

#WWDC19

# Designing Great ML Experiences

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Cas Lemmens, Designer, Apple Design Team







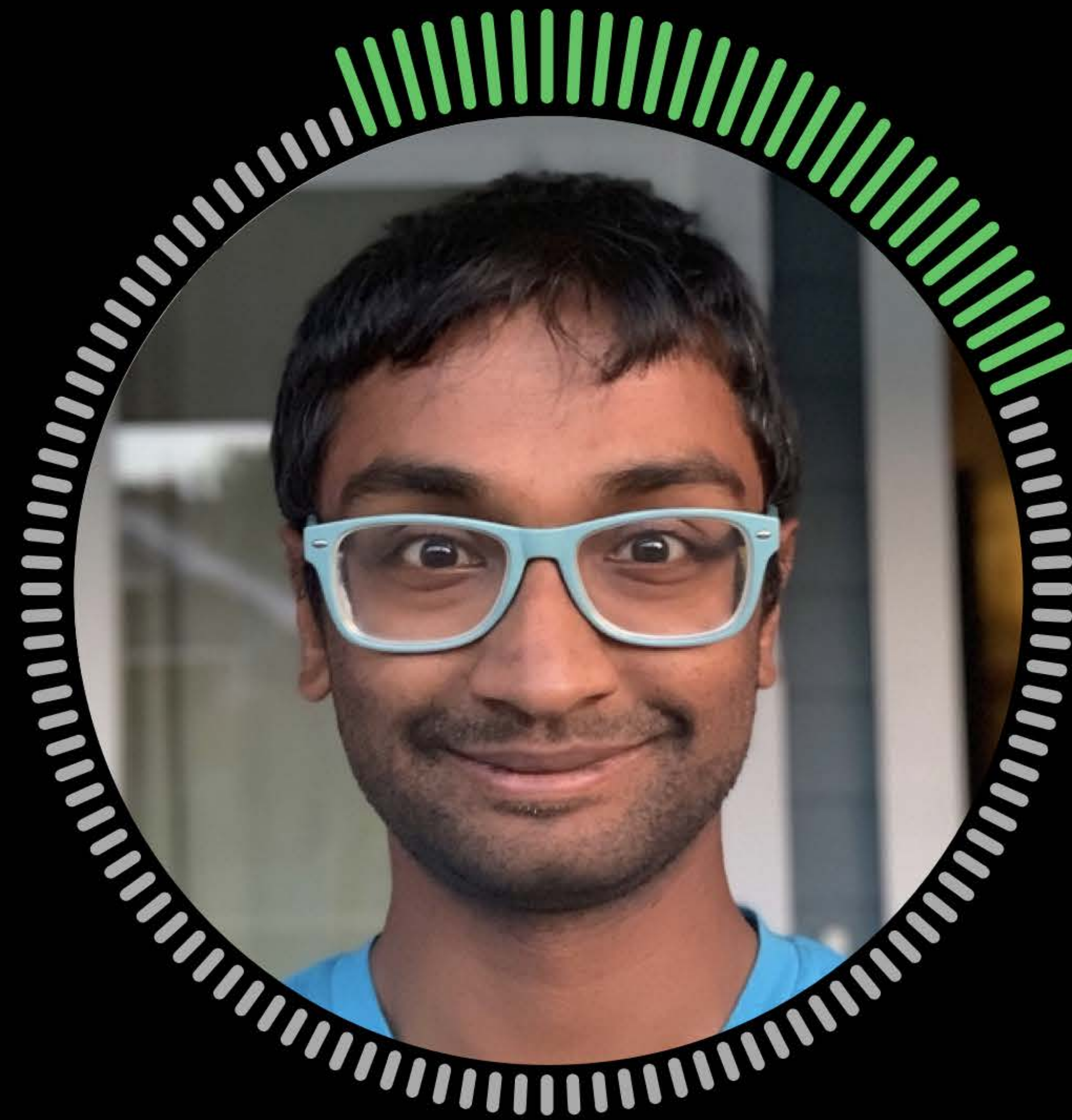




9:41



Cancel



**Move your head slowly to  
complete the circle.**

Accessibility Options



















9:41



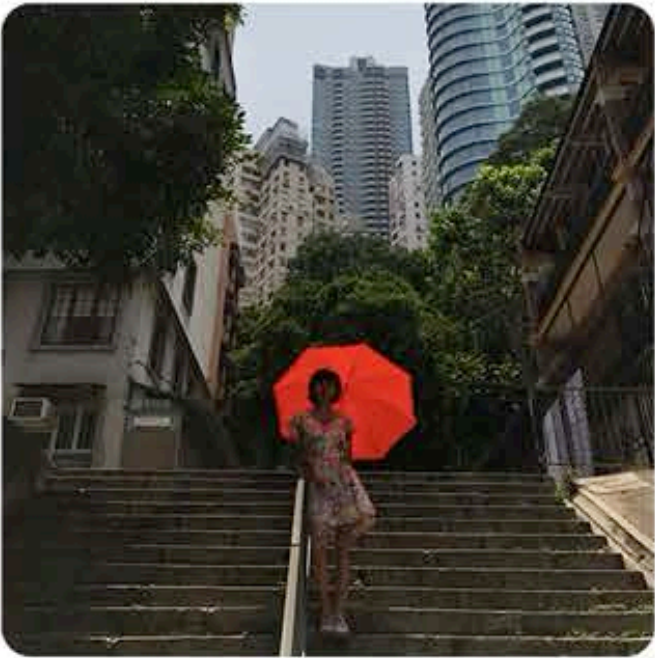
# Search

Q Photos, People, Places...

## Moments



Memorial Day



One Year Ago



Spring

## People



Barry

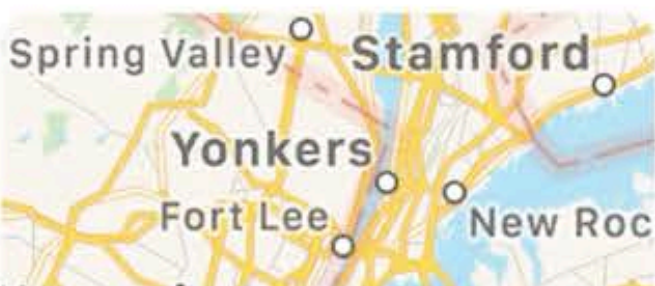


Samantha



Natalie

## Places



Photos



For You

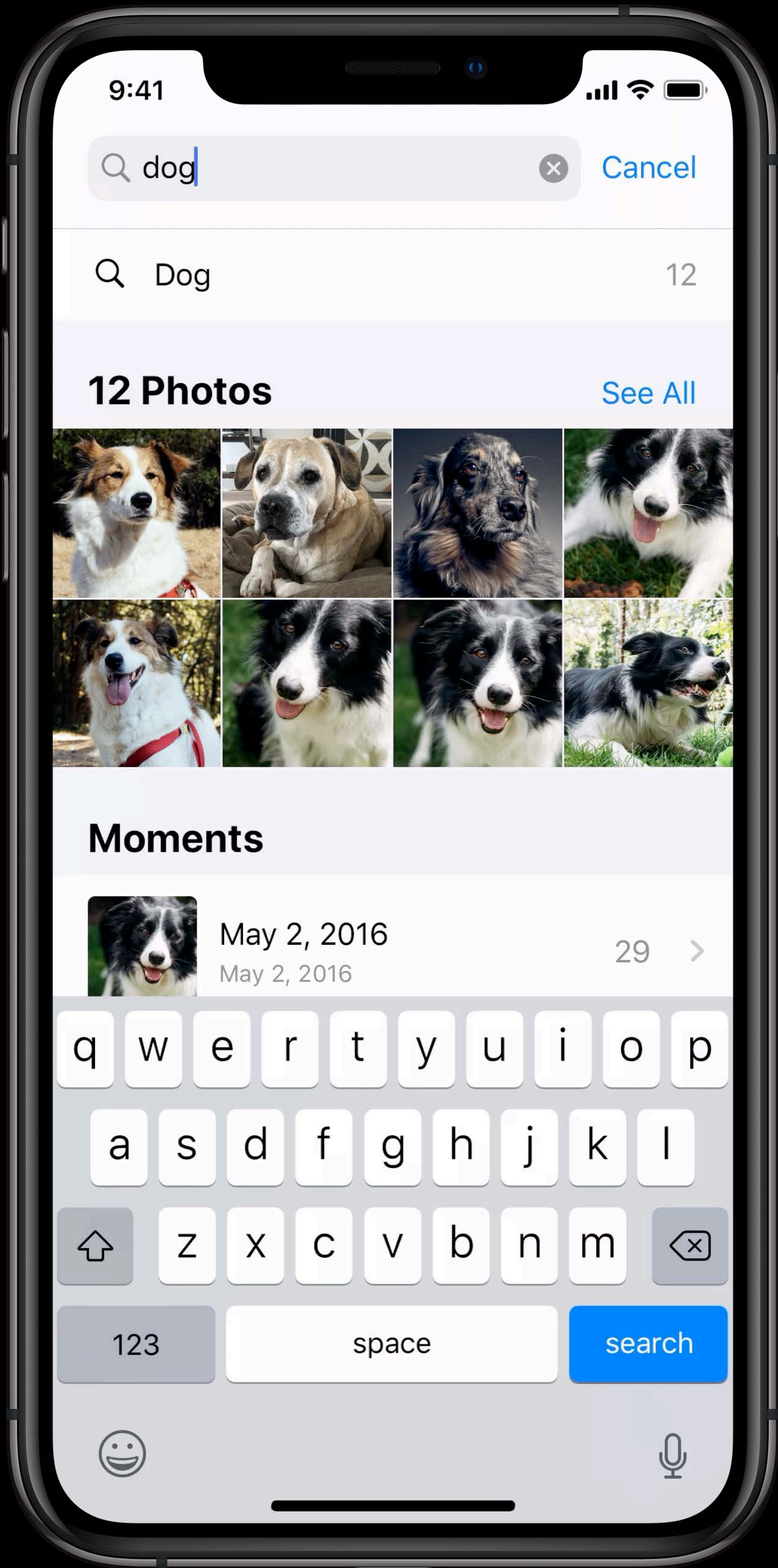


Albums



Search







9:41



Q dog



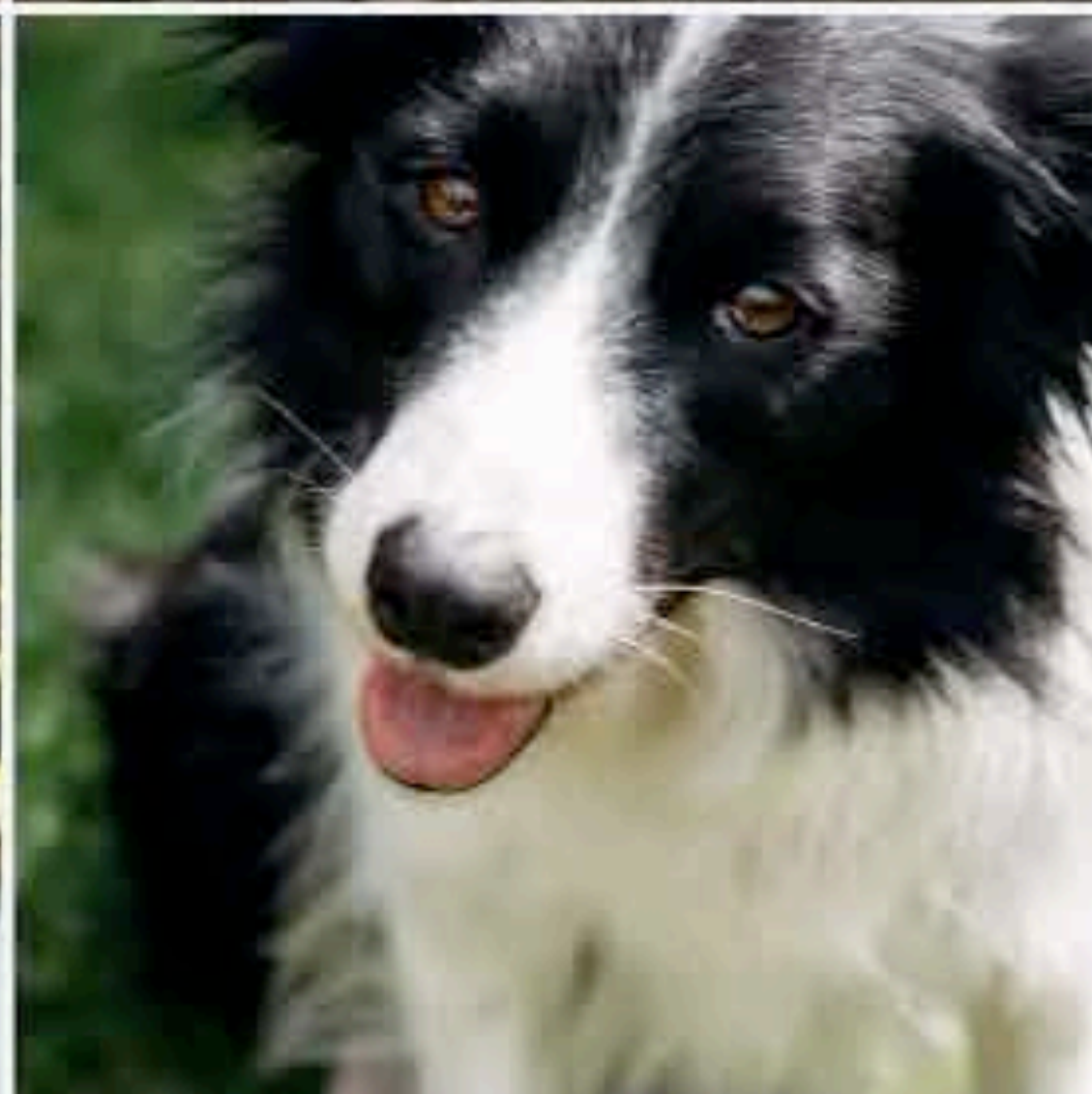
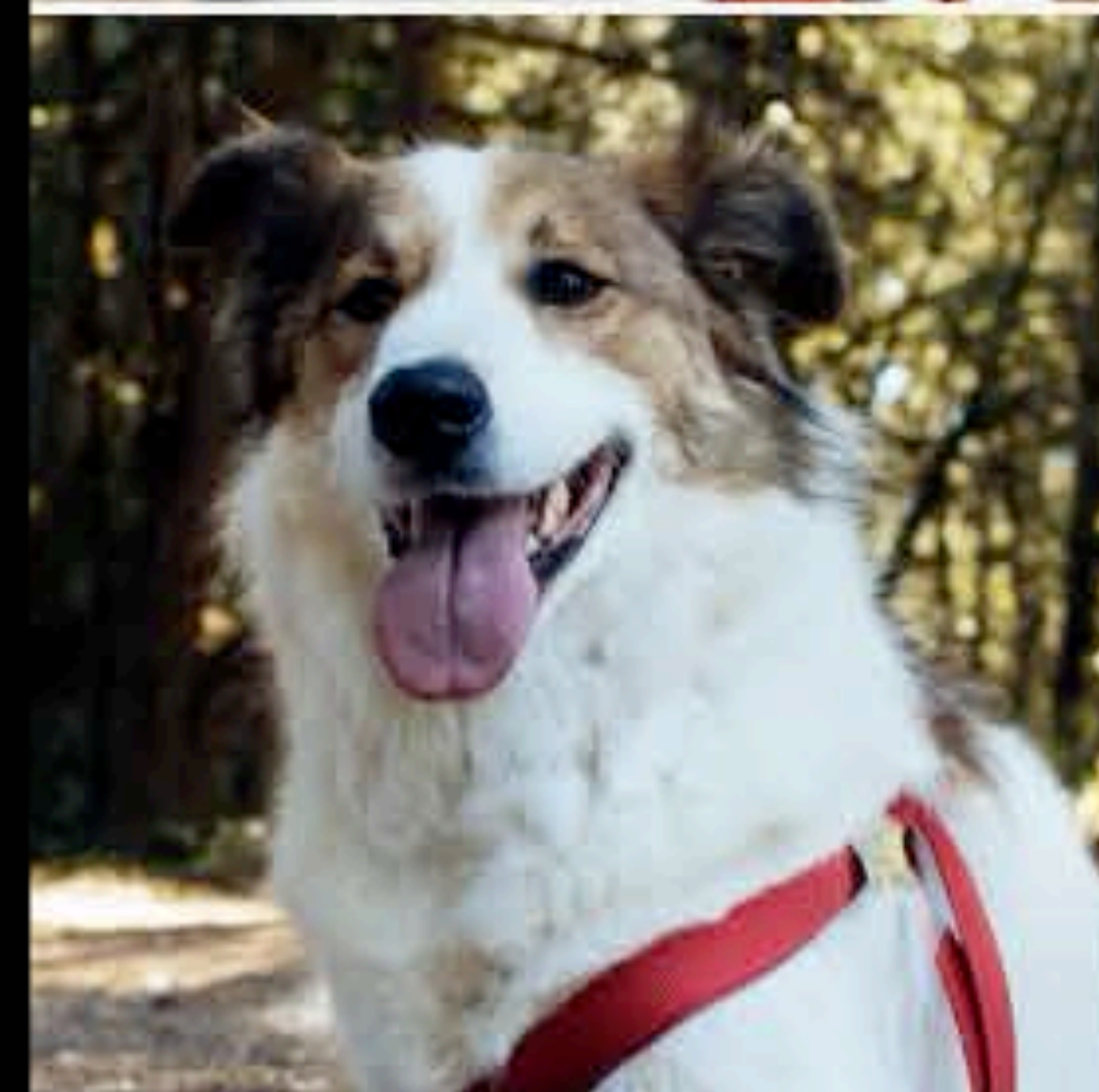
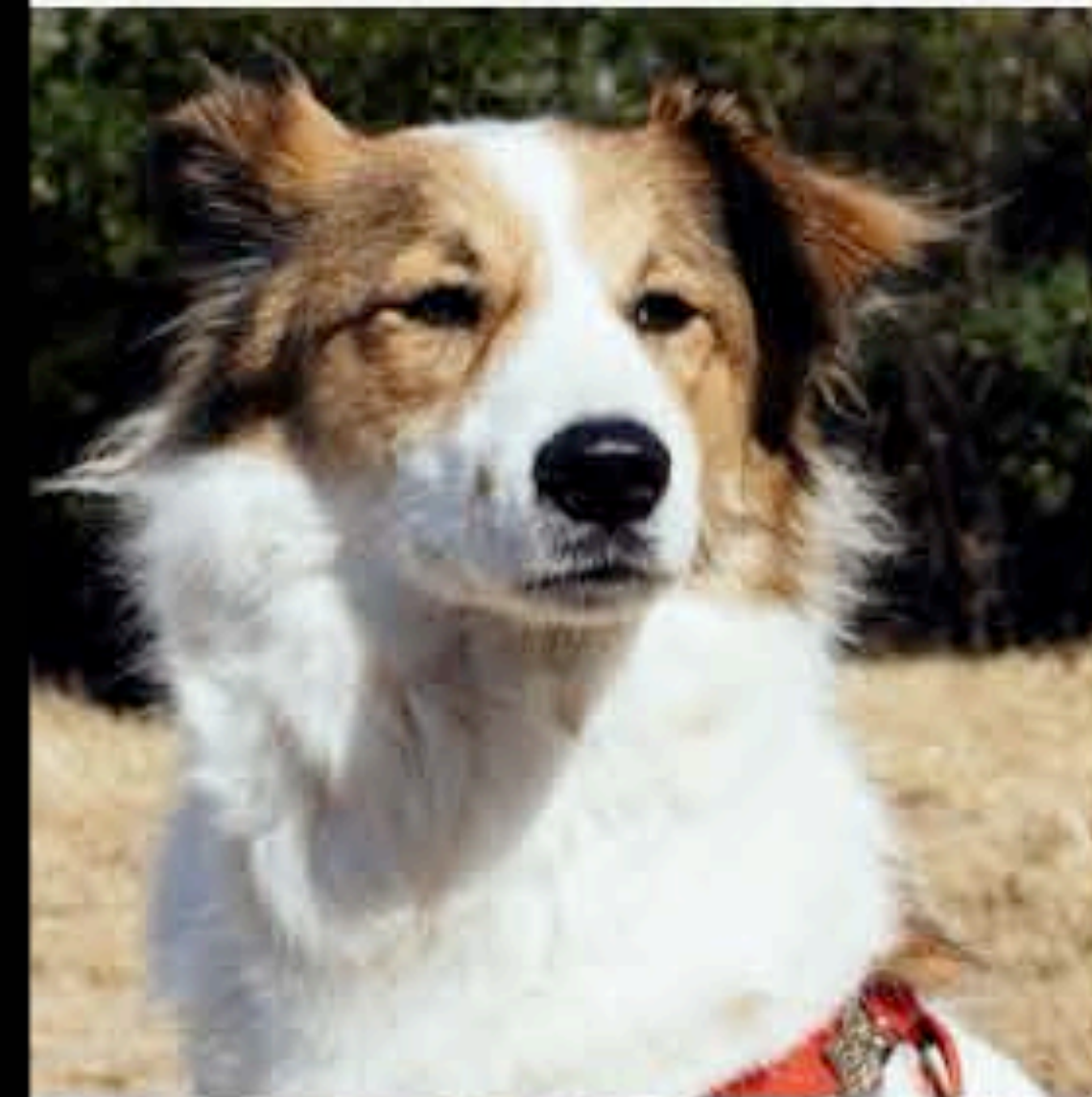
Cancel

Q Dog

12

**12 Photos**

[See All](#)

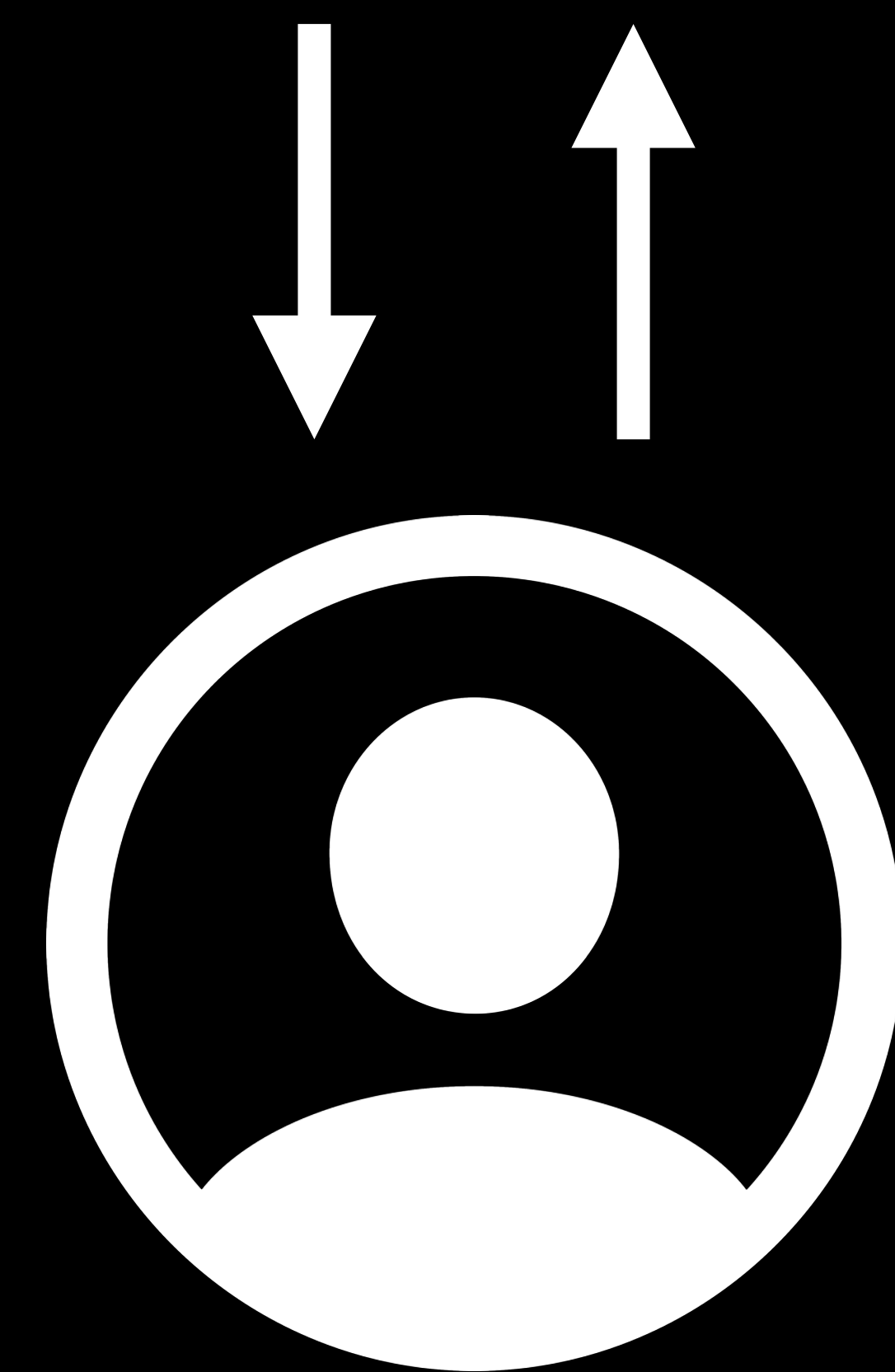




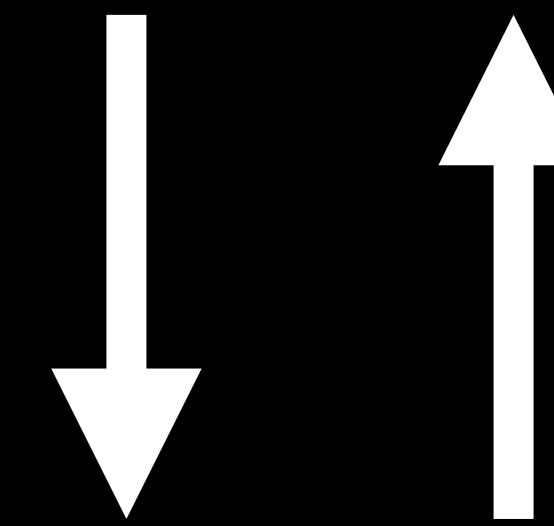
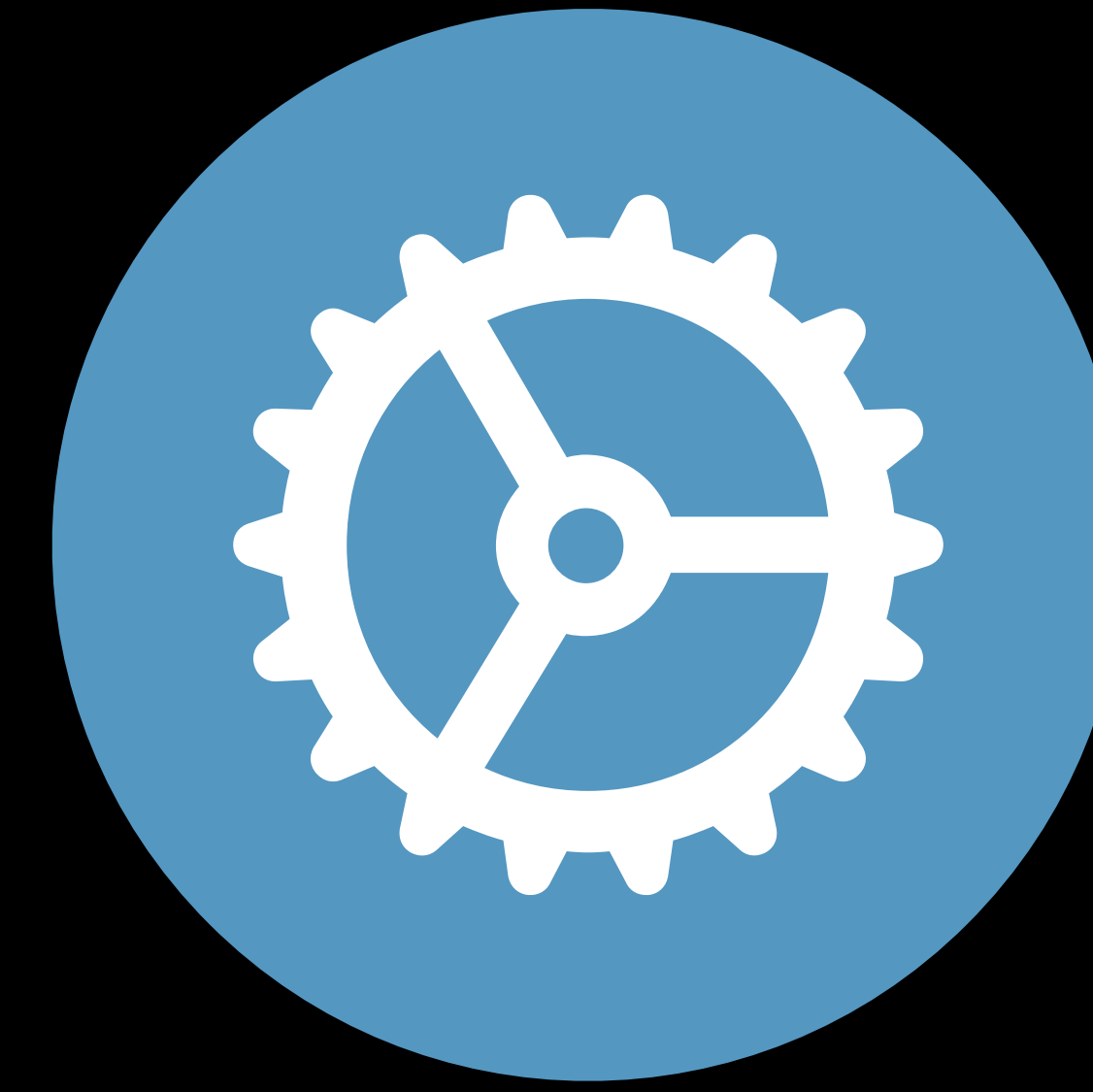
Design more than just the interface



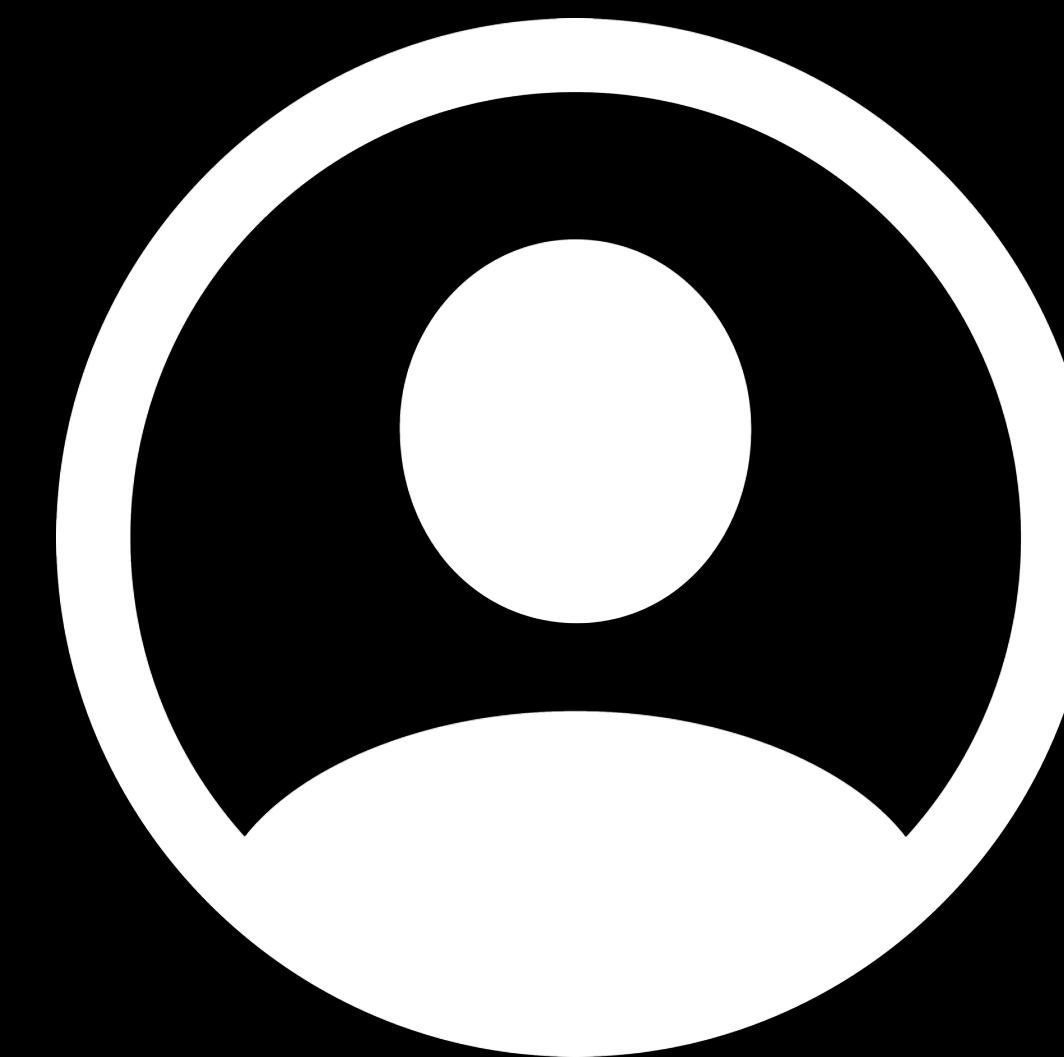
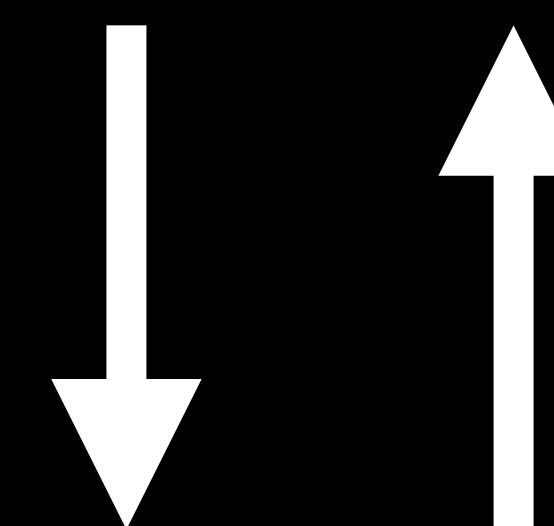
Interface







**Interface**







Dog









Dog

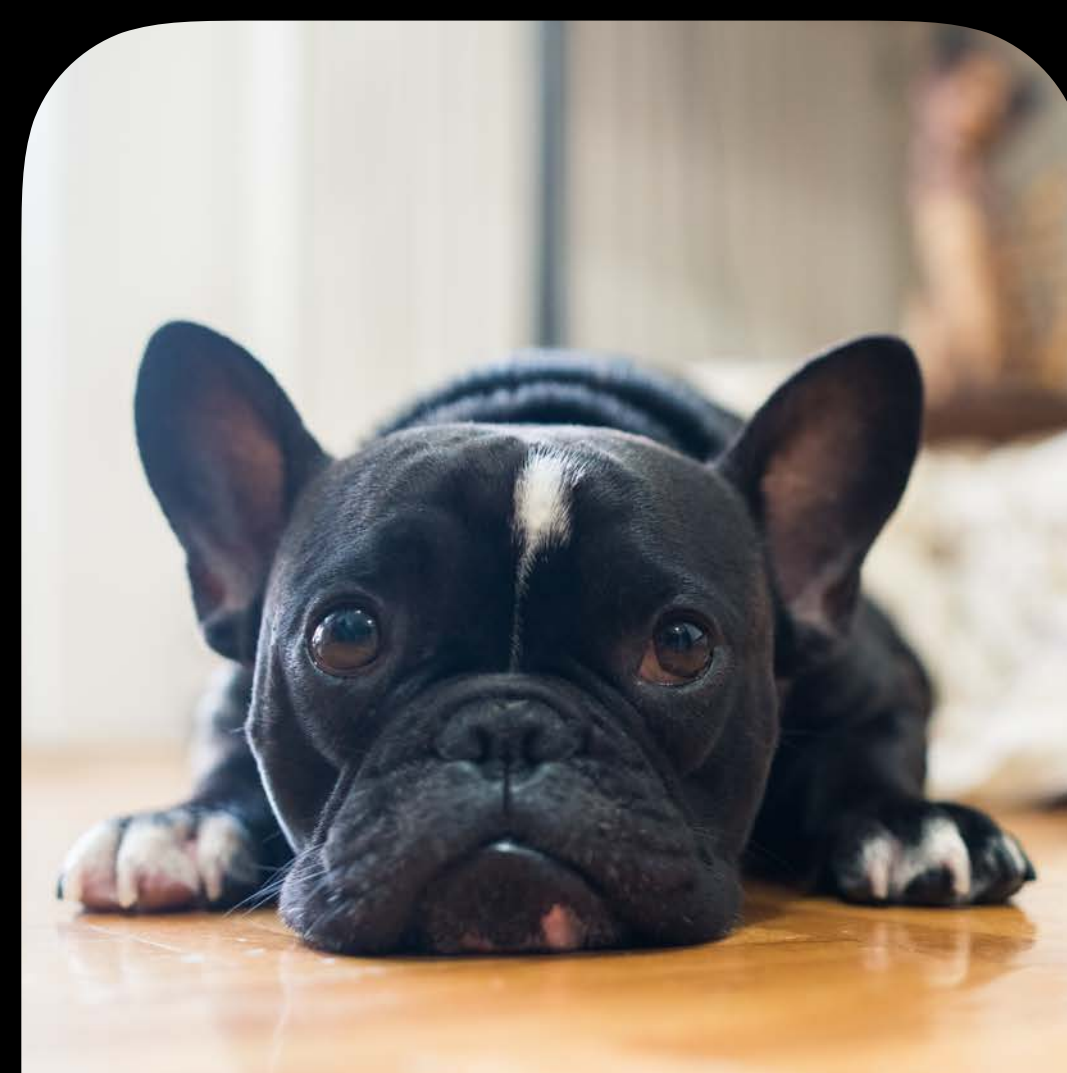












Dog



Not dog



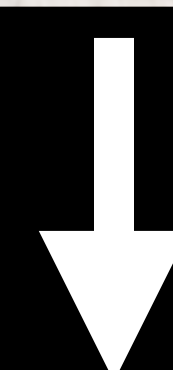
Dog



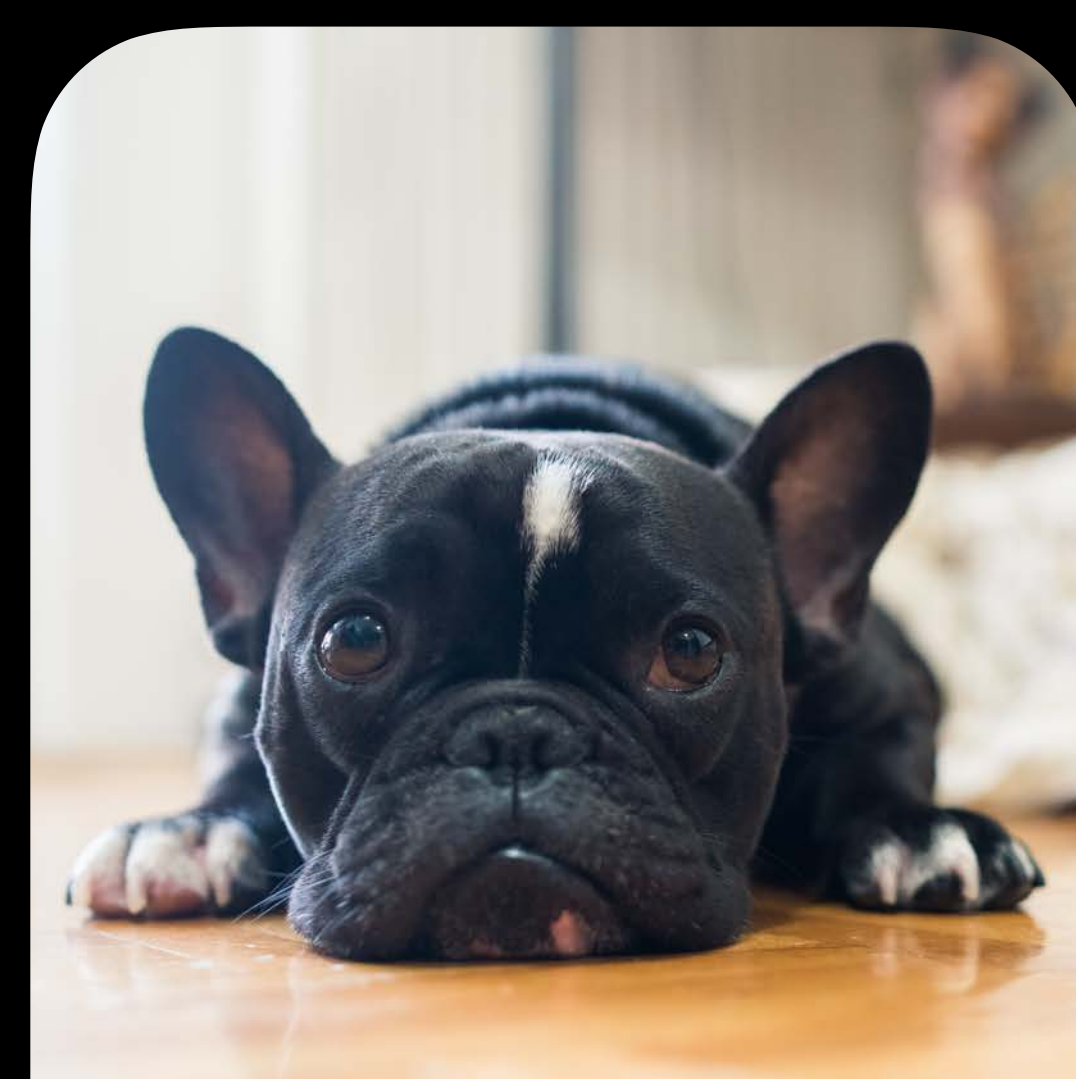
Not dog



Dog







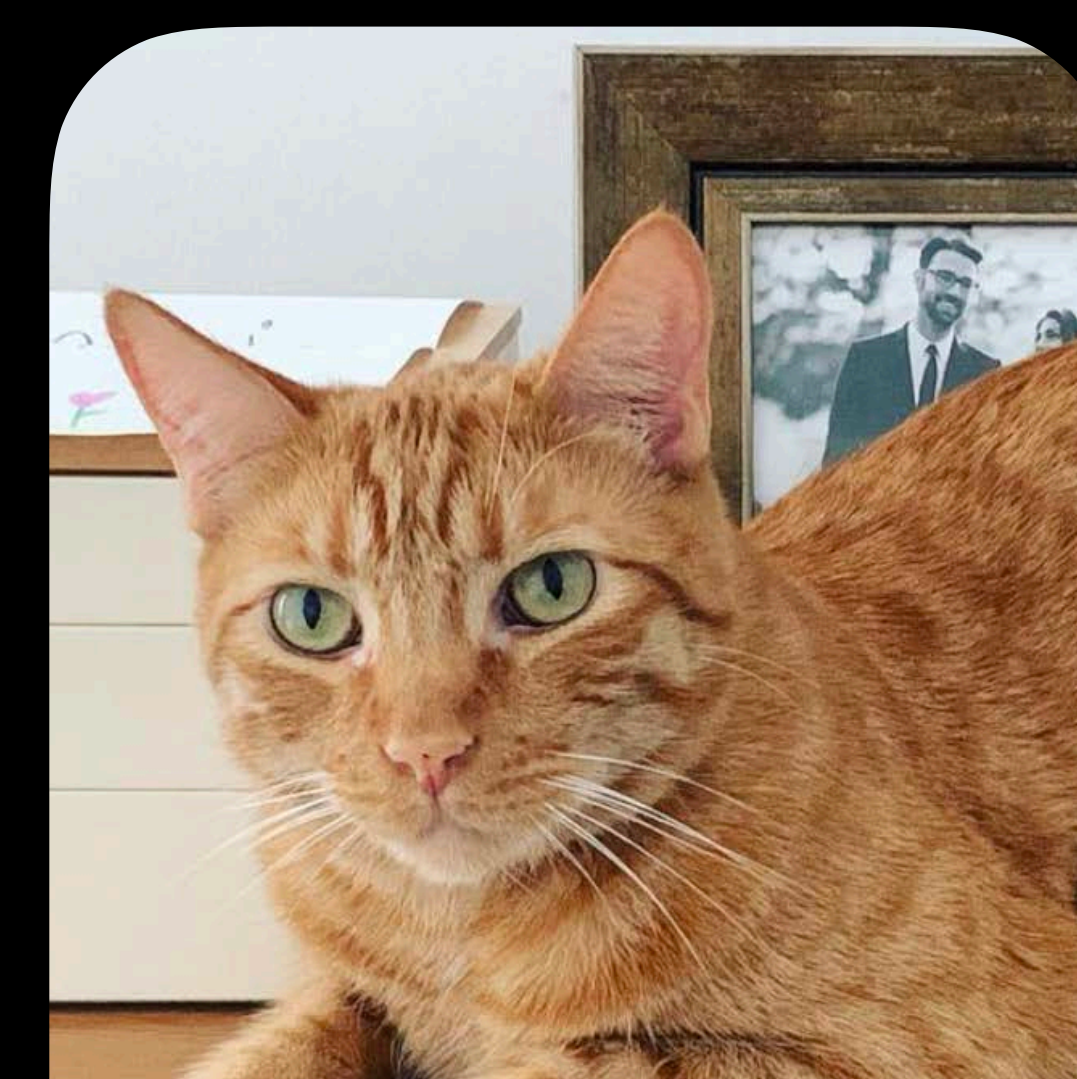
Dog



Not dog



Dog



Not dog



Dog







Dog



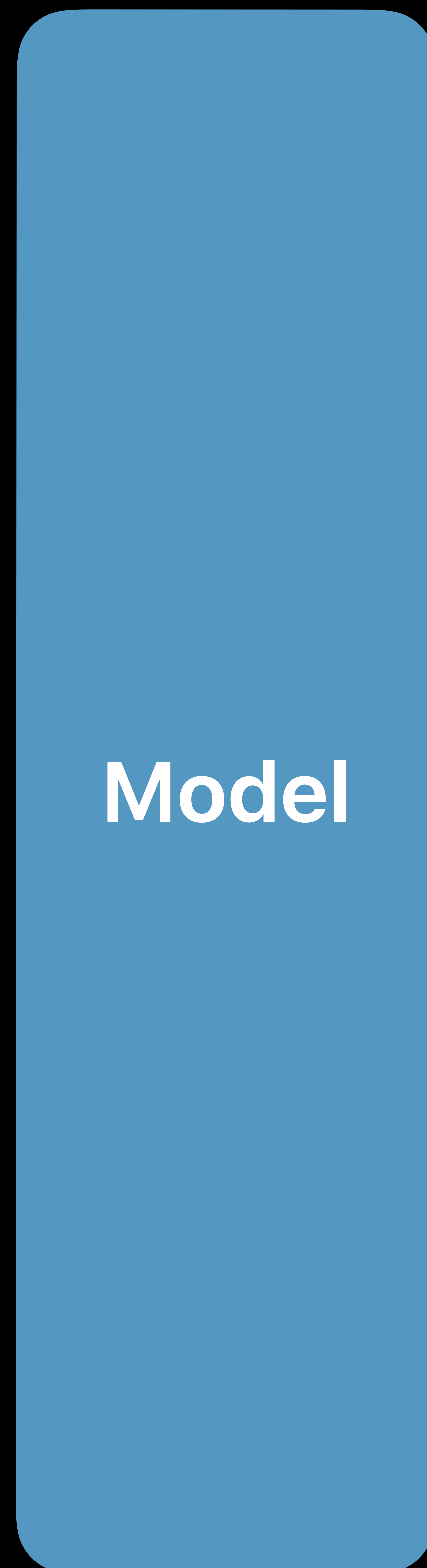


Model



Dog





Dog



Dog



Not dog



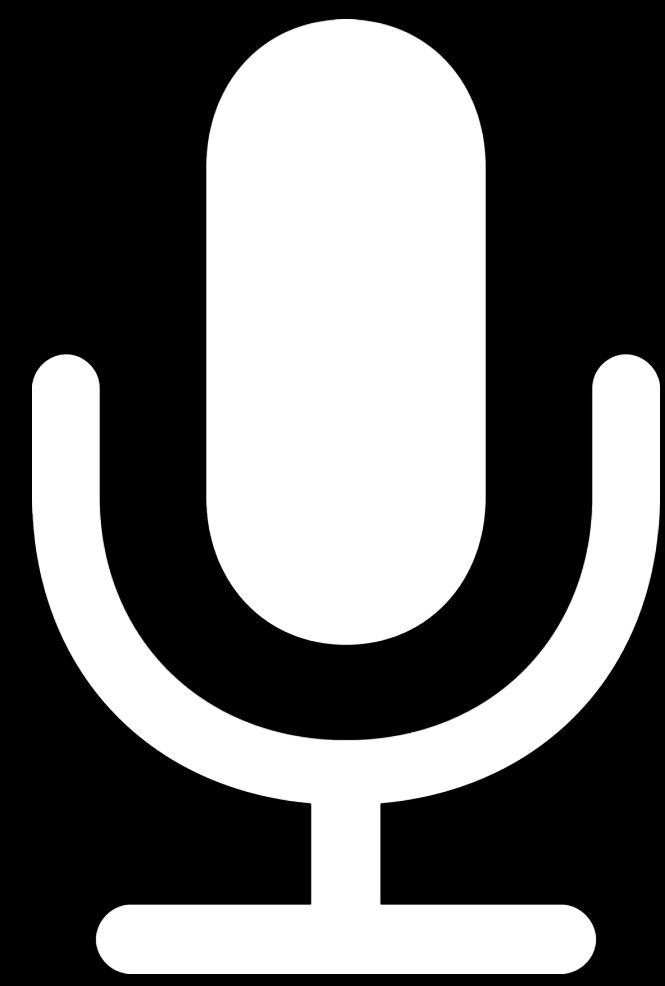


Model



Dog





Model



"Hey Siri"



Model



Dog

machi



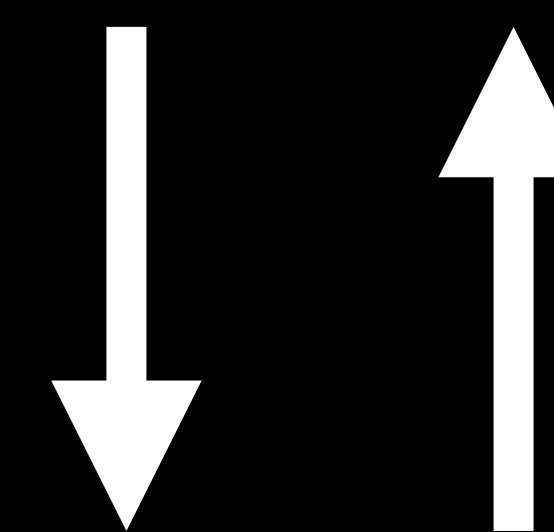
Model



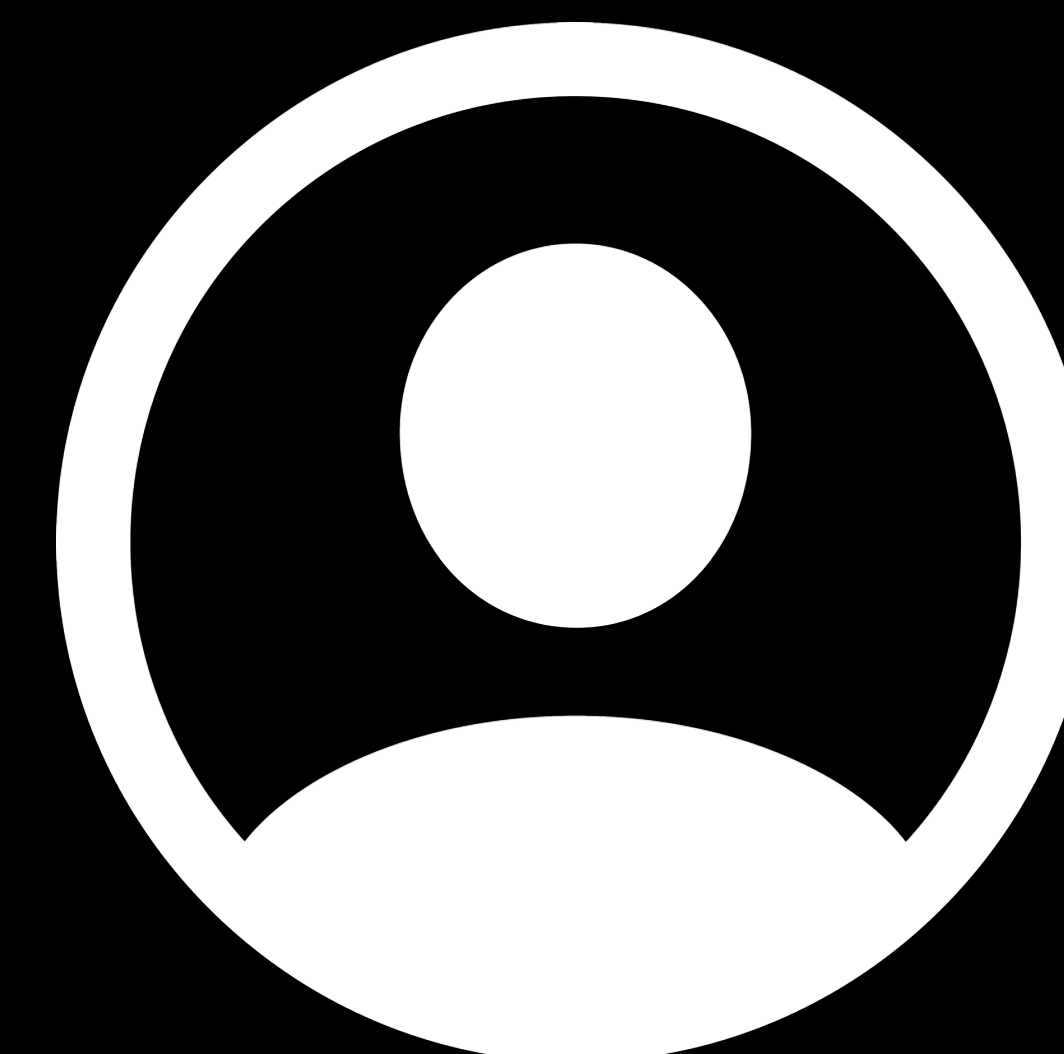
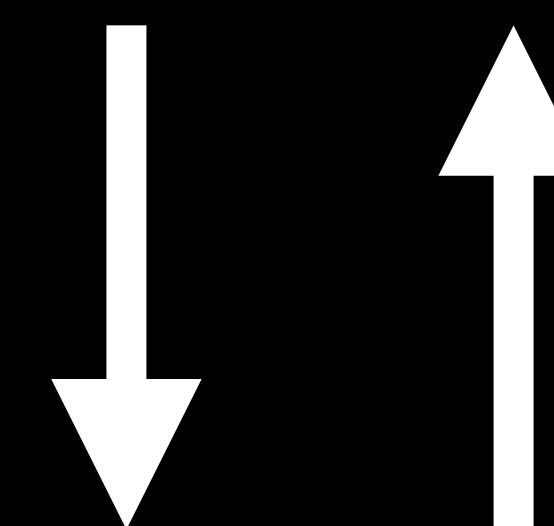
machine



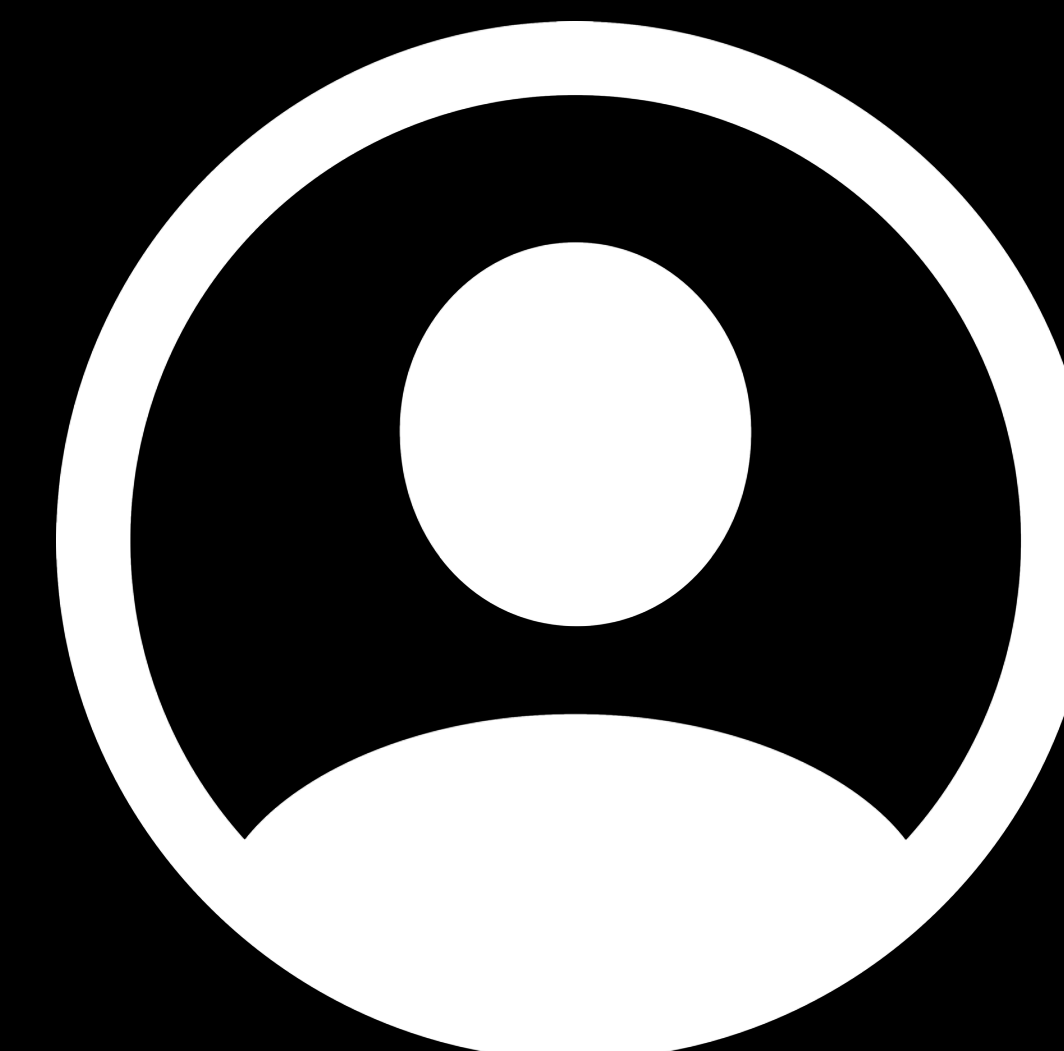
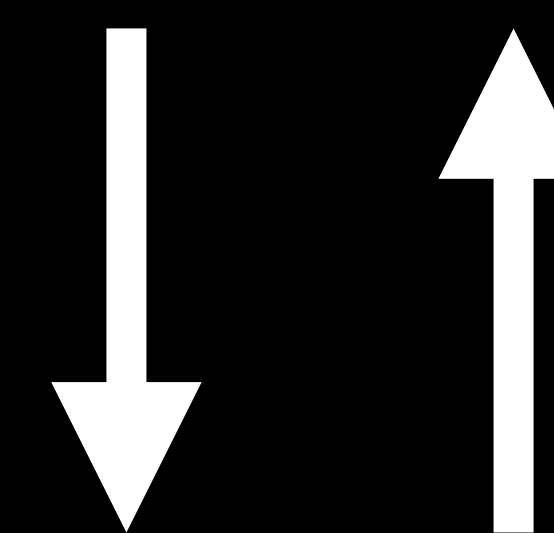
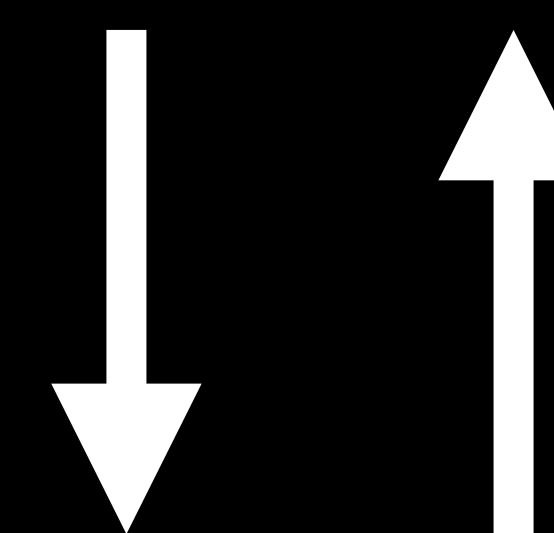
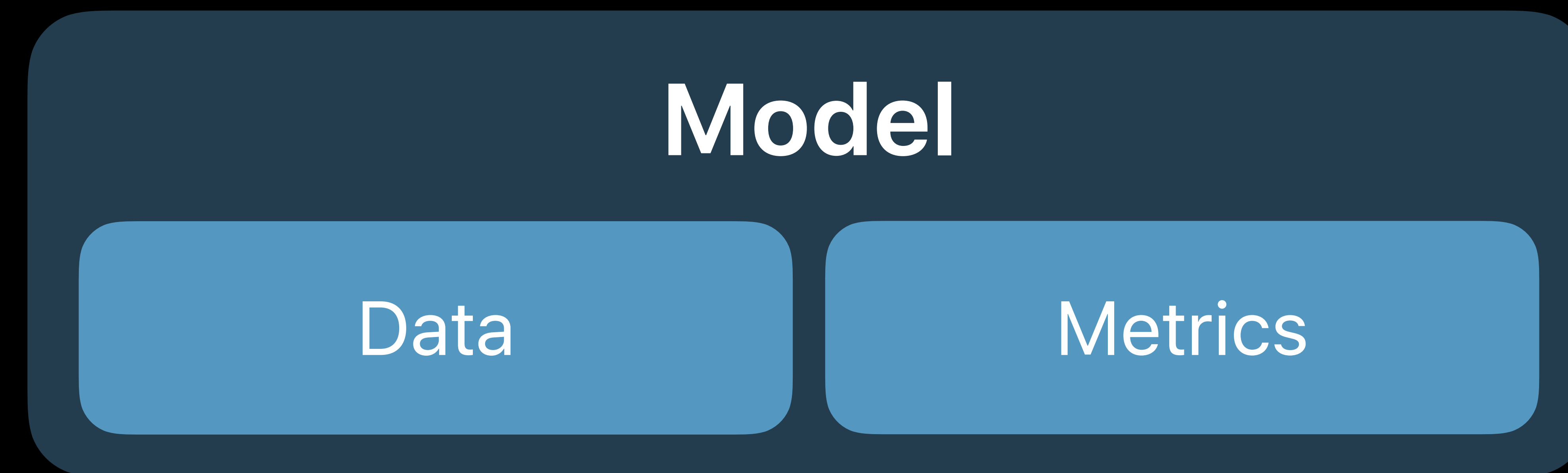
Model



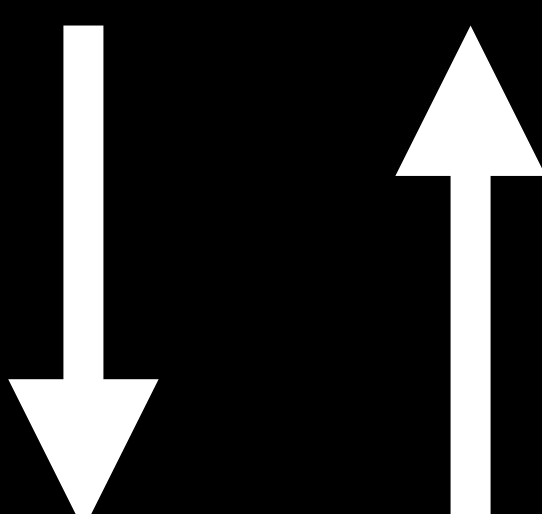
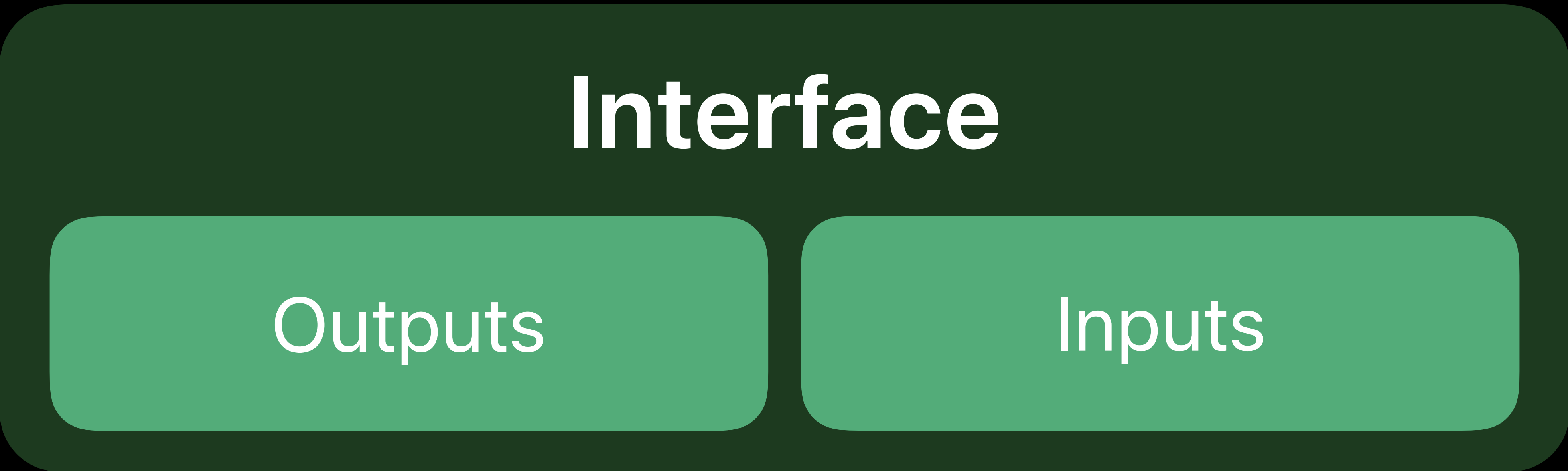
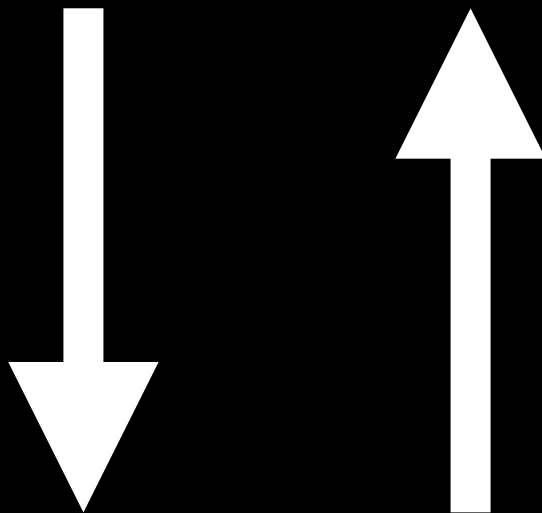
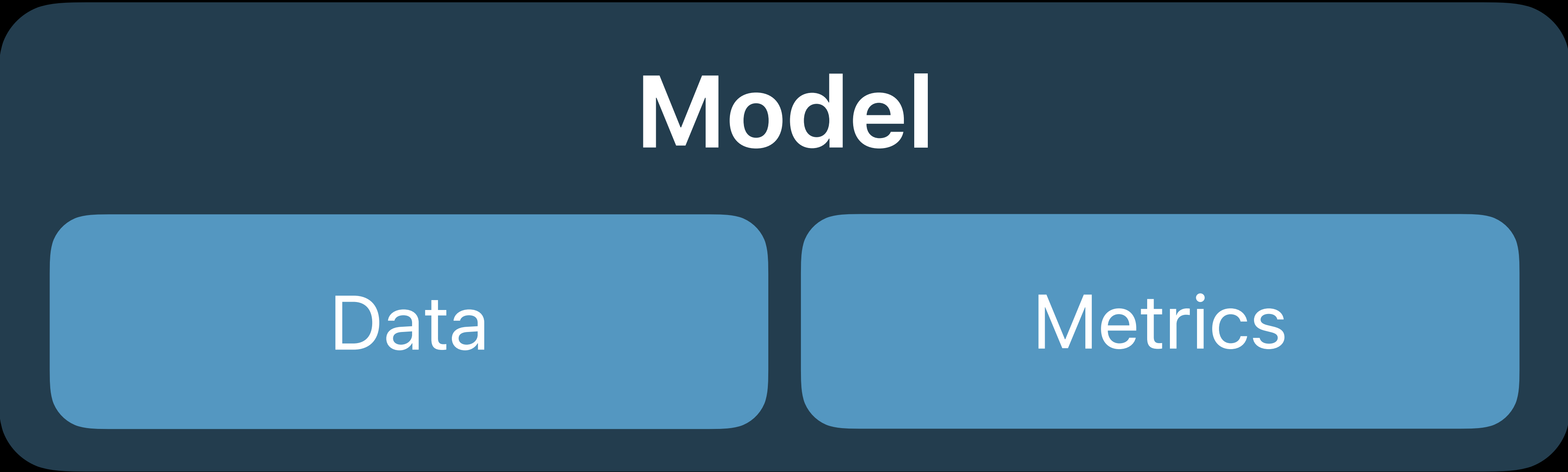
Interface



