

#WWDC19

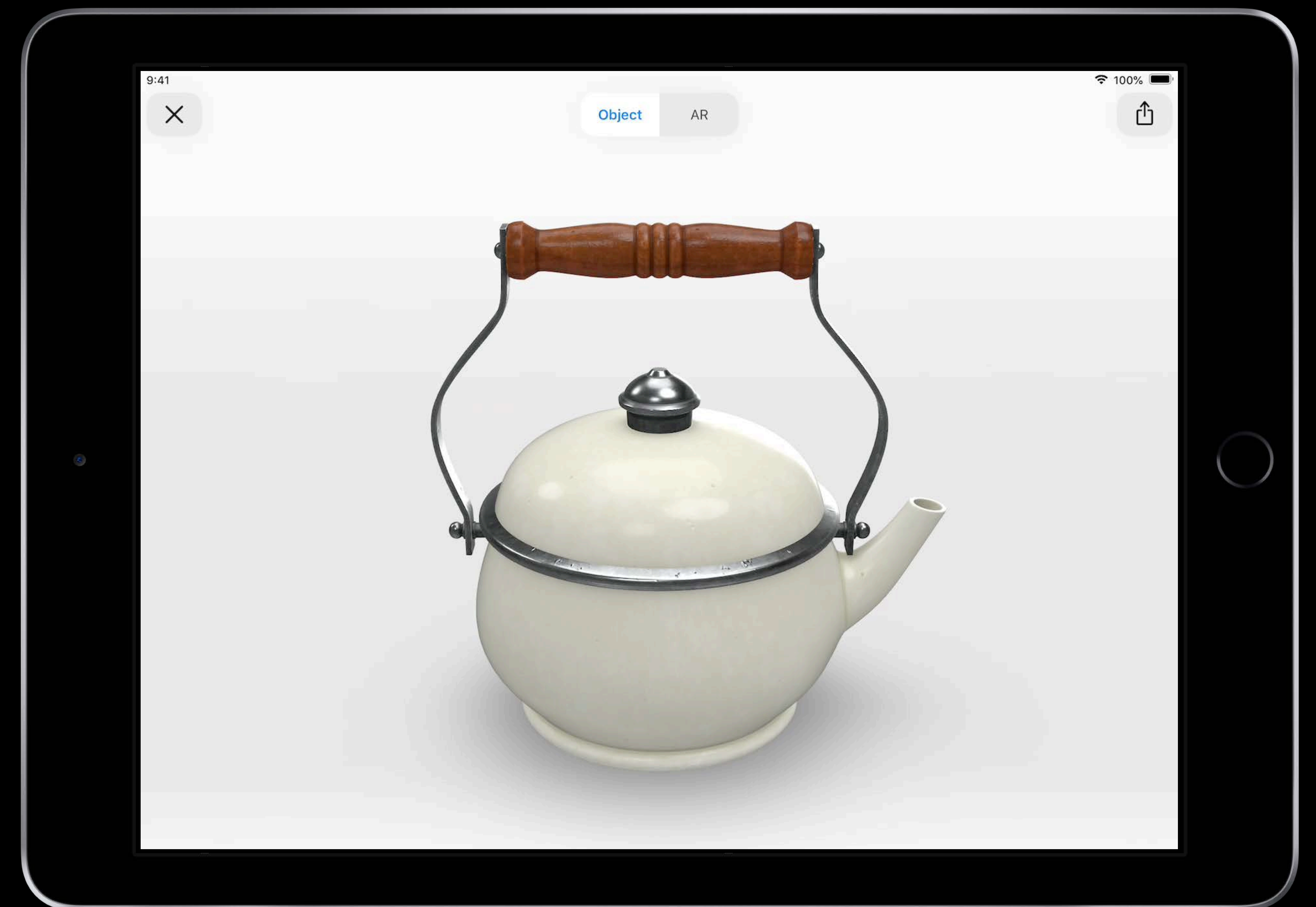
Advances in AR Quick Look

David Lui, ARKit Engineering
Jerry Yu, ARKit Engineering

AR Quick Look

iOS 12

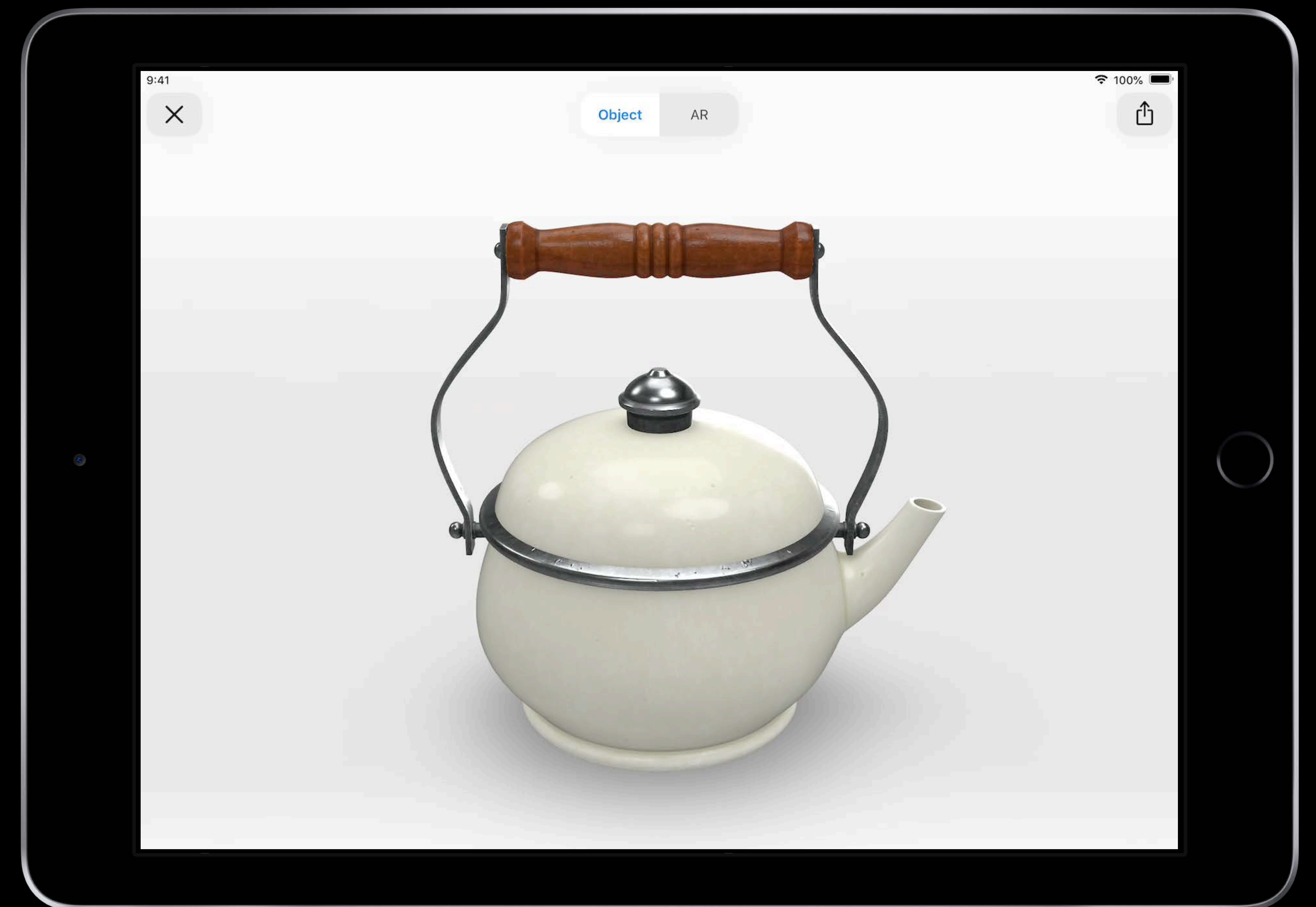
Really easy to see 3D content in the world



