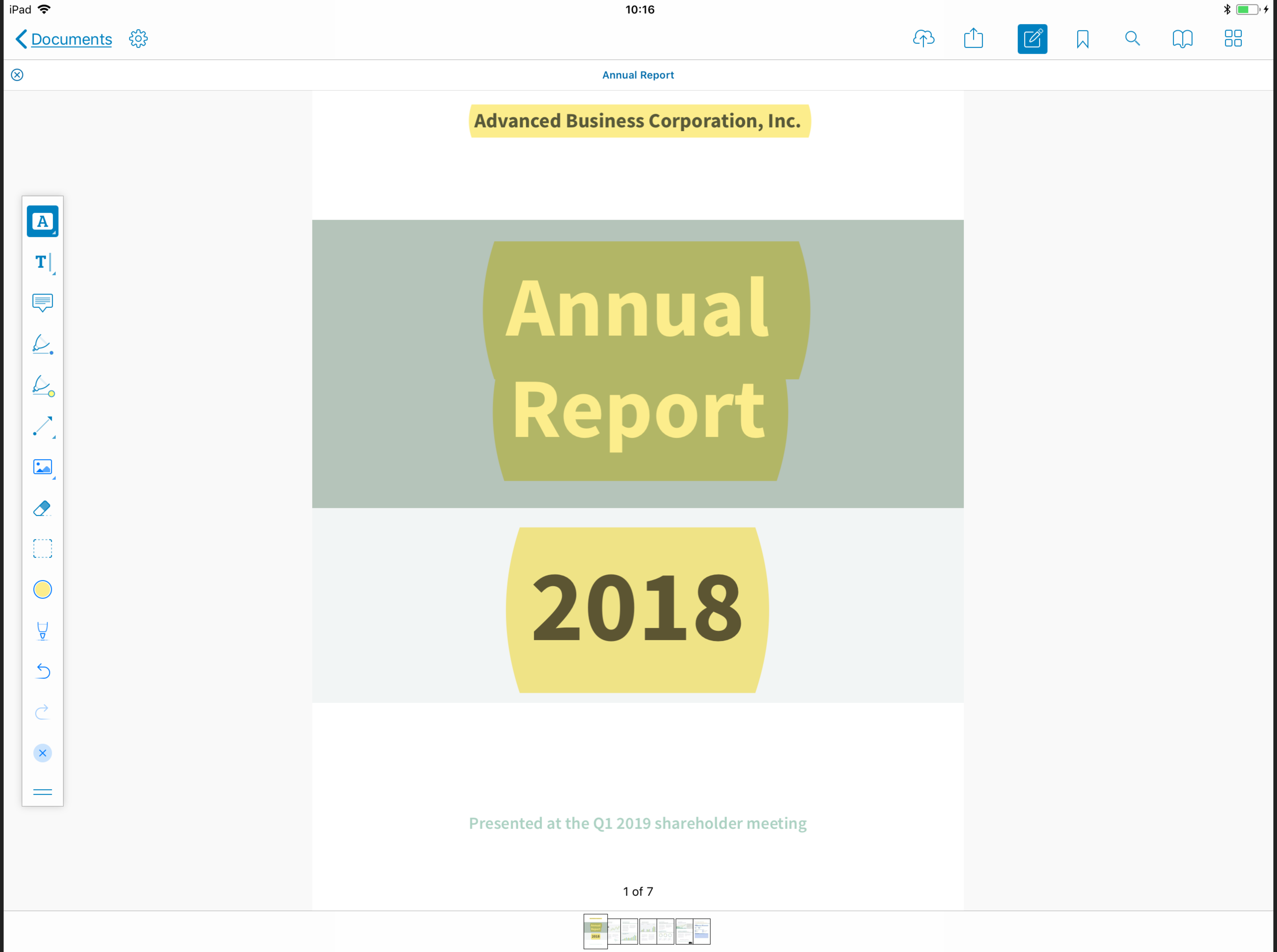
Douglas Hill, June 2018

@qdoug

I can't draw!

PSPDFKit

PDF Viewer



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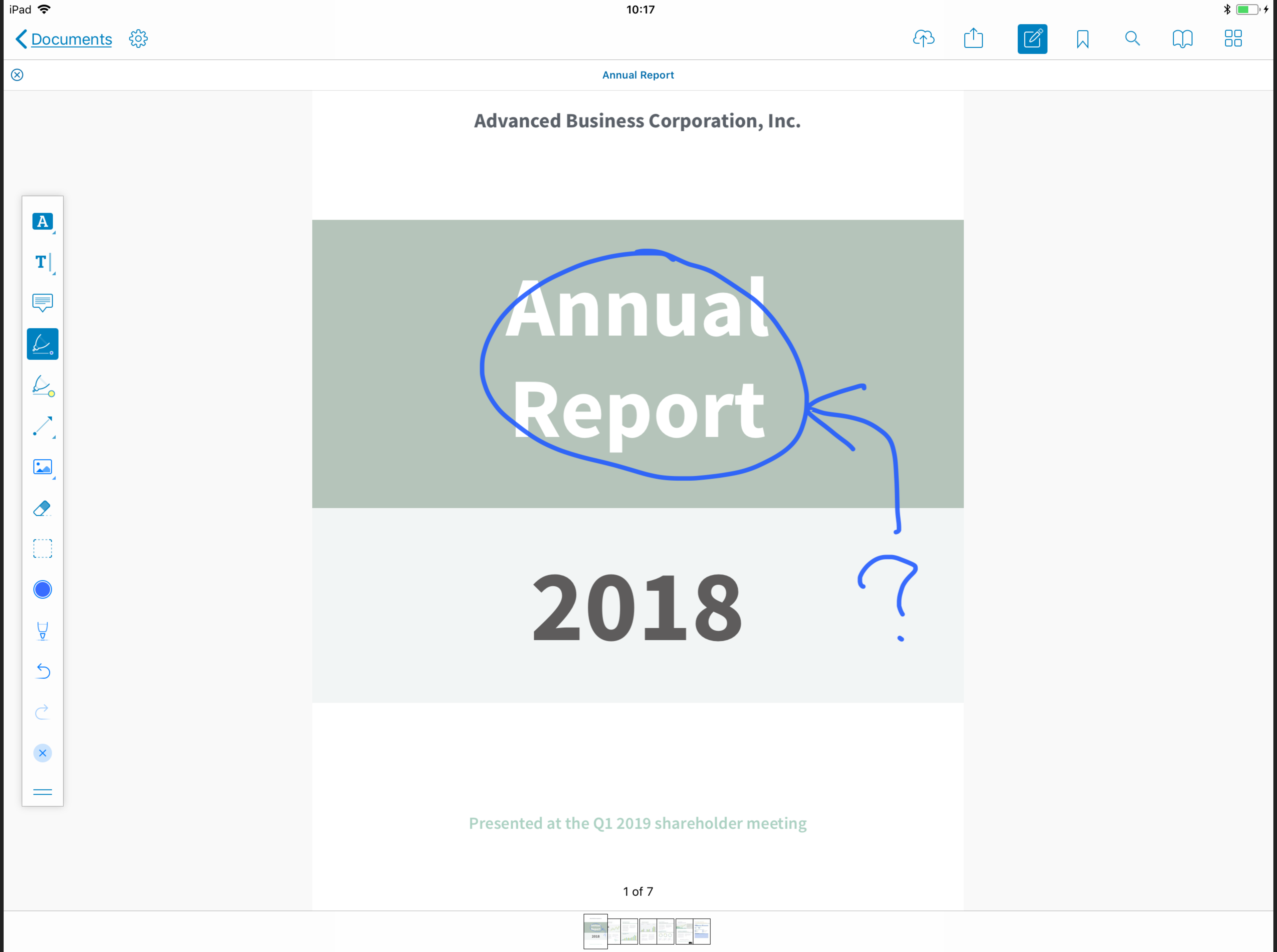
Annual Report

2018

Presented at the Q1 2019 shareholder meeting

1 of 7



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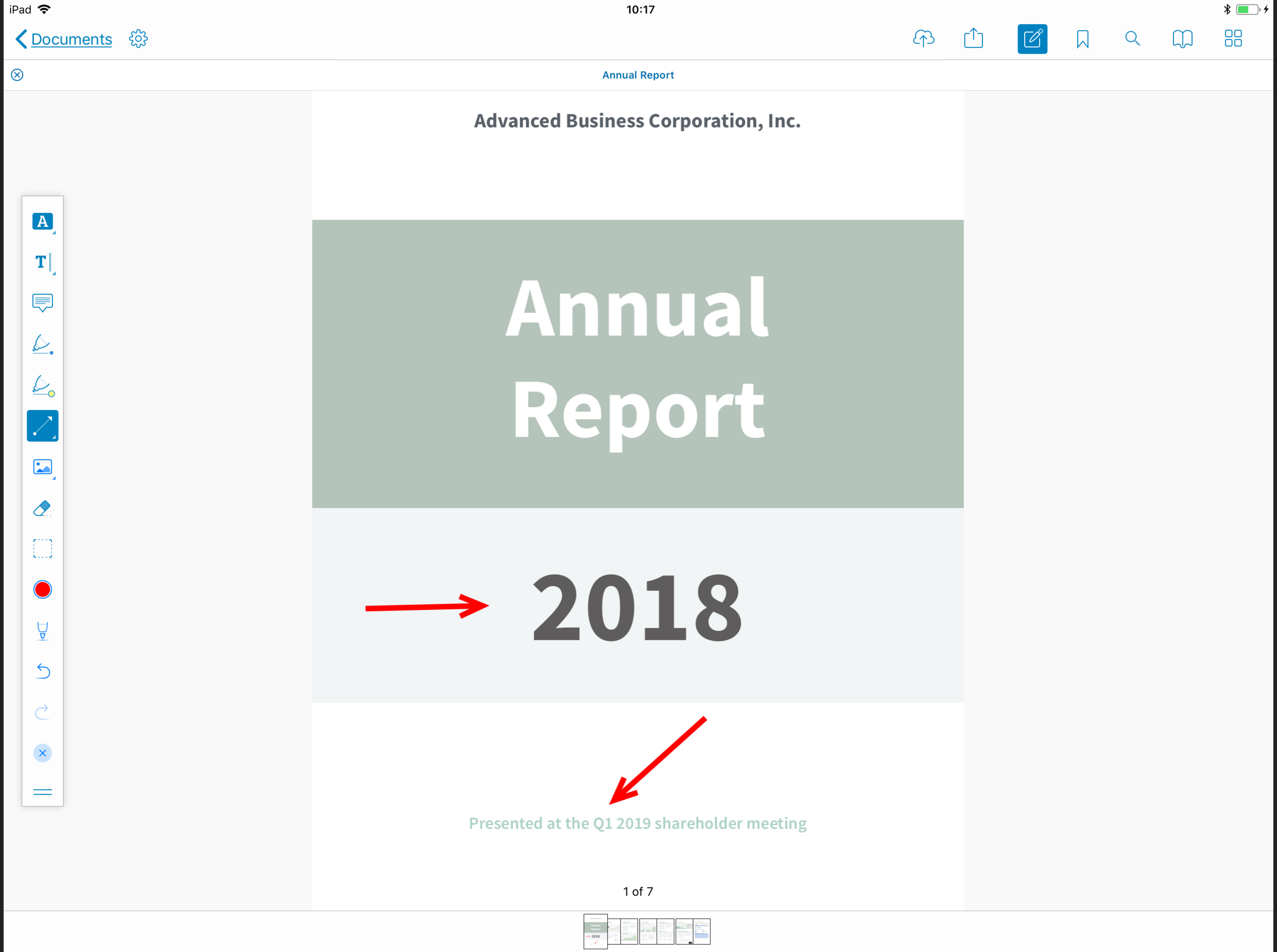

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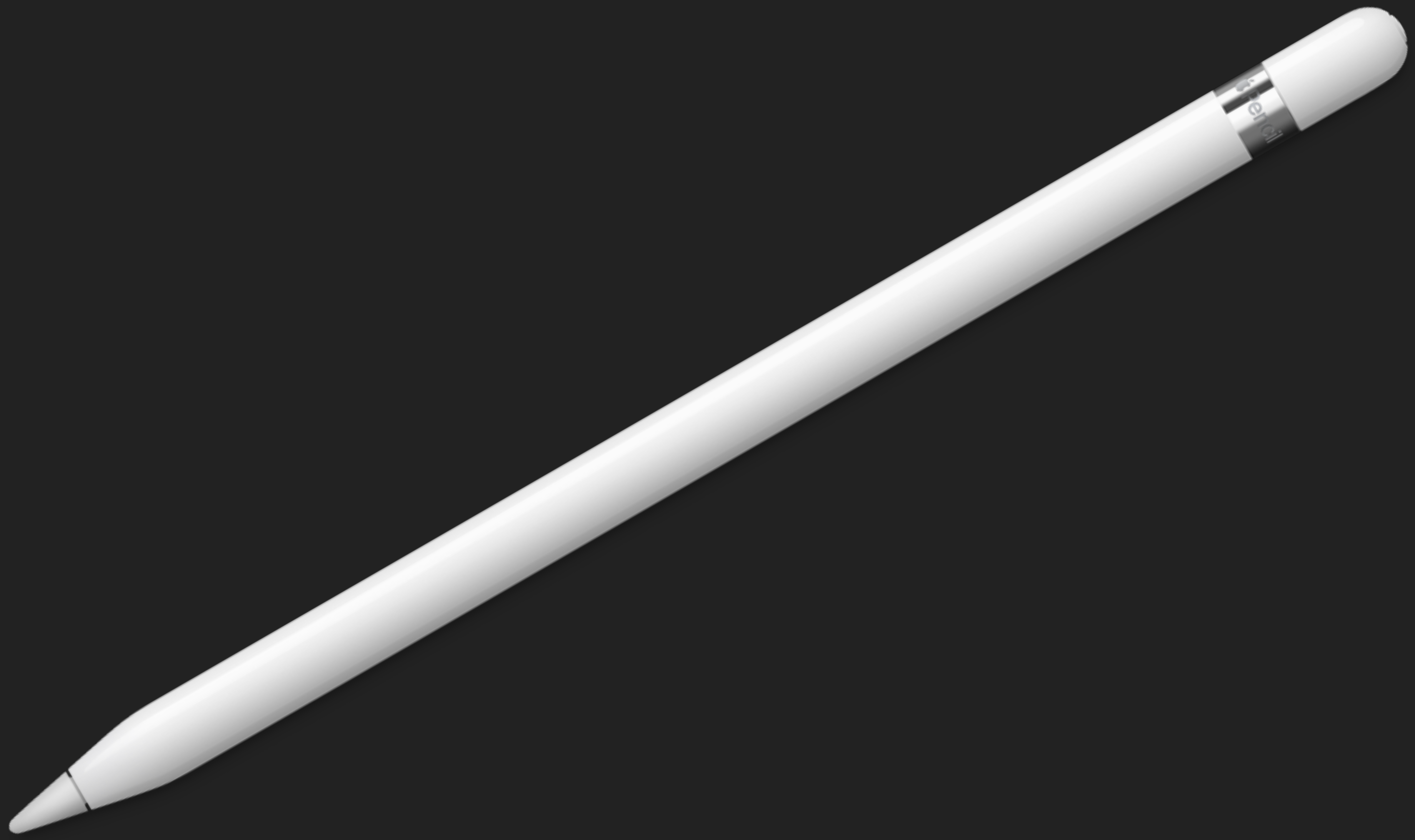
Design