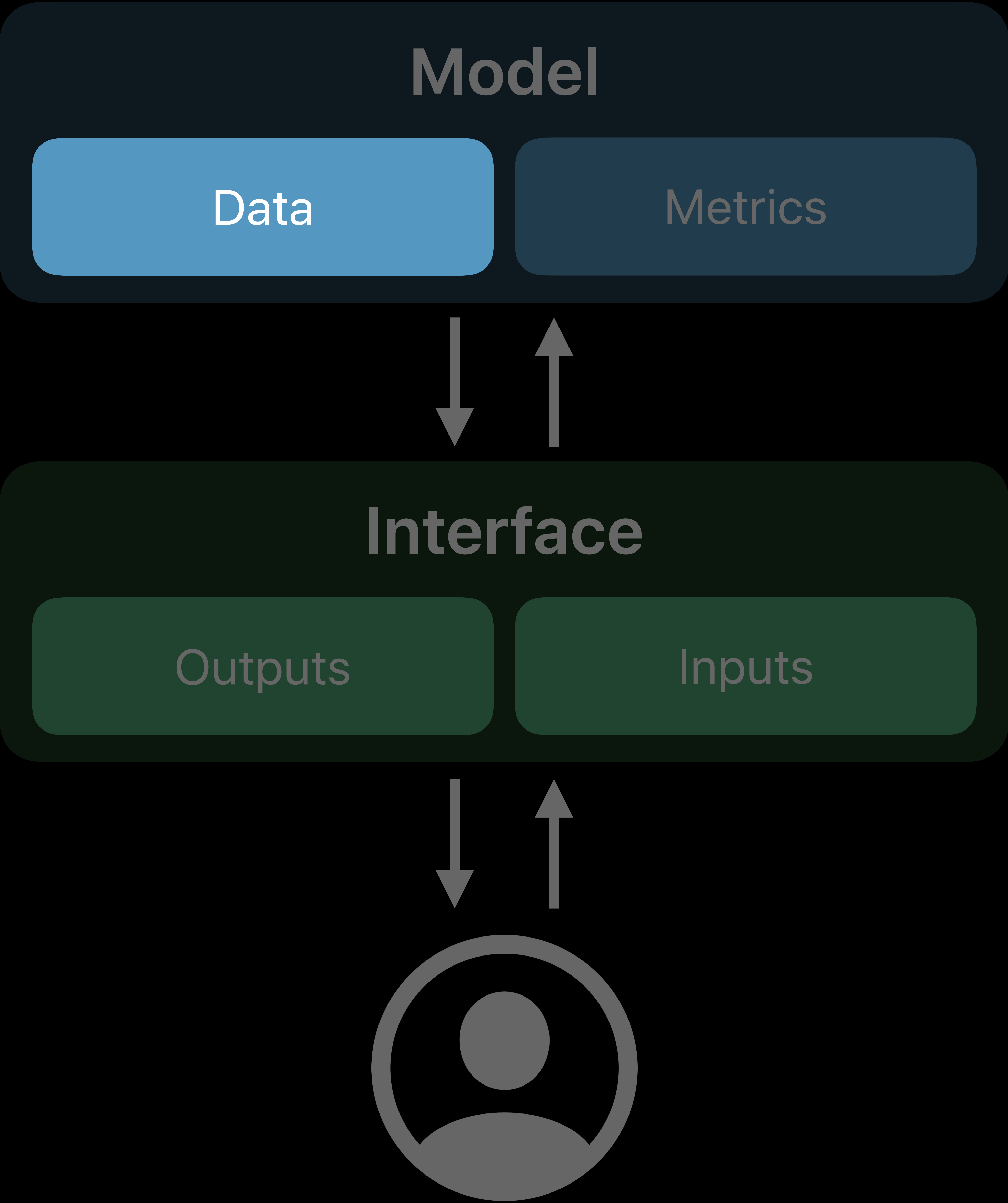




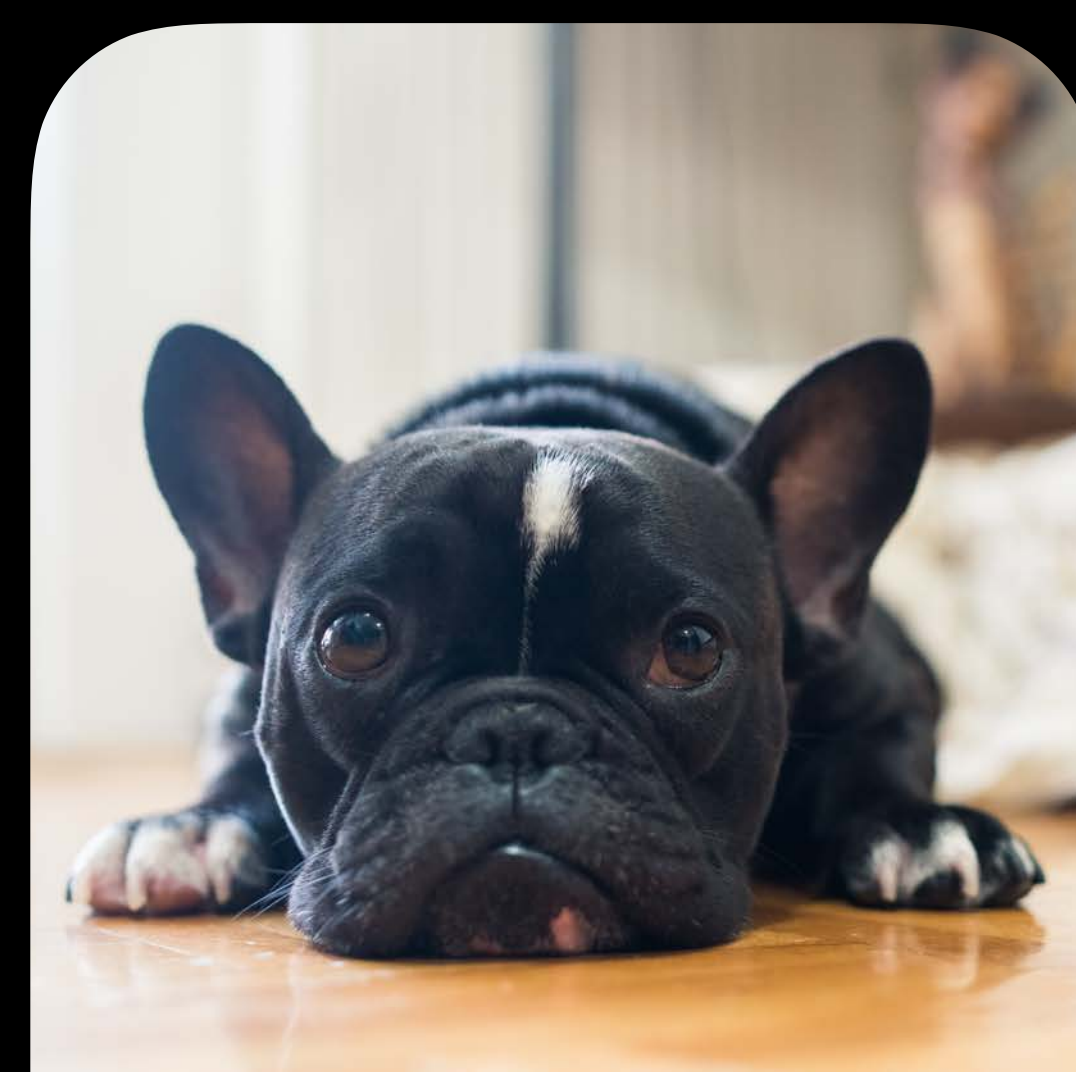












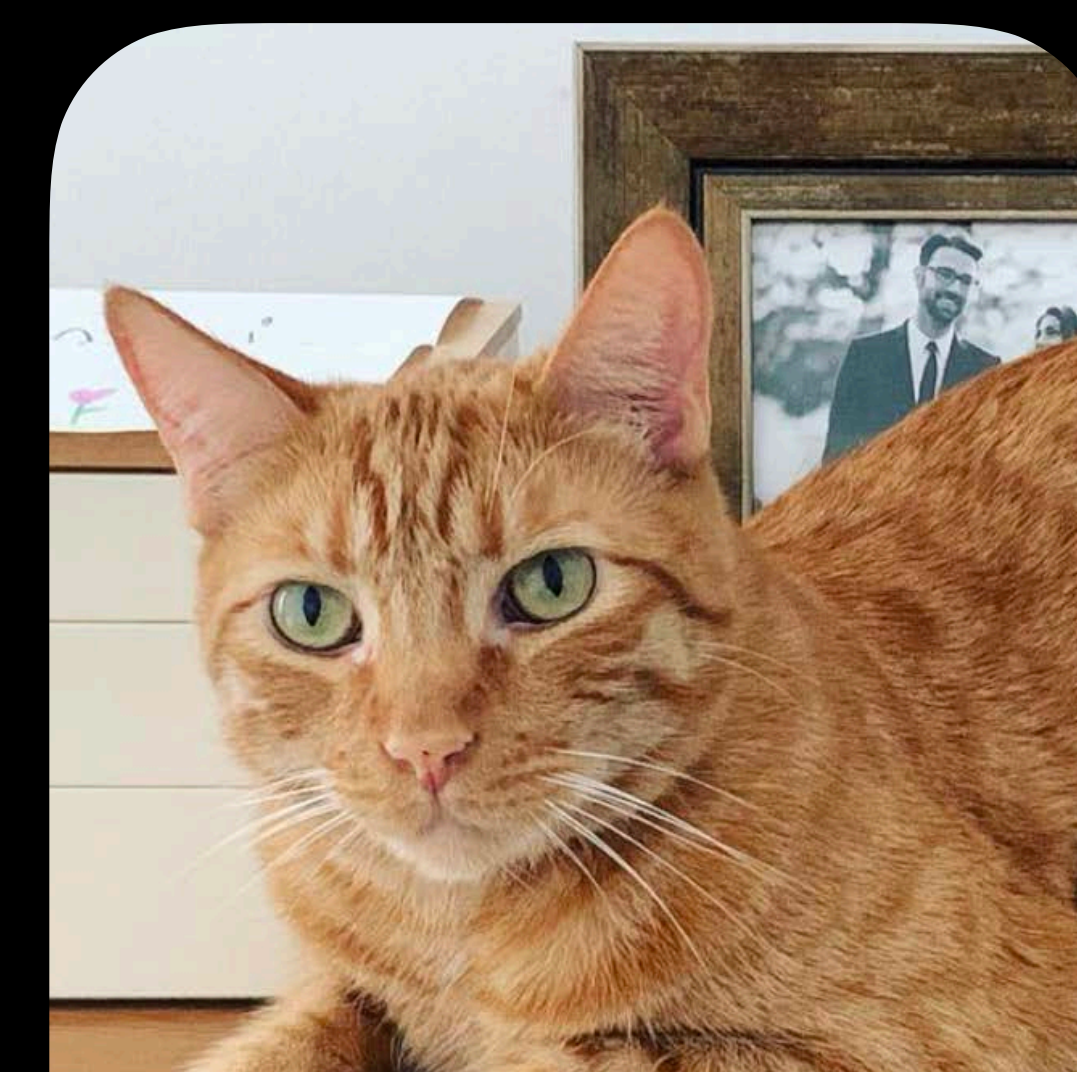
Dog



Not dog



Dog



Not dog



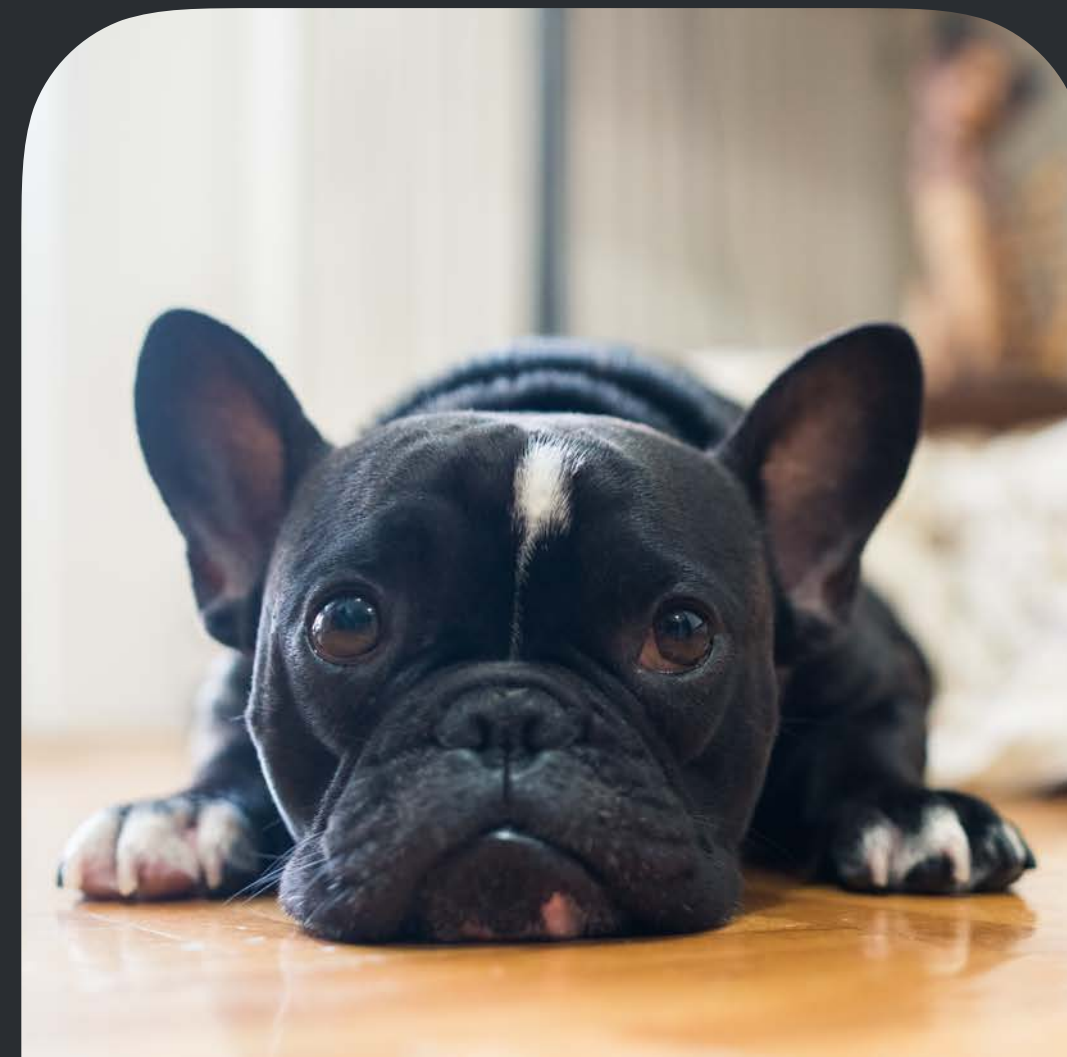
Dog



Model



## Data



Dog



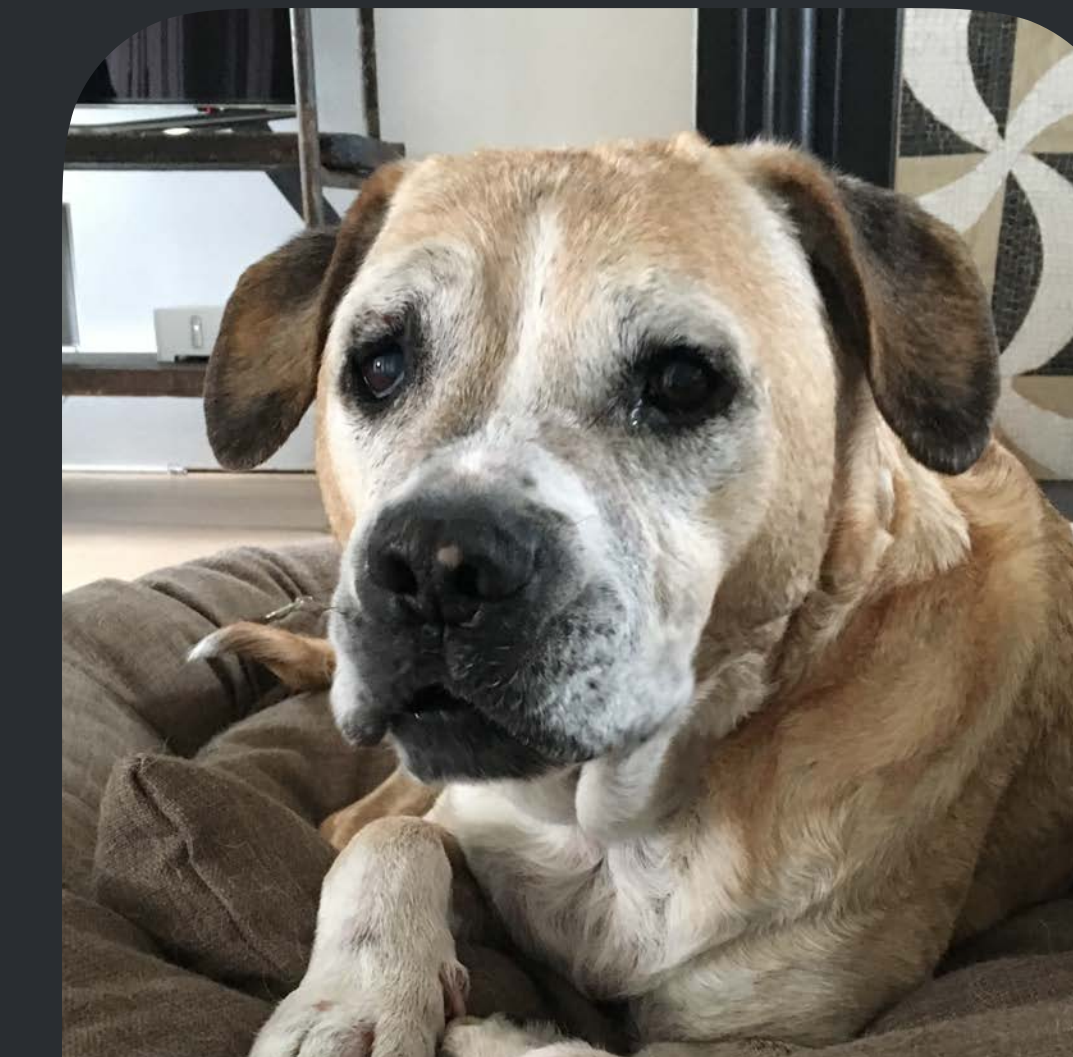
Not dog



Dog



Not dog

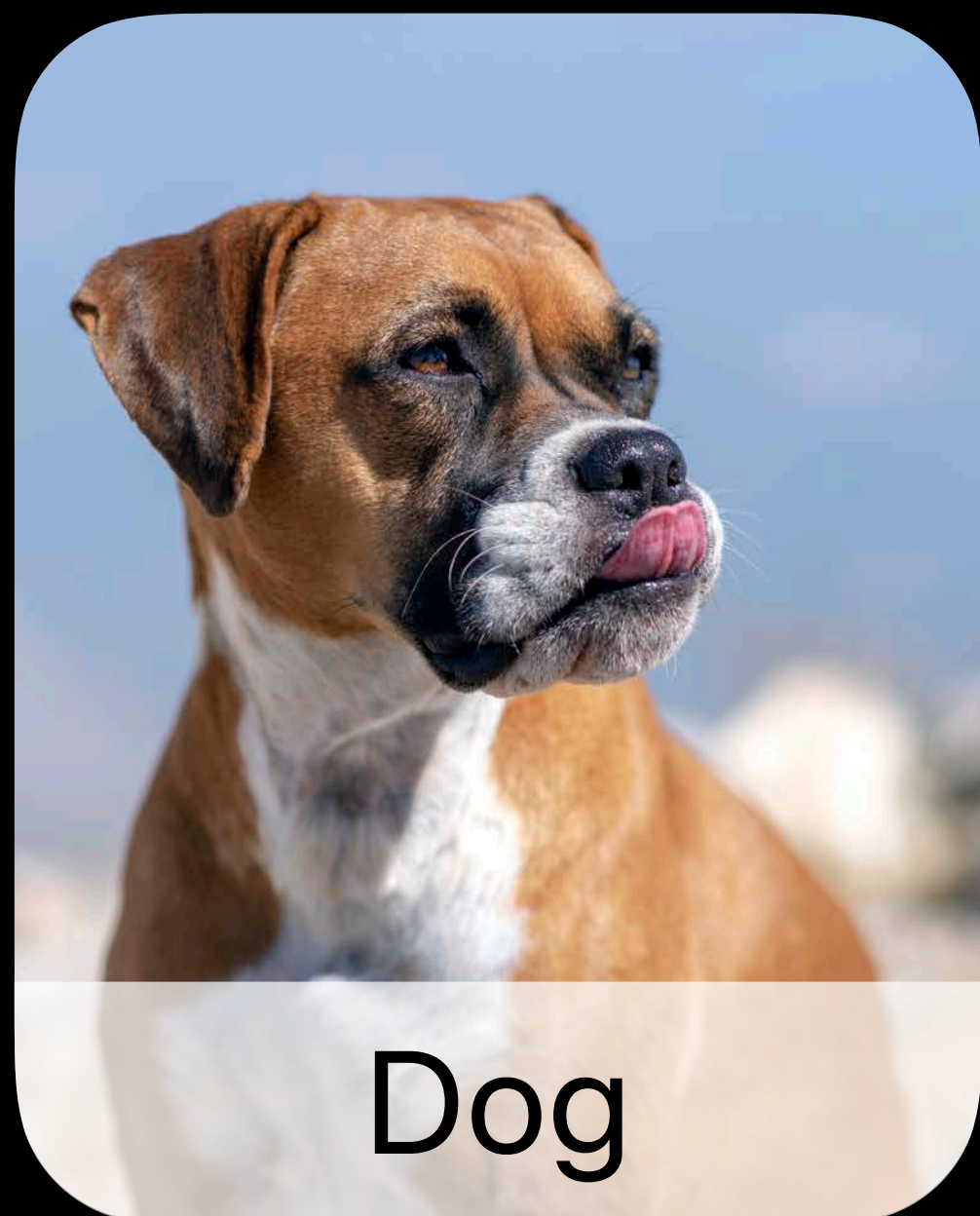
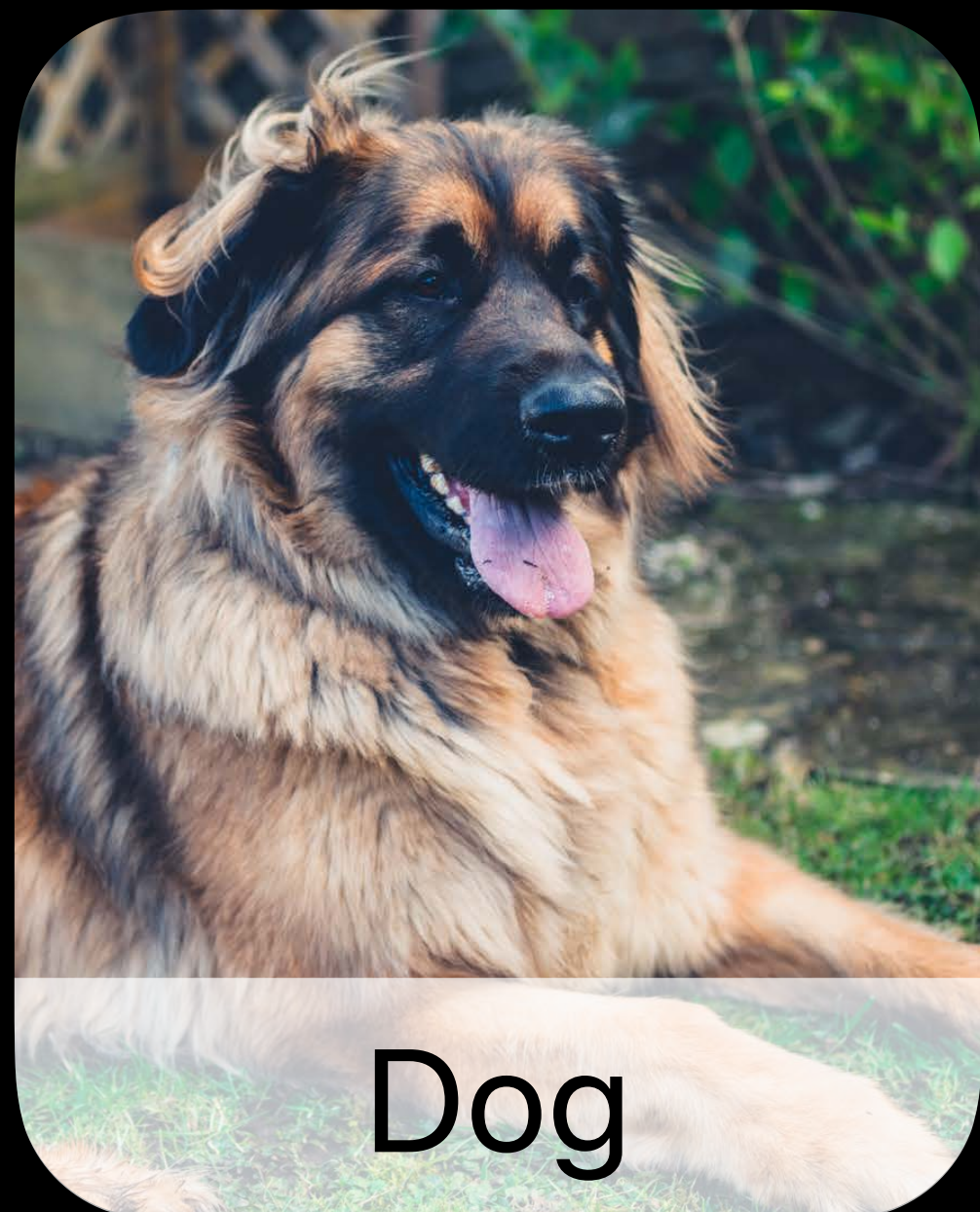
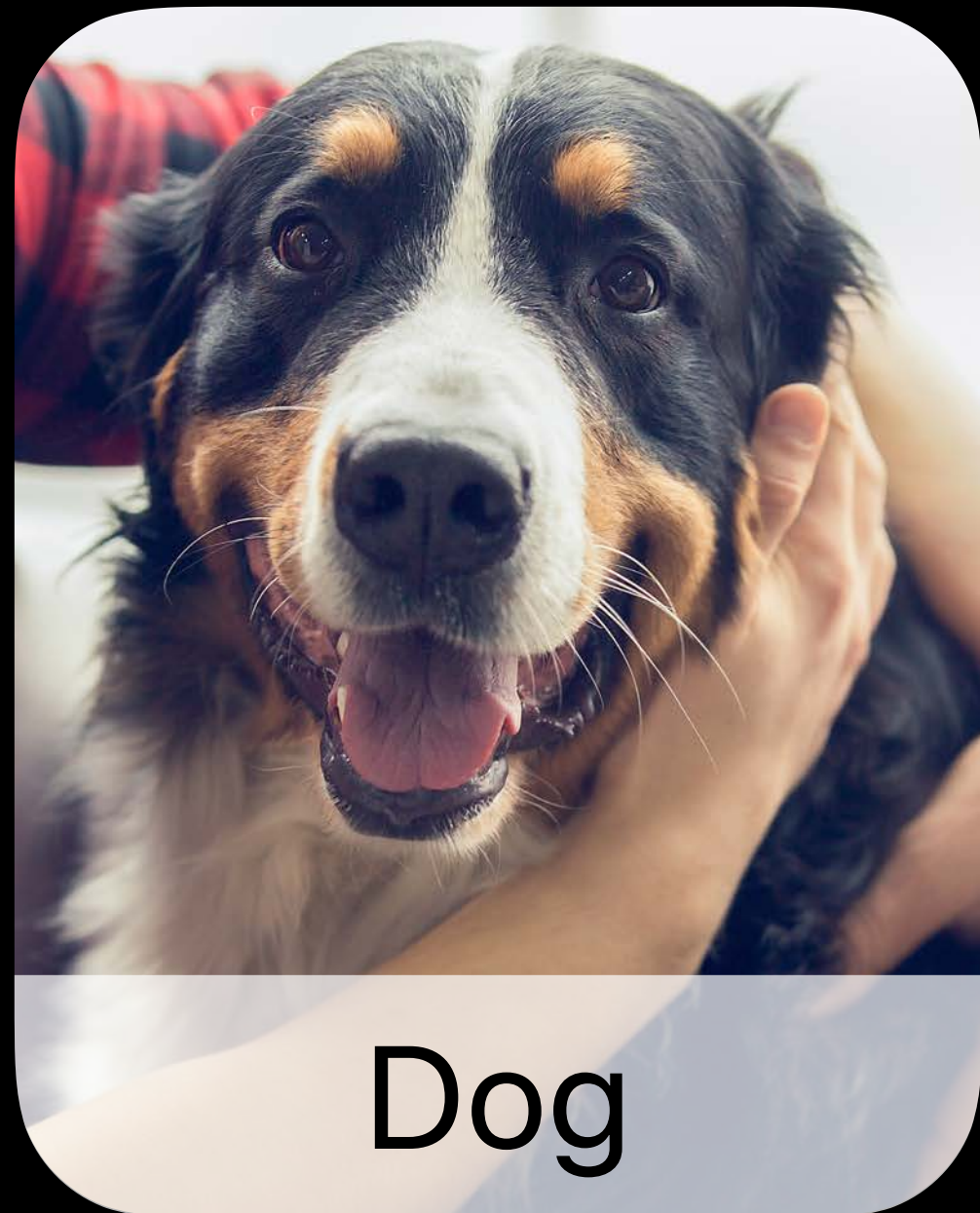
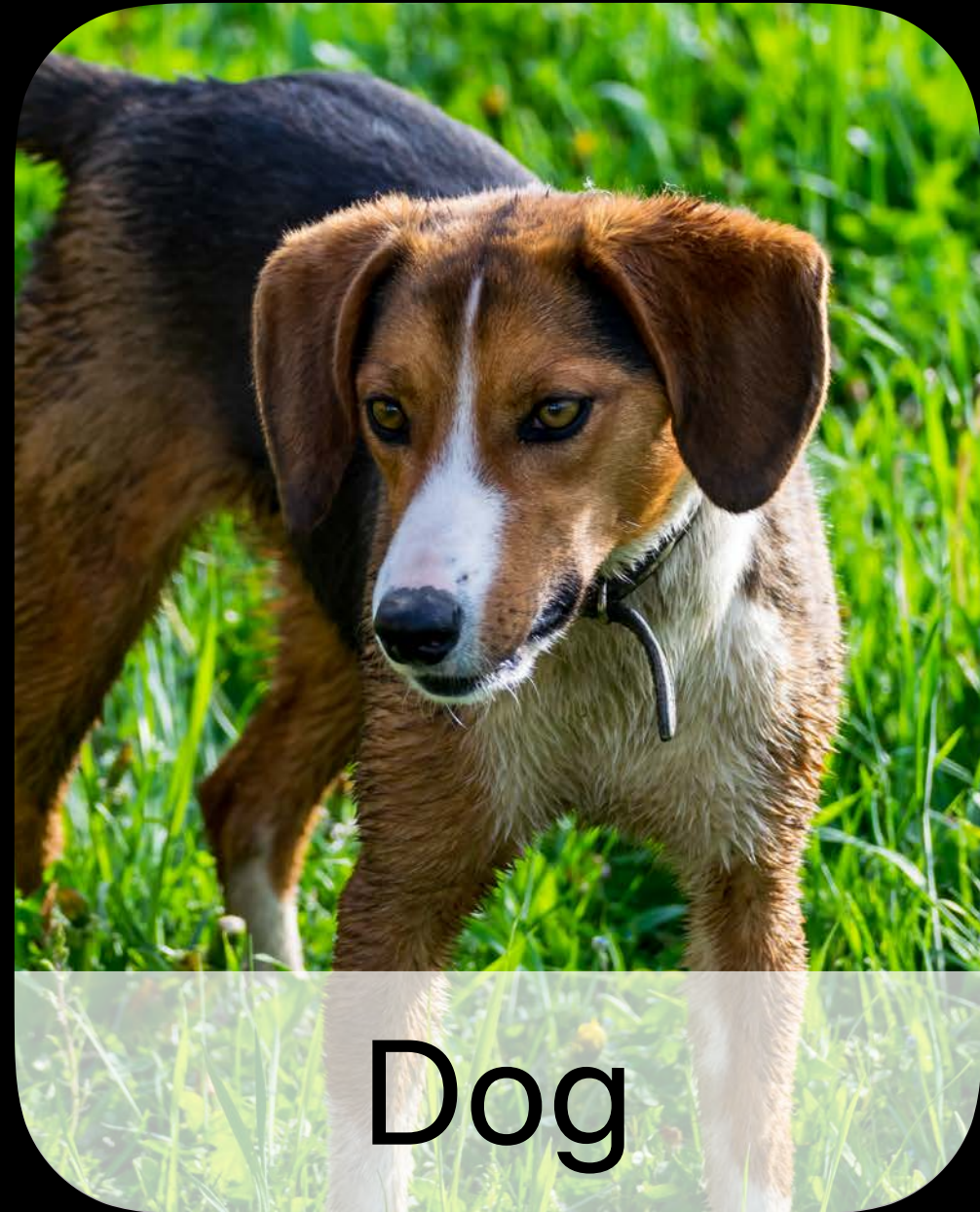