AR Quick Look

iOS 12

Really easy to see 3D content in the world

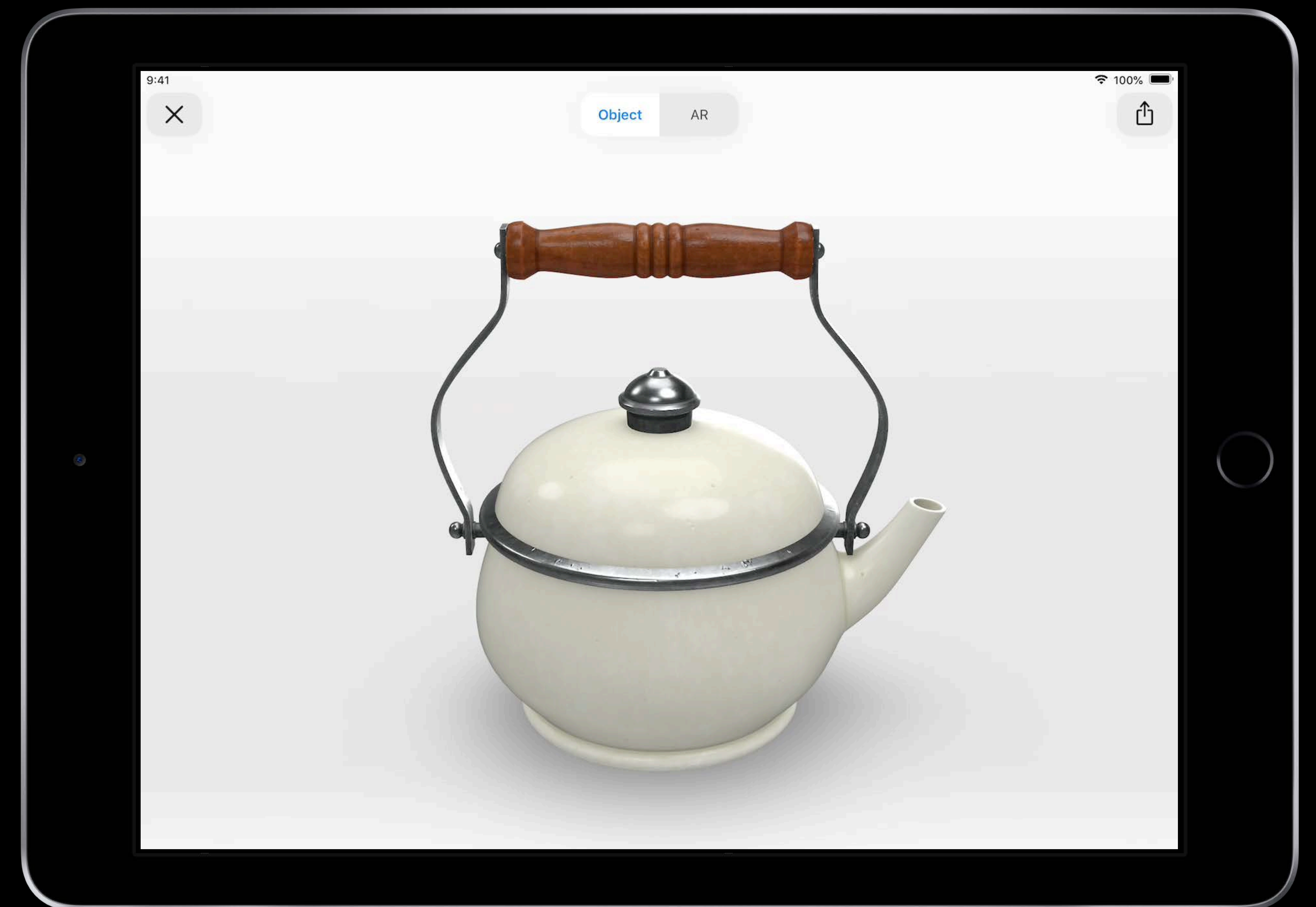


AR Quick Look

iOS 12

Really easy to see 3D content in the world

Realistic model previewing



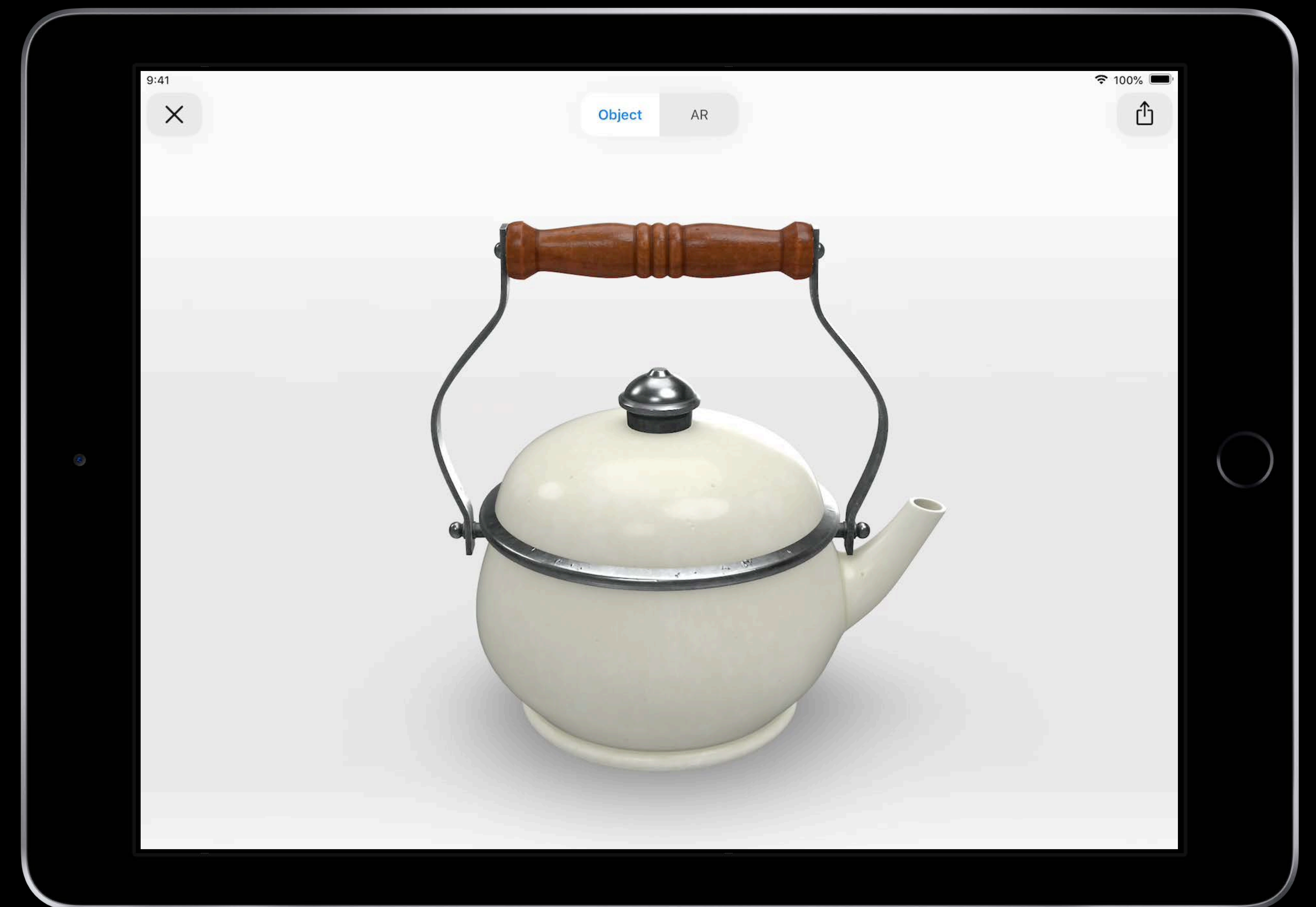
AR Quick Look

iOS 12

Really easy to see 3D content in the world

Realistic model previewing

Available on iOS from web and apps



AR Quick Look

iOS 13

Integration with Reality Composer

AR Quick Look

iOS 13

Integration with Reality Composer

Visual improvements to AR Quick Look

AR Quick Look

iOS 13

Integration with Reality Composer

Visual improvements to AR Quick Look

Enhancements to the viewing experience

AR Quick Look

iOS 13

Integration with Reality Composer

Visual improvements to AR Quick Look

Enhancements to the viewing experience

Web integration and customization

AR Quick Look

iOS 13

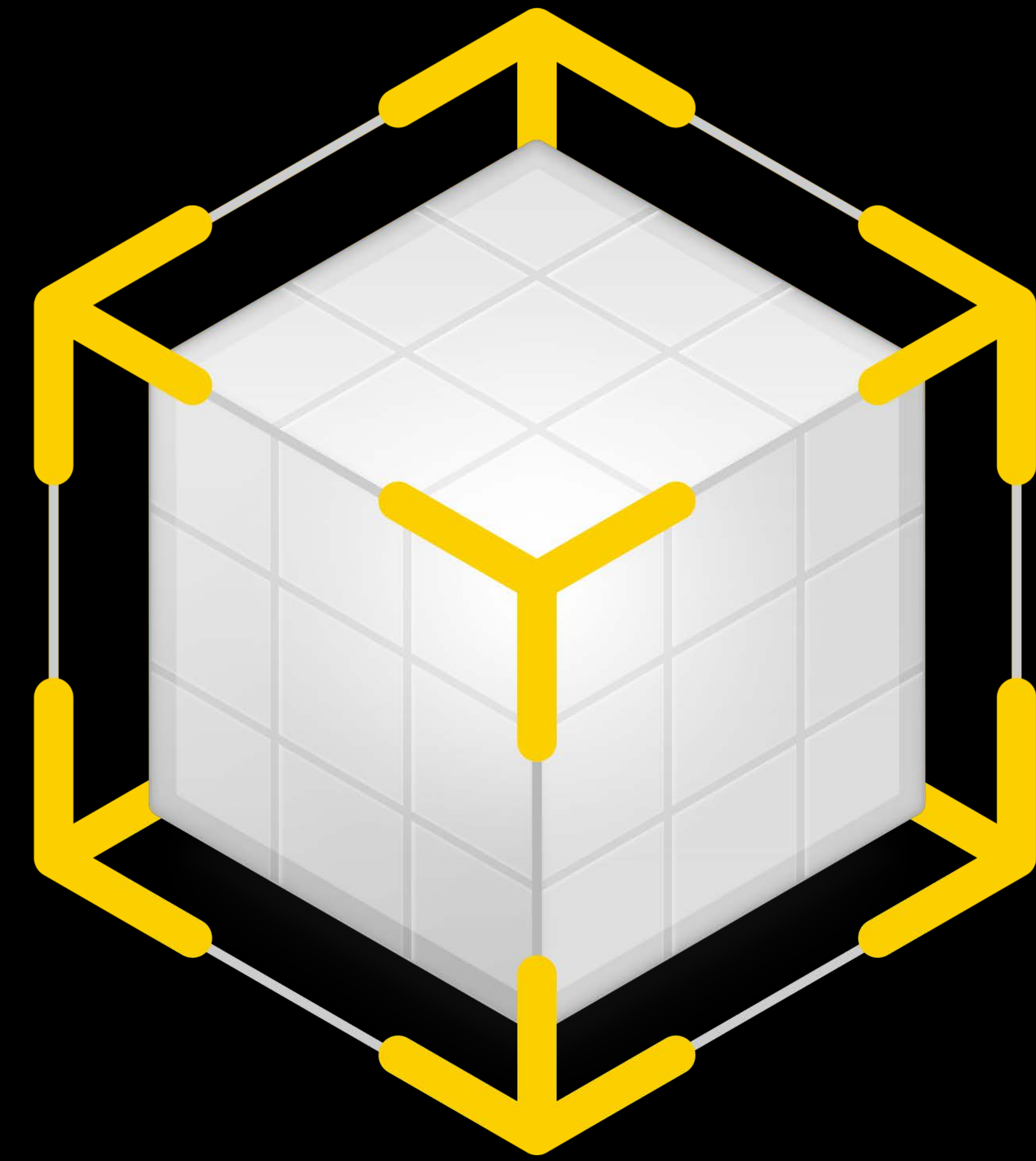
Integration with Reality Composer

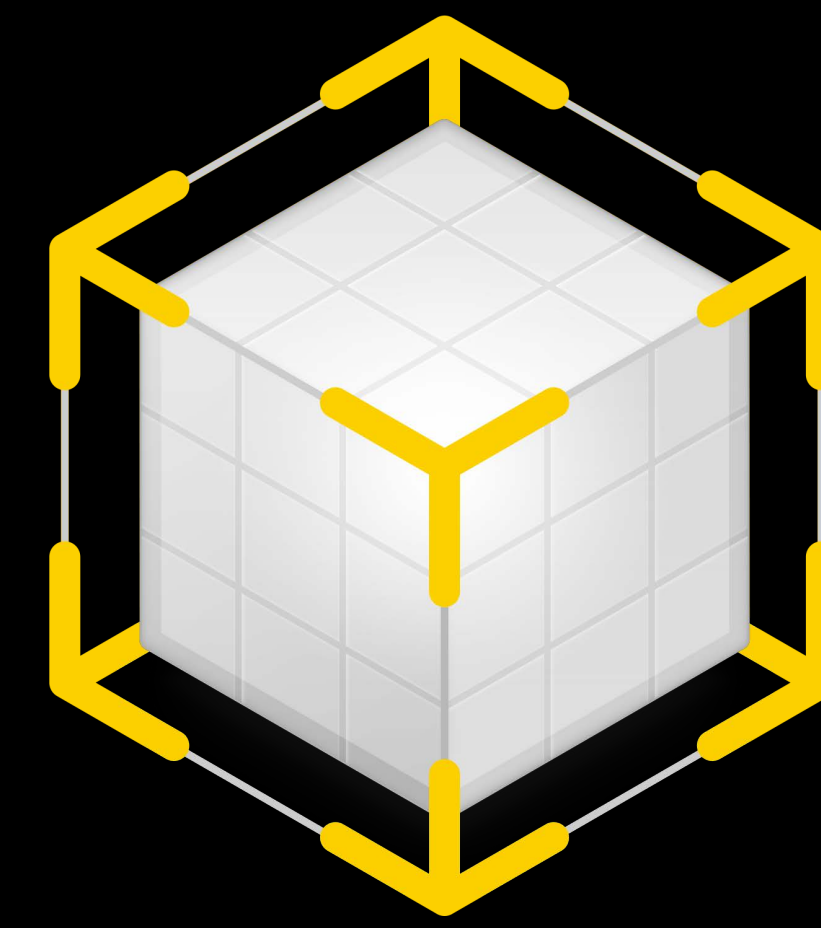
Visual improvements to AR Quick Look

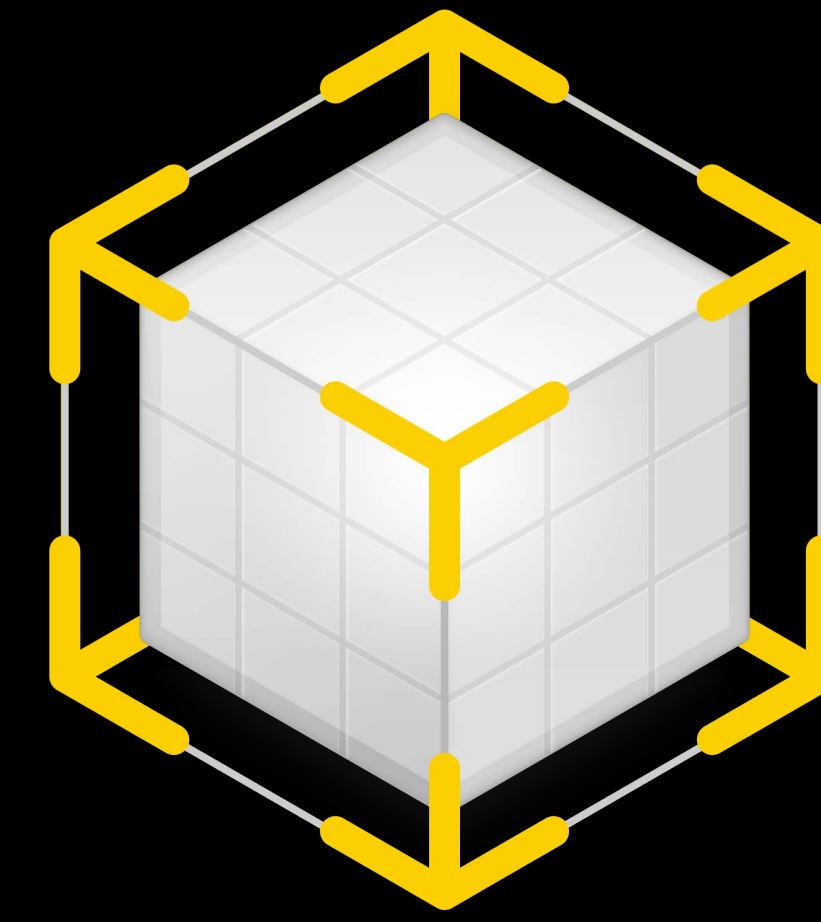
Enhancements to the viewing experience

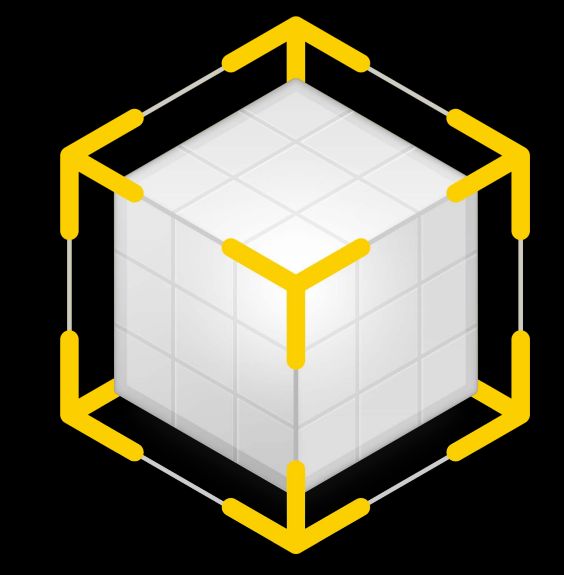
Web integration and customization

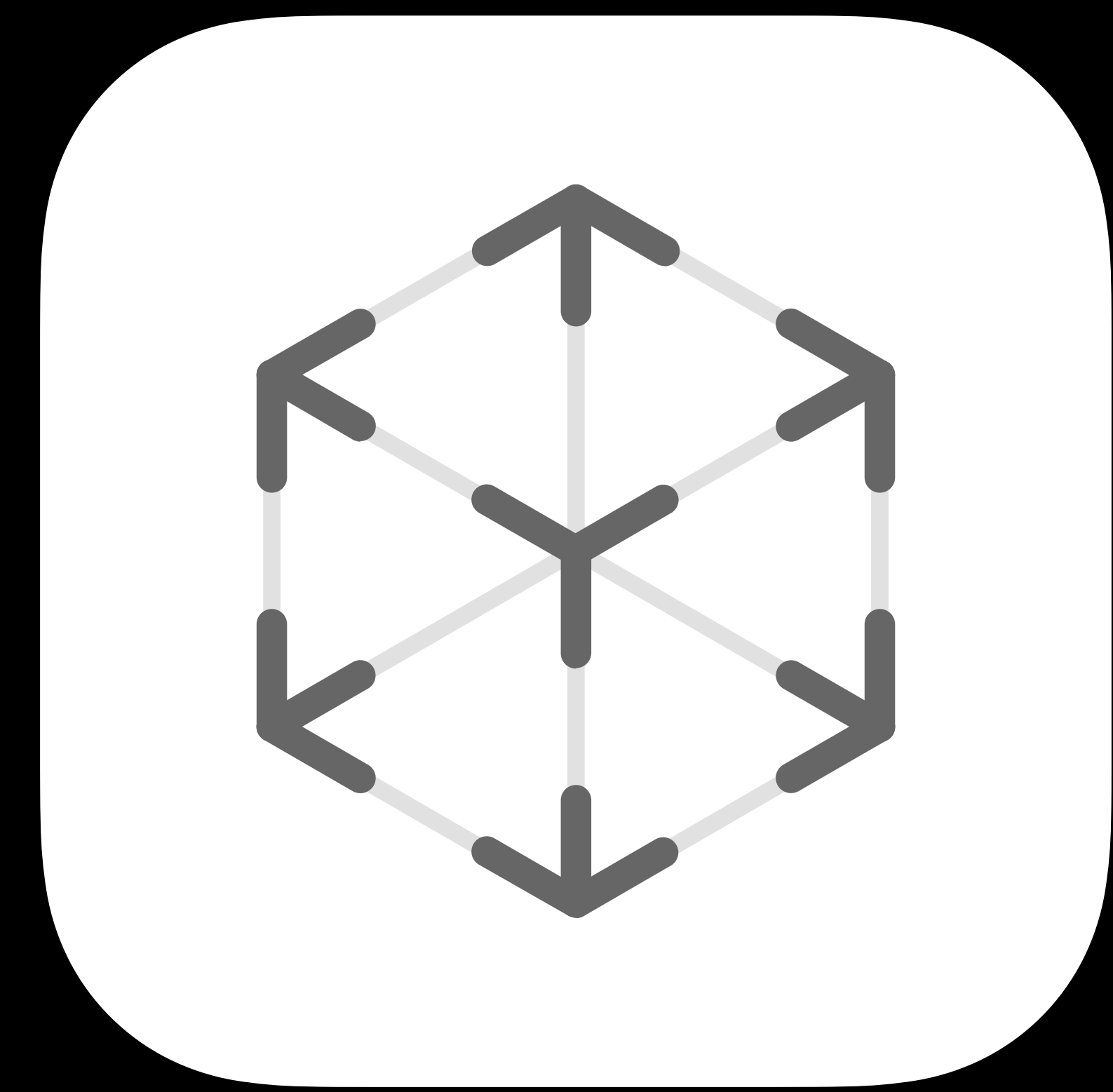
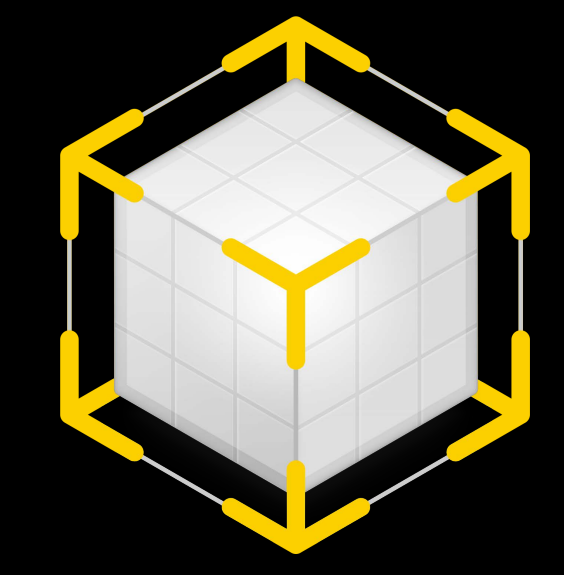
Customizable call to action in AR Quick Look











Color correction

People occlusion

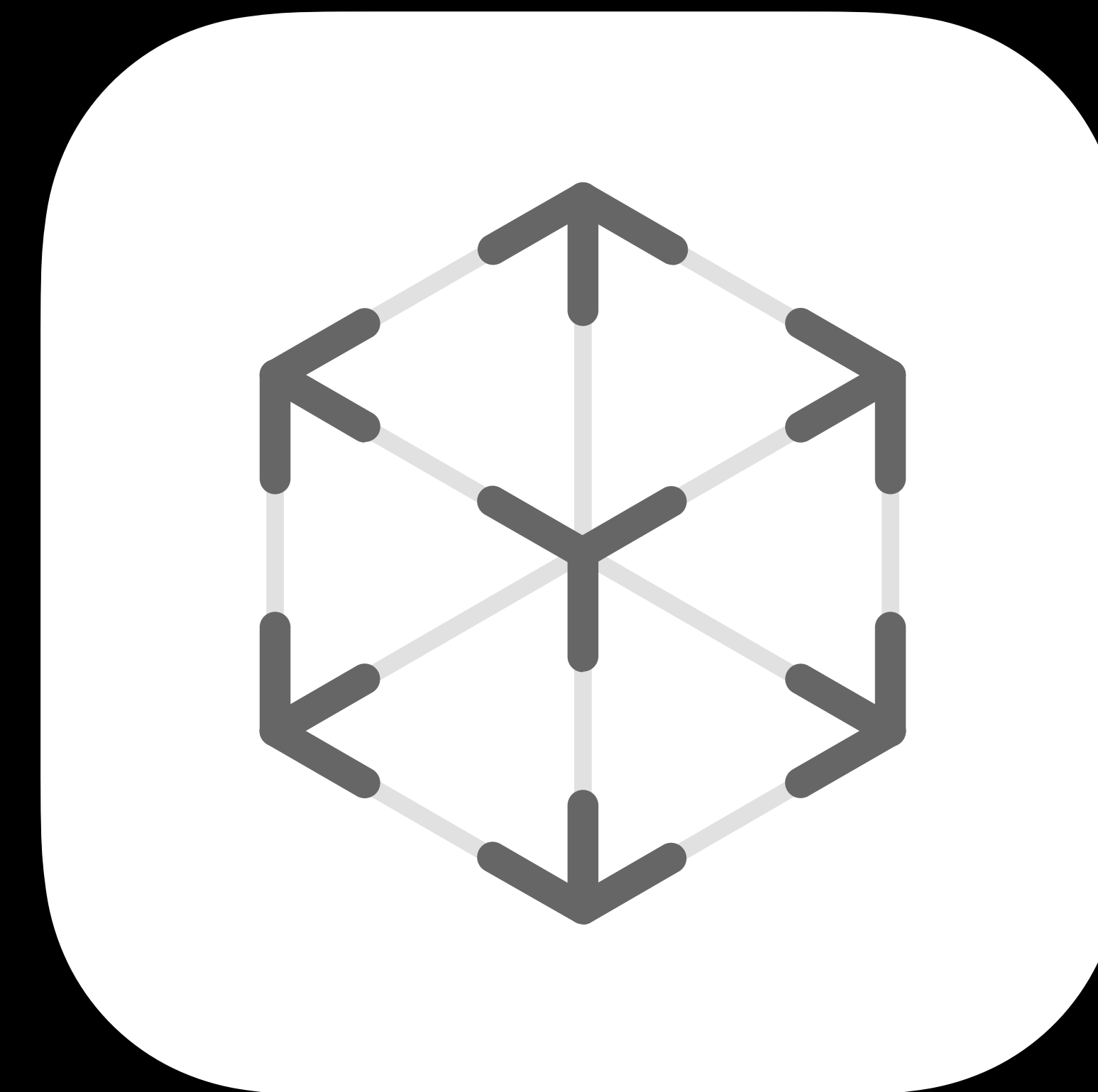
Tone mapping

Camera grain

Automatic quality selection

HDR

Ray-traced shadows



Specular anti-aliasing

Projective shadows

Face occlusion

Depth of field

Motion blur

Clear coat

MSAA

Inertial interactions

Multi-model translation

Launch straight into AR

Collision

Color correction

People occlusion

Ambient and spatial audio

Customization API

Tone mapping

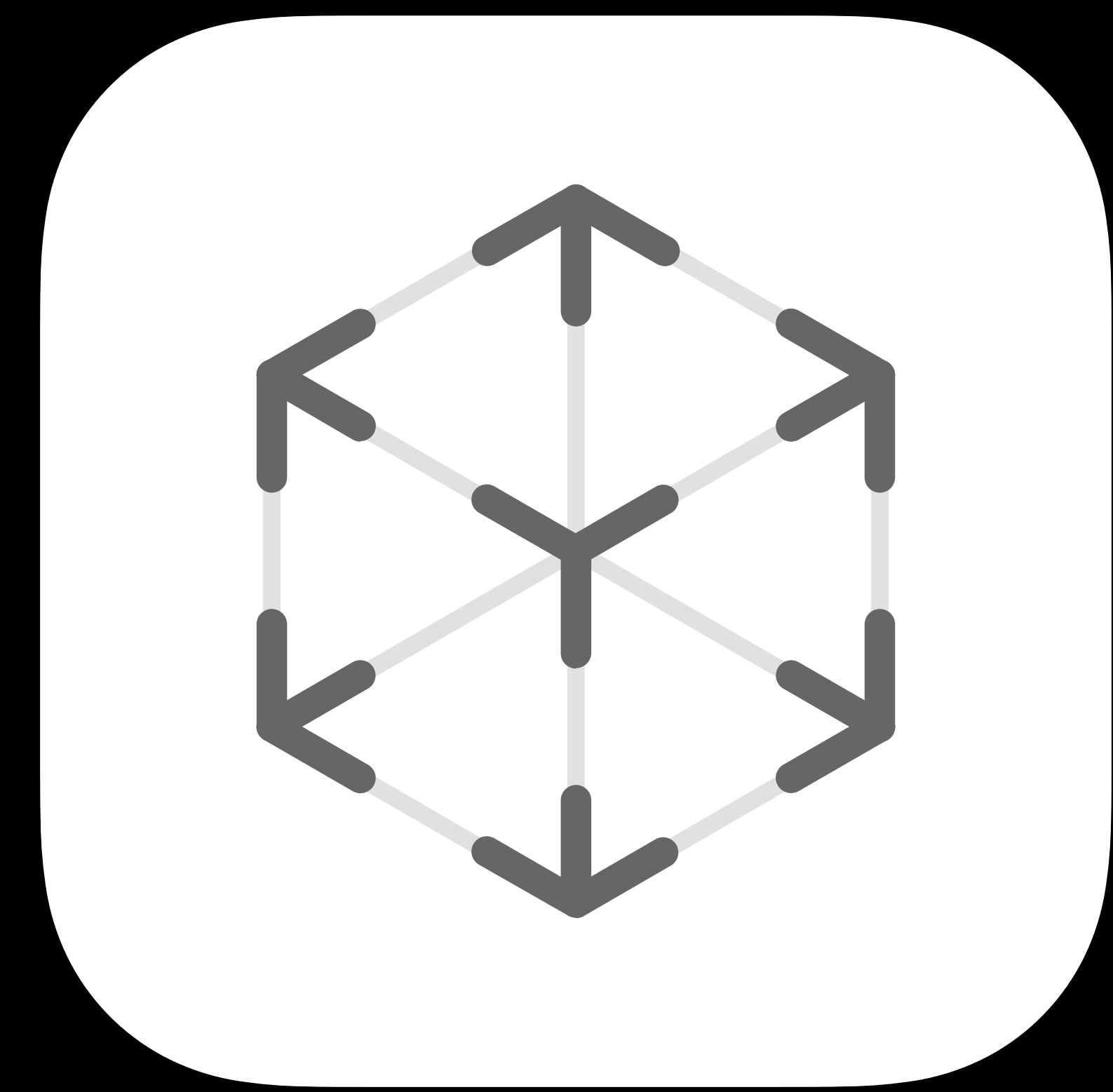
Camera grain

Vertical plane support

Automatic quality selection

HDR

Ray-traced shadows



Specular anti-aliasing

Projective shadows

Face anchoring

Face occlusion

Depth of field

Video recording

Dark Mode

Motion blur

Clear coat

MSAA

Triggers and behaviors

Animation scrubber

Physics

Multiple model viewing

Image anchoring

Object anchoring

Levitate gesture

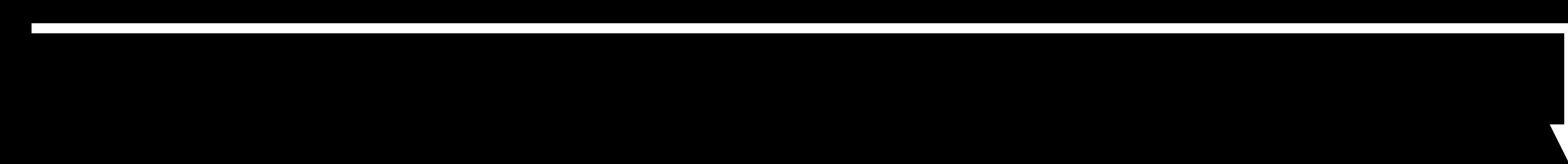
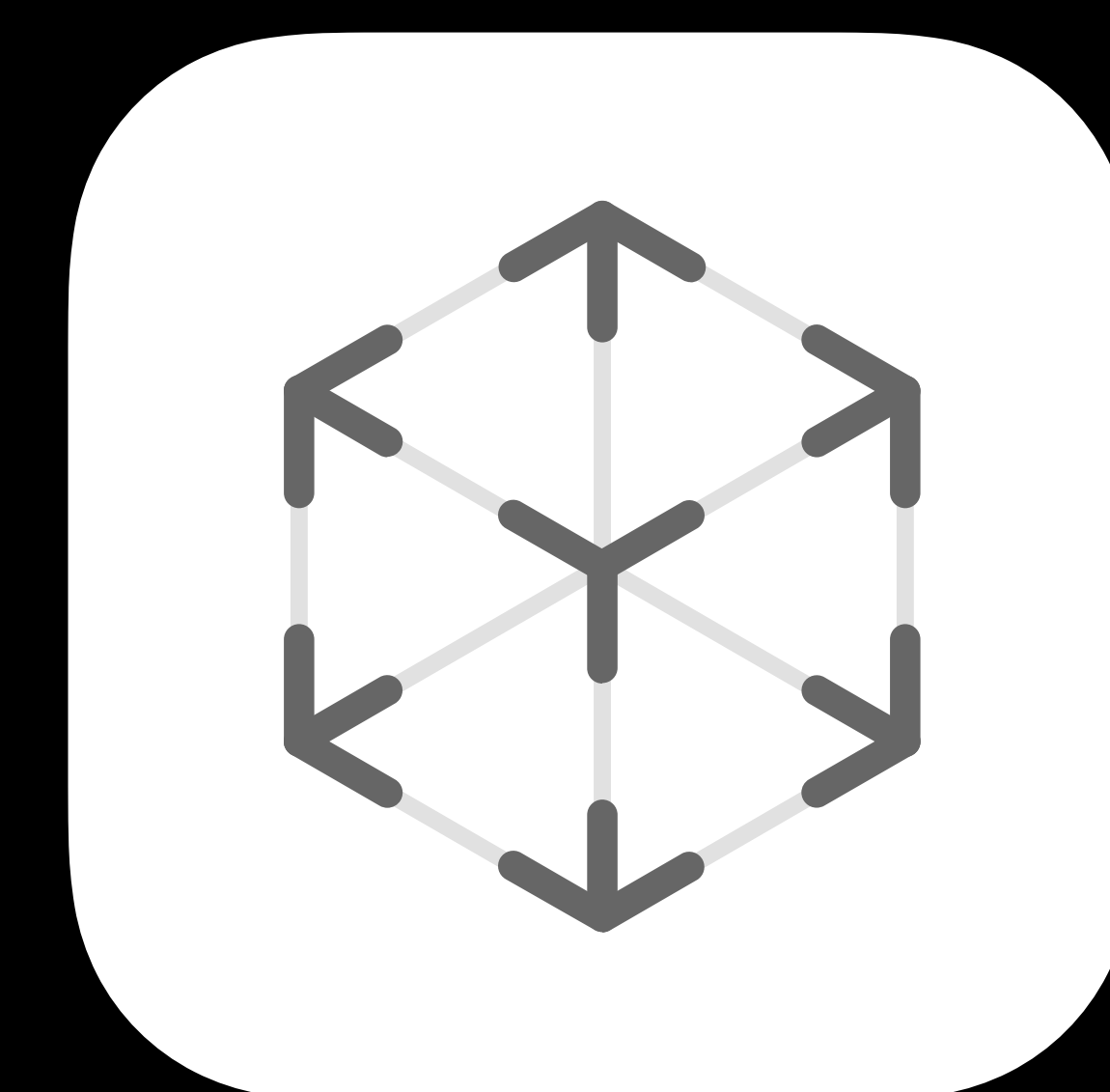
Integration with Reality Composer