API

Performance


Pencil

iPad Air

iPad Mini 2

iPad Air 2

iPad Mini 3

iPad Mini 4

✓ iPad Pro 12.9-inch (1st gen)

✓ iPad Pro 9.7-inch

iPad (2017)

✓ iPad Pro 10.5-inch

✓ iPad Pro 12.9-inch (2nd gen)

✓ iPad (2018) NEW

> “"If you see a stylus, they blew it”
>
> – Steve Jobs

gel pen

piece of chalk

eraser

quill

paint marker

highlighter

marker

charcoal stick

ballpoint pen

note-taker

shader

paintbrush

grease pencil

retoucher

crayon

scalpel

selector

bristle fan brush

spray can

fountain pen

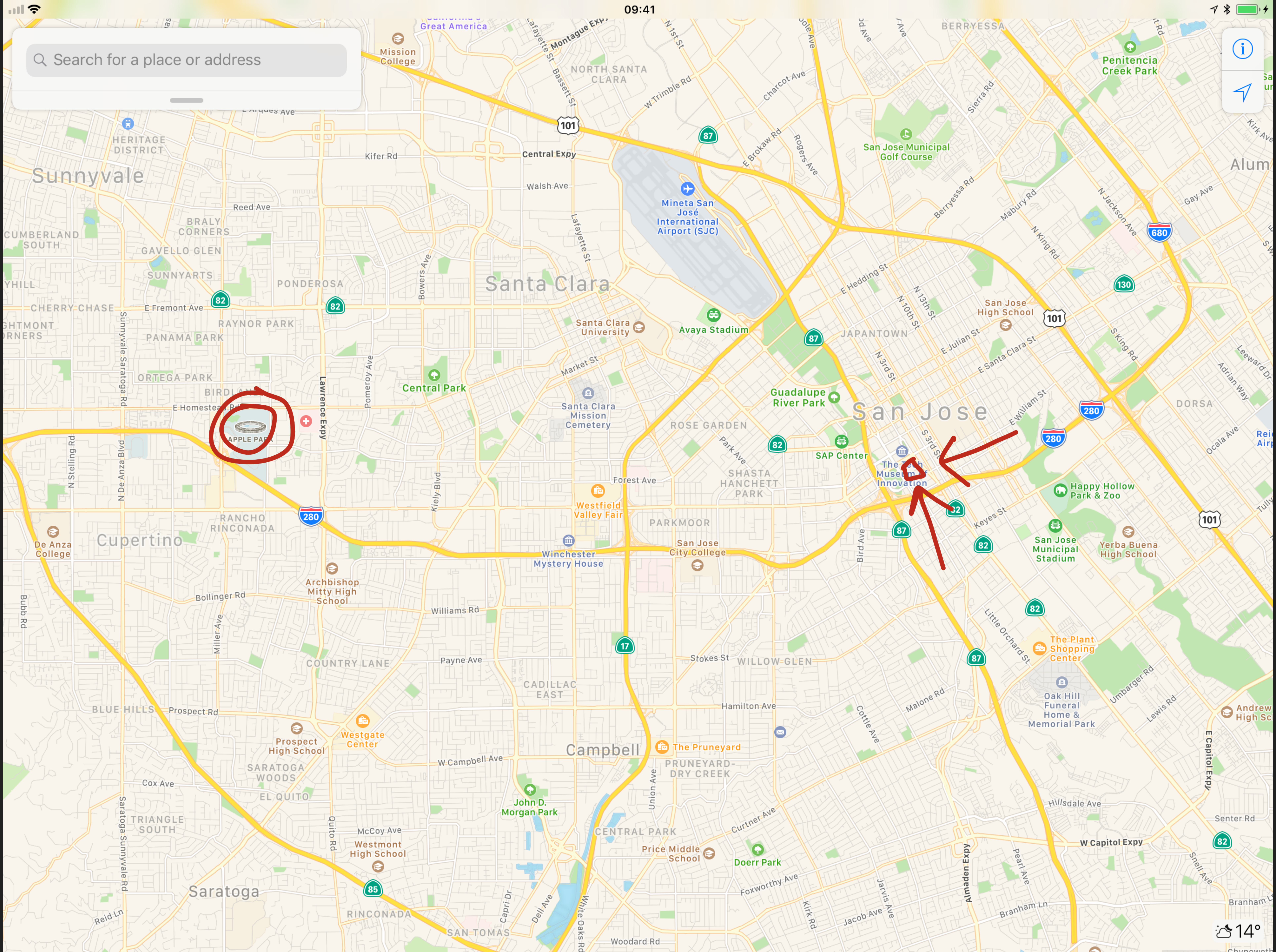
magic wand

“I actually think it’s very clear the Pencil is for making marks, and the finger is a fundamental point of interface for everything within the operating system.”

– Jonathan Ive

> “I actually think it’s very clear the Pencil is for making marks, and the finger is a fundamental point of interface for everything within the operating system.”
>
> – Jonathan Ive

Drawing

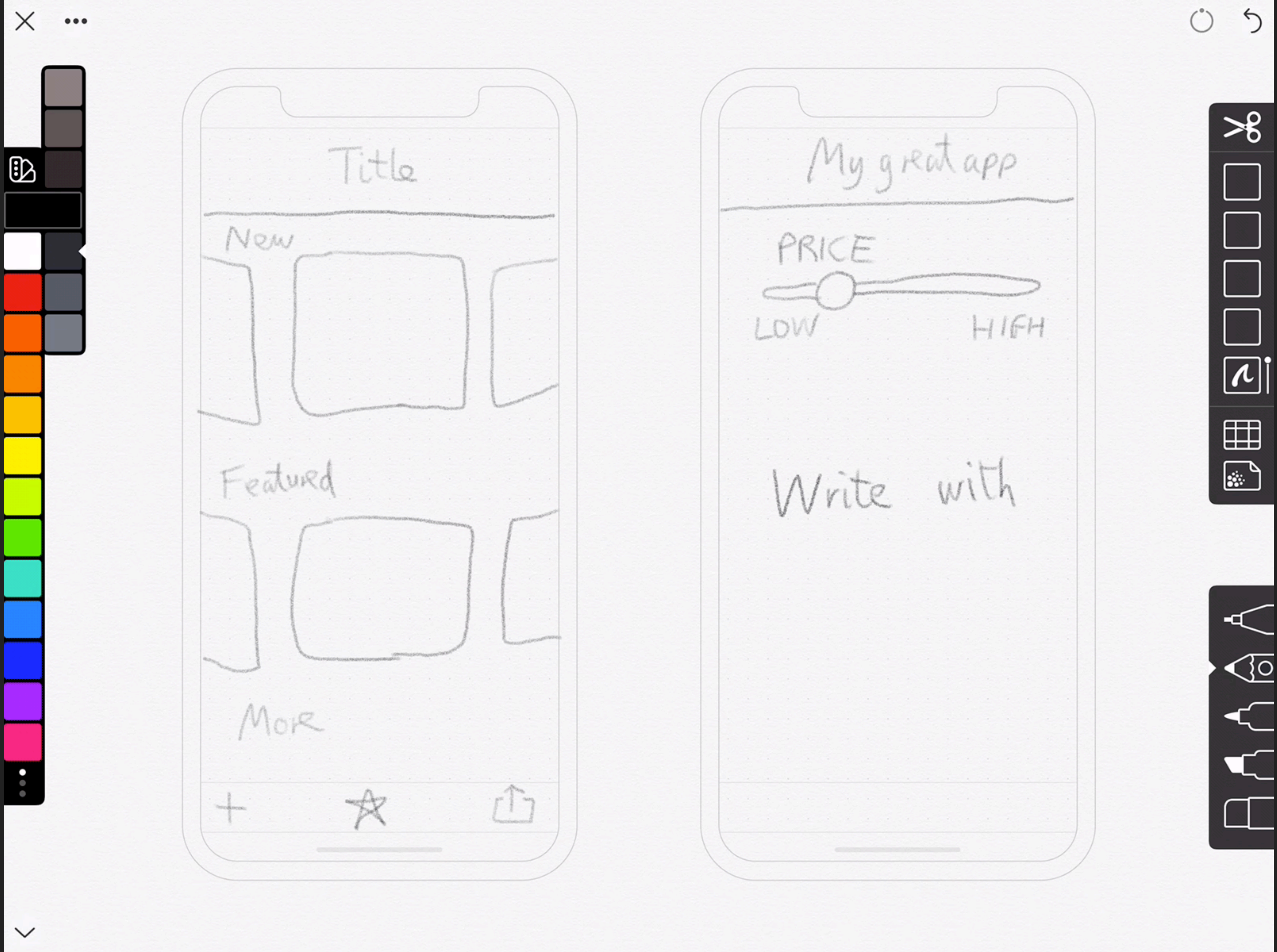

09:41
Search for a place or address
14°
Sunnyvale
Santa Clara
San Jose
Cupertino
Campbell
Saratoga
Alum
Mission College
Great America
NORTH SANTA CLARA
BERRYESSA
Penitencia Creek Park
HERITAGE DISTRICT
Kifer Rd
Central Expy
Walsh Ave
Reed Ave
Mineta San José International Airport (SJC)
San Jose Municipal Golf Course
BRALY CORNERS
GAVELLO GLEN
SUNNYARTS
CUMBERLAND SOUTH
PONDEROSA
CHERRY CHASE
E Fremont Ave
RAYNOR PARK
PANAMA PARK
ORTEGA PARK
E Homestead Rd
APPLE PARK
Lawrence Expy
Central Park
Santa Clara University
Avaya Stadium
JAPANTOWN
San Jose High School
Santa Clara Mission Cemetery
Guadalupe River Park
ROSE GARDEN
SAP Center
The Tech Museum of Innovation
SHASTA HANCHETT PARK
Happy Hollow Park & Zoo
DORSA
Forest Ave
Westfield Valley Fair
PARKMOOR
Winchester Mystery House
San Jose City College
San Jose Municipal Stadium
Yerba Buena High School
RANCHO RINCONADA
De Anza College
Archbishop Mitty High School
Bollinger Rd
Williams Rd
Payne Ave
COUNTRY LANE
CADILLAC EAST
Stokes St
WILLOW GLEN
Hamilton Ave
The Plant Shopping Center
Oak Hill Funeral Home & Memorial Park
BLUE HILLS
Prospect Rd
Prospect High School
Westgate Center
SARATOGA WOODS
Cox Ave
EL QUITO
W Campbell Ave
The Pruneyard
PRUNEYARD-DRY CREEK
John D. Morgan Park
TRIANGLE SOUTH
McCoy Ave
Westmont High School
CENTRAL PARK
Price Middle School
Doerr Park
Hillsdale Ave
W Capitol Expy
Almaden Expy
RINCONADA
SAN TOMAS
Woodard Rd
Branham Ln
101
87
82
280
680
130
17
85