Dog



Model









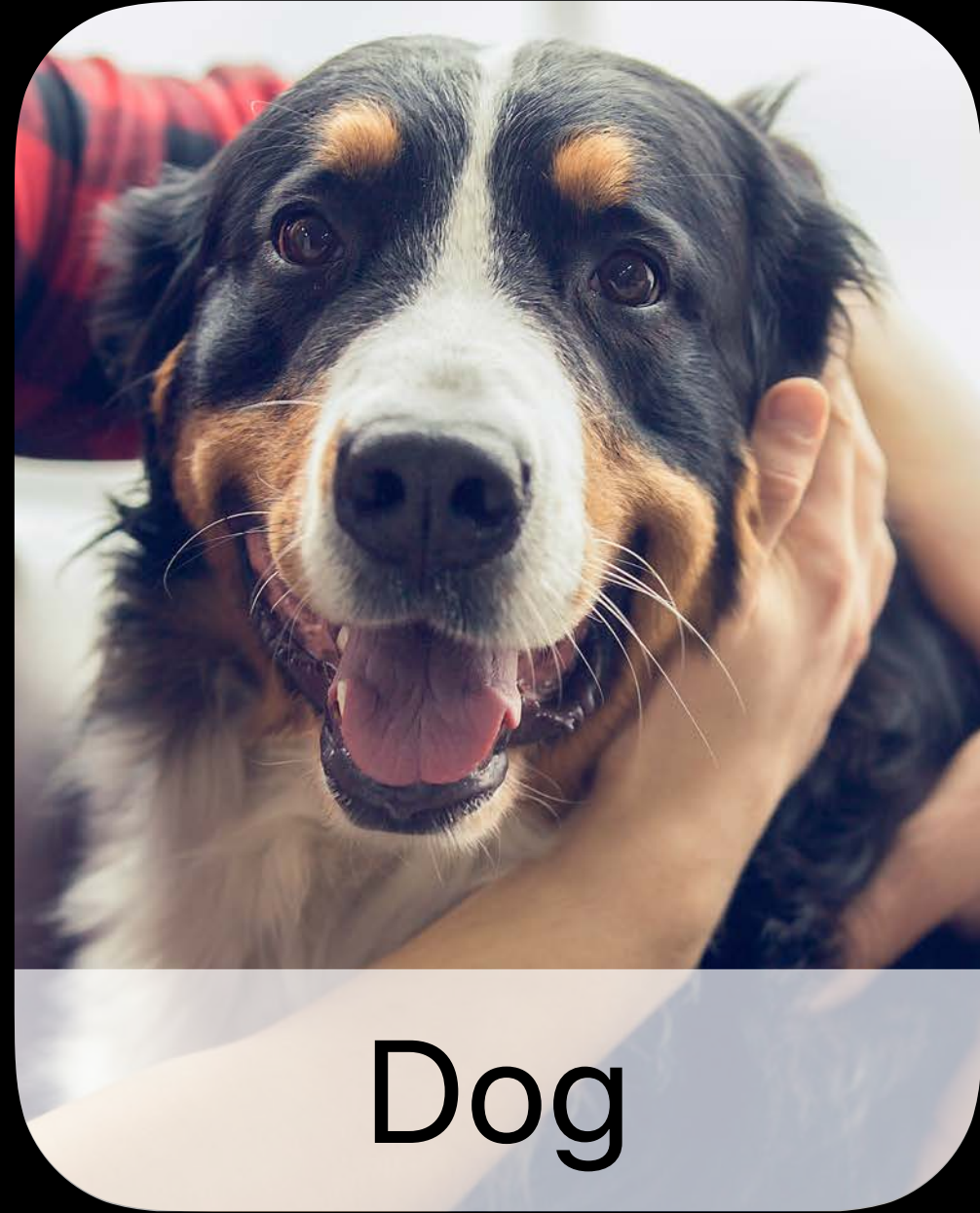
Dog



Cow



Cat



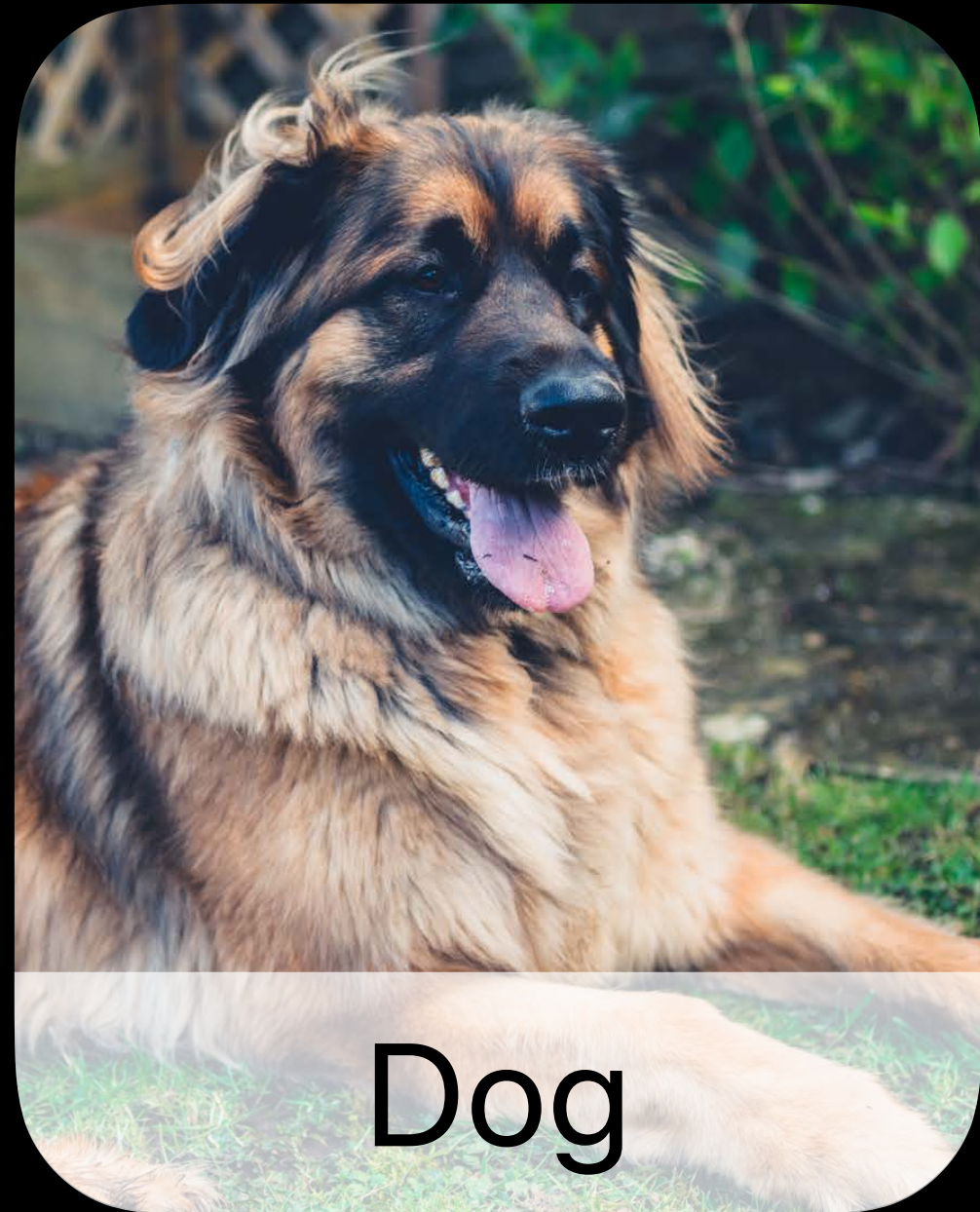
Dog



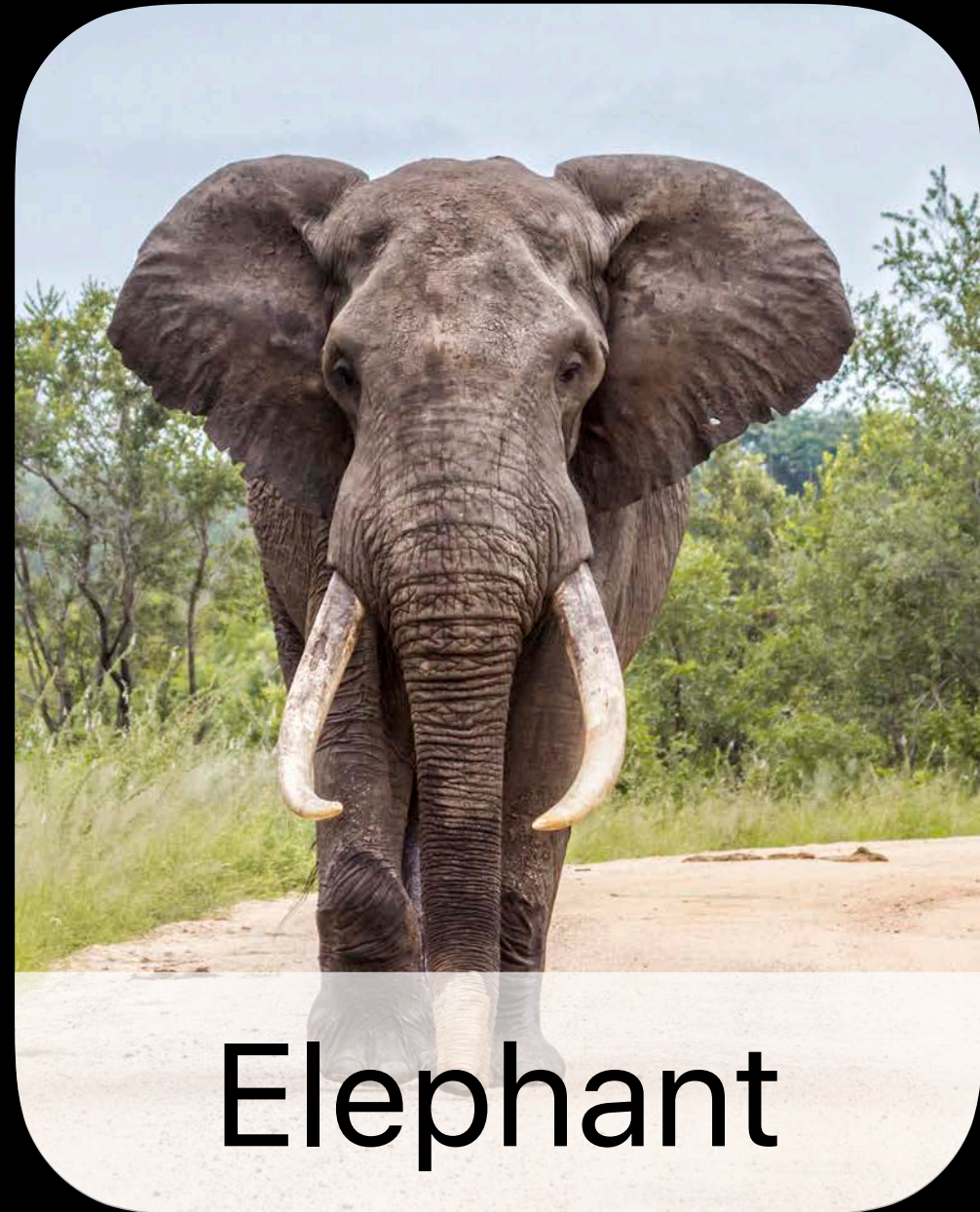
Tiger



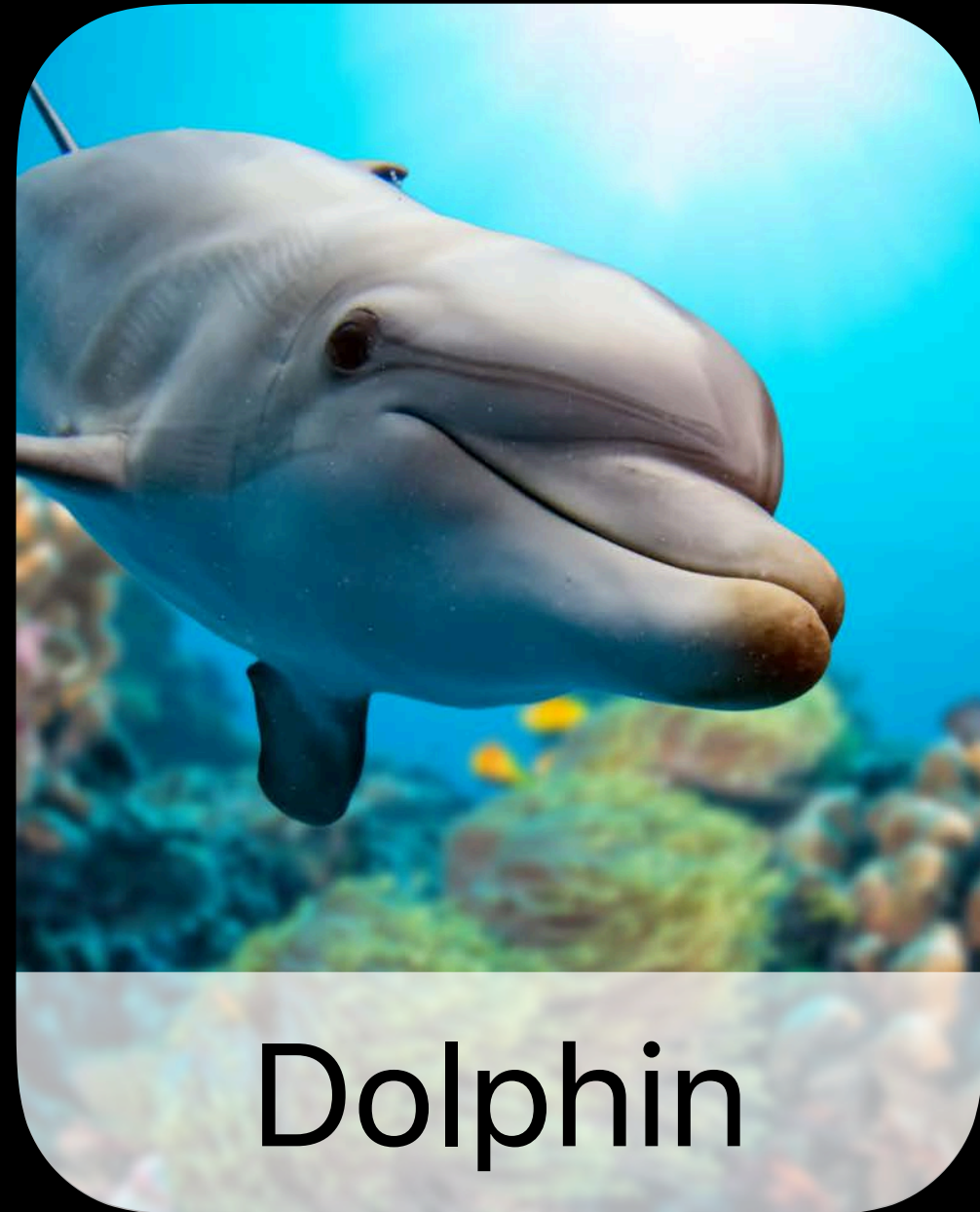
Chicken



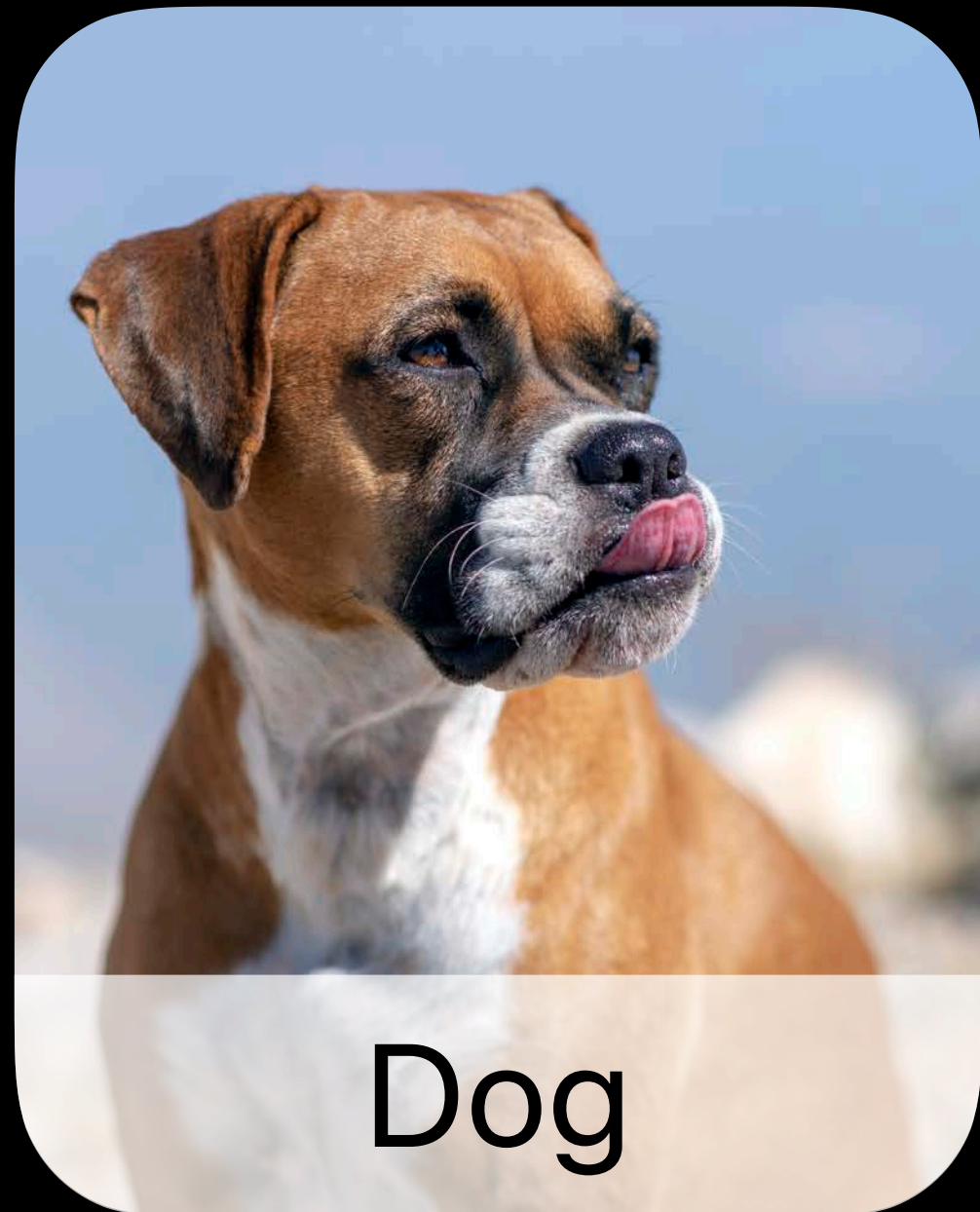
Dog



Elephant



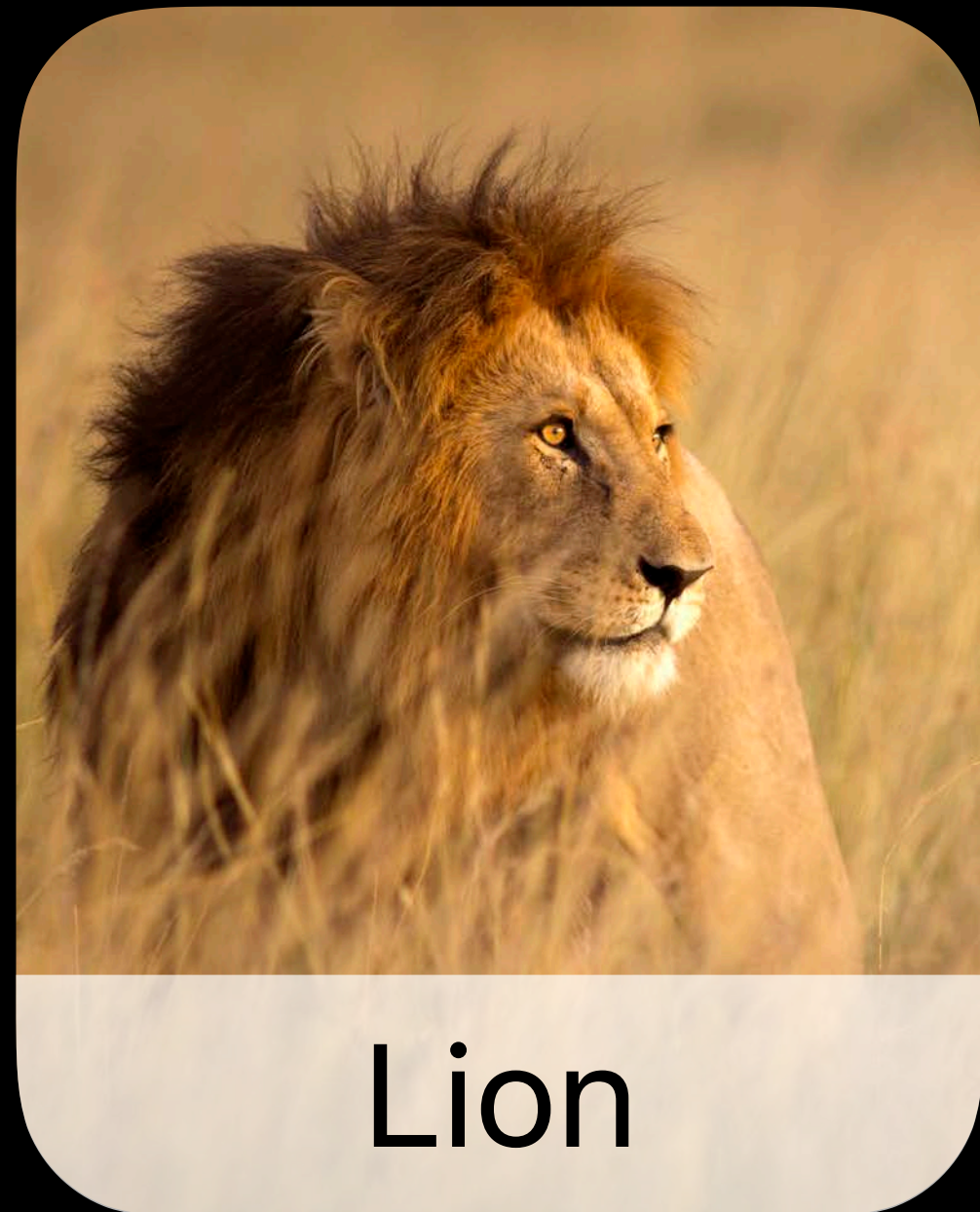
Dolphin



Dog

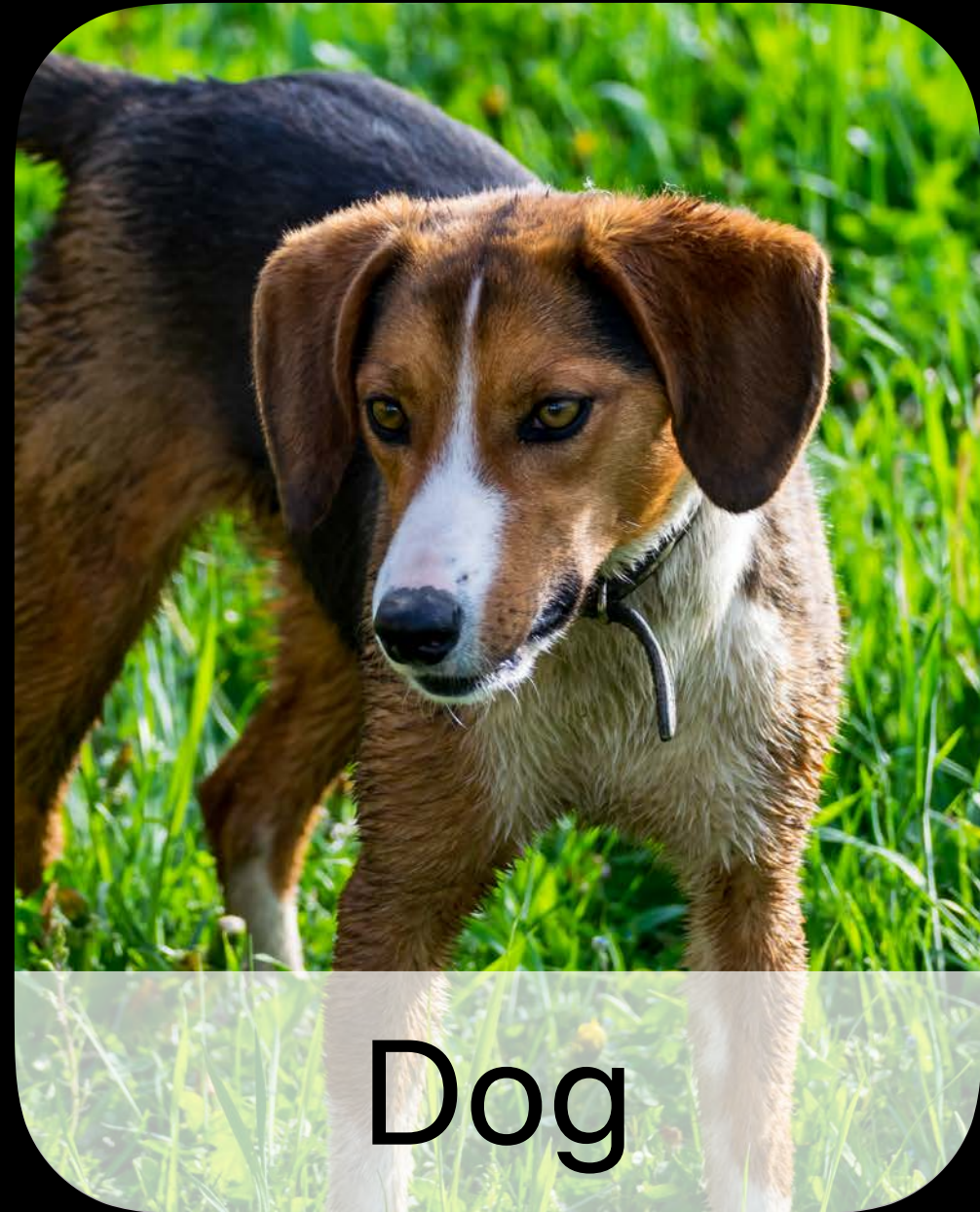


Mouse



Lion





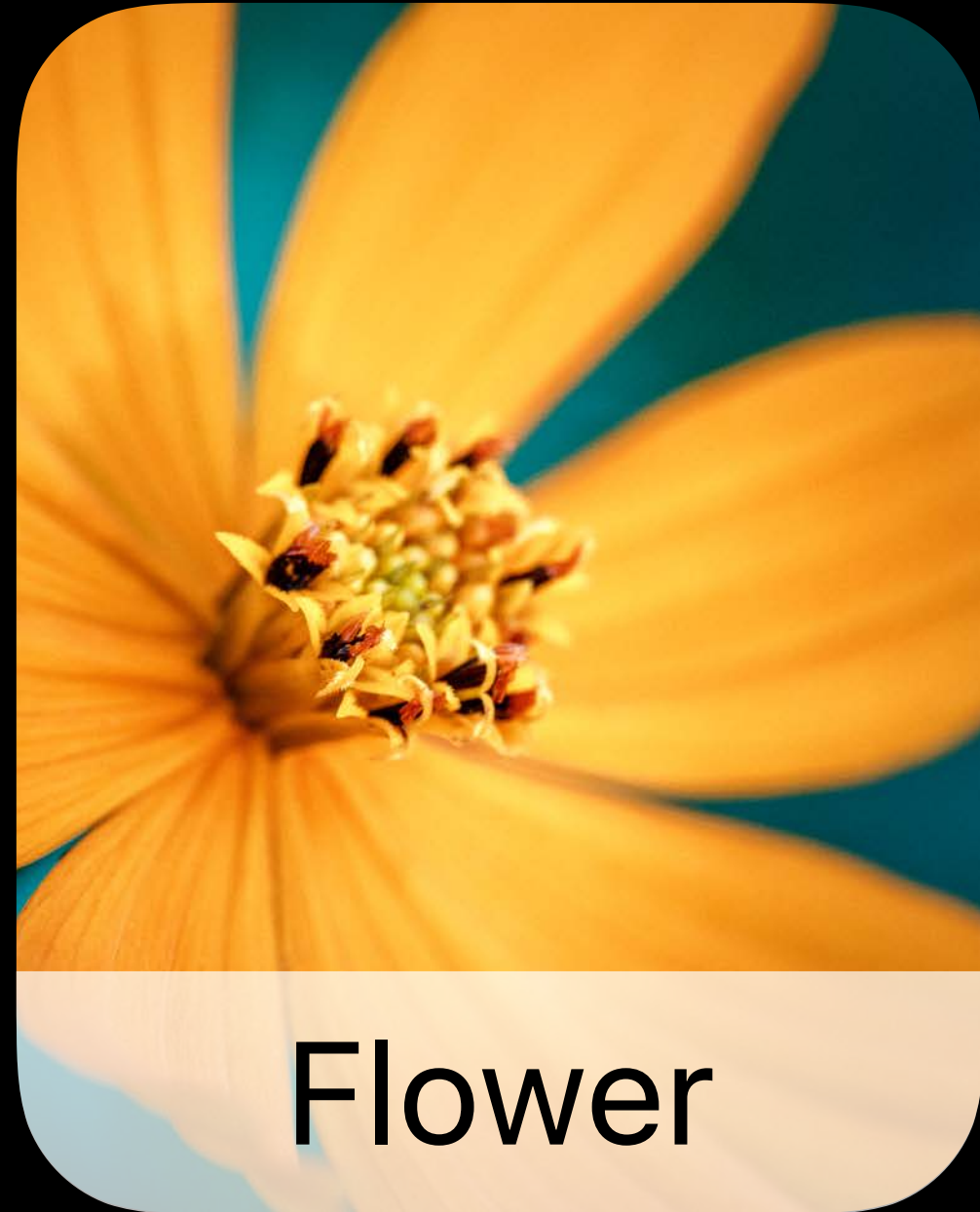
Dog



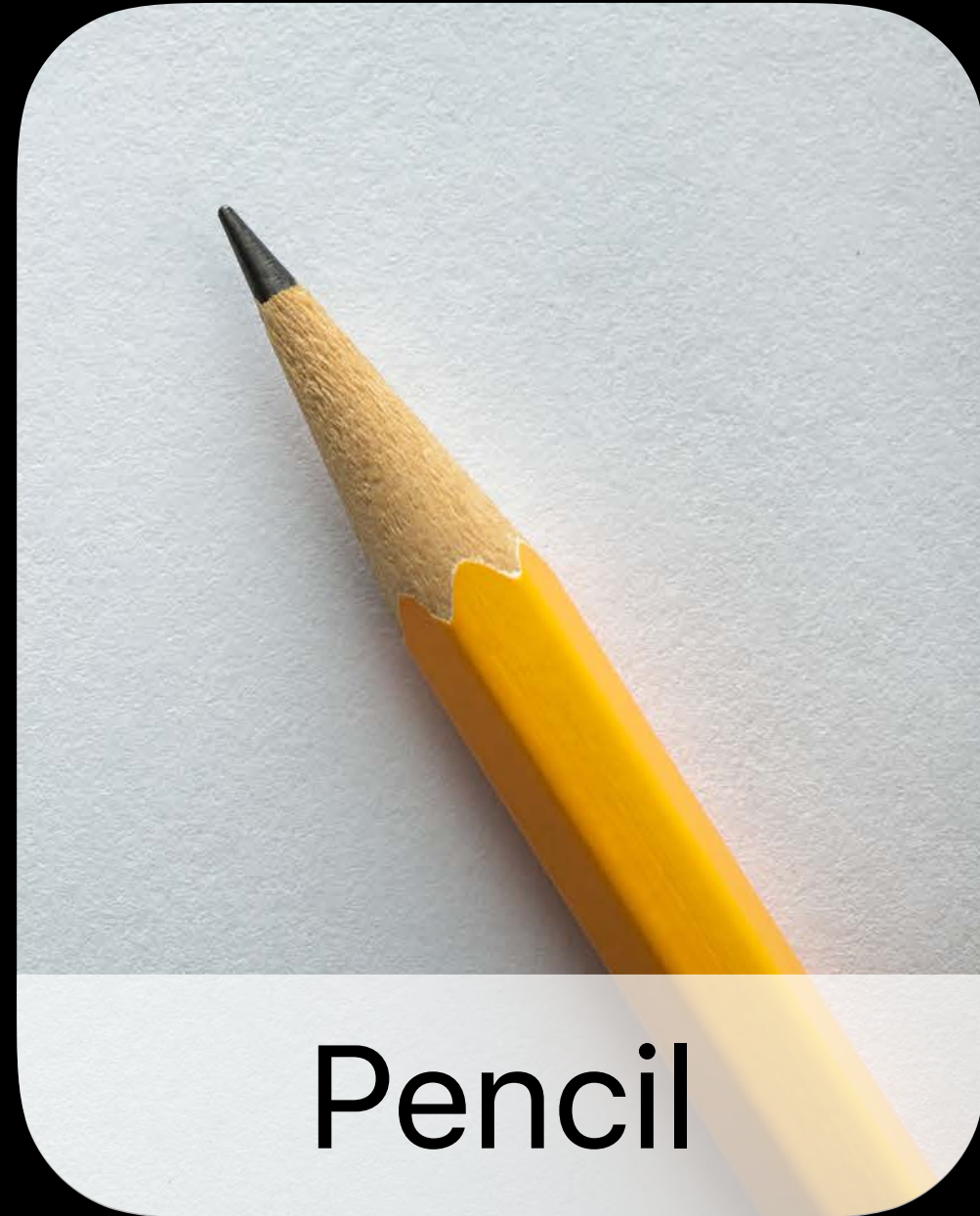
Cow



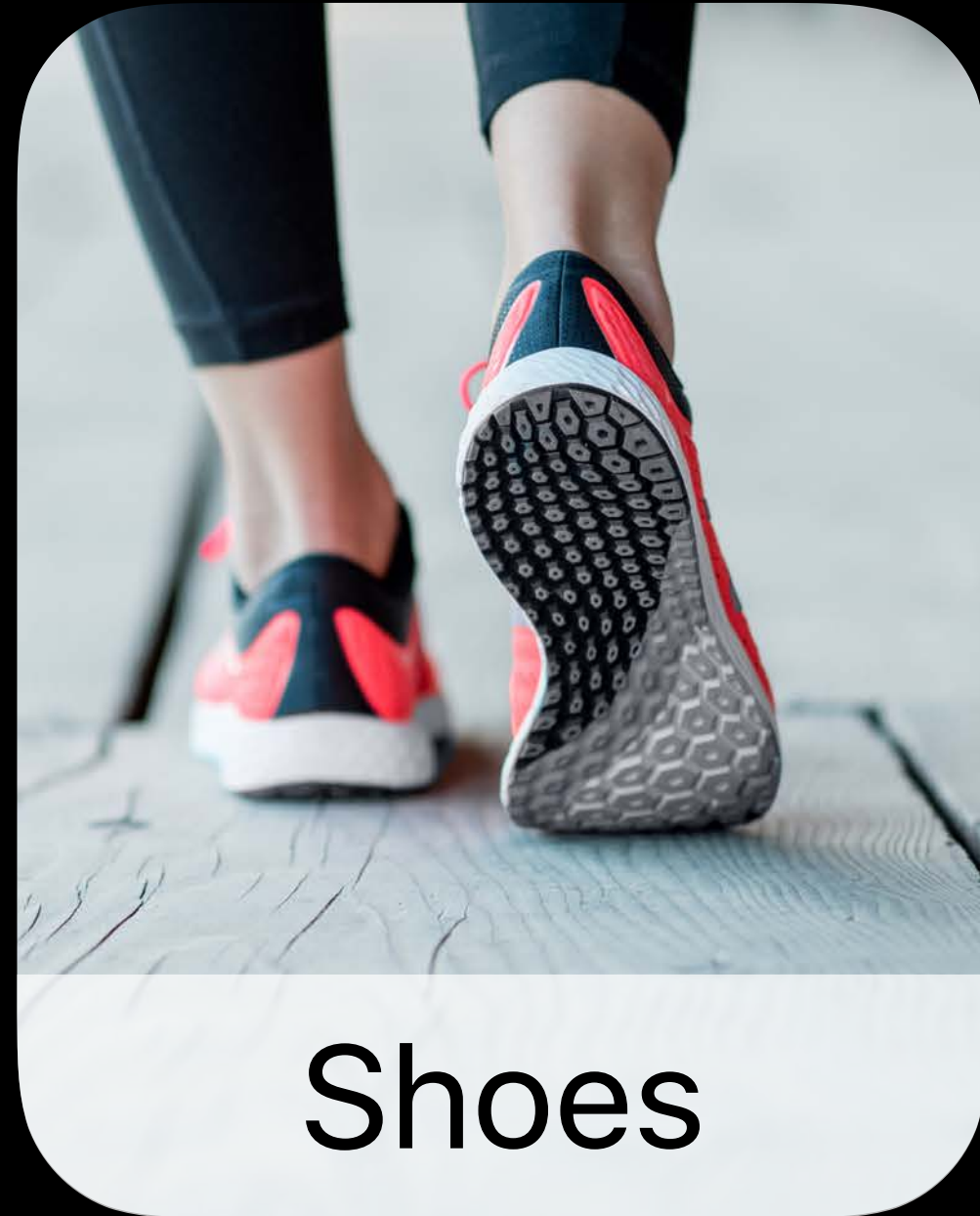
Cat



Flower



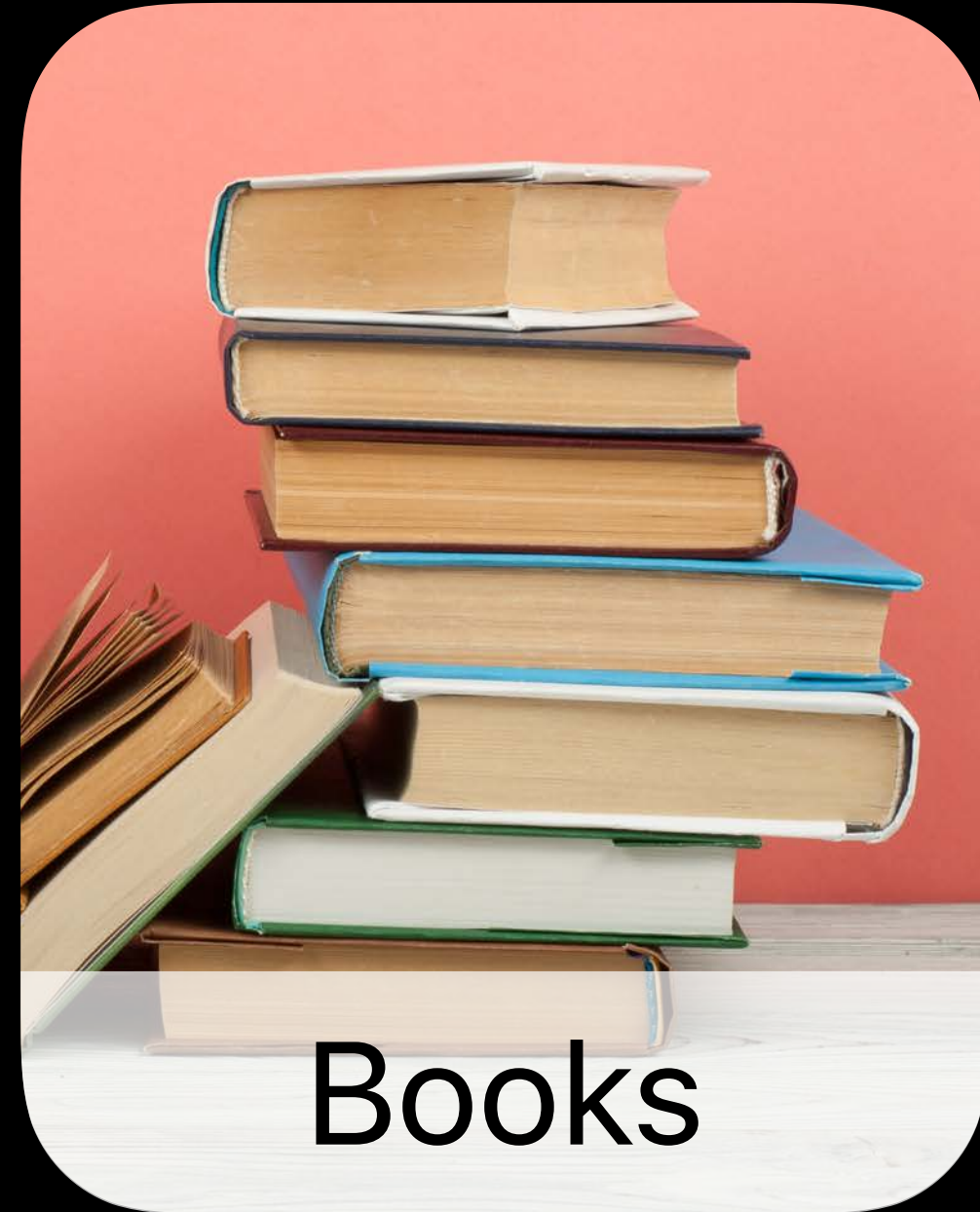
Pencil



Shoes



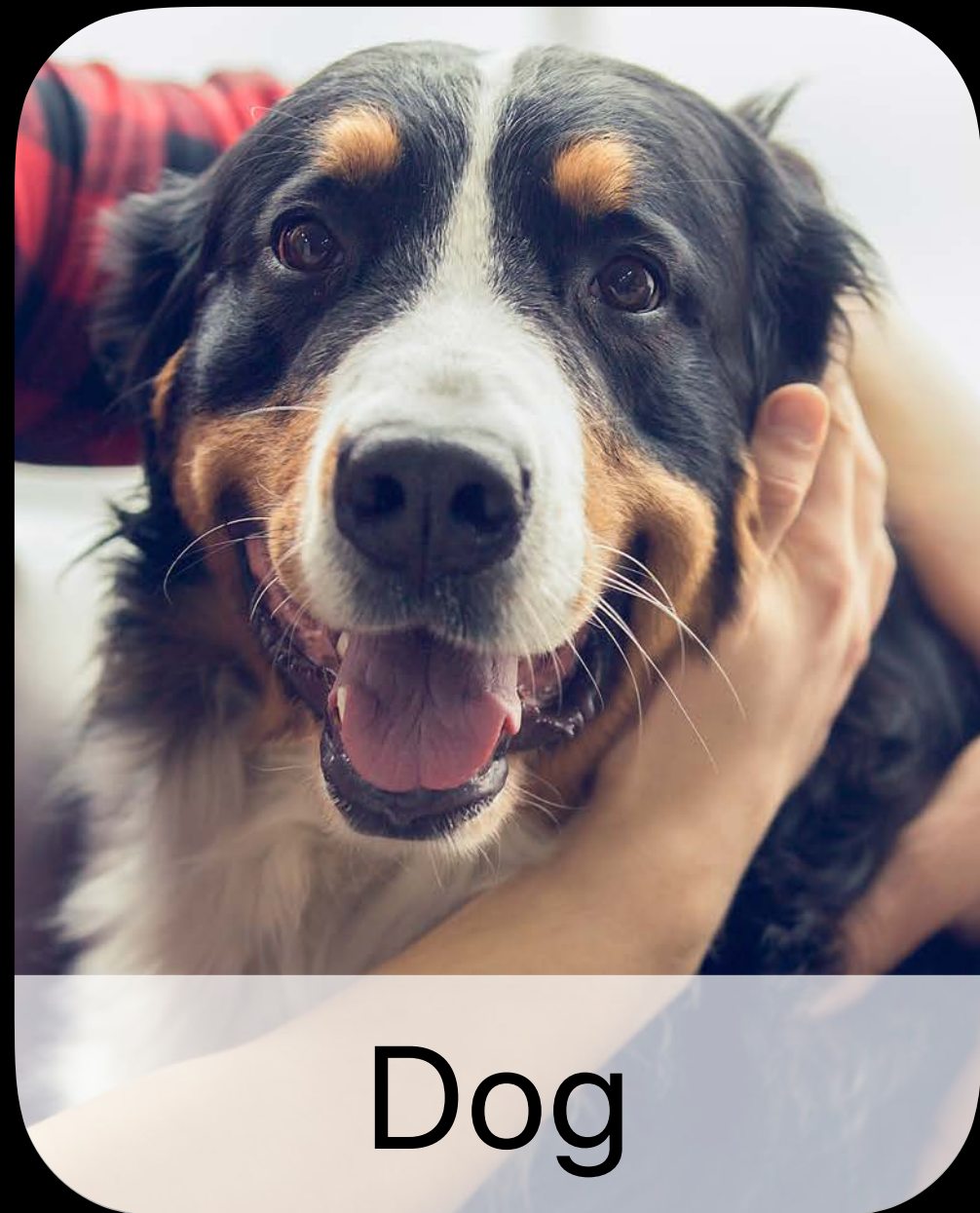
Moon



Books



Wallet



Dog



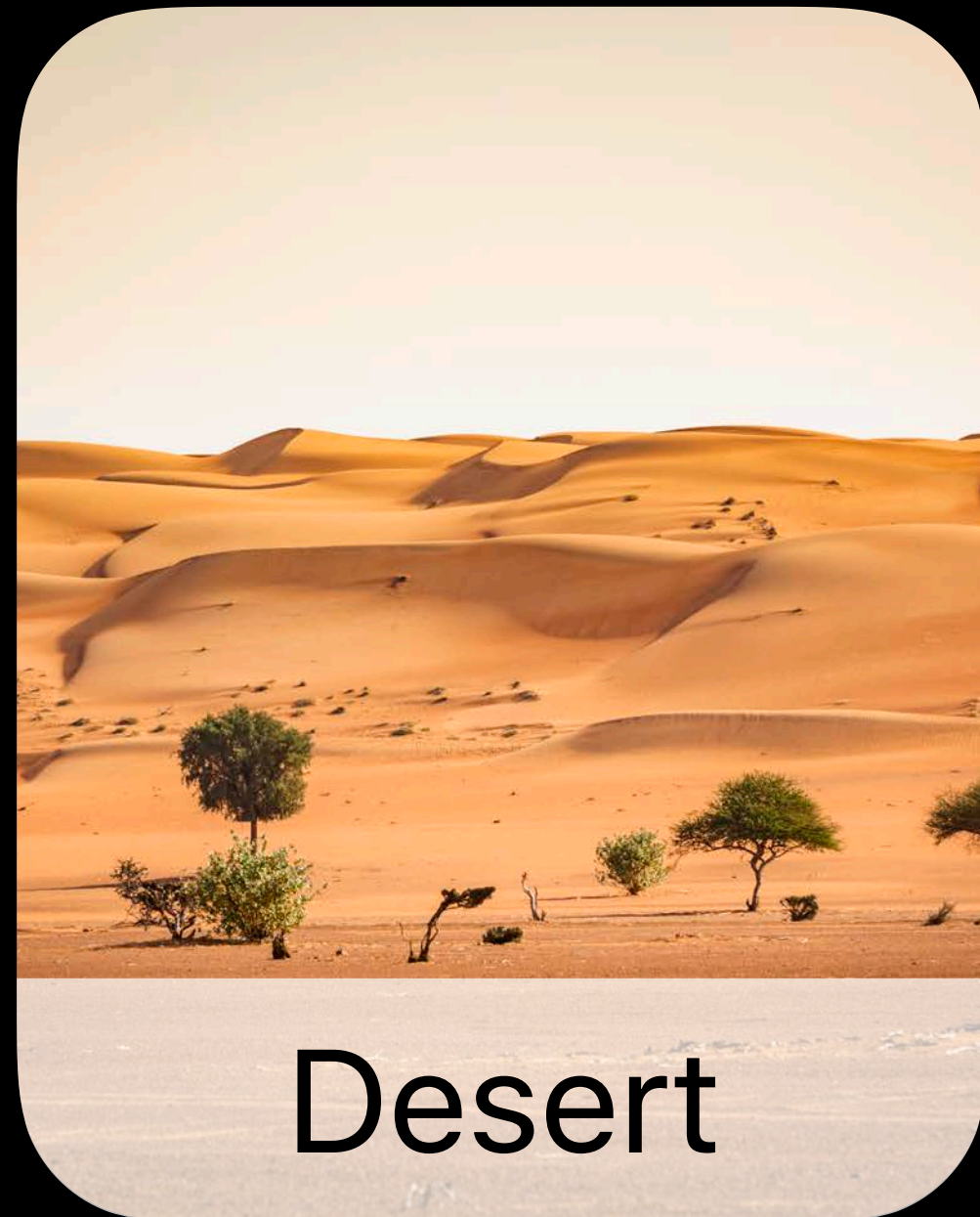
Tiger



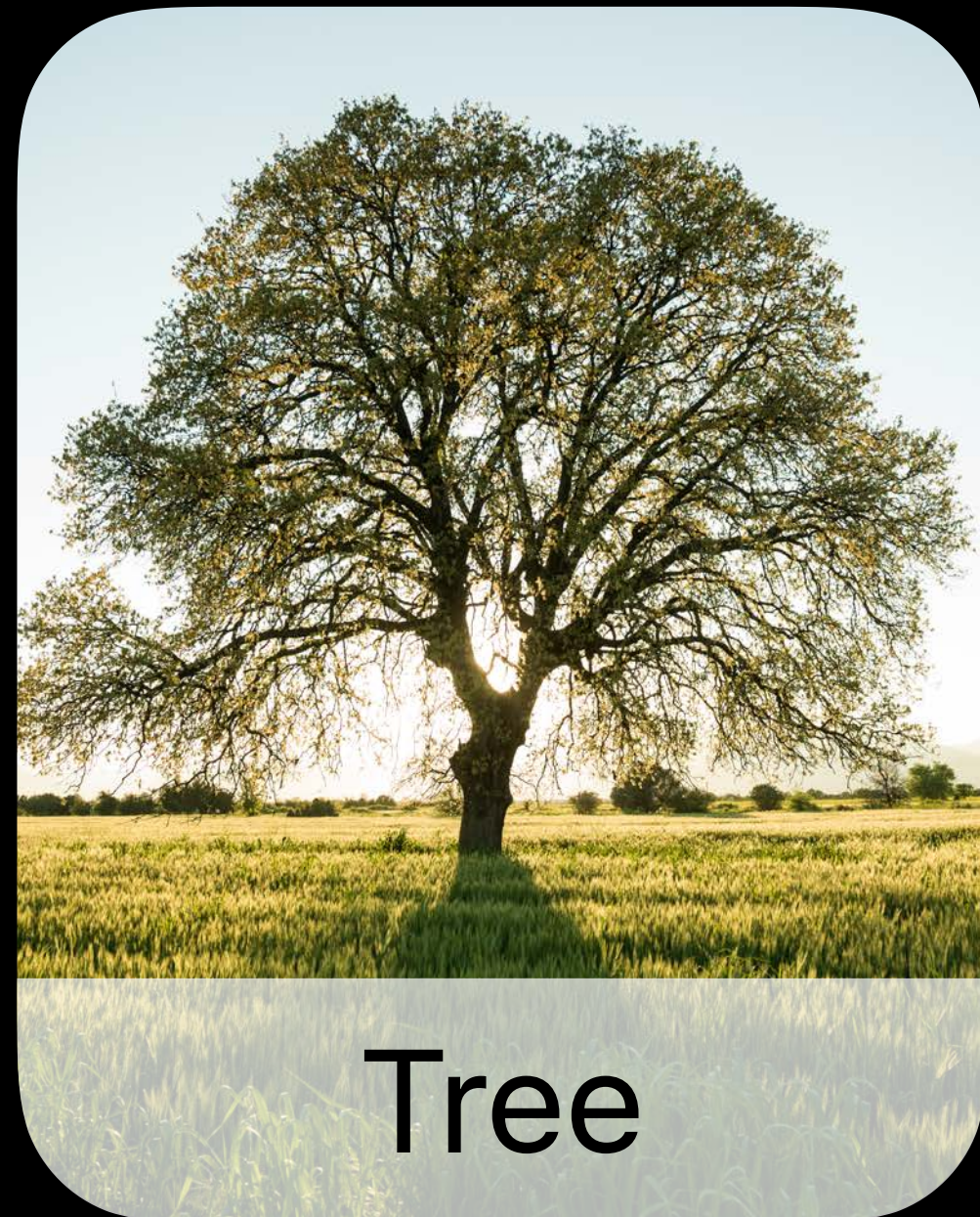
Chicken



Train



Desert



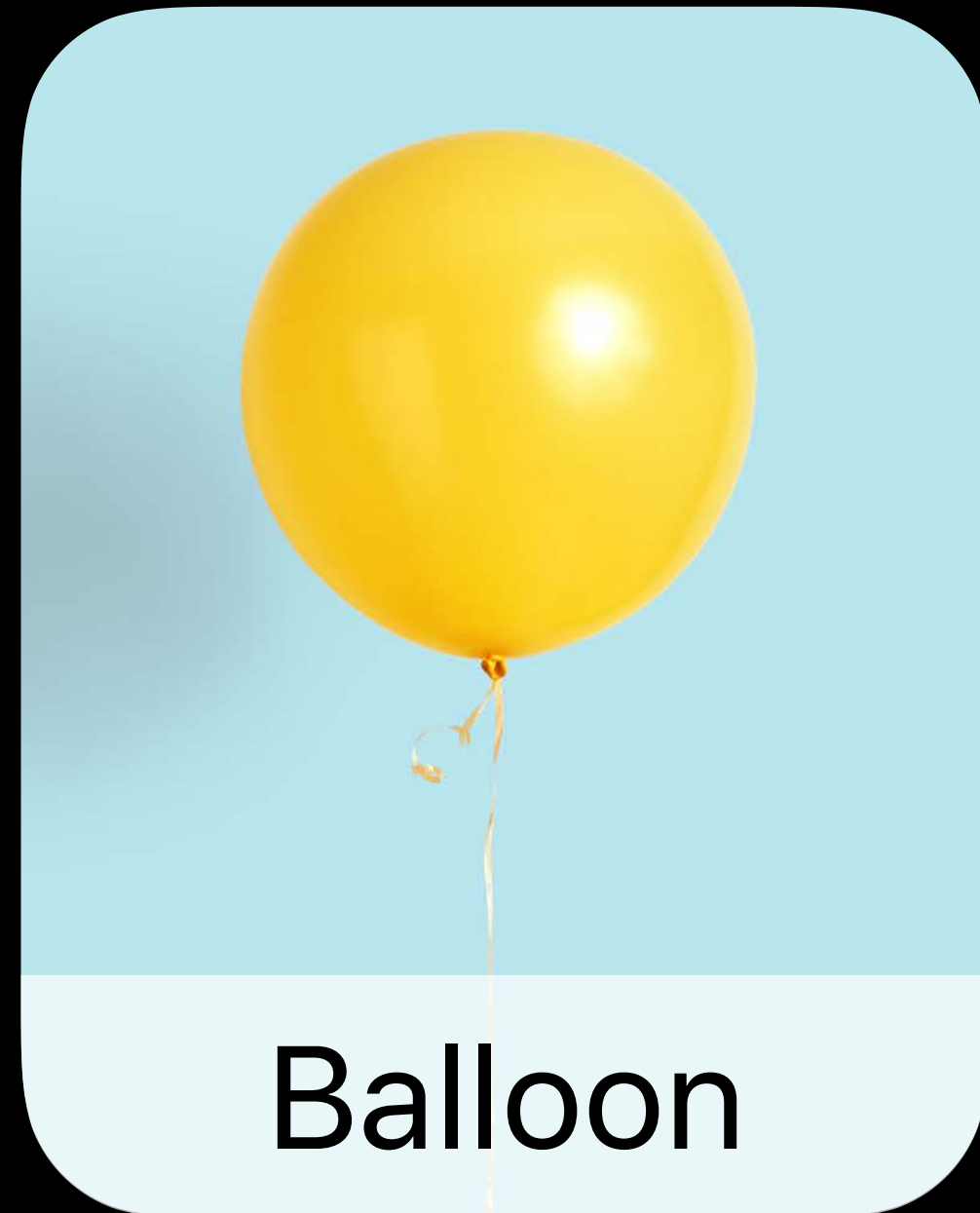
Tree



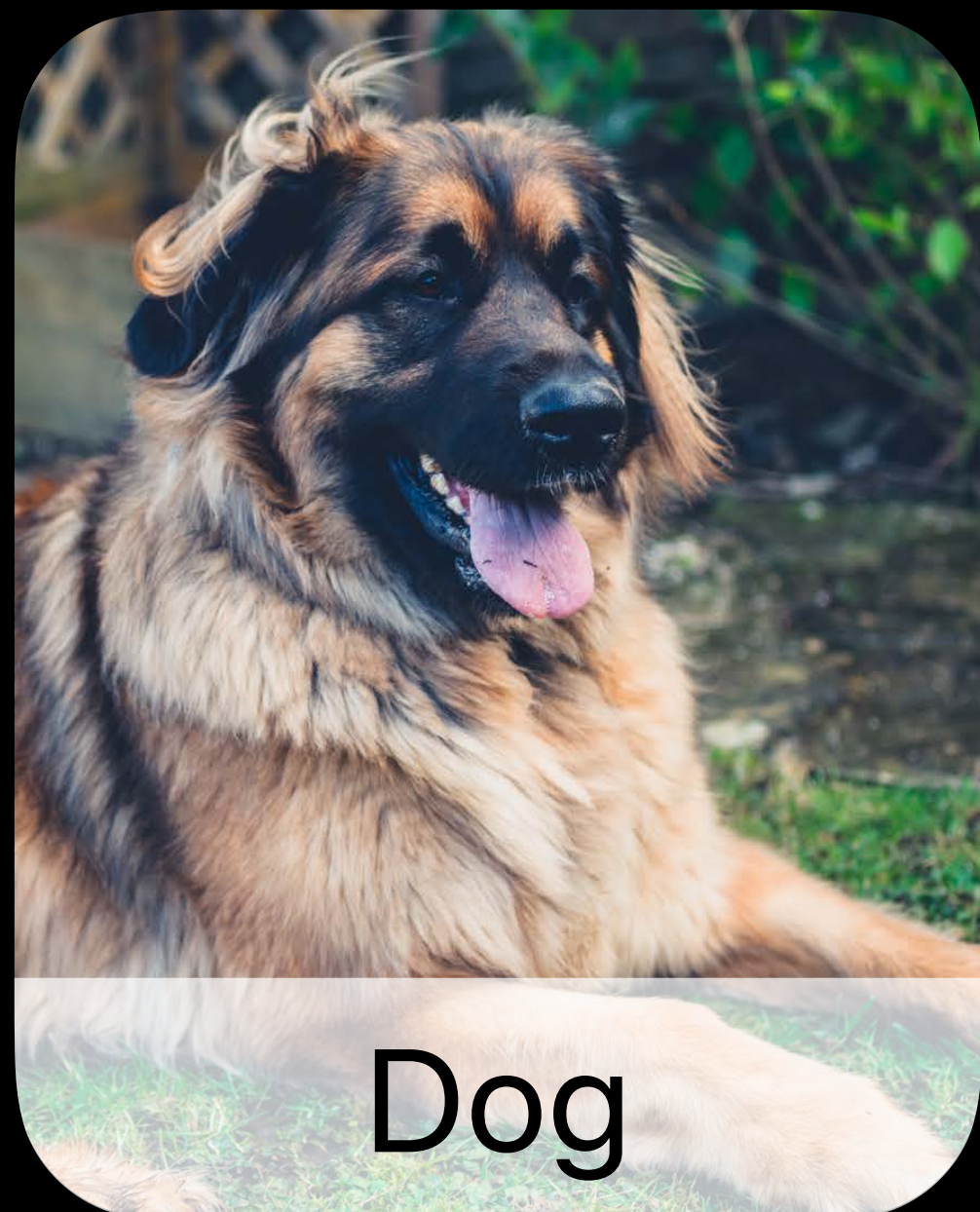
Apple



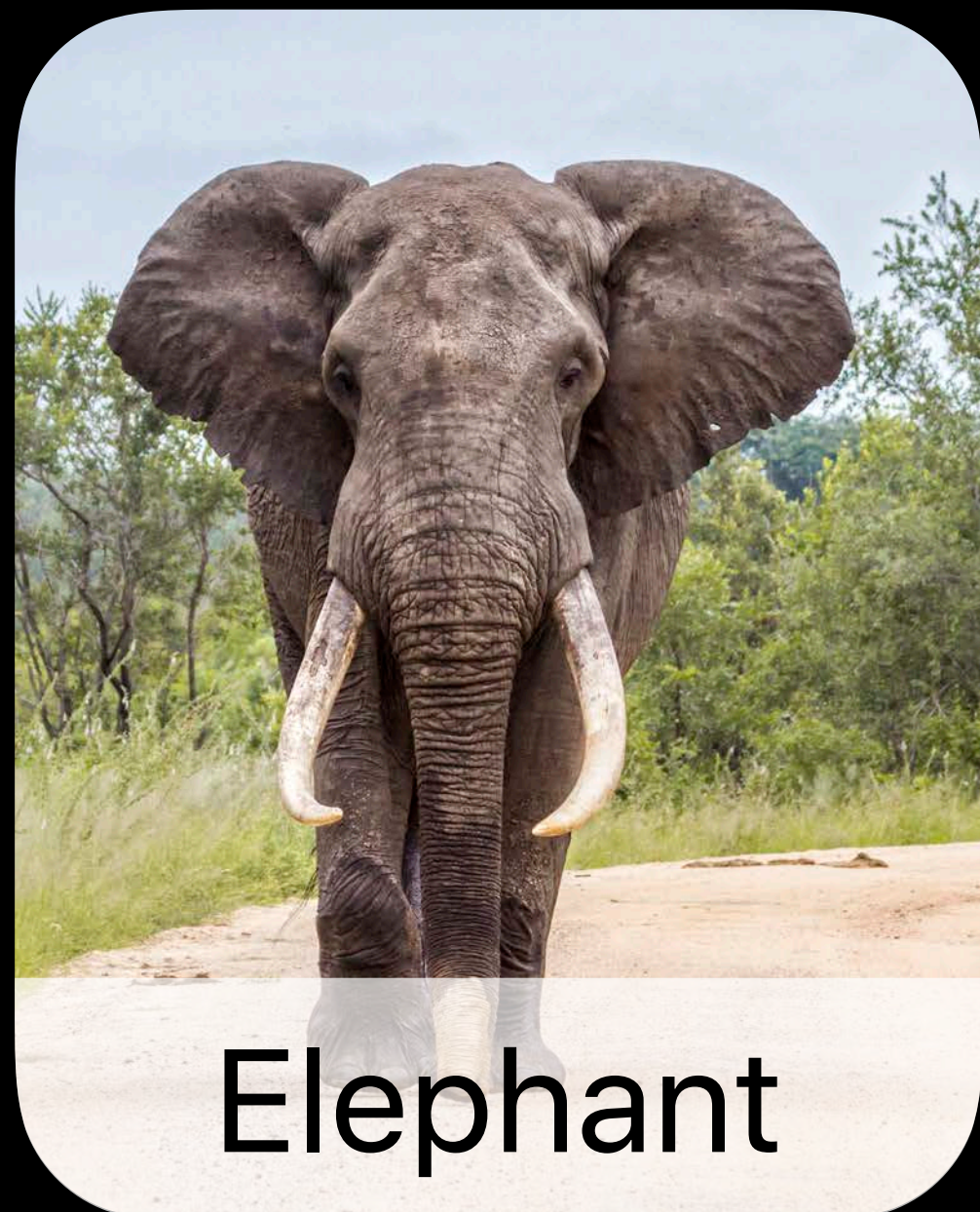
Pie



Balloon



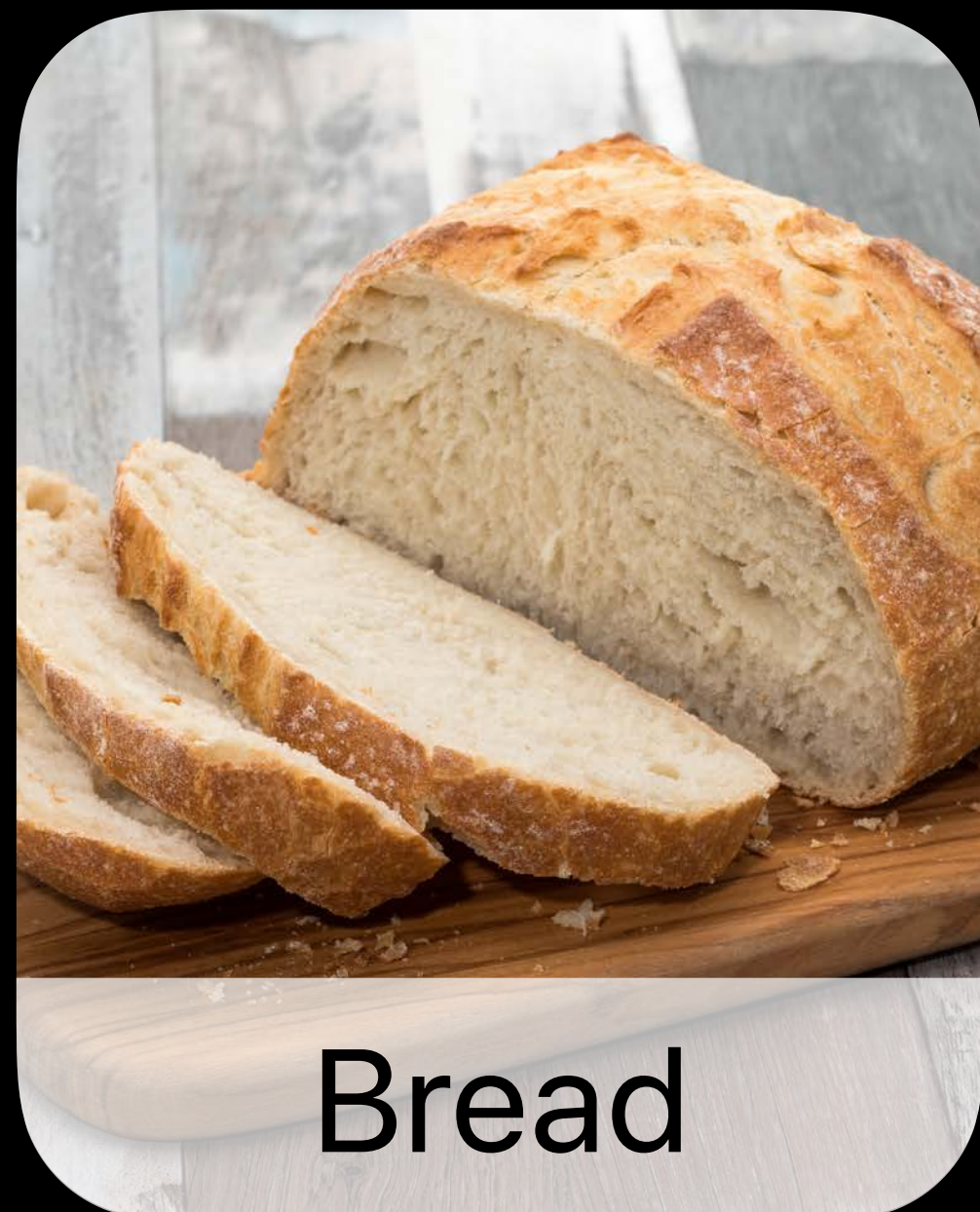
Dog



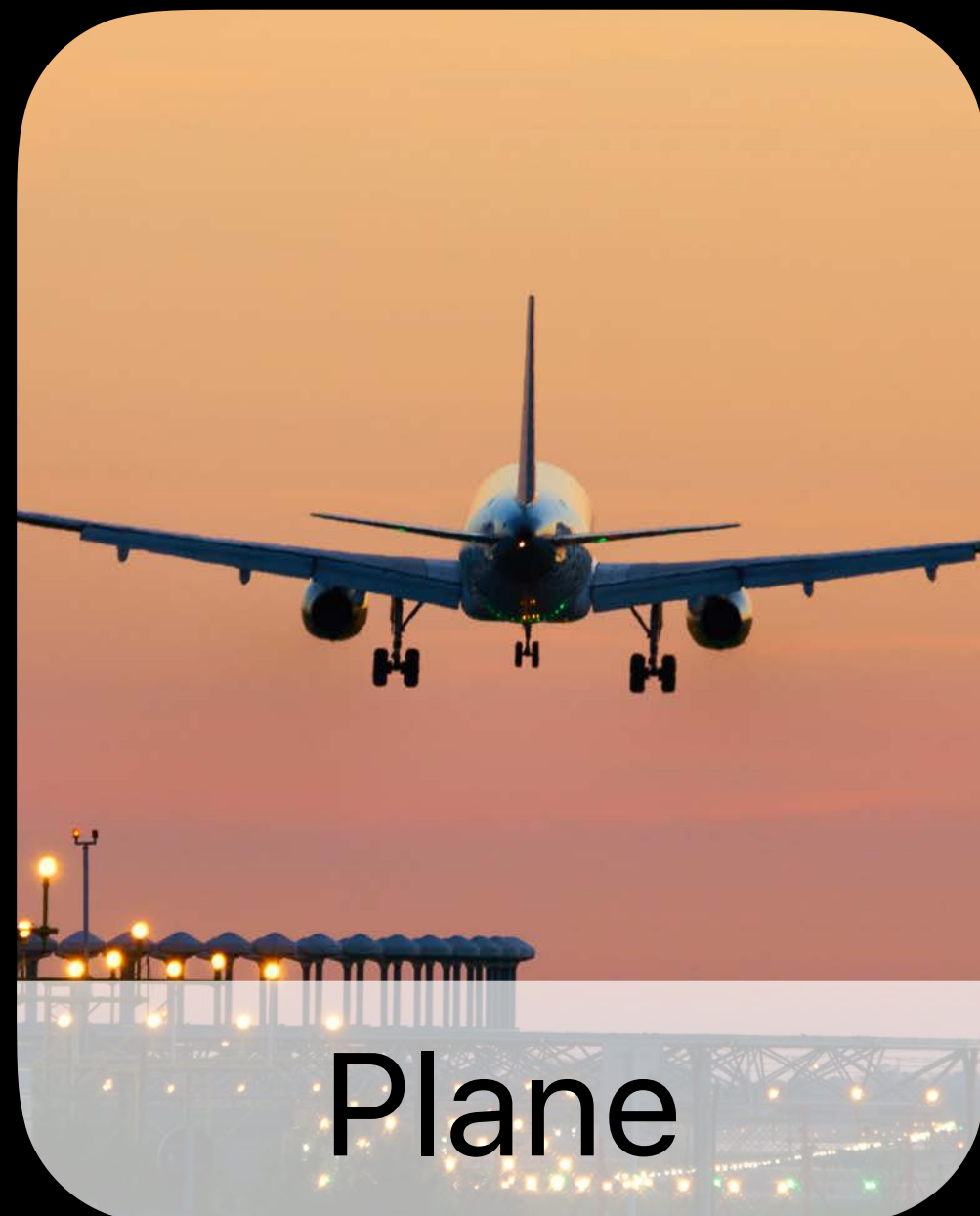
Elephant



Dolphin



Bread



Plane



Tent



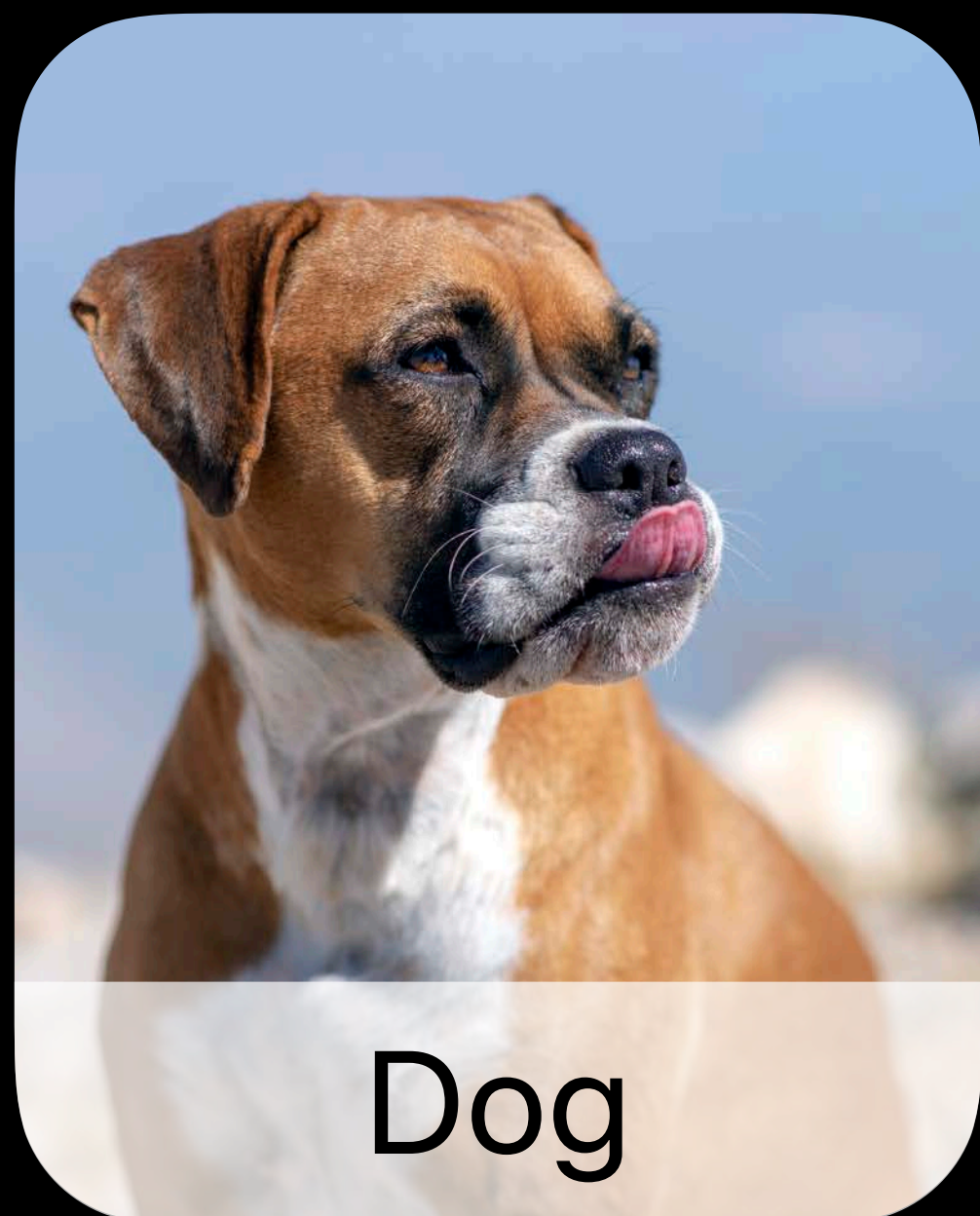
Sunset



Rutabaga



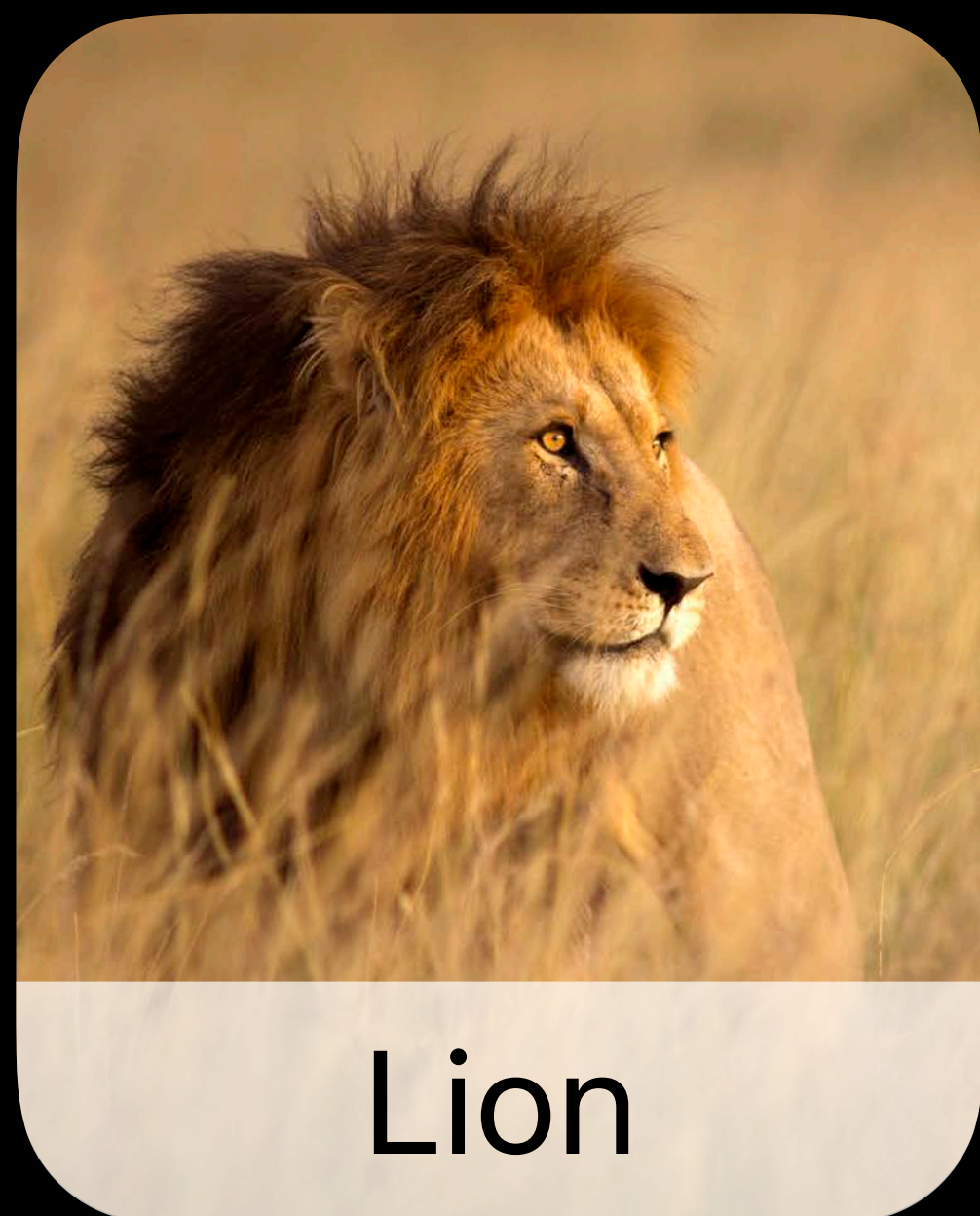
Toothbrush



Dog



Mouse



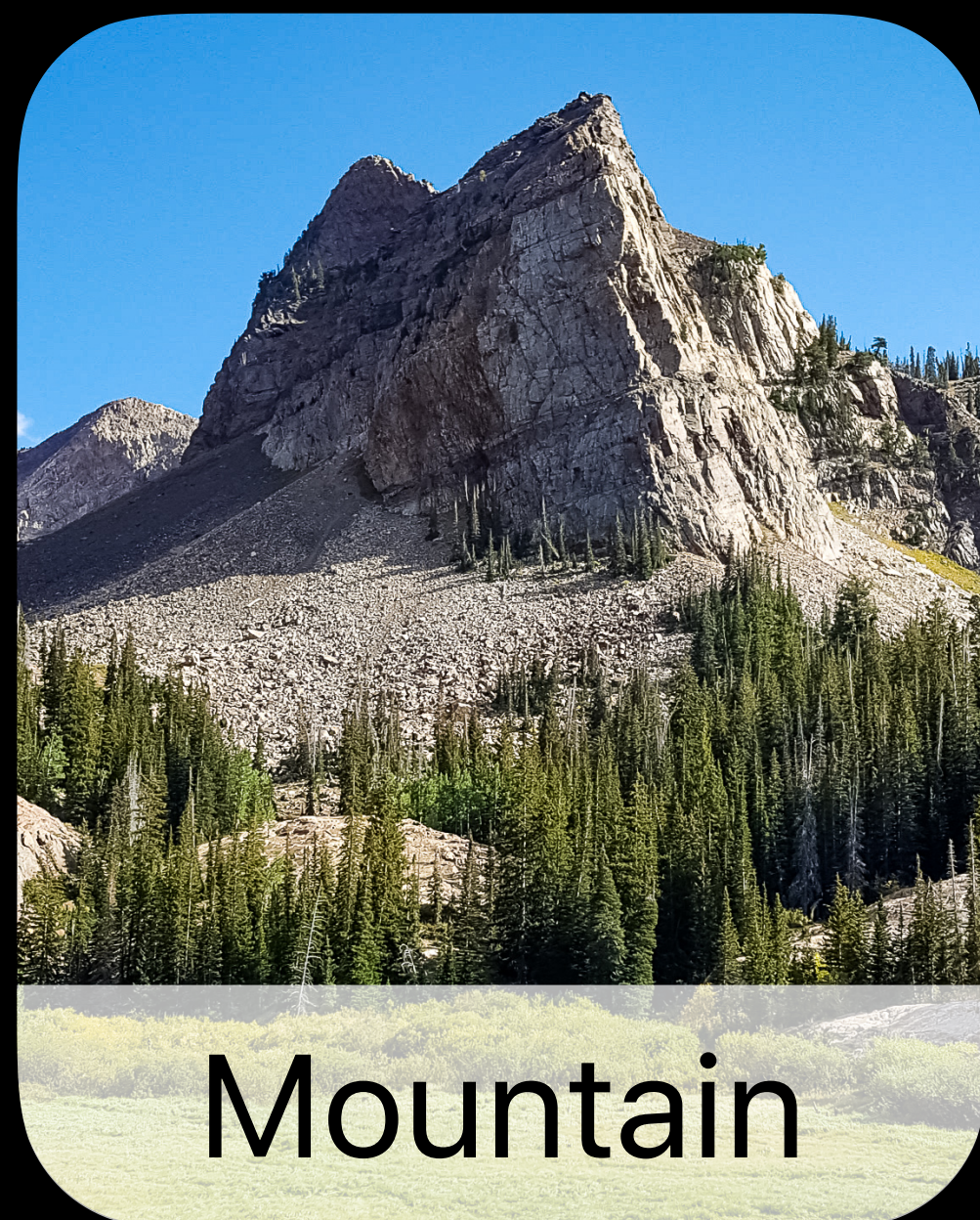
Lion



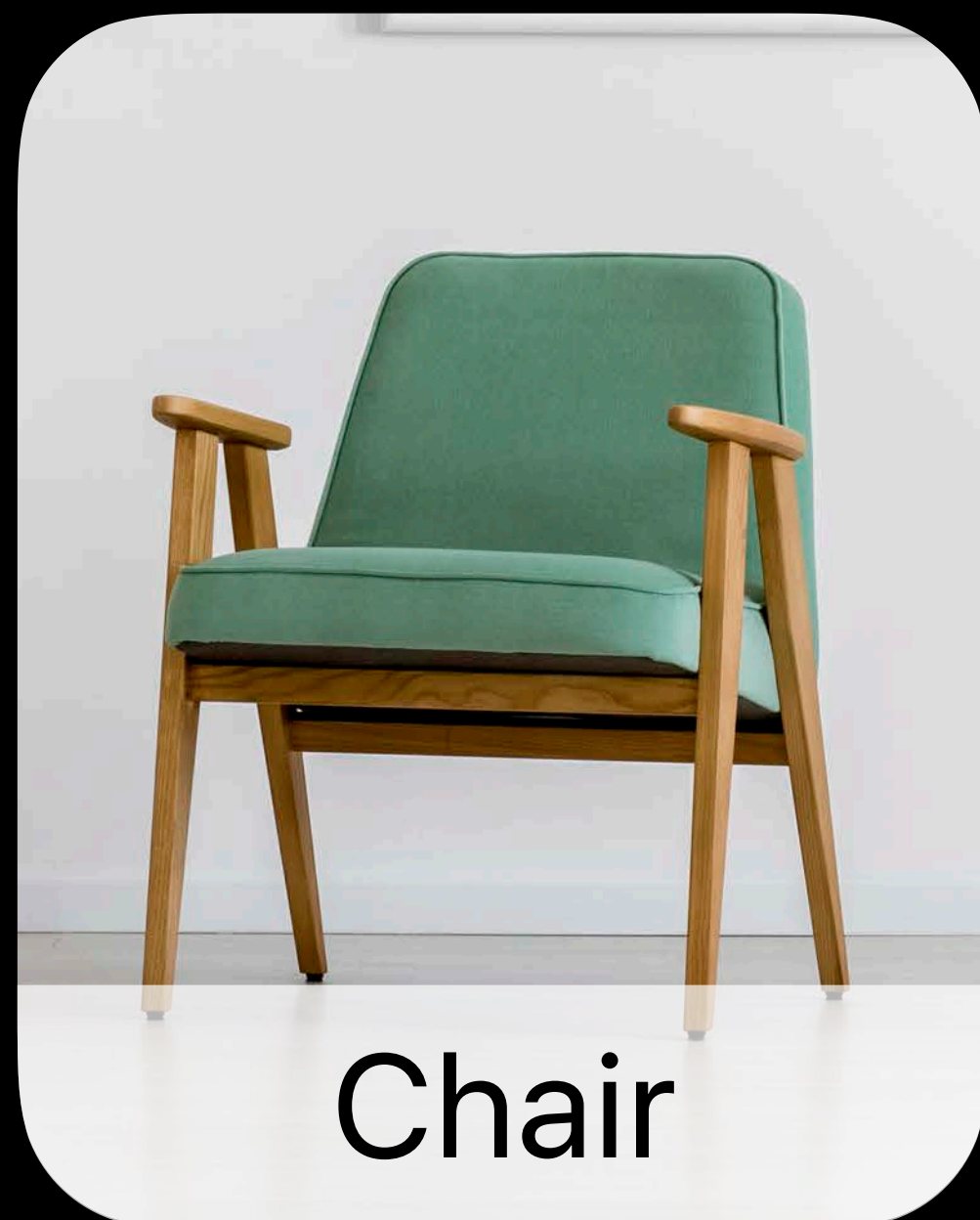
Street



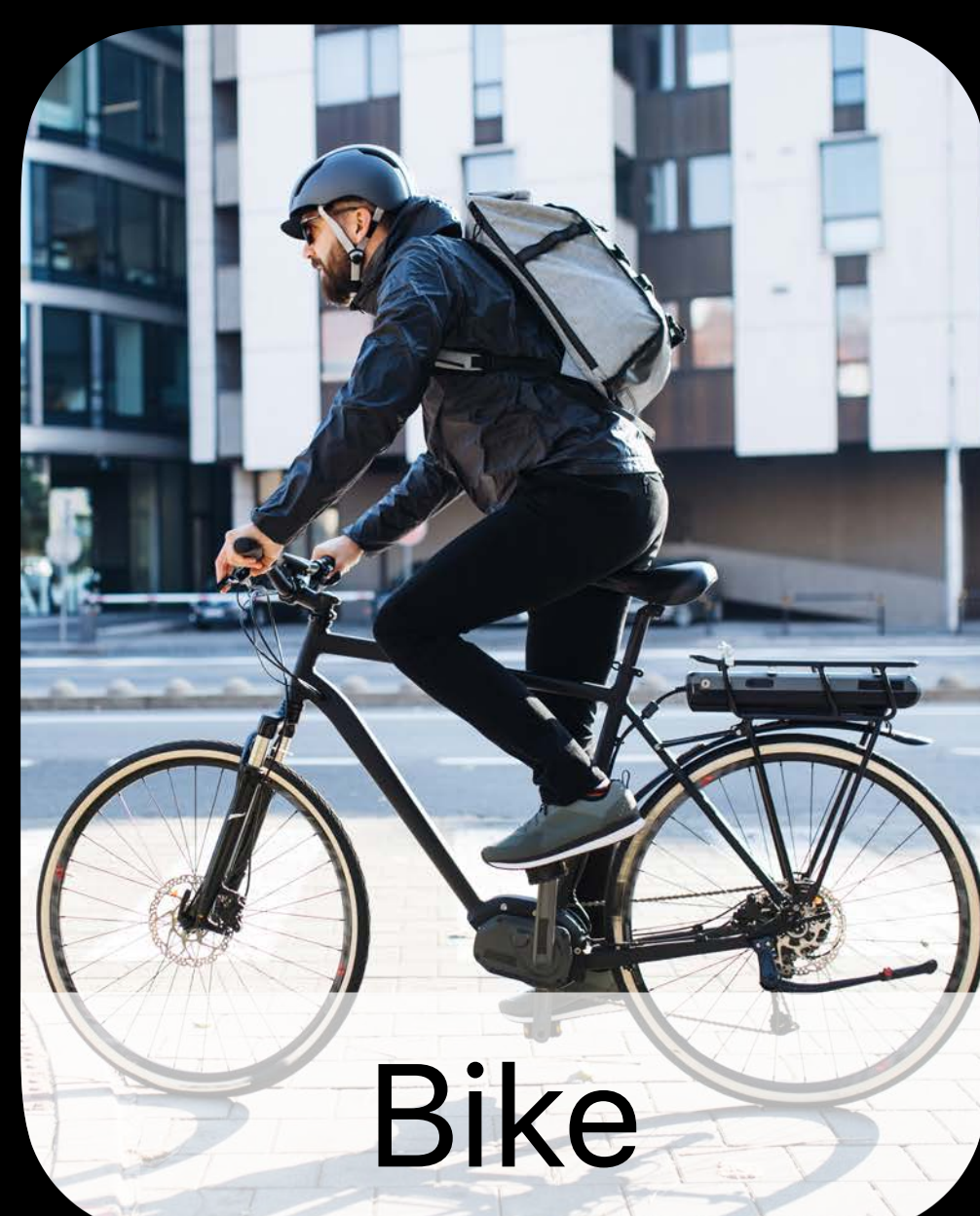
Luggage



Mountain



Chair



Bike



Traffic Light

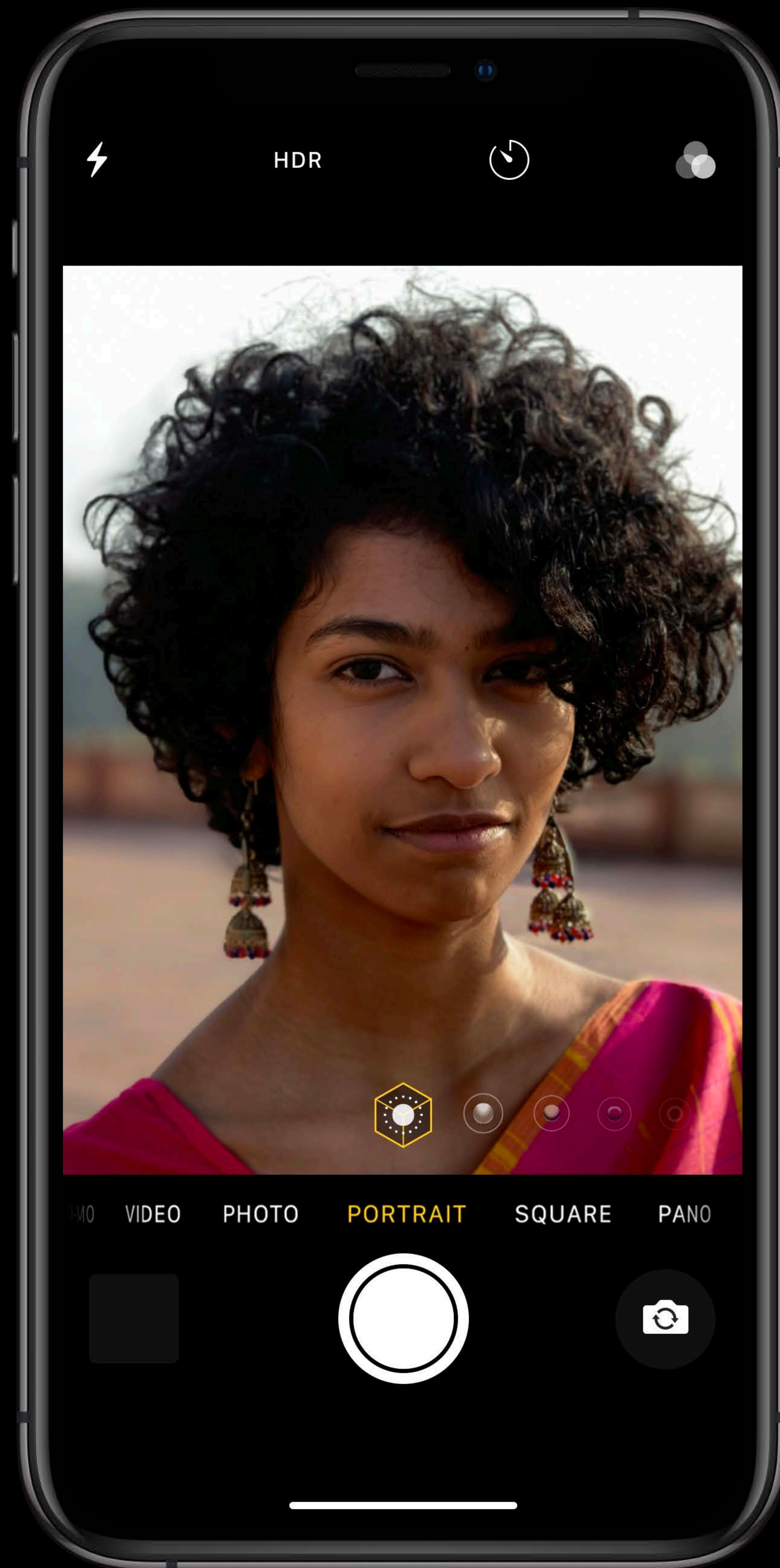


Data determines  
the behavior of the model



Data needs to be designed









Model









Collect data intentionally



Don't just reflect the world



# Data Needs to Be Designed



# Data Needs to Be Designed

Collect data intentionally



# Data Needs to Be Designed

Collect data intentionally

Test for biases



# Data Needs to Be Designed

Collect data intentionally

Test for biases

Update data as products change



# Data Needs to Be Designed

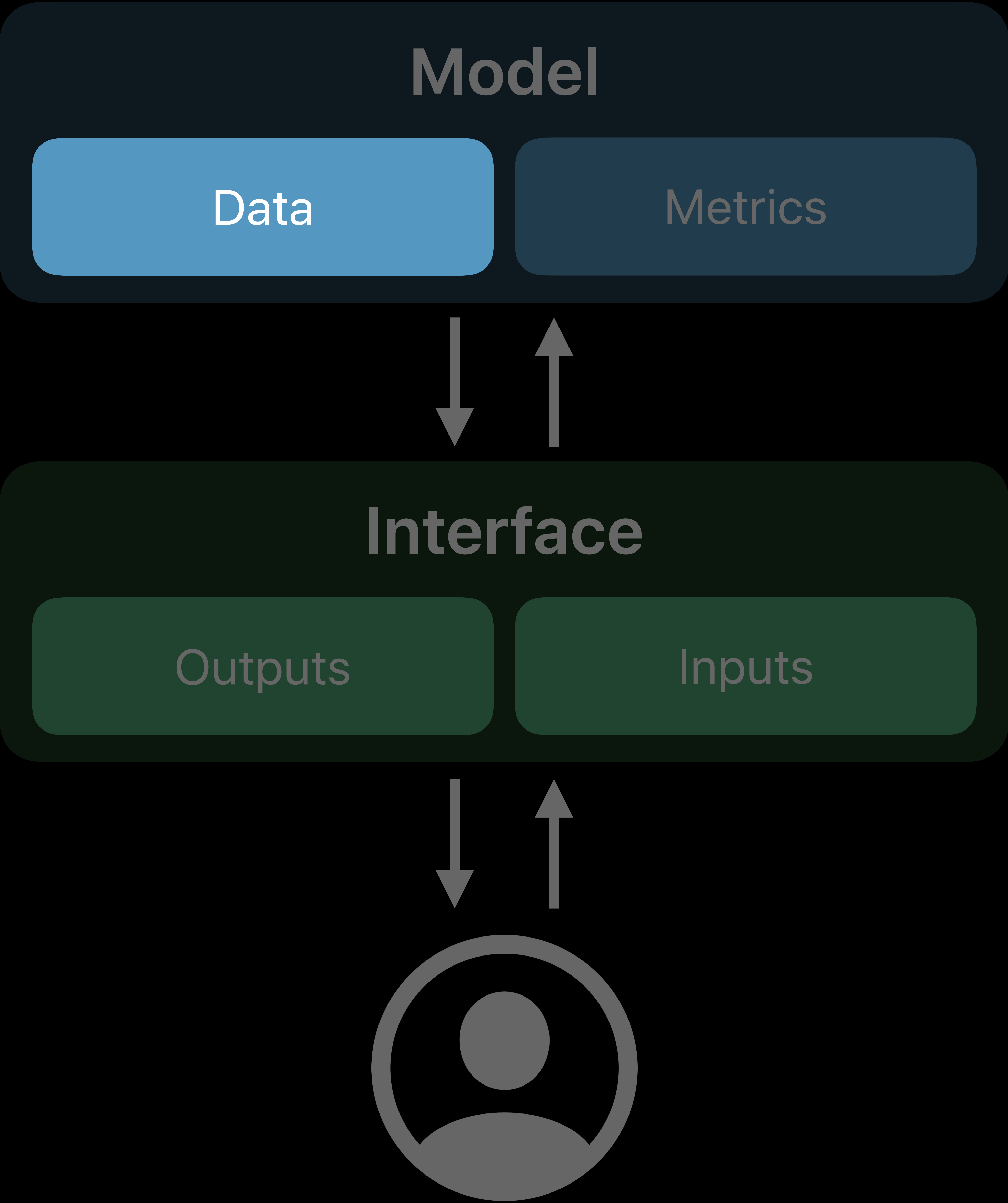
Collect data intentionally

Test for biases

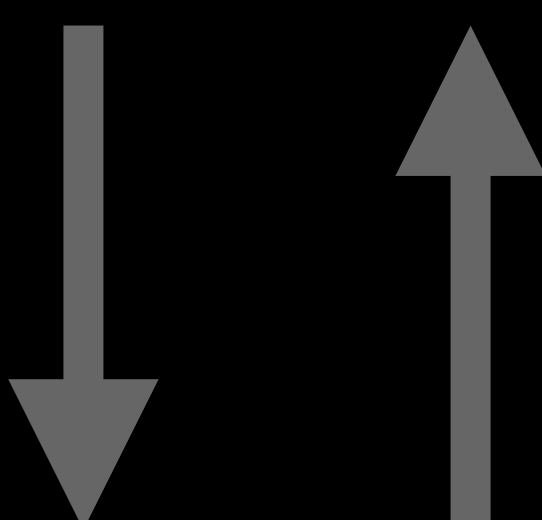
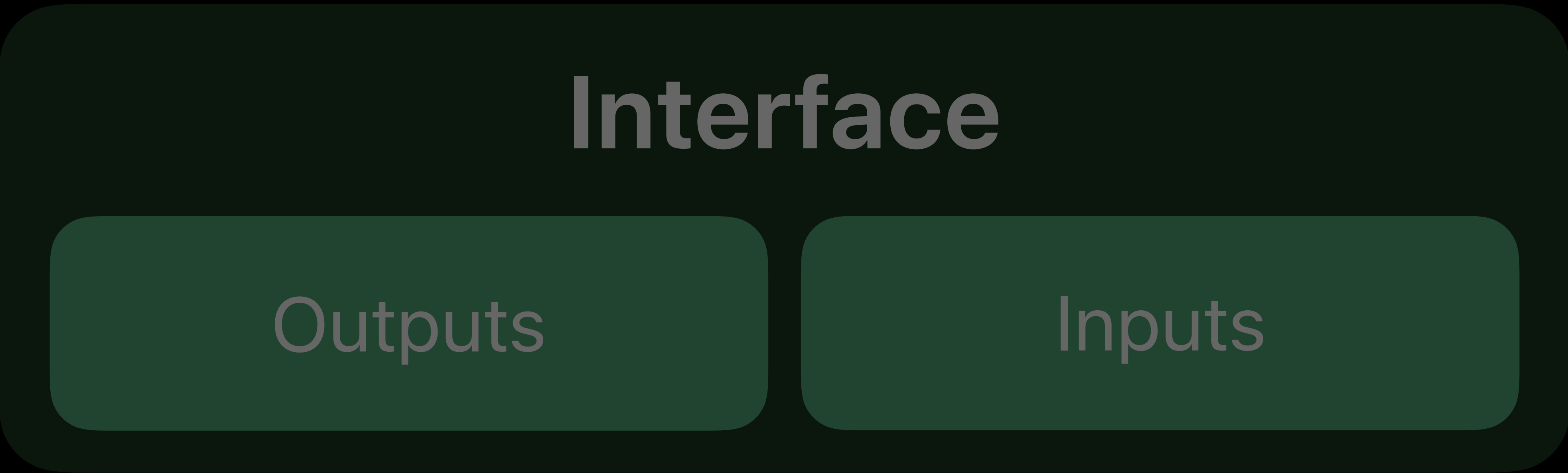
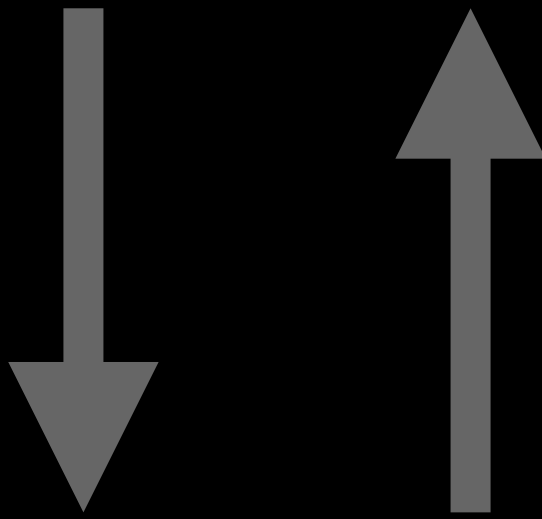
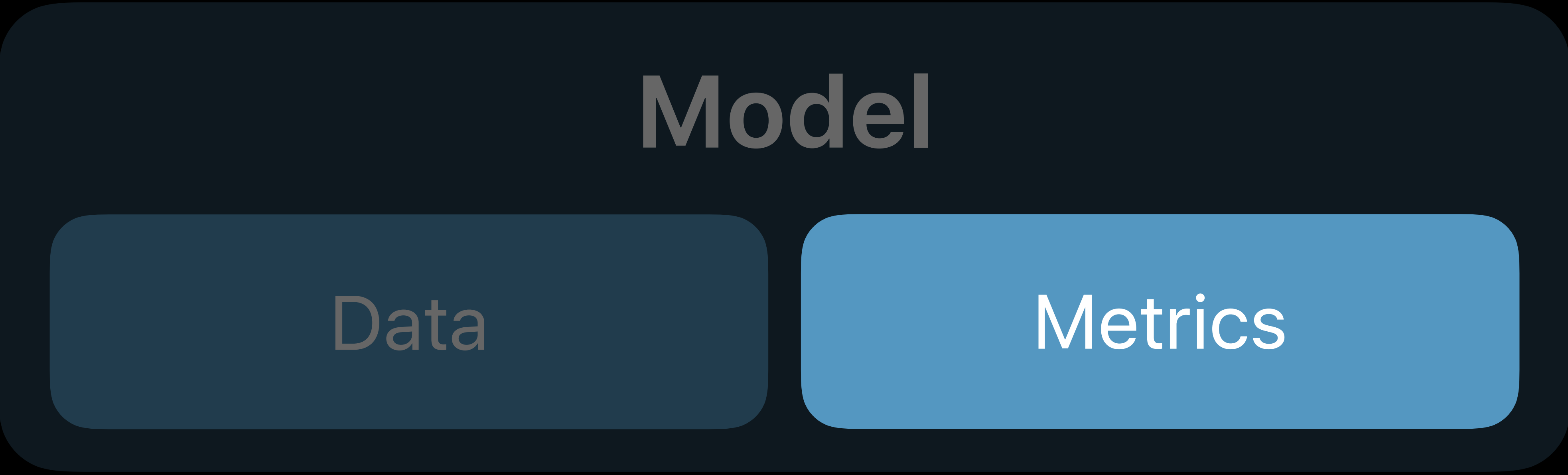
Update data as products change

Beware of standard datasets













**Model**





Model





Model



Dog



Dog

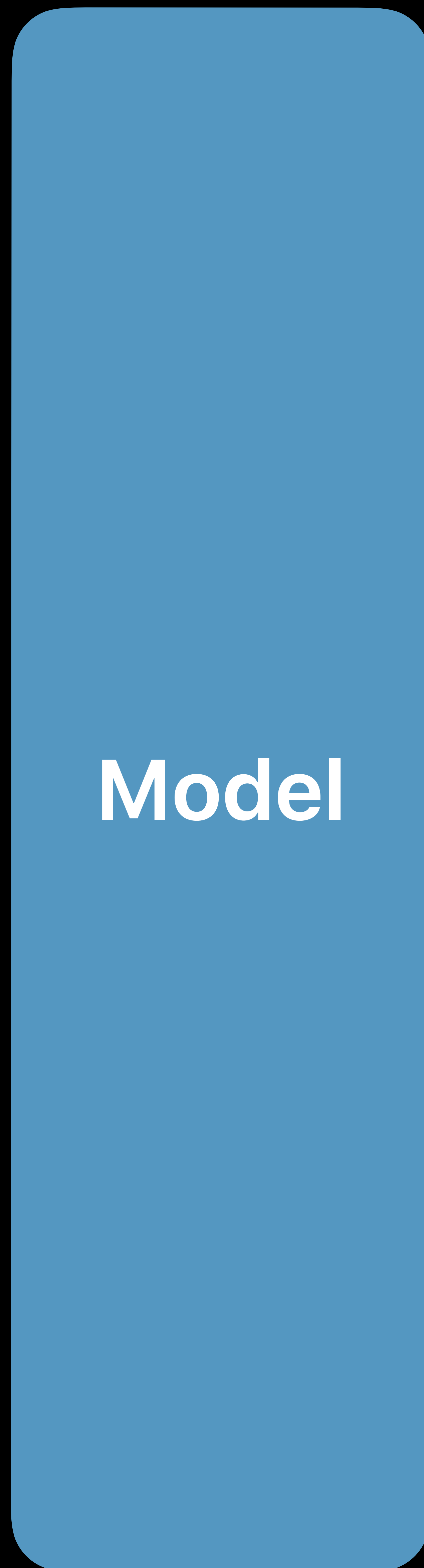


Not dog



Not dog





Dog



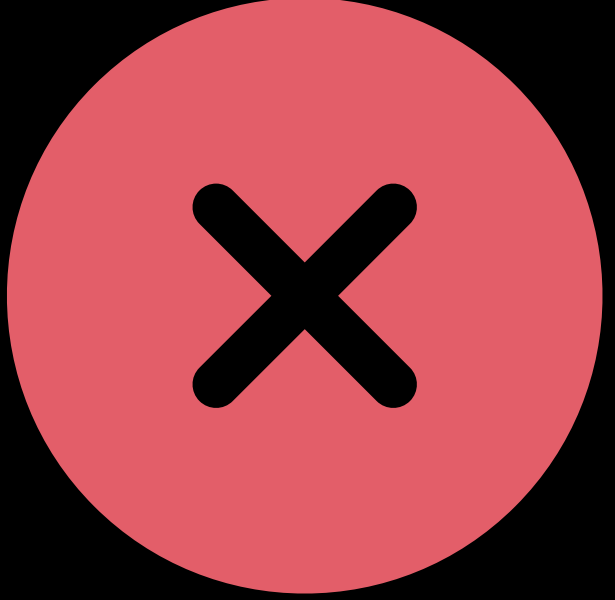
Dog



Not dog



Not dog





75%

Accuracy



Metrics are how we define  
if an experience is good



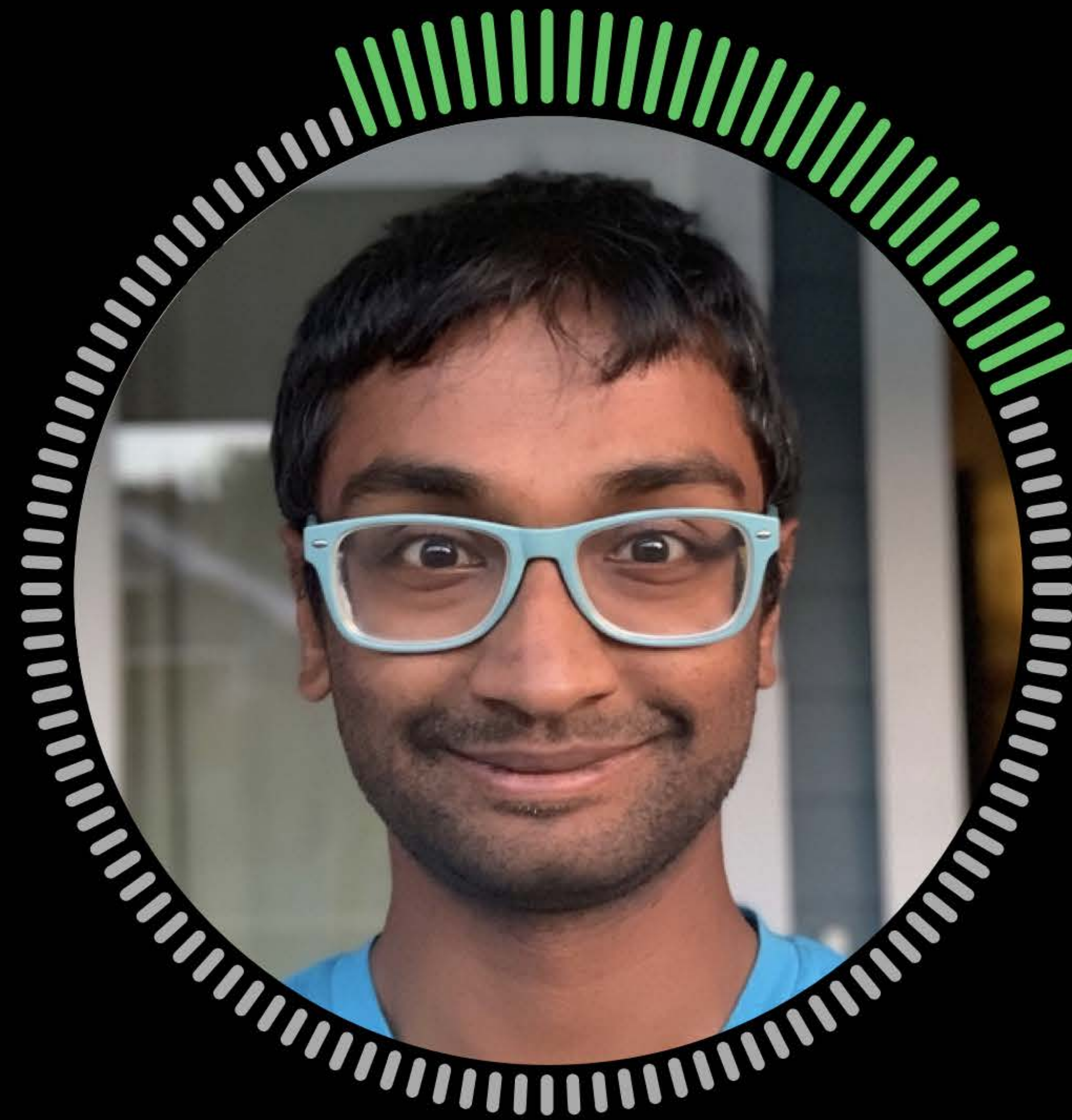
Metrics reflect values



9:41



Cancel



**Move your head slowly to  
complete the circle.**

Accessibility Options





Model





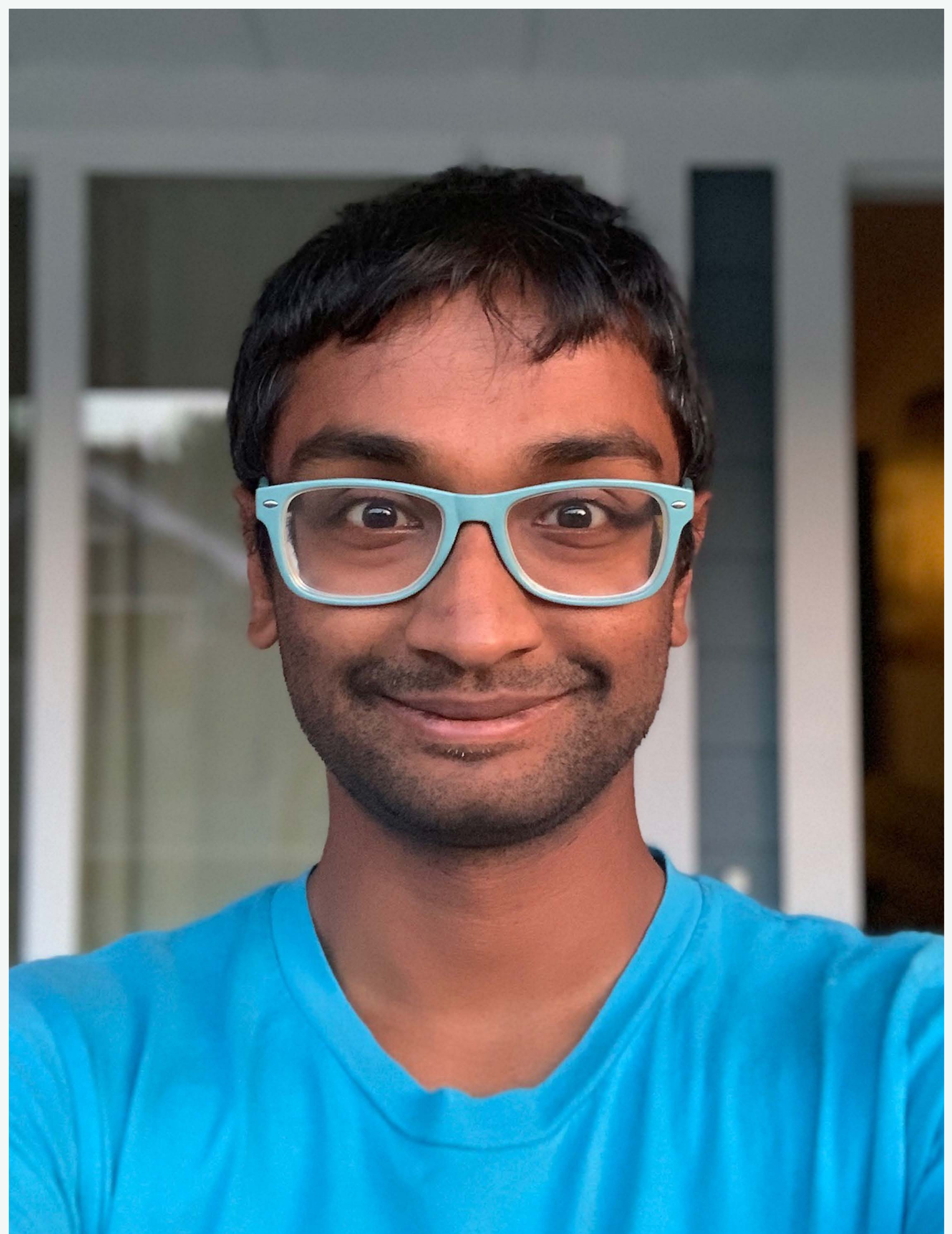
Secure  
Private  
Adaptive  
Fast  
Accessible  
Intuitive



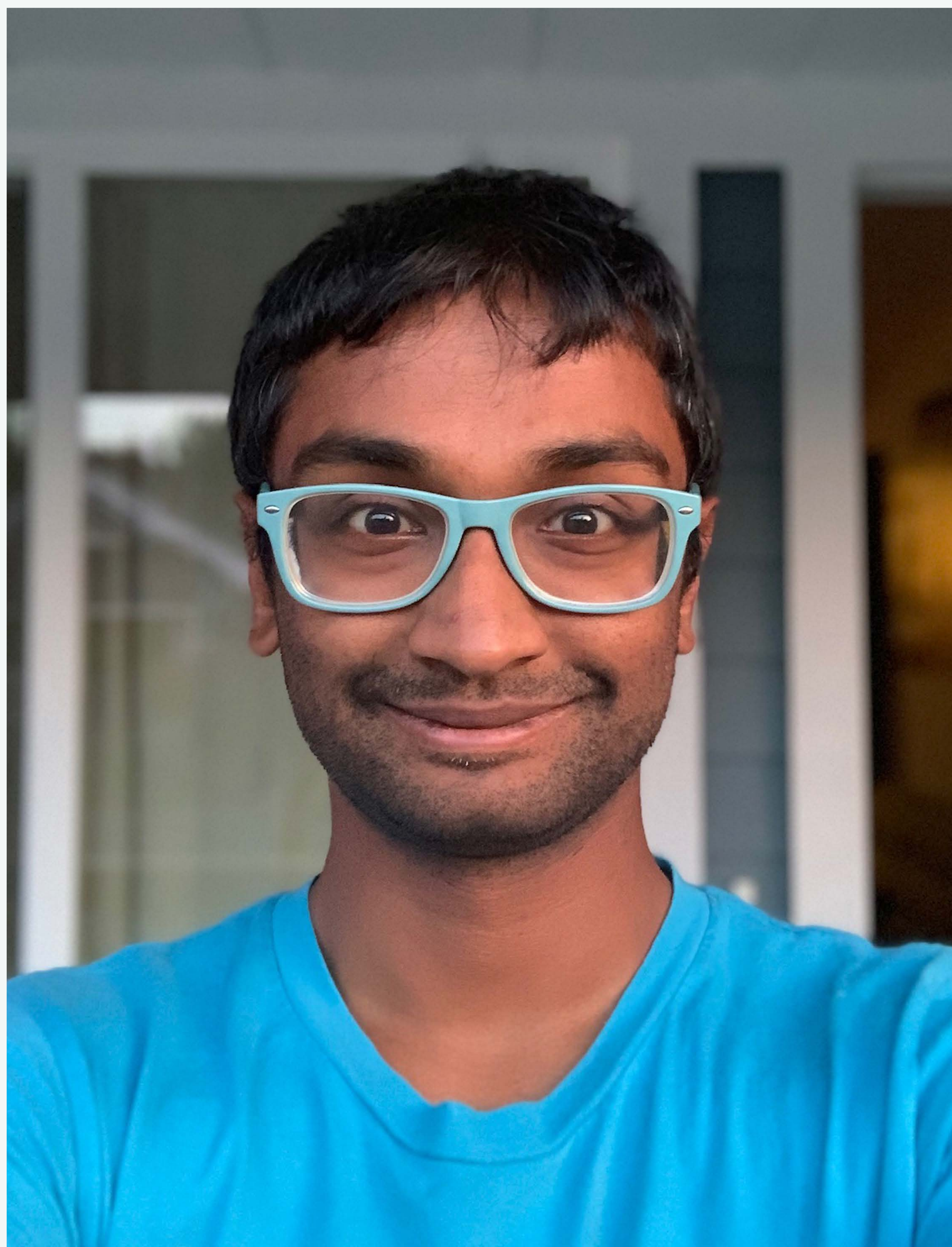
**1 in 1,000,000**

Face ID











Not all mistakes are equal



Metrics are proxies for what  
we actually care about









Model







**\$6.99**



**\$2.99**



GET

A circular icon featuring Woody, the cowboy character from Toy Story, wearing his signature brown hat and plaid shirt. He is surrounded by three yellow star-shaped confetti pieces against a blue background with white clouds.