3D Modeling
Software

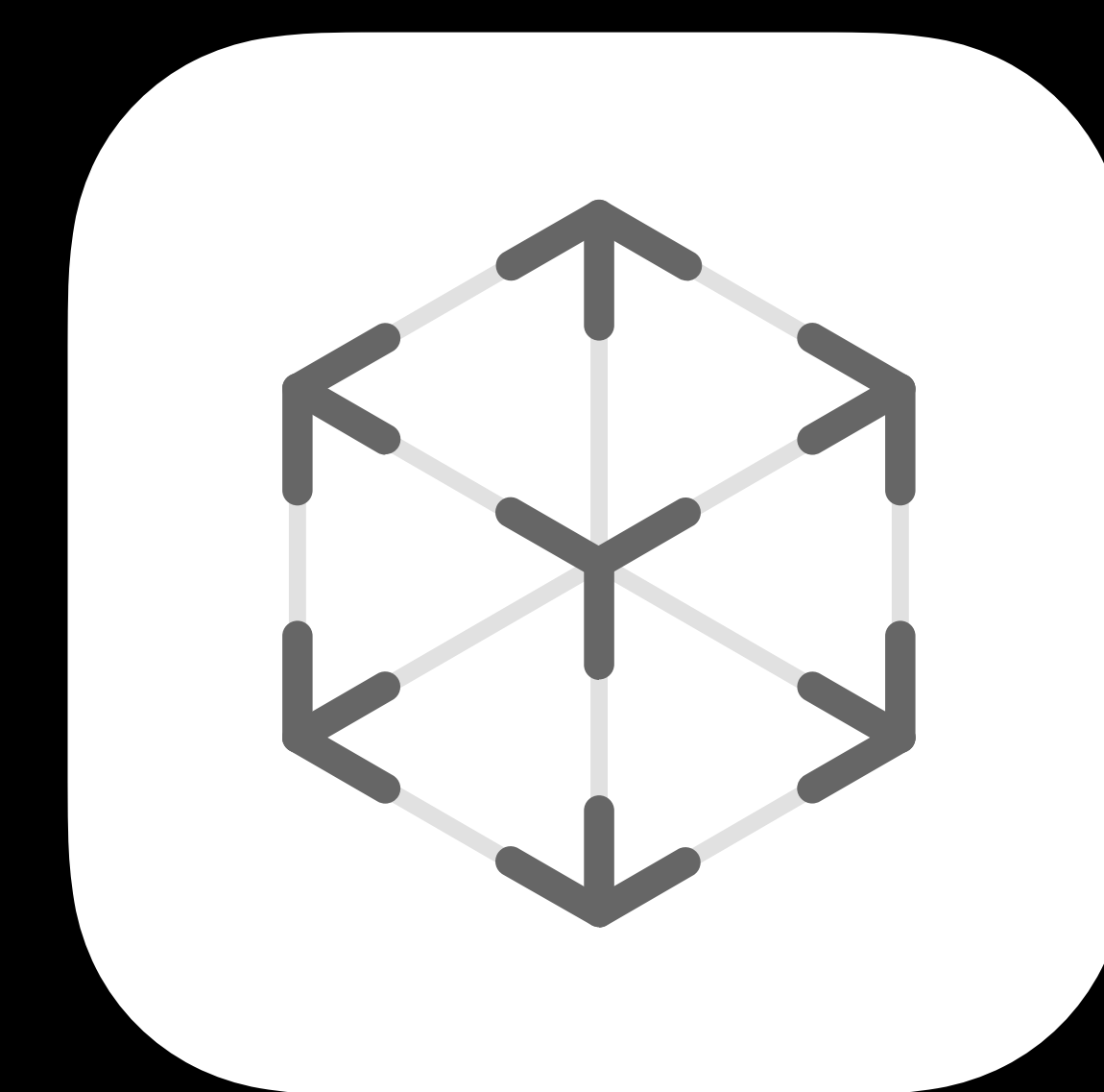
3D Modeling
Software



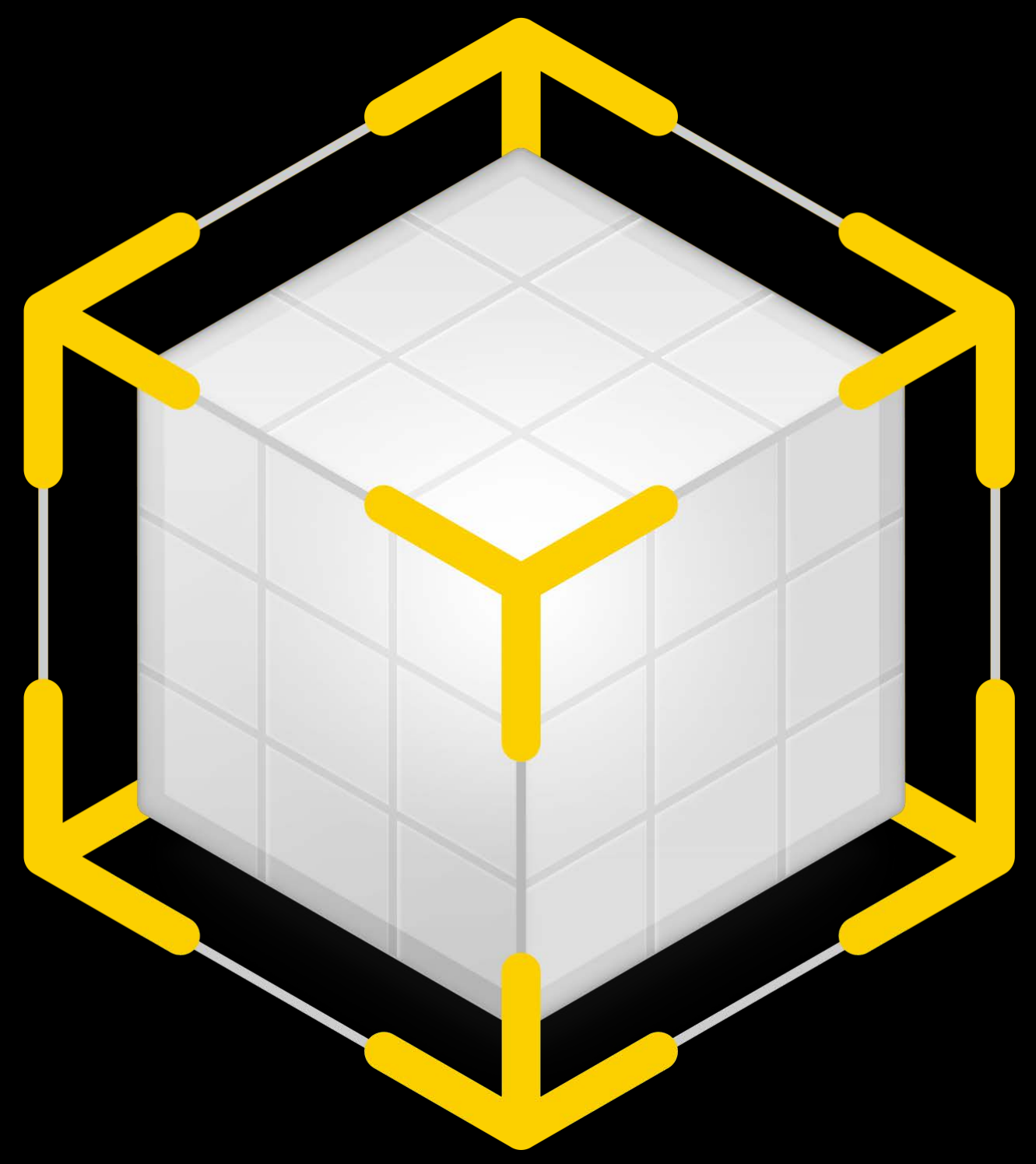
3D Modeling
Software



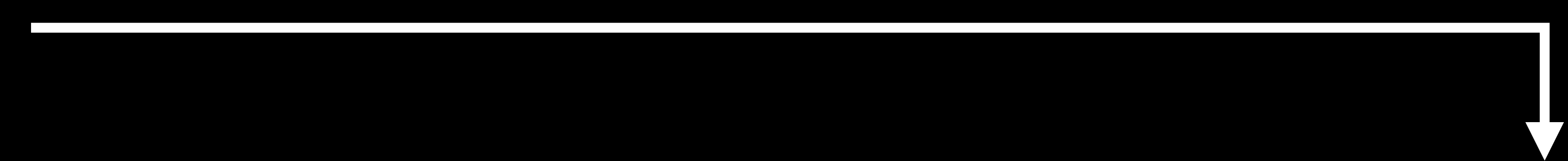
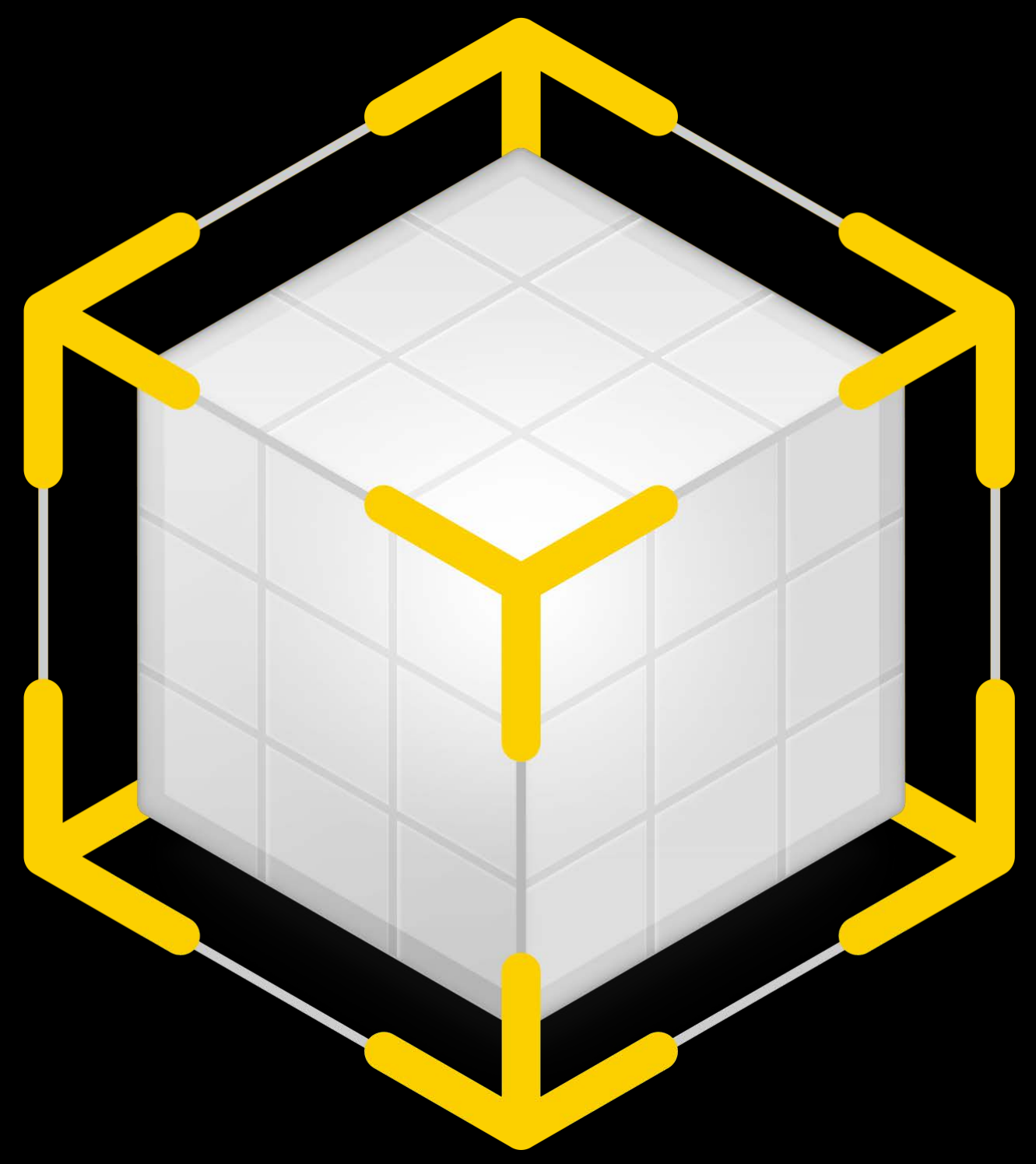
3D Modeling
Software