Low latency

Highly precise

Captures subtlety

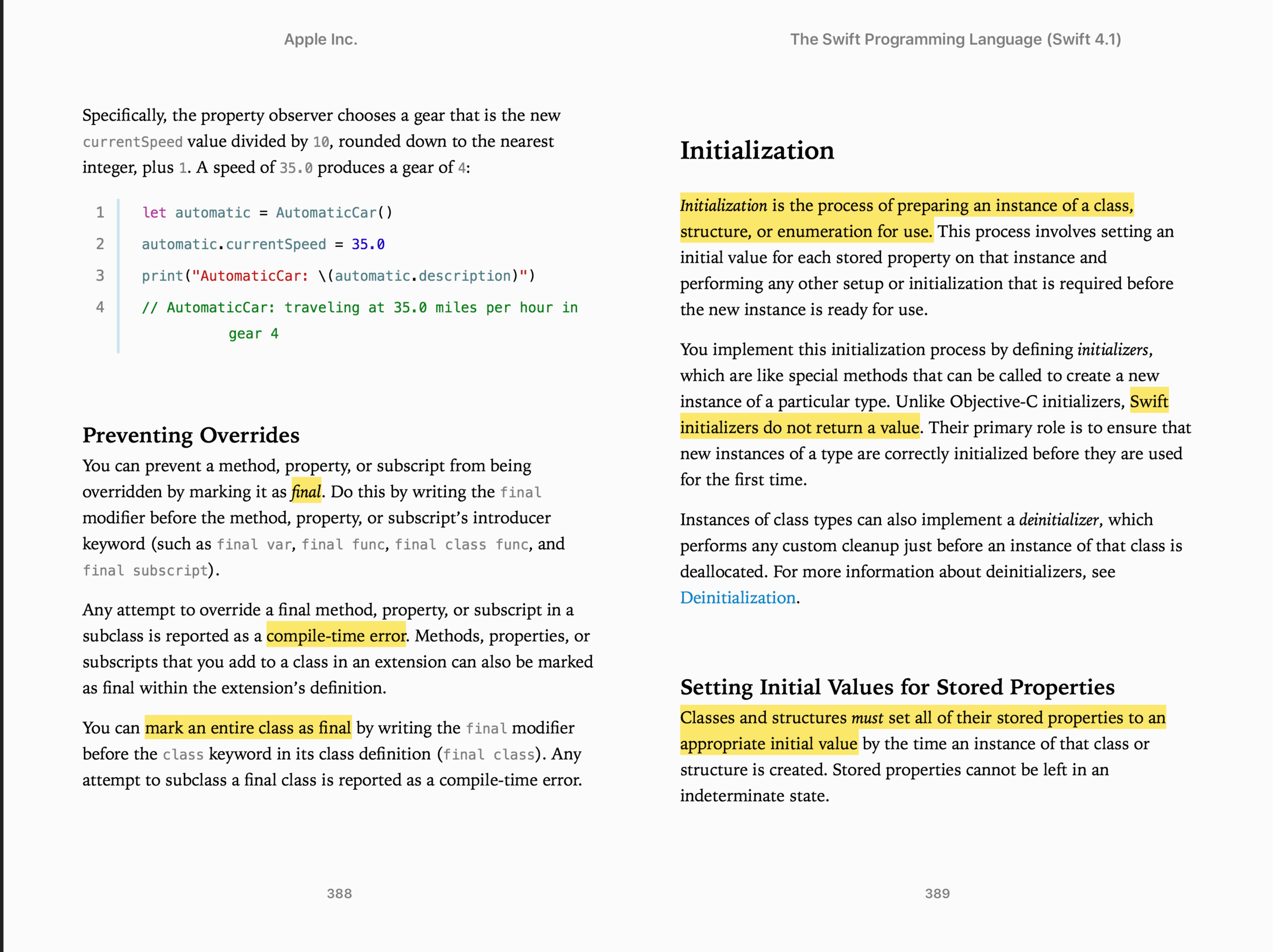
Reduce modes



Linea Sketch

The Iconfactory

Highlighting



Specifically, the property observer chooses a gear that is the new `currentSpeed` value divided by `10`, rounded down to the nearest integer, plus `1`. A speed of `35.0` produces a gear of `4`:

```
let automatic = AutomaticCar()
automatic.currentSpeed = 35.0
print("AutomaticCar: \(automatic.description)")
// AutomaticCar: traveling at 35.0 miles per hour in gear 4
```

Preventing Overrides

You can prevent a method, property, or subscript from being overridden by marking it as *final*. Do this by writing the `final` modifier before the method, property, or subscript's introducer keyword (such as `final var`, `final func`, `final class func`, and `final subscript`).

Any attempt to override a final method, property, or subscript in a subclass is reported as a compile-time error. Methods, properties, or subscripts that you add to a class in an extension can also be marked as final within the extension's definition.

You can mark an entire class as final by writing the `final` modifier before the `class` keyword in its class definition (`final class`). Any attempt to subclass a final class is reported as a compile-time error.

Initialization

Initialization is the process of preparing an instance of a class, structure, or enumeration for use. This process involves setting an initial value for each stored property on that instance and performing any other setup or initialization that is required before the new instance is ready for use.

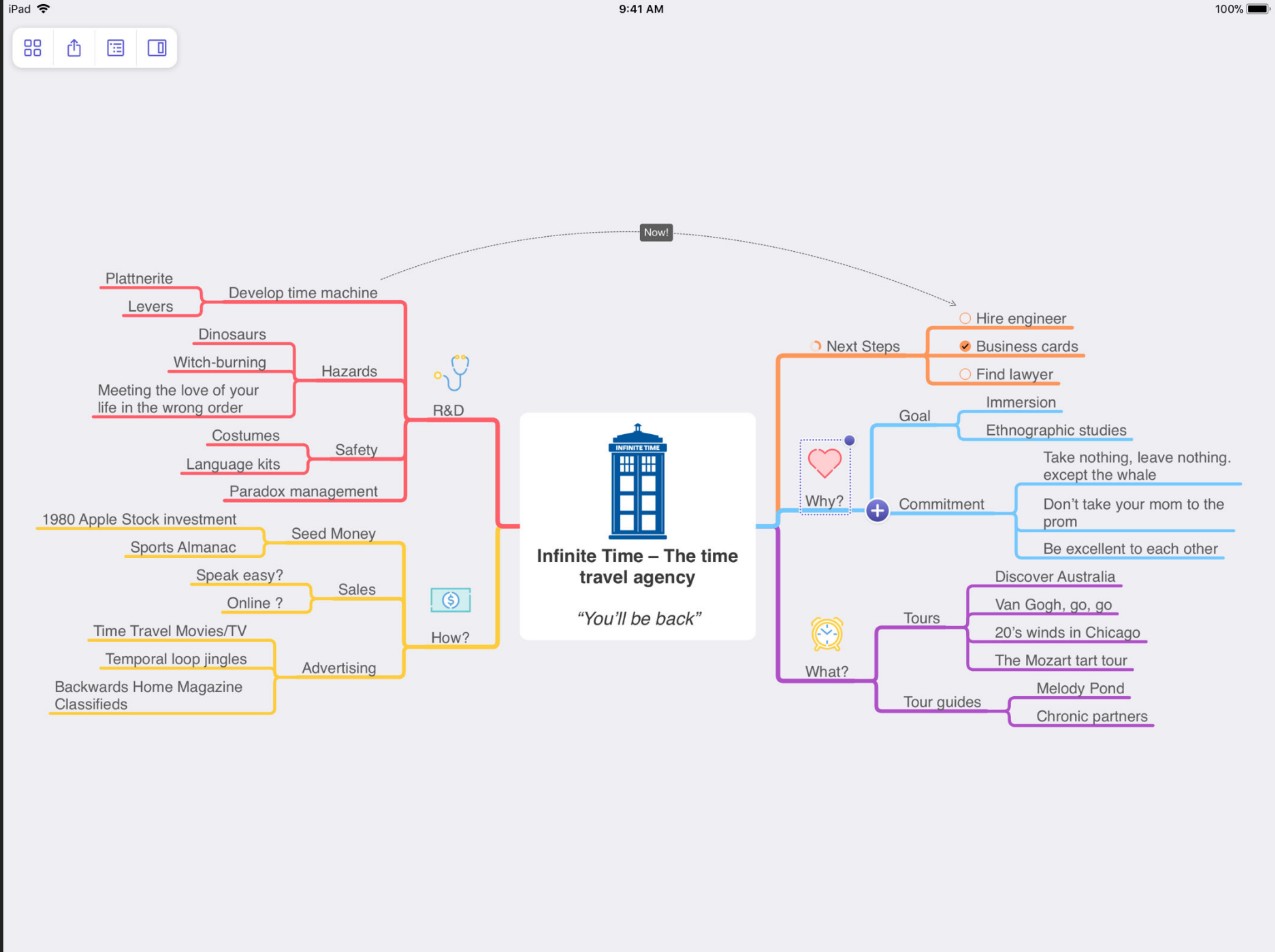
You implement this initialization process by defining *initializers*, which are like special methods that can be called to create a new instance of a particular type. Unlike Objective-C initializers, Swift initializers do not return a value. Their primary role is to ensure that new instances of a type are correctly initialized before they are used for the first time.

Instances of class types can also implement a *deinitializer*, which performs any custom cleanup just before an instance of that class is deallocated. For more information about deinitializers, see Deinitialization.

Setting Initial Values for Stored Properties

Classes and structures *must* set all of their stored properties to an appropriate initial value by the time an instance of that class or structure is created. Stored properties cannot be left in an indeterminate state.

Apple Books



Infinite Time – The time travel agency

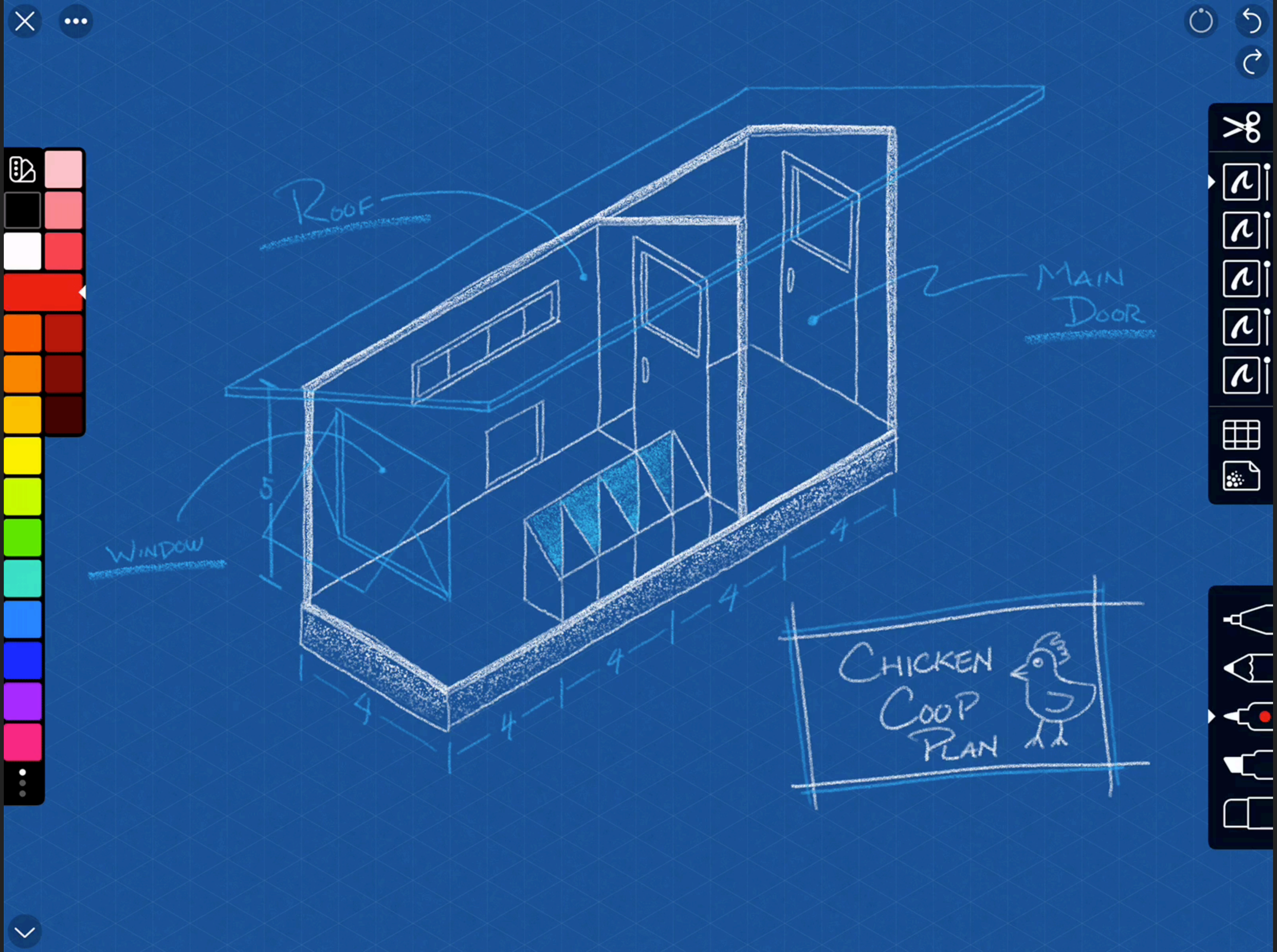
"You'll be back"

- R&D
  - Develop time machine
    - Plattnerite
    - Levers
  - Hazards
    - Dinosaurs
    - Witch-burning
    - Meeting the love of your life in the wrong order
  - Safety
    - Costumes
    - Language kits
  - Paradox management
- How?
  - Seed Money
    - 1980 Apple Stock investment
    - Sports Almanac
  - Sales
    - Speak easy?
    - Online ?
  - Advertising
    - Time Travel Movies/TV
    - Temporal loop jingles
    - Backwards Home Magazine Classifieds
- Next Steps
  - ○ Hire engineer
  - ✓ Business cards
  - ○ Find lawyer
- Why?
  - Goal
    - Immersion
    - Ethnographic studies
  - Commitment
    - Take nothing, leave nothing. except the whale
    - Don't take your mom to the prom
    - Be excellent to each other
- What?
  - Tours
    - Discover Australia
    - Van Gogh, go, go
    - 20's winds in Chicago
    - The Mozart tart tour
  - Tour guides
    - Melody Pond
    - Chronic partners