GET

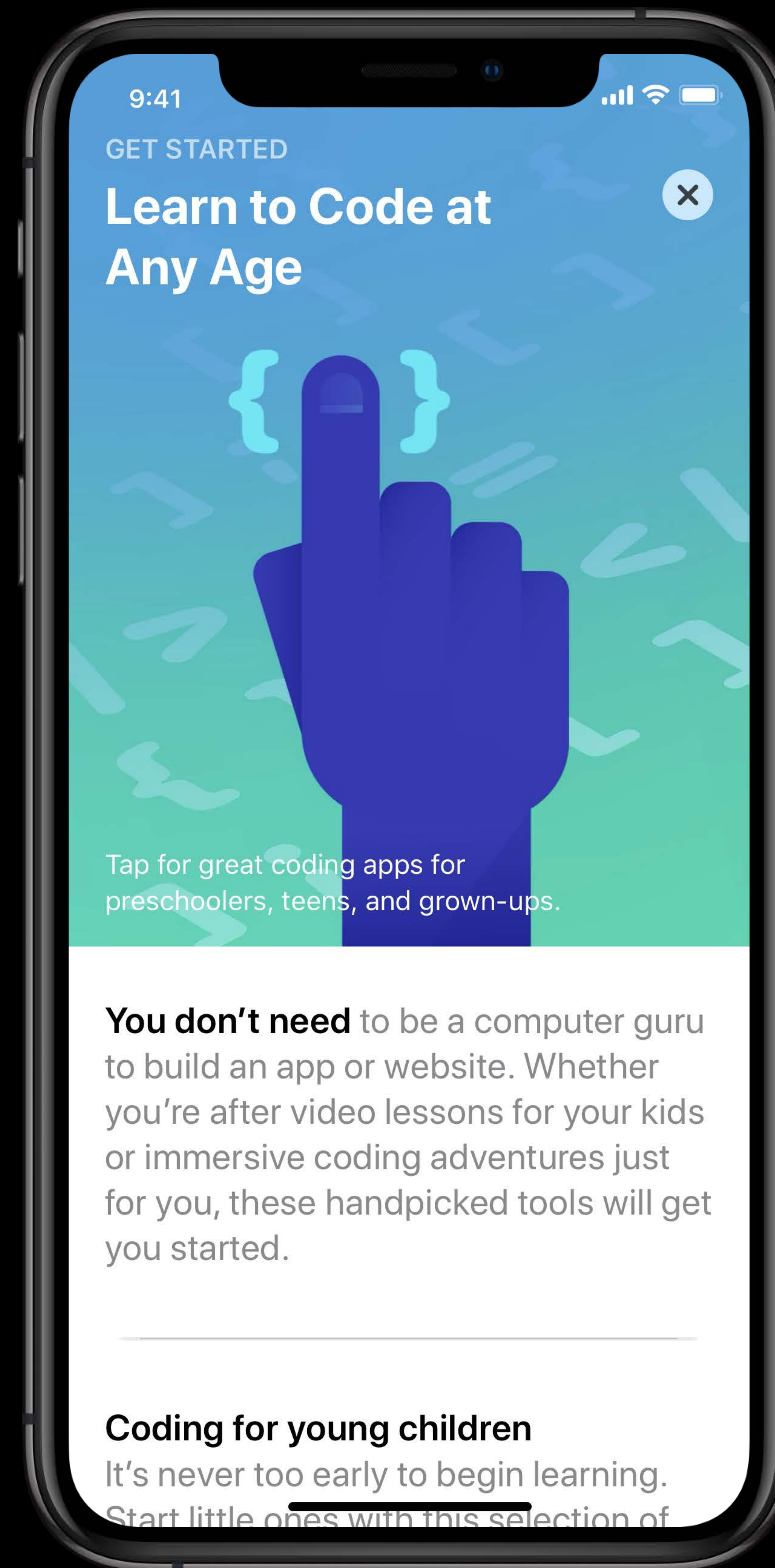
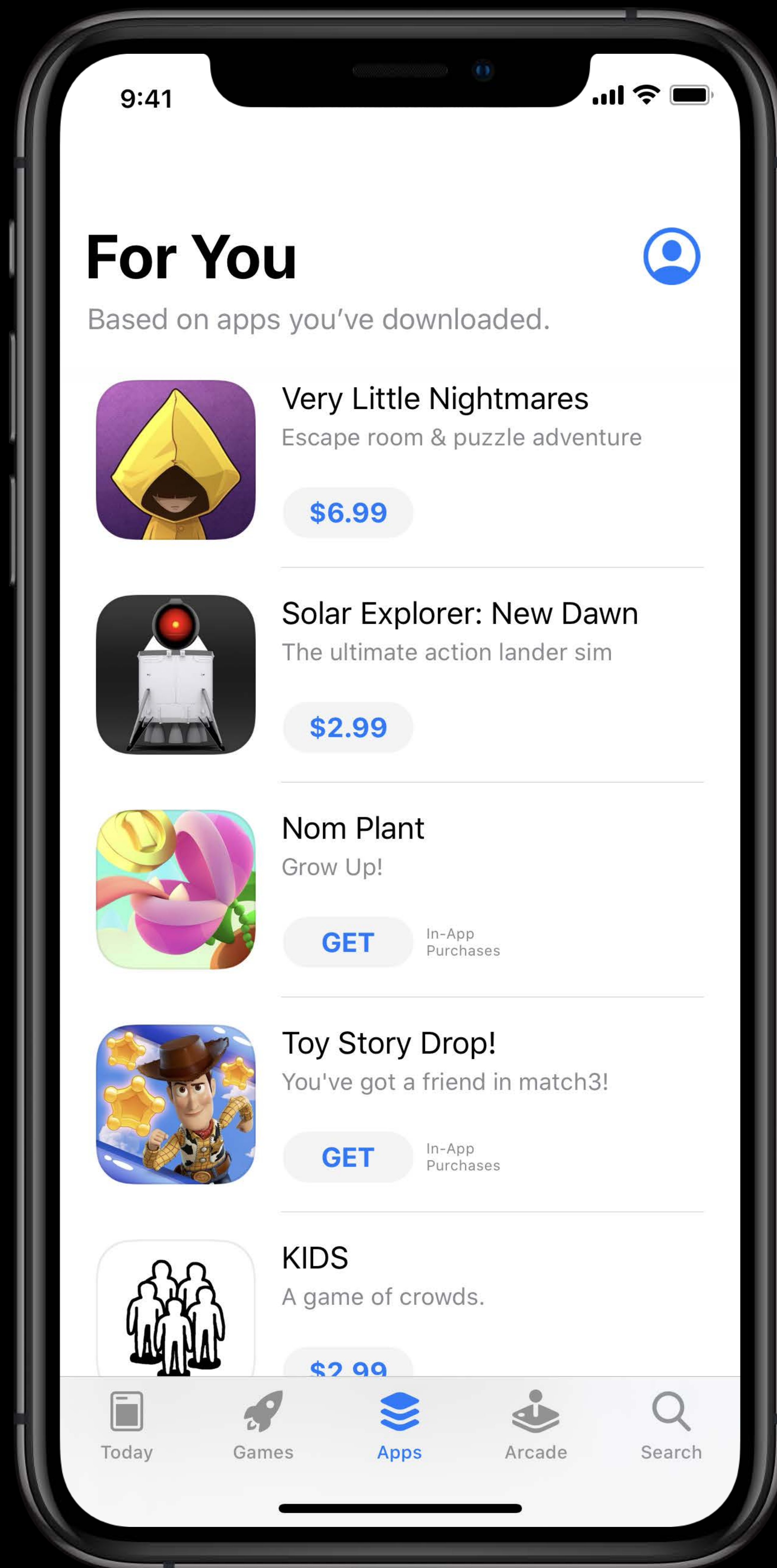


**\$2 99**



Search







What we care about evolves



# Metrics Reflect Values



# Metrics Reflect Values

Understand mistakes



# Metrics Reflect Values

Understand mistakes

Design failure scenarios



# Metrics Reflect Values

Understand mistakes

Design failure scenarios

Evaluate the experience



# Metrics Reflect Values

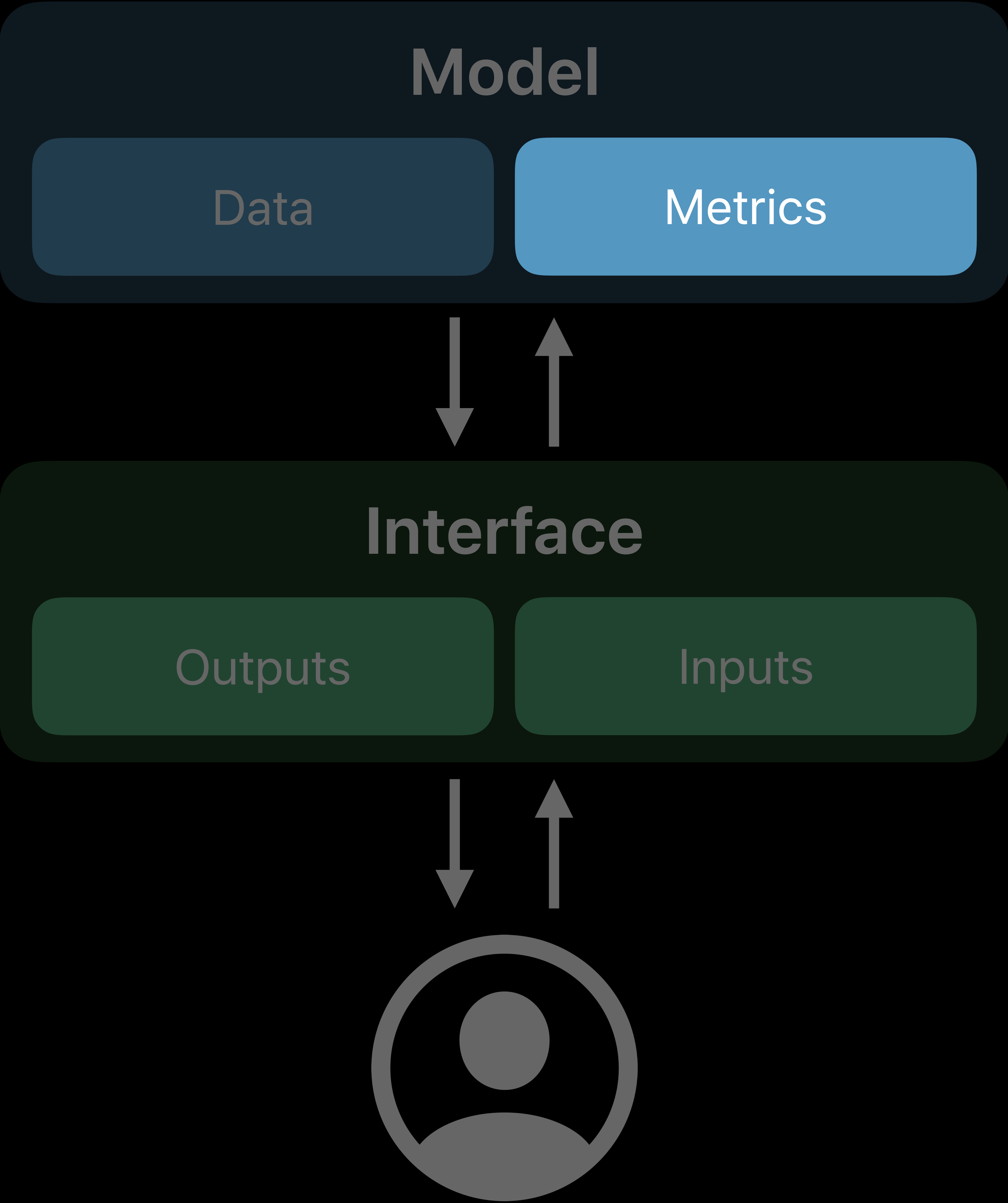
Understand mistakes

Design failure scenarios

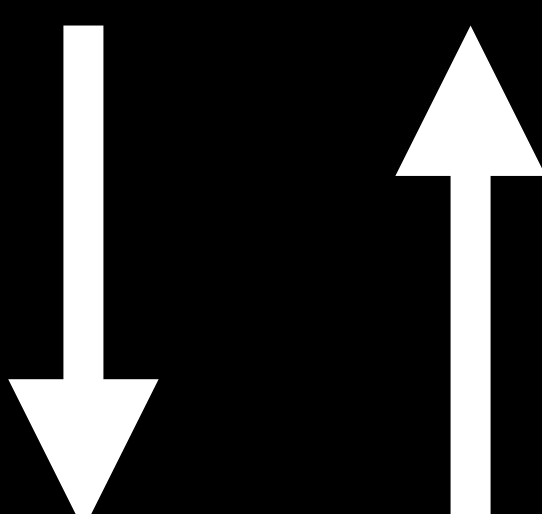
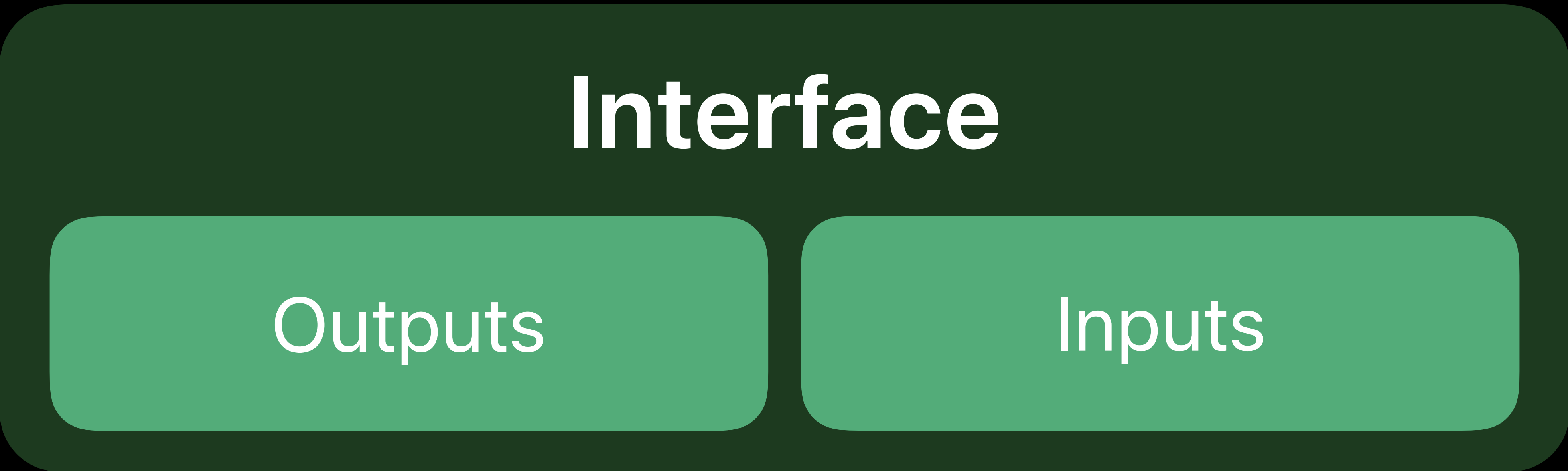
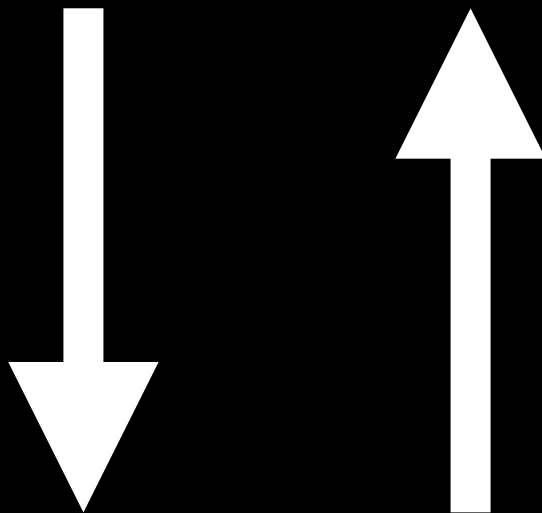
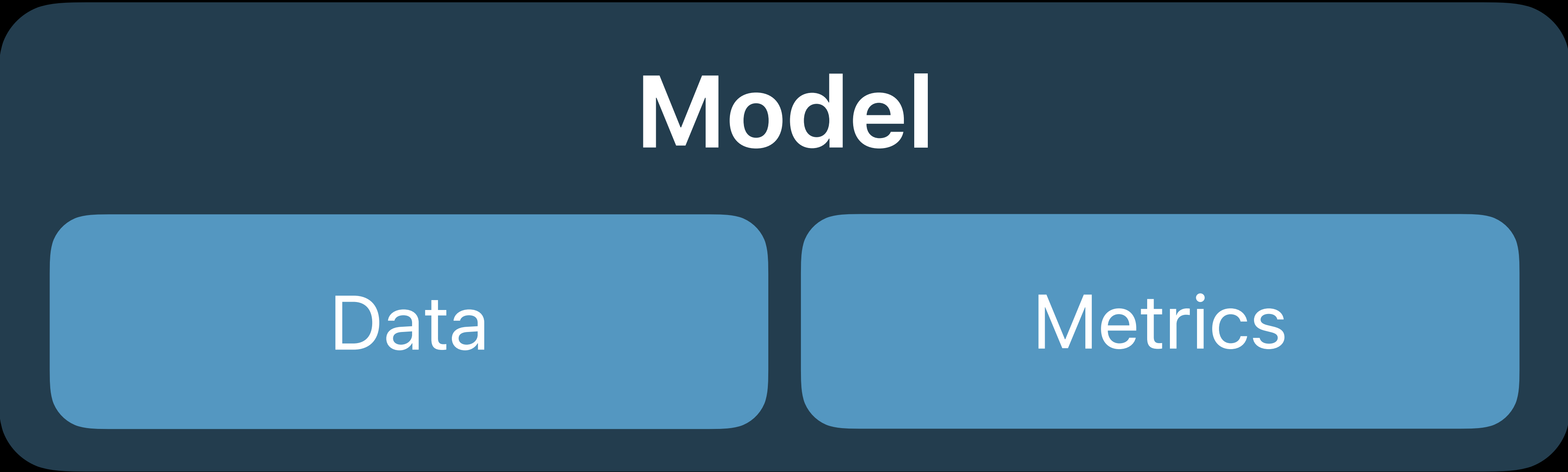
Evaluate the experience

Evolve your metrics

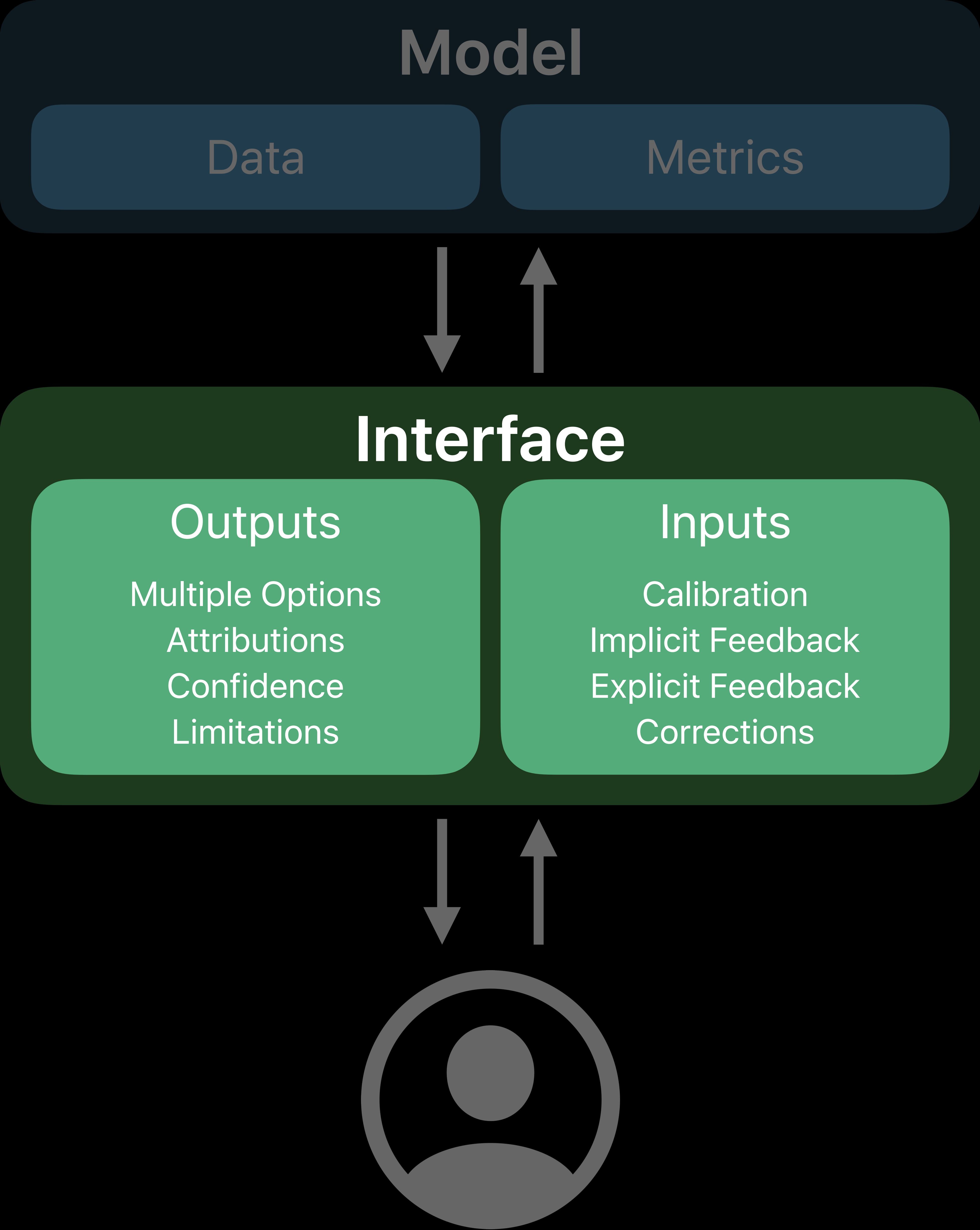














# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Outputs

Multiple Options

Attributions

Confidence

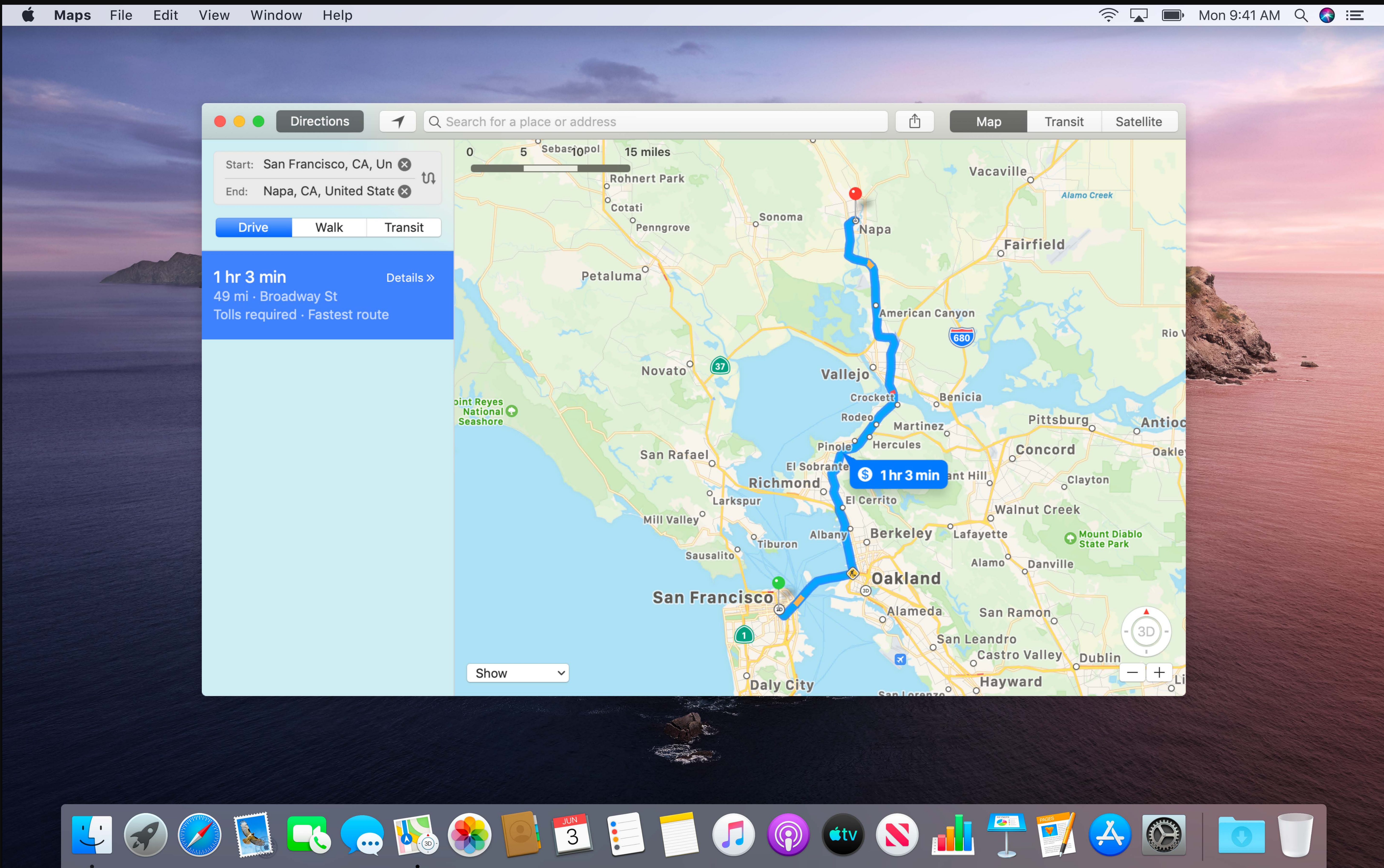
Limitations



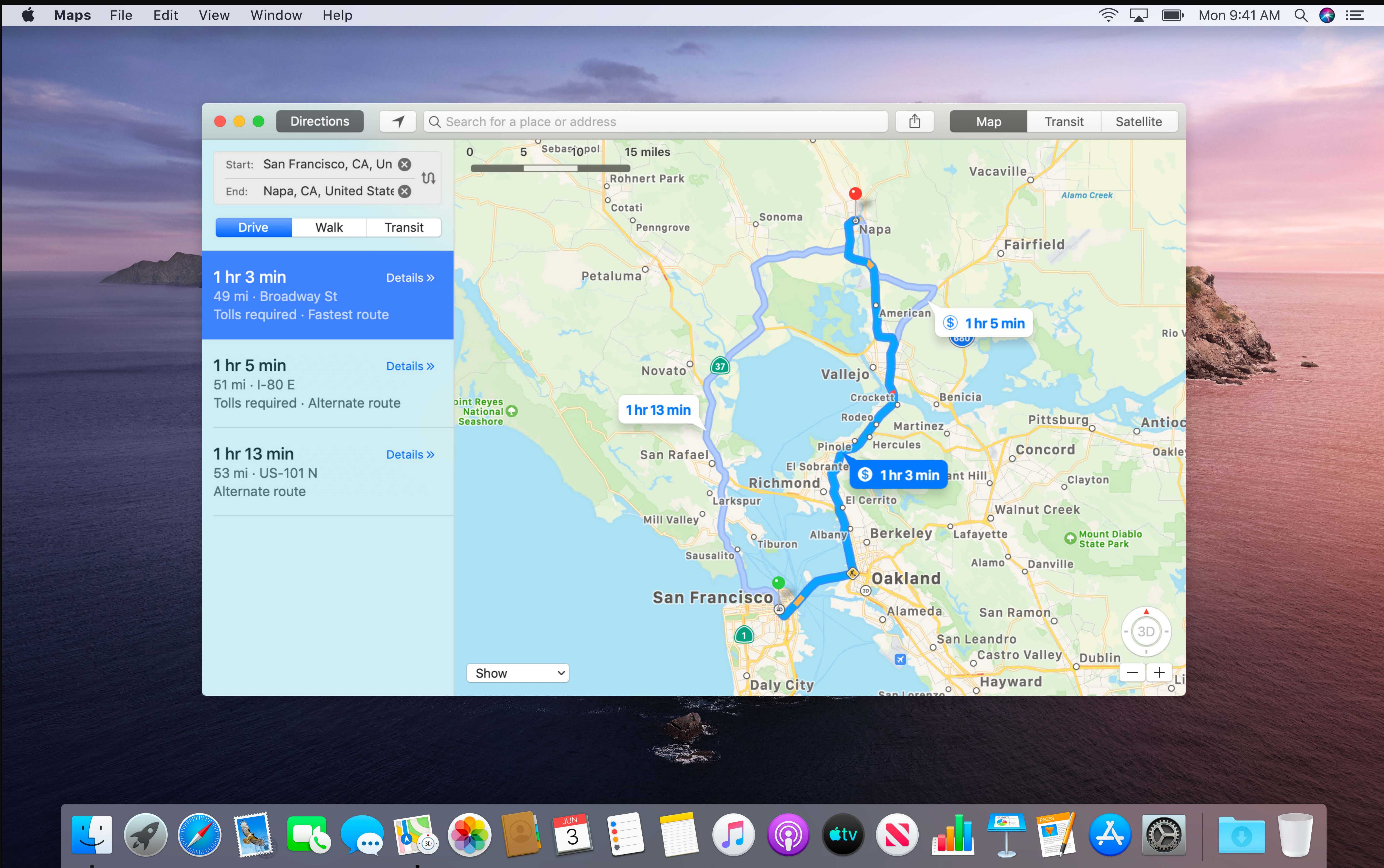
# Multiple Options

Multiple options allow people to choose from among the results a feature generates









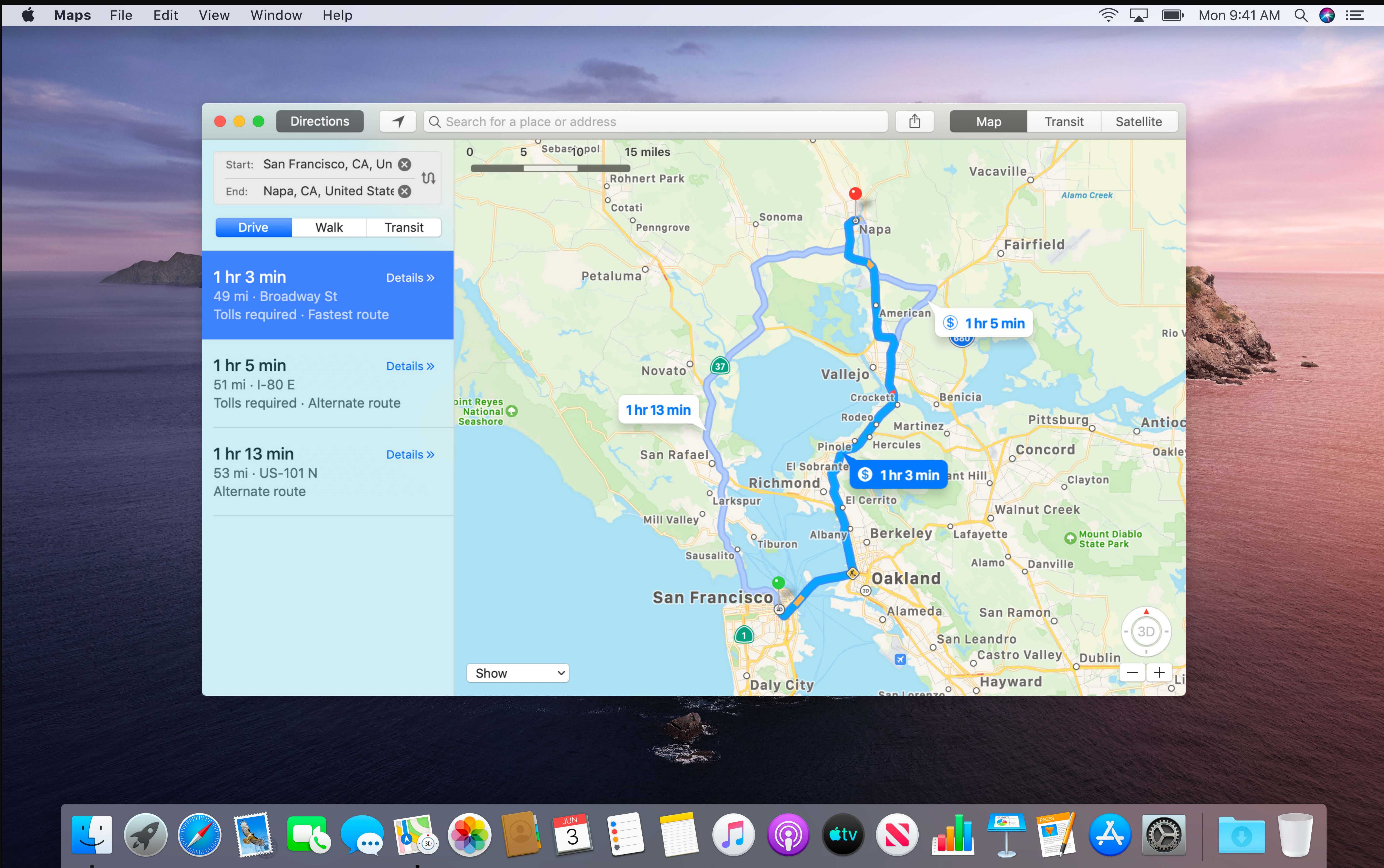
MacBook Pro



# Multiple Options

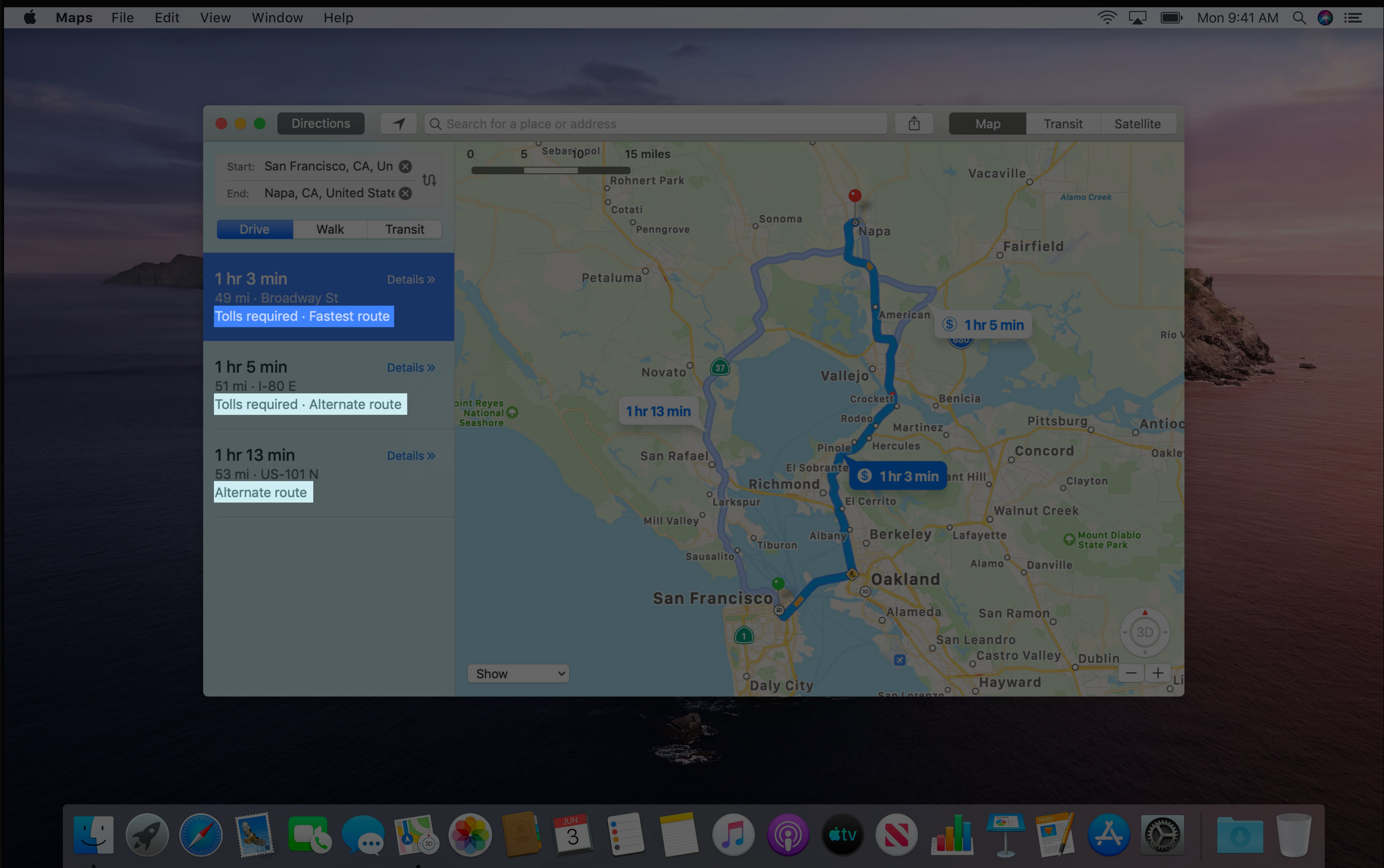
Prefer diverse options





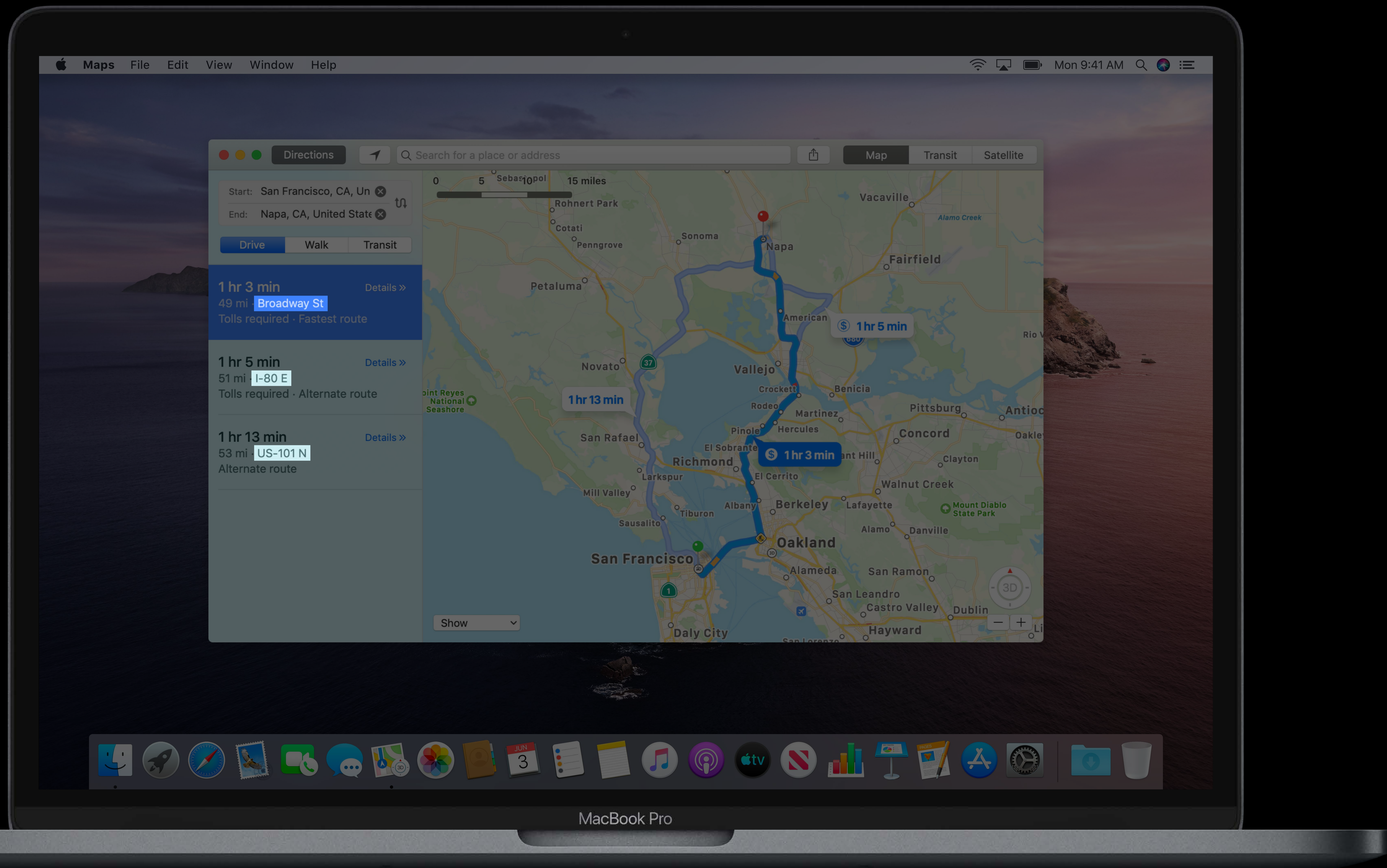
MacBook Pro



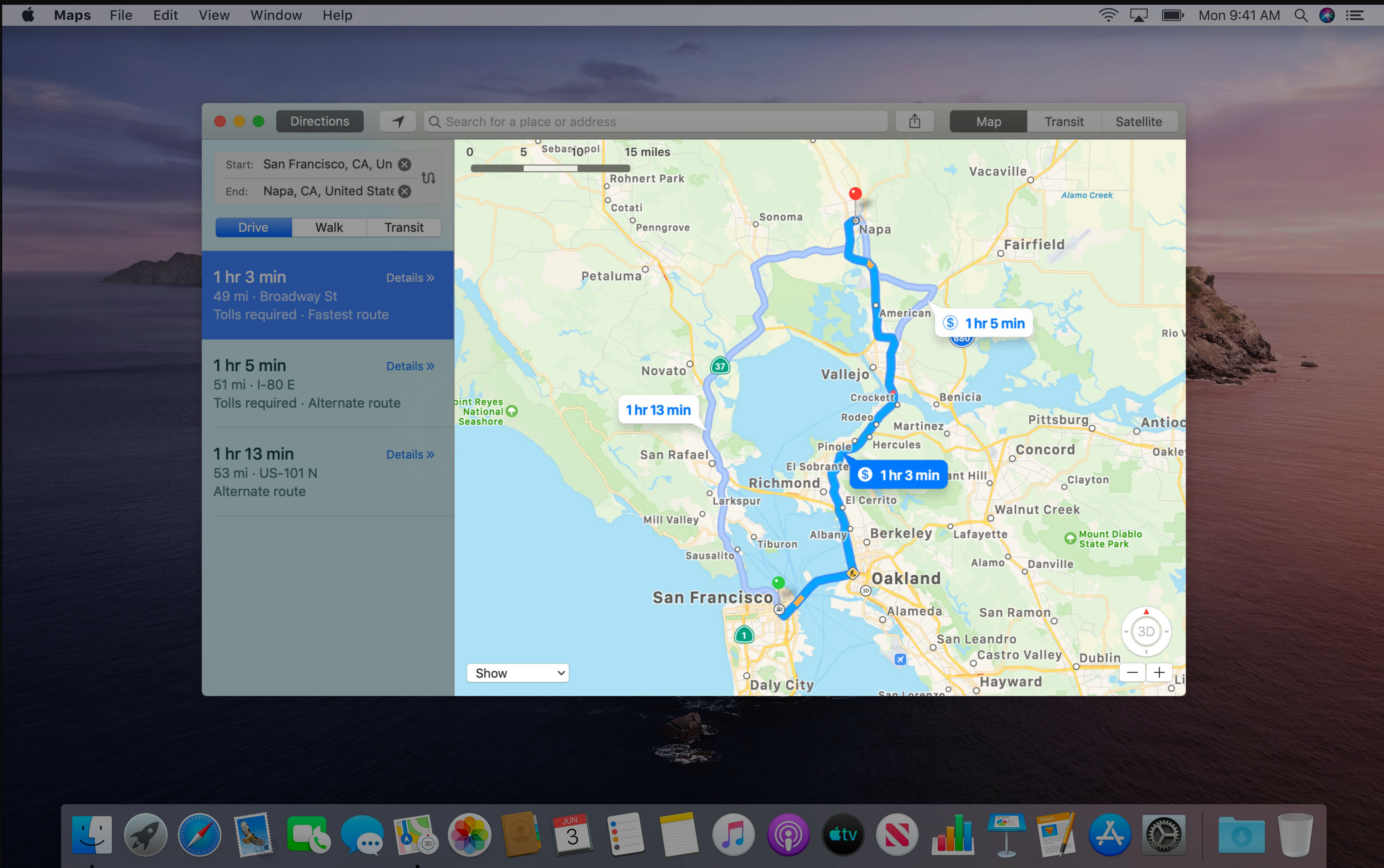


MacBook Pro









MacBook Pro



# Multiple Options

Prefer diverse options

Differentiate between options





JUN 7



10:09

San Jose



65°/52°

11:00–12:00 PM

WWDC Presentation  
Work Calendar





JUN 7



10:09

11:00–12:00 PM

WWDC Presentation  
Work Calendar

🕒 **Reminders**

Reserve Kayaks for...  
3:00 PM





JUN 7



10:09

🕒 **Reminders**

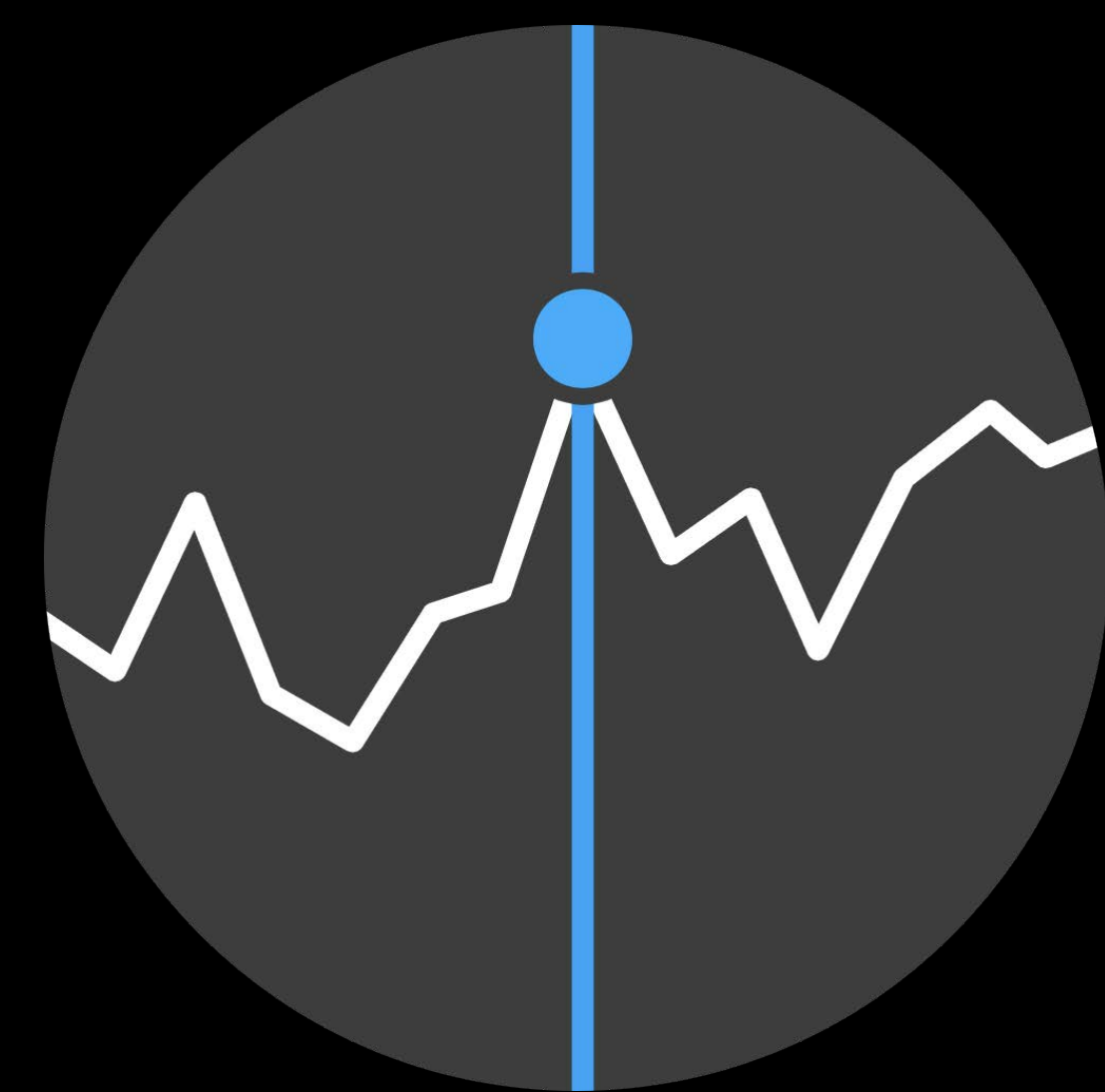
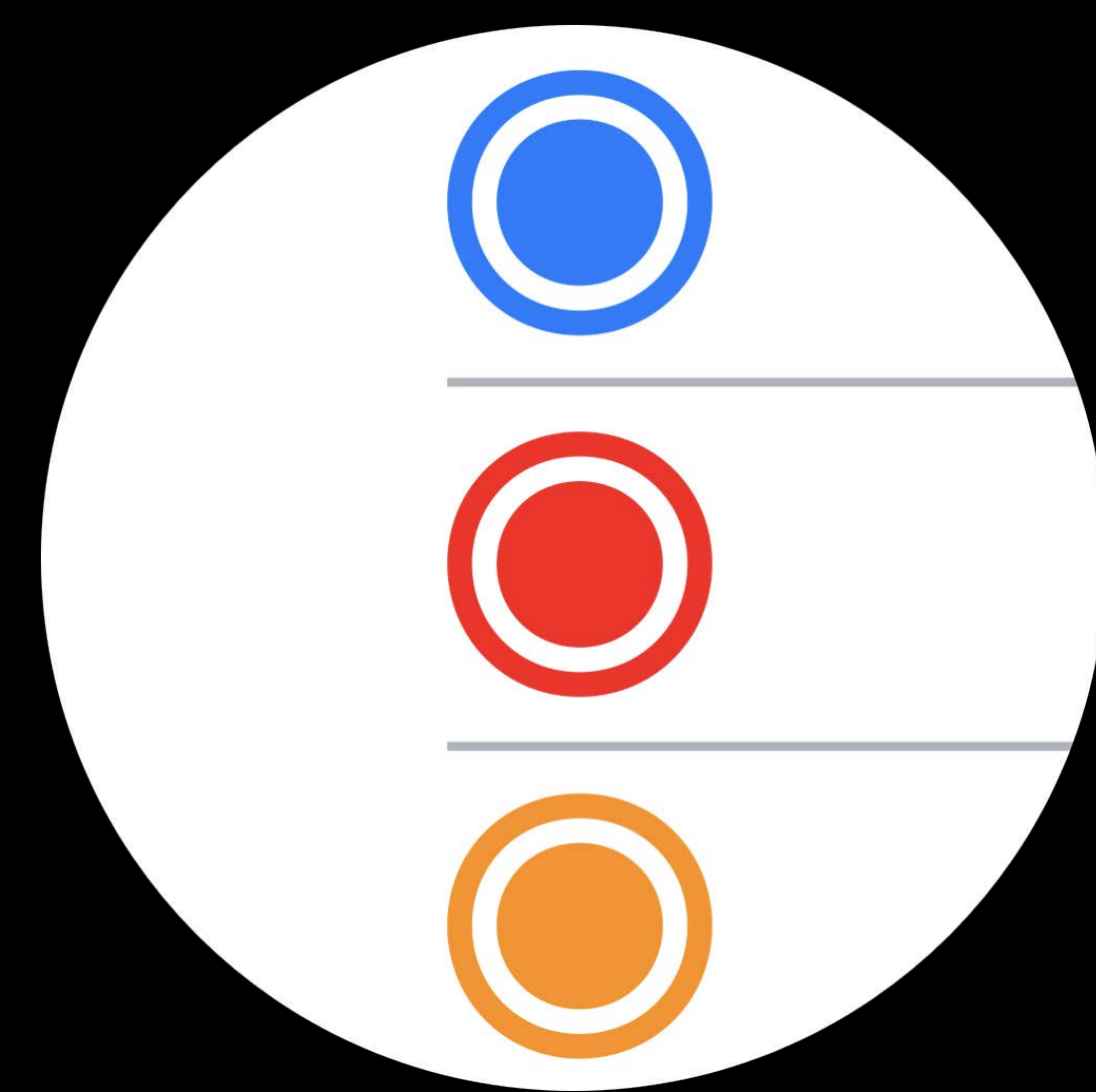
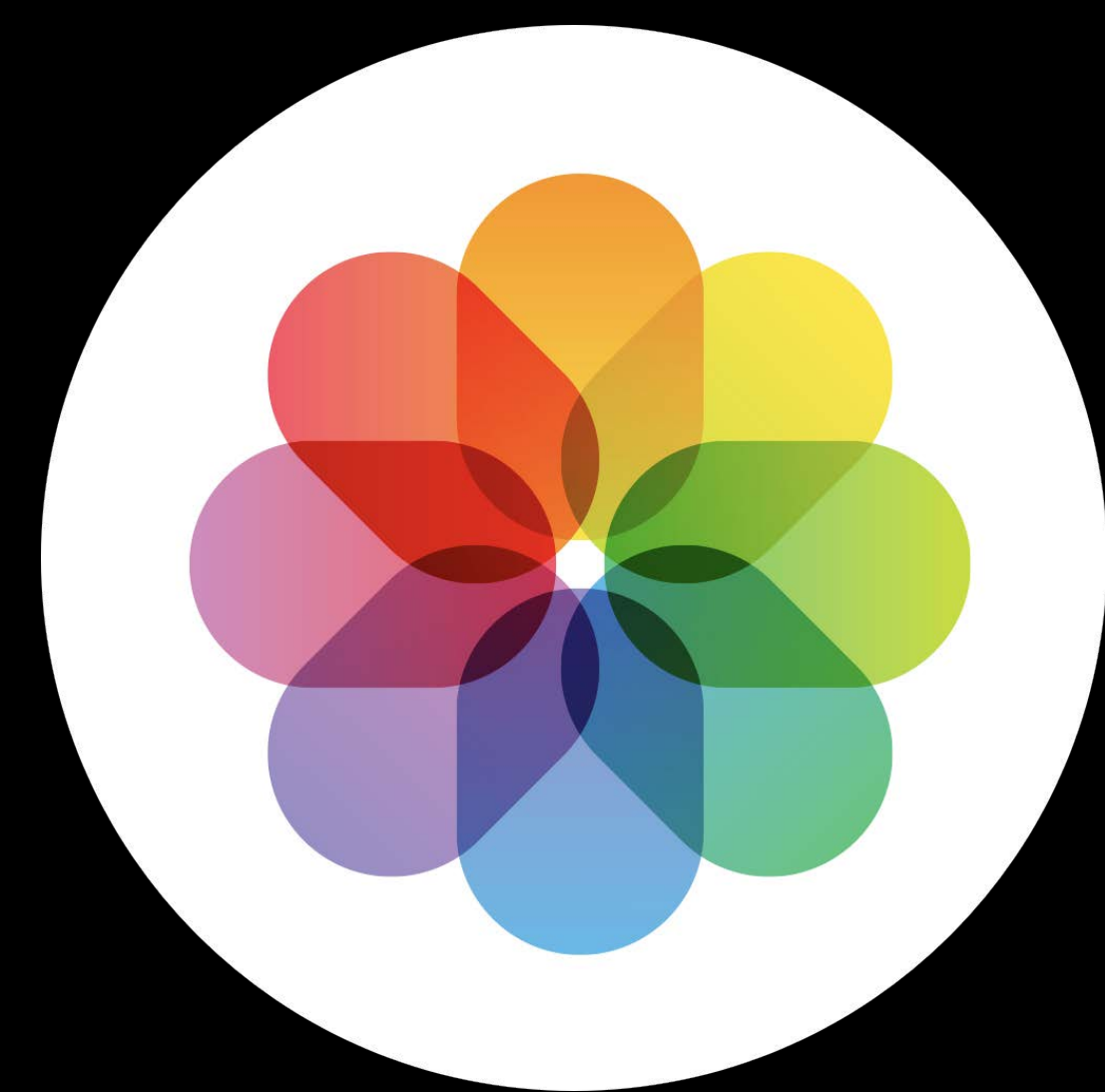
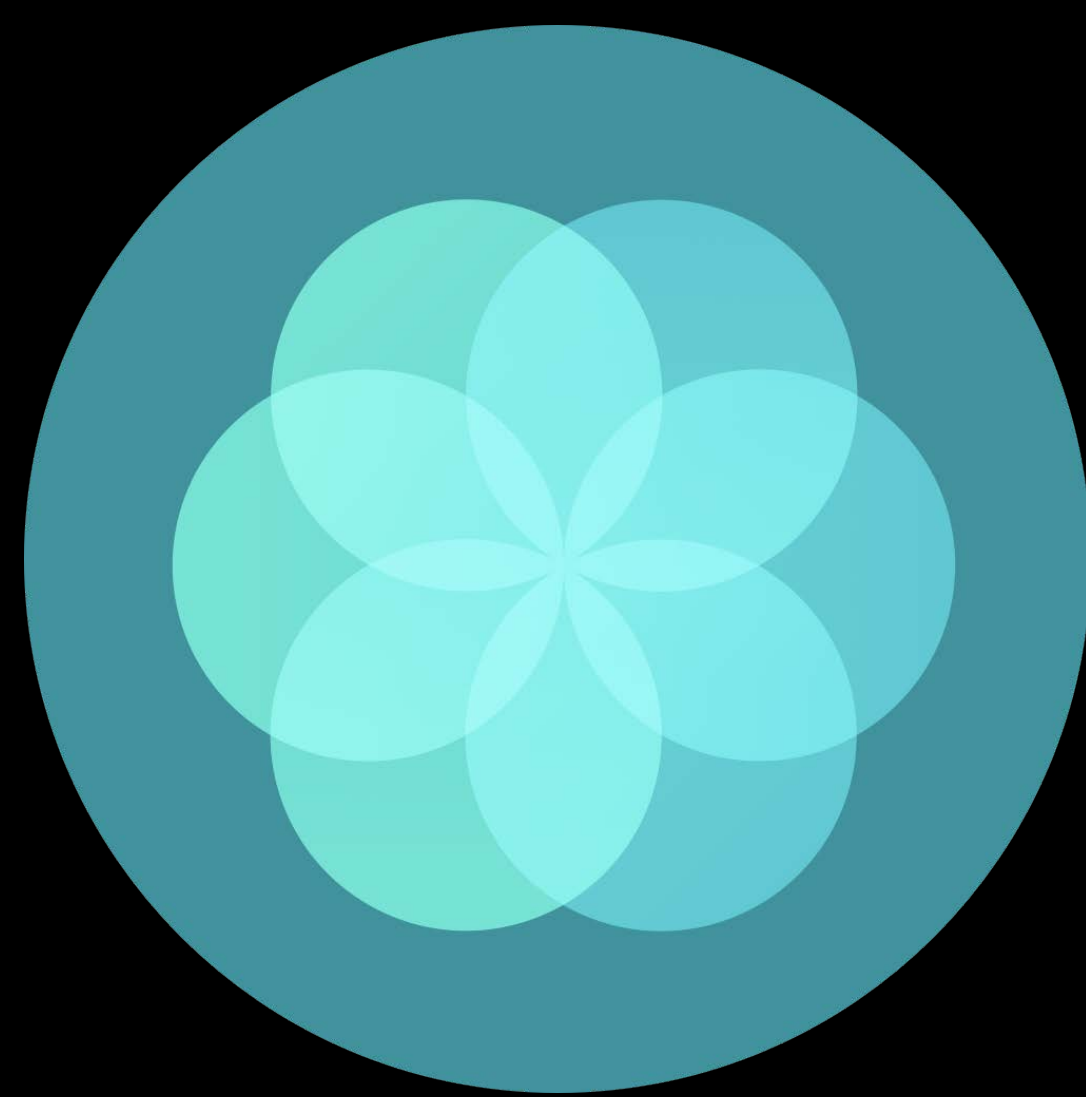
Reserve Kayaks for...  
3:00PM

**My Home**



Arrived  
Home









JUN 7



10:09

**My Home**



Arrived  
Home

**15 Events**

Your first one's at  
8:30.



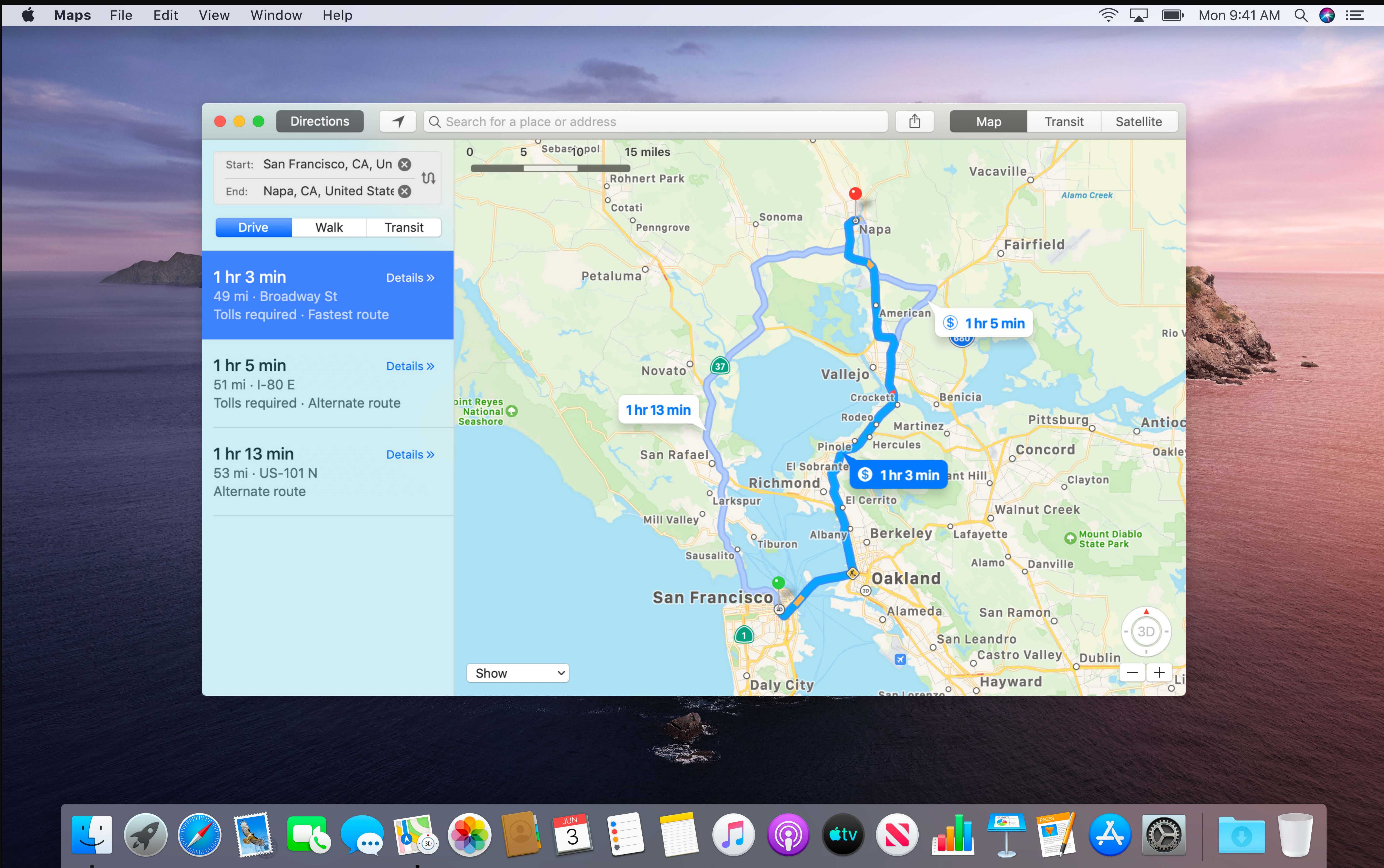
# Multiple Options

Prefer diverse options

Differentiate between options

Learn from selection to improve ranking





MacBook Pro



Apple Maps File Edit View Window Help

Wi-Fi Signal Battery Mon 9:41 AM Search Icons

Directions

Search for a place or address

Map Transit Satellite

Start: San Francisco, CA, Un

End: Napa, CA, United State

Drive Walk Transit

1 hr 3 min

49 mi · Broadway St

Tolls required · Fastest route

Details >

1 hr 5 min

51 mi · I-80 E

Tolls required · Alternate route

Details >

1 hr 13 min

53 mi · US-101 N

Alternate route

Details >

0 5 10 15 miles

Map of the San Francisco Bay Area showing a route from San Francisco to Napa. The route is highlighted in blue and passes through cities like San Francisco, Oakland, Berkeley, Richmond, Vallejo, and Napa. A scale bar at the top left shows distances up to 15 miles. A search bar at the top right allows for finding specific locations. The map includes various geographical features like the Golden Gate Bridge, San Francisco Bay, and surrounding hills. A sidebar on the left provides detailed information about the selected route, including travel time, distance, and toll requirements. The bottom of the screen shows a dock with various application icons.