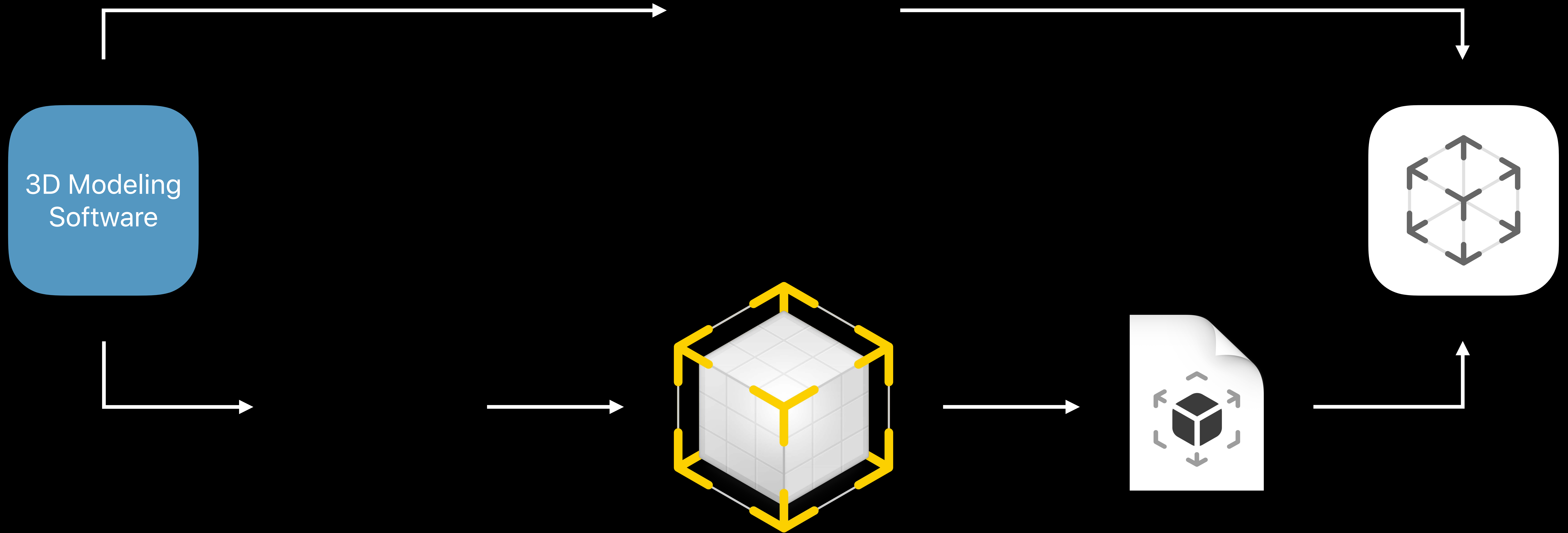


3D Modeling
Software

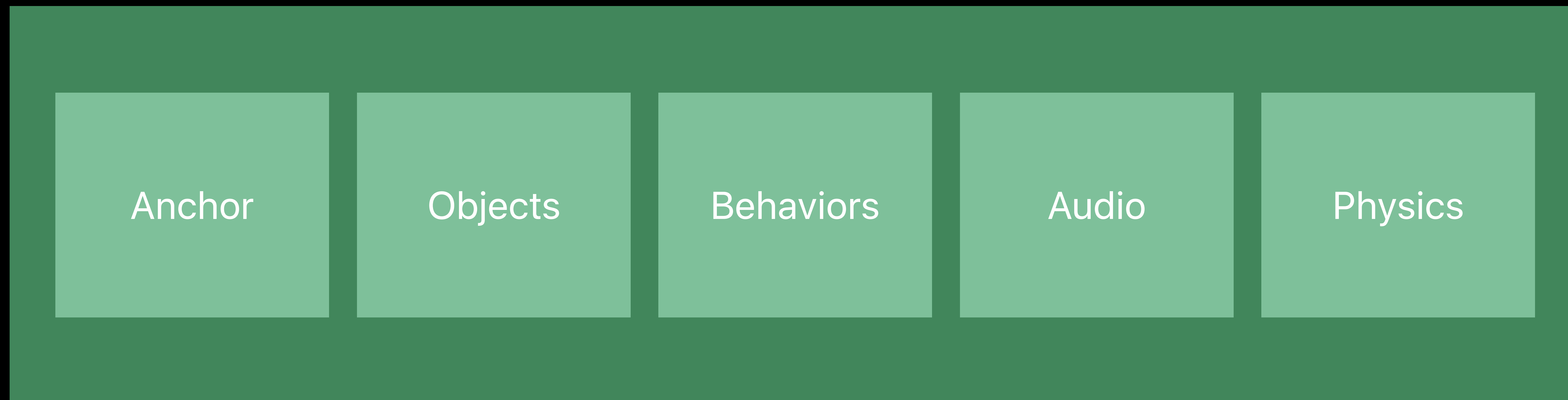


3D Modeling
Software





Anatomy of a Scene



Anatomy of a Scene

Anchor

Objects

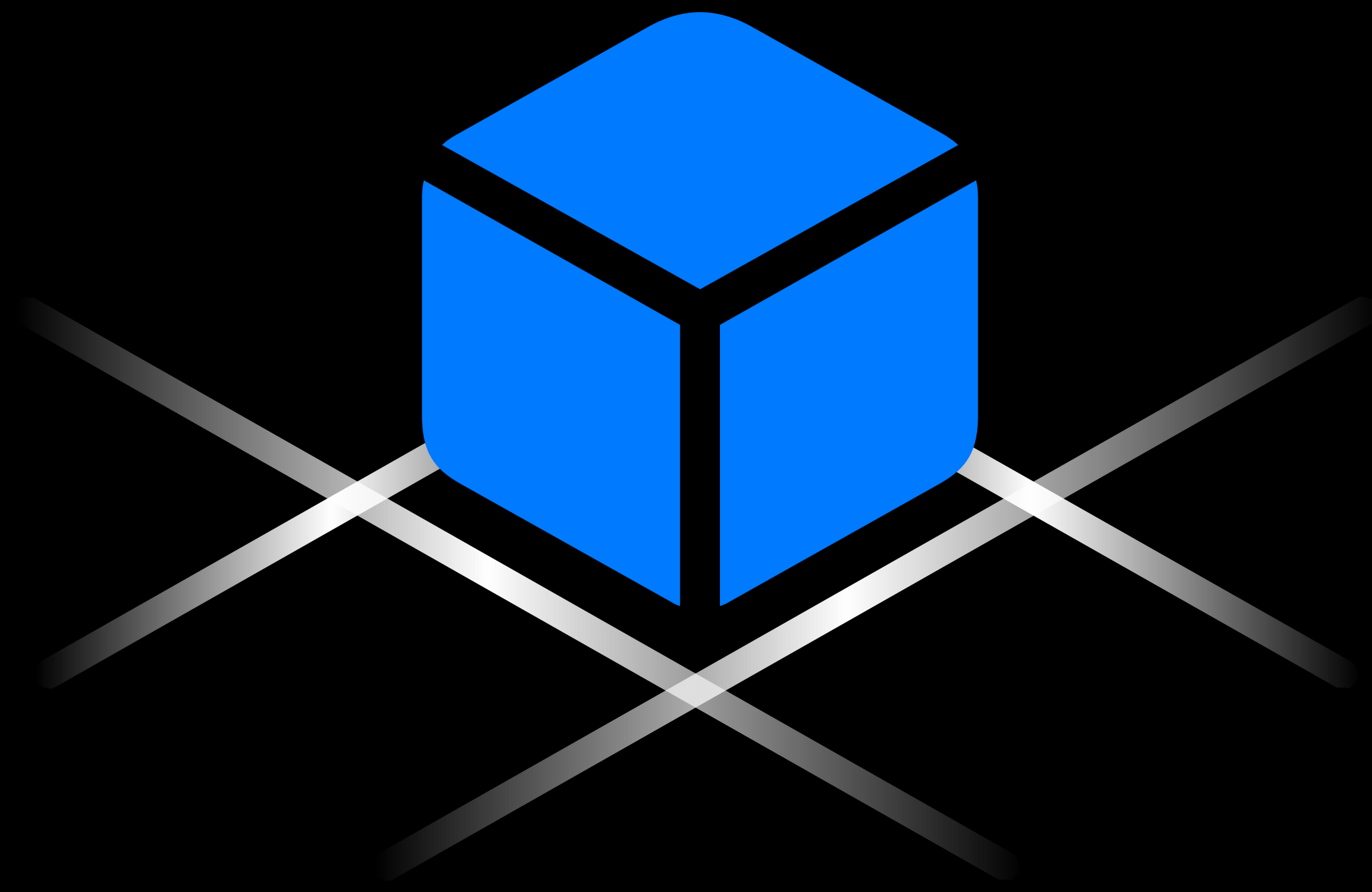
Behaviors

Audio

Physics

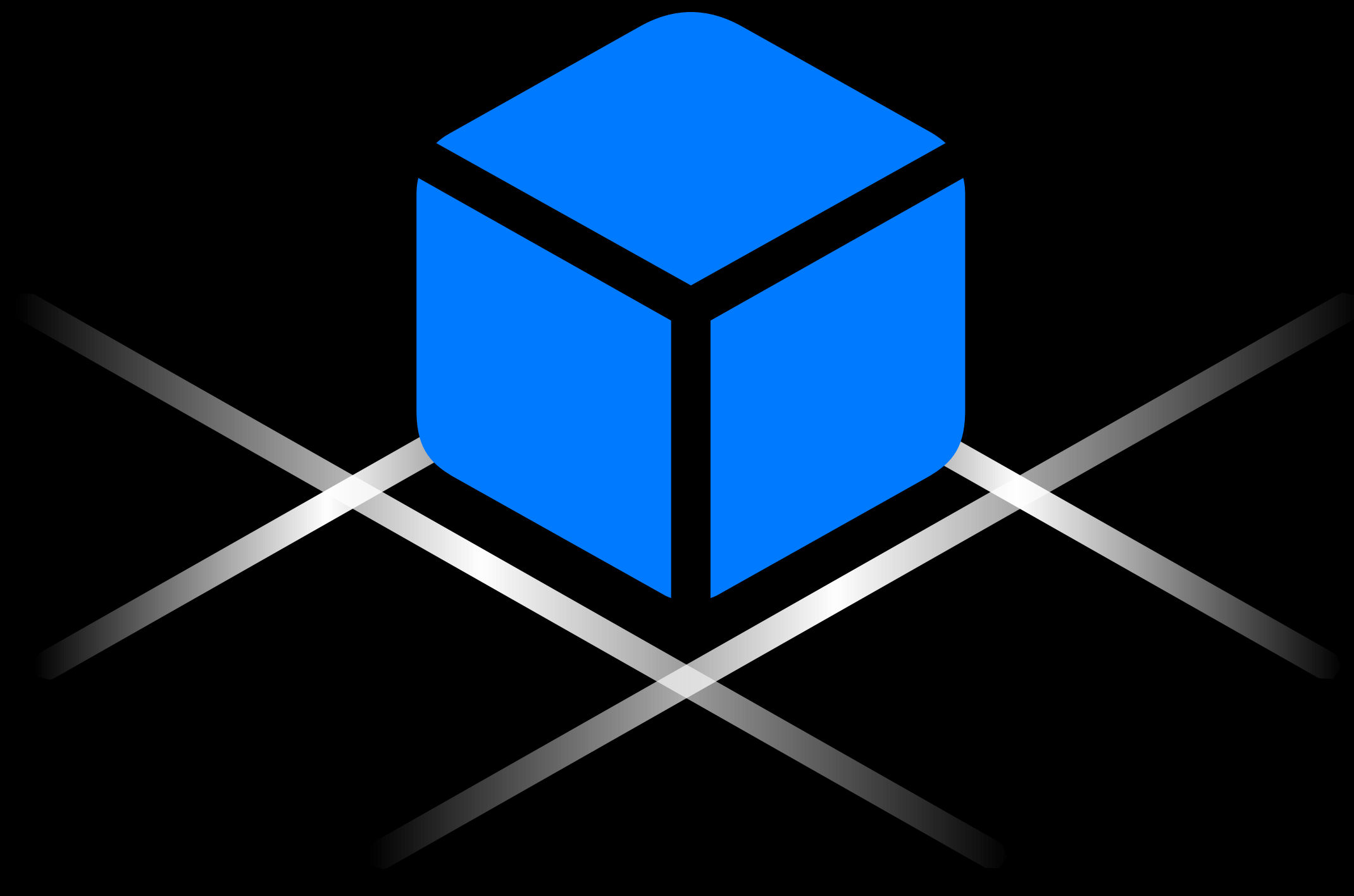
Anchors

Anchors

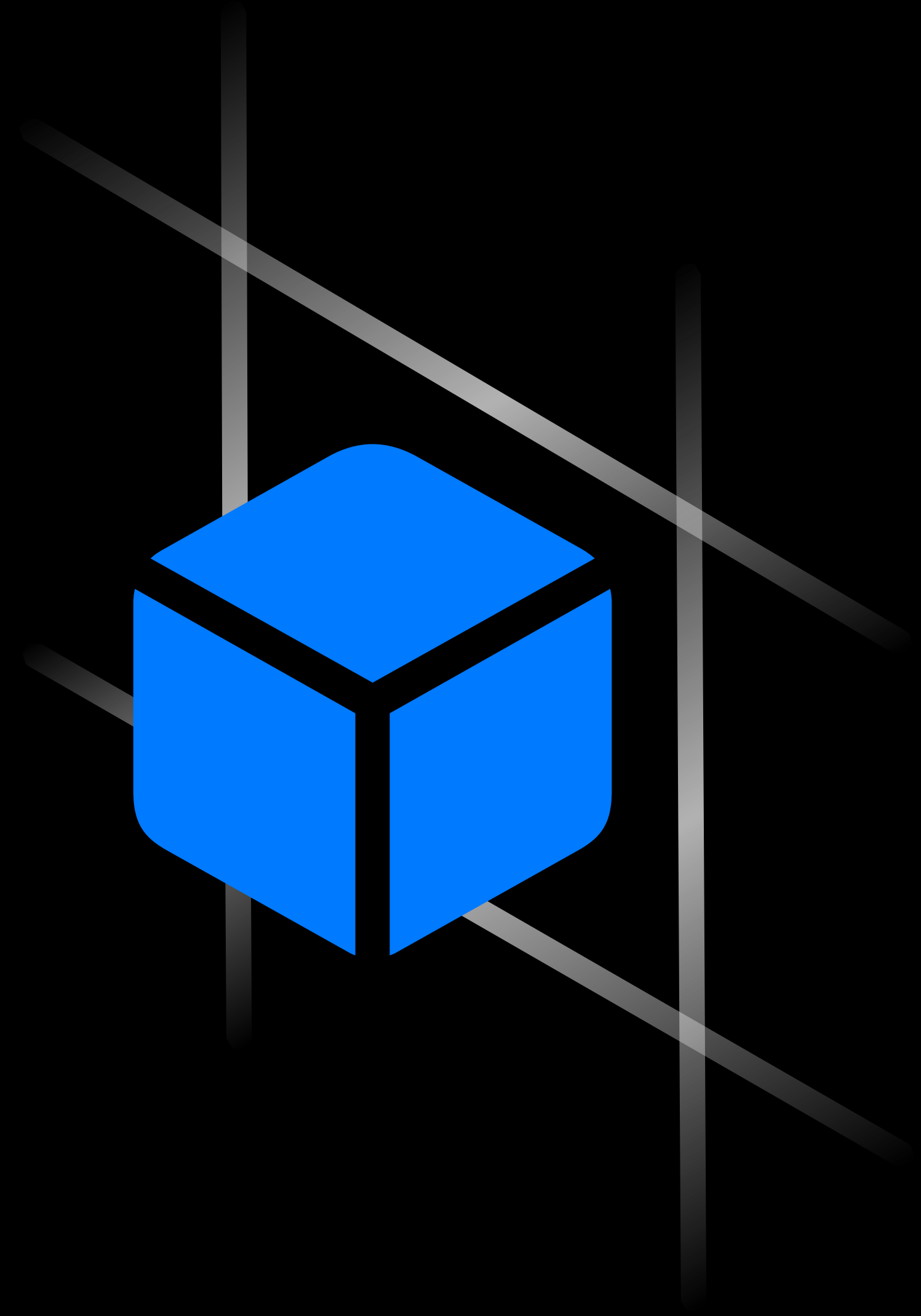


Horizontal

Anchors

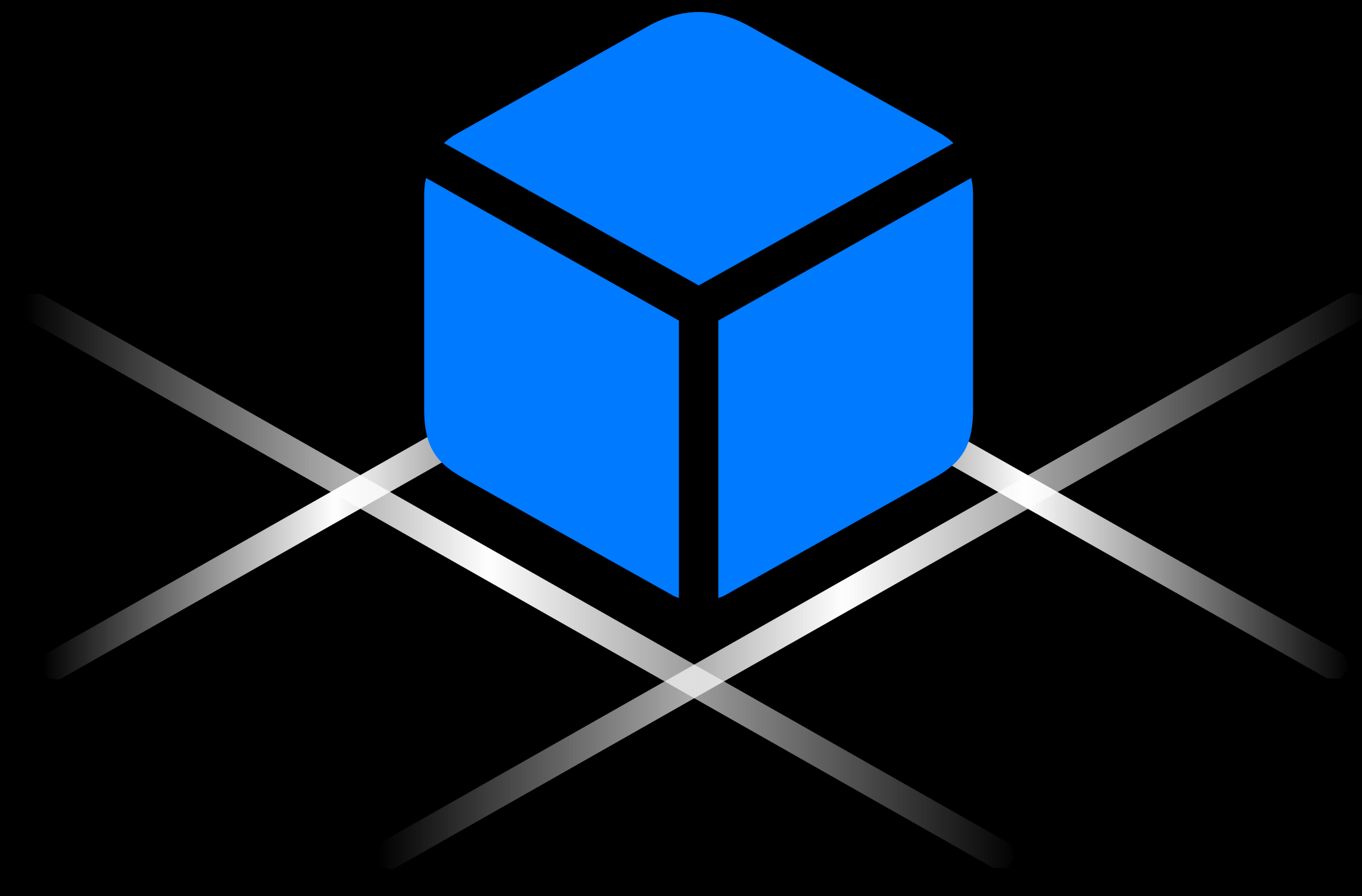


Horizontal

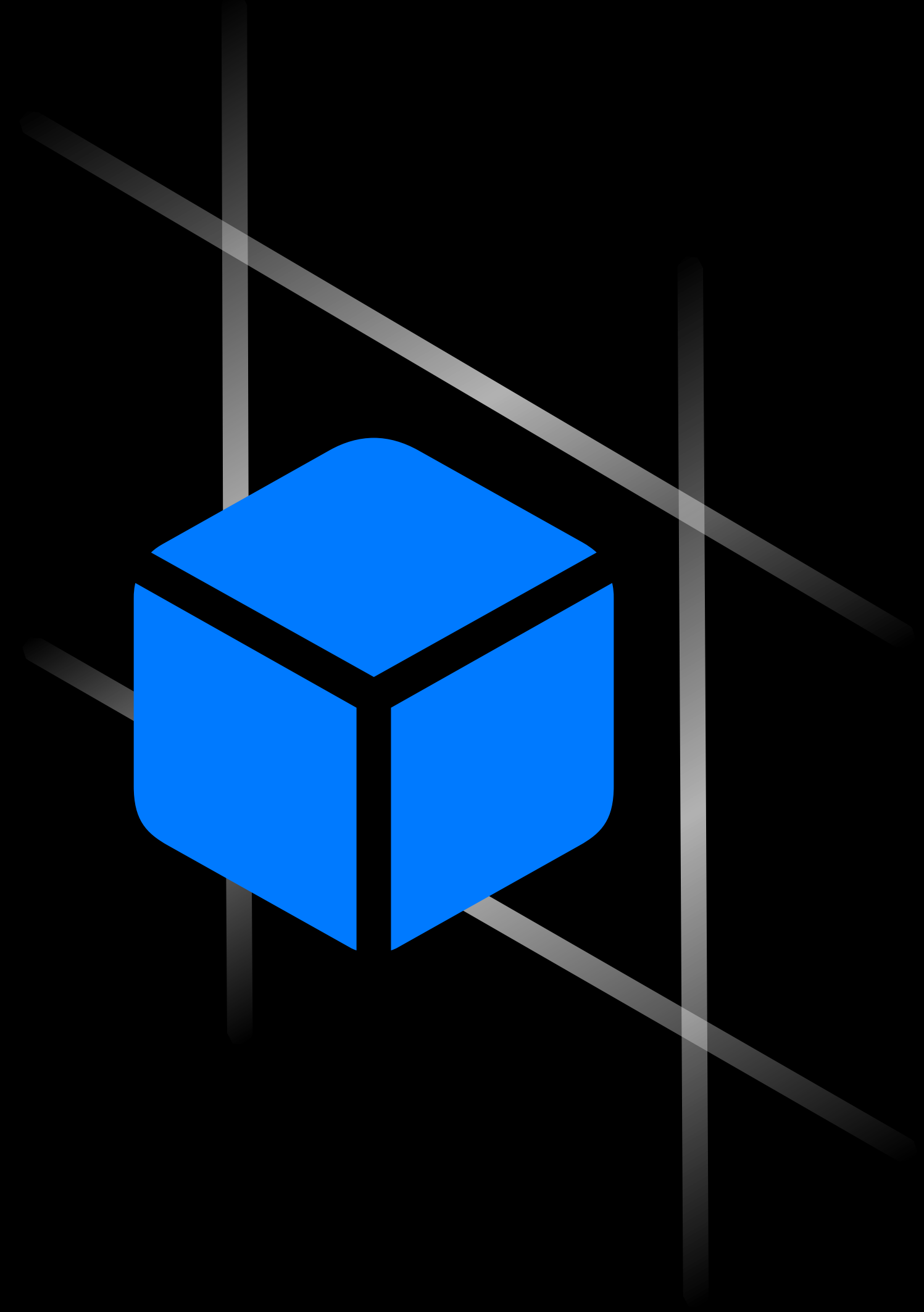


Vertical

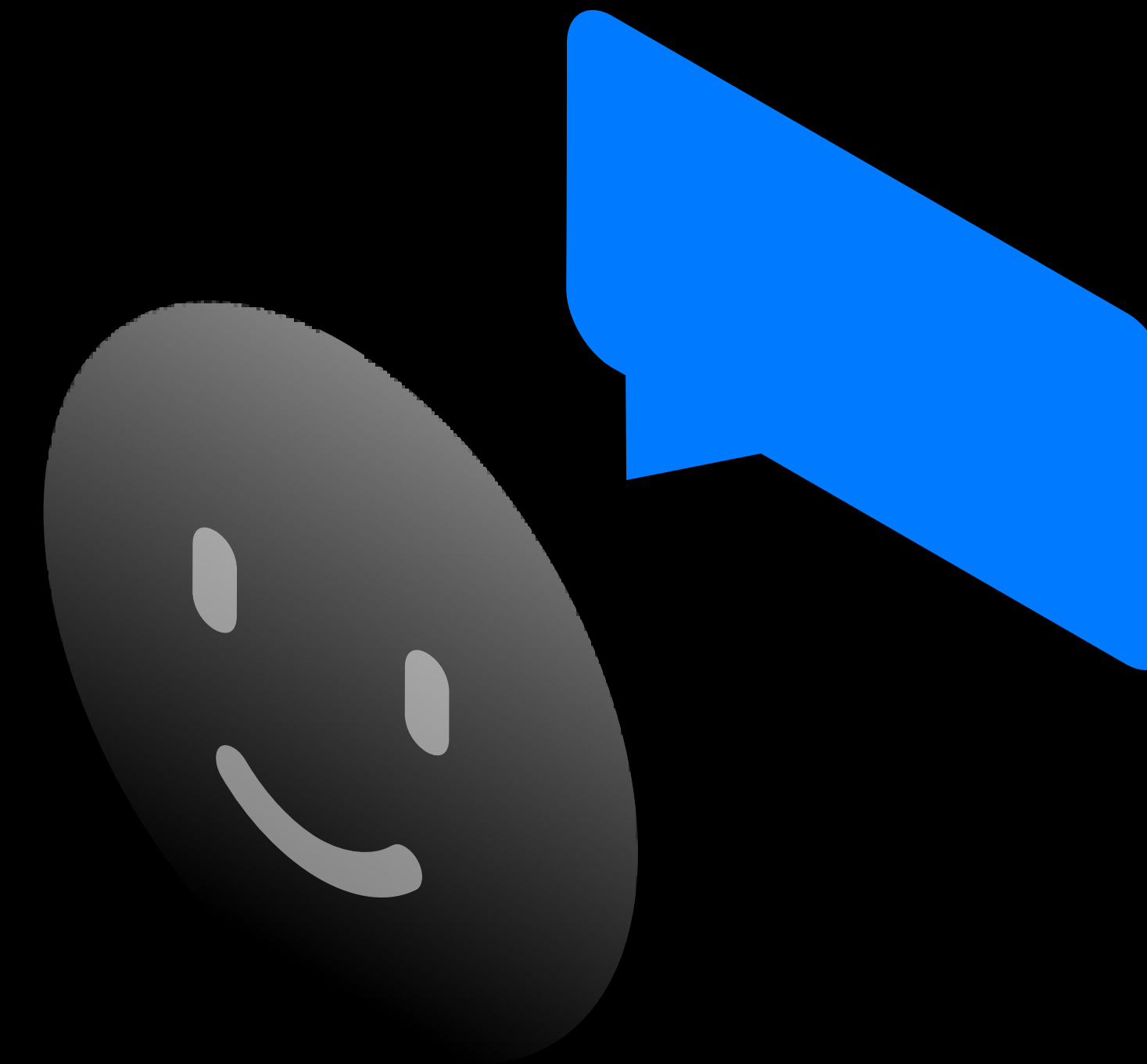
Anchors



Horizontal

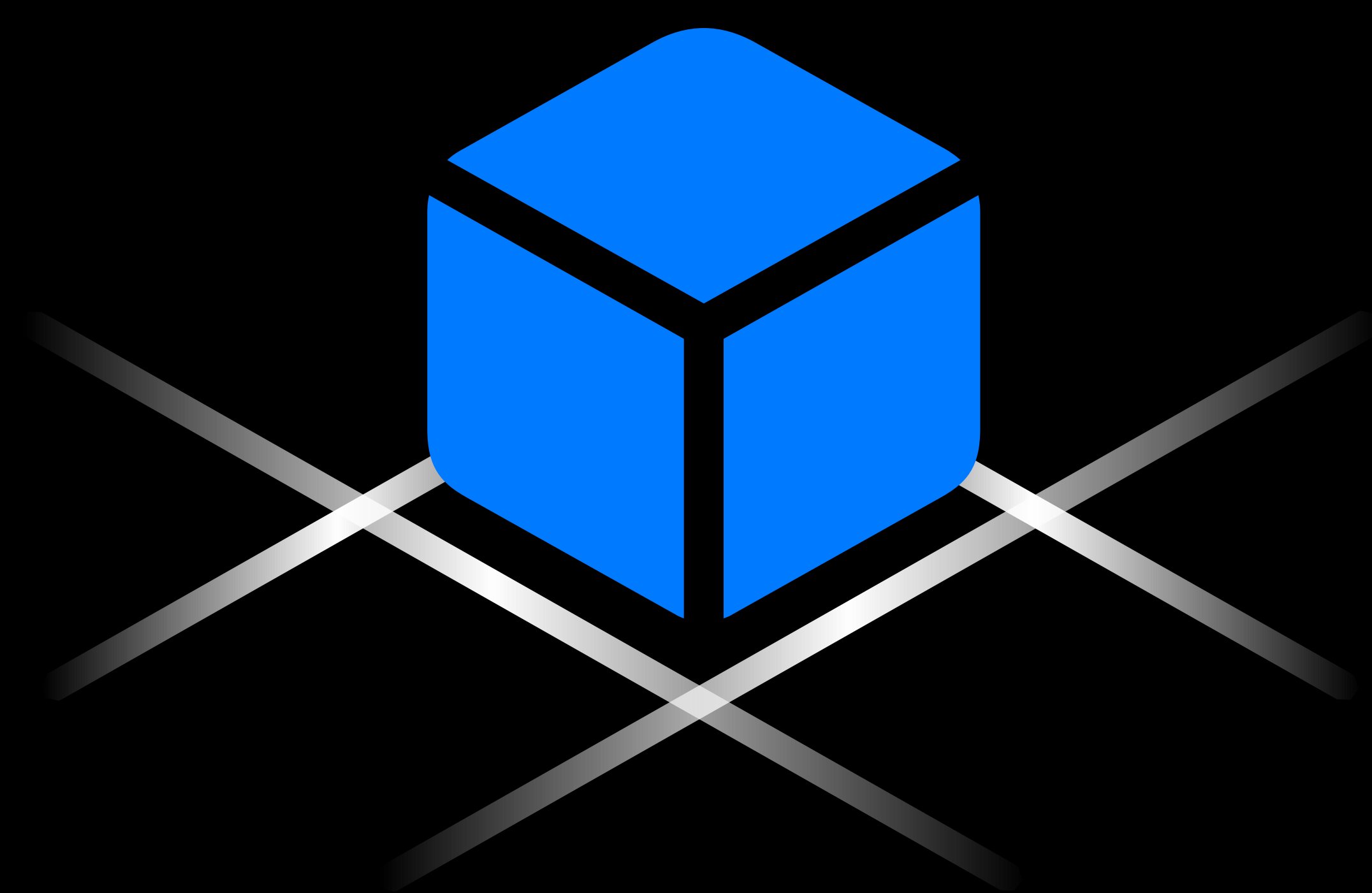


Vertical

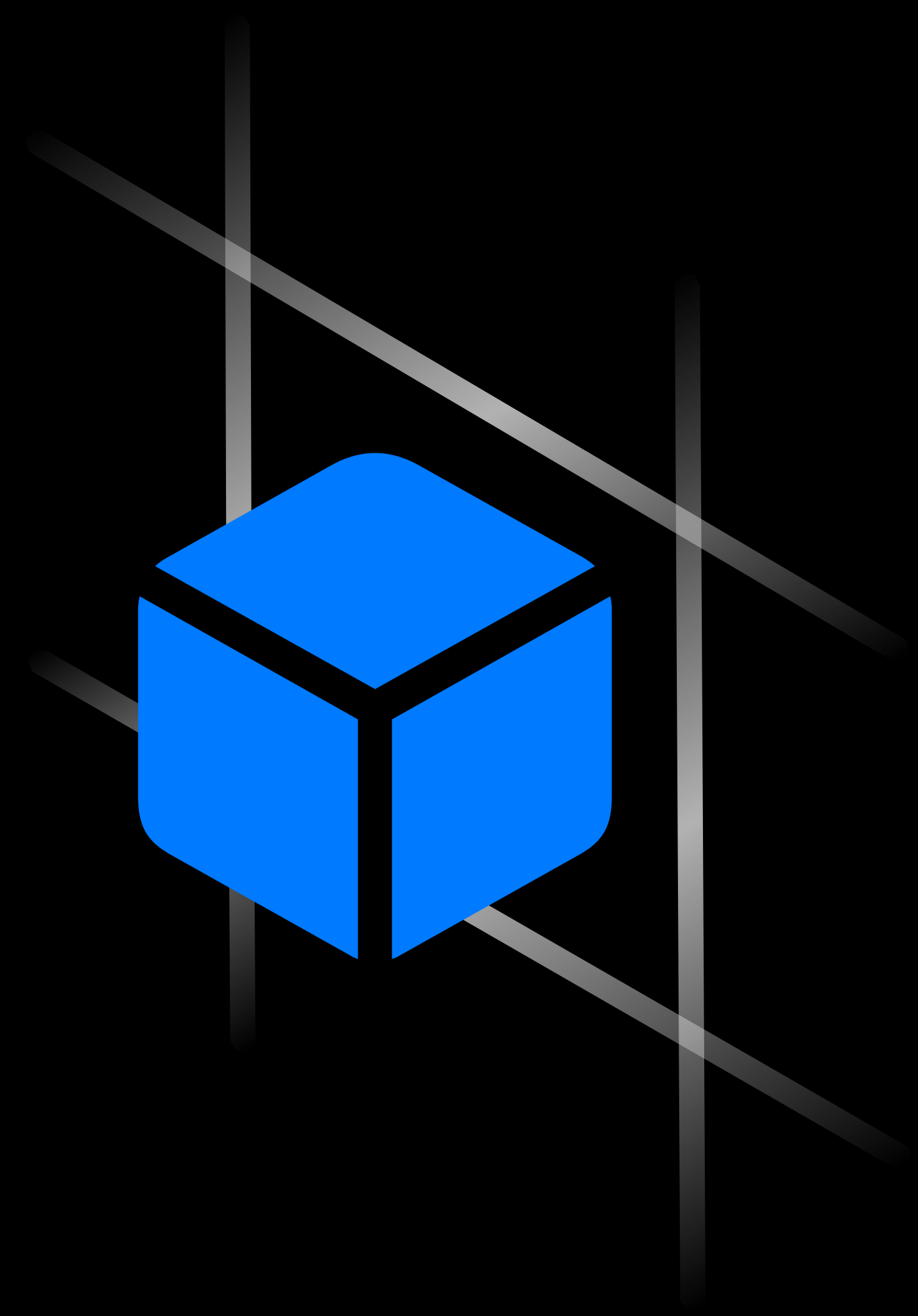


Face

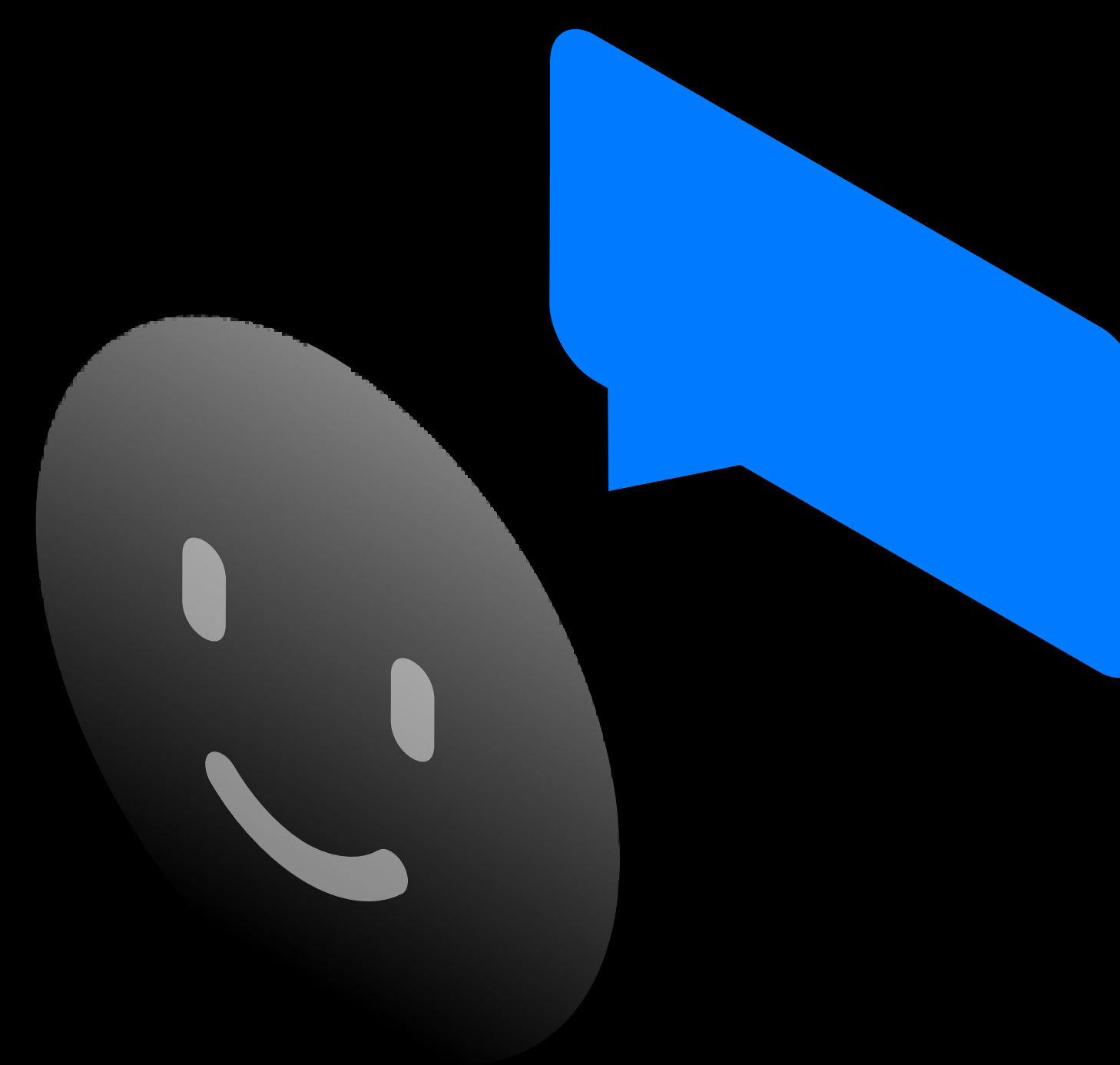
Anchors



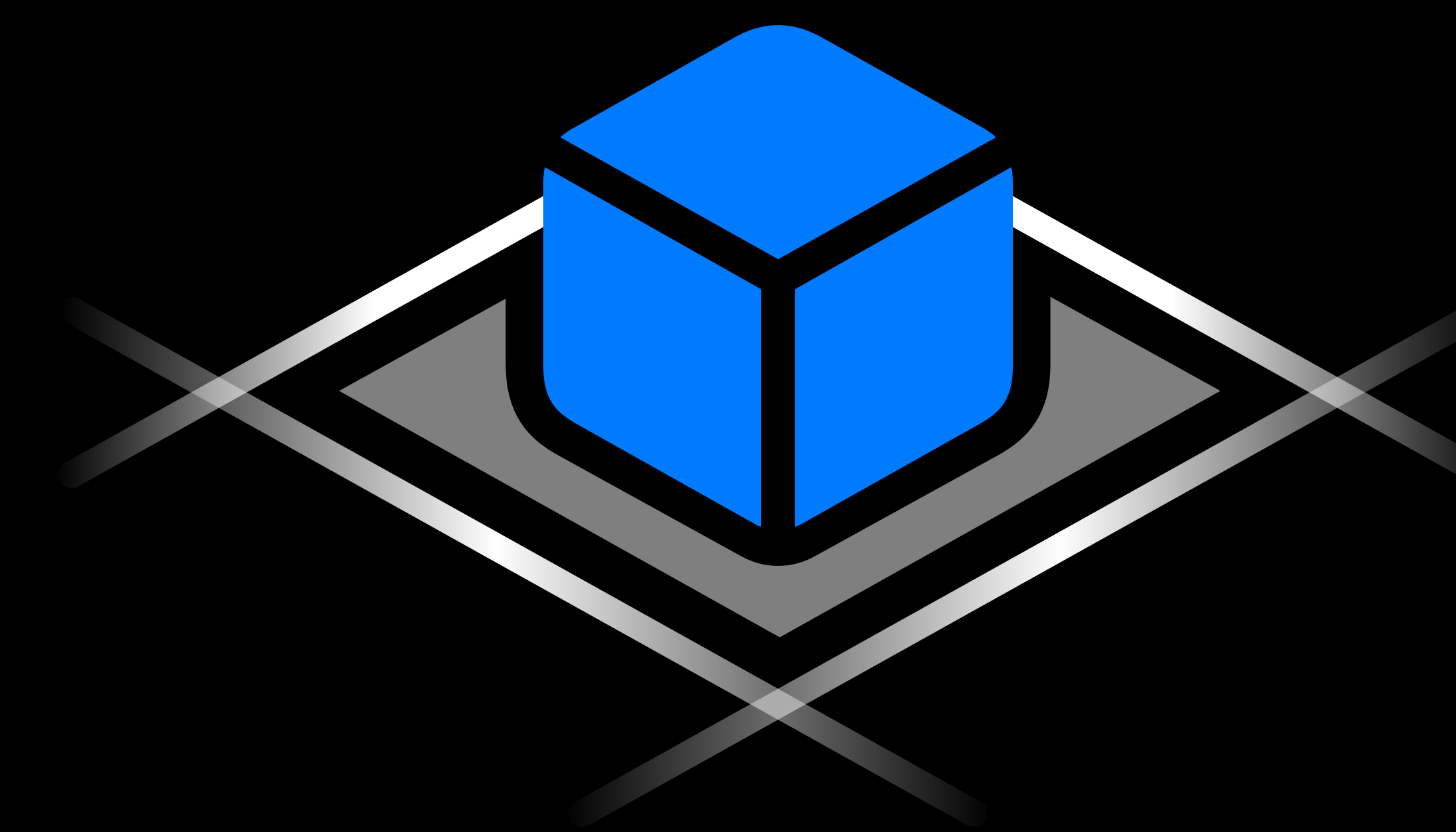
Horizontal



Vertical



Face

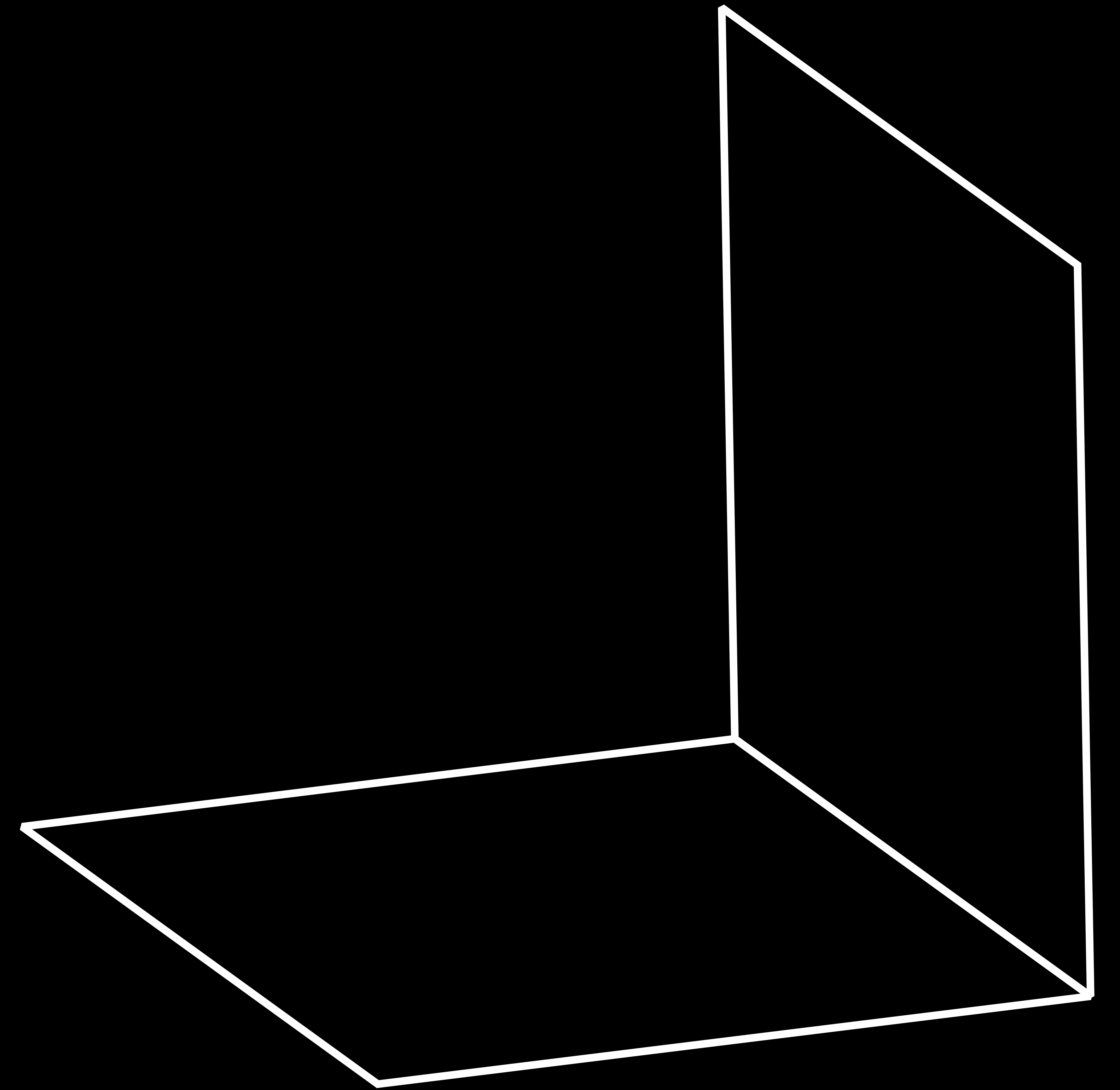


Image

Anchors

Horizontal and vertical

Common in everyday environments