MindNode

IdeasOnCanvas

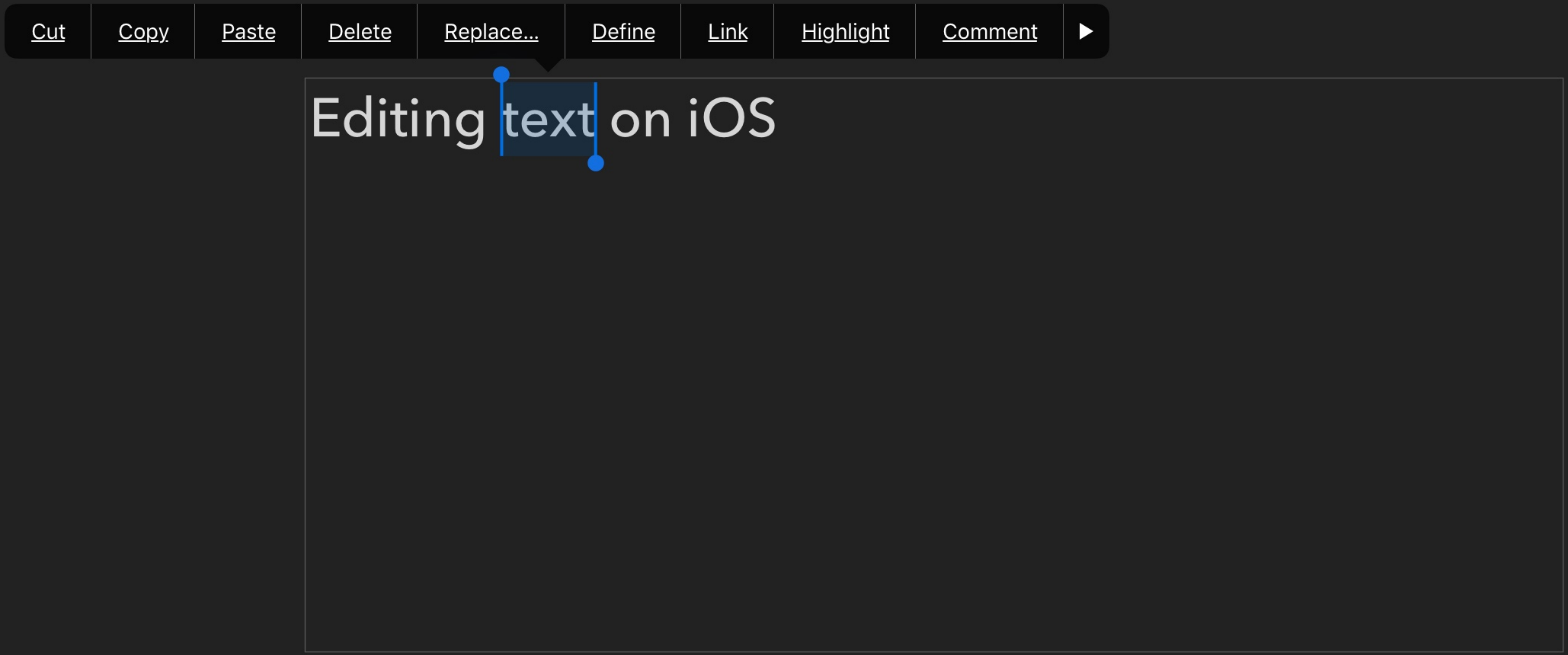
Higher interaction density



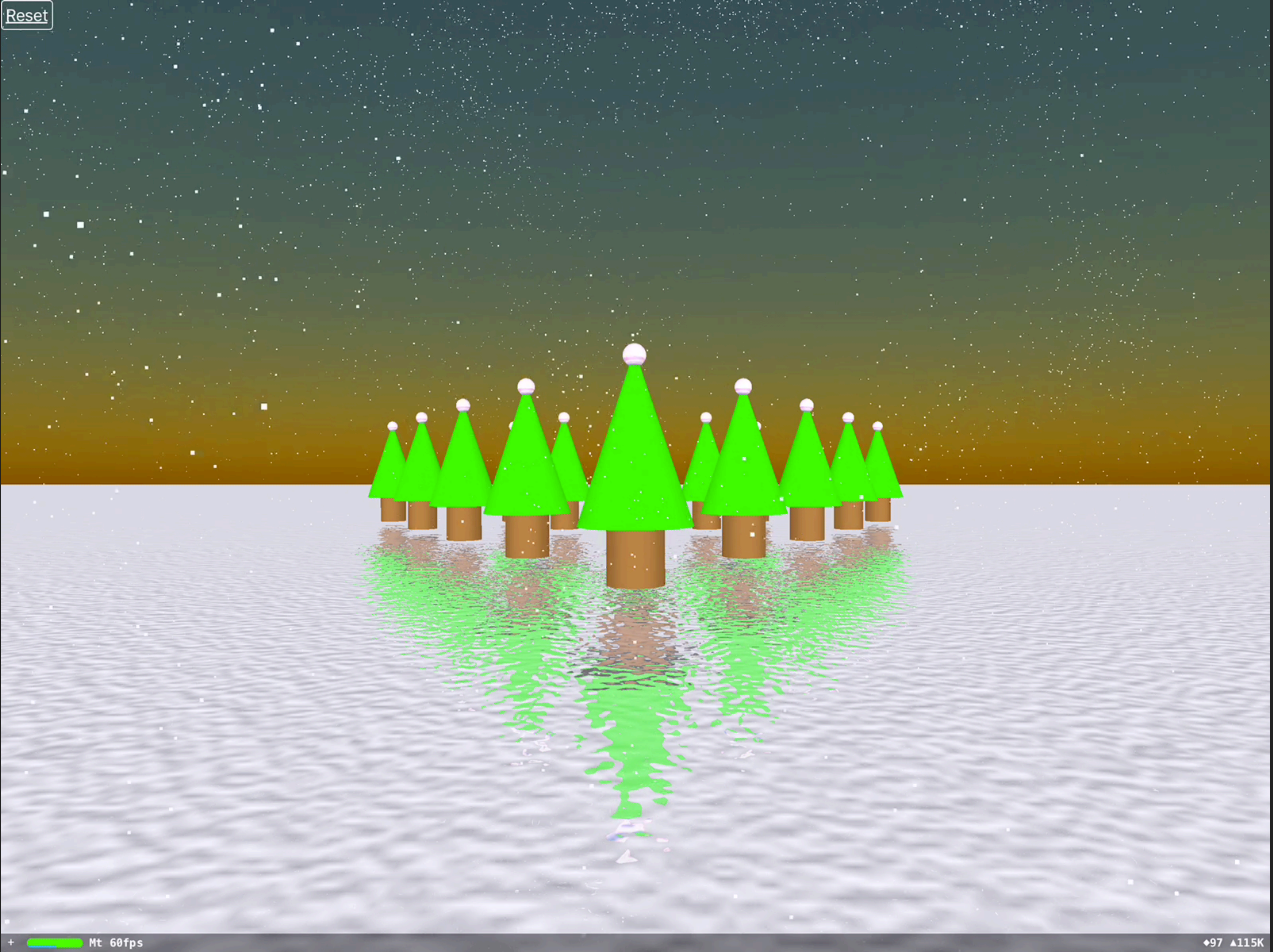
Linea Sketch

The Iconfactory

Text editing



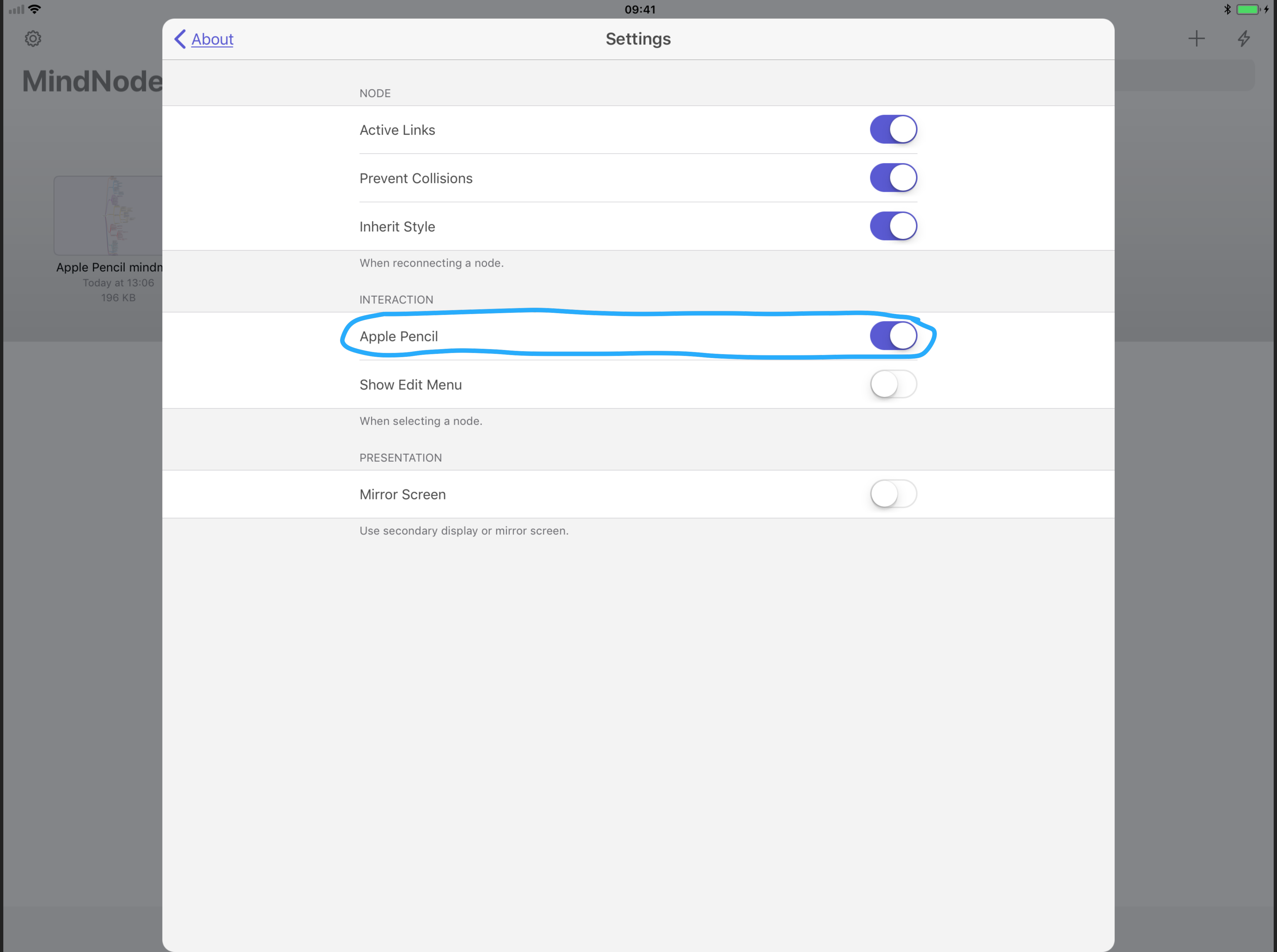
Editing text on iOS



Christmas Tree Bowling

github.com/FlexMonkey/Christmas-Tree-Bowling

Optional



Settings

NODE

Active Links ☑

Prevent Collisions ☑

Inherit Style ☑

When reconnecting a node.

INTERACTION

Apple Pencil ☑

Show Edit Menu □

When selecting a node.

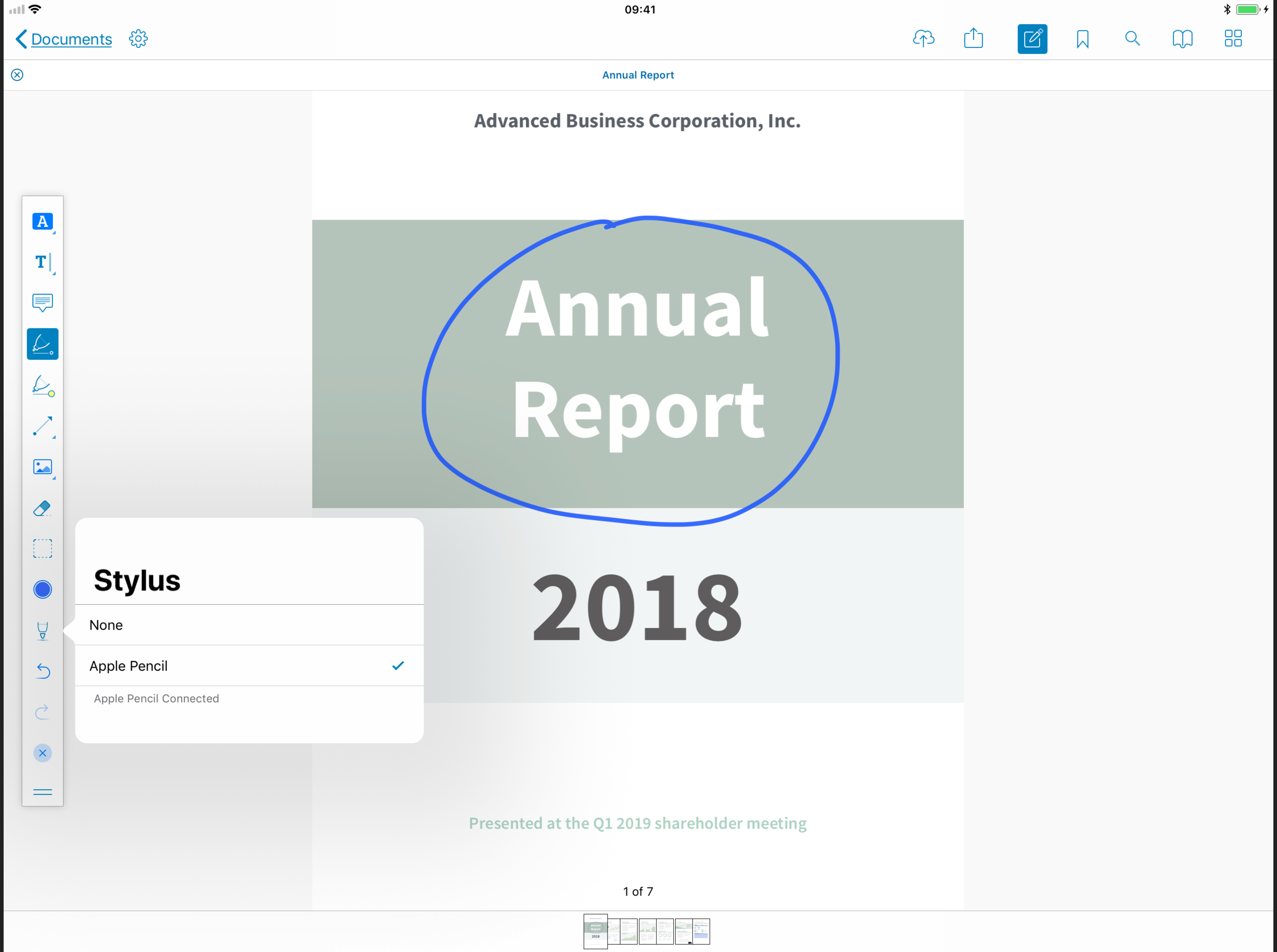
PRESENTATION

Mirror Screen □

Use secondary display or mirror screen.