Show

3D

MacBook Pro



# Outputs

Multiple Options

Attributions

Confidence

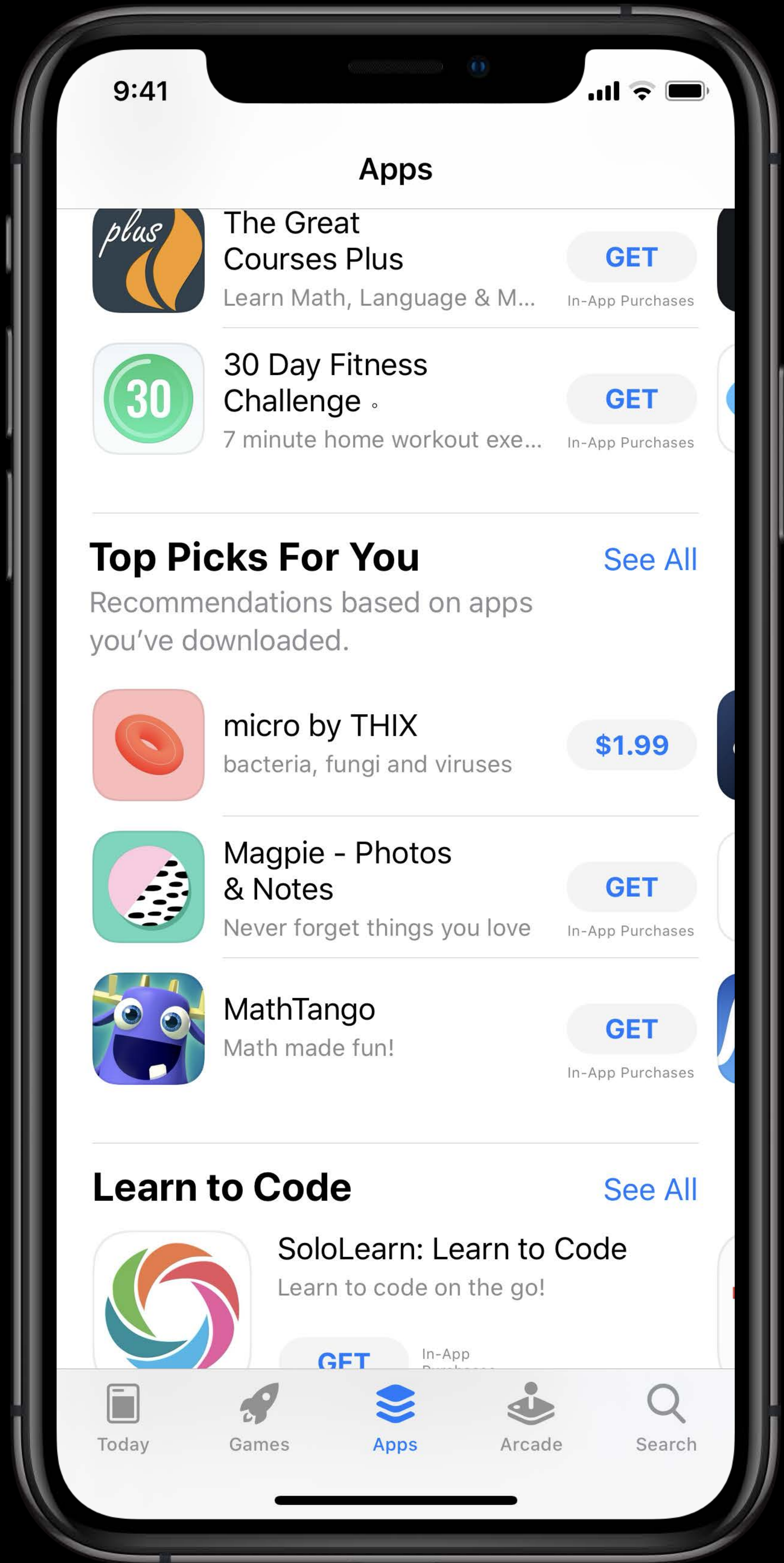
Limitations



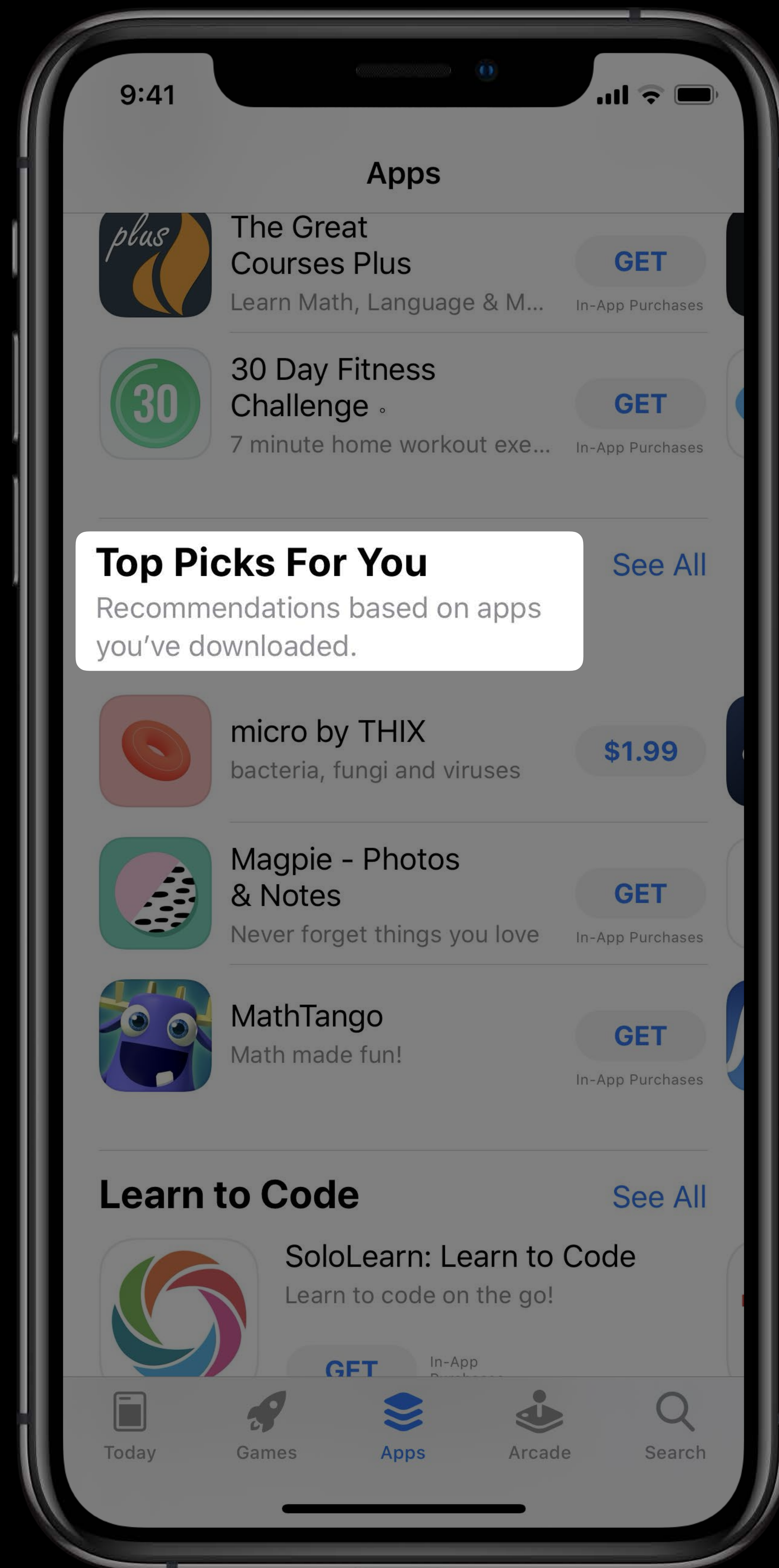
# Attributions

Attributions are explanations that help people understand more about how your app makes decisions













TikTok - Real  
Short Videos  
Make Every Second Count

GET

In-App Purchases

## Top Picks For You

[See All](#)

Because you're into cooking



Kitchen Stories  
Recipes  
Thousands of dishes to enjoy

GET

In-App Purchases



Tasty  
Food videos and recipes

GET



Food Network In  
the Kitchen  
70k+ recipes & fun food vid...

GET

## Road Trip Essentials

[See All](#)

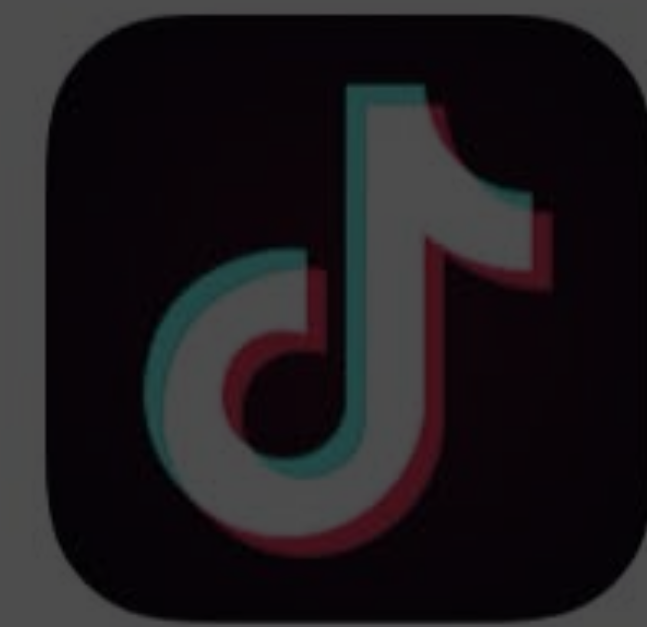


Weather Underground  
Hyper-Local Forecast

GET

In-App Purchases





TikTok - Real  
Short Videos  
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GET

In-App Purchases

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## Road Trip Essentials

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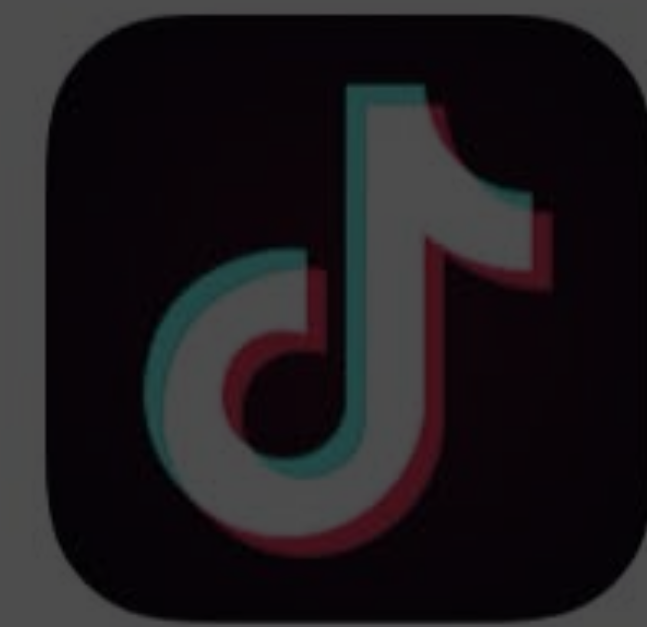


Weather Underground  
Hyper-Local Forecast

GET

In-App Purchases





TikTok - Real  
Short Videos  
Make Every Second Count

GET

In-App Purchases

## Top Picks For You

[See All](#)

Because you love NYT Cooking



Kitchen Stories  
Recipes  
Thousands of dishes to enjoy

GET

In-App Purchases



Tasty  
Food videos and recipes

GET



Food Network In  
the Kitchen  
70k+ recipes & fun food vid...

GET

## Road Trip Essentials

[See All](#)

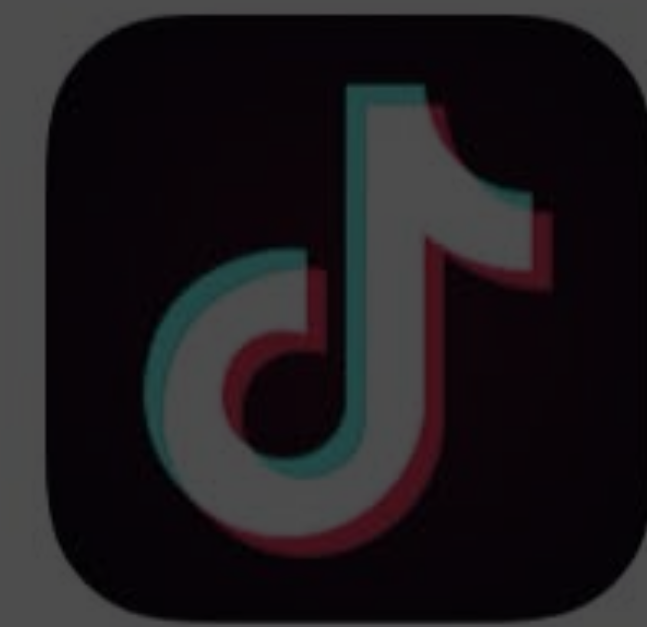


Weather Underground  
Hyper-Local Forecast

GET

In-App Purchases





TikTok - Real  
Short Videos  
Make Every Second Count

GET

In-App Purchases

## Top Picks For You

[See All](#)

Because you've downloaded NYT Cooking



Kitchen Stories  
Recipes  
Thousands of dishes to enjoy

GET

In-App Purchases



Tasty  
Food videos and recipes

GET



Food Network In  
the Kitchen  
70k+ recipes & fun food vid...

GET

## Road Trip Essentials

[See All](#)



Weather Underground  
Hyper-Local Forecast

GET

In-App Purchases



# Attributions

Avoid profiling people

Relate to objective facts, not subjective taste



9:41



What can I help  
you with?



9:41



What can I help  
you with?



9:41



## Jupiter will rise at 8:40 P.M. EDT on Tuesday, June 4, 2019.



WOLFRAM ALPHA

Input interpretation

Jupiter next rise

Result

8:40 pm EDT | Tuesday, June 4, 2019

Time difference from now (1:04:10 P.M.)

7 hours 35 minutes 49 seconds in the future

Time until midnight (EDT)

3 hours 20 minutes

Sky position from New York City, New York at 8:...

(not currently visible)

altitude

-38° 39.45" (below horizon)



9:41



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# Attributions

Avoid profiling people

Relate to objective facts, not subjective taste

Cite data sources



# Outputs


Multiple Options

Attributions


Confidence

Limitations



Courses Plus  
Learn Math, Language & M...  
In-App Purchases

GET


30 Day Fitness Challenge  
7 minute home workout exe...  
In-App Purchases

GET


## Top Picks For You

[See All](#)


85% Match

micro by THIX  
bacteria, fungi and viruses

\$1.99

Magpie - Photos & Notes  
Never forget things you love  
In-App Purchases


GET

MathTango  
Math made fun!  
In-App Purchases

GET

## Learn to Code


[See All](#)

SoloLearn: Learn to Code  
Learn to code on the go!

GET

In-App




- 

Courses Plus

Learn Math, Language & M...

GET

In-App Purchases
- 

30 Day Fitness Challenge

7 minute home workout exe...


GET

In-App Purchases

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In-App Purchases
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See All

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In-App




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Courses Plus

Learn Math, Language & M...

GET

In-App Purchases
- 

30 Day Fitness Challenge

7 minute home workout exe...


GET

In-App Purchases

## Top Picks For You


Recommendations based on apps you've downloaded.

[See All](#)

- 

micro by THIX


bacteria, fungi and viruses

\$1.99
- 

Magpie - Photos & Notes

Never forget things you love

GET

In-App Purchases
- 

MathTango


Math made fun!

GET

In-App Purchases

## Learn to Code

[See All](#)



SoloLearn: Learn to Code

Learn to code on the go!



# Confidence

Confidence is a measurement of certainty for a result







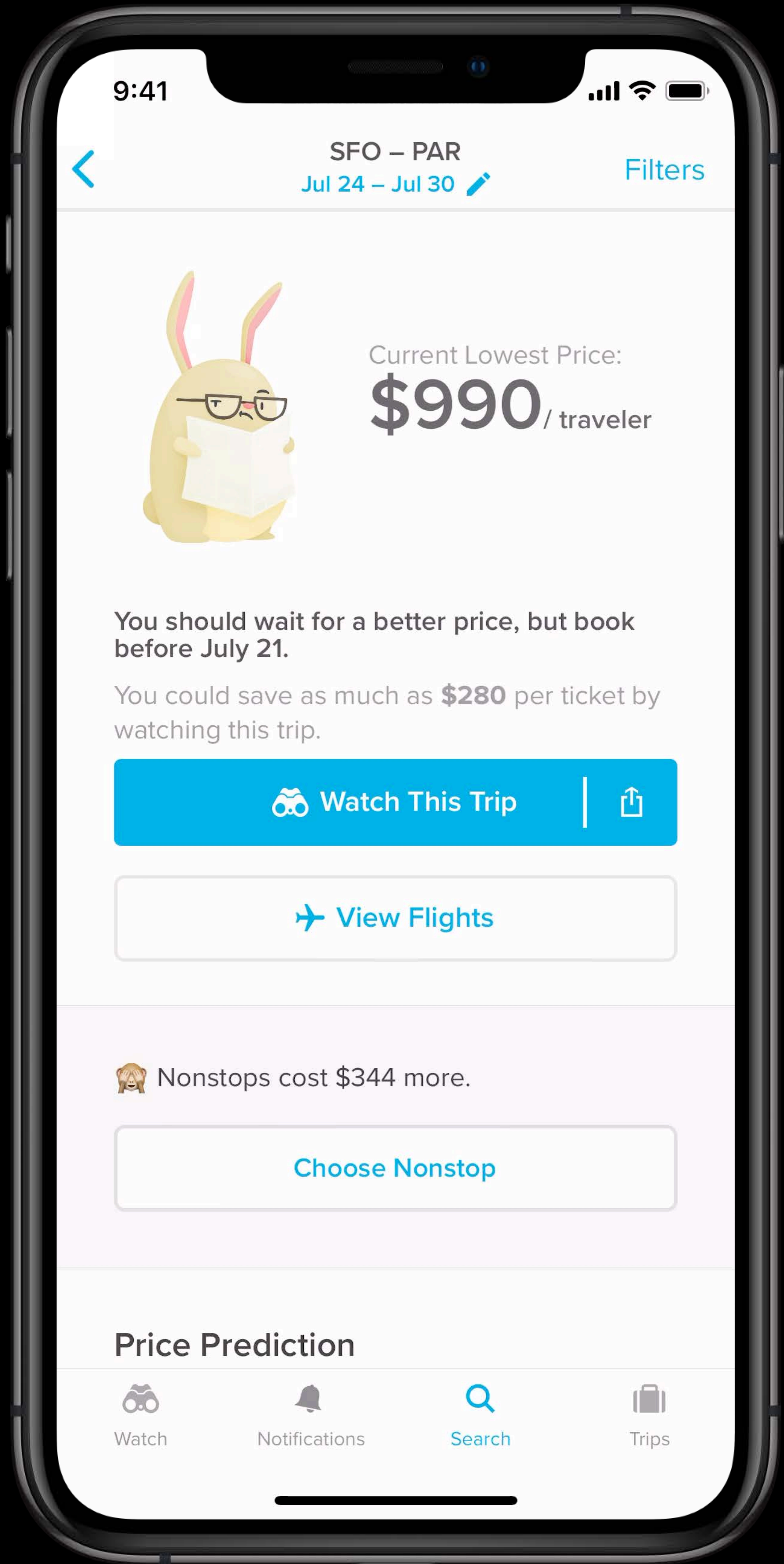




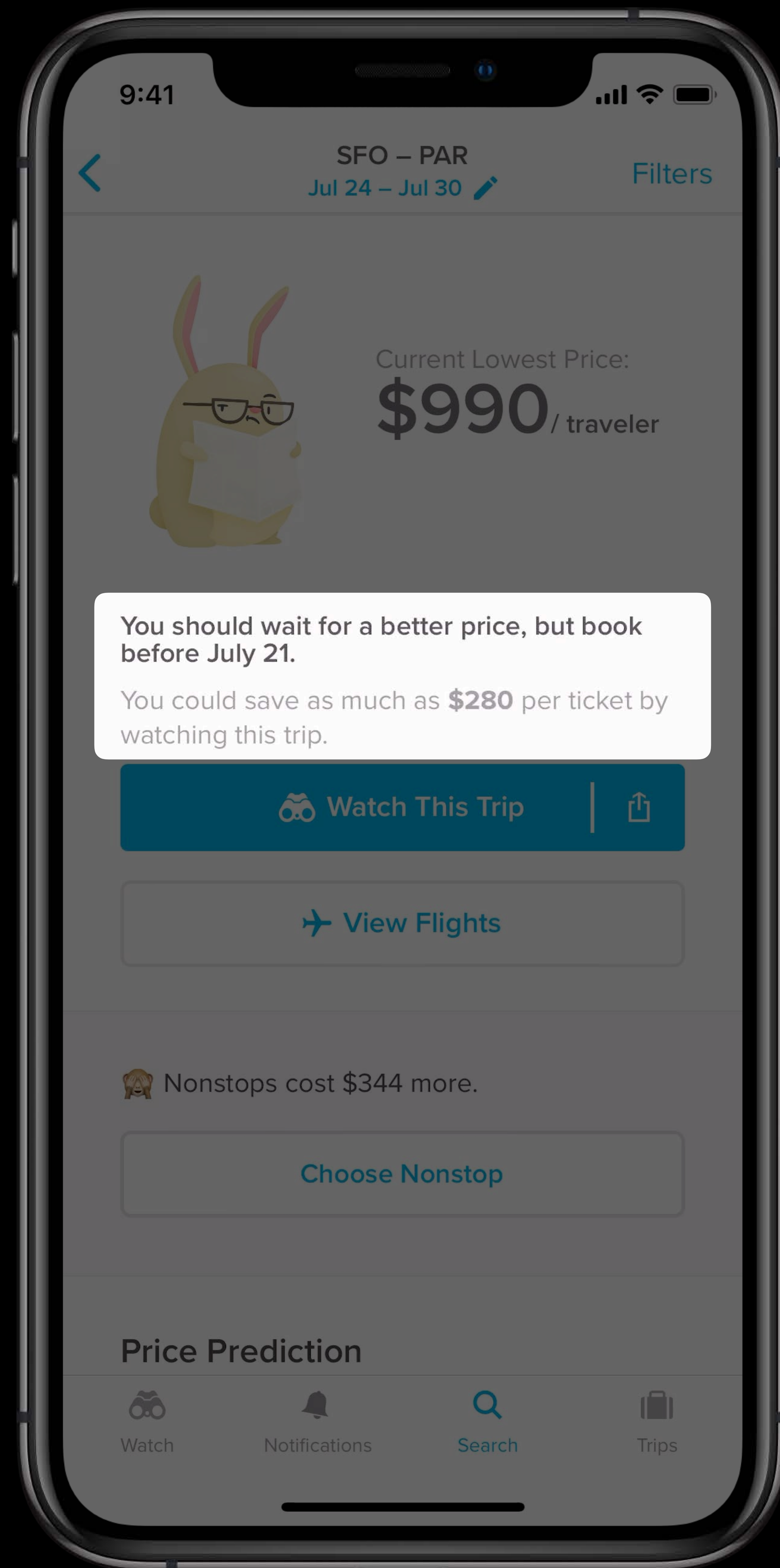
# Confidence

Numbers are appropriate for statistical predictions

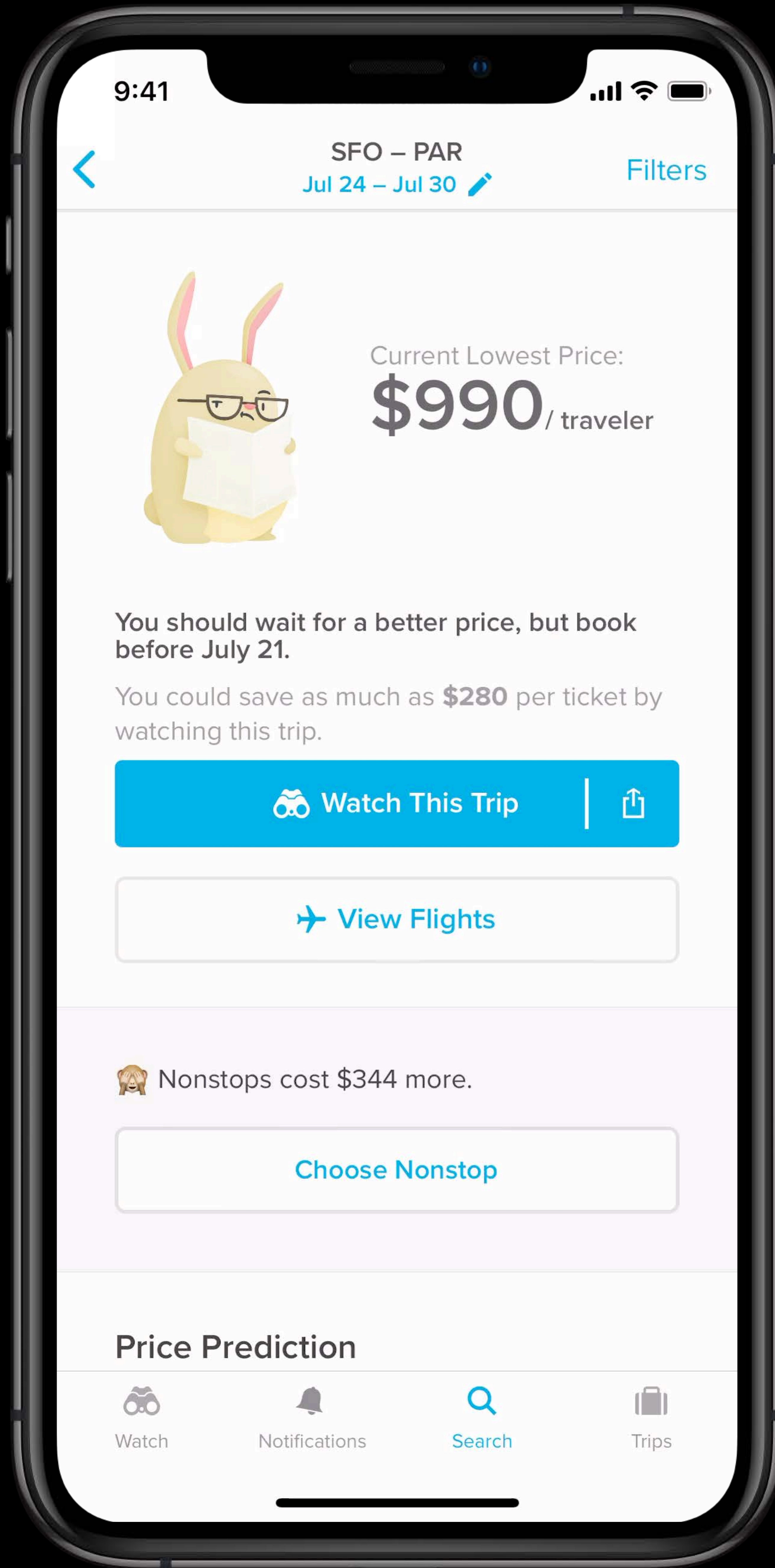




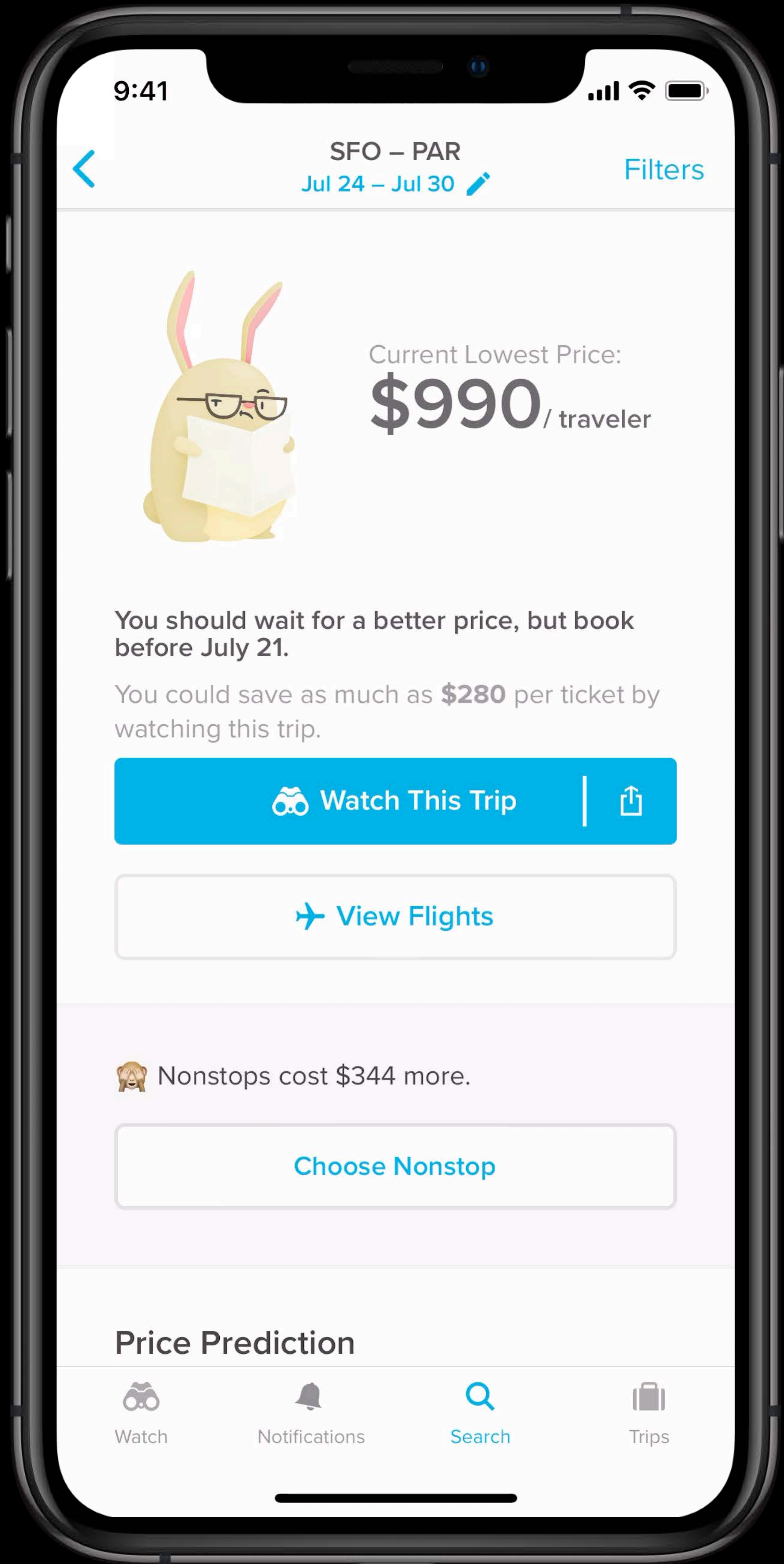












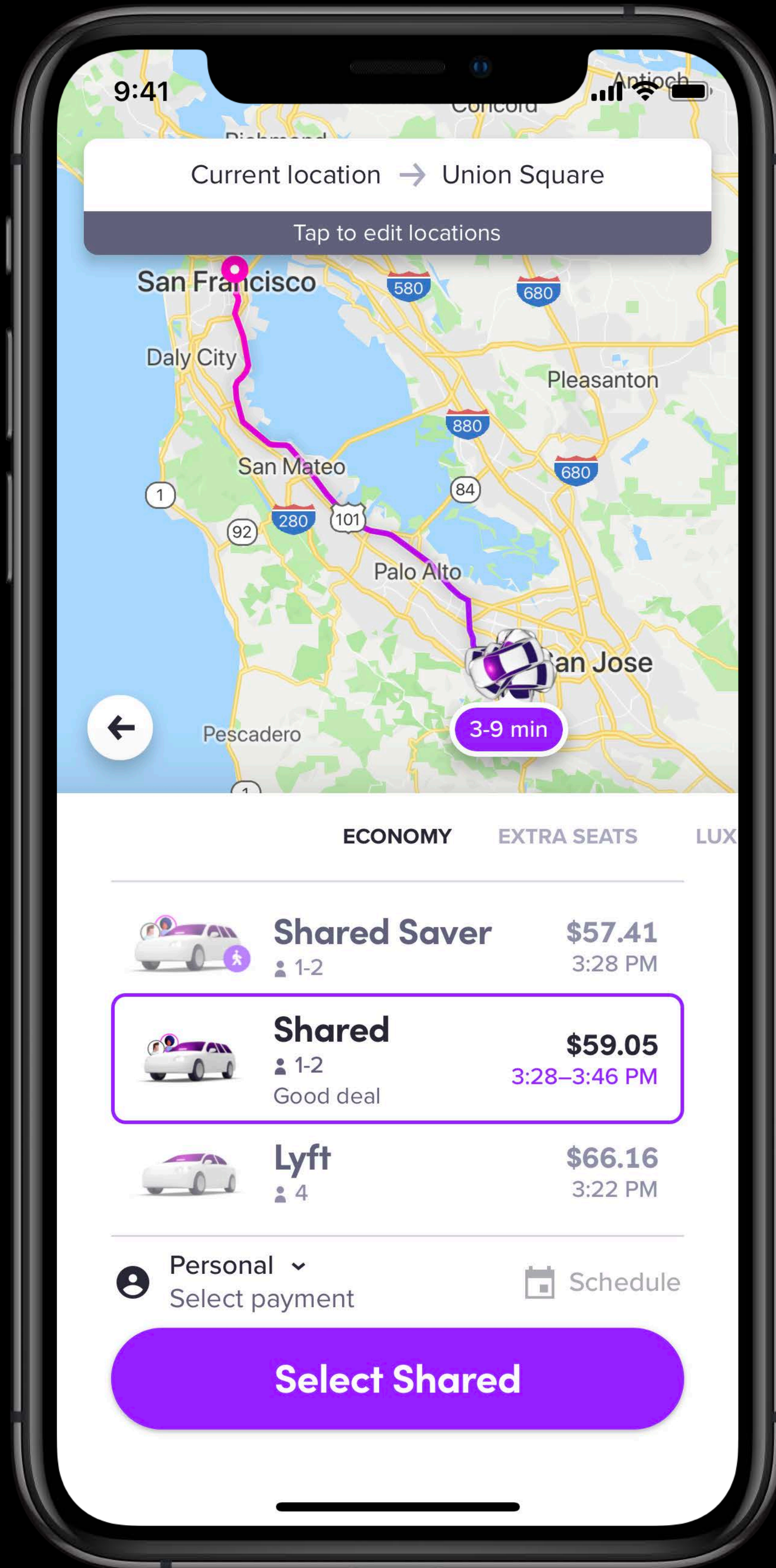


# Confidence

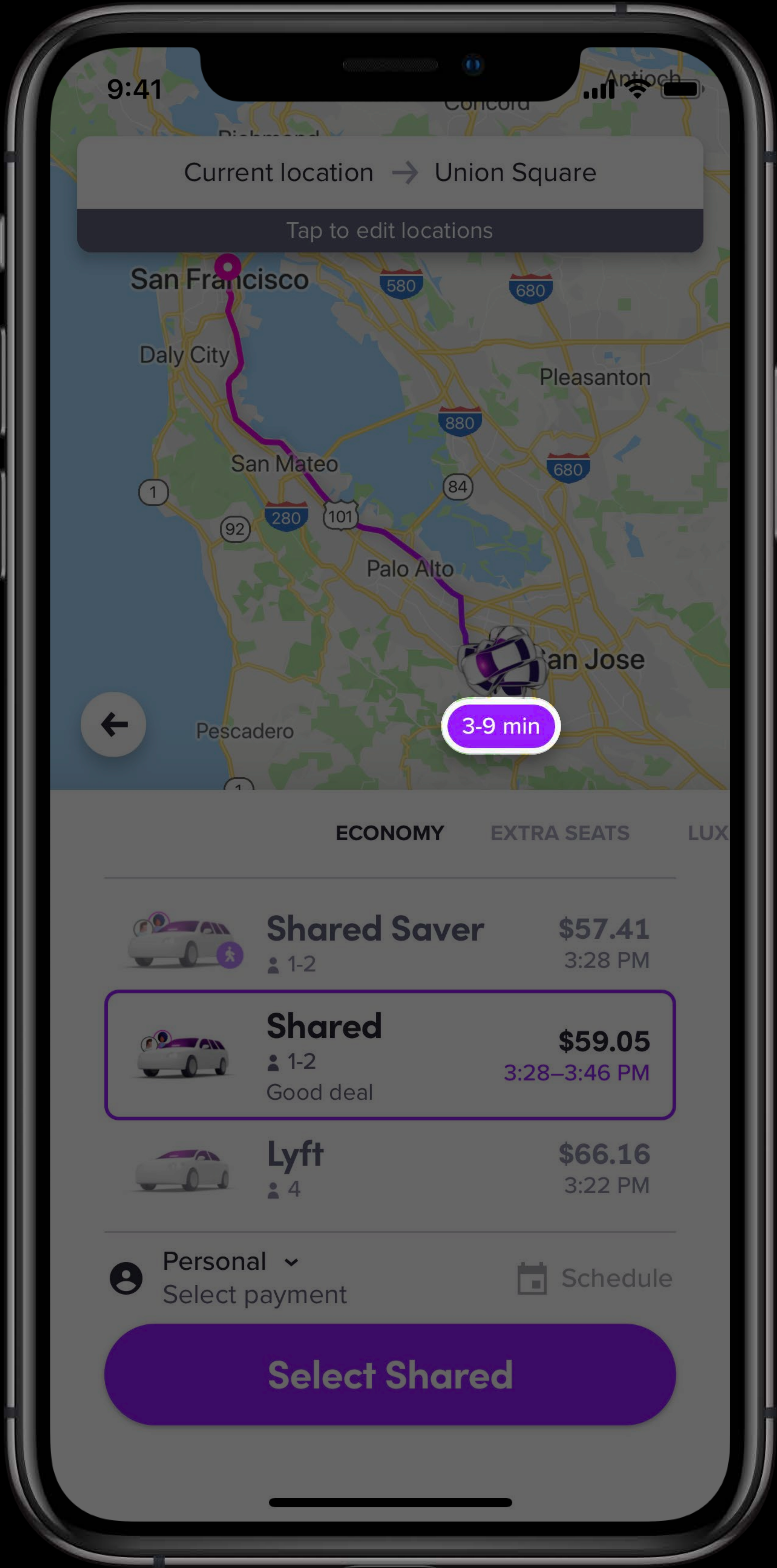
Numbers are appropriate for statistical predictions

Translate confidence into easy to understand terms

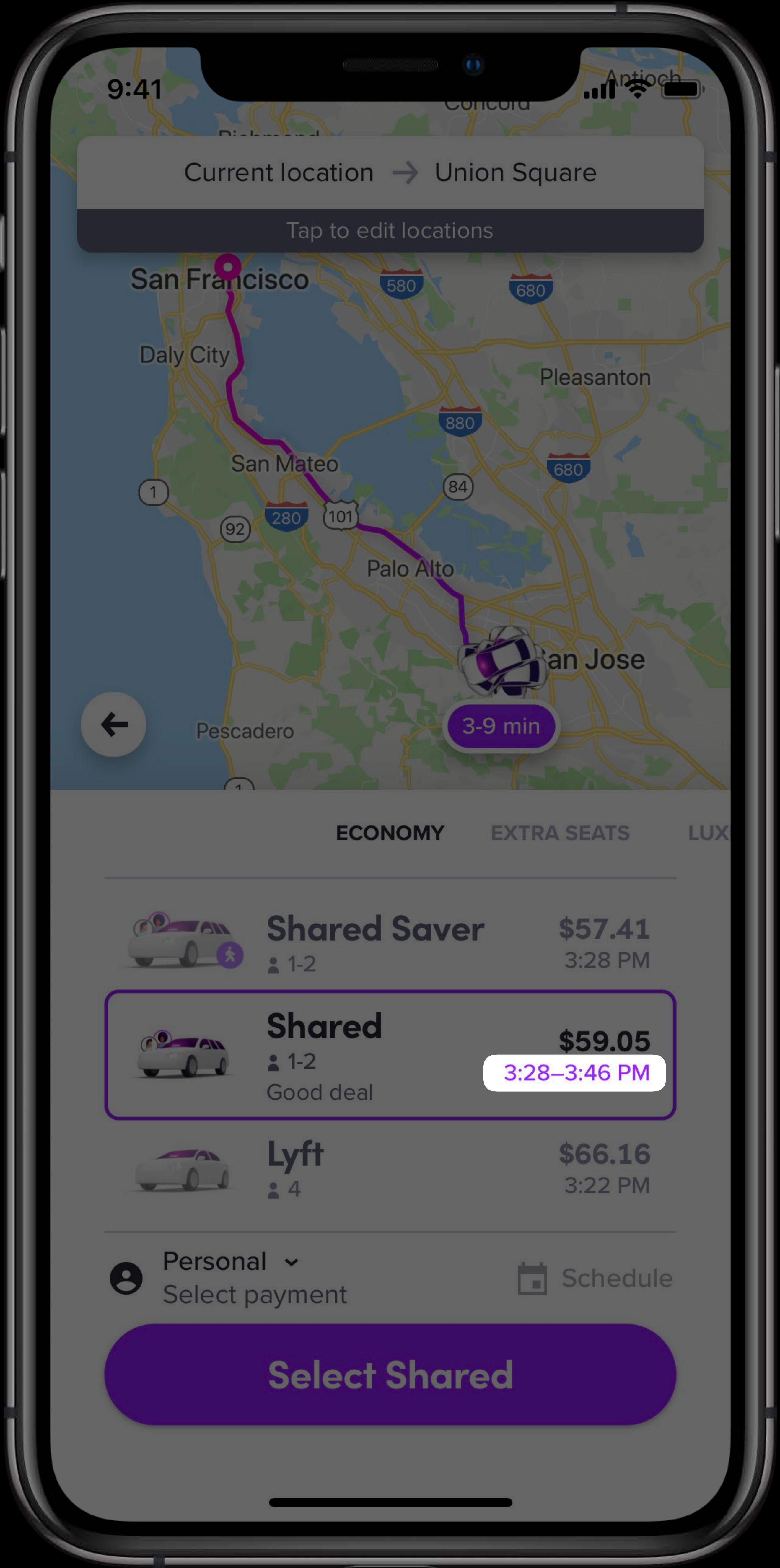














# Confidence

- Numbers are appropriate for statistical predictions
- Translate confidence into easy to understand terms
- Use range to help people understand risk



9:41



Rubii



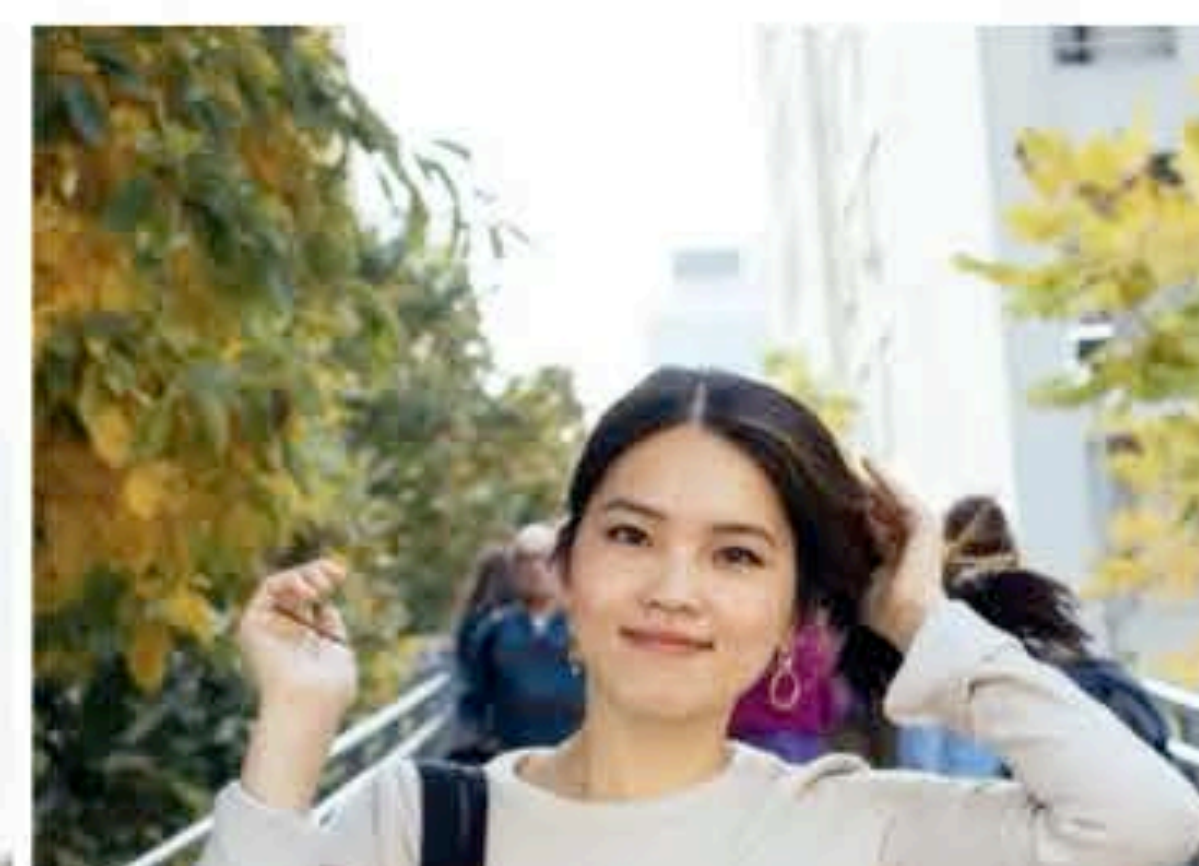
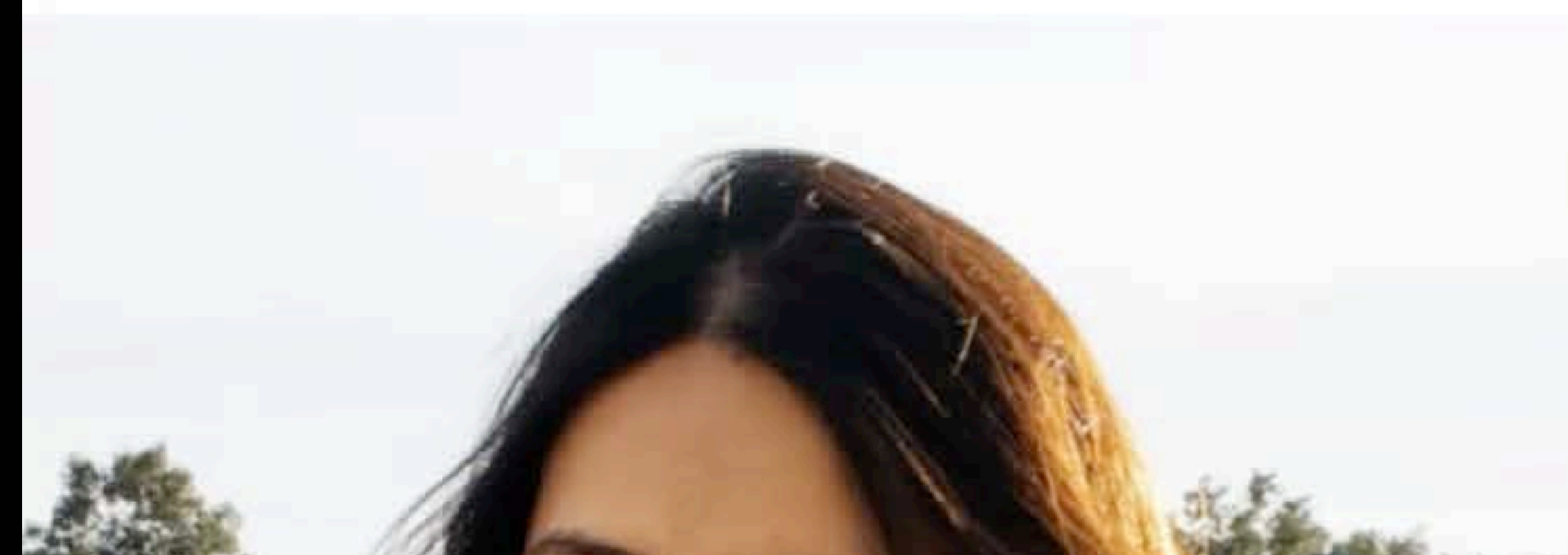
There are additional  
photos for review.

REVIEW



Show More

Select





9:41



Rubii



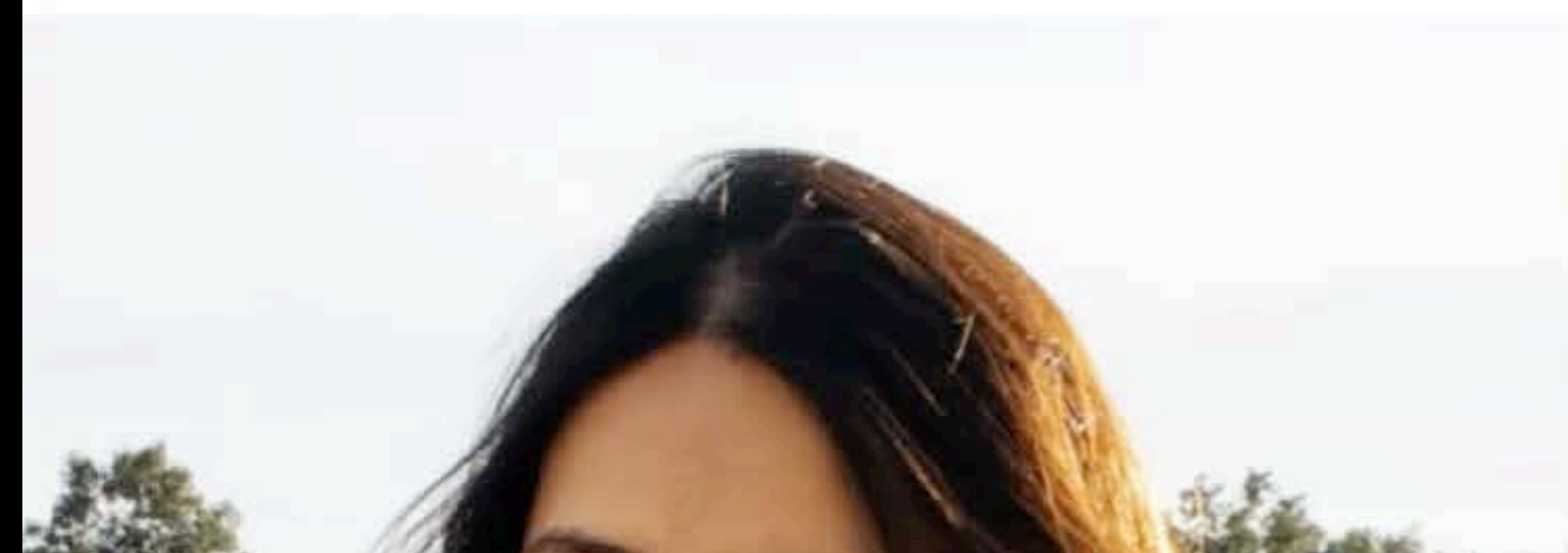
There are additional  
photos for review.

REVIEW



Show More

Select





9:41

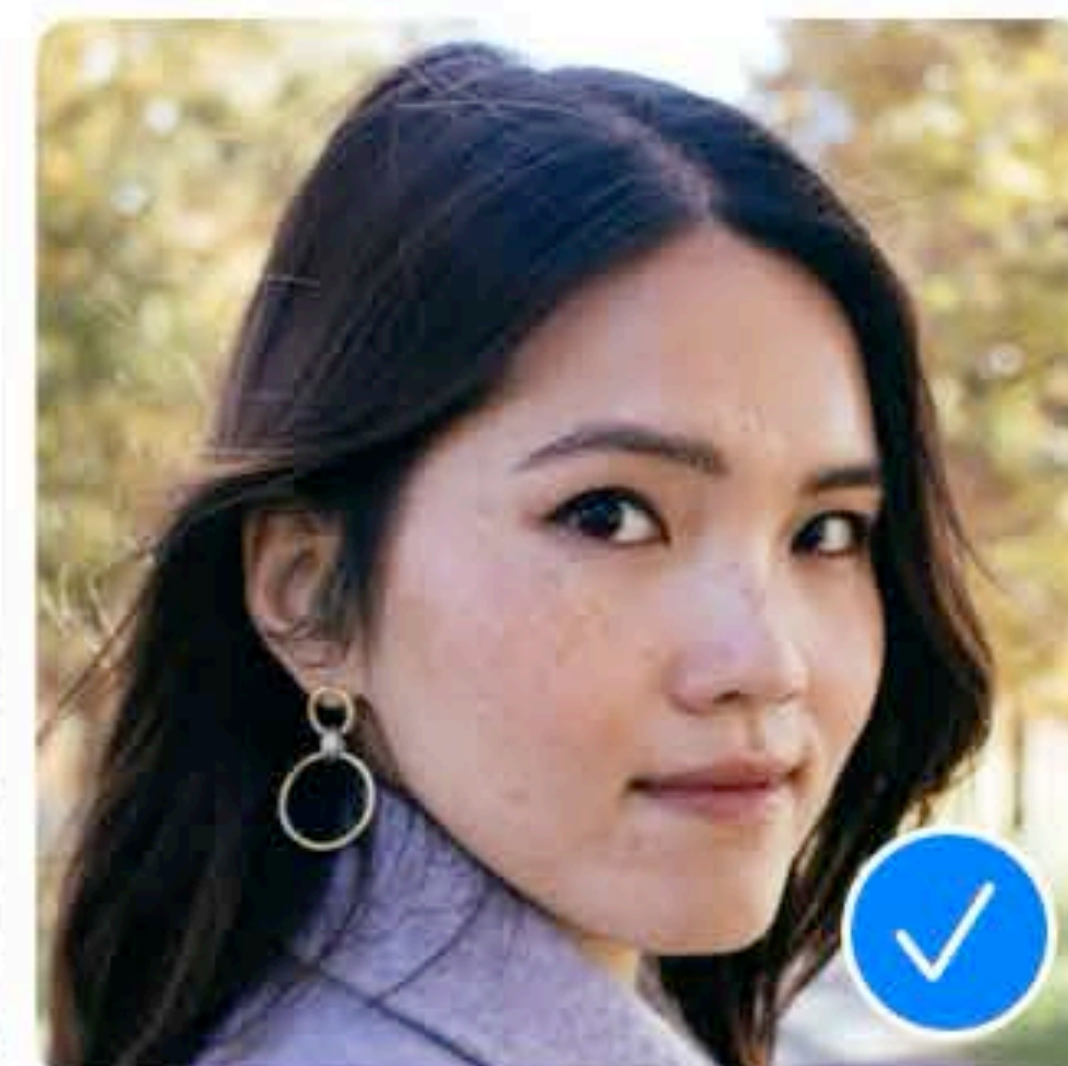
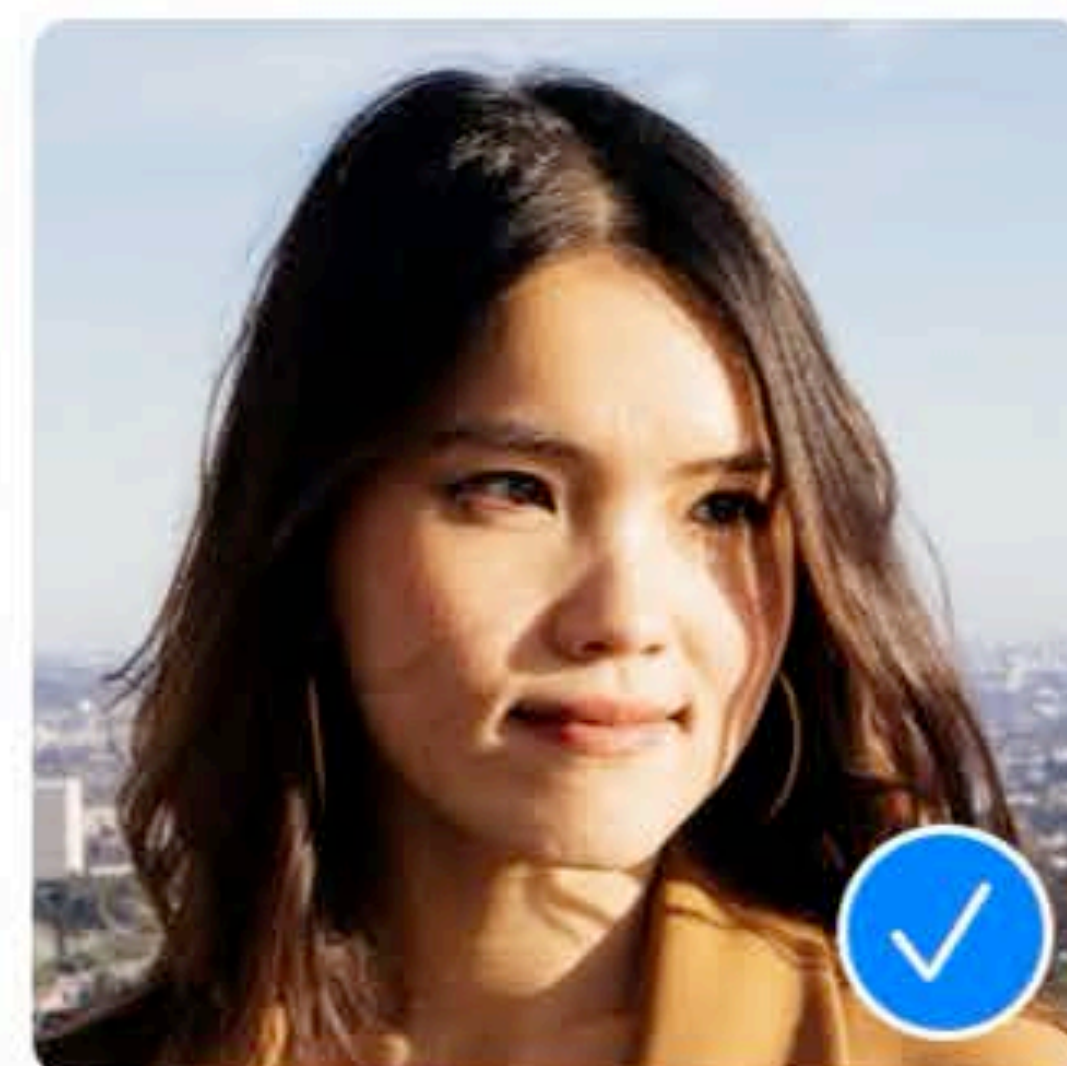
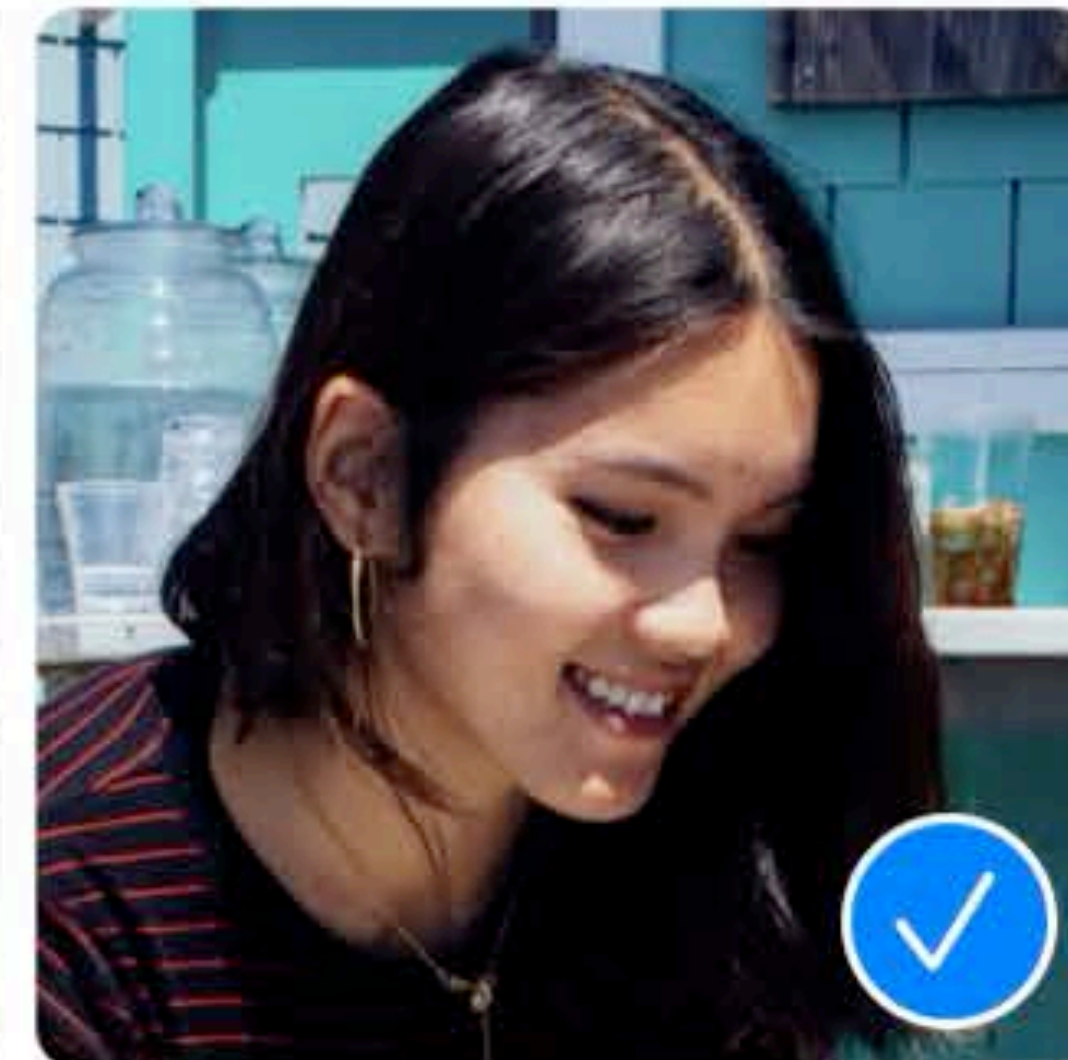
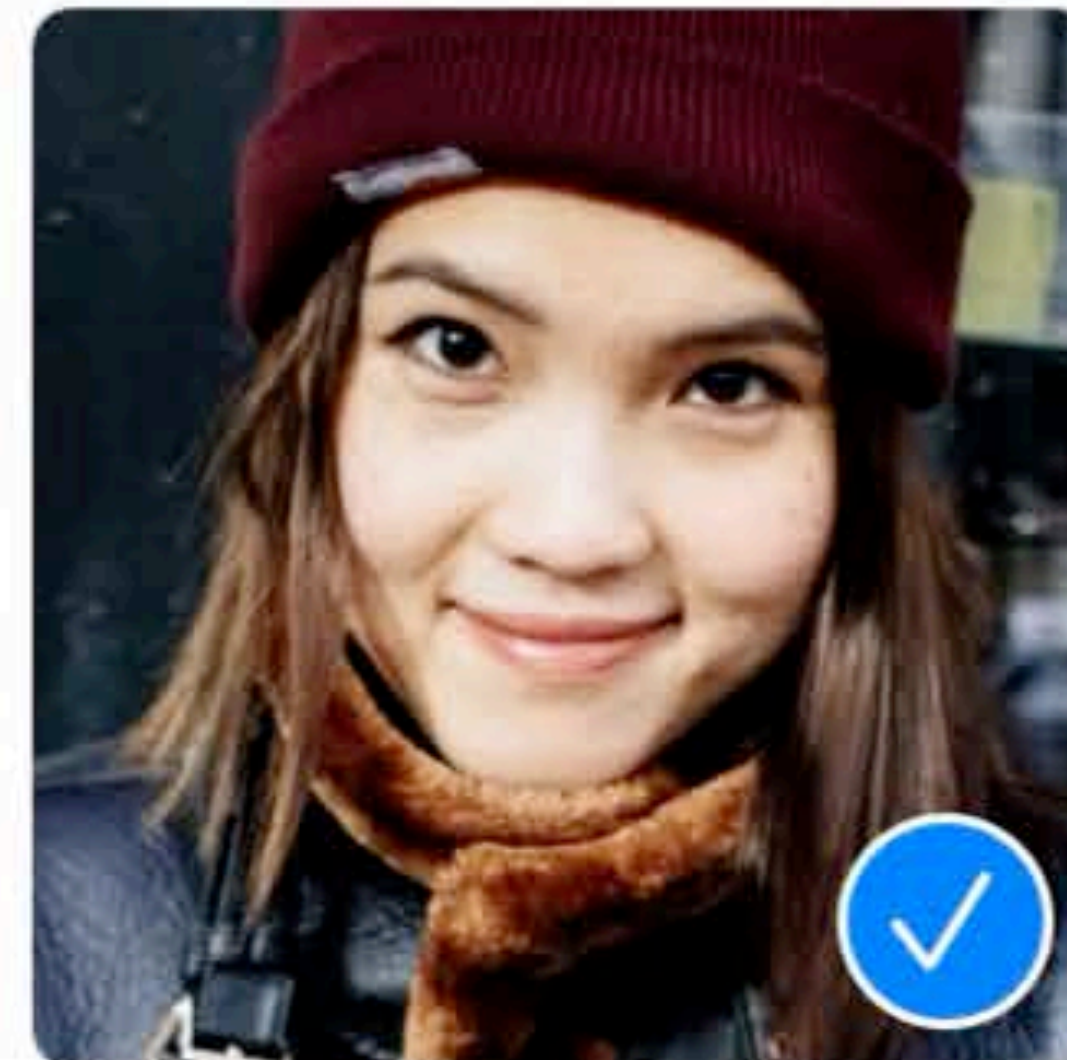
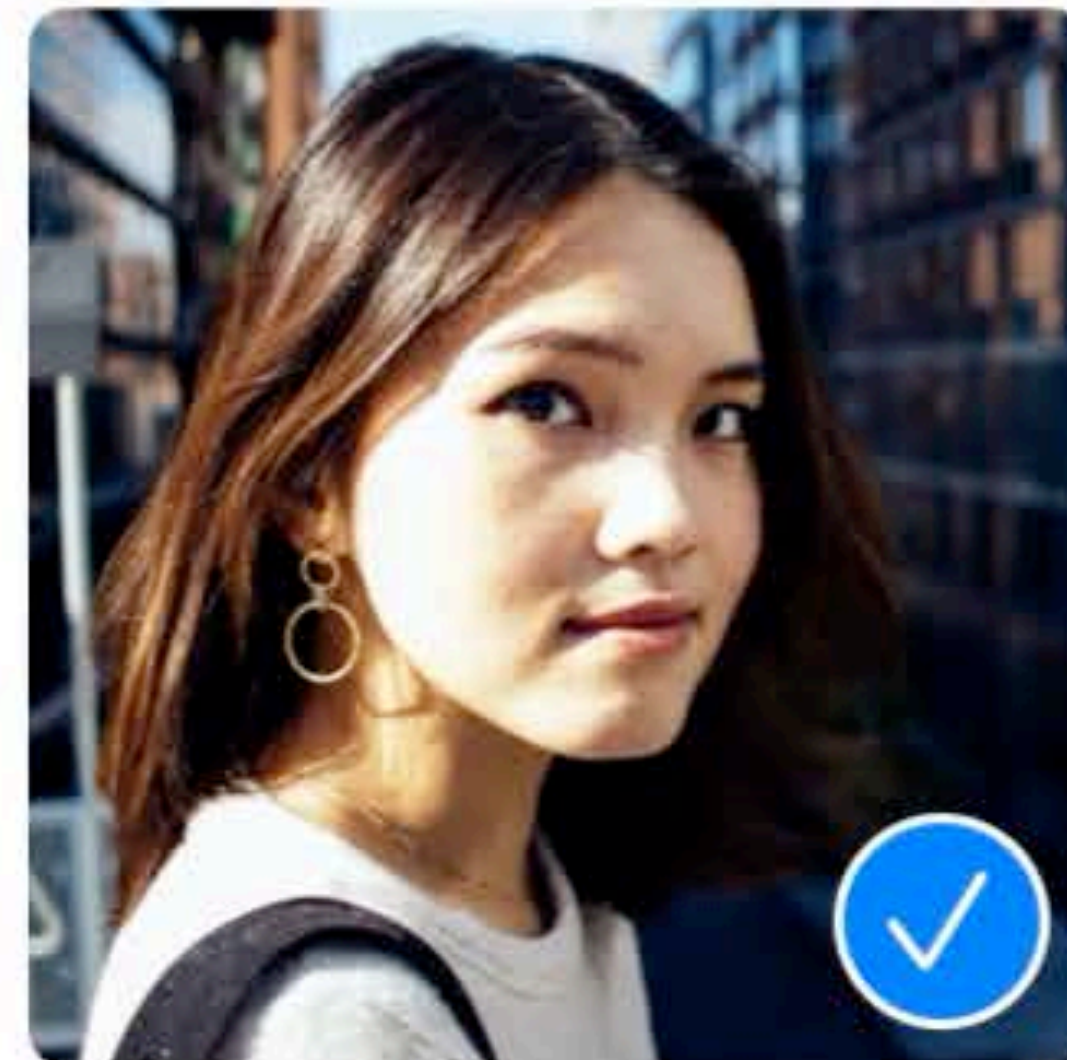
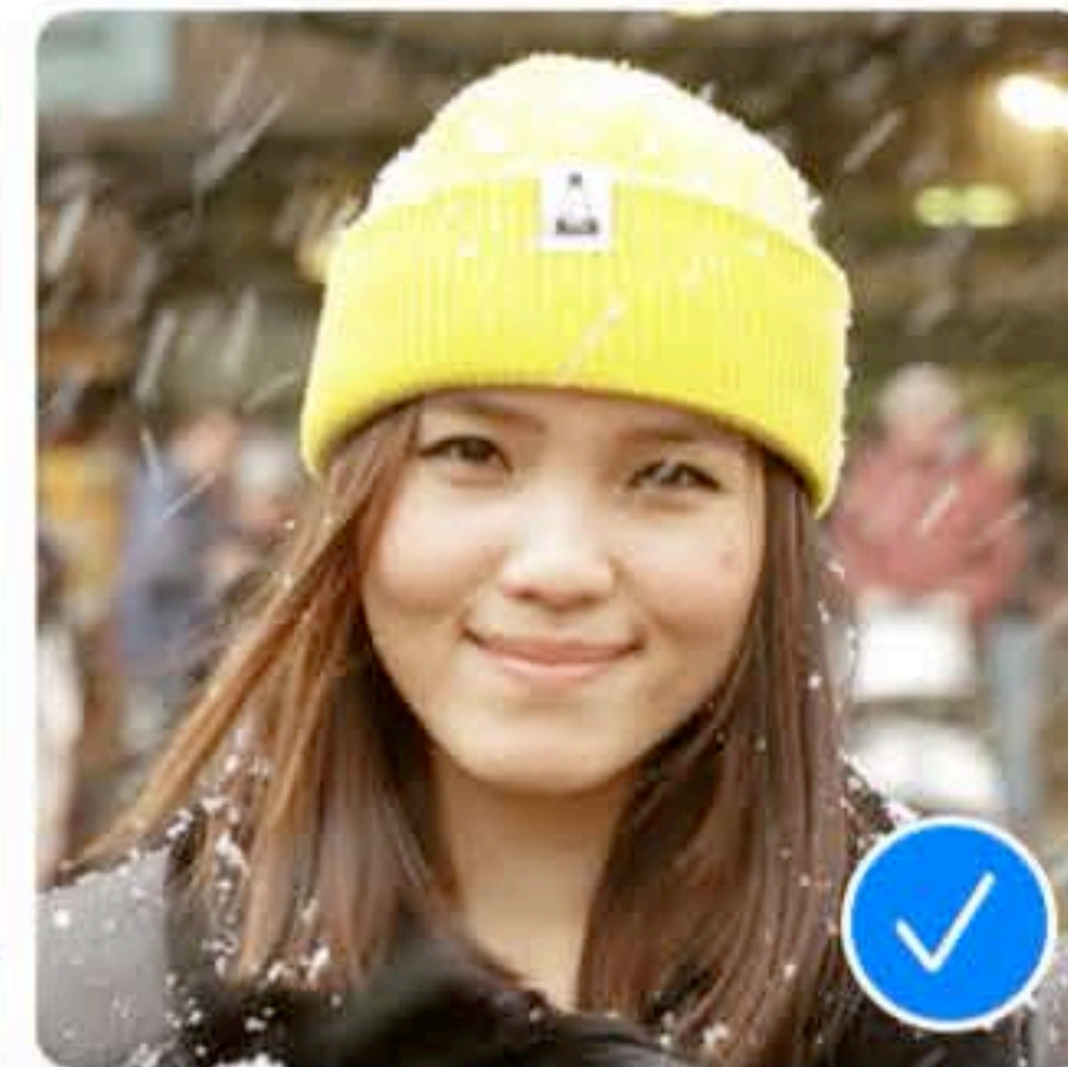
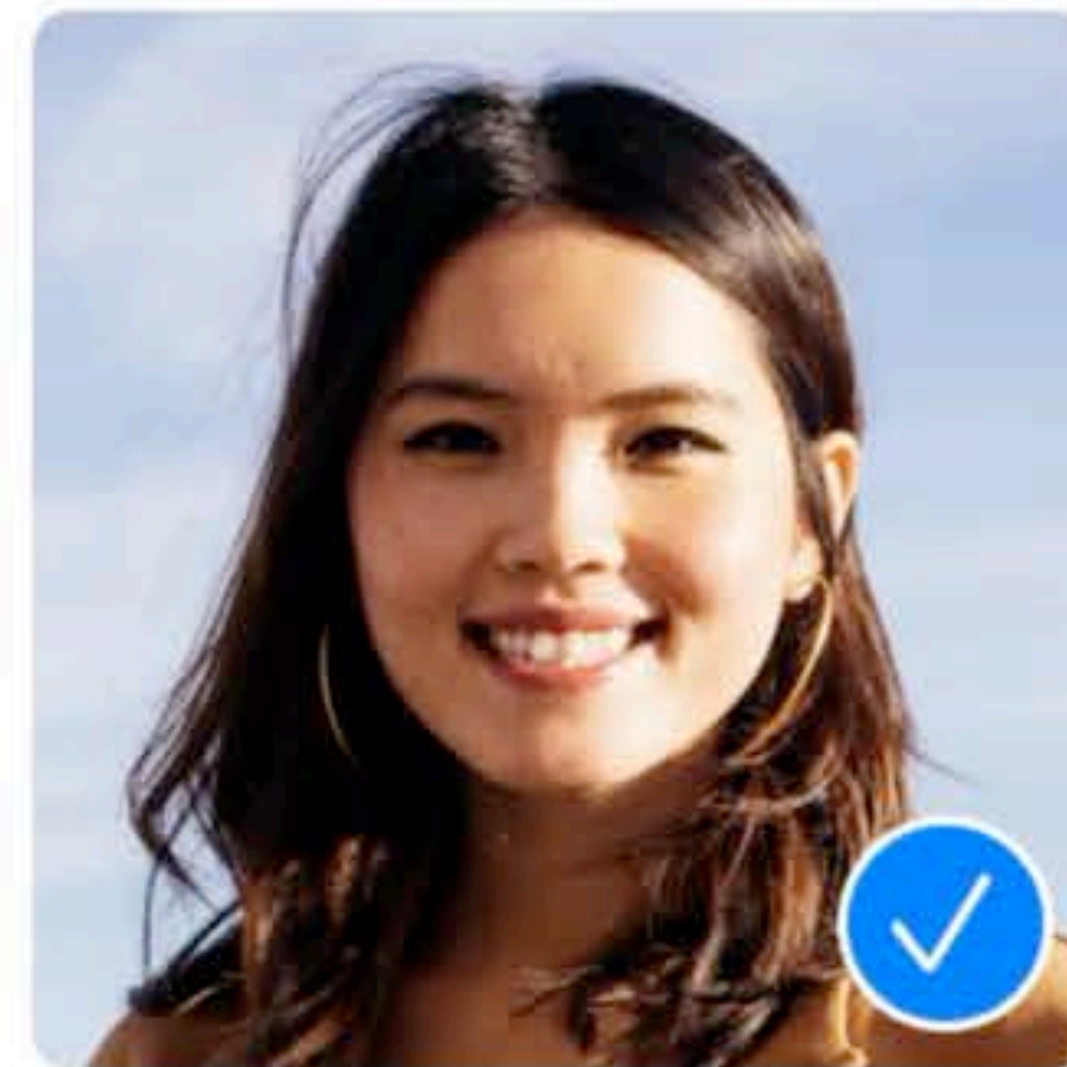
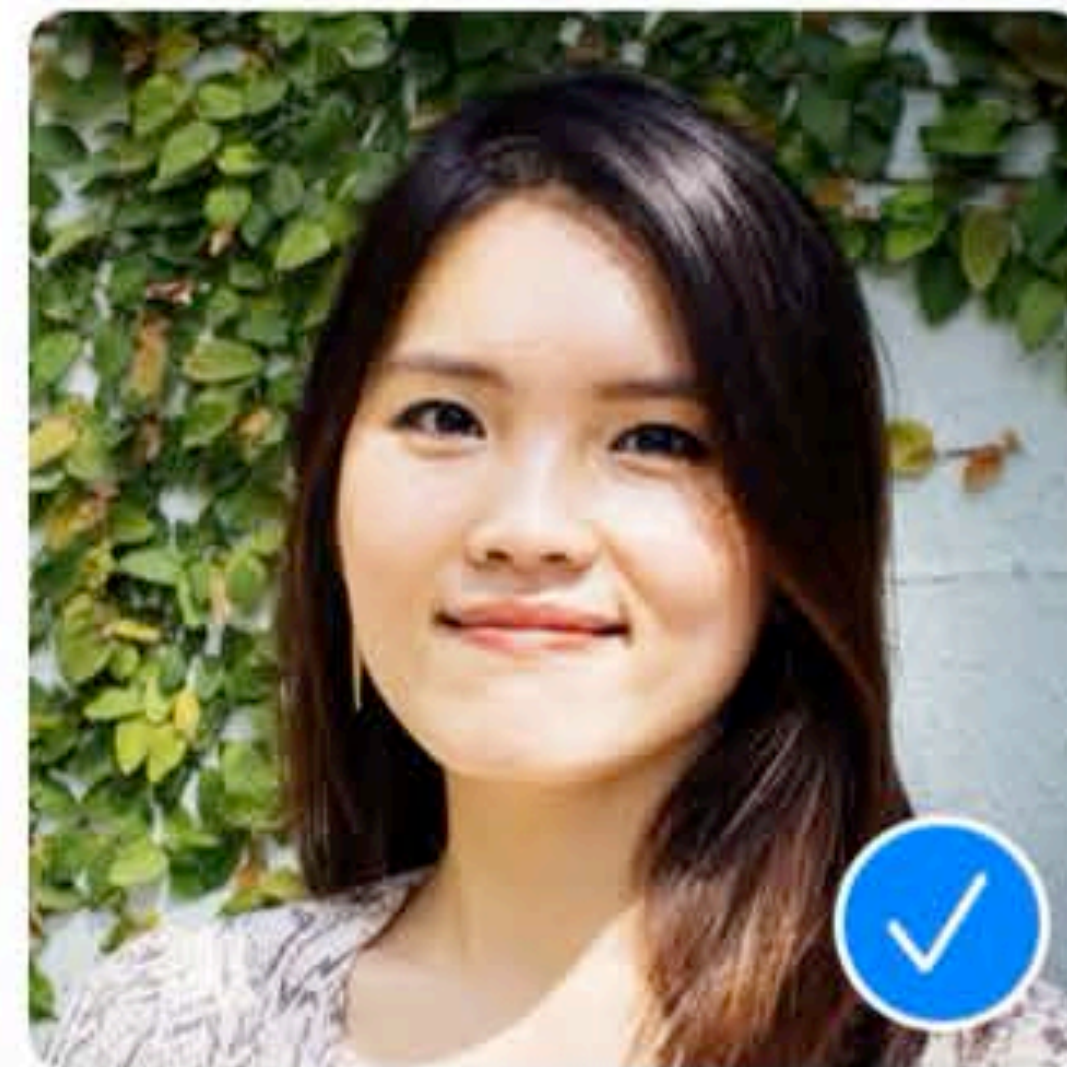