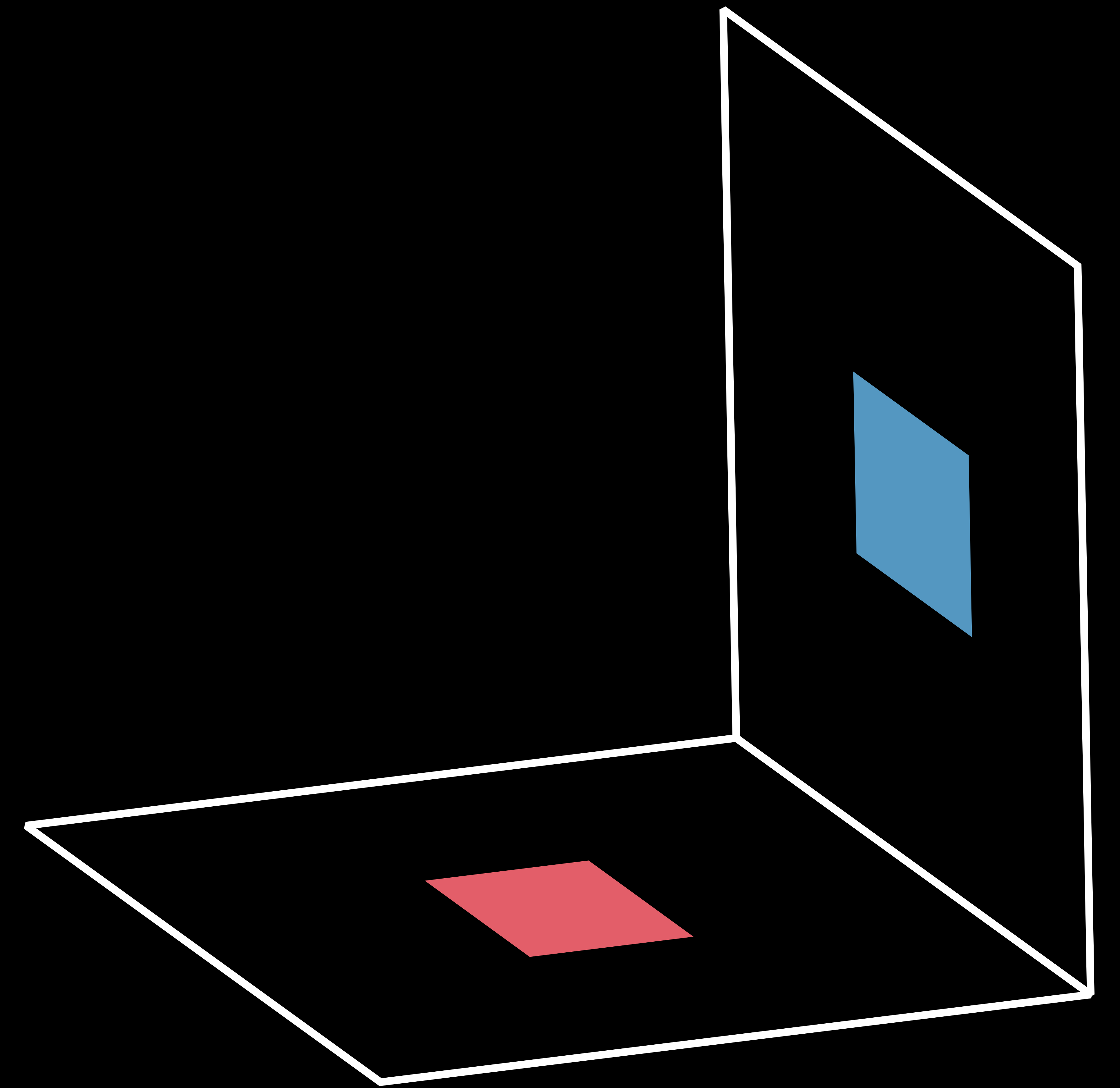


Anchors

Horizontal and vertical

Common in everyday environments

Objects are placed on the first detected plane



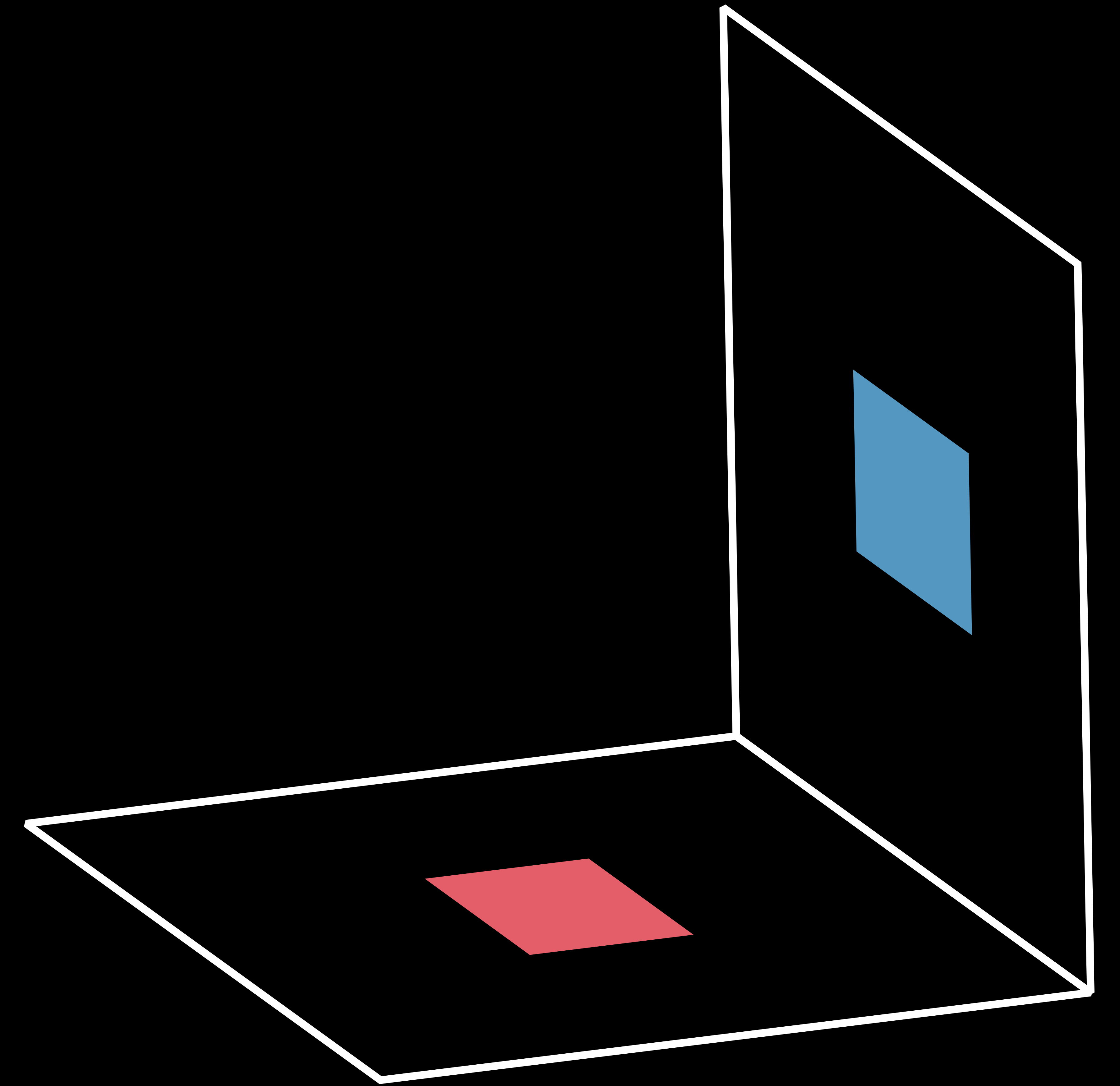
Anchors

Horizontal and vertical

Common in everyday environments

Objects are placed on the first detected plane

Tap-and-drag between horizontal and vertical



Anchors

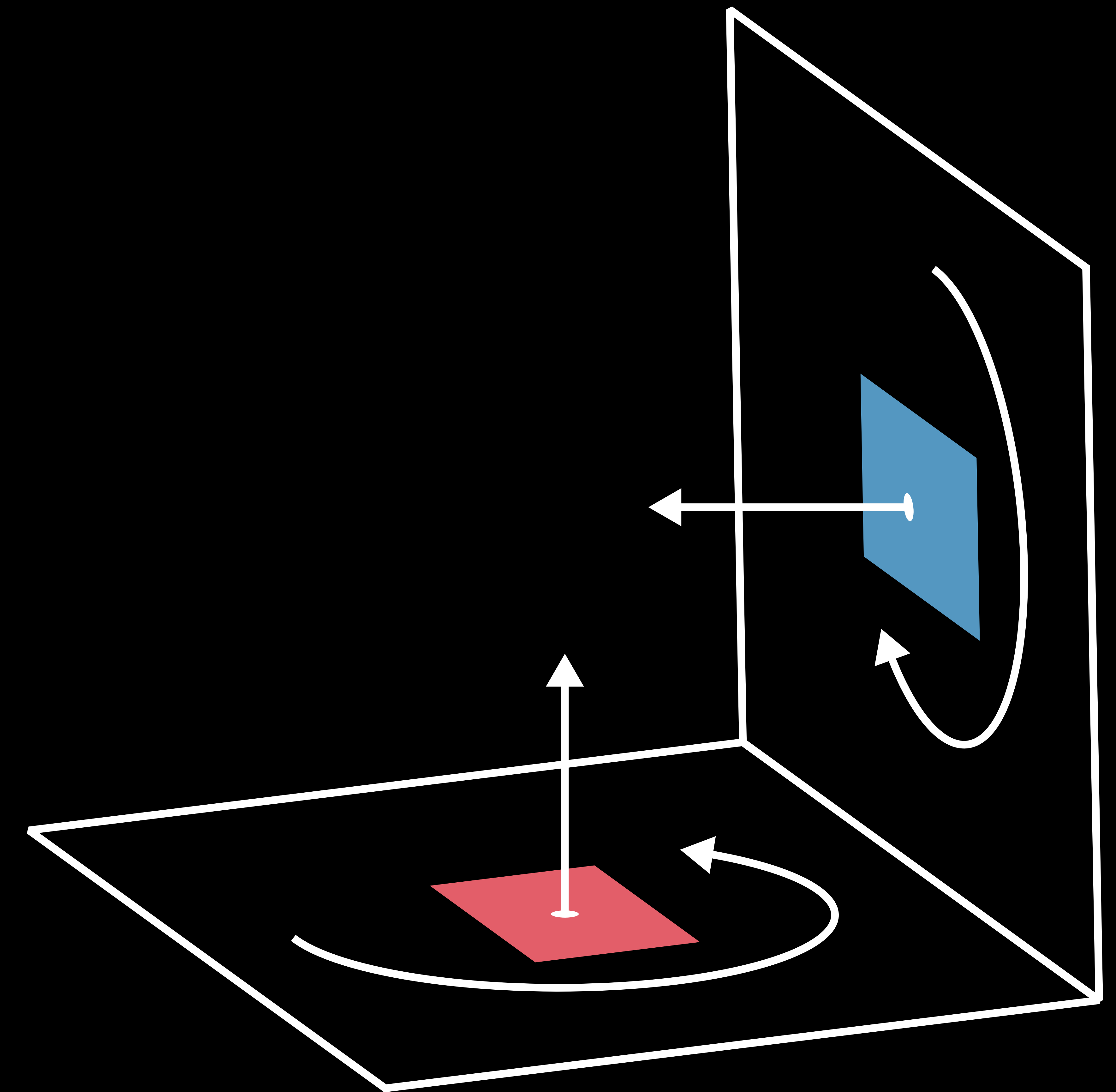
Horizontal and vertical

Common in everyday environments

Objects are placed on the first detected plane

Tap-and-drag between horizontal and vertical

Rotation gestures for horizontal and vertical anchors



Anchors

Horizontal and vertical

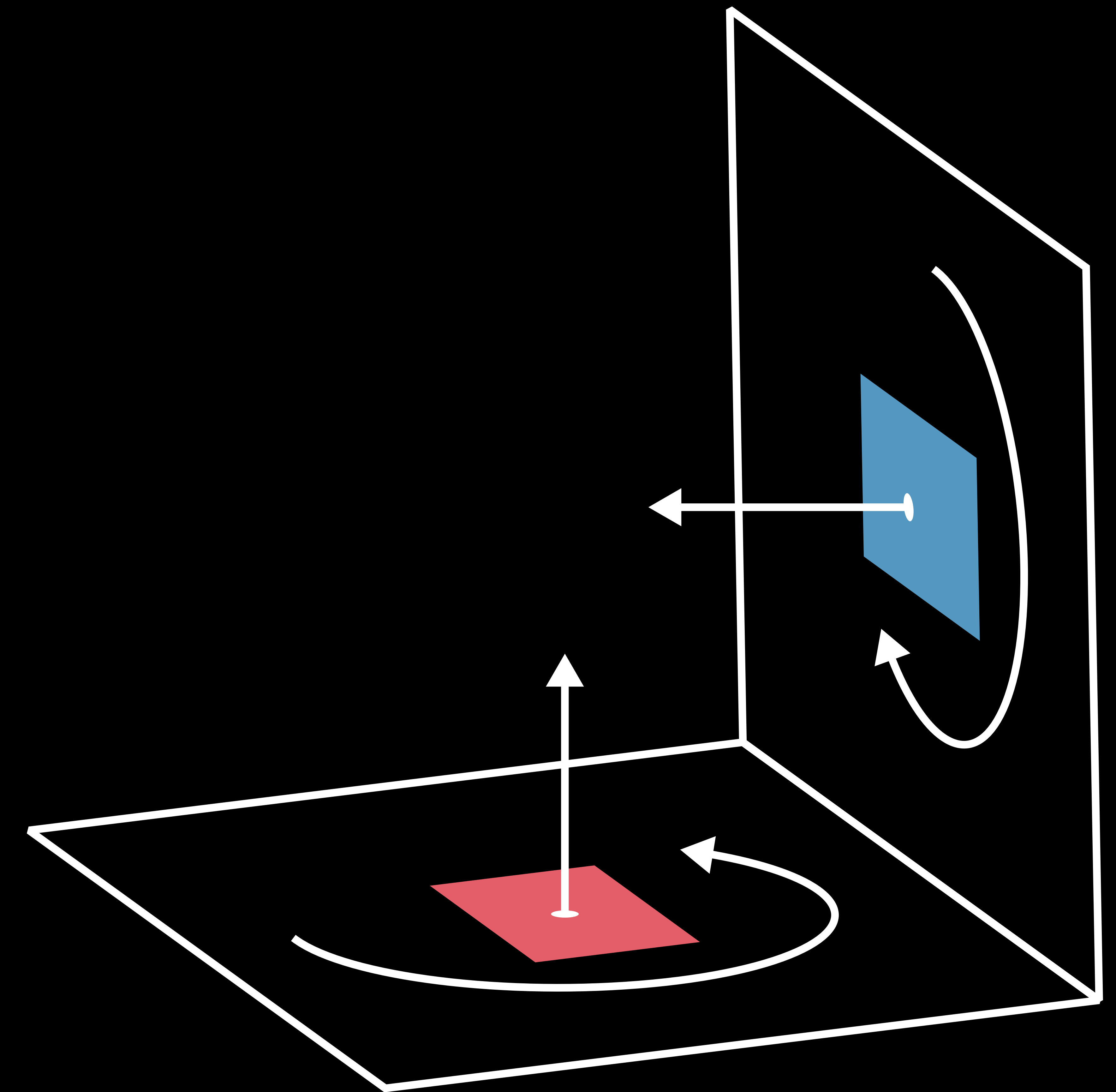
Common in everyday environments

Objects are placed on the first detected plane

Tap-and-drag between horizontal and vertical

Rotation gestures for horizontal and vertical anchors

Applies for usdz and Reality Files