MindNode

IdeasOnCanvas



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Stylus

None

Apple Pencil ✓

Apple Pencil Connected

Design

API

Performance

Distinguishing Pencil touches

Distinguishing Pencil touches

```
UITouch.type

public enum TouchType : Int {
    case direct
    case indirect
    case pencil
}
```

Distinguishing Pencil touches

```
UIGestureRecognizer.allowedTouchTypes
```

Distinguishing Pencil touches

```
strokeRecogniser.allowedTouchTypes =
    [UITouchType.pencil.rawValue as NSNumber]

scrollView.panGestureRecognizer.allowedTouchTypes =
    [UITouchType.direct.rawValue as NSNumber]
```

Detecting Pencil availability

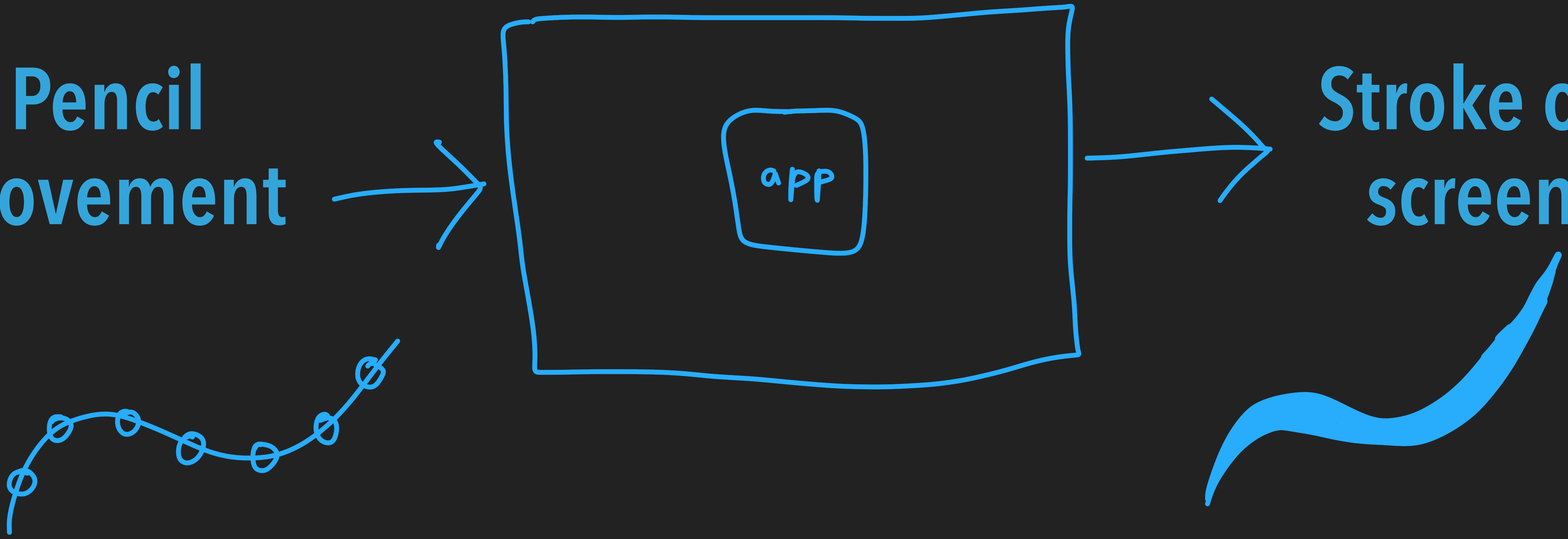
Detecting Pencil availability

```
class Application: UIApplication {
    override func sendEvent(_ event: UIEvent) {
        super.sendEvent(event)
        guard event.type == .touches, let touches = event.allTouches else {
            return
        }
        if (touches.contains { $0.type == .stylus && $0.phase == .began }) {
            // Apple Pencil is connected
        }
    }
}
```

Detecting Pencil availability

```swift
let bluetoothManager = CBCentralManager(delegate: nil, queue: nil)
if (bluetoothManager.state != .poweredOn) {
    // Apple Pencil is not connected
}
```