Select photos that are also Rubii

Cancel

Confirm

Done





9:41

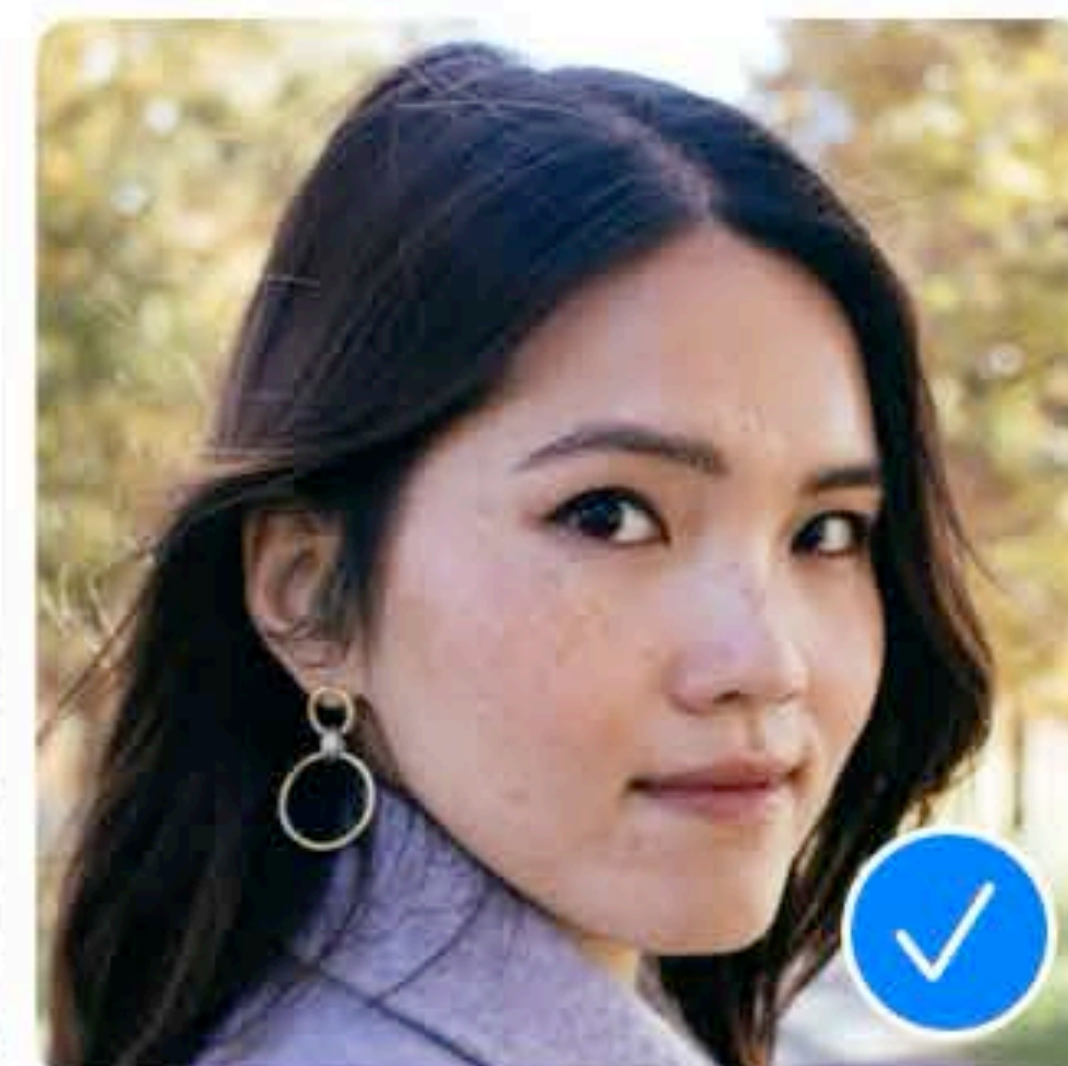
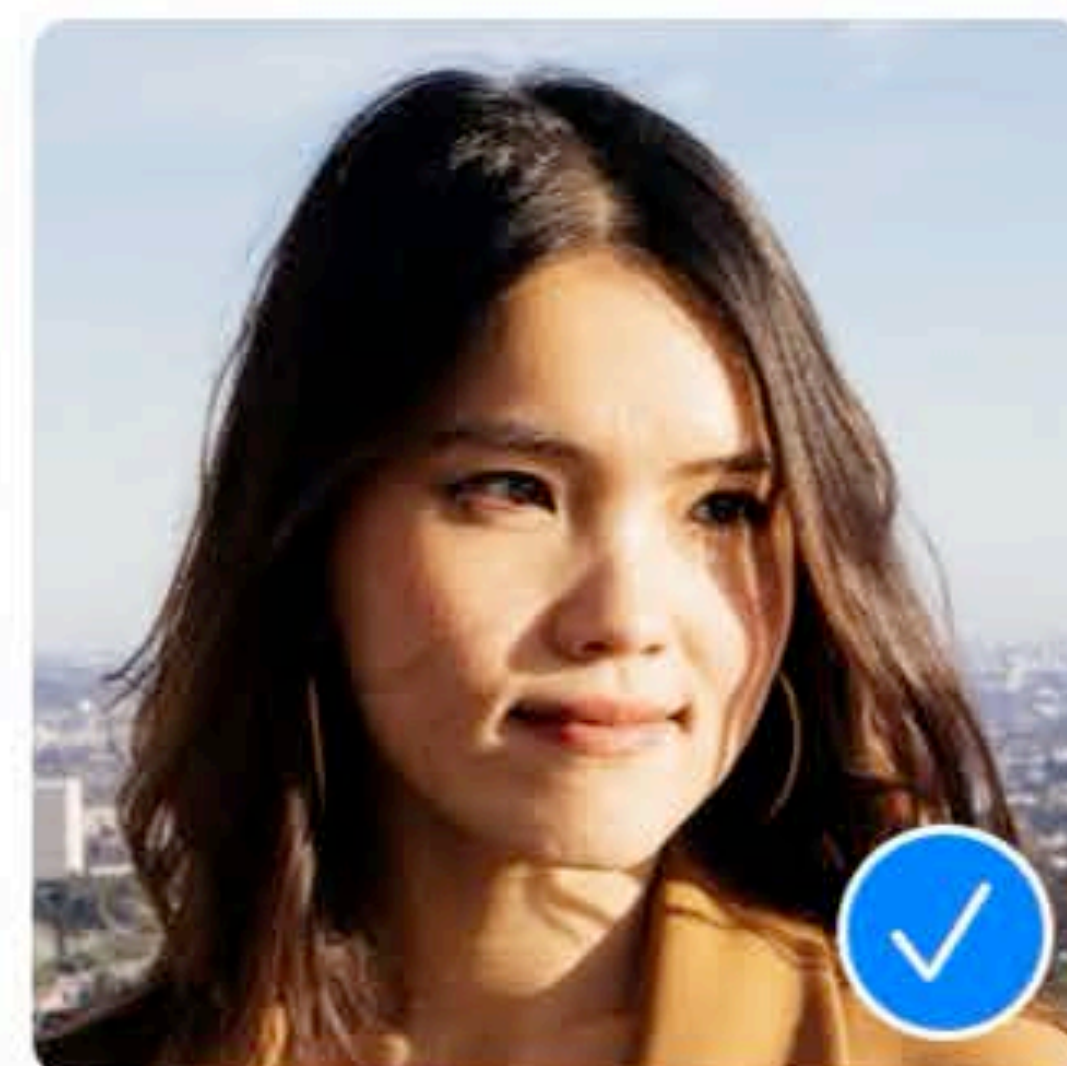
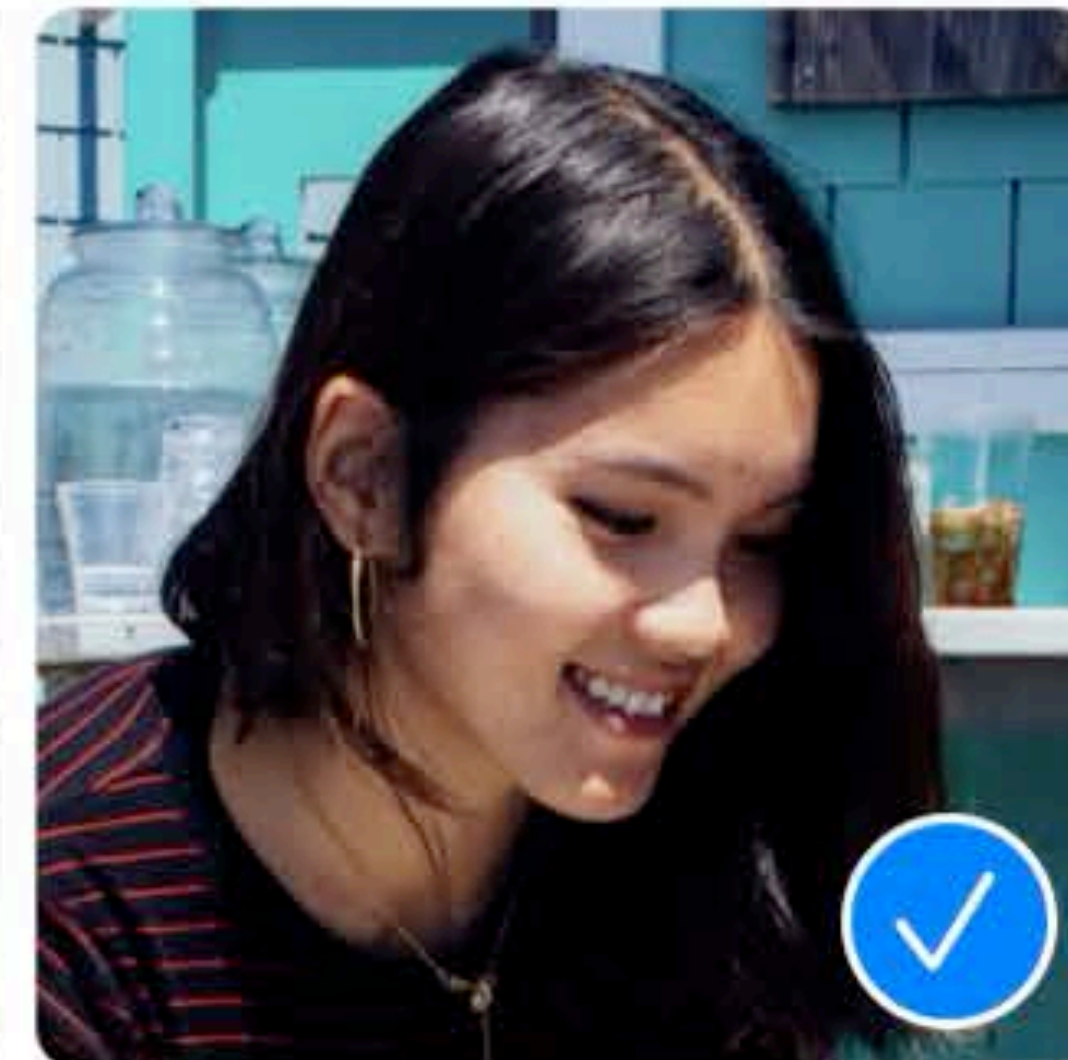
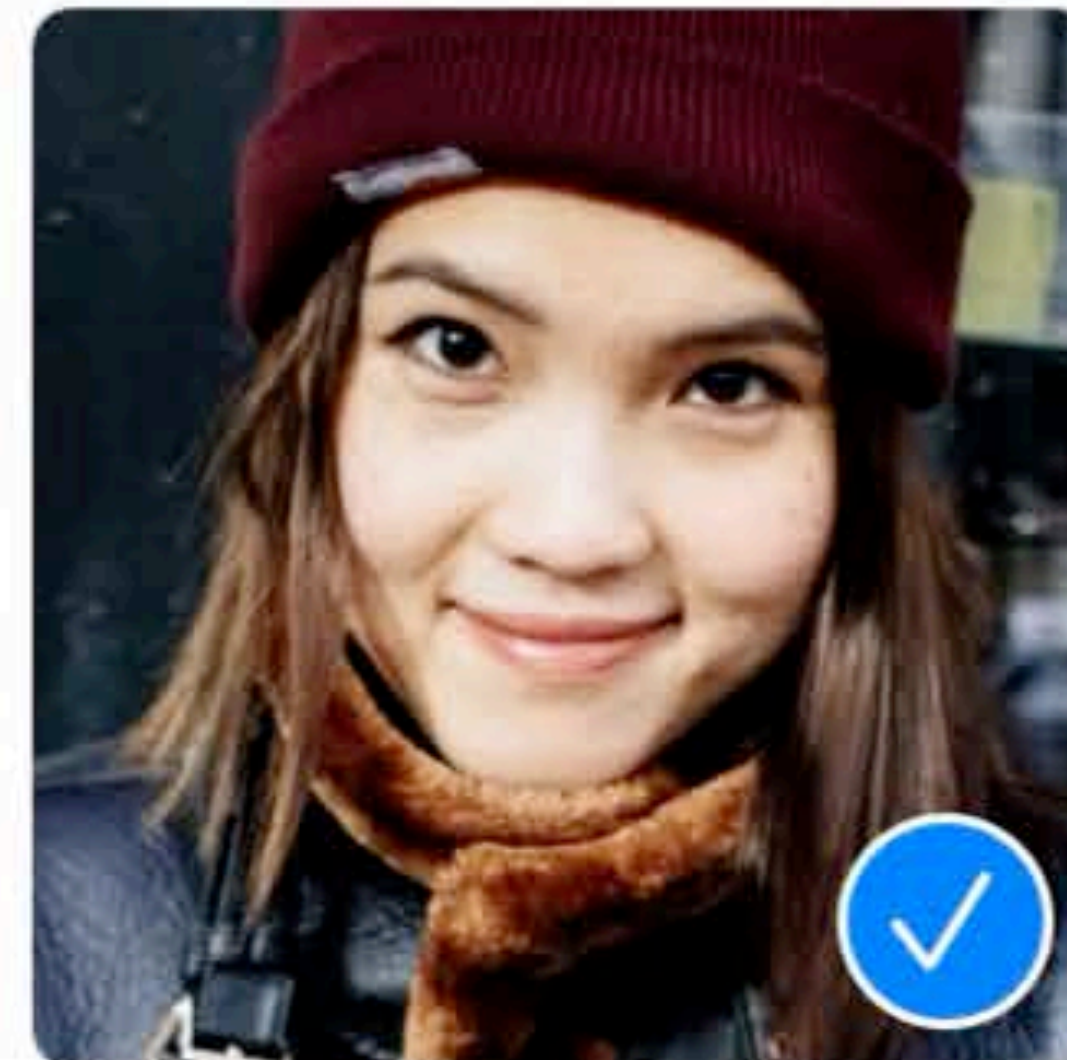
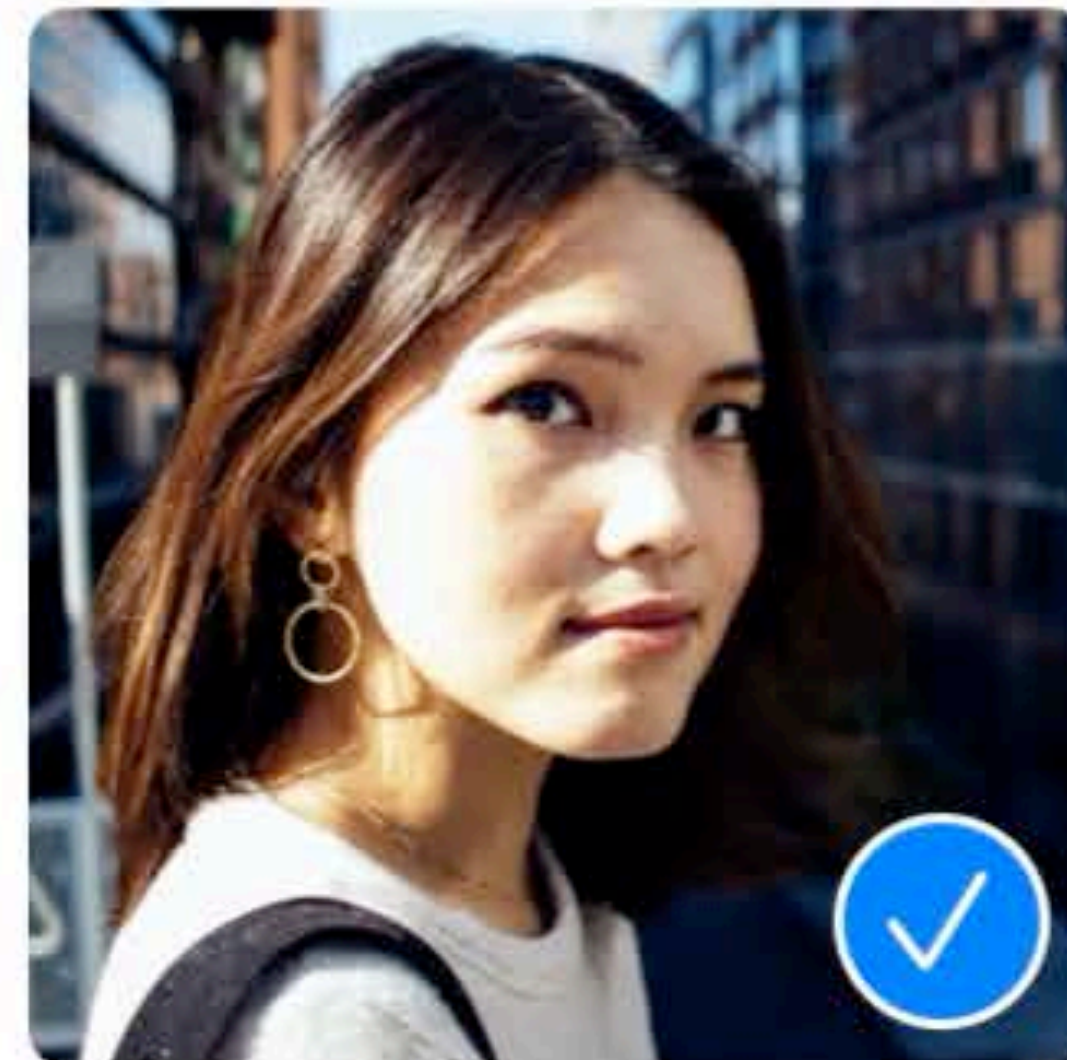
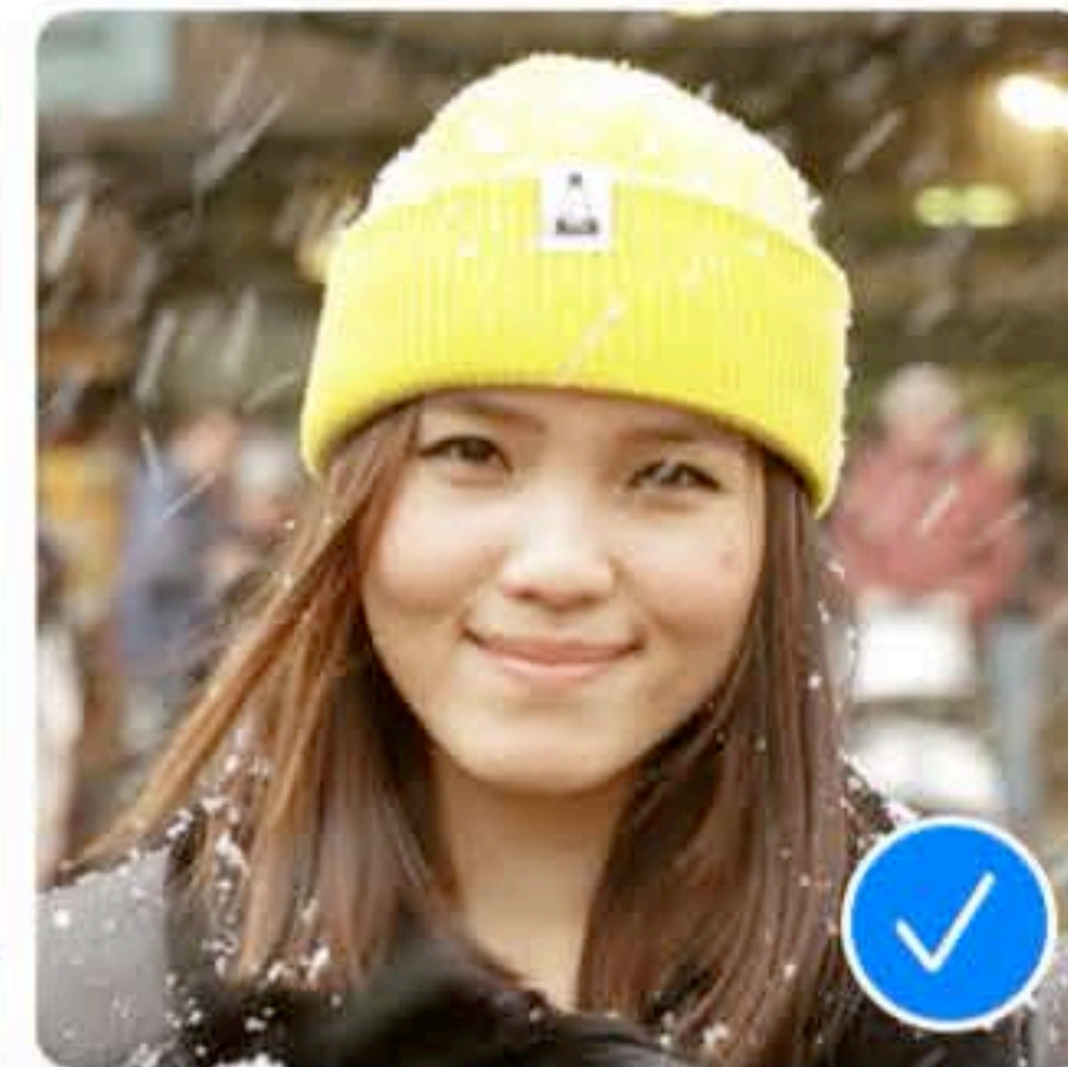
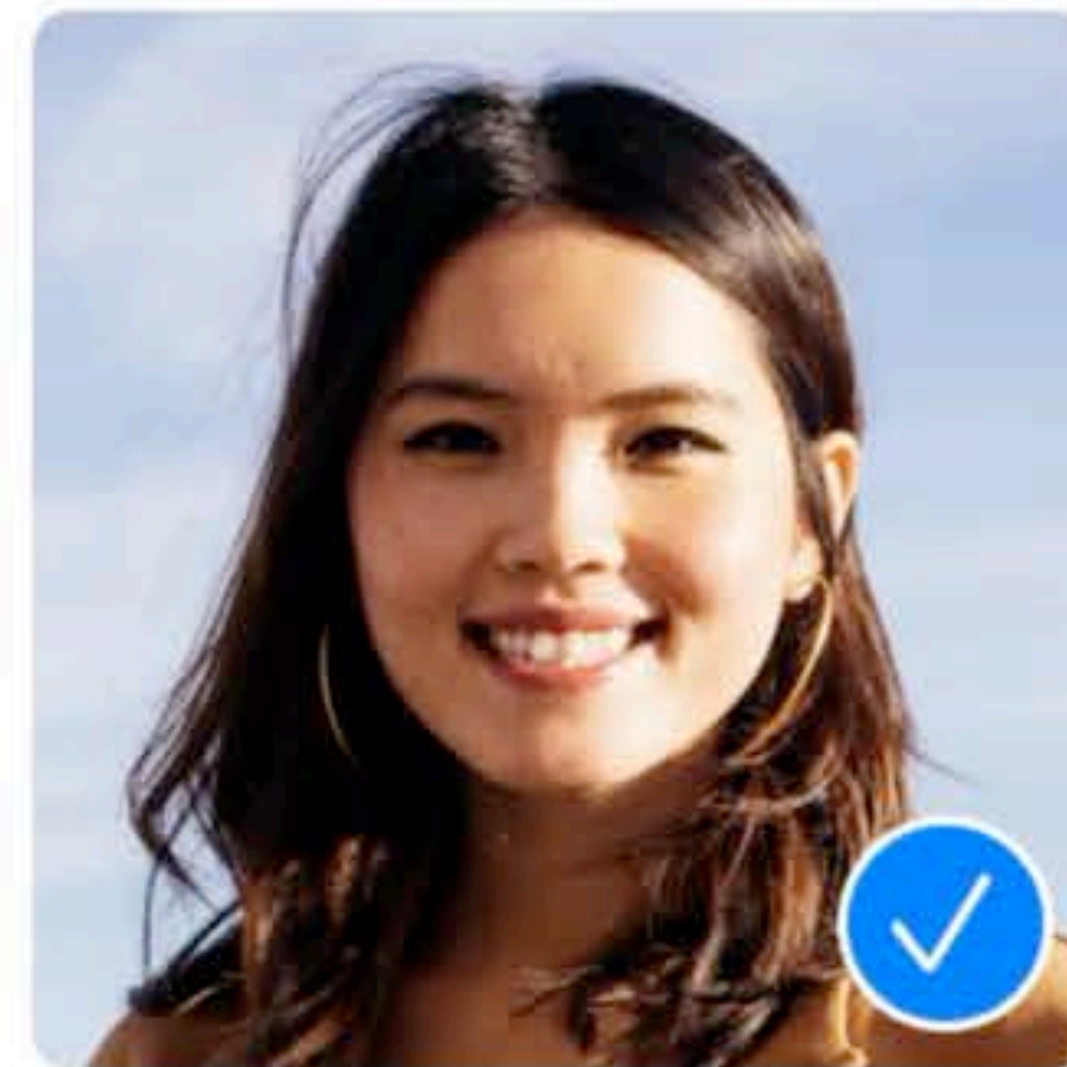
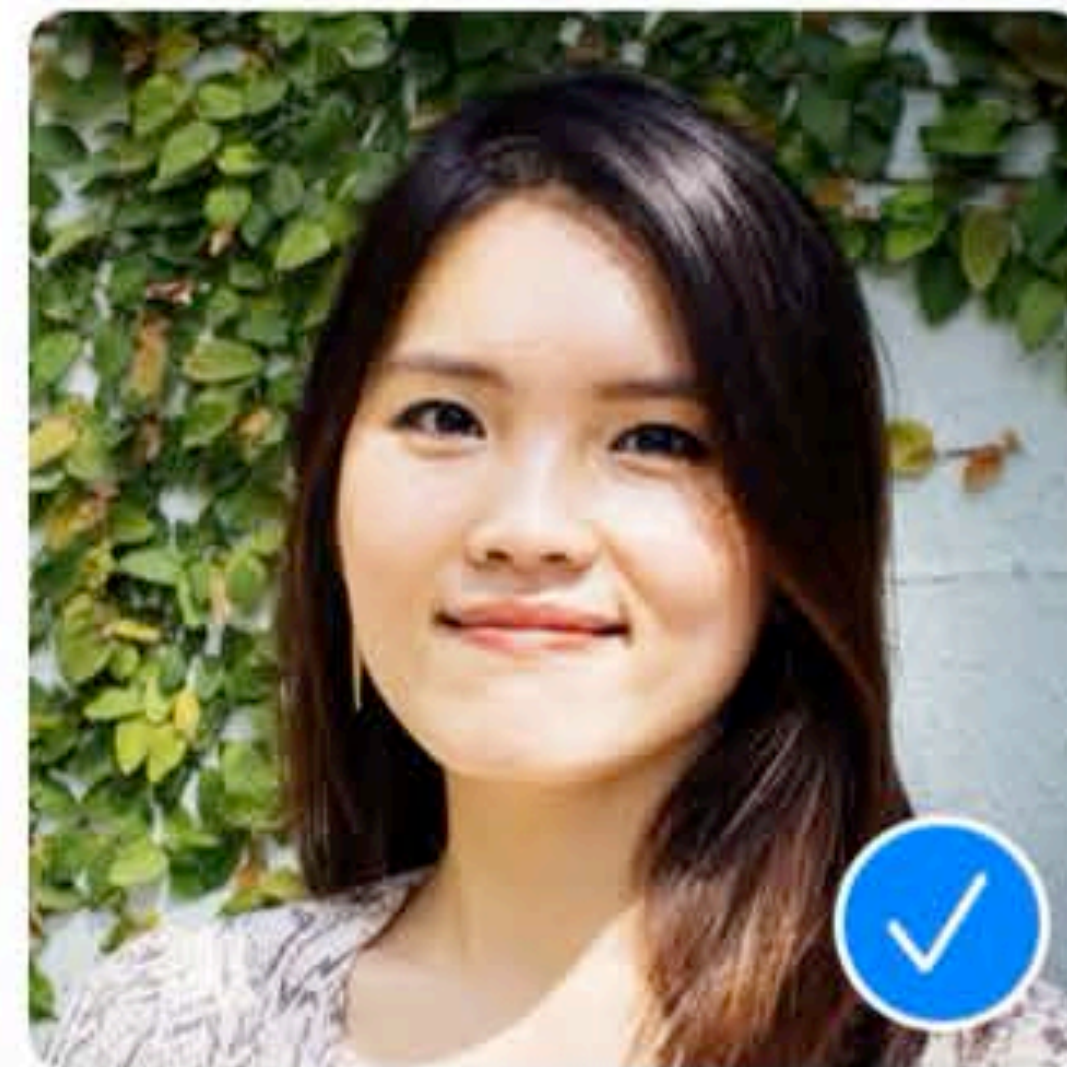


Select photos that are also Rubii

Cancel

Confirm

Done





9:41

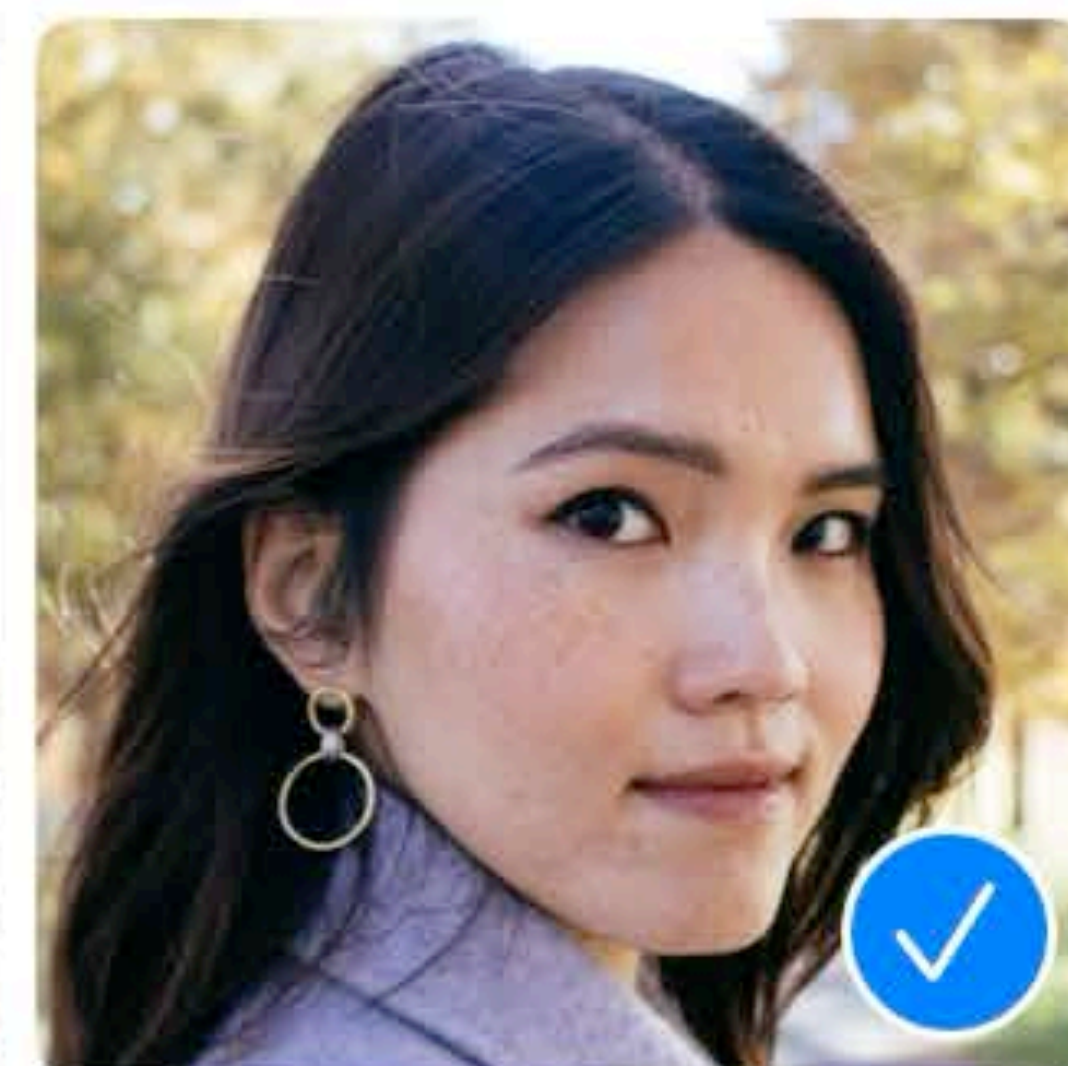
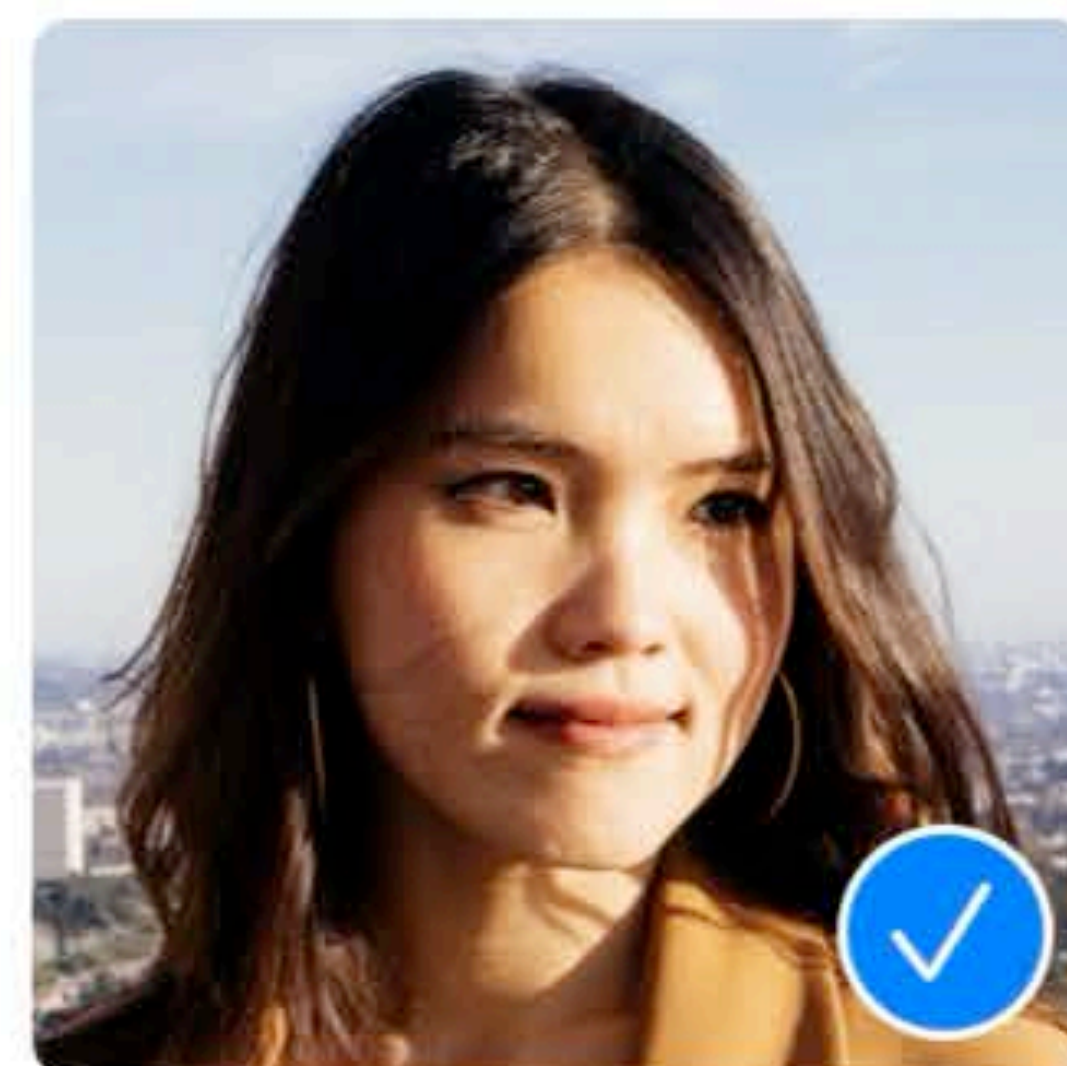
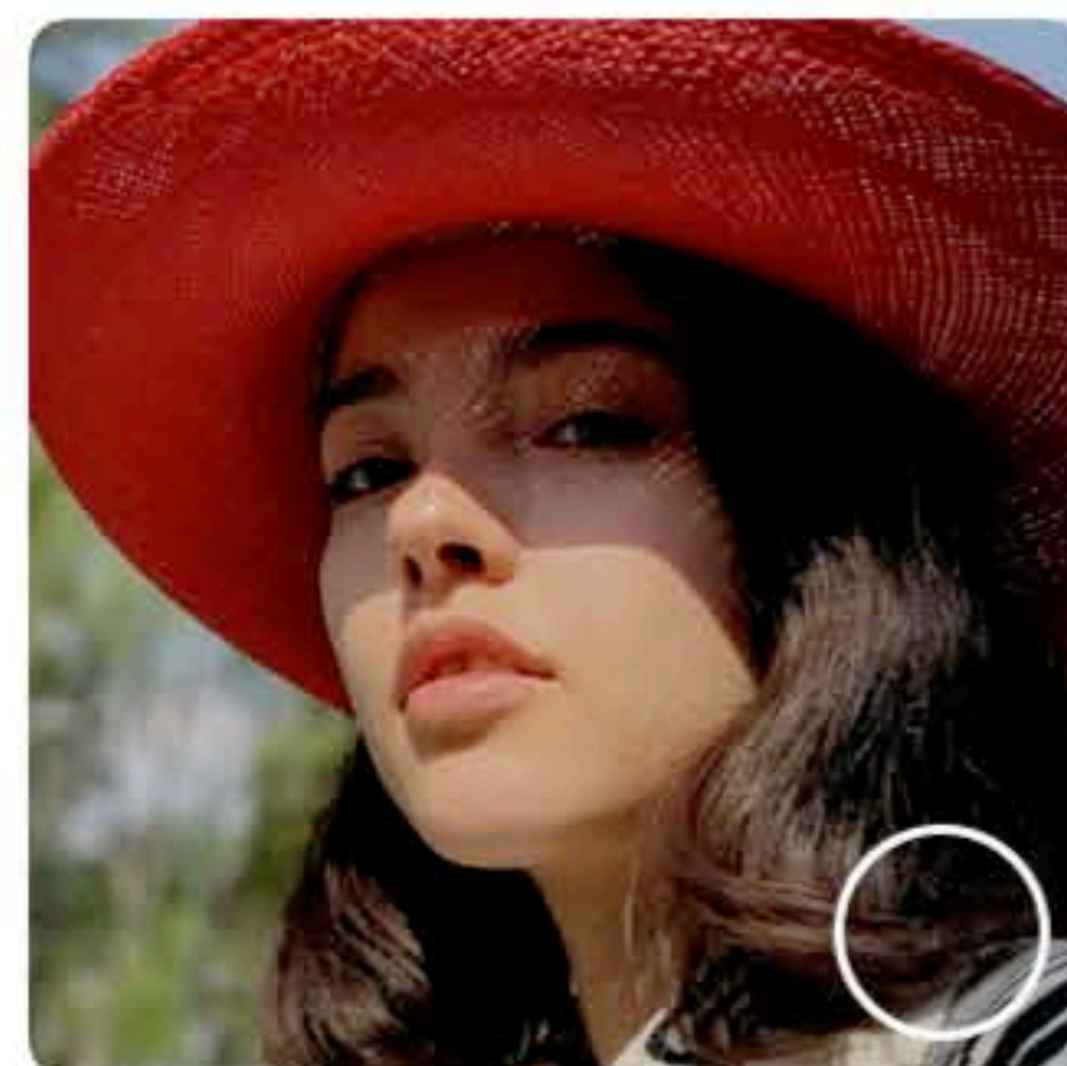
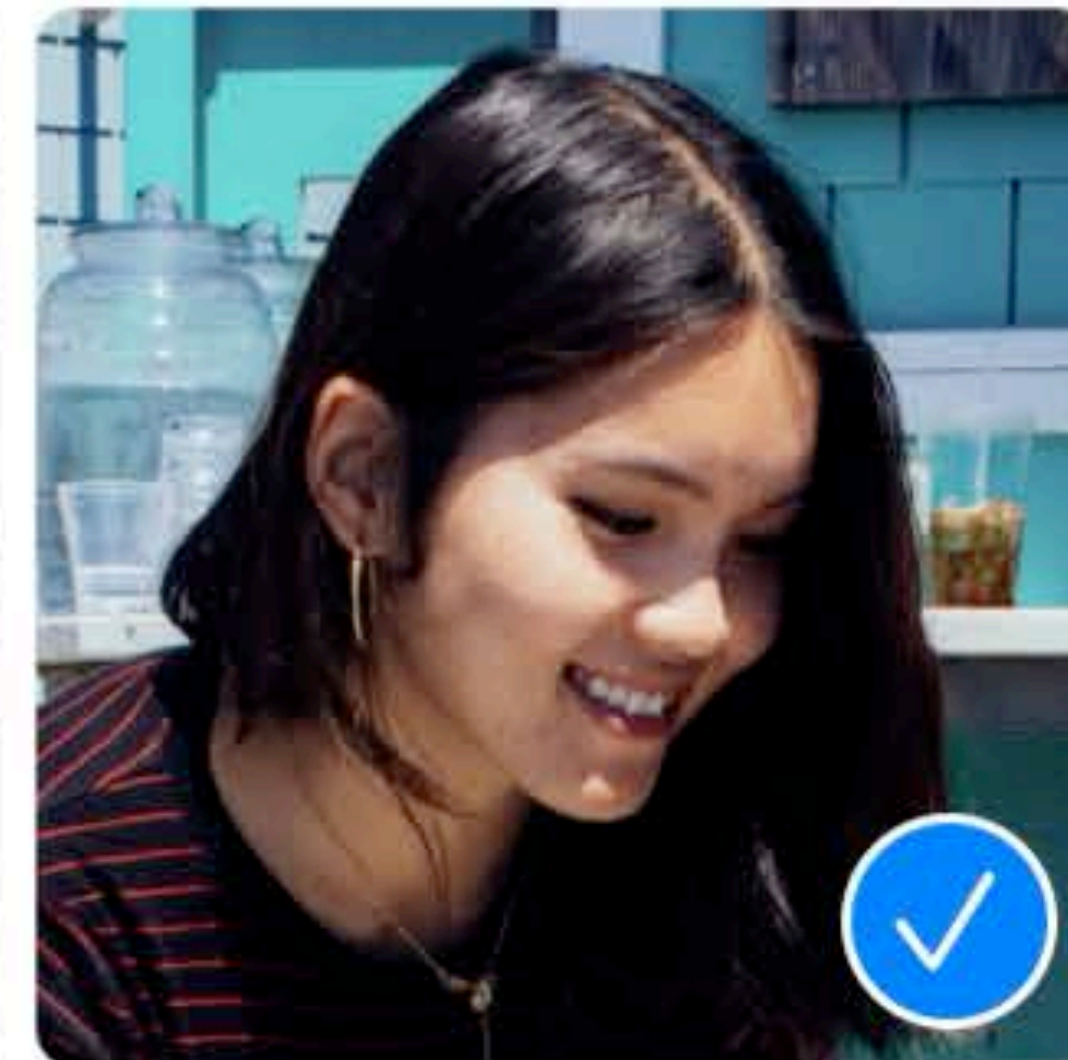
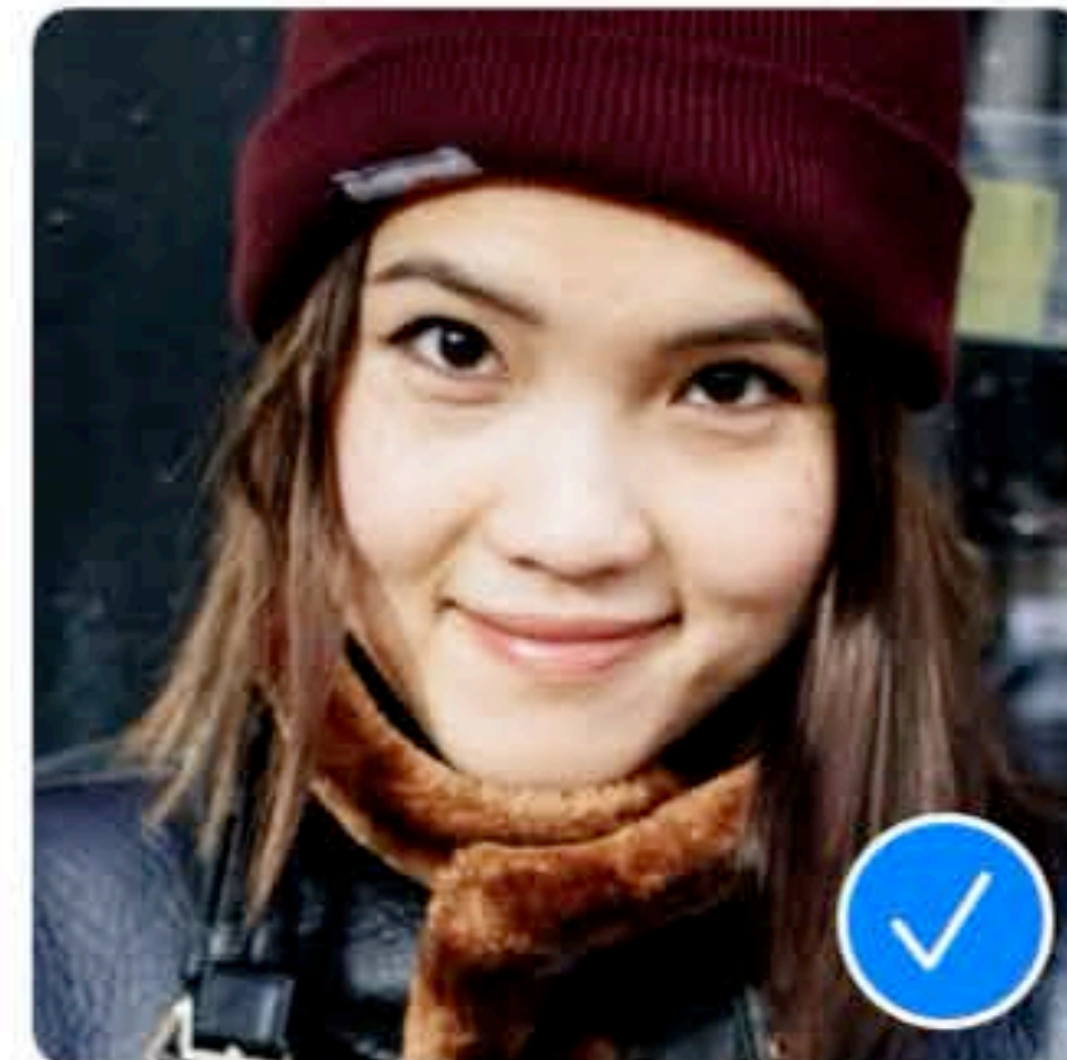
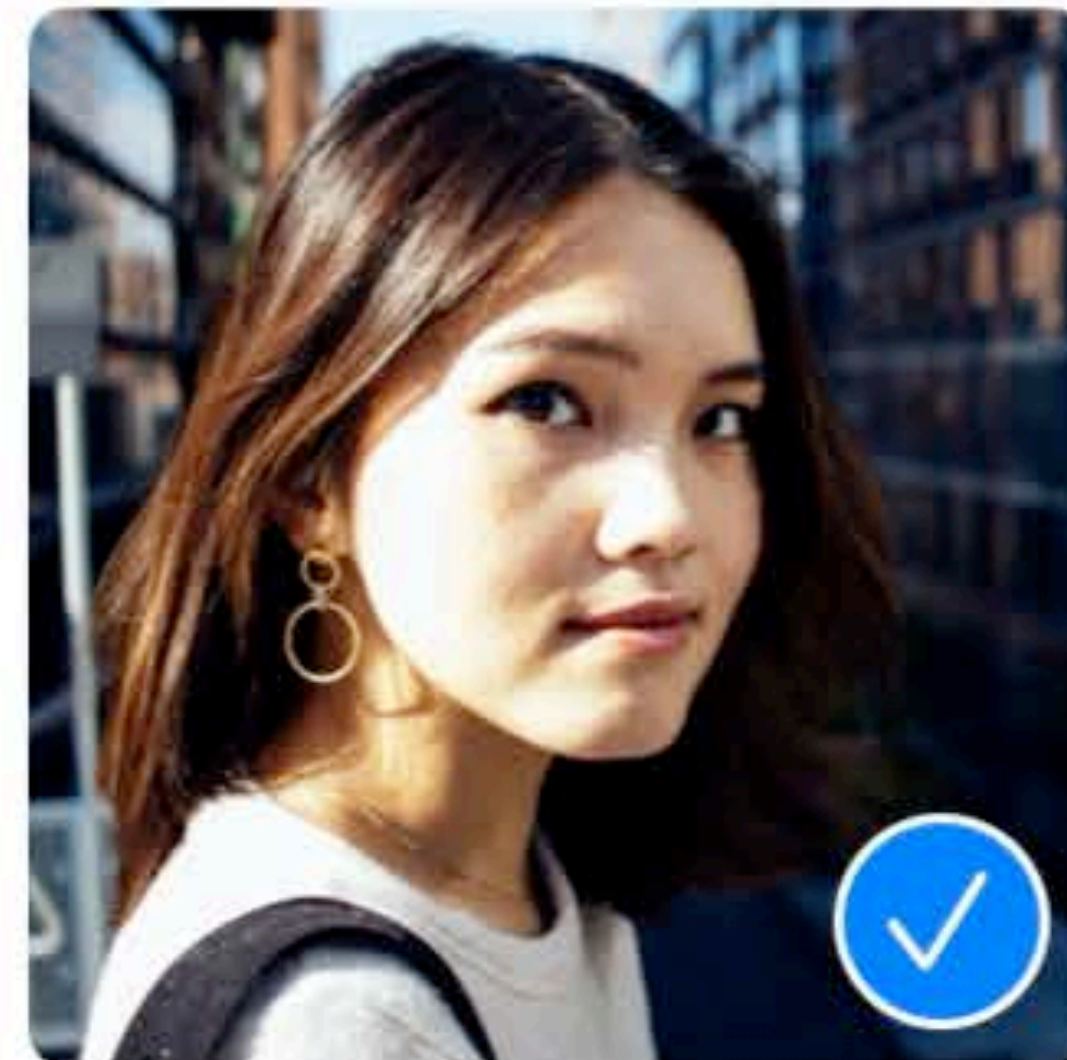
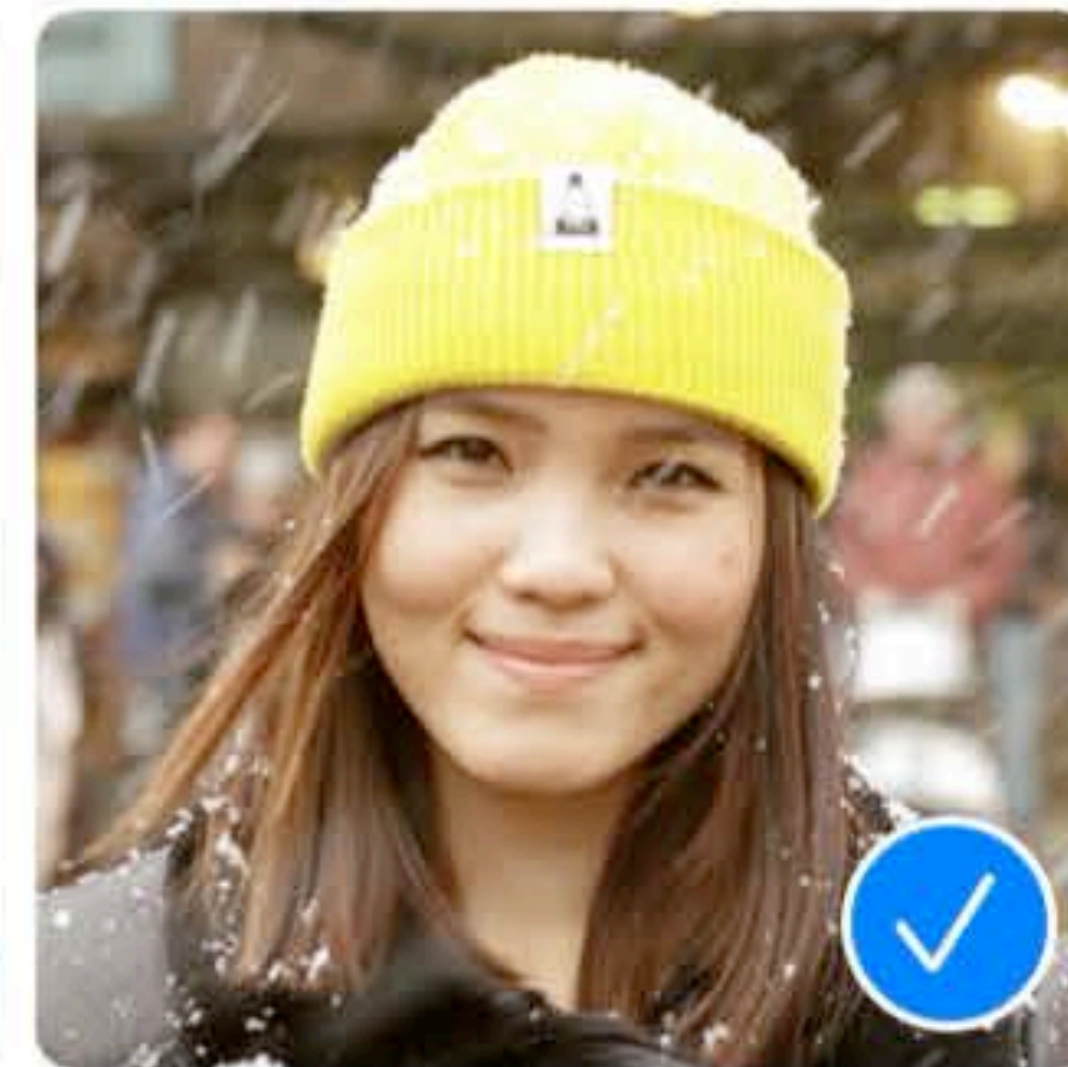
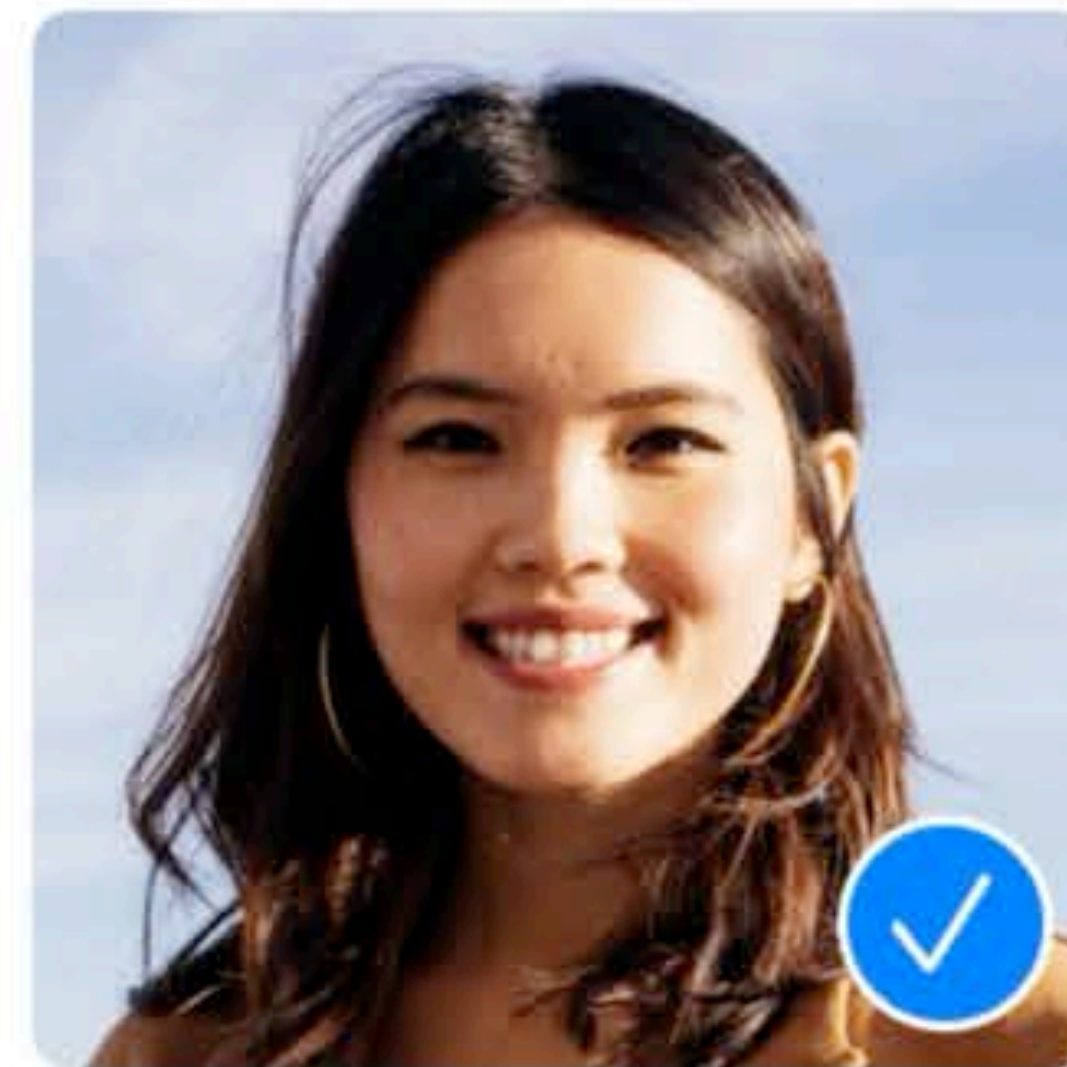
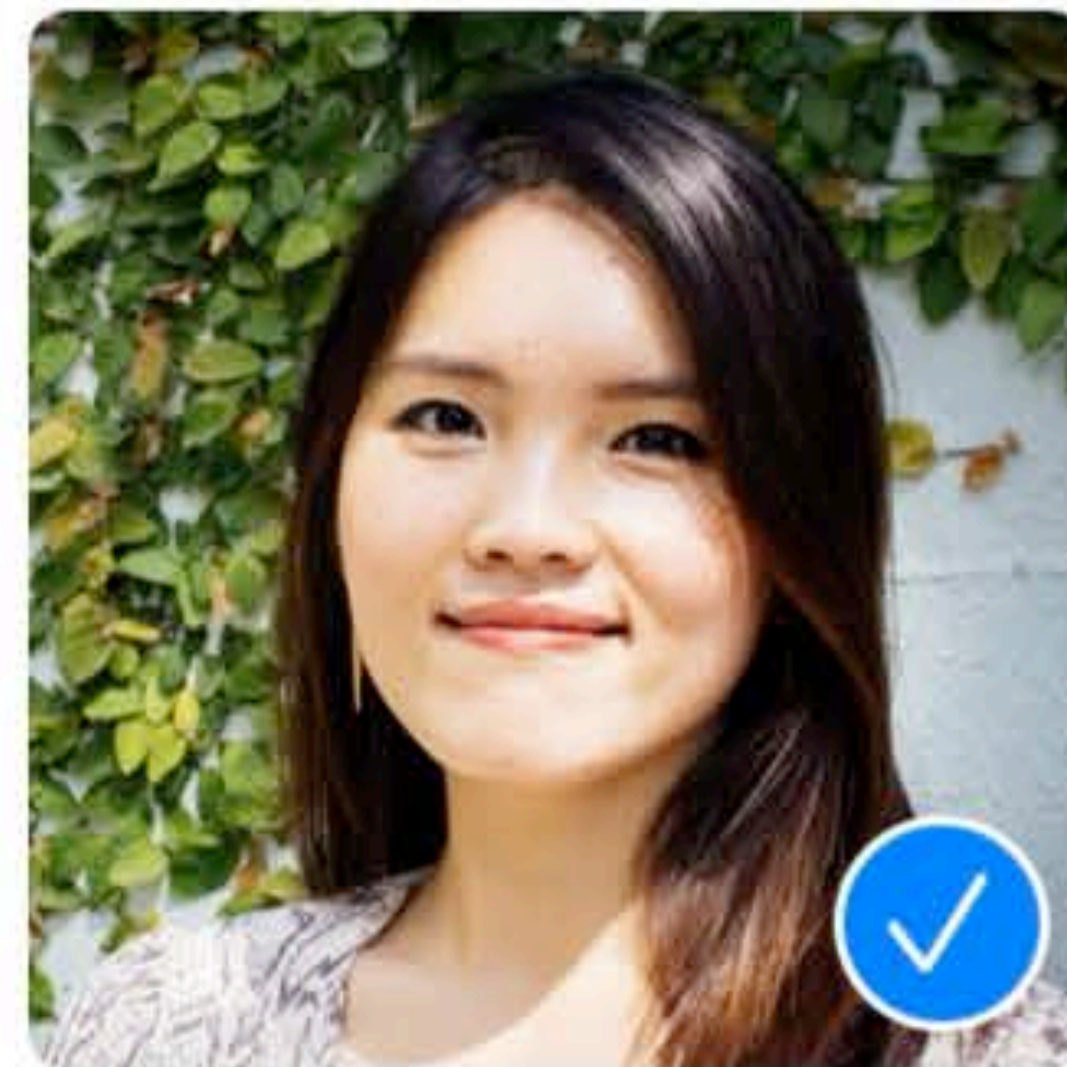