Anchors

Horizontal and vertical



Anchors

Horizontal and vertical



Anchors

Face

Turns on front-facing camera

Anchors

Face

Turns on front-facing camera

Uses face occlusion geometry provided by ARKit

Anchors

Face

Turns on front-facing camera

Uses face occlusion geometry provided by ARKit

Gestures are disabled

Anchors

Face

Turns on front-facing camera

Uses face occlusion geometry provided by ARKit

Gestures are disabled

Respects authored physical size

Anchors

Face

Turns on front-facing camera

Uses face occlusion geometry provided by ARKit

Gestures are disabled

Respects authored physical size

Simultaneously supports multiple faces

Anchors

Face

Turns on front-facing camera

Uses face occlusion geometry provided by ARKit

Gestures are disabled

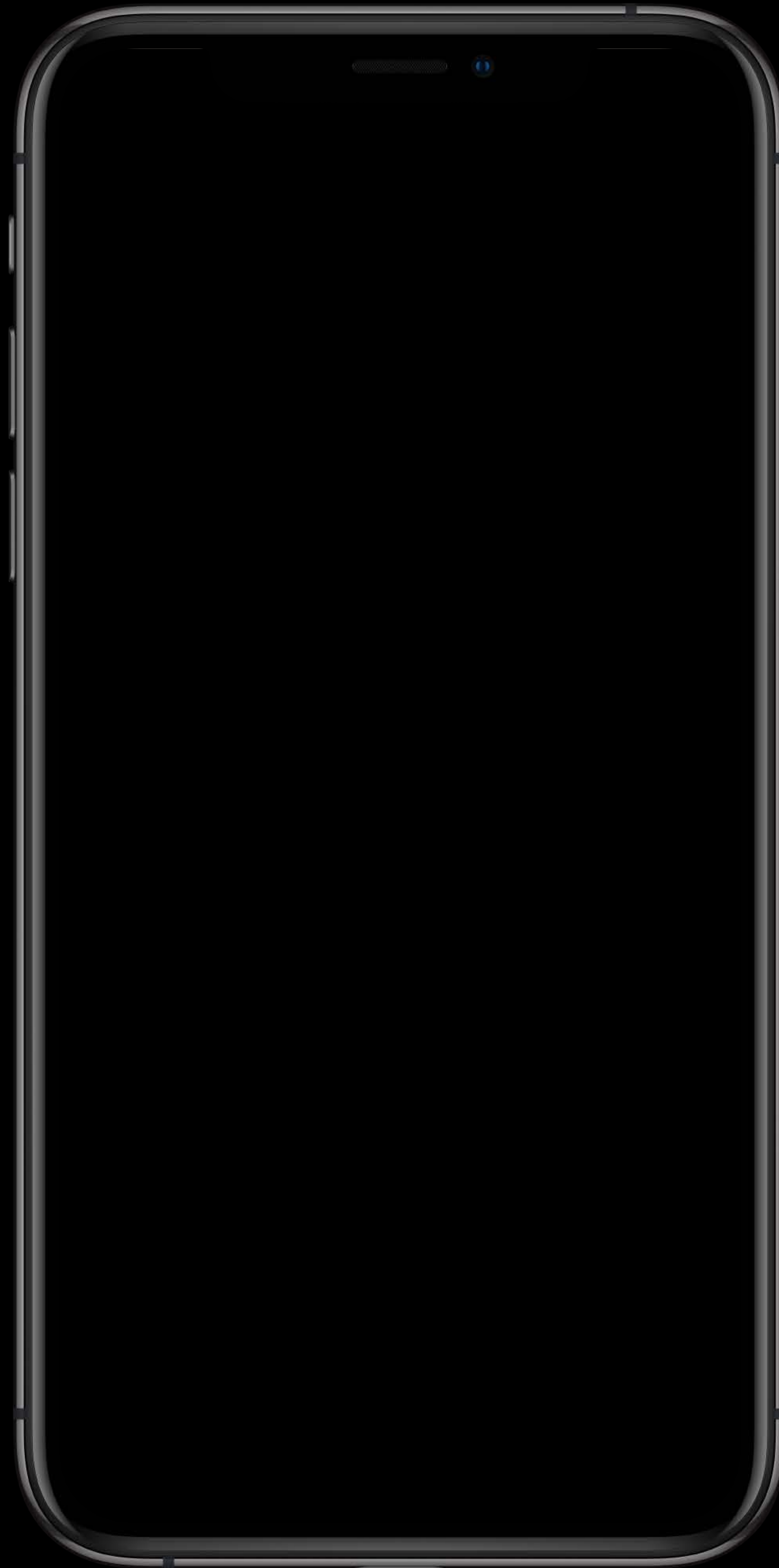
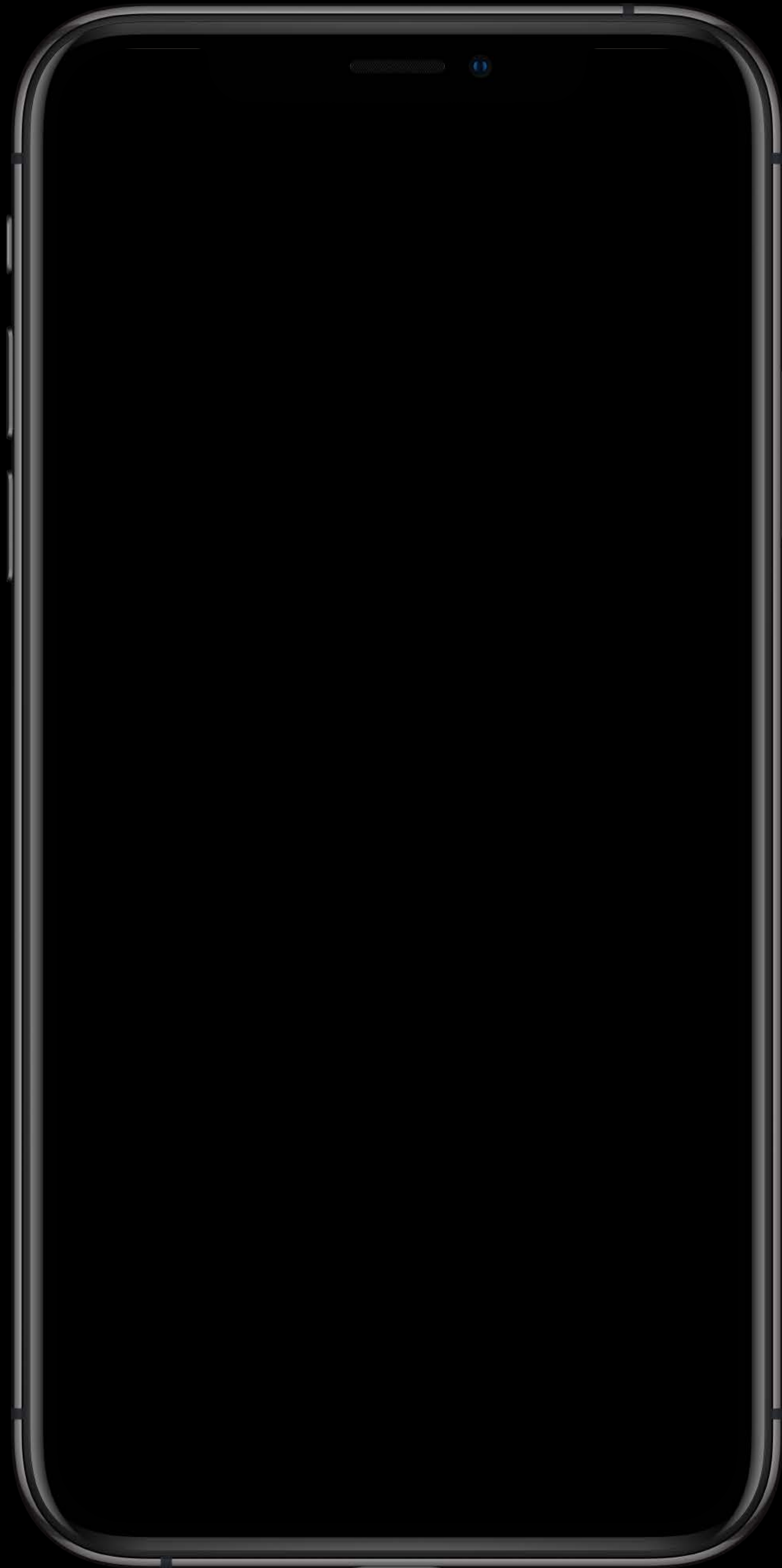
Respects authored physical size