Drawing



Pencil movement

Stroke on screen

60 Hz

120 Hz

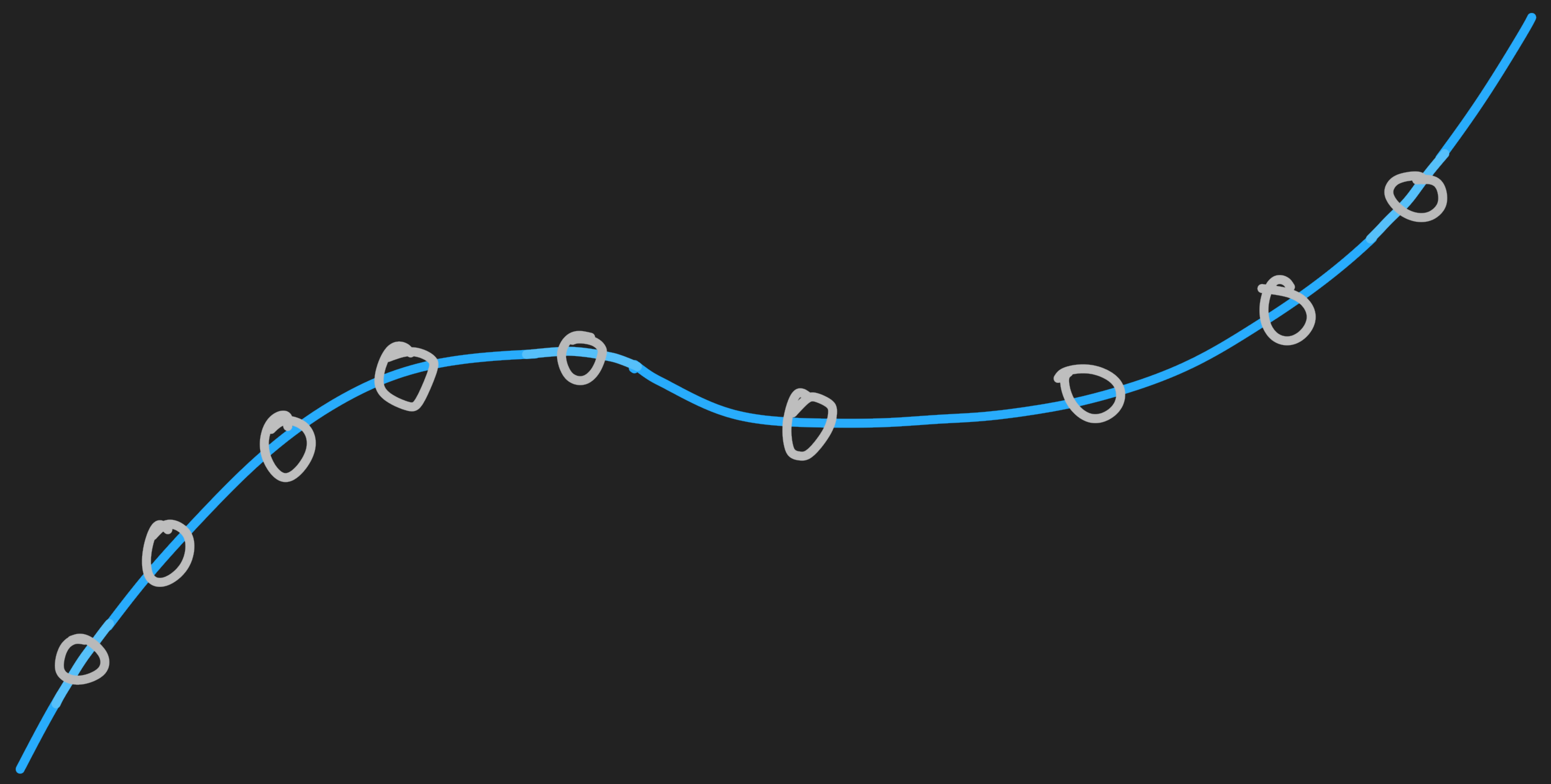
240 Hz

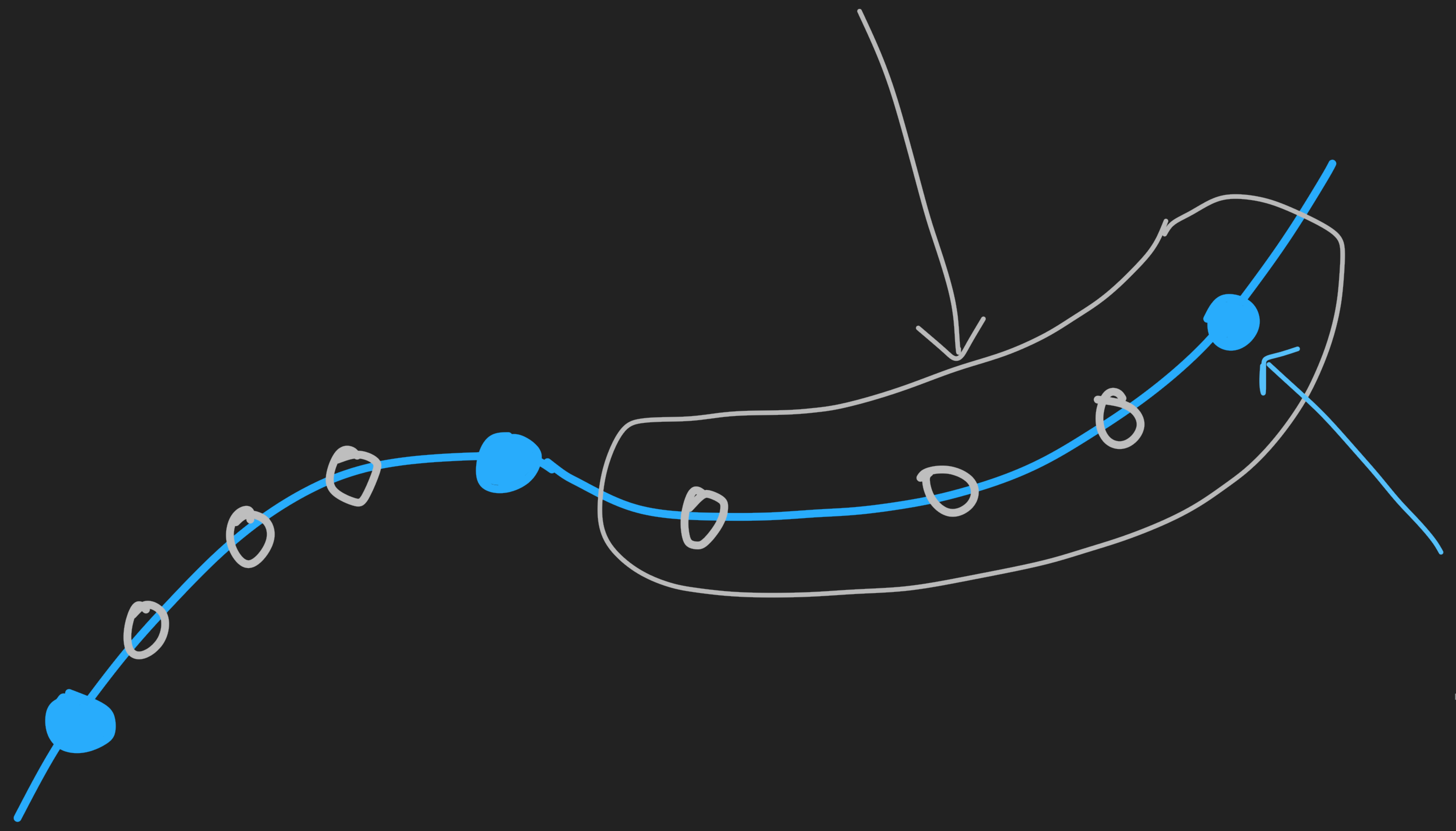
60 Hz

120 Hz

Precision

```
UITouch.location(in: view)
UITouch.preciseLocation(in: view)
```



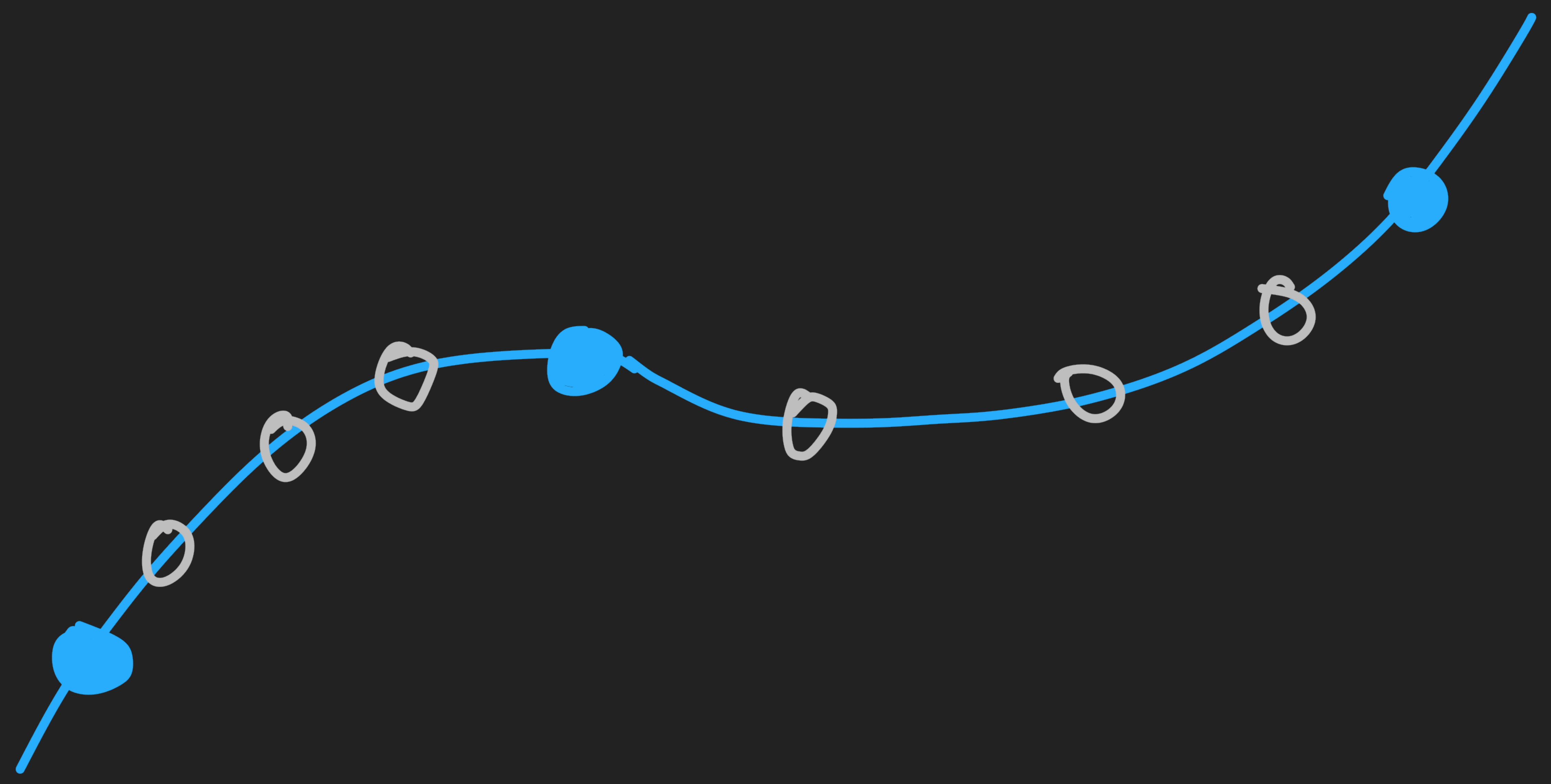


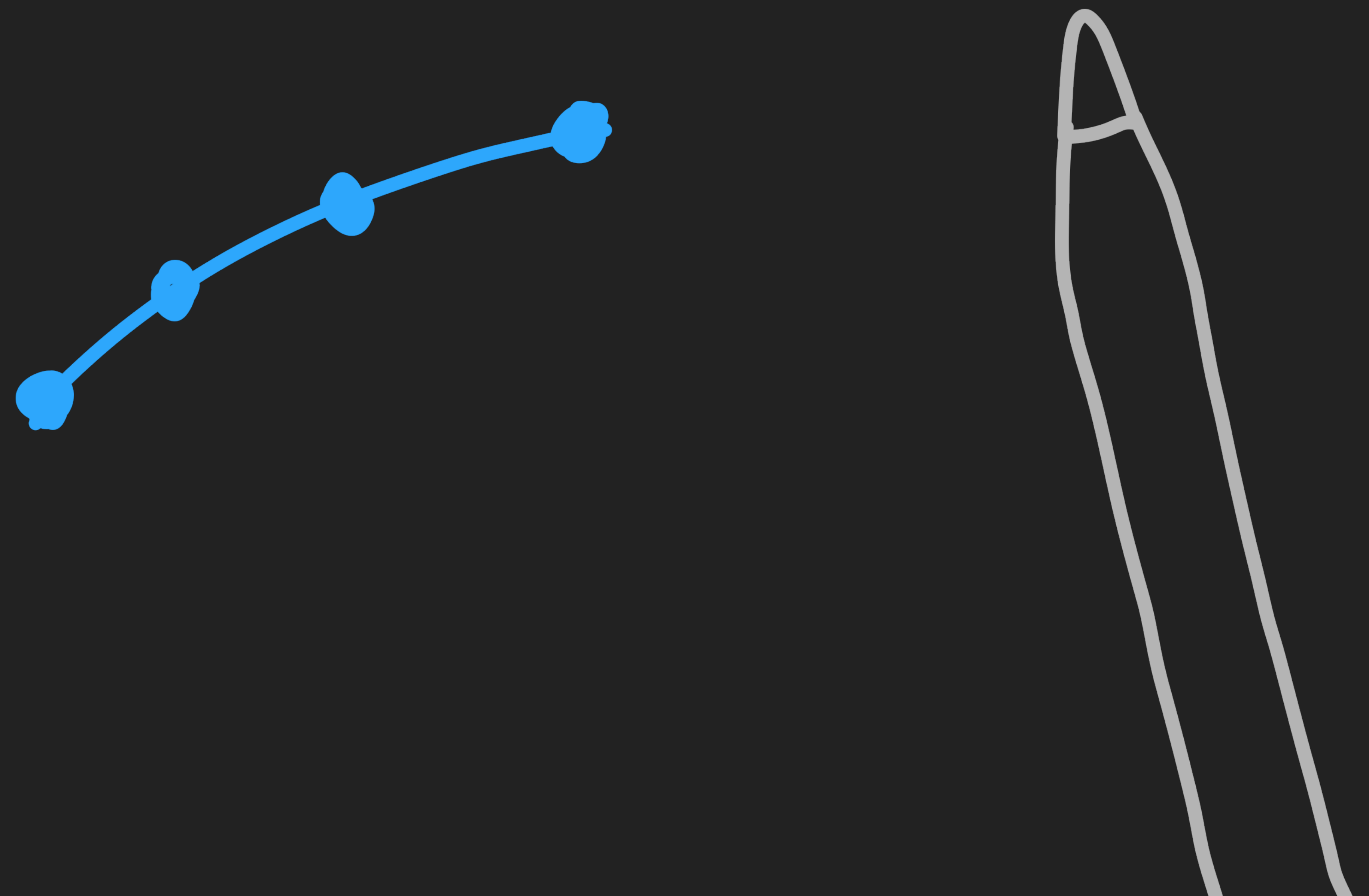
coalesced
touches

main
touch

Coalesced touches

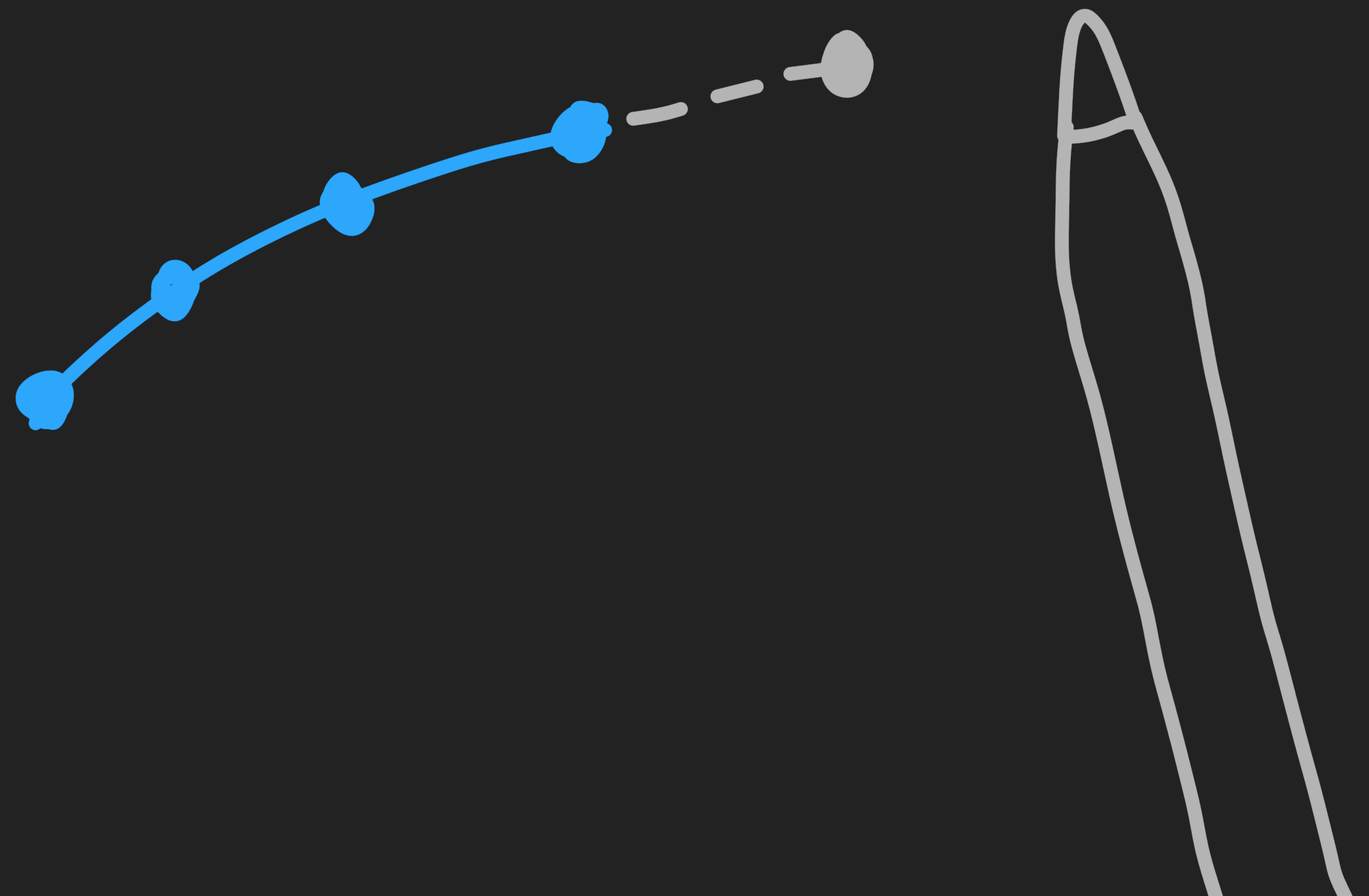
```
UIEvent.coalescedTouches(for: touch)
```