Select photos that are also Rubii

Cancel

Confirm

Done





9:41

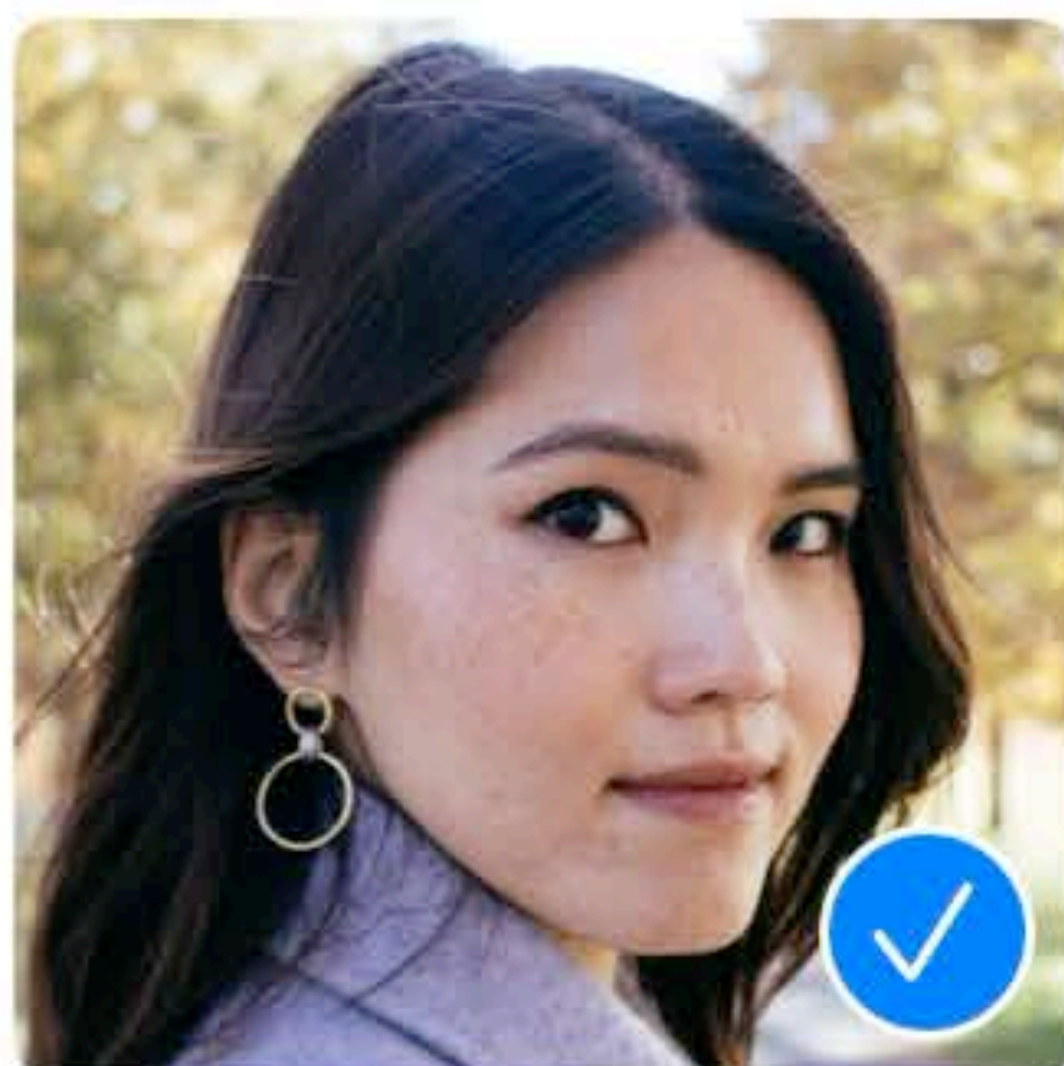
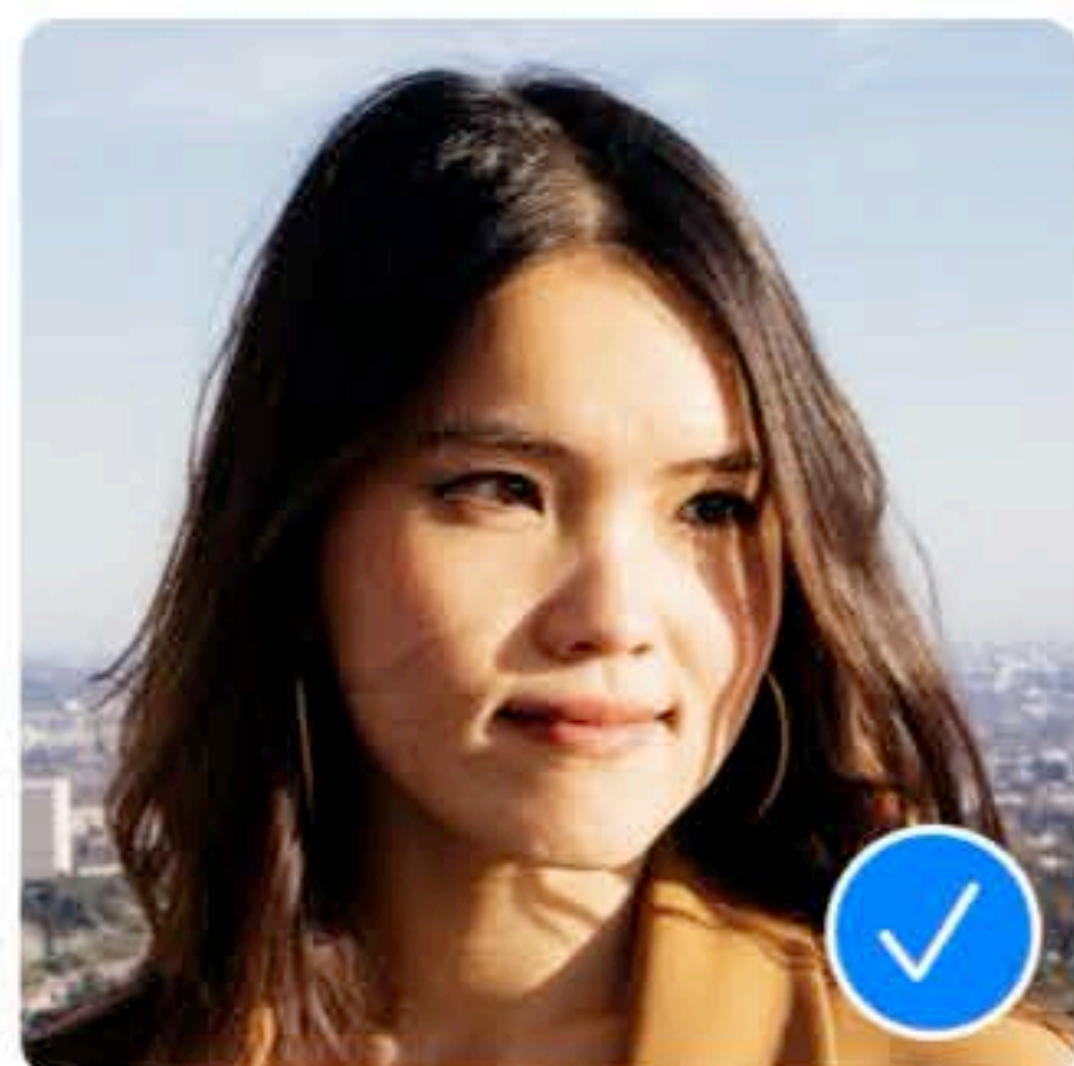
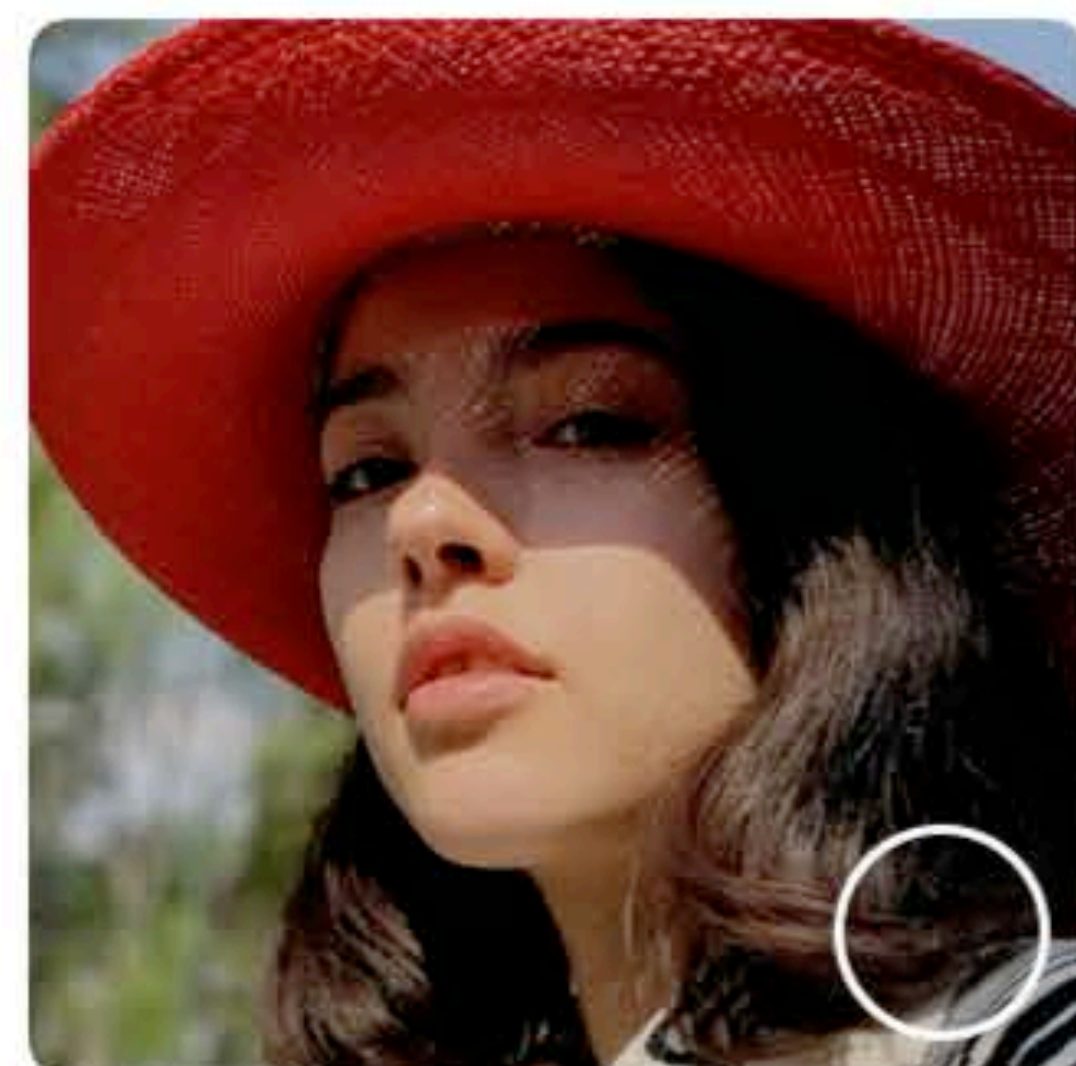
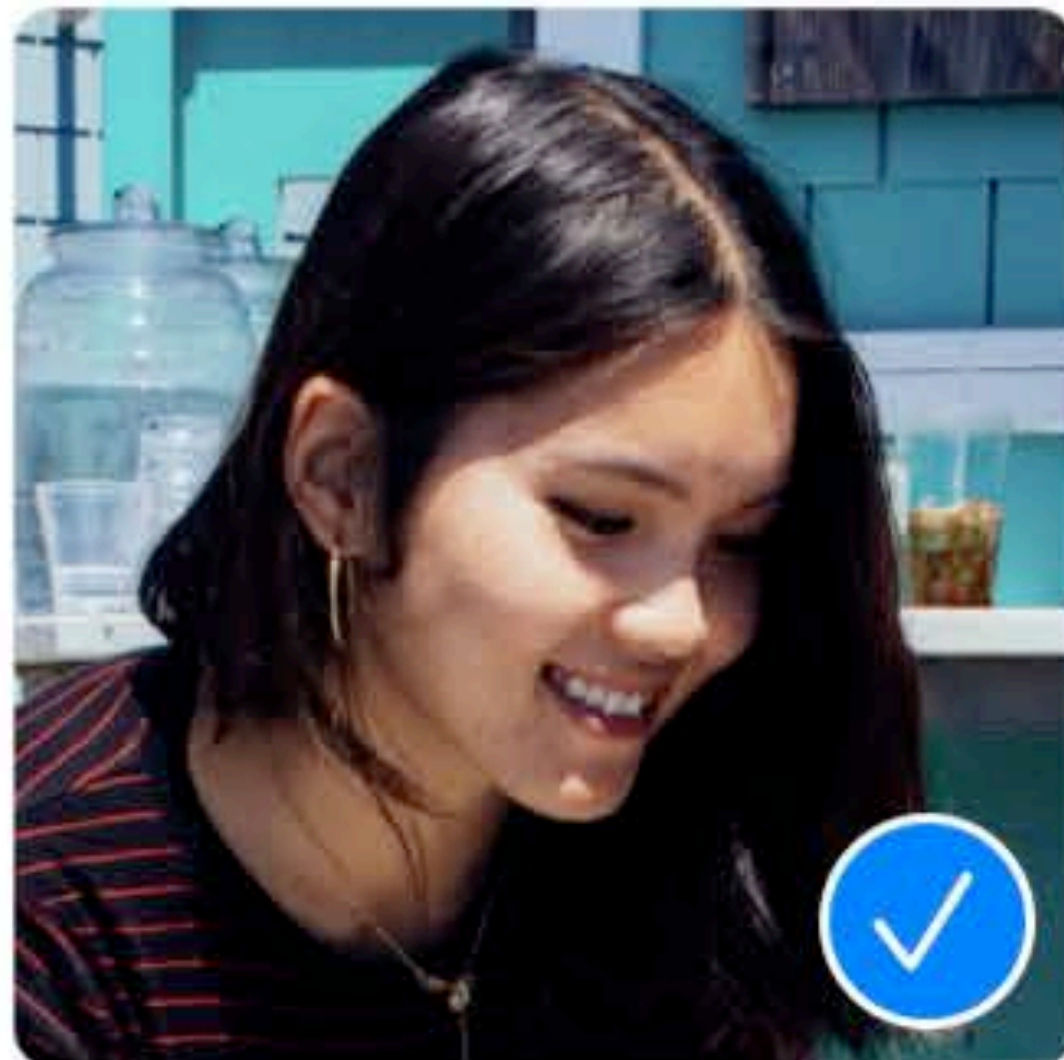
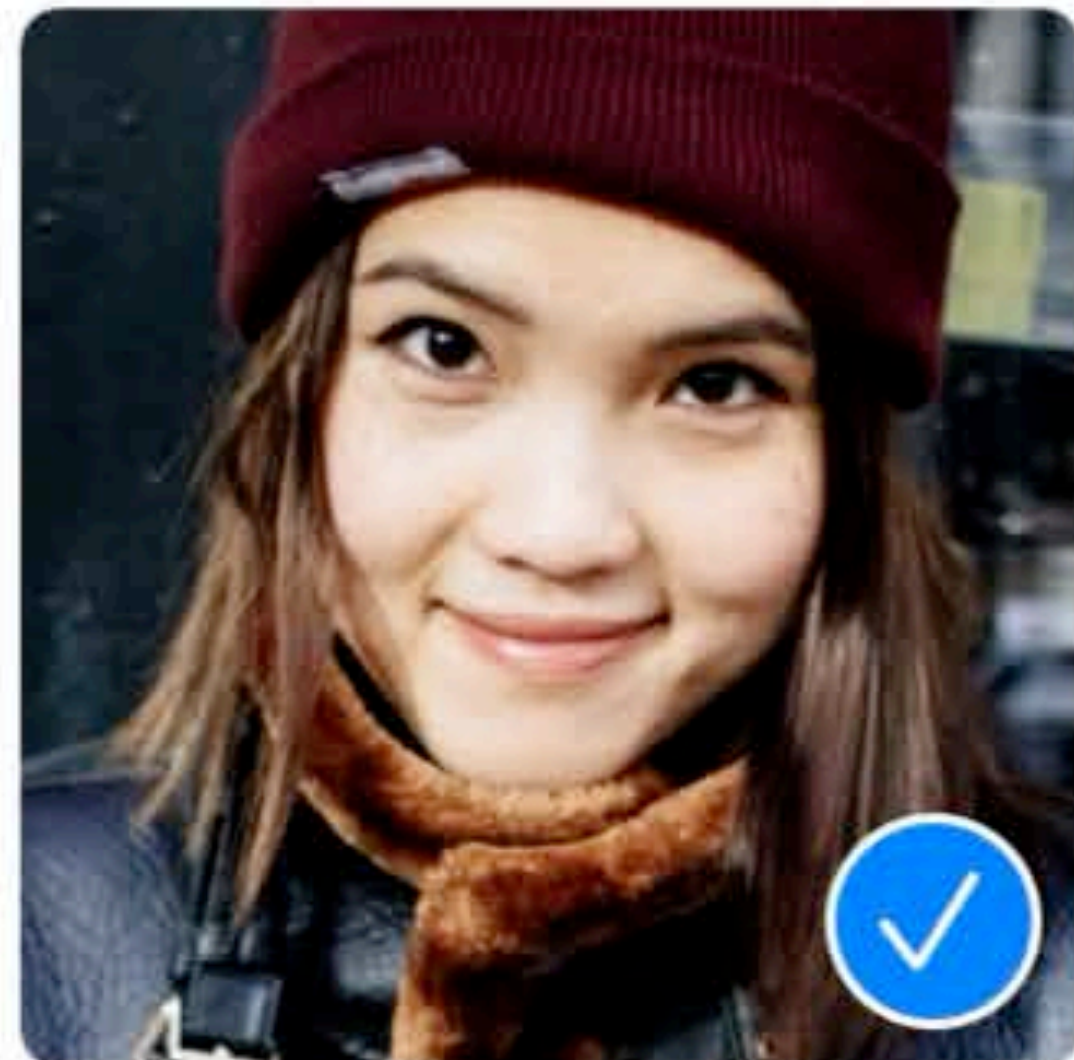
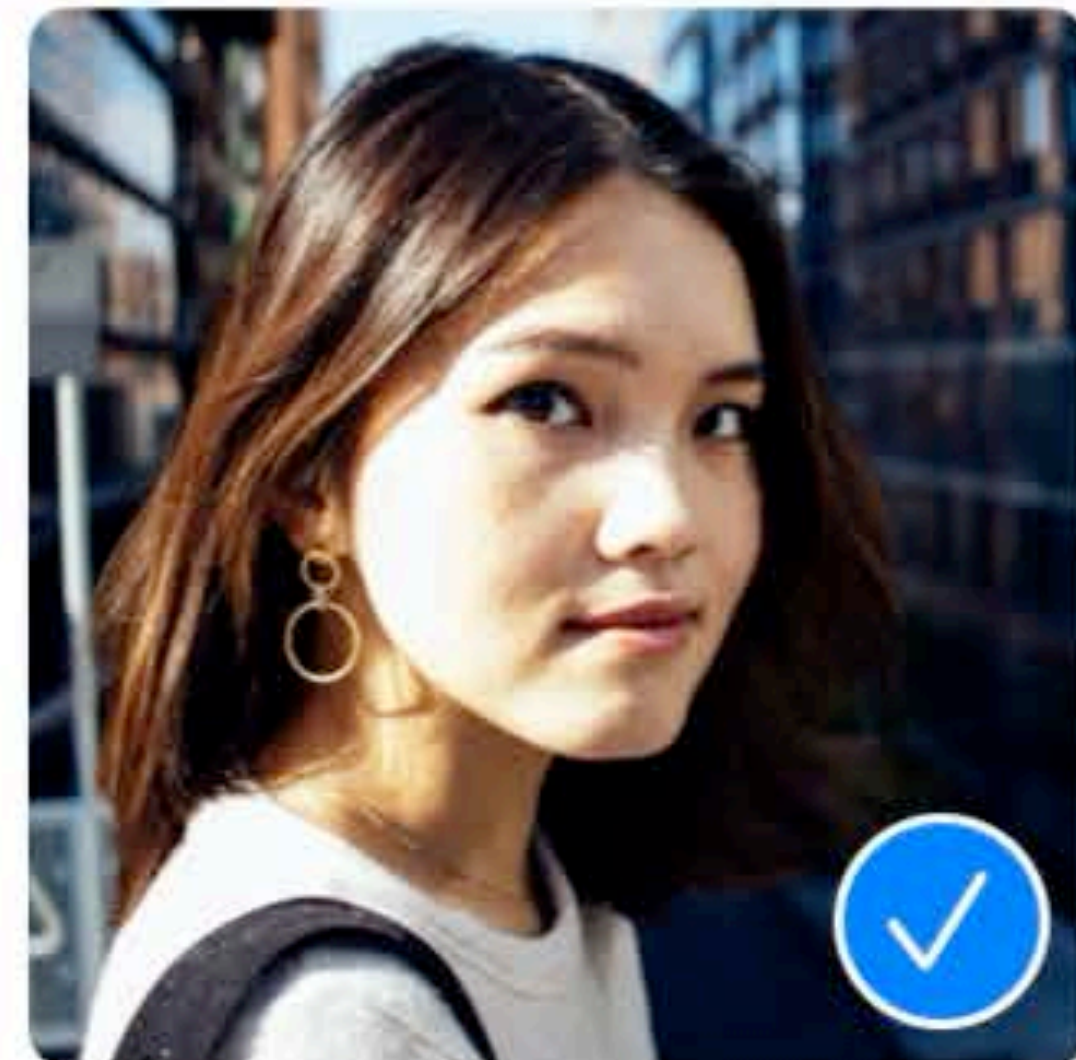
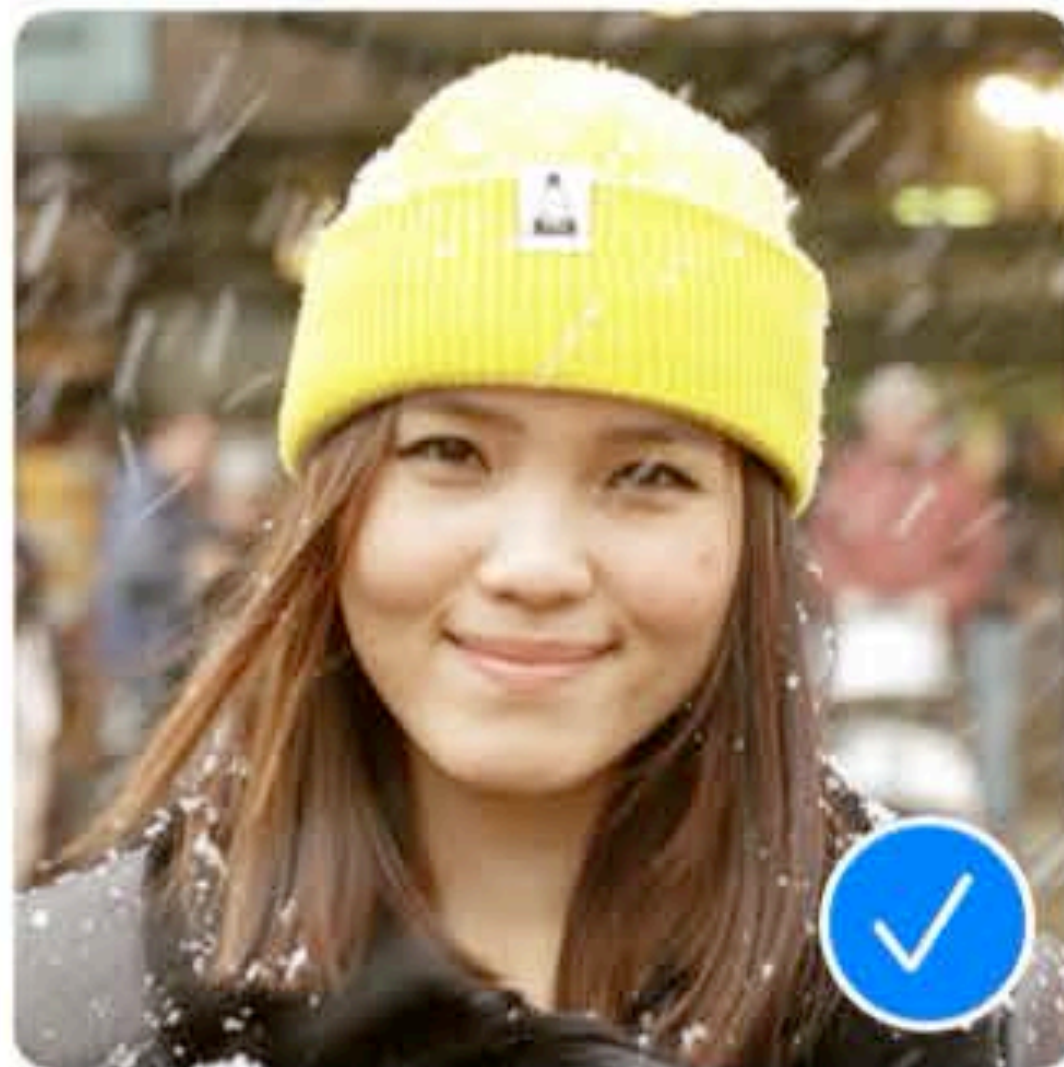
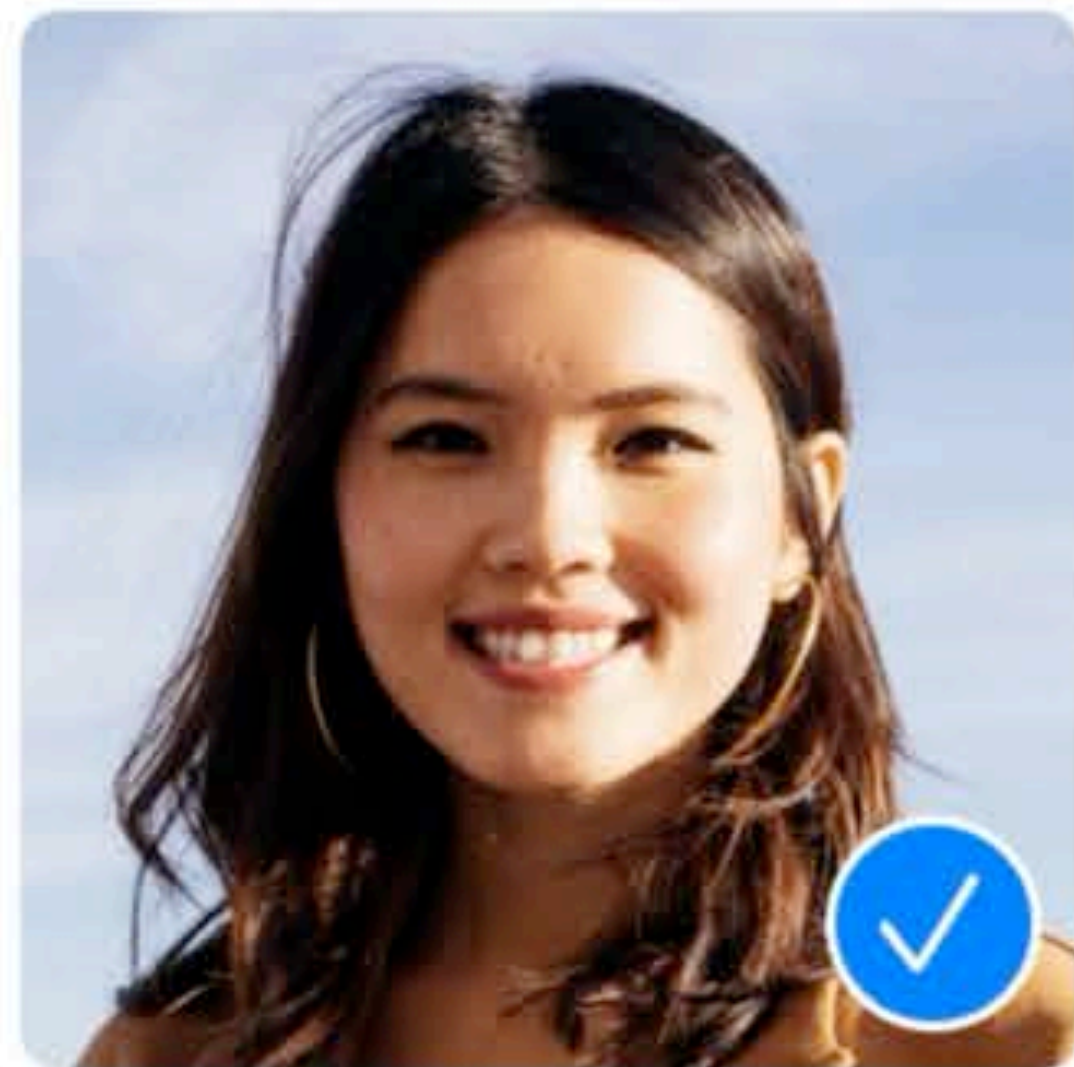
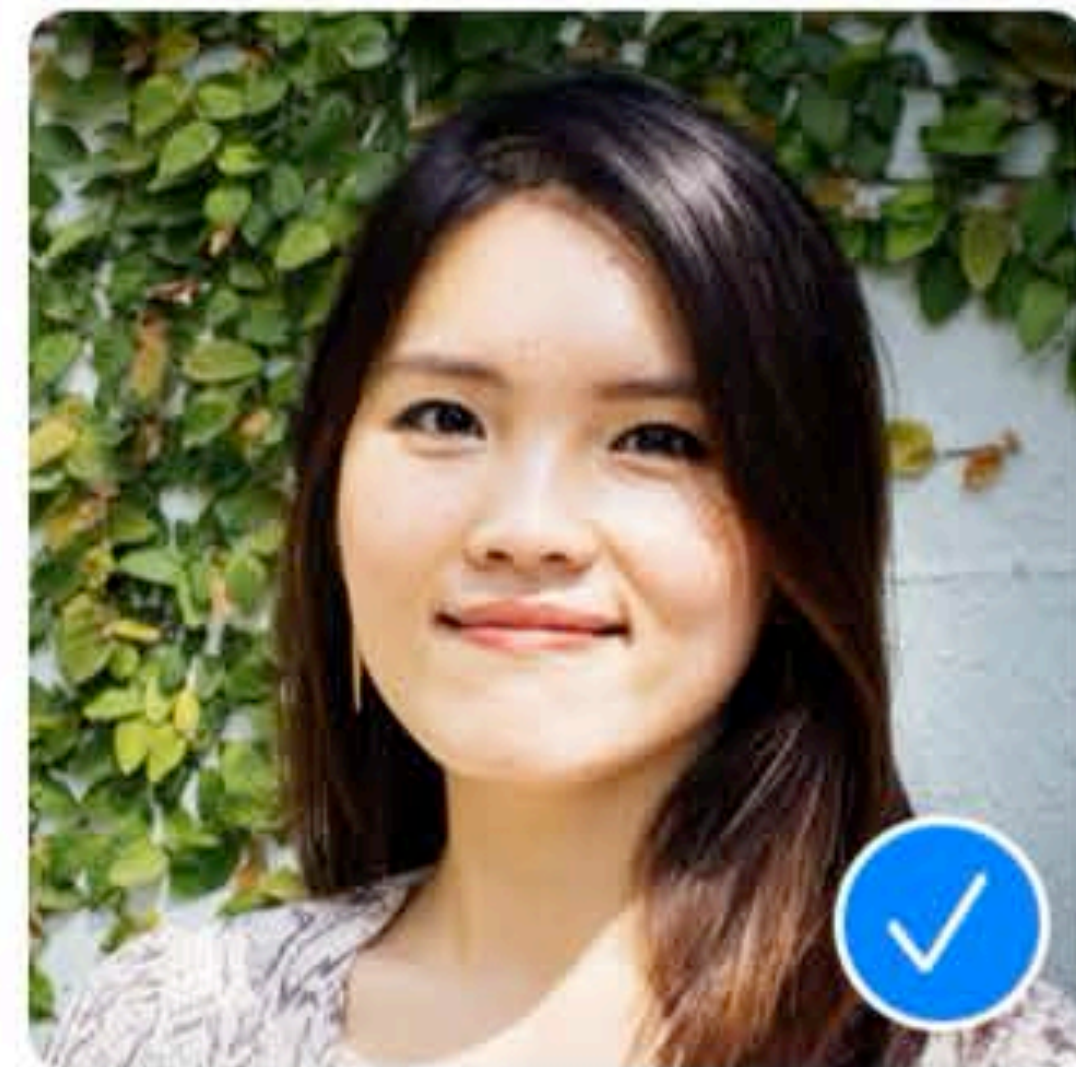


Select photos that are also Rubii

Cancel

Confirm

Done





# Outputs

Multiple Options

Attributions

Confidence

Limitations



# Limitations

Limitations happen when there's a mismatch between people's mental model of the feature and what the feature can actually do

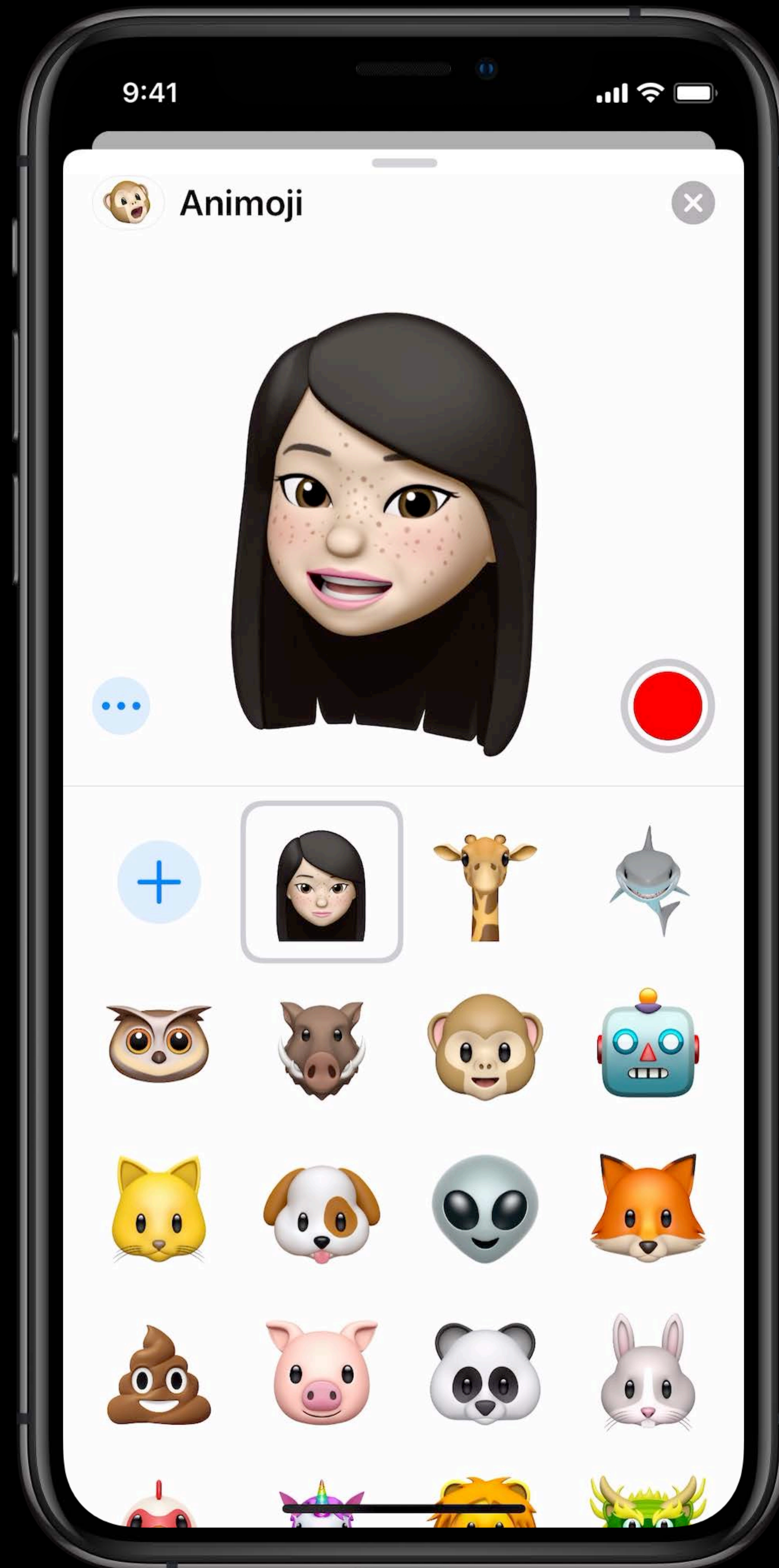




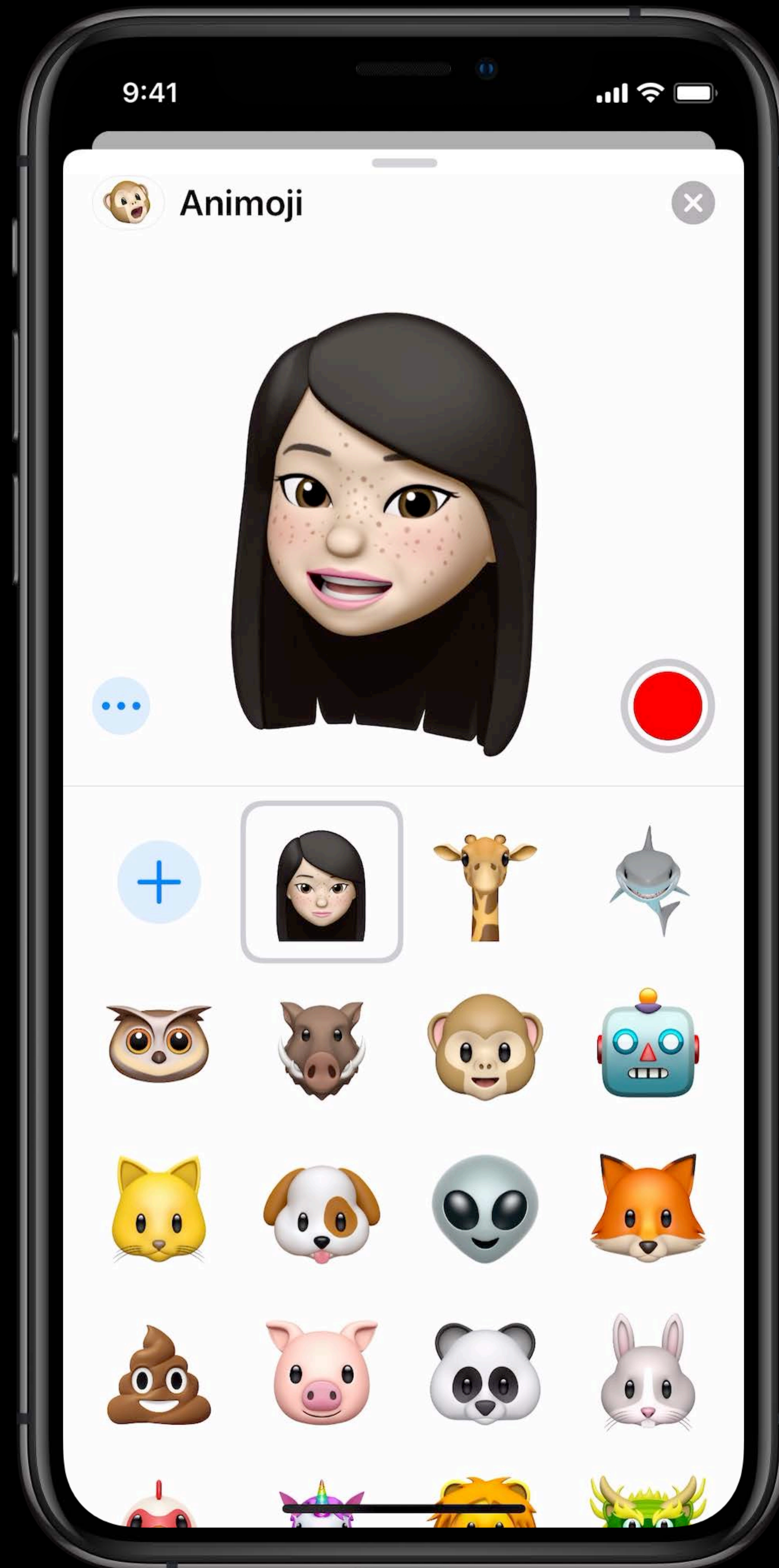




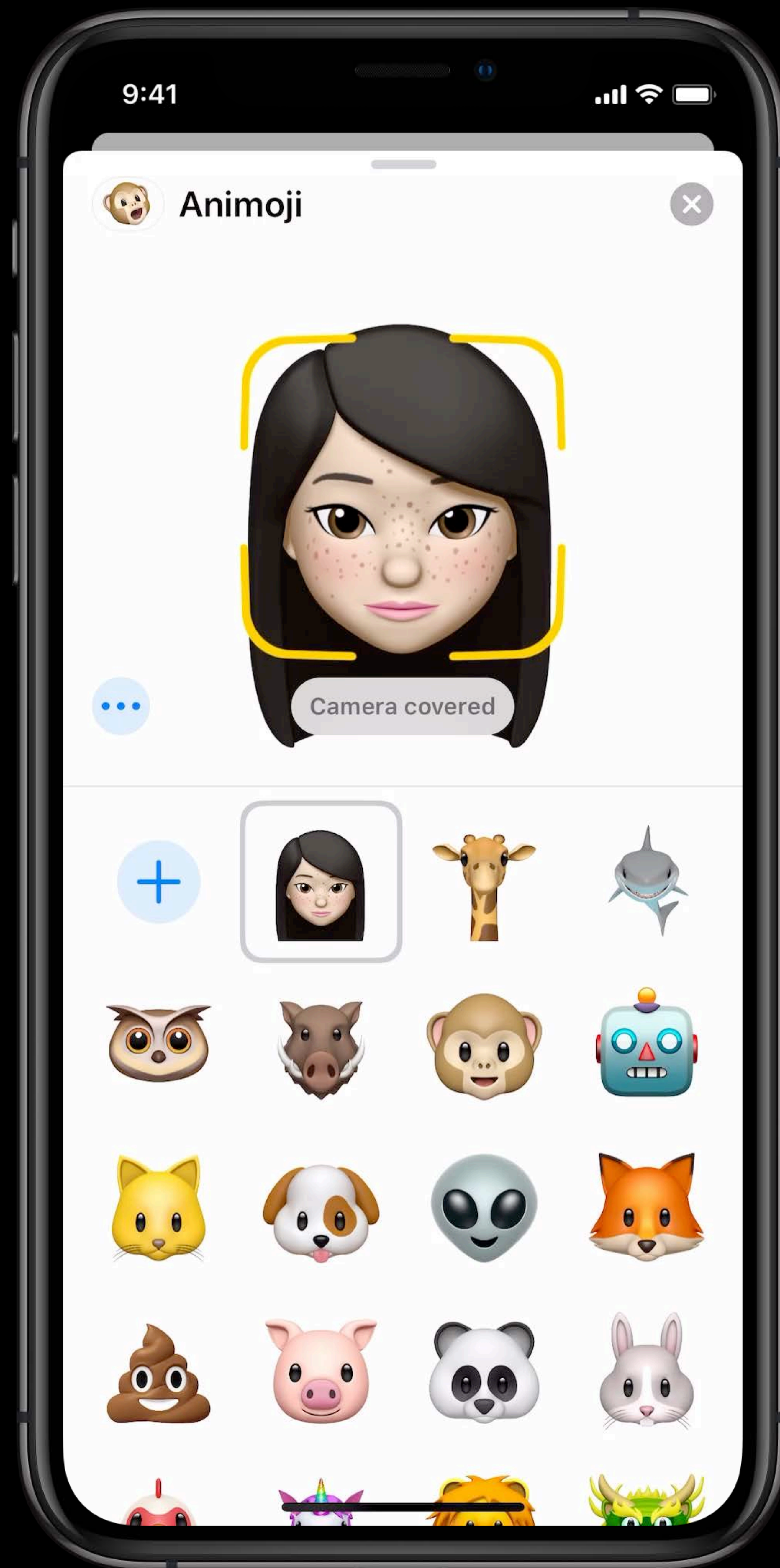




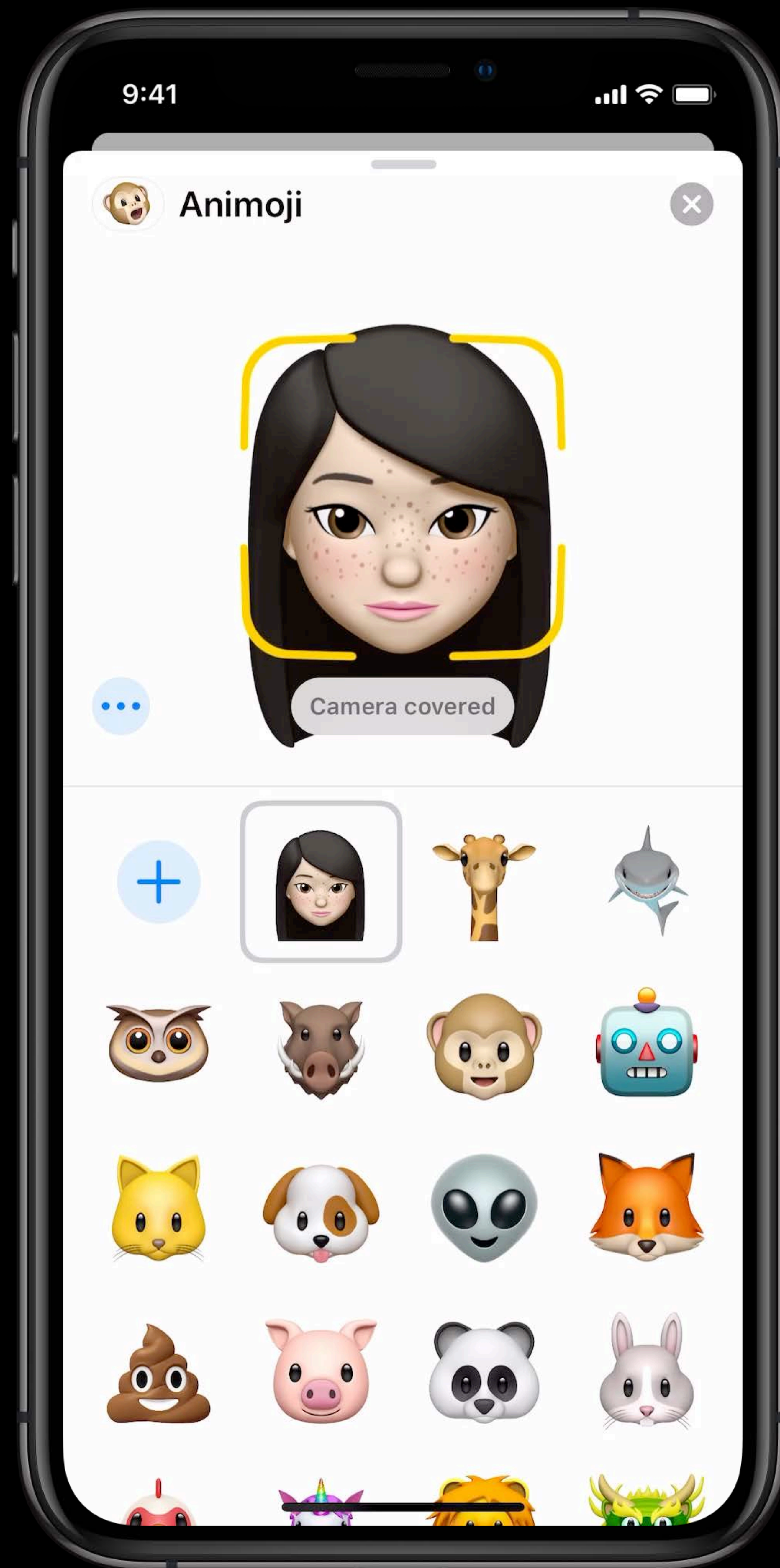




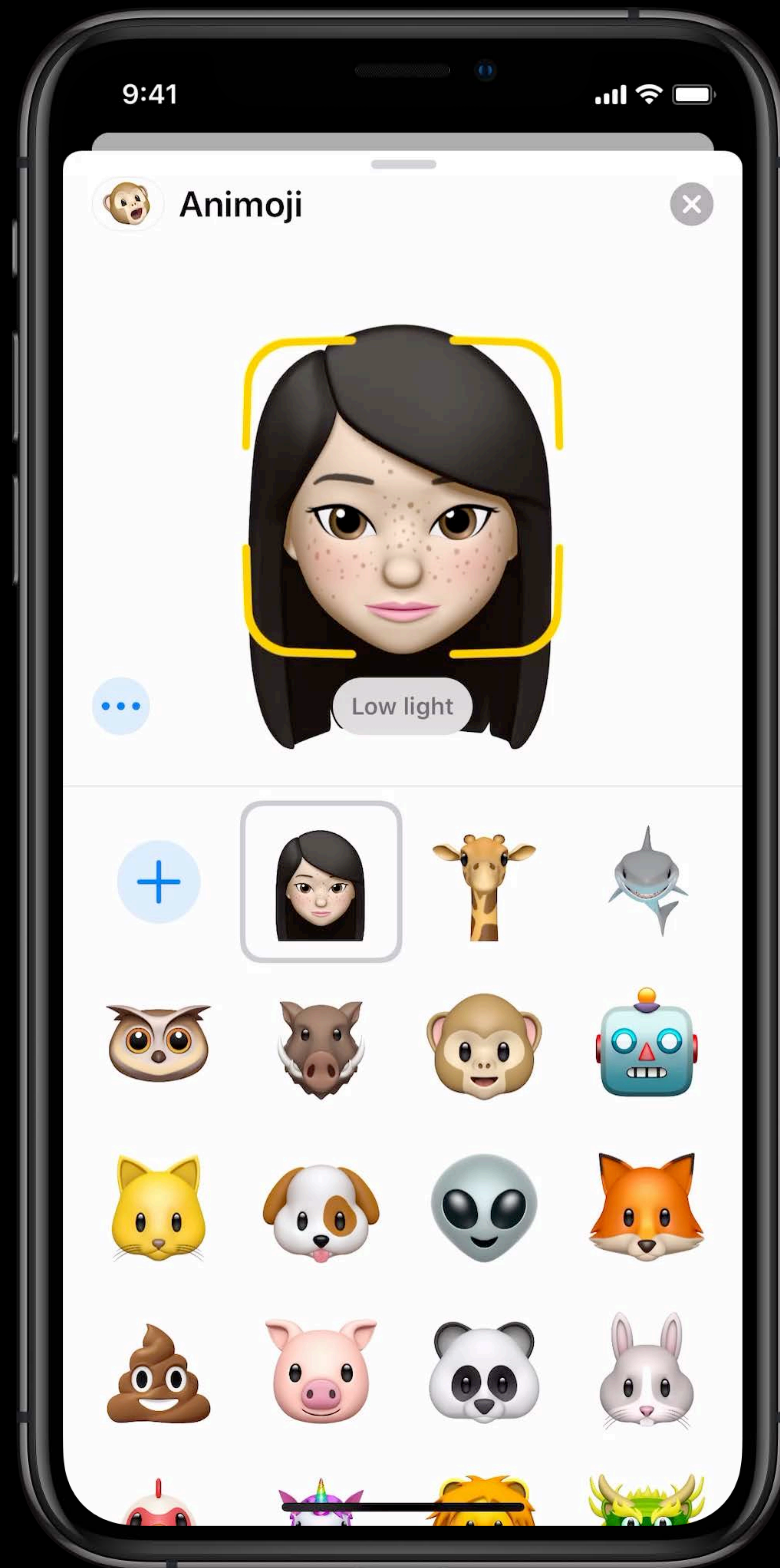




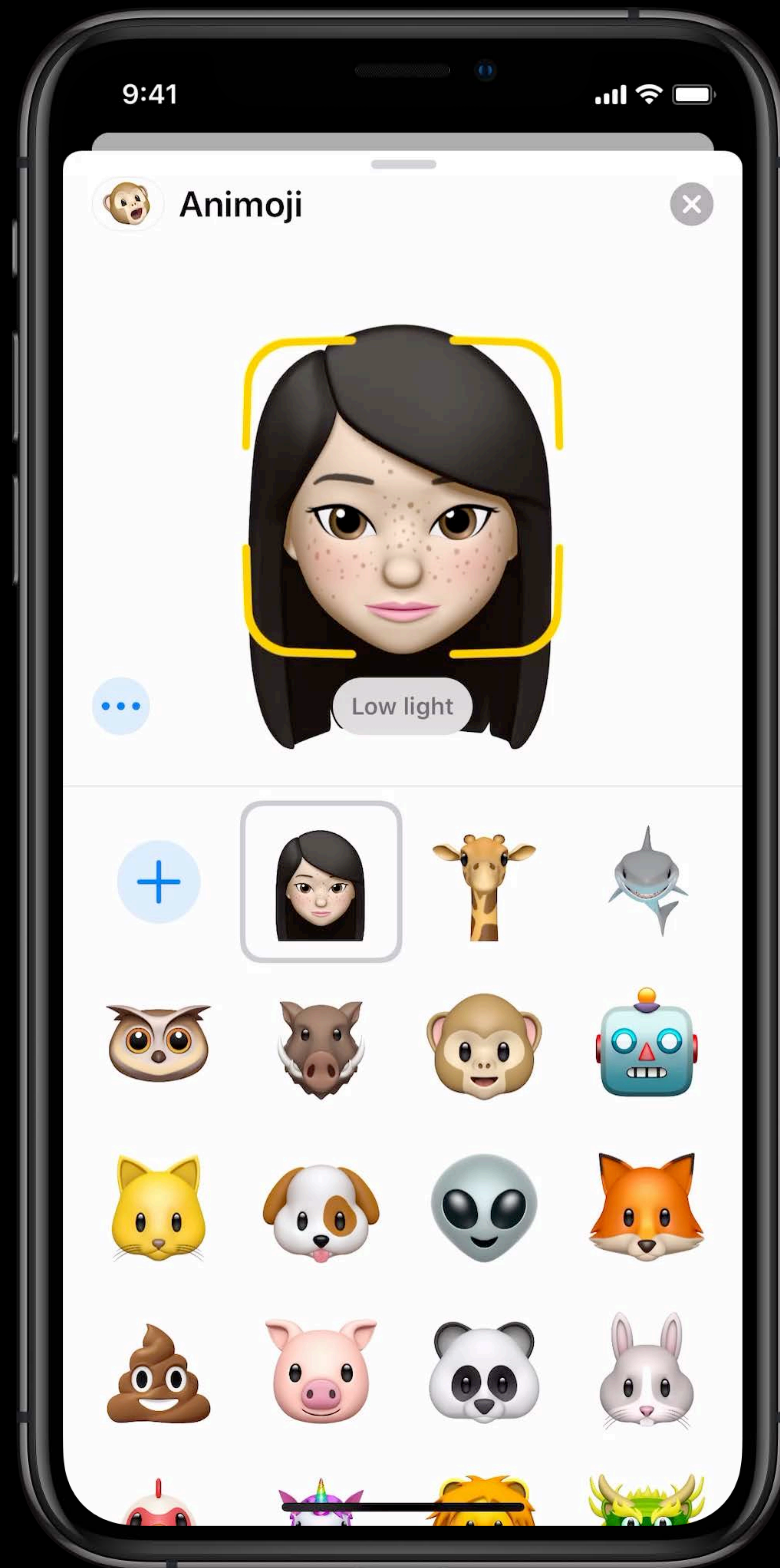














# Limitations

Manage expectations



# Limitations

Manage expectations

Guide people to move past limitations





MacBook Pro





MacBook Pro









MacBook Pro



# Limitations

Manage expectations

Guide people to move past limitations

Suggest alternatives



Outputs are a design medium



# Outputs

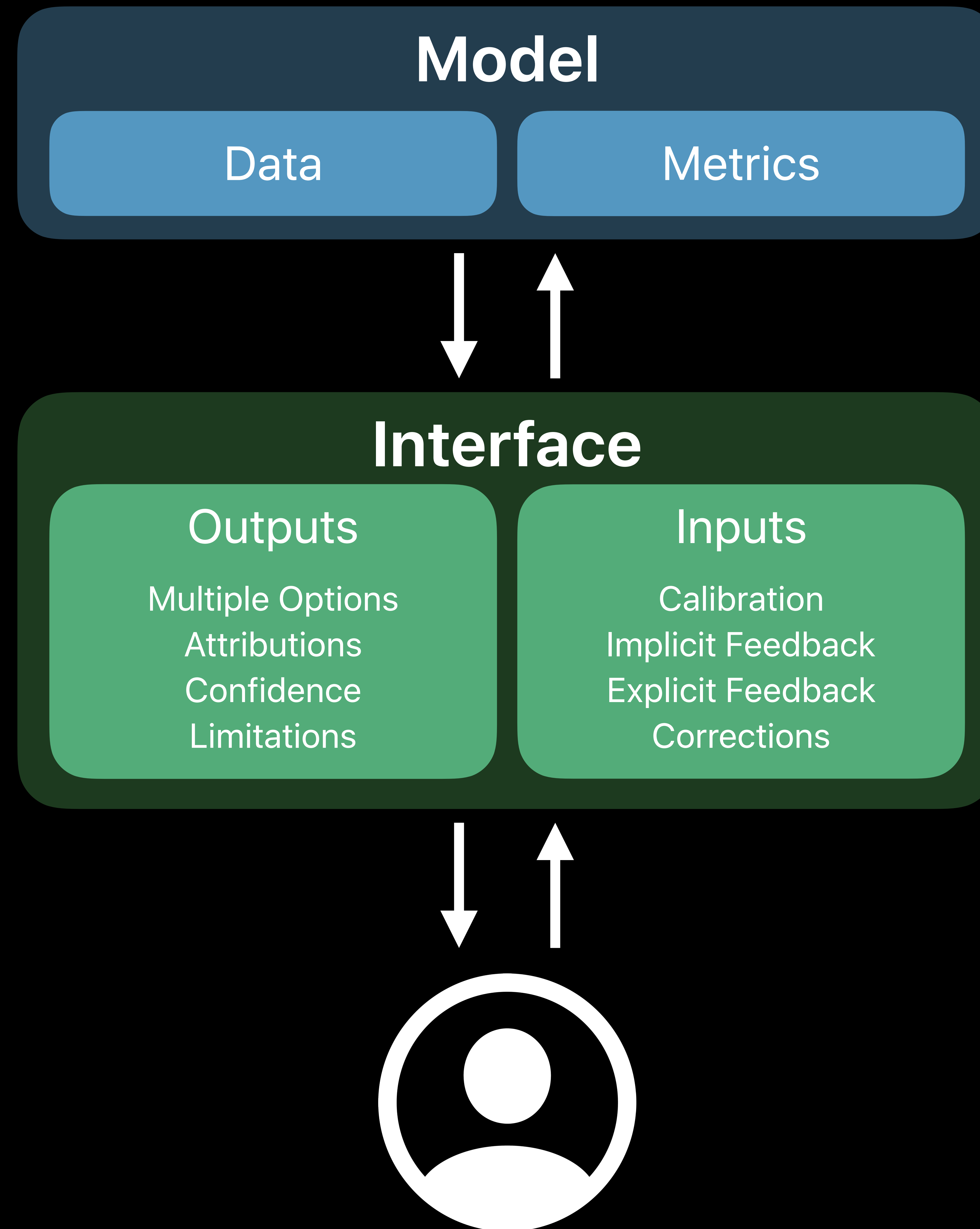
Multiple Options

Attributions

Confidence

Limitations







# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

## Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



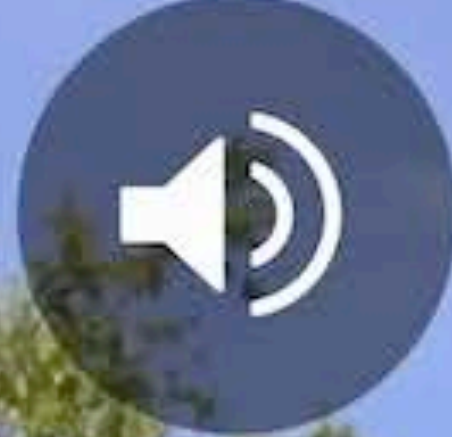
# Calibration

Calibration allows people to provide essential information needed to engage in an experience

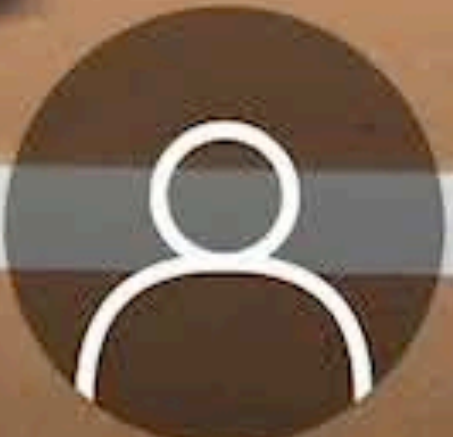
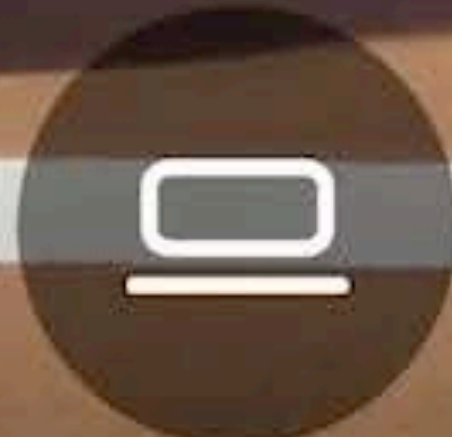








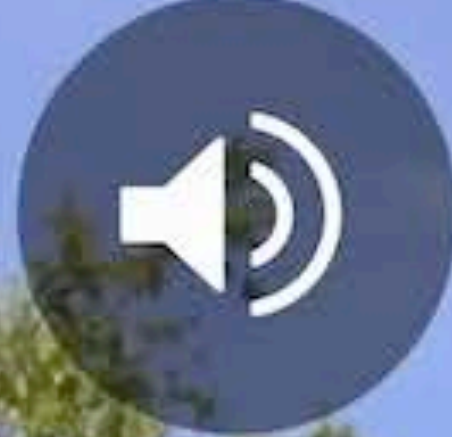
Hoop



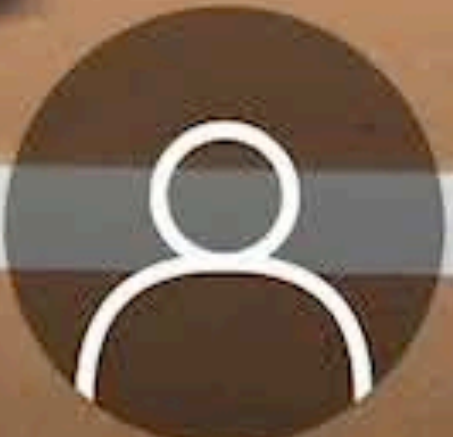
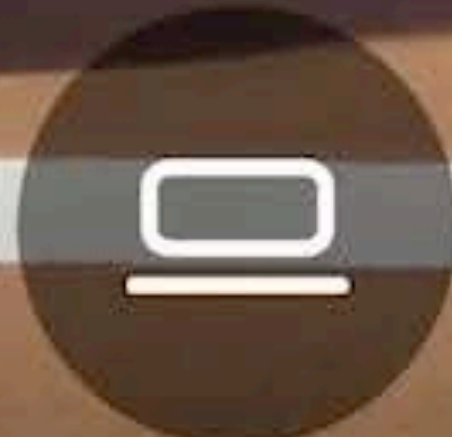
View should cover player and hoop.

NEXT





Hoop



View should cover player and hoop.

NEXT



9:41



[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)



# Calibration



# Calibration

Be quick and effortless



# Calibration

Be quick and effortless

Avoid the need for multiple calibrations



9:41



[Cancel](#)



## Face ID

iPhone can recognize the unique, three-dimensional features of your face to unlock automatically, use Apple Pay, and make purchases from the iTunes and App Stores.

[About Face ID & Privacy...](#)

Continue

[Set Up Later in Settings](#)



9:41



[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)



9:41



[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)



9:41



[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)



9:41



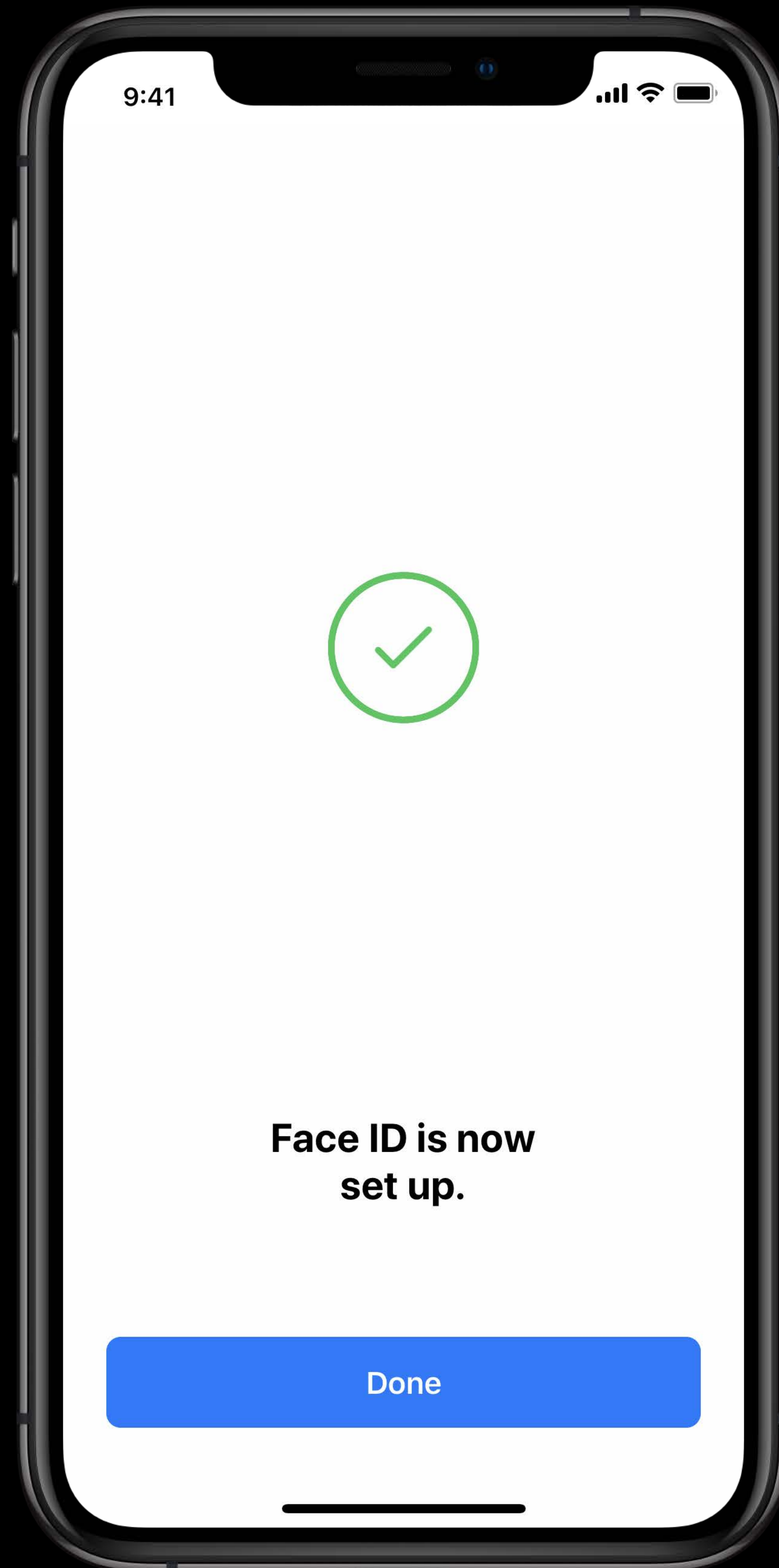
[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)







# Calibration

Be quick and effortless

Avoid the need for multiple calibrations



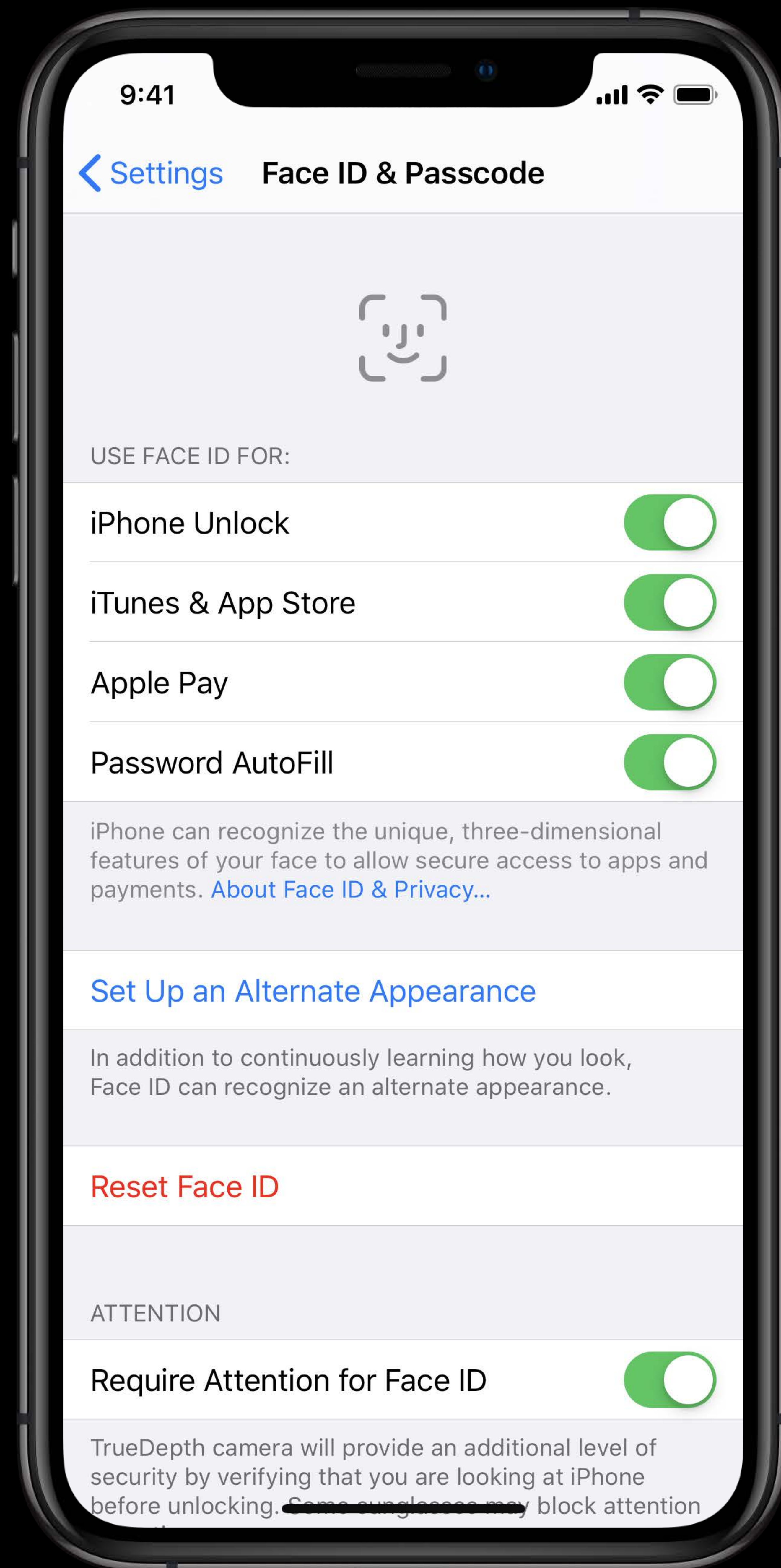
# Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm







# Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm



# Calibration

Be quick and effortless

Avoid the need for multiple calibrations

Introduce, guide and confirm

Allow people to update information



9:41



[Cancel](#)



**Move your head slowly to  
complete the circle.**

[Accessibility Options](#)



# Inputs

## Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Implicit Feedback

Implicit feedback is information that arises from the interactions people have with your app



9:41



Search



Cancel

SIRI SUGGESTIONS

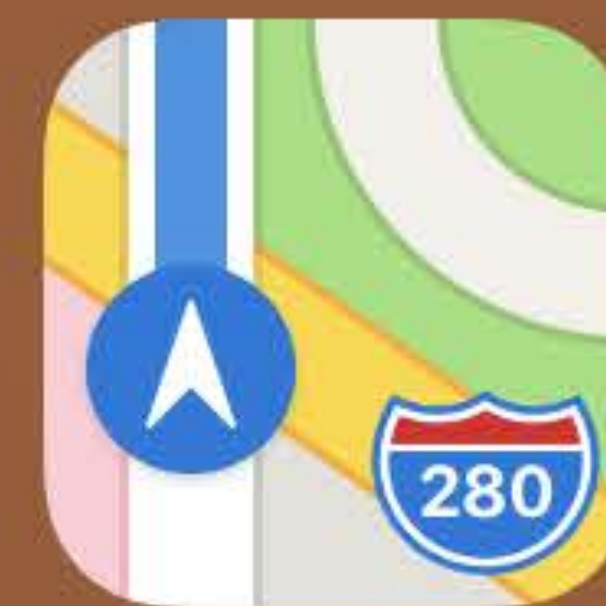
Show More



Calendar



Podcasts



Maps



Music



9:41



🔍 Search



Cancel

SIRI SUGGESTIONS

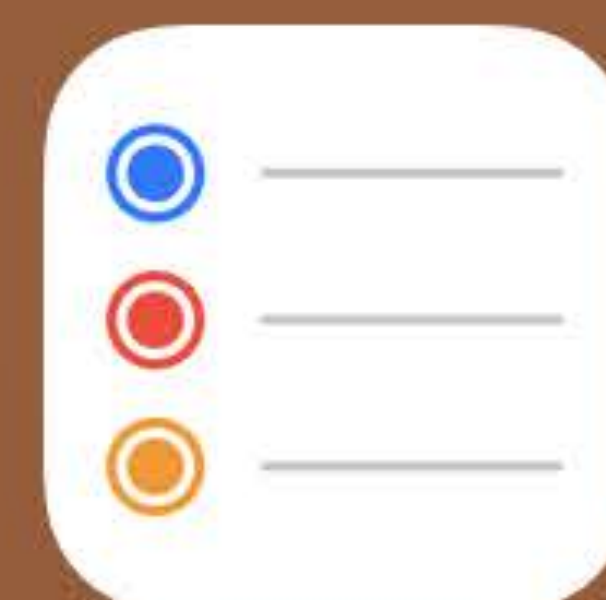
Show More



Mail



Notes



Reminders



Files



9:41



🔍 Search



Cancel

SIRI SUGGESTIONS

Show More



Home



Messages



Activity



News



# Implicit Feedback



# Implicit Feedback

Strive to identify people's intention



9:41



🔍 Search



Cancel

SIRI SUGGESTIONS

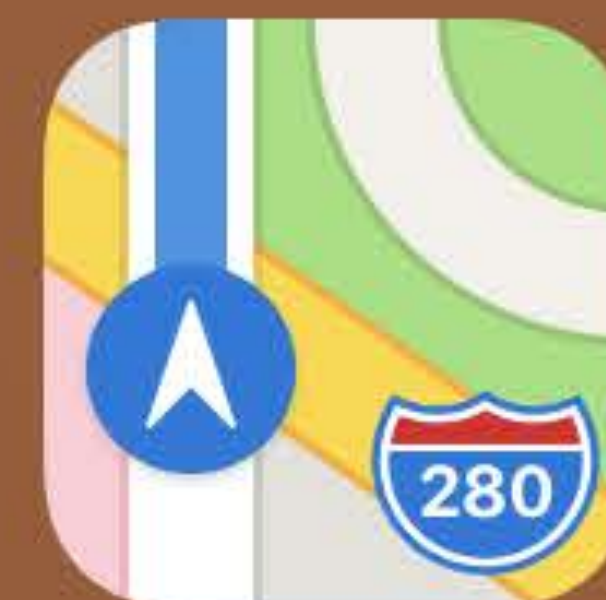
Show More



Calendar



Podcasts



Maps



Music



9:41



Search



Cancel

SIRI SUGGESTIONS

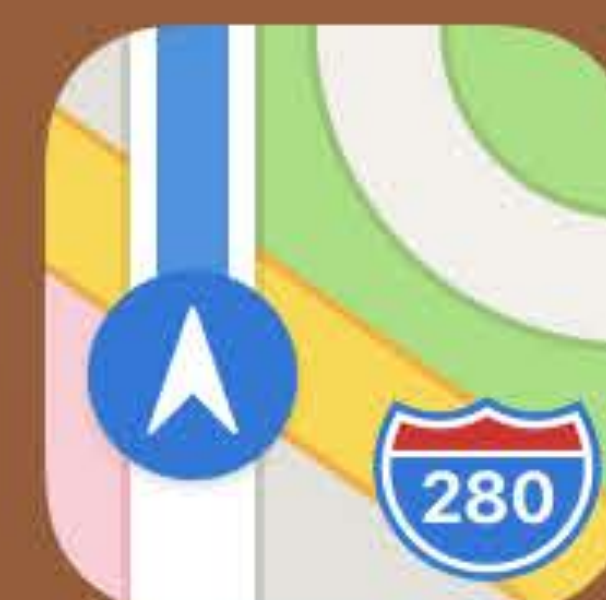
Show More



Calendar



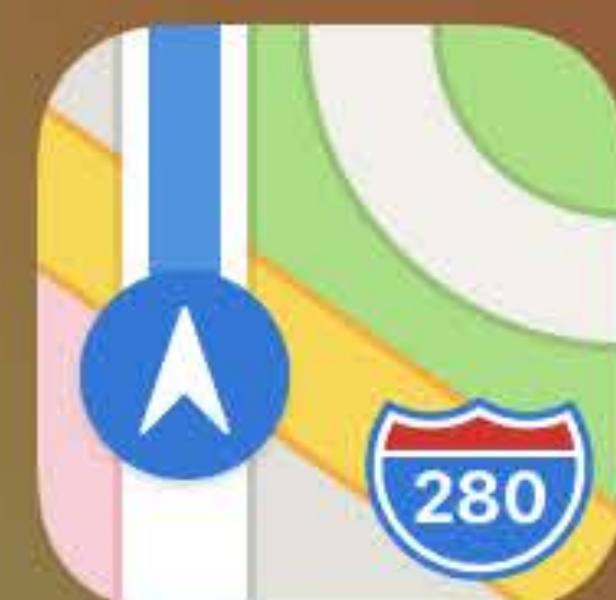
Podcasts



Maps



Music



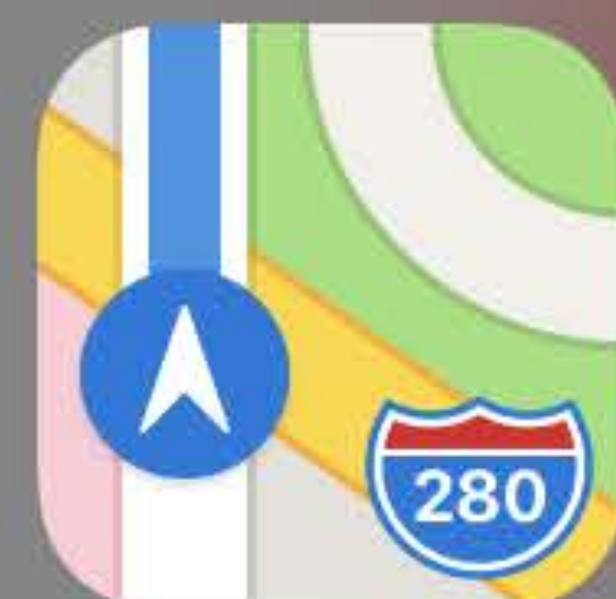
Get directions to Apple Park

Maps



View Today

Calendar



Search for 'lunch'

Maps





9:41



Search



Cancel

SIRI SUGGESTIONS

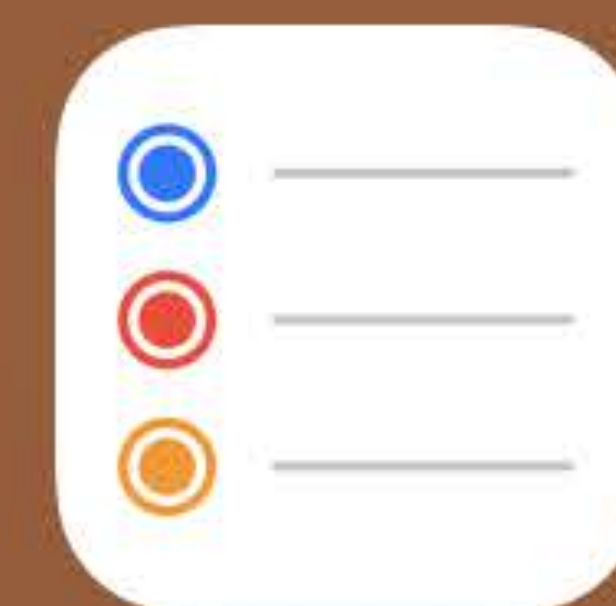
Show More



Mail



Notes



Reminders

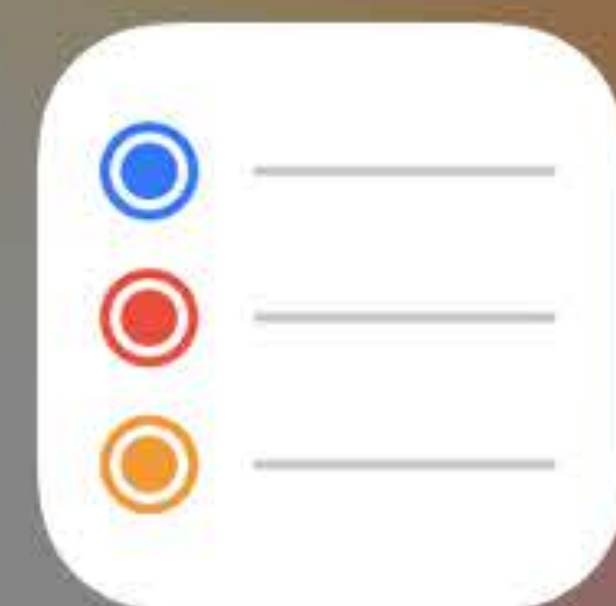


Files



View Meeting Notes

Notes



View 'Work'

Reminders



Send an email to Ryan O.