Simultaneously supports multiple faces

Available on devices with front-facing TrueDepth camera

Anchors

Face



Anchors

Face



Anchors

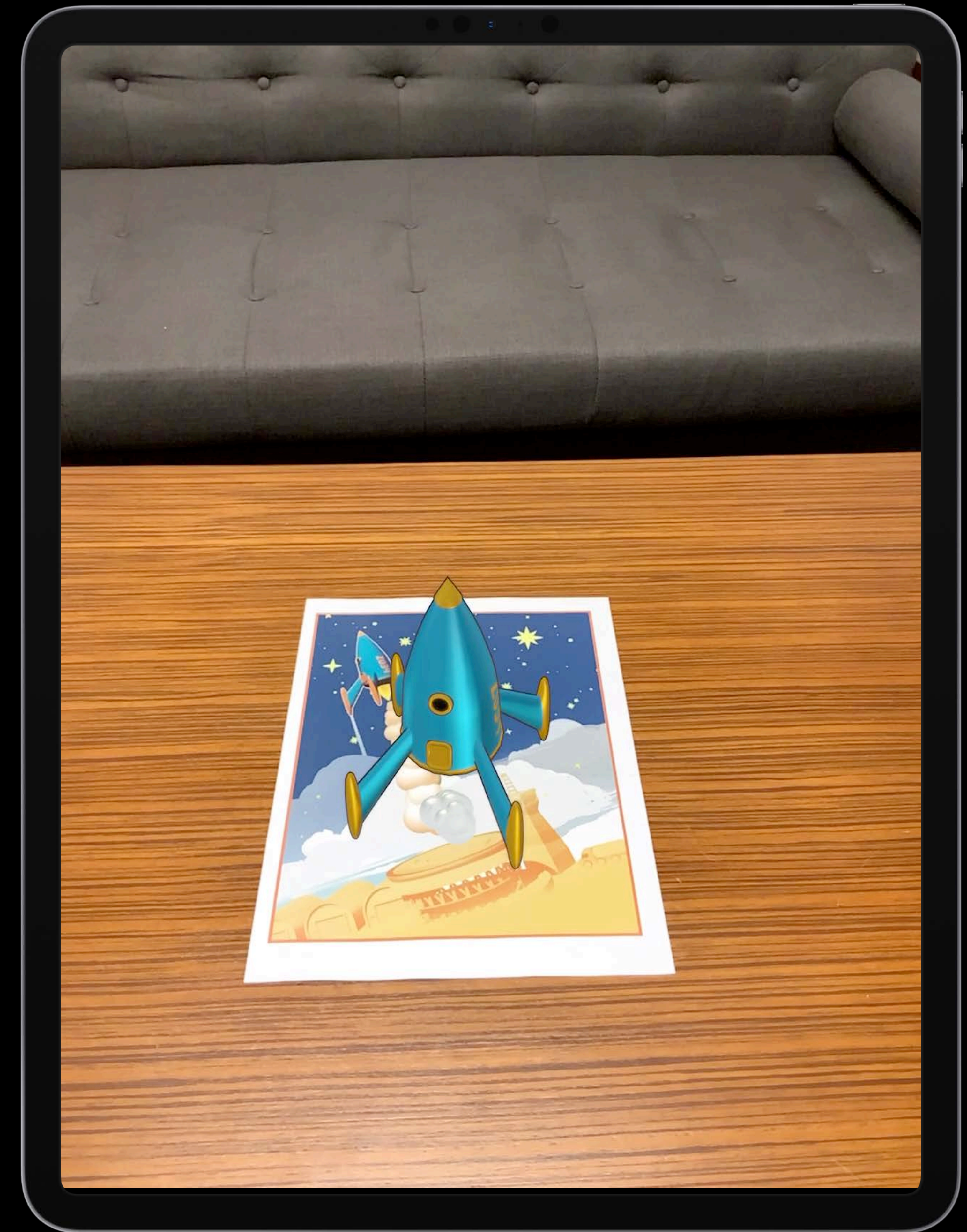
Face



Anchors

Image

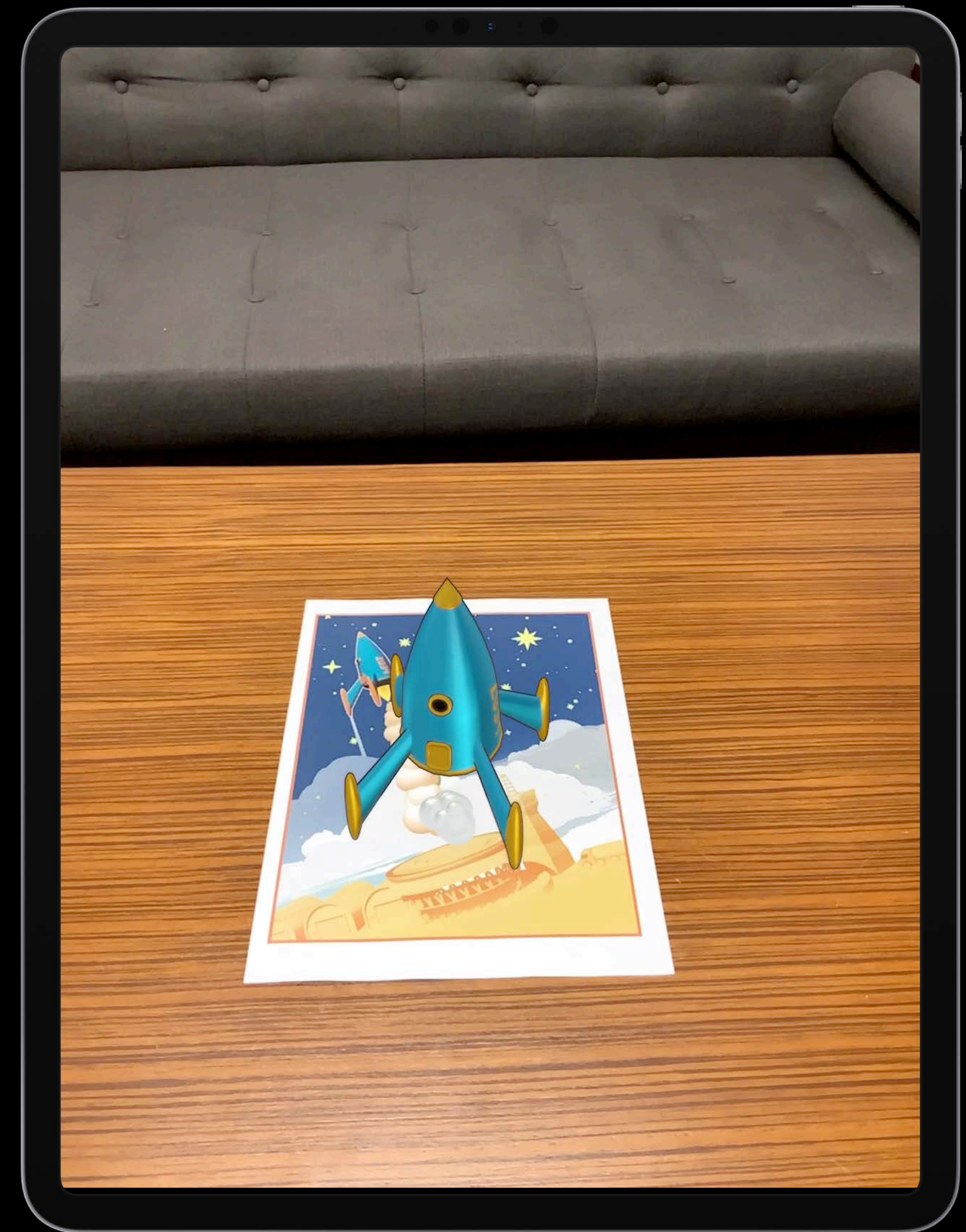
Anchored to a real-world image



Anchors

Image

Anchored to a real-world image

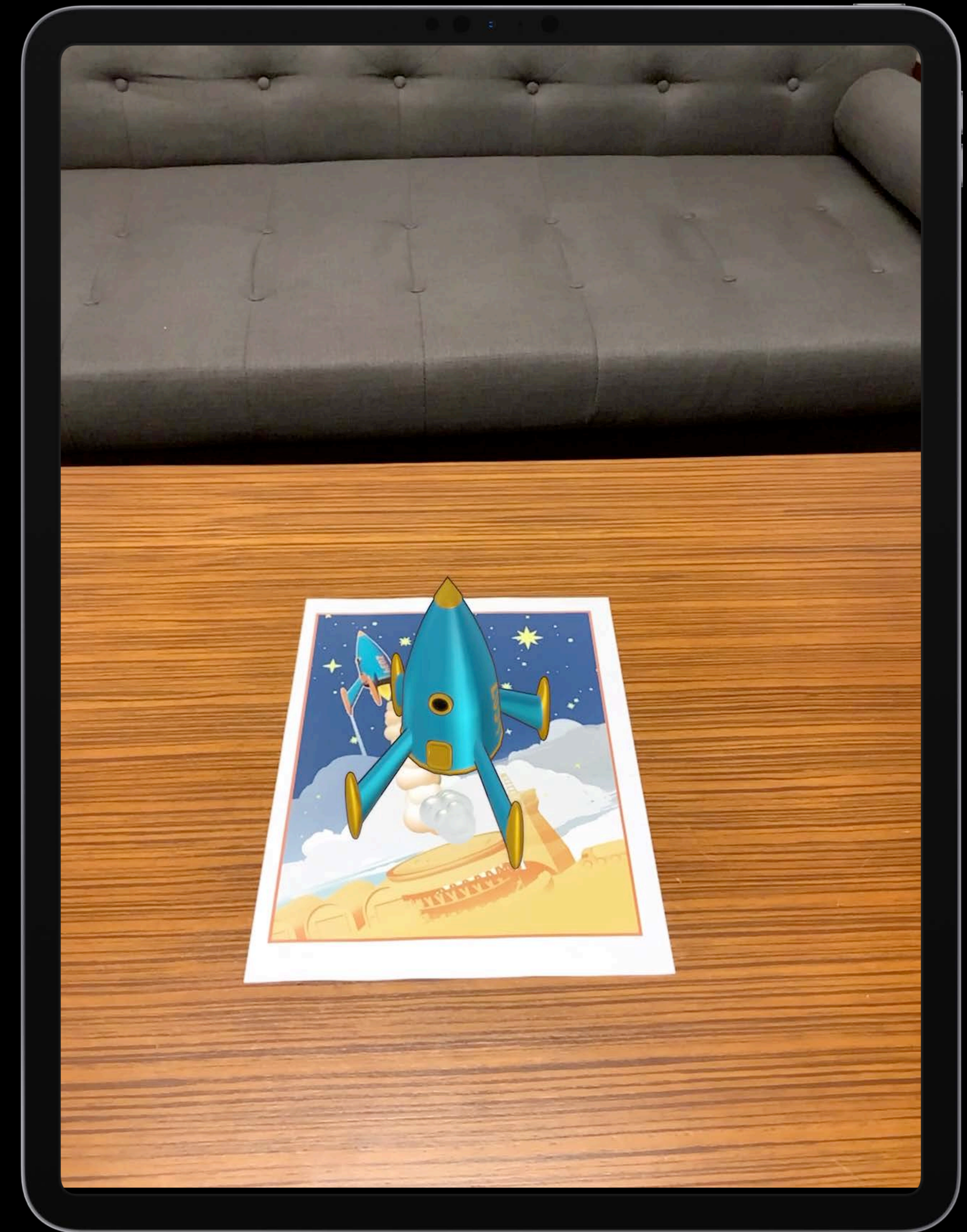


Anchors

Image

Anchored to a real-world image

Prioritize placing content



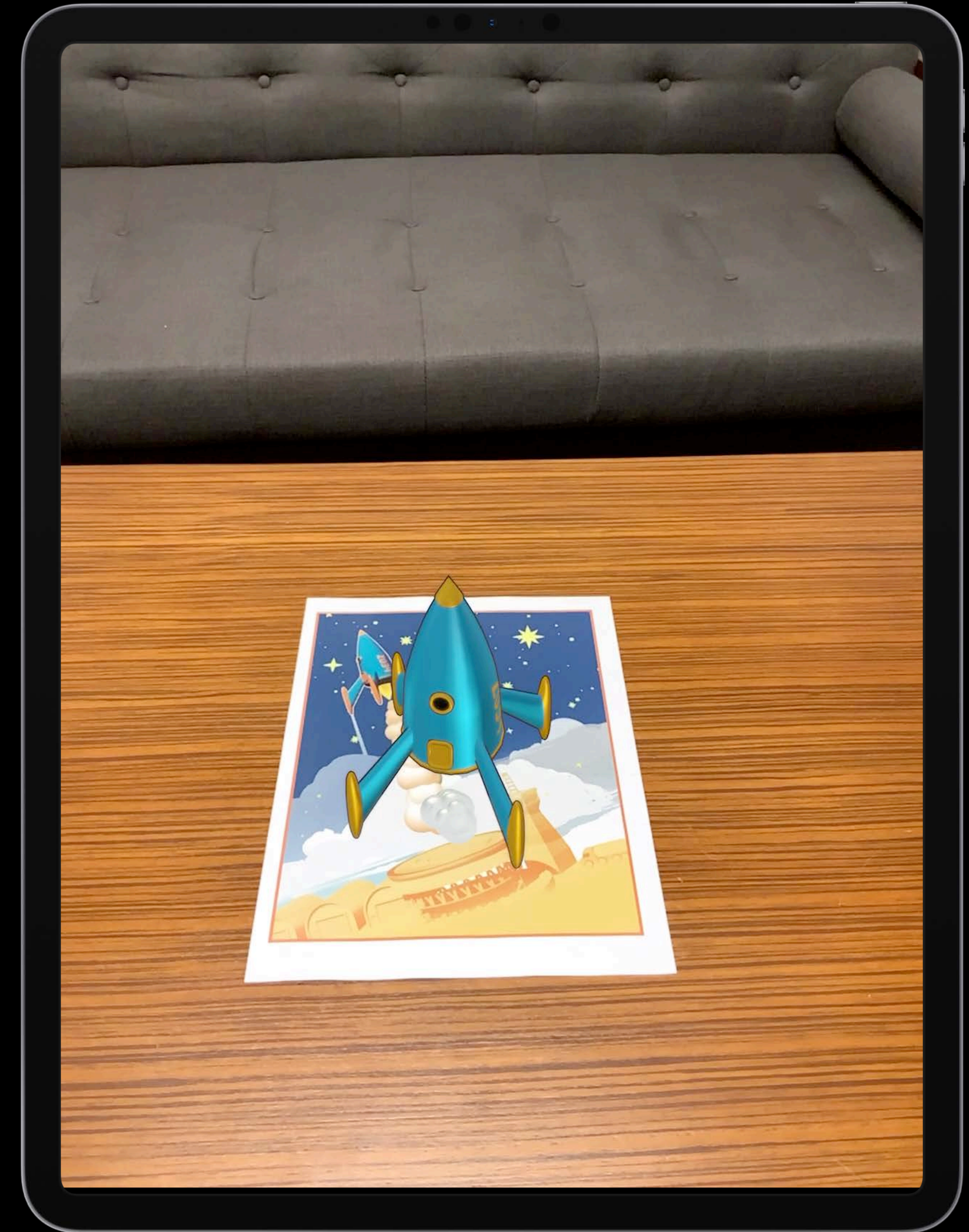
Anchors

Image

Anchored to a real-world image

Prioritize placing content

Physical manipulation when anchored



Anchors

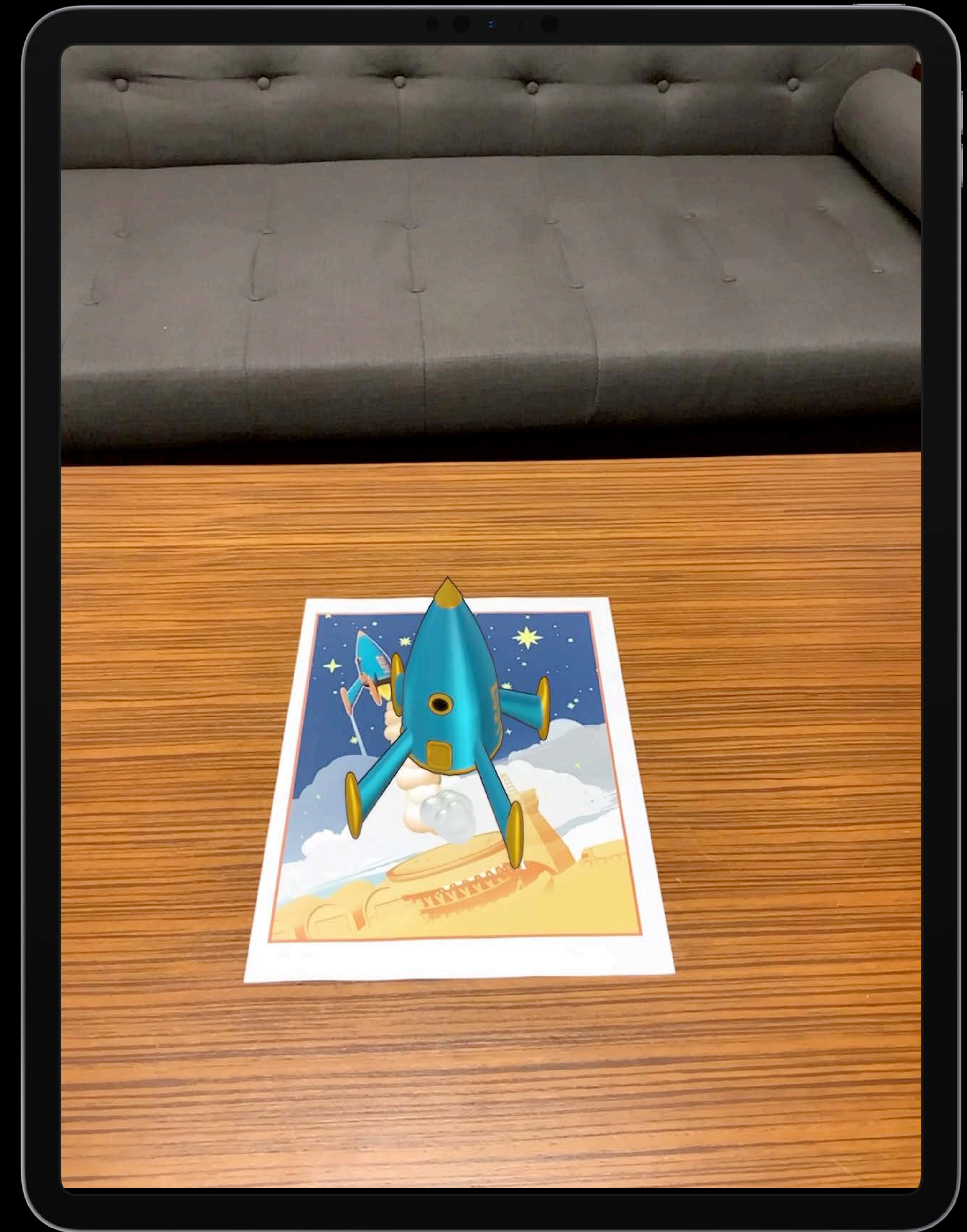
Image

Anchored to a real-world image

Prioritize placing content

Physical manipulation when anchored

Respects authored physical size



Anchors

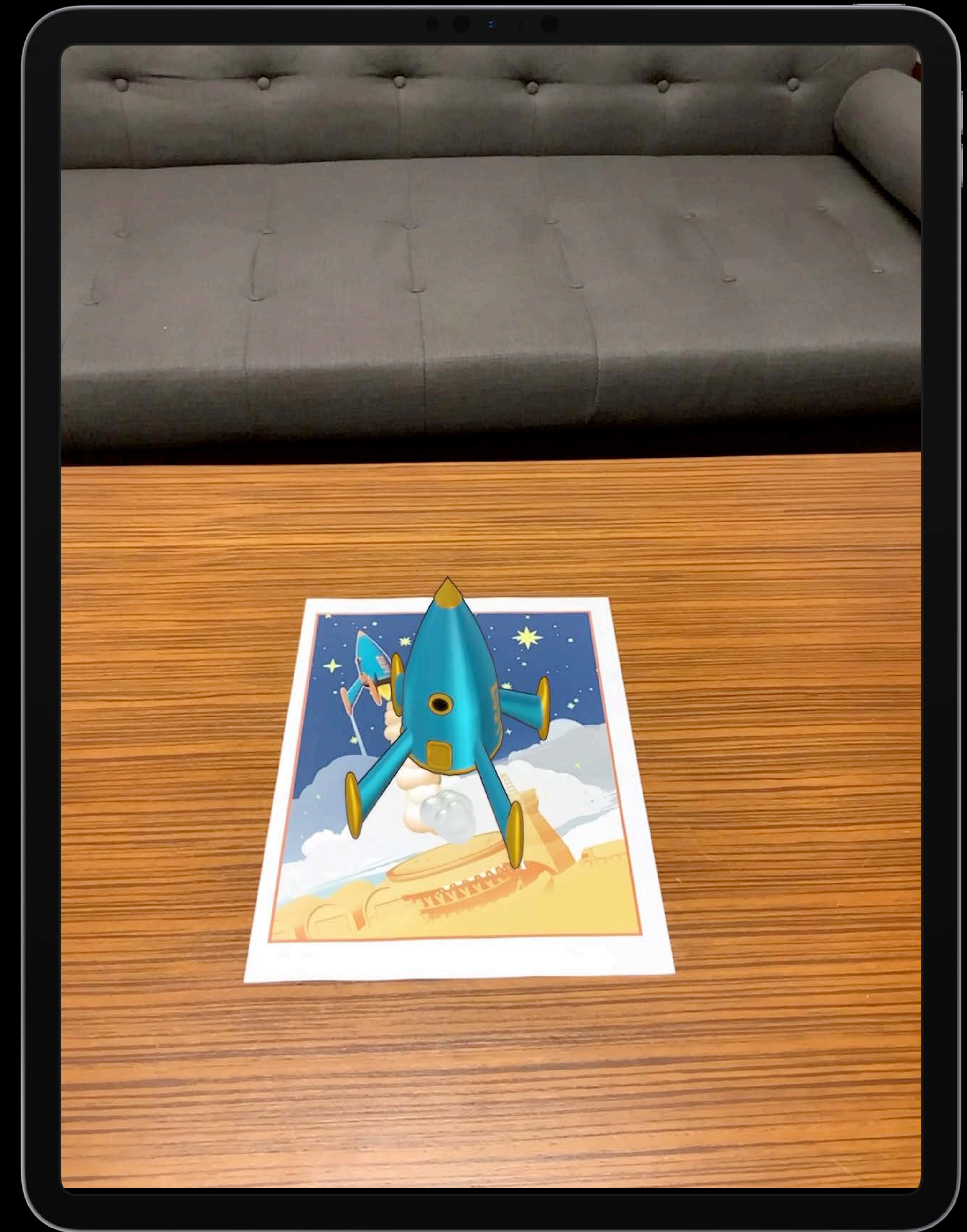
Image

Anchored to a real-world image

Prioritize placing content

Physical manipulation when anchored

Respects authored physical size



Anchors

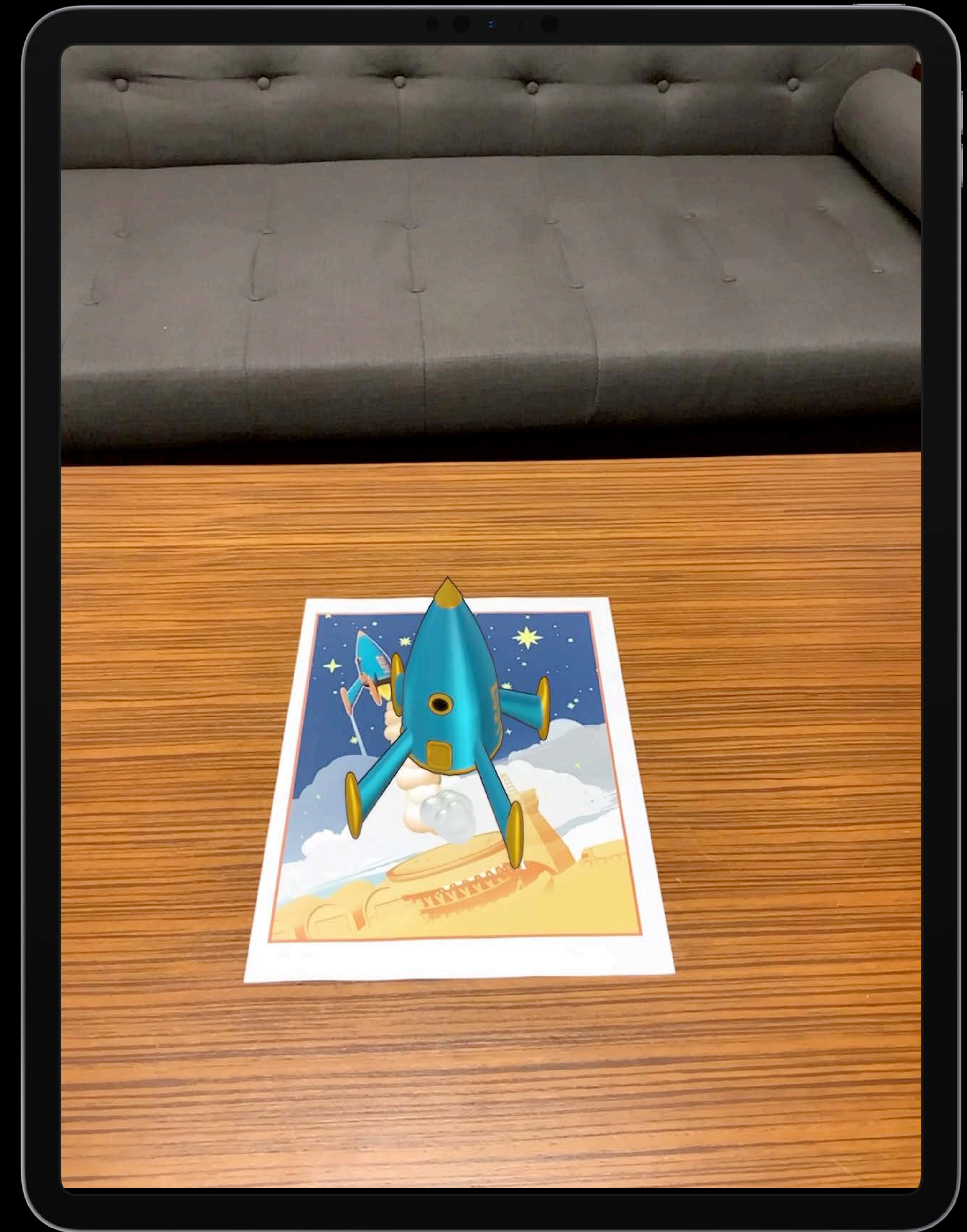
Image

Anchored to a real-world image

Prioritize placing content

Physical manipulation when anchored

Respects authored physical size



Behaviors

Brings life to your content

Behaviors

Brings life to your content

Comprised of a trigger and action(s)

Behaviors

Brings life to your content

Comprised of a trigger and action(s)

Defined in behaviors panel in Reality Composer

Behaviors

Triggers and Actions

Triggers

Tap
Scene start
Proximity to camera
Collide

Actions

Emphasize
Show/hide
Move, rotate, scale
Add force
Orbit
Spin
Change scene
Look at camera
Audio
Animation