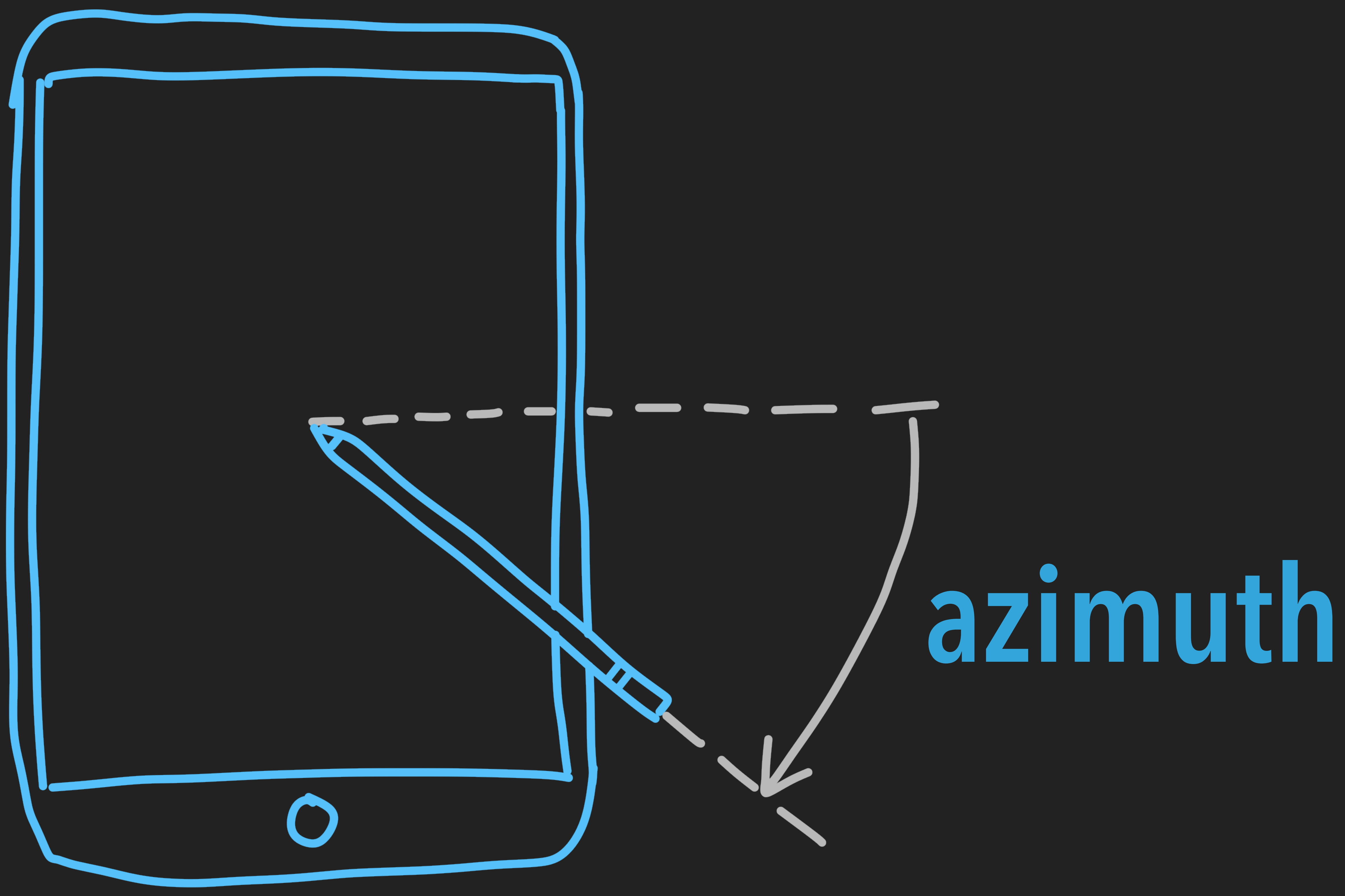




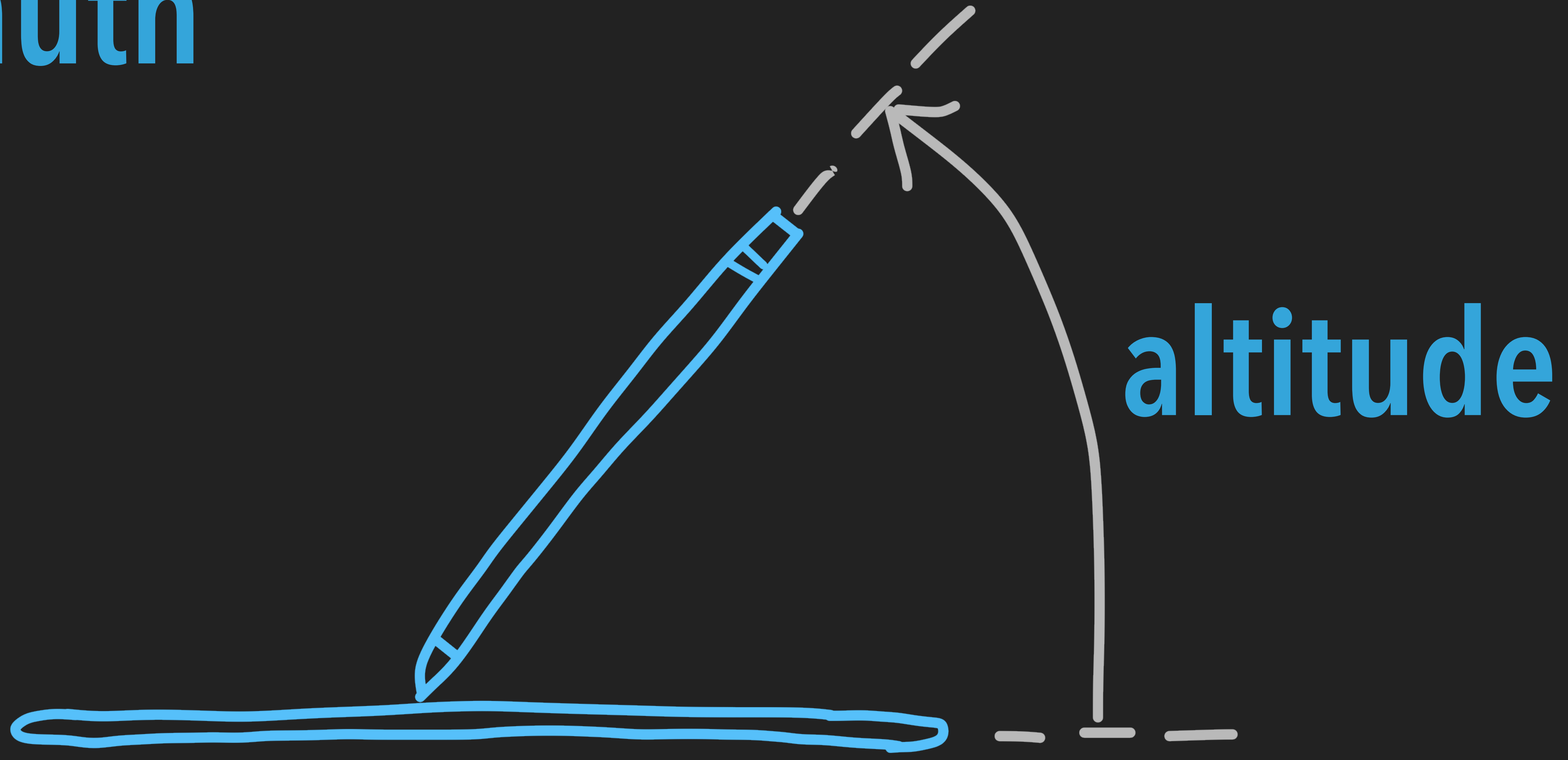
Predicted touches

```
UIEvent.predictedTouches(for: touch)
```





azimuth



altitude

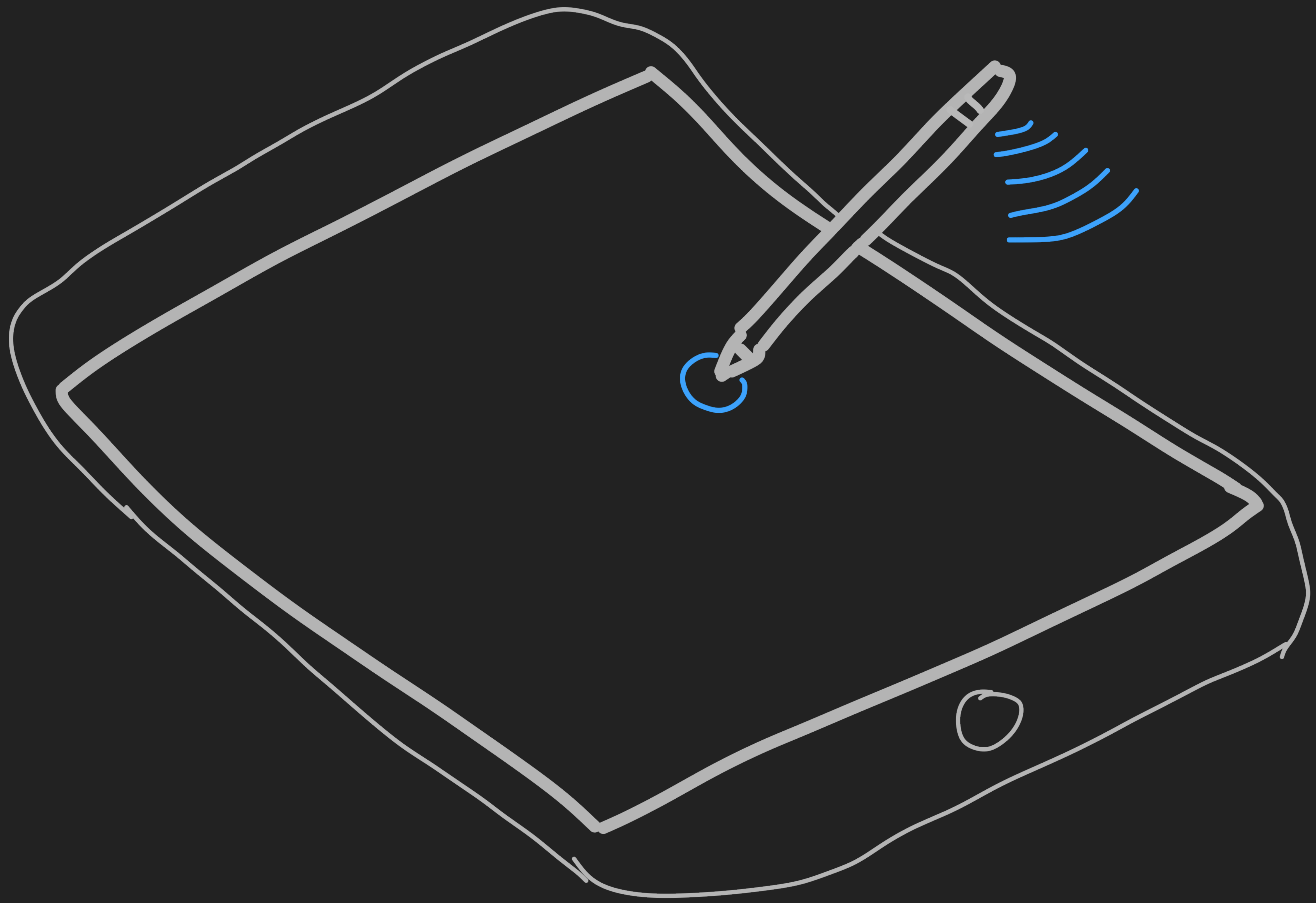
Pressure and angle

```
UITouch.force

UITouch.azimuthAngle(in: view)

UITouch.altitudeAngle
```

Pressure and angle



Pressure and angle

```
UITouch.estimatedProperties

UITouch.estimatedPropertiesExpectingUpdates
```

Pressure and angle

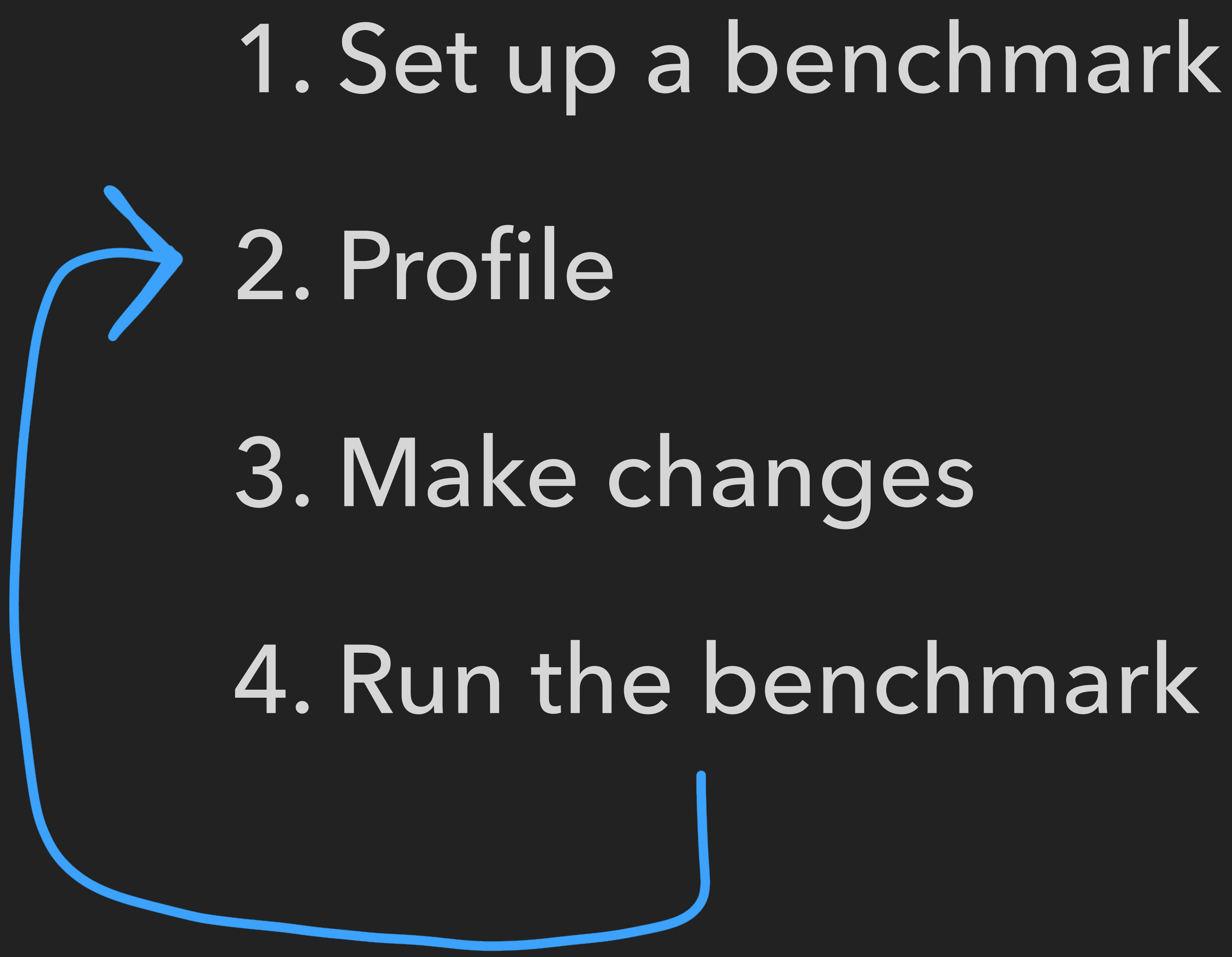
```
override func touchesEstimatedPropertiesUpdated(_ touches: Set<UITouch>) {
    ...
}
```

Design

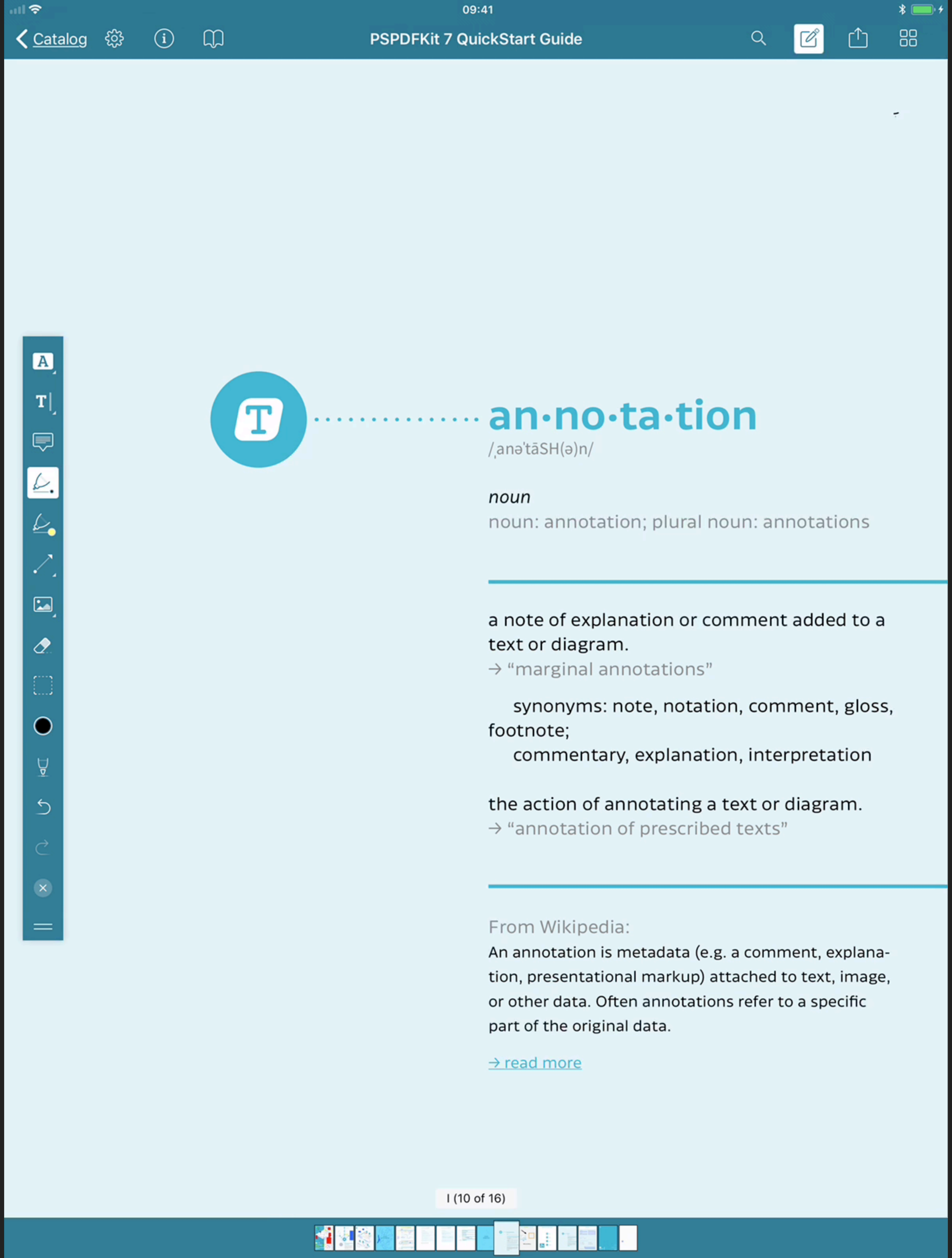
API

[✓ Performance]

Performance



1. Set up a benchmark
2. Profile
3. Make changes
4. Run the benchmark



an·no·ta·tion

/ˌanəˈtāSH(ə)n/

noun

noun: annotation; plural noun: annotations

a note of explanation or comment added to a text or diagram.