Mail





9:41



Search



Cancel

SIRI SUGGESTIONS

Show More



Home



Messages



Activity



News



Run Arrive Home

Home



Send Message to Lexi

Messages



FaceTime Mom

FaceTime





# Implicit Feedback

Strive to identify people's intention



# Implicit Feedback

Strive to identify people's intention

Accuracy over speed



9:41



Search



Cancel

SIRI SUGGESTIONS

Show More



Home



Messages



Activity



News



Run Arrive Home

Home



Send Message to Lexi

Messages



FaceTime Mom

FaceTime





9:41



[← Siri & Search](#)   Calendar

IN "CALENDAR"

Show Siri Suggestions in App



Learn from this App



Allow Siri to make suggestions in "Calendar" and learn from how you use "Calendar" to make suggestions across apps.

IN SEARCH

Show in Search



Suggest Shortcuts



Allow Search and Look Up to show information or shortcut suggestions for "Calendar". Shortcut suggestions are based on how you use "Calendar".

ON LOCK SCREEN



9:41



## [← Siri & Search](#) Calendar

### IN "CALENDAR"

Show Siri Suggestions in App



Learn from this App



Allow Siri to make suggestions in "Calendar" and learn from how you use "Calendar" to make suggestions across apps.

### IN SEARCH

Show in Search



Suggest Shortcuts



Allow Search and Look Up to show information or shortcut suggestions for "Calendar". Shortcut suggestions are based on how you use "Calendar".

### ON LOCK SCREEN



# Implicit Feedback

Strive to identify people's intention

Accuracy over speed



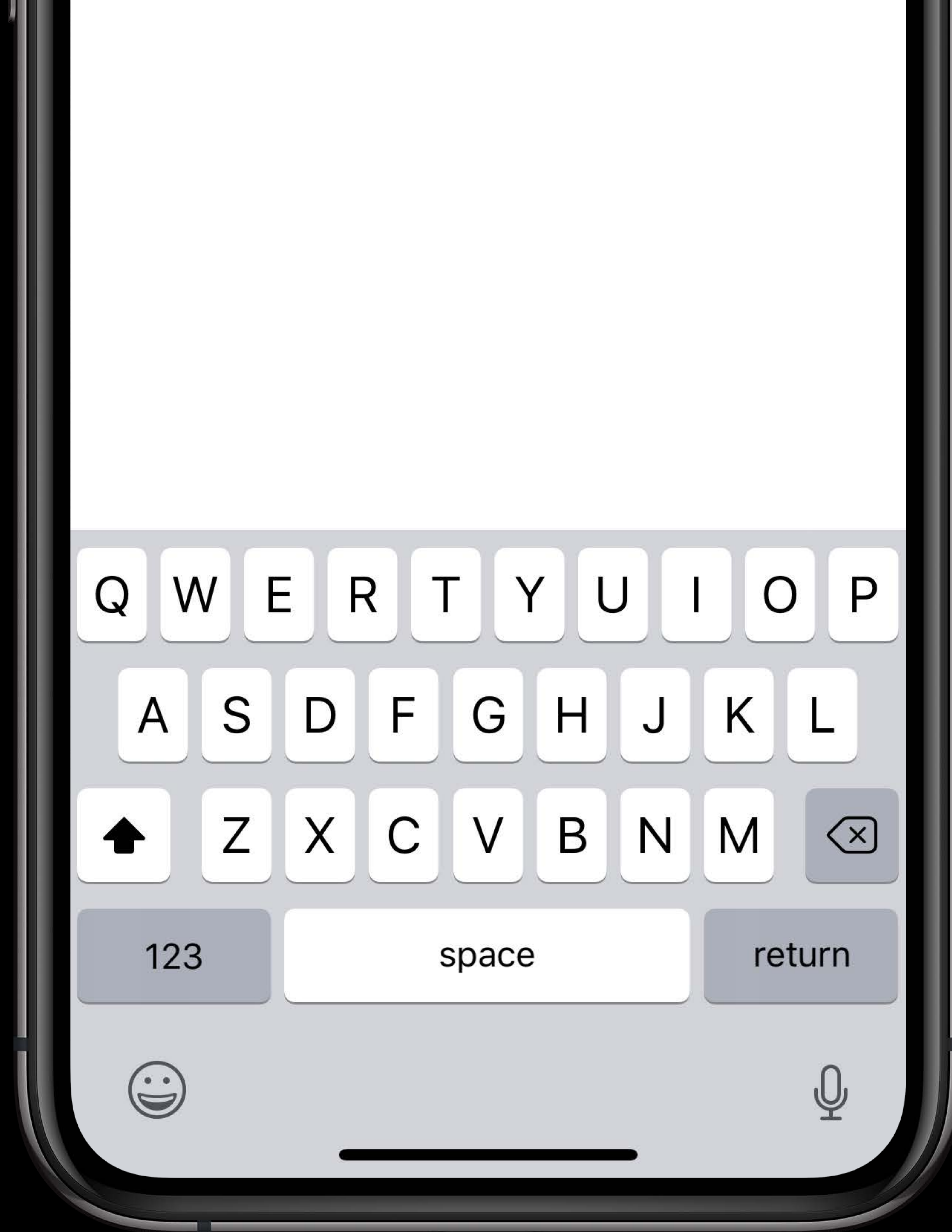
# Implicit Feedback

Strive to identify people's intention

Accuracy over speed

Respect people's privacy









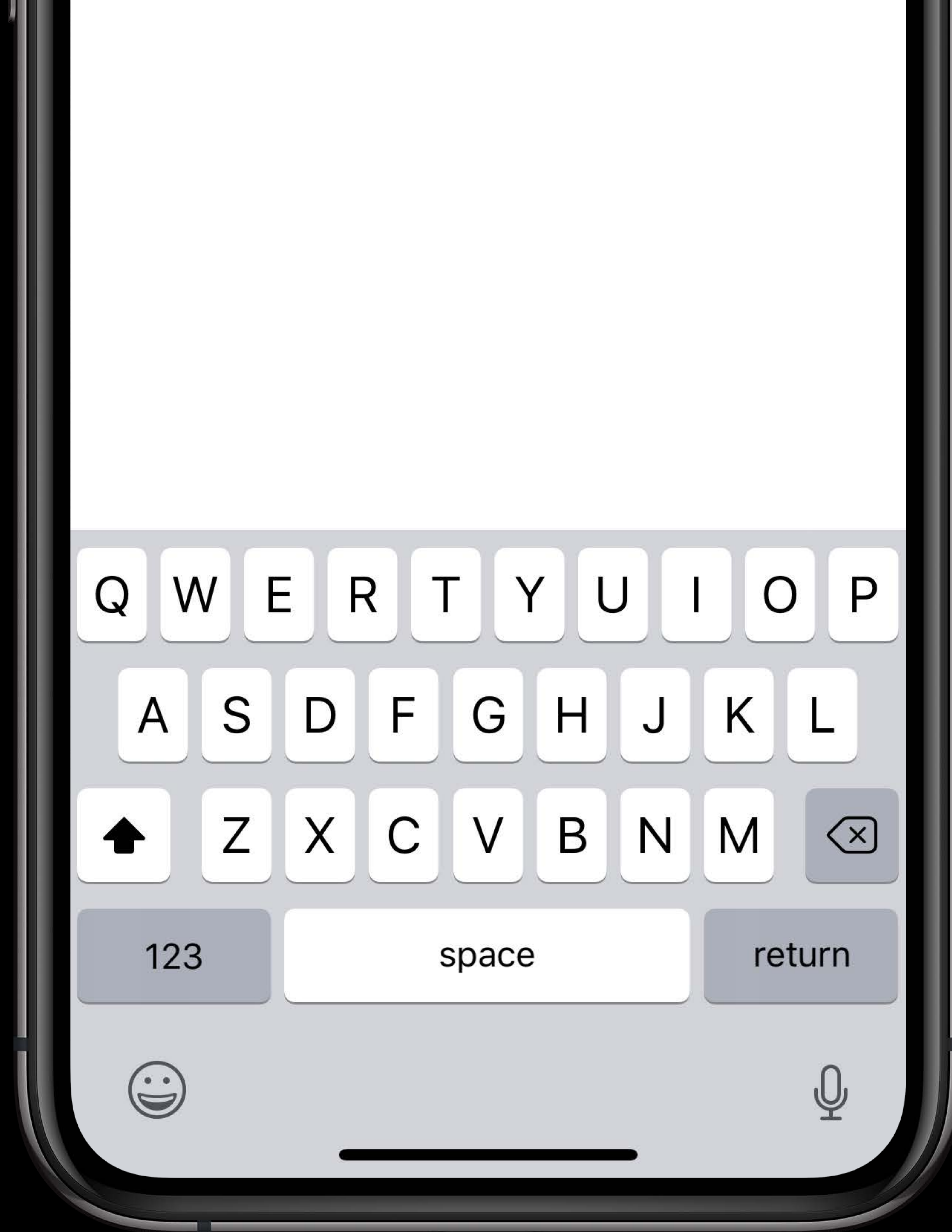














# Implicit Feedback

Strive to identify people's intention

Accuracy over speed

Respect people's privacy



# Implicit Feedback

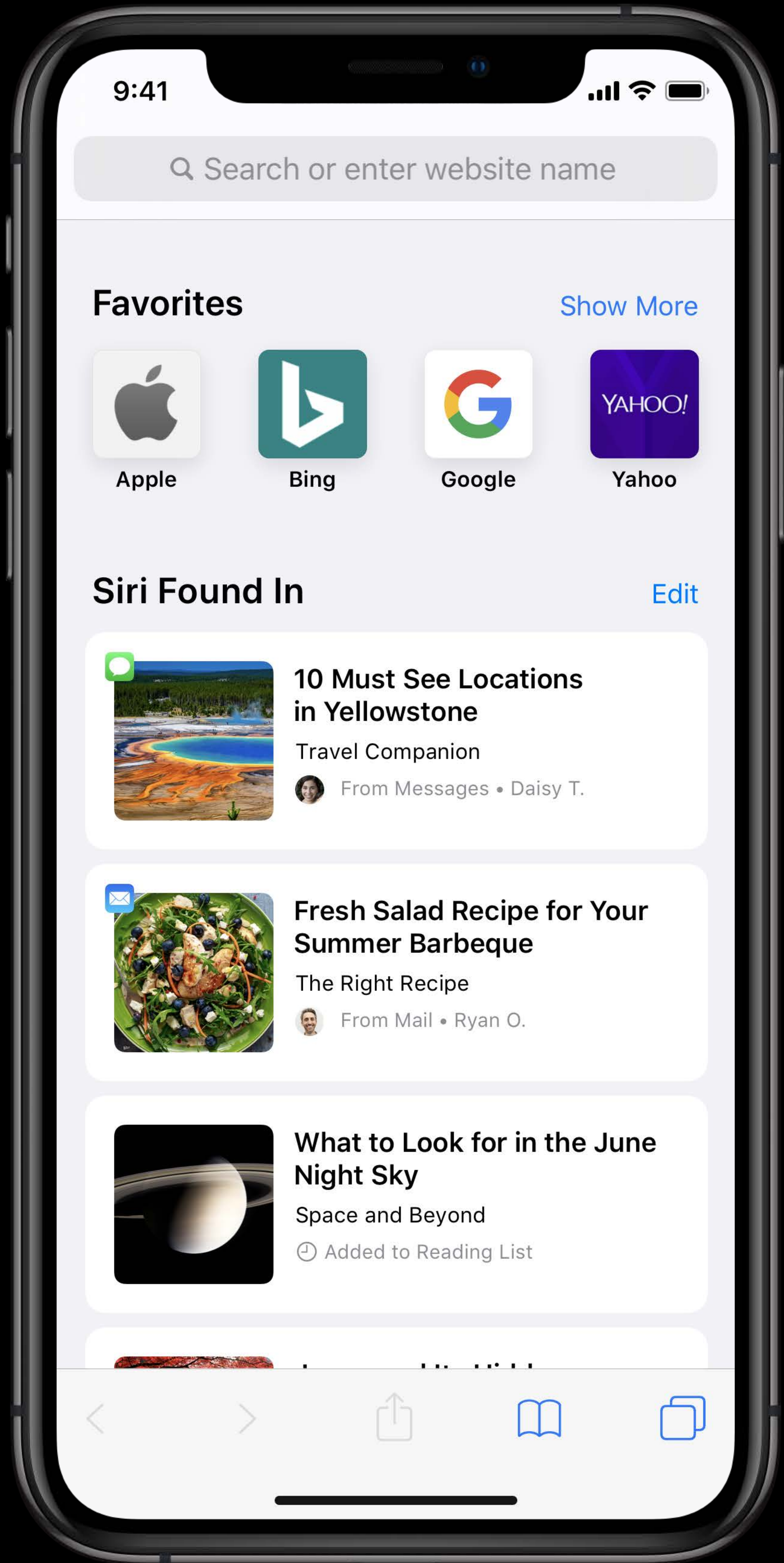
Strive to identify people's intention

Accuracy over speed

Respect people's privacy

Make interactions more accurate and delightful





9:41



Search or enter website name

Favorites

Show More



Apple



Bing



Google



Yahoo

Siri Found In

Edit



10 Must See Locations  
in Yellowstone

Travel Companion

From Messages • Daisy T.



Fresh Salad Recipe for Your  
Summer Barbeque

The Right Recipe

From Mail • Ryan O.



What to Look for in the June  
Night Sky

Space and Beyond

Added to Reading List





# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

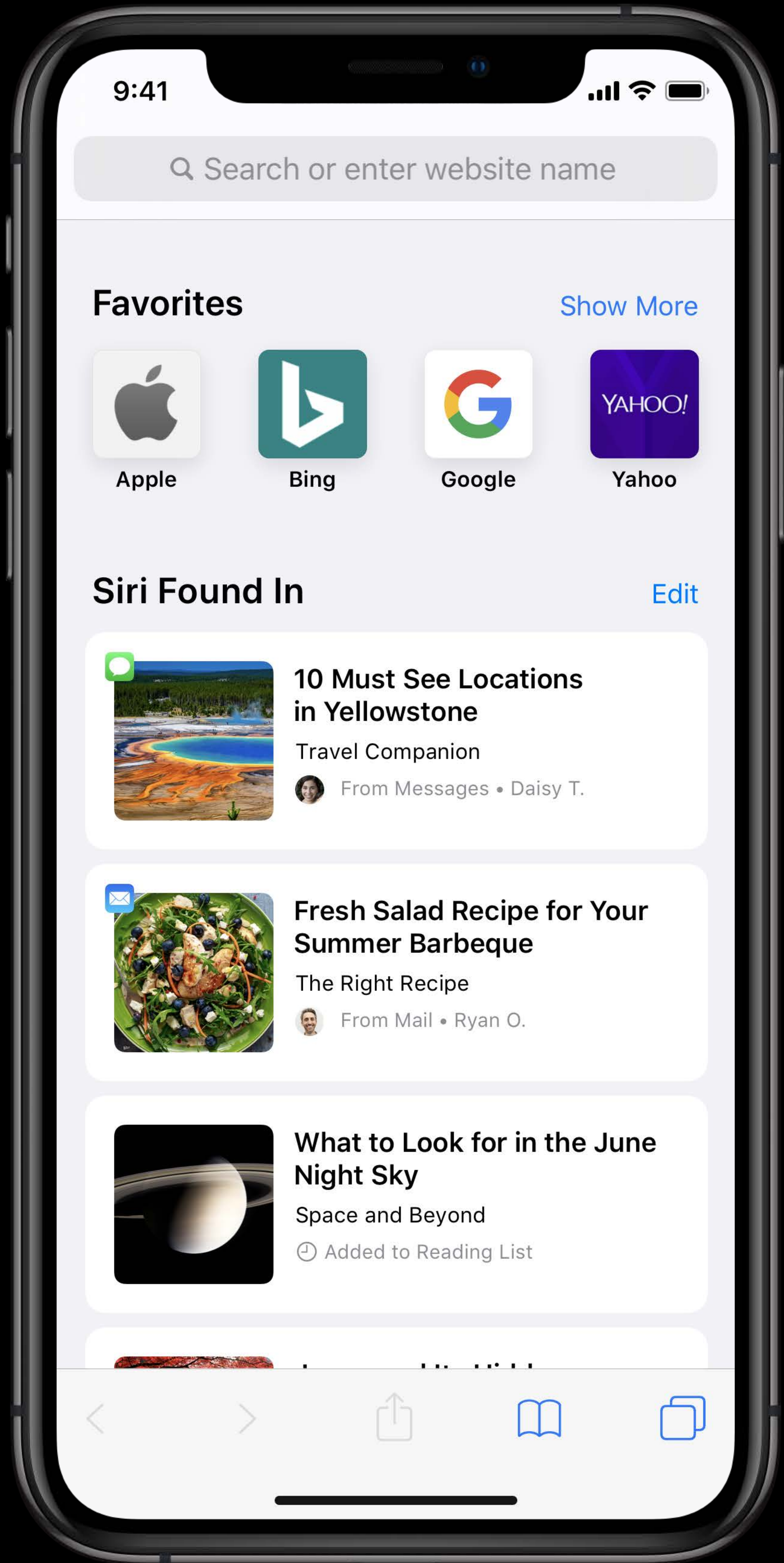
Corrections



# Explicit Feedback

Explicit Feedback allows your app to collect information by asking specific questions regarding your results





9:41



Search or enter website name

Favorites

Show More



Apple



Bing



Google



Yahoo

Siri Found In

Edit



10 Must See Locations  
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What to Look for in the June  
Night Sky

Space and Beyond



Added to Reading List









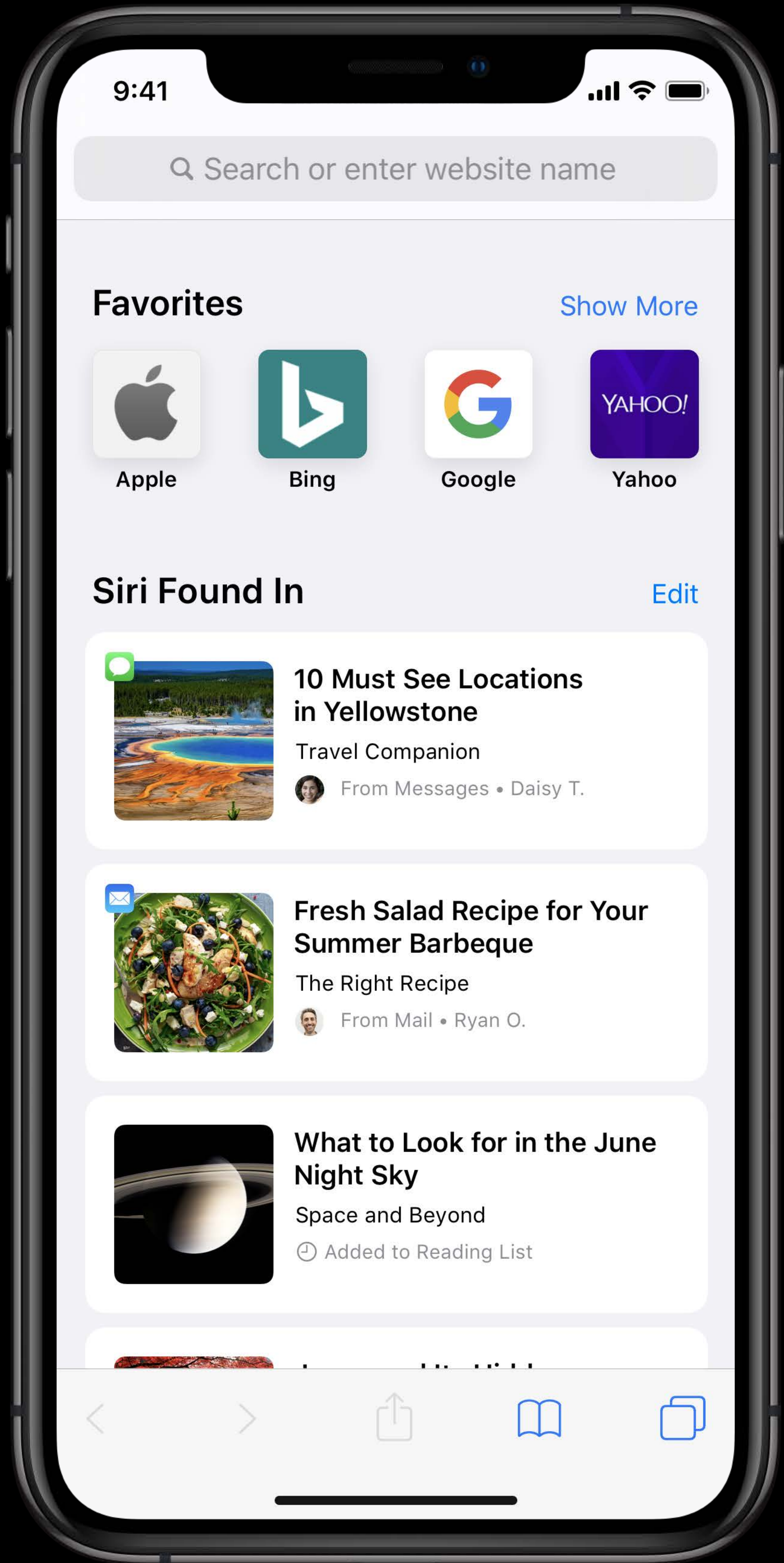


Love

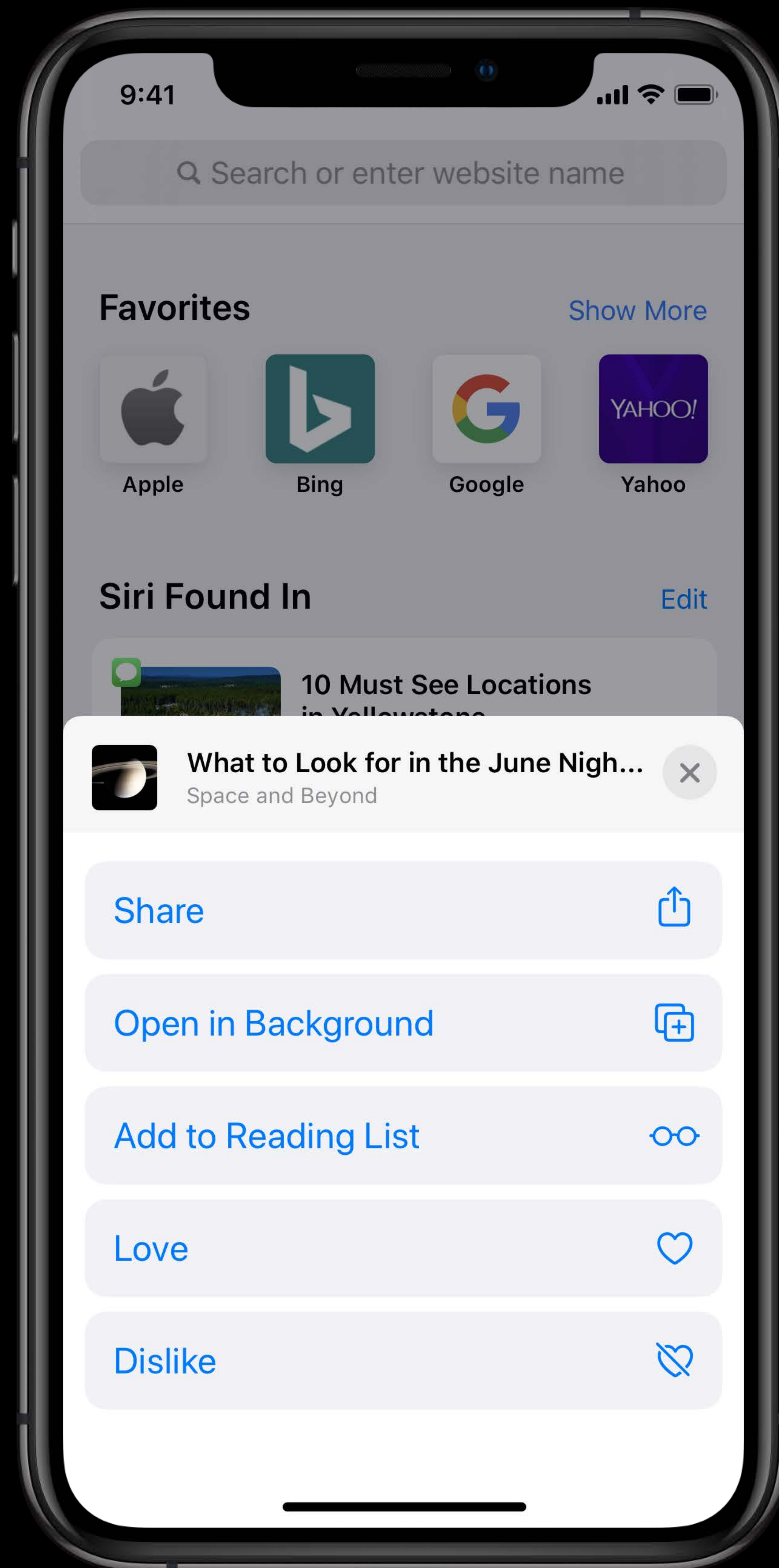


Dislike

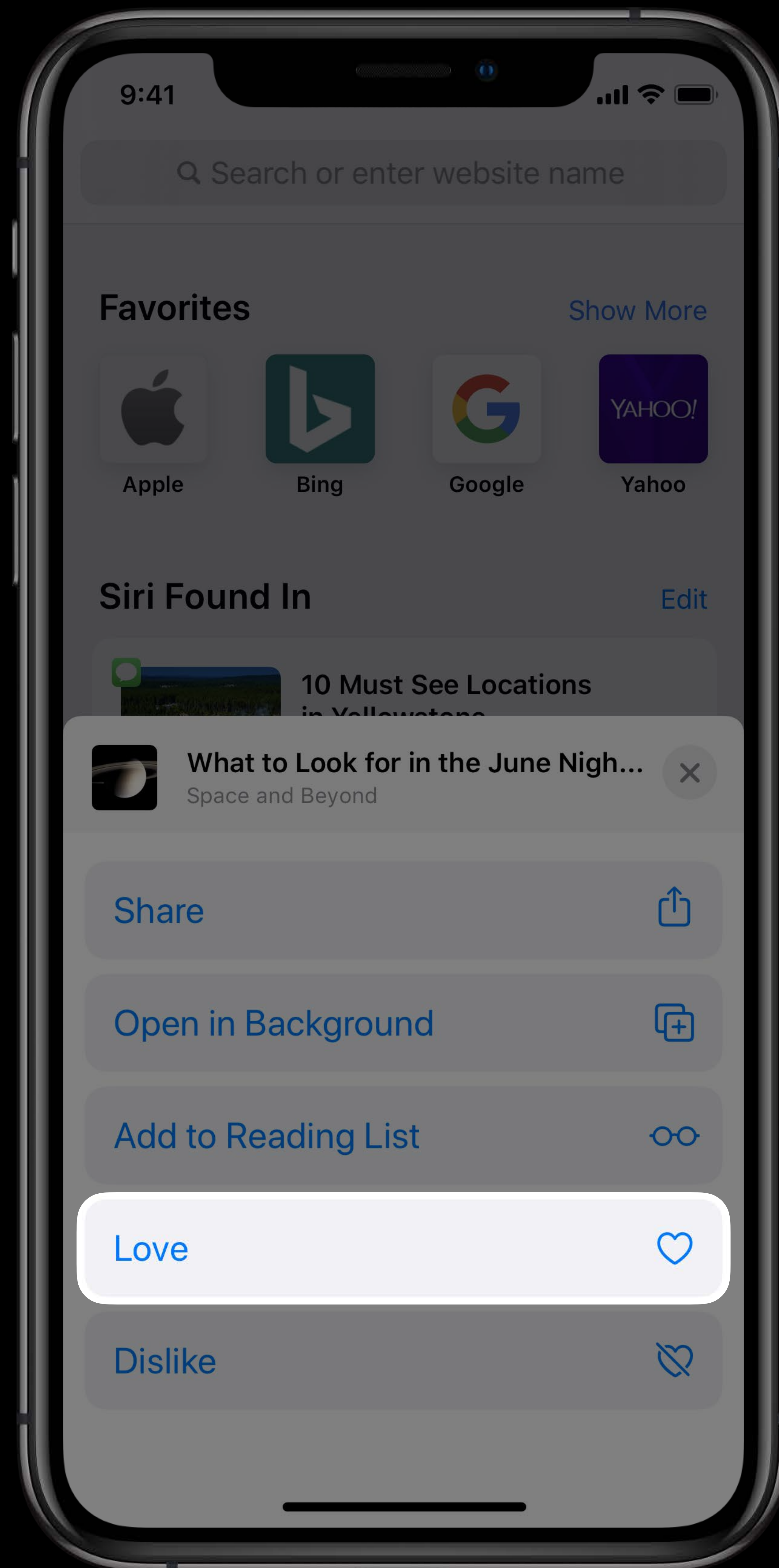










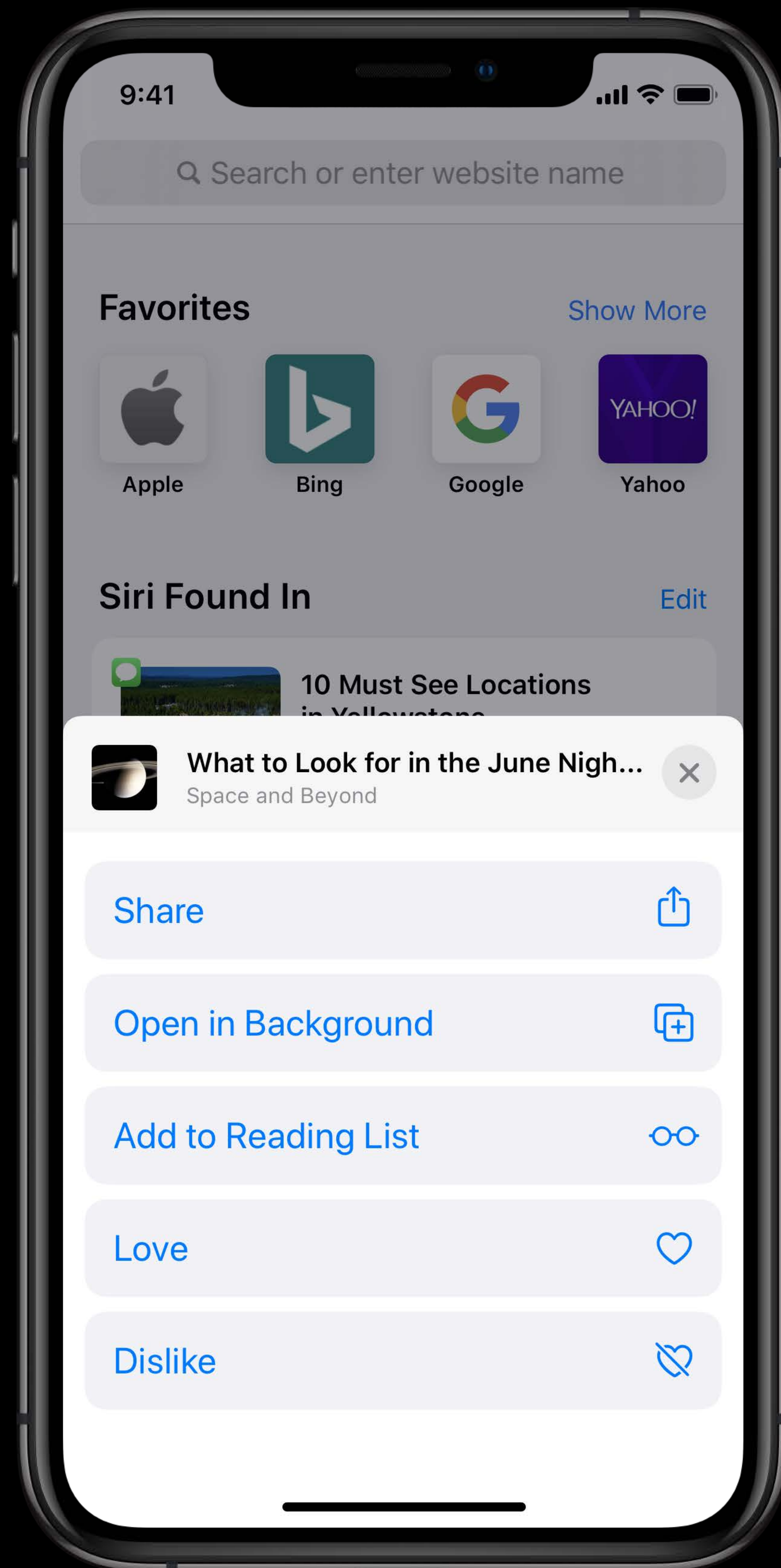




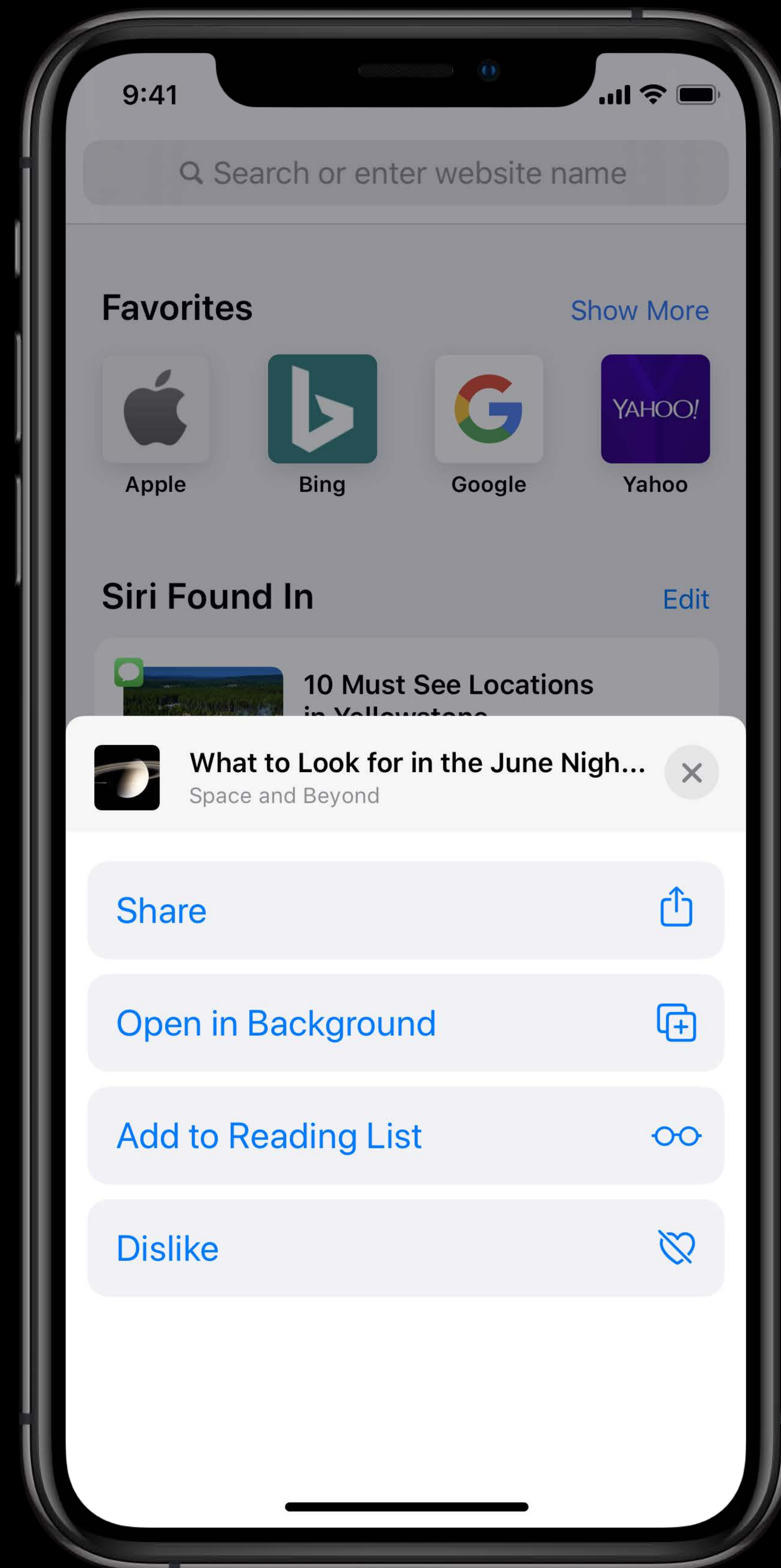
# Explicit Feedback

Prioritize negative feedback over positive

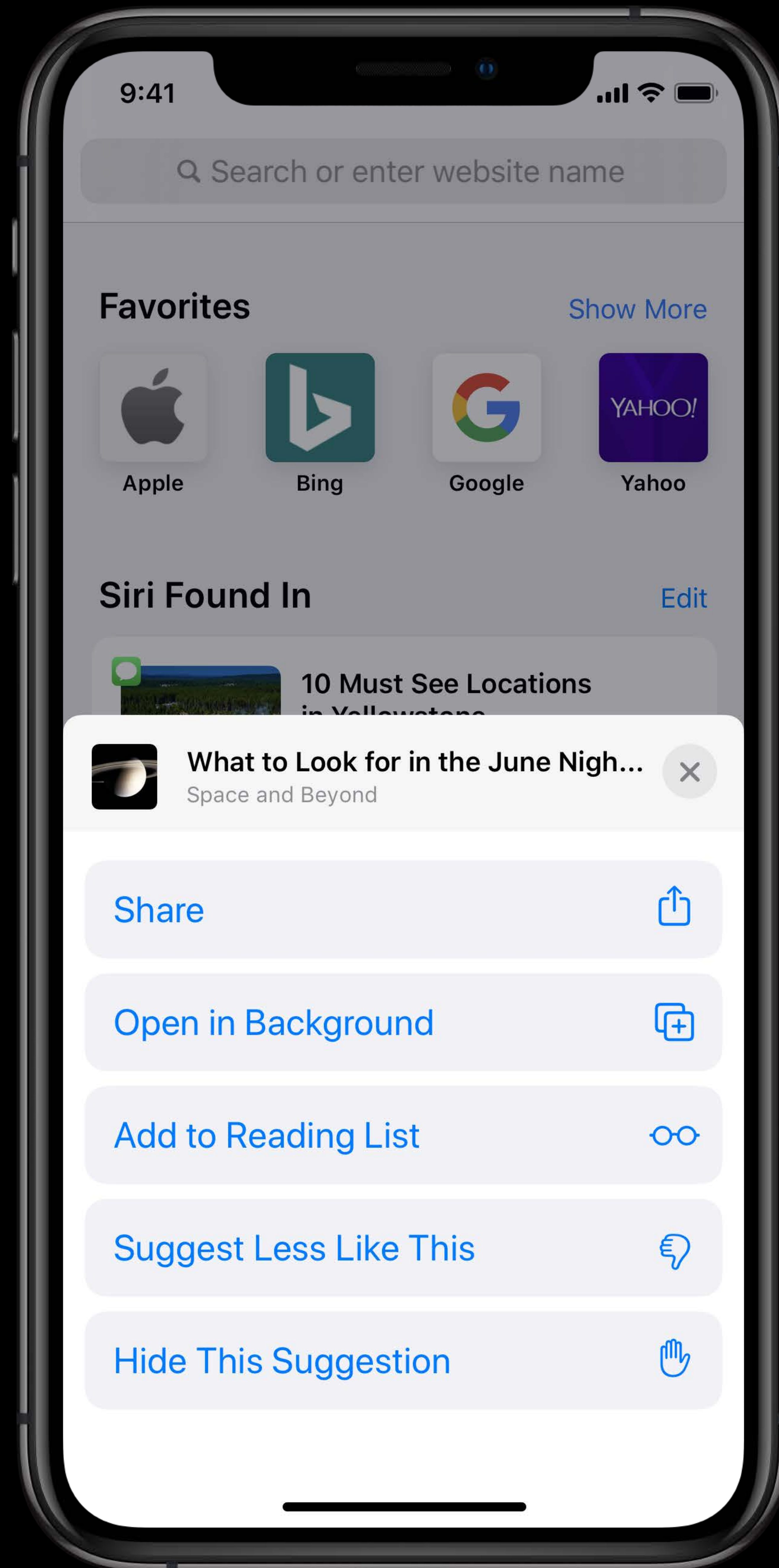




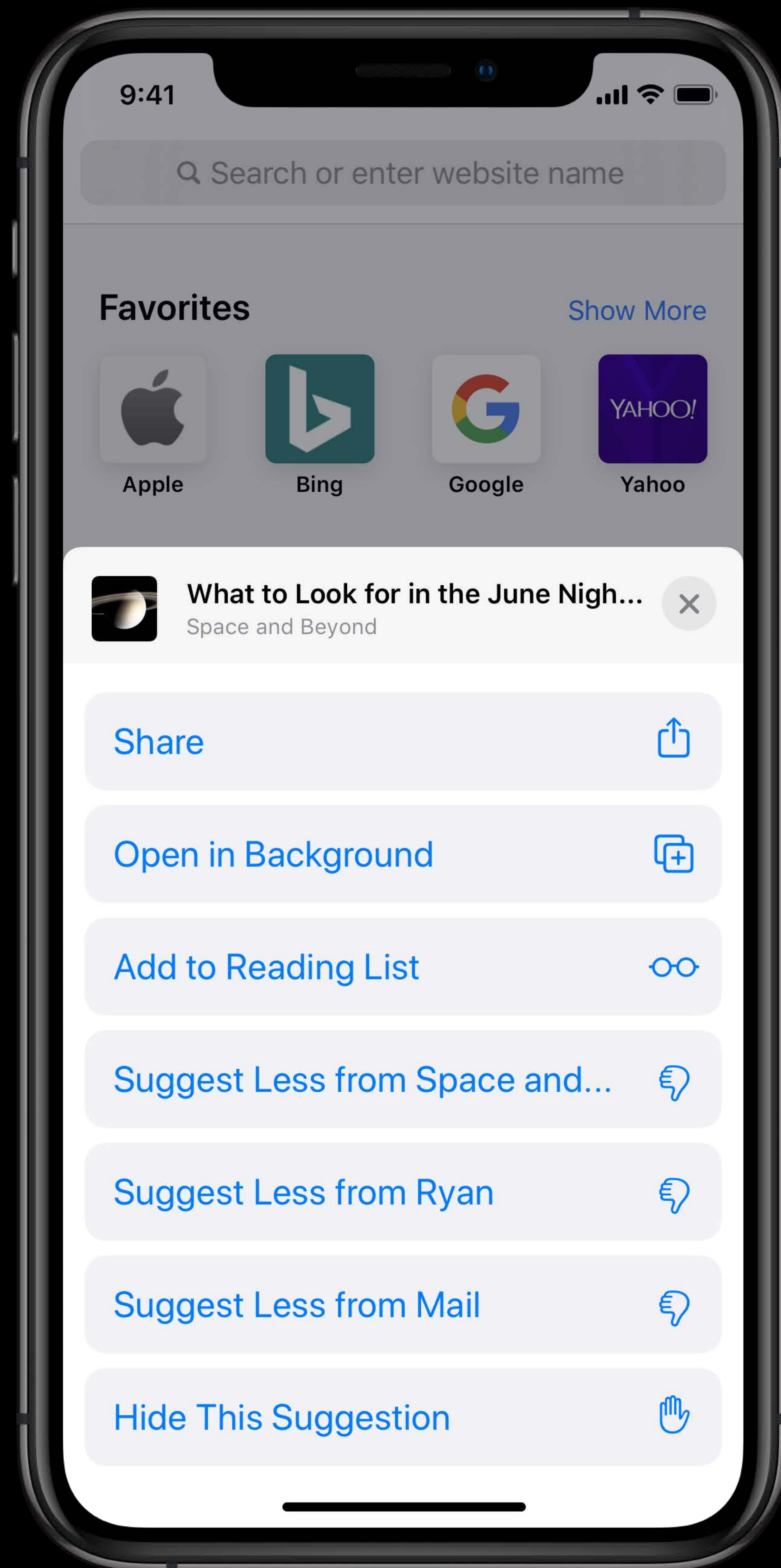














# Explicit Feedback

Prioritize negative feedback over positive

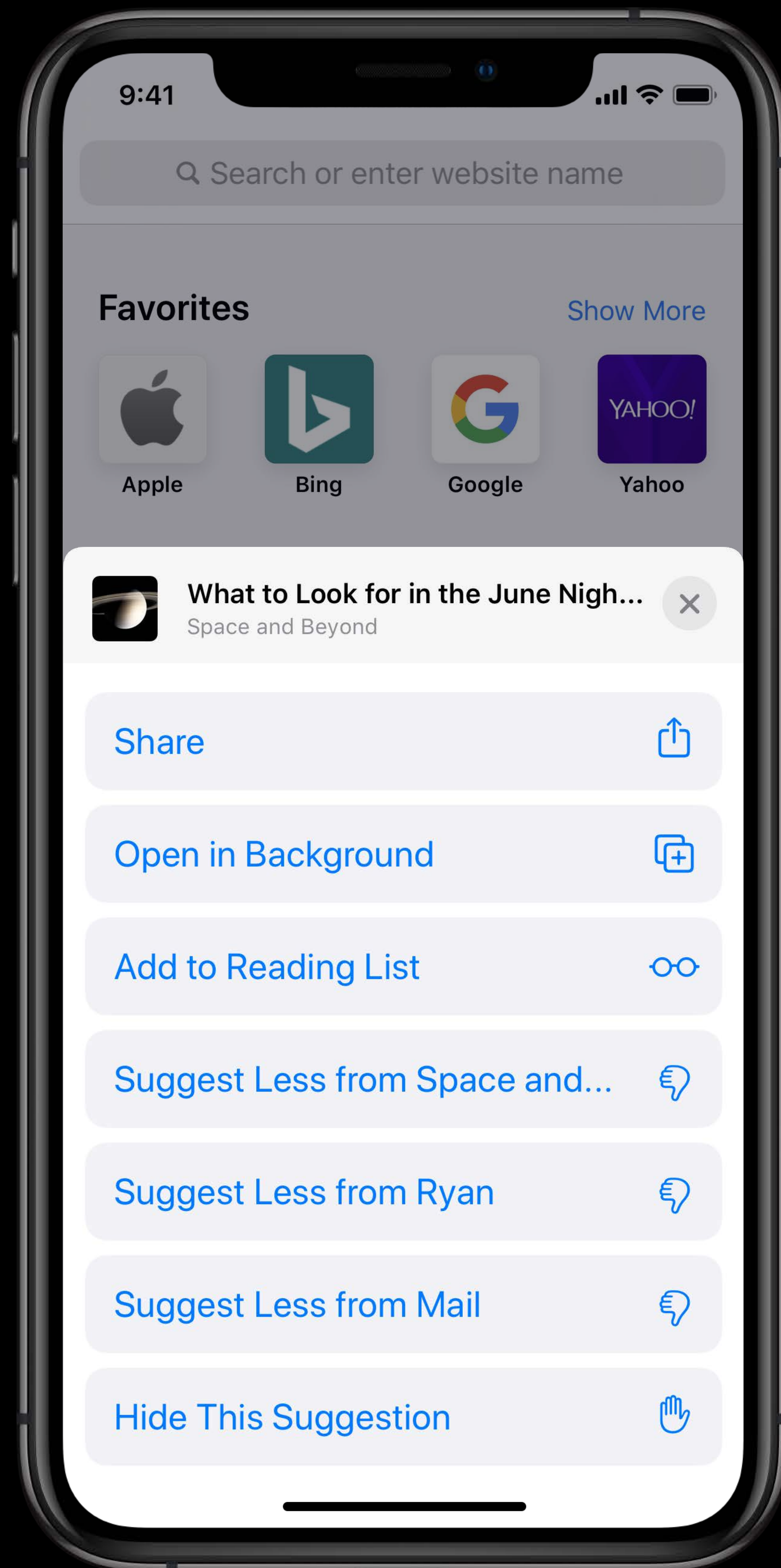


# Explicit Feedback

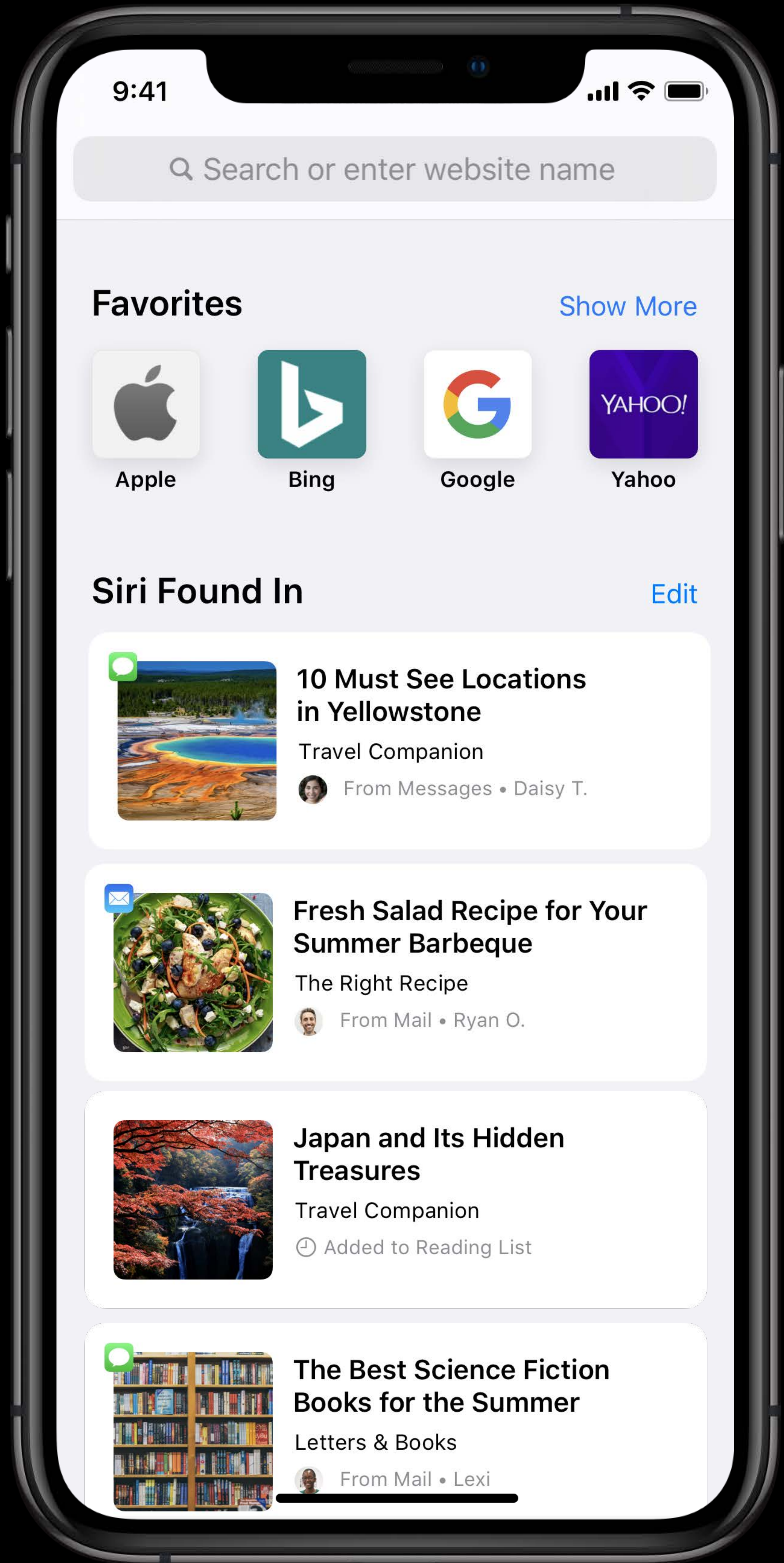
Prioritize negative feedback over positive

Clearly describe each option and its consequences









9:41



Search or enter website name

### Favorites

Show More



Apple



Bing



Google



Yahoo

### Siri Found In

Edit



#### 10 Must See Locations in Yellowstone

Travel Companion

From Messages • Daisy T.



#### Fresh Salad Recipe for Your Summer Barbeque

The Right Recipe

From Mail • Ryan O.



#### Japan and Its Hidden Treasures

Travel Companion

Added to Reading List



#### The Best Science Fiction Books for the Summer

Letters & Books

From Mail • Lexi



# Explicit Feedback

Prioritize negative feedback over positive

Clearly describe each option and its consequences



# Explicit Feedback

Prioritize negative feedback over positive

Clearly describe each option and its consequences

Act immediately and persistently





Angie



to Muir Woods! So excited!!

Delivered

Yes absolutely! Muir Woods is on! Let's meet at 8am at my place!

> Sounds good! Are you bringing angie ↑

"angie"angleangel

qwertyuiopq  
asdgfhjkl  
↑zxcvbnm⌫  
123spacereturn  
😊🎤



angle

Don't Correct "Angie"



Don't Correct to "angle"





to Muir Woods! So excited!!

Delivered

Yes absolutely! Muir Woods is on! Let's meet at 8am at my place!

Sounds good! Are you bringing angle with you?

angles

anglers

q w e r t y u i o p

a s d f g h j k l

↑ z x c v b n m ↵

123

space

return





to Muir Woods! So excited!!

Delivered

Yes absolutely! Muir Woods is on! Let's meet at 8am at my place!



Sounds good! Are you bringing Angie with you?



"Angie"

q w e r t y u i o p

a s d f g h j k l

↑ z x c v b n m ↵

123

space

return





Sounds good! Are you bringing Angie with you?

Delivered

Yes of course! She wouldn't want to miss it!

Woohoo! Can't wait to see Angie

"Angie"

q w e r t y u i o p

a s d f g h j k l

↑ z x c v b n m ↵

123

space

return





# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Inputs

Calibration

Implicit Feedback

Explicit Feedback

Corrections



# Corrections

Corrections allows people to fix a mistake a model has made using known tasks



Sounds good! Are you bringing Angie with you?

Delivered

Yes of course! She wouldn't want to miss it!

Woohoo! Can't wait to see Angie

"Angie"

q w e r t y u i o p

a s d f g h j k l

↑ z x c v b n m ↵

123

space

return

































# Corrections



# Corrections

Allow corrections through familiar ways



# Corrections

Allow corrections through familiar ways

Provide immediate value



# Corrections

Allow corrections through familiar ways

Provide immediate value

Use corrections as implicit feedback



# Interface

## Outputs

Multiple Options

Attributions

Confidence

Limitations

## Inputs

Calibration

Implicit Feedback

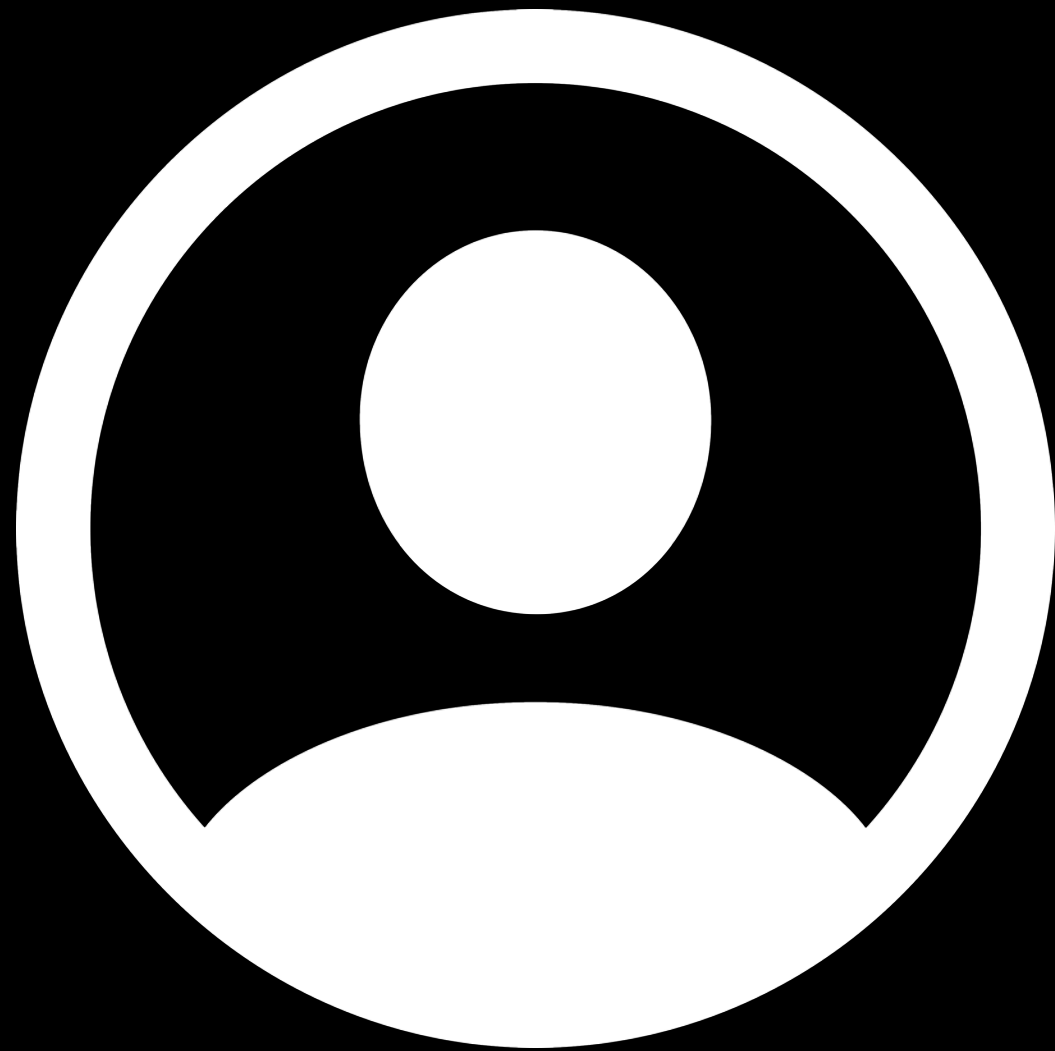
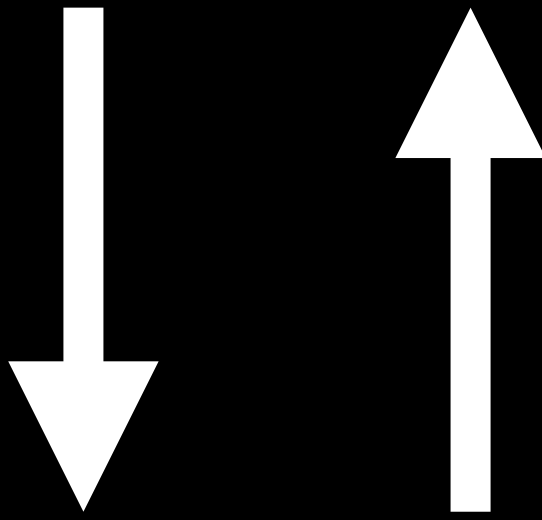
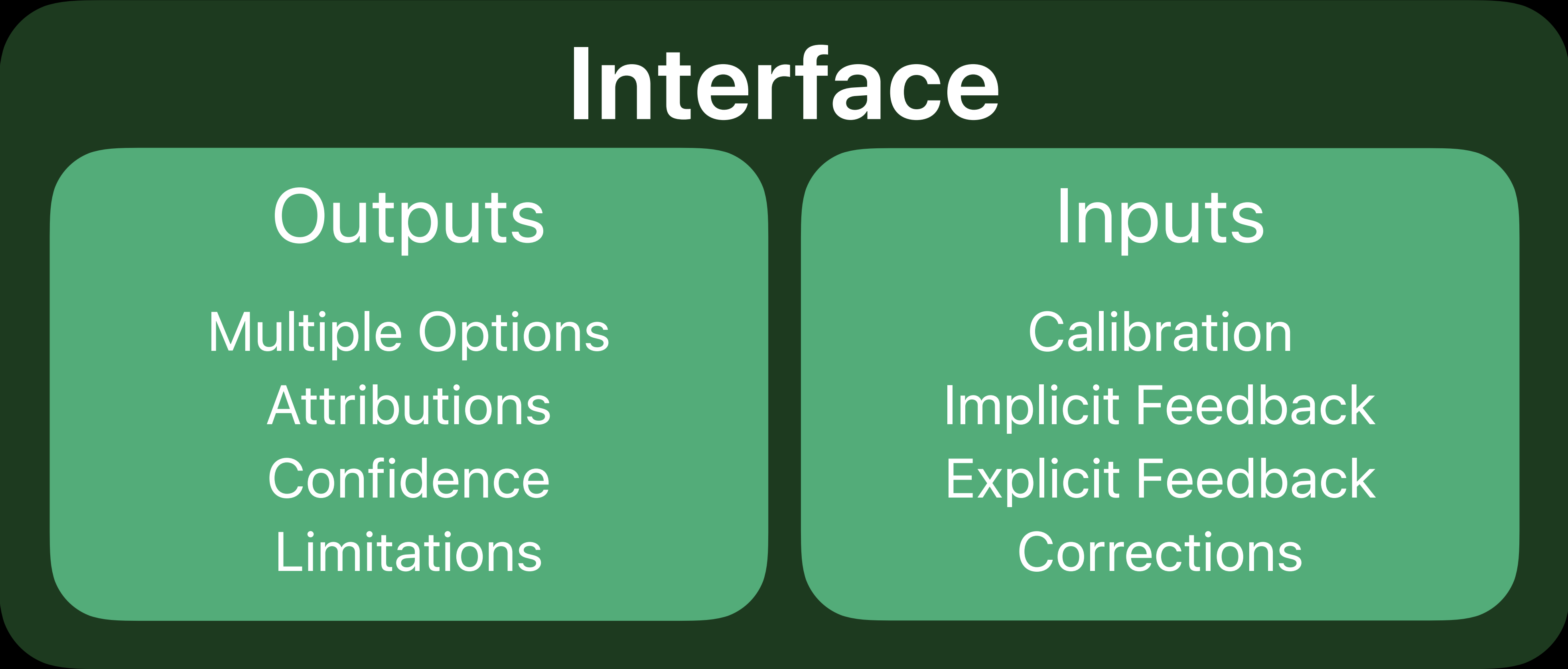
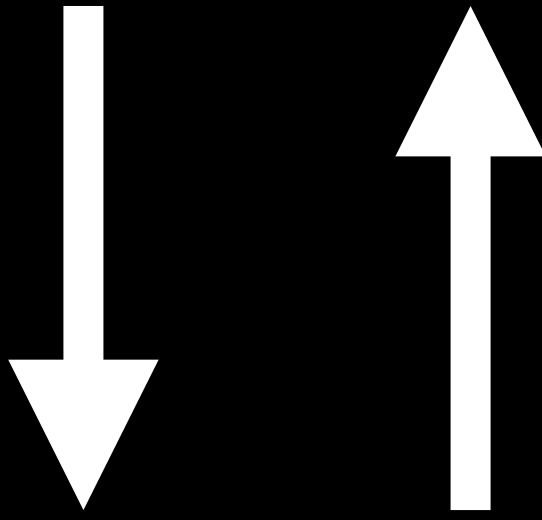
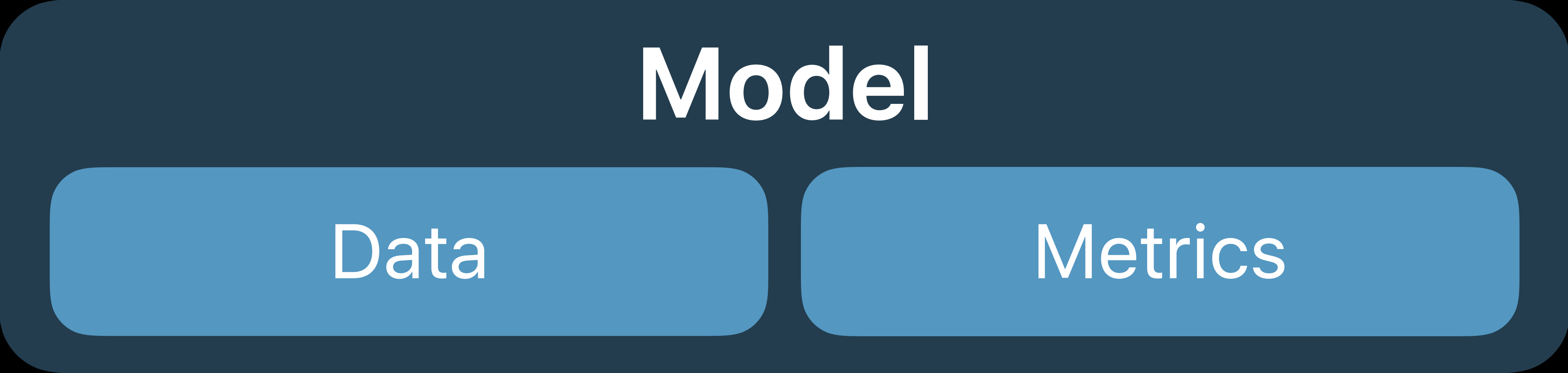
Explicit Feedback

Corrections



Respect people's work















# Attention management



Attention management  
Great recommendations



Attention management  
Great recommendations  
Contextual information



Attention management  
Great recommendations  
Contextual information  
Automate mundane tasks



... and much more.





Be Healthy



A close-up, slightly blurred photograph of a person's hand holding a black smartphone. The person has a beard and is wearing a grey sweater. The background is out of focus, showing what appears to be a doorway or a window. Overlaid on the center of the image is the text "Be Inclusive" in a large, white, sans-serif font.

**Be Inclusive**



Be Safe







Be Creative



Elevate the best of humanity



[developer.apple.com/design/human-interface-guidelines/machine-learning](https://developer.apple.com/design/human-interface-guidelines/machine-learning)



# More Information

[developer.apple.com/wwdc2019/803](https://developer.apple.com/wwdc2019/803)

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Design Lab

Friday, 12:00

---

Machine Learning Lab

Friday, 2:00

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