→ “marginal annotations”

synonyms: note, notation, comment, gloss, footnote;
commentary, explanation, interpretation

the action of annotating a text or diagram.

→ “annotation of prescribed texts”

From Wikipedia:

An annotation is metadata (e.g. a comment, explanation, presentational markup) attached to text, image, or other data. Often annotations refer to a specific part of the original data.

→ read more

Instruments

1. Convert strokes to bezier paths
2. Render bezier paths

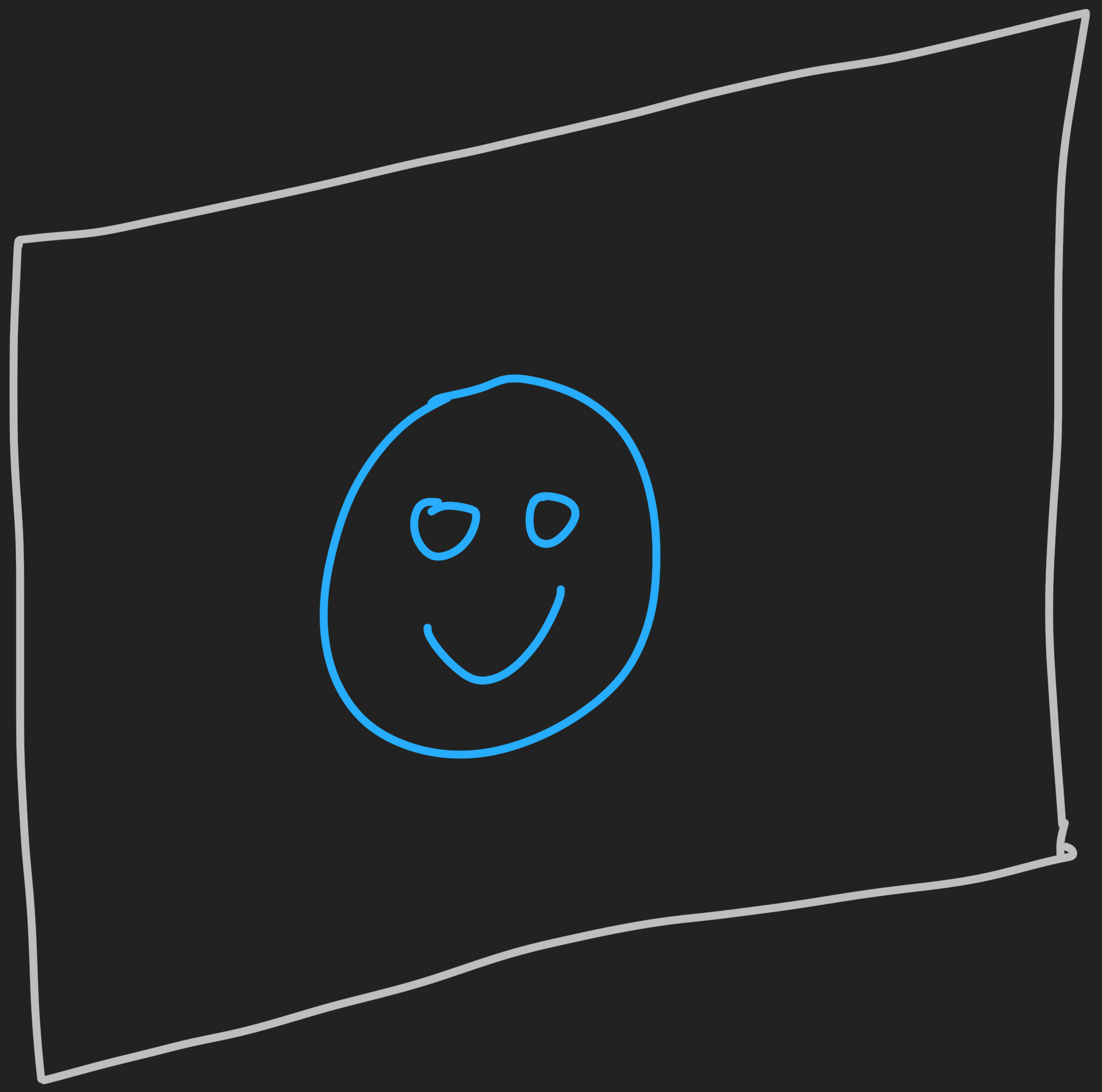
1. Convert strokes to bezier paths
2. Render bezier paths

Cache and append

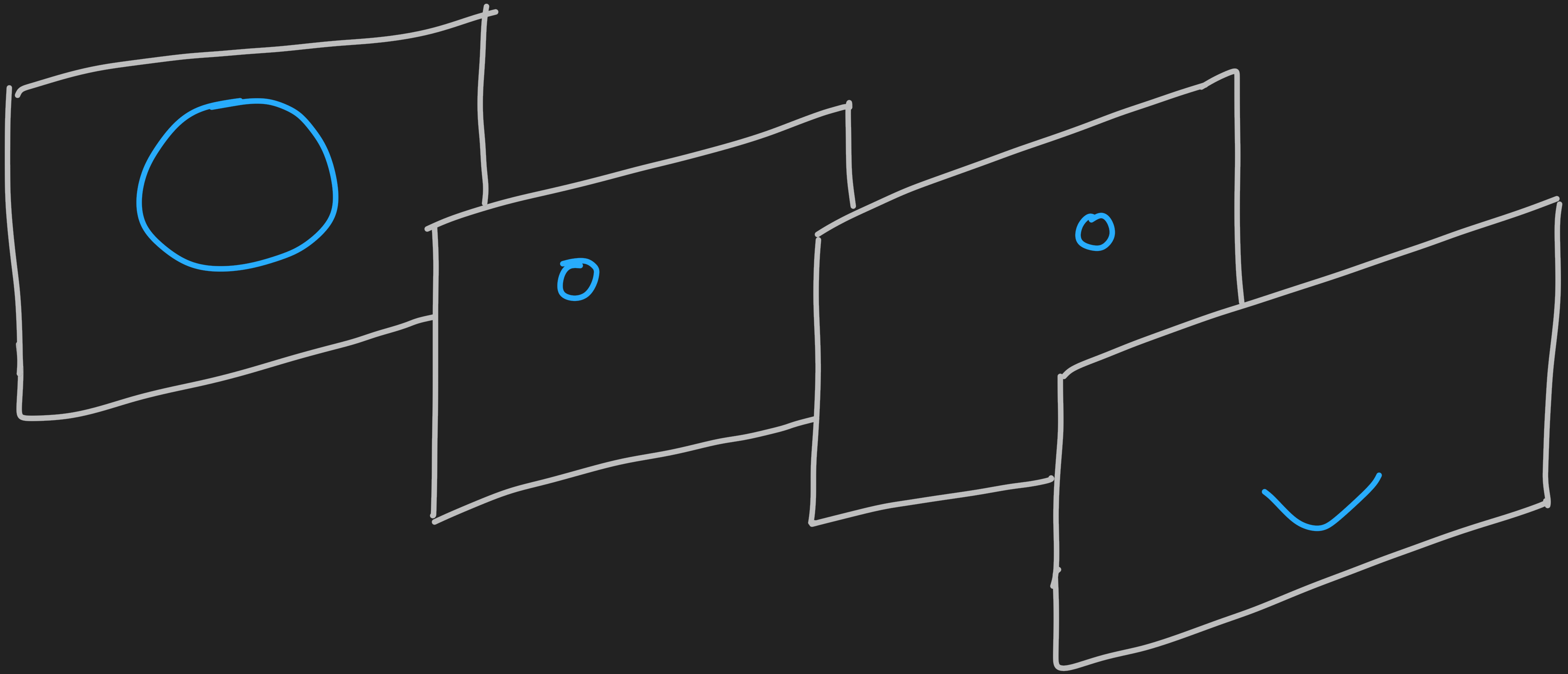
1. Convert strokes to bezier paths
2. Render bezier paths

CAShapeLayer

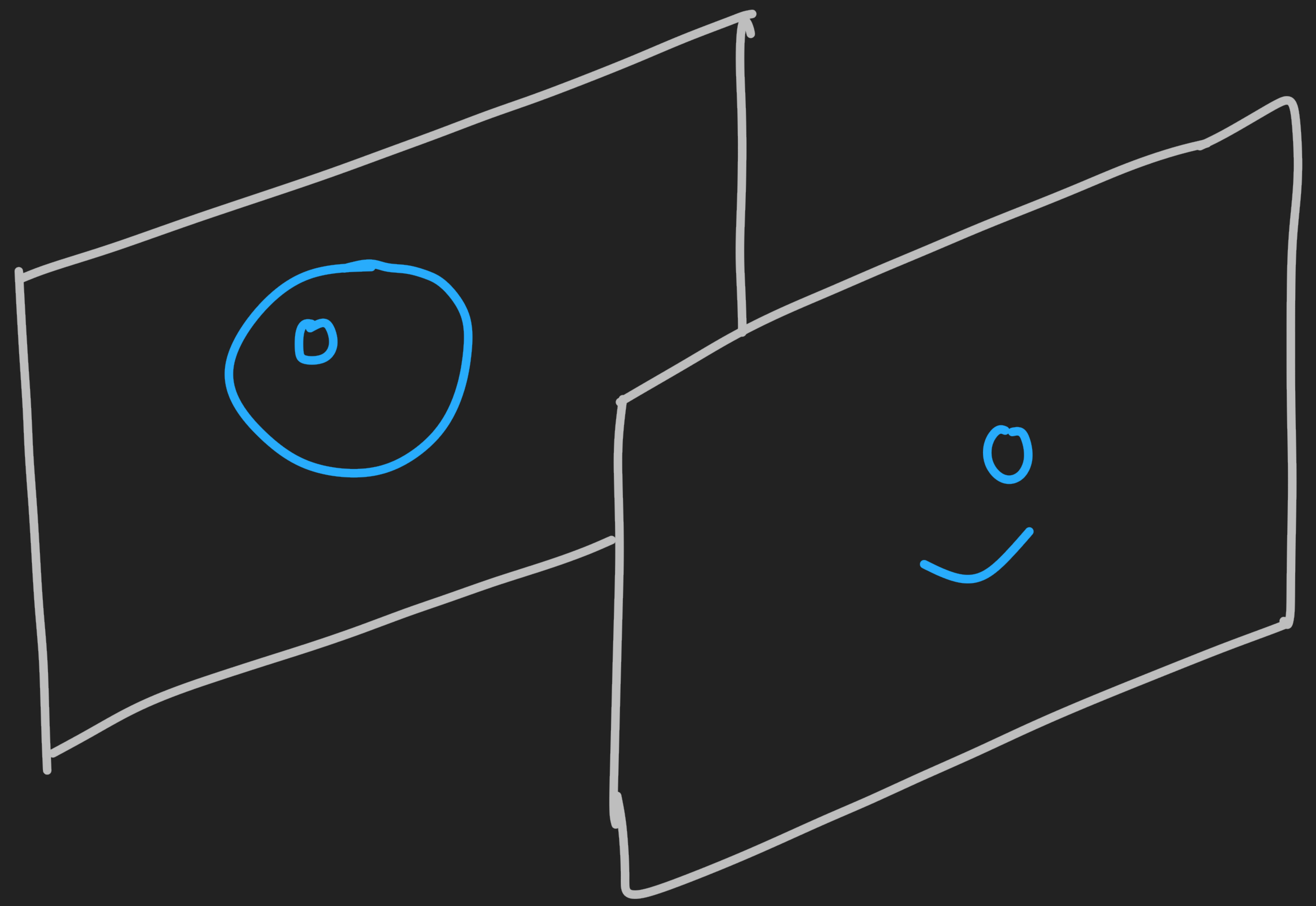
Rendering vs blending



Rendering vs blending



Rendering vs blending



Summary

Apple Pencil is for making marks and reducing modes

Touch have the type `UITouchType.stylus`

Drawing should use `preciseLocation(in: view)`

Drawing should use coalesced and predicated touches

Pressure and angle are possible but more work

Keep an eye on performance

Learn more

WWDC sessions:

- 2015/233: Advanced Touch Input on iOS
- 2016/220: Leveraging Touch Input on iOS
- 2017/219: Modern User Interaction on iOS

Improving user experience with Apple Pencil

Douglas Hill, June 2018

@qdoug