Reality File

Support for multiple scenes

Anchors

- Horizontal
- Vertical
- Face
- Image

Behaviors

Audio



Demo

Visual Improvements to AR Quick Look

Visual Improvements

Real-time dynamic shadows

Camera noise

HDR with tone mapping

People Occlusion

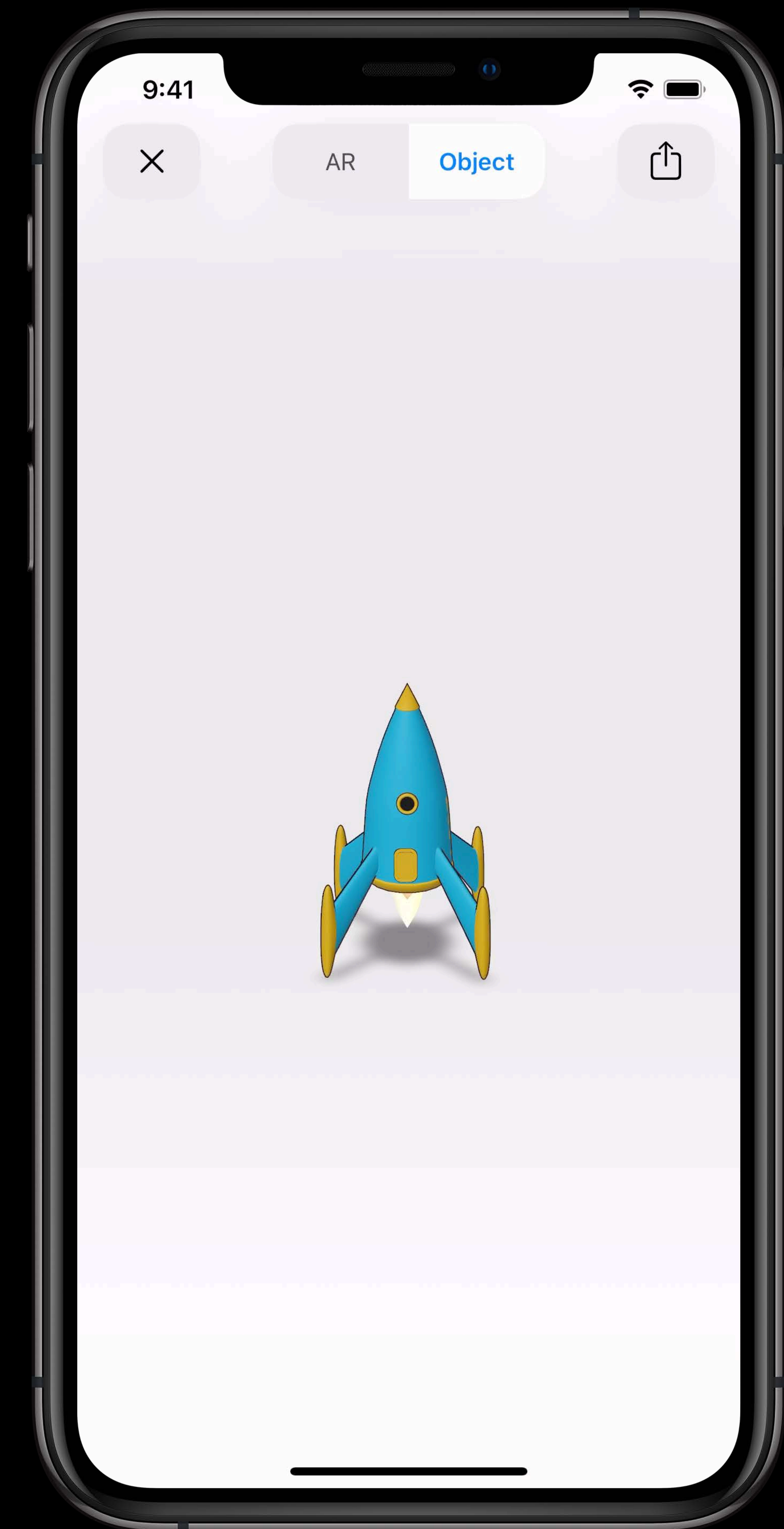
Depth of field

Motion blur

Real-Time Shadows

Projective

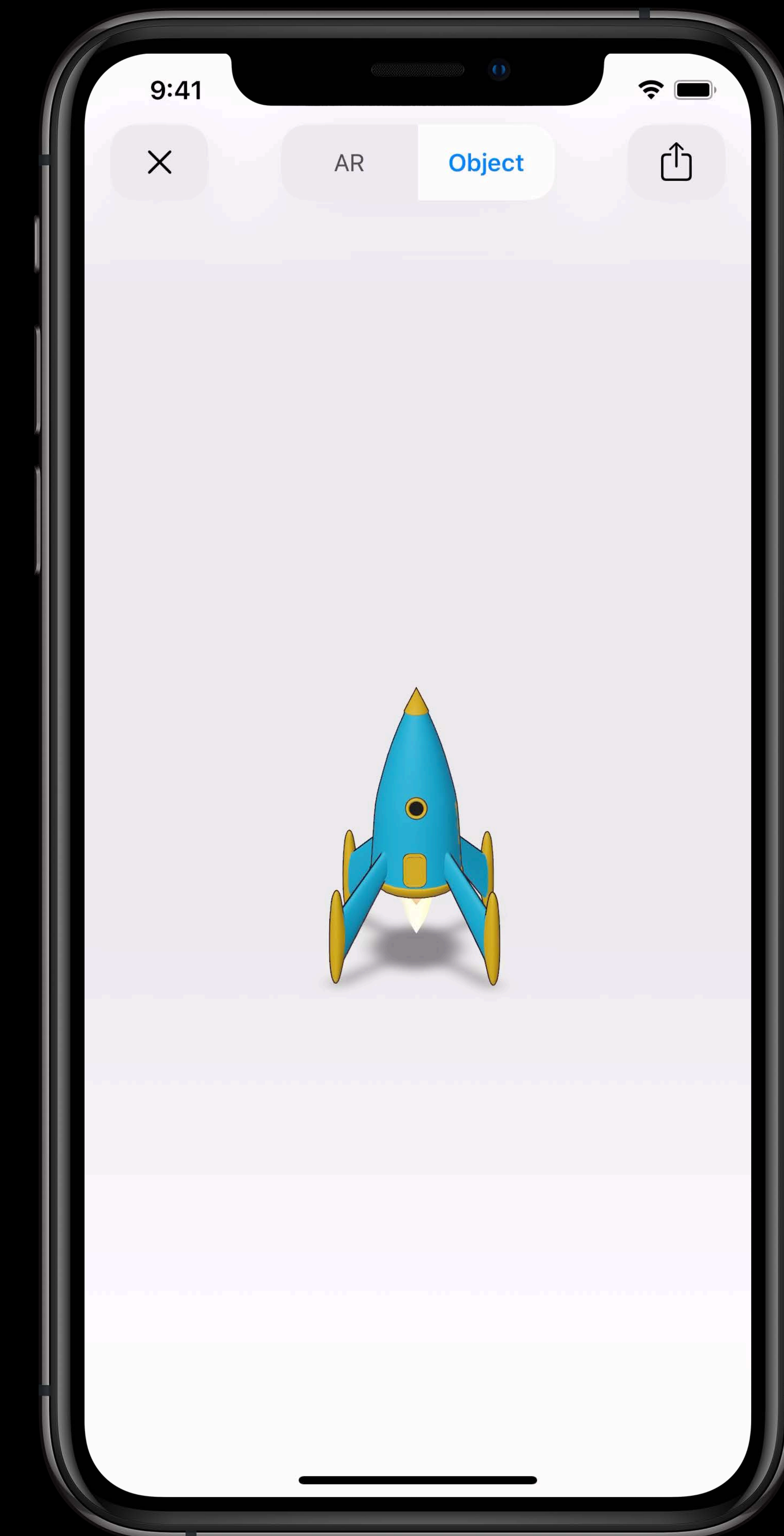
Brings animation to life



Real-Time Shadows

Projective

Brings animation to life

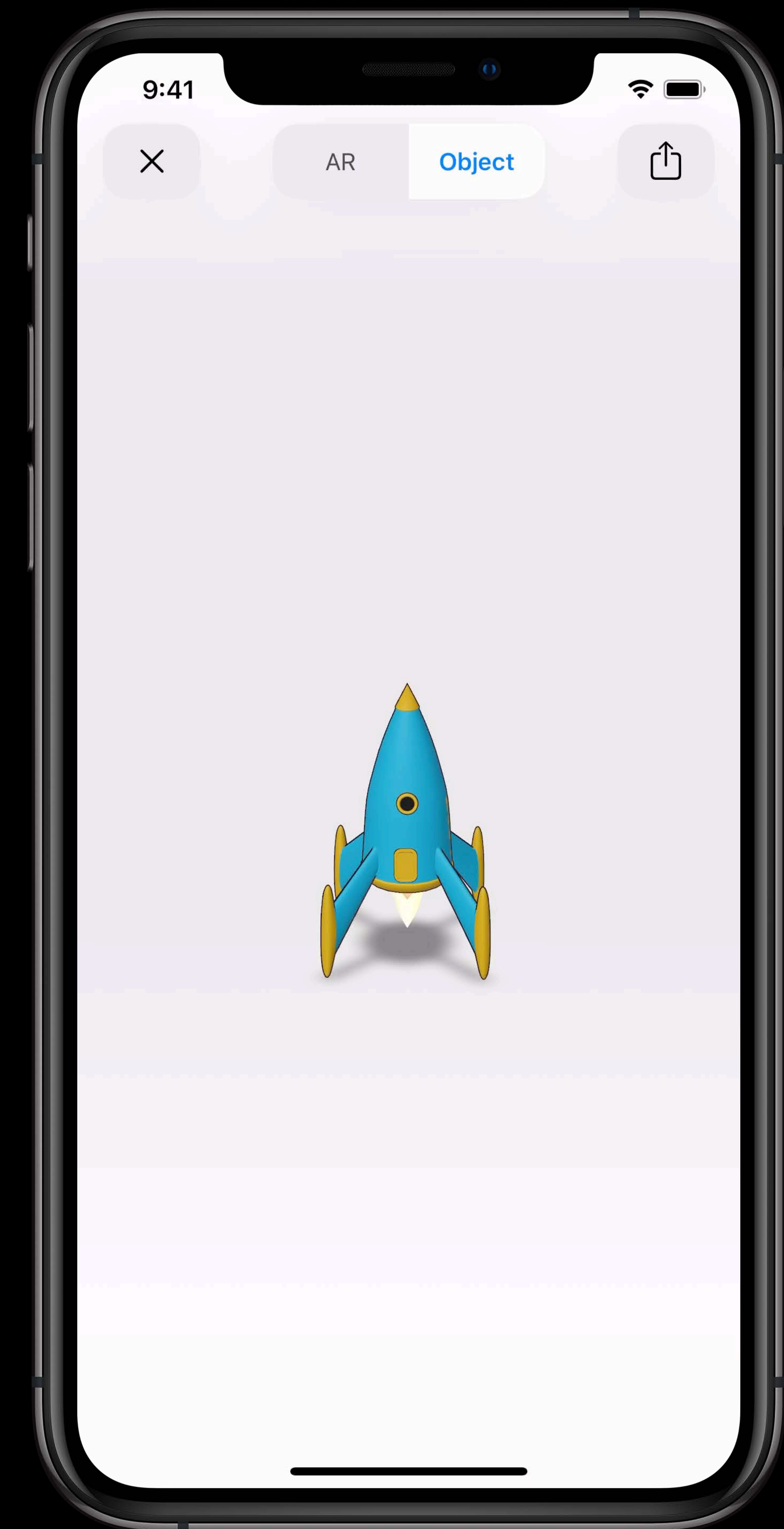


Real-Time Shadows

Projective

Brings animation to life

Uses projective shadows by default



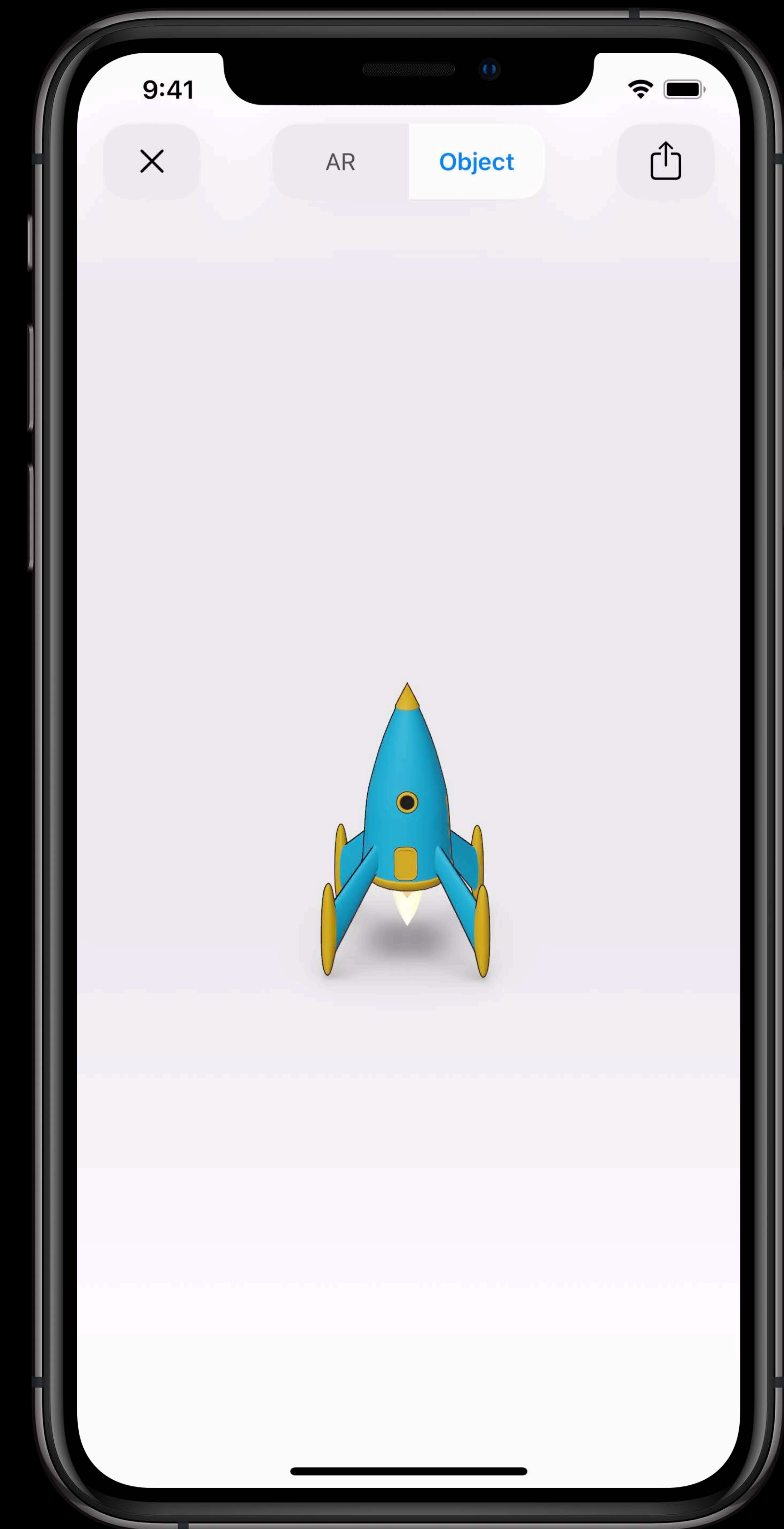
Real-Time Shadows

Ray-traced

Brings animation to life

Uses projective shadows by default

Ray-traced shadows available on A12 and later



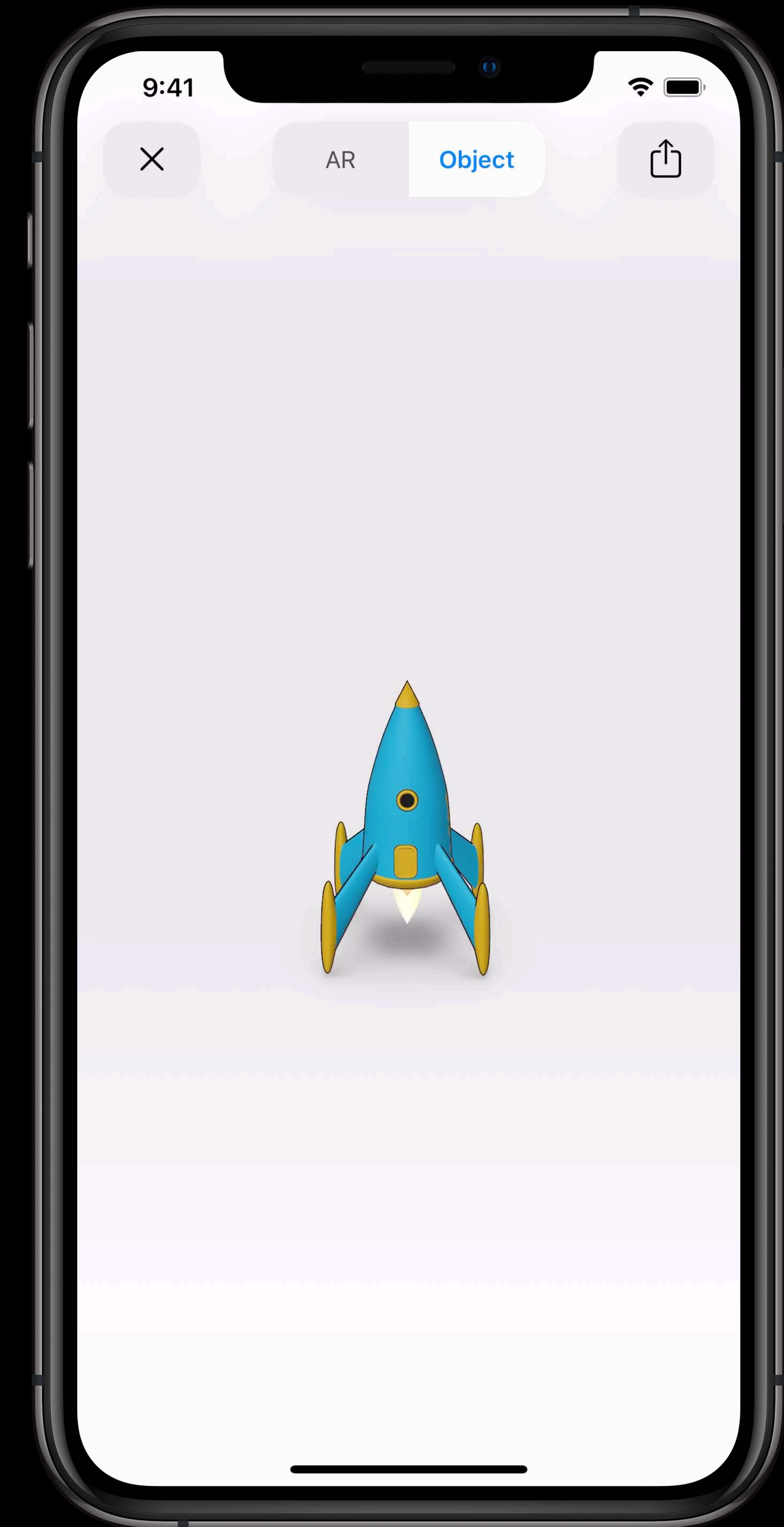
Real-Time Shadows

Ray-traced

Brings animation to life

Uses projective shadows by default

Ray-traced shadows available on A12 and later



Real-Time Shadows

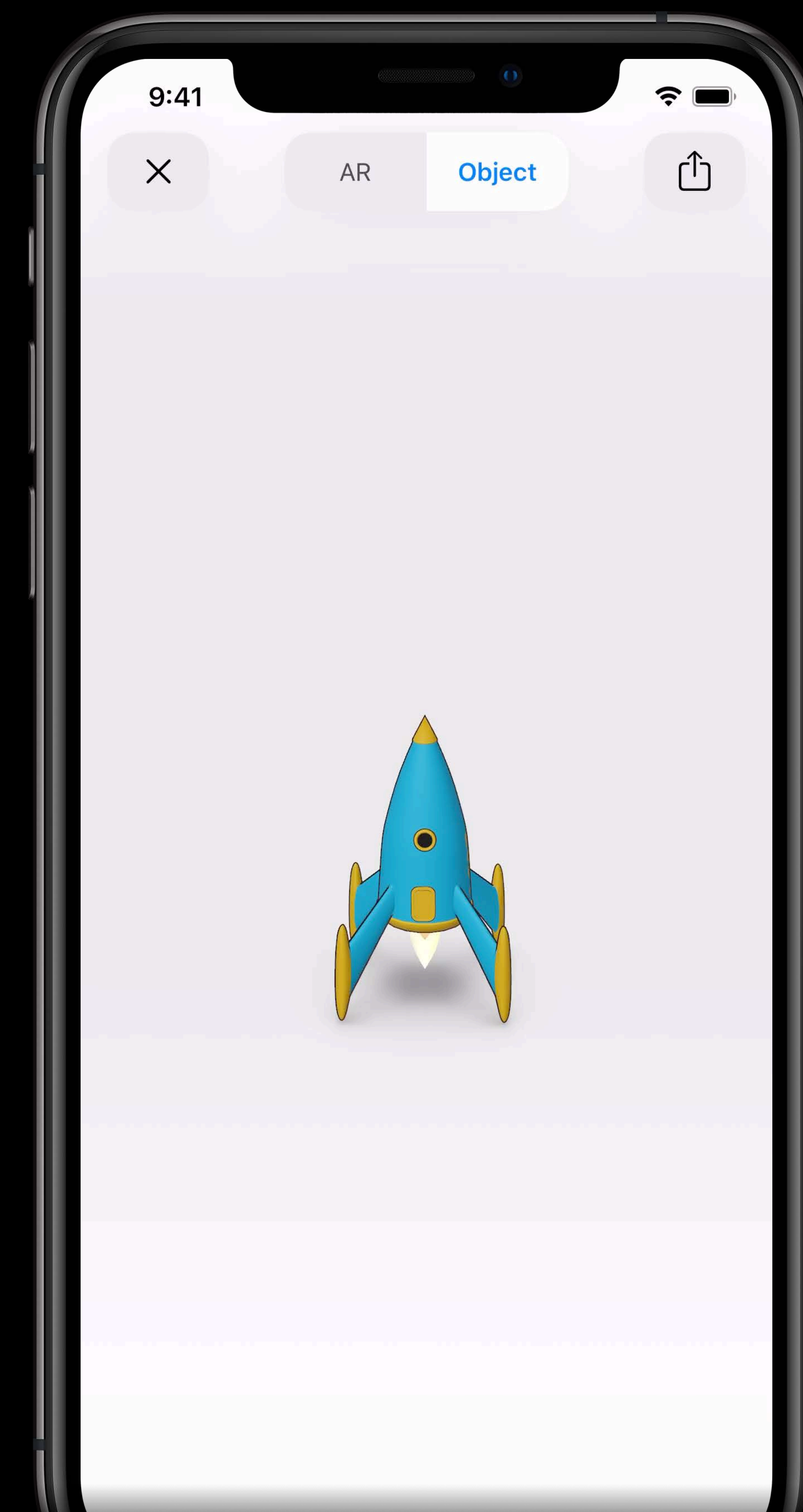
Ray-traced

Brings animation to life

Uses projective shadows by default

Ray-traced shadows available on A12 and later

Softer shadows and fine contact points



Real-Time Shadows

Ray-traced

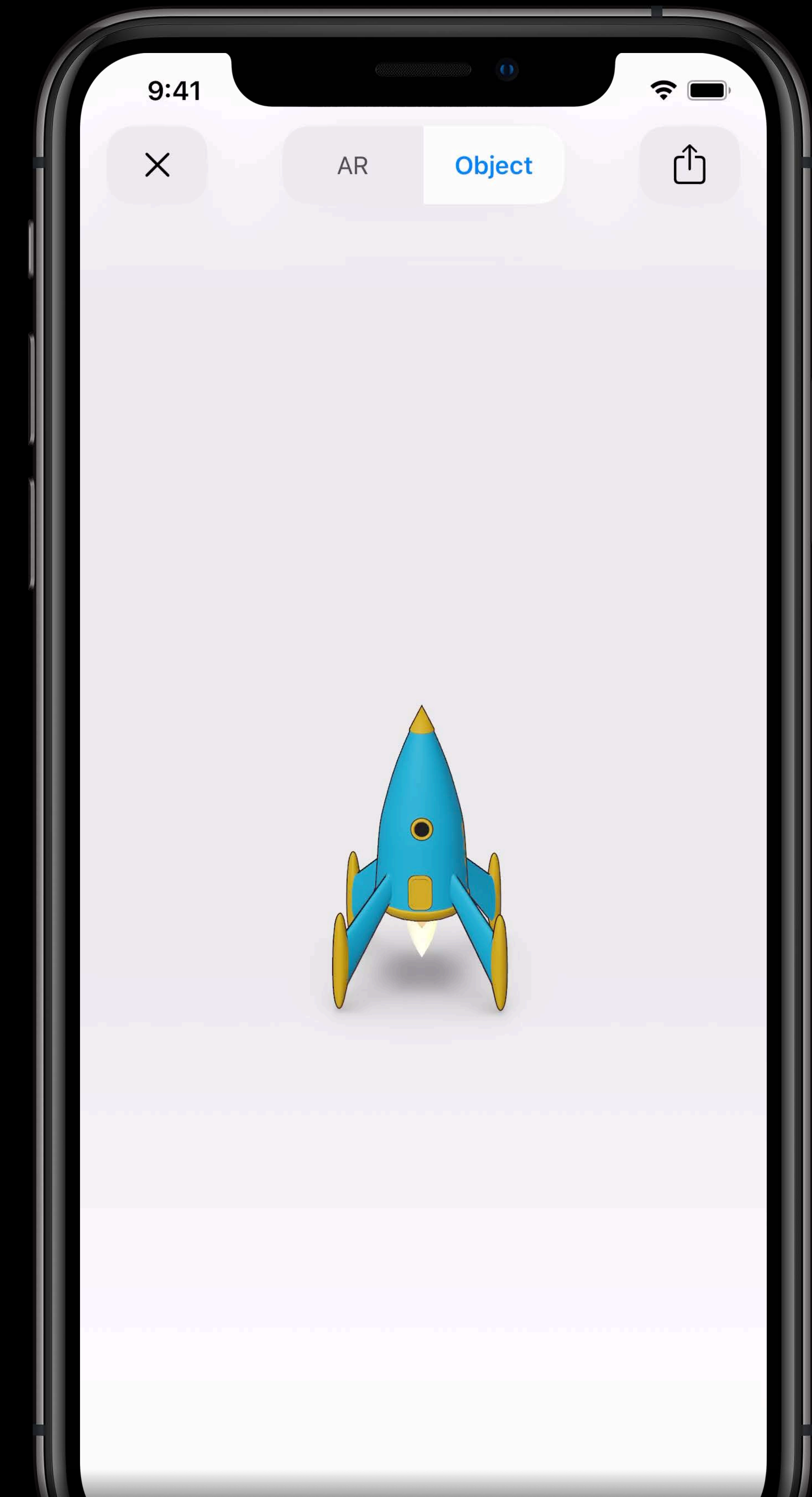
Brings animation to life

Uses projective shadows by default

Ray-traced shadows available on A12 and later

Softer shadows and fine contact points

Don't bake shadow as part of model



Camera Noise

Camera noise inherent to digital camera systems



Camera Noise

Camera noise inherent to digital camera systems



Camera Noise

Camera noise inherent to digital camera systems

Adds grain to visual content to match camera noise



Camera Noise

Camera noise inherent to digital camera systems

Adds grain to visual content to match camera noise

Applies grain texture provided by ARKit



Camera Noise

Camera noise inherent to digital camera systems

Adds grain to visual content to match camera noise

Applies grain texture provided by ARKit

Available on all ARKit supported devices



HDR with Tone Mapping

Environment affects brightness of scene



HDR with Tone Mapping

Environment affects brightness of scene

Alleviates colors looking "blown out"



HDR with Tone Mapping

Environment affects brightness of scene

Alleviates colors looking "blown out"



HDR with Tone Mapping

Environment affects brightness of scene

Alleviates colors looking "blown out"

HDR uses 16 bits of precision



HDR with Tone Mapping

Environment affects brightness of scene

Alleviates colors looking "blown out"

HDR uses 16 bits of precision

Applies tone mapping curve



HDR with Tone Mapping

Environment affects brightness of scene

Alleviates colors looking "blown out"

HDR uses 16 bits of precision

Applies tone mapping curve

Available on A10X and later



People Occlusion

Previously virtual content was rendered in front of people



People Occlusion

Previously virtual content was rendered in front of people

Maintains the illusion of people in front of virtual content



People Occlusion

Previously virtual content was rendered in front of people

Maintains the illusion of people in front of virtual content

Uses segmentation data provided by ARKit



People Occlusion

Previously virtual content was rendered in front of people

Maintains the illusion of people in front of virtual content

Uses segmentation data provided by ARKit

Available on A12 and later



Depth of Field

Camera focuses on a certain distance
at any given time



Depth of Field

Camera focuses on a certain distance
at any given time



Depth of Field

Camera focuses on a certain distance
at any given time

Rendered with object's distance taken
into account



Depth of Field

Camera focuses on a certain distance at any given time

Rendered with object's distance taken into account

Matches blur of content to focal distance of camera



Depth of Field

Camera focuses on a certain distance at any given time

Rendered with object's distance taken into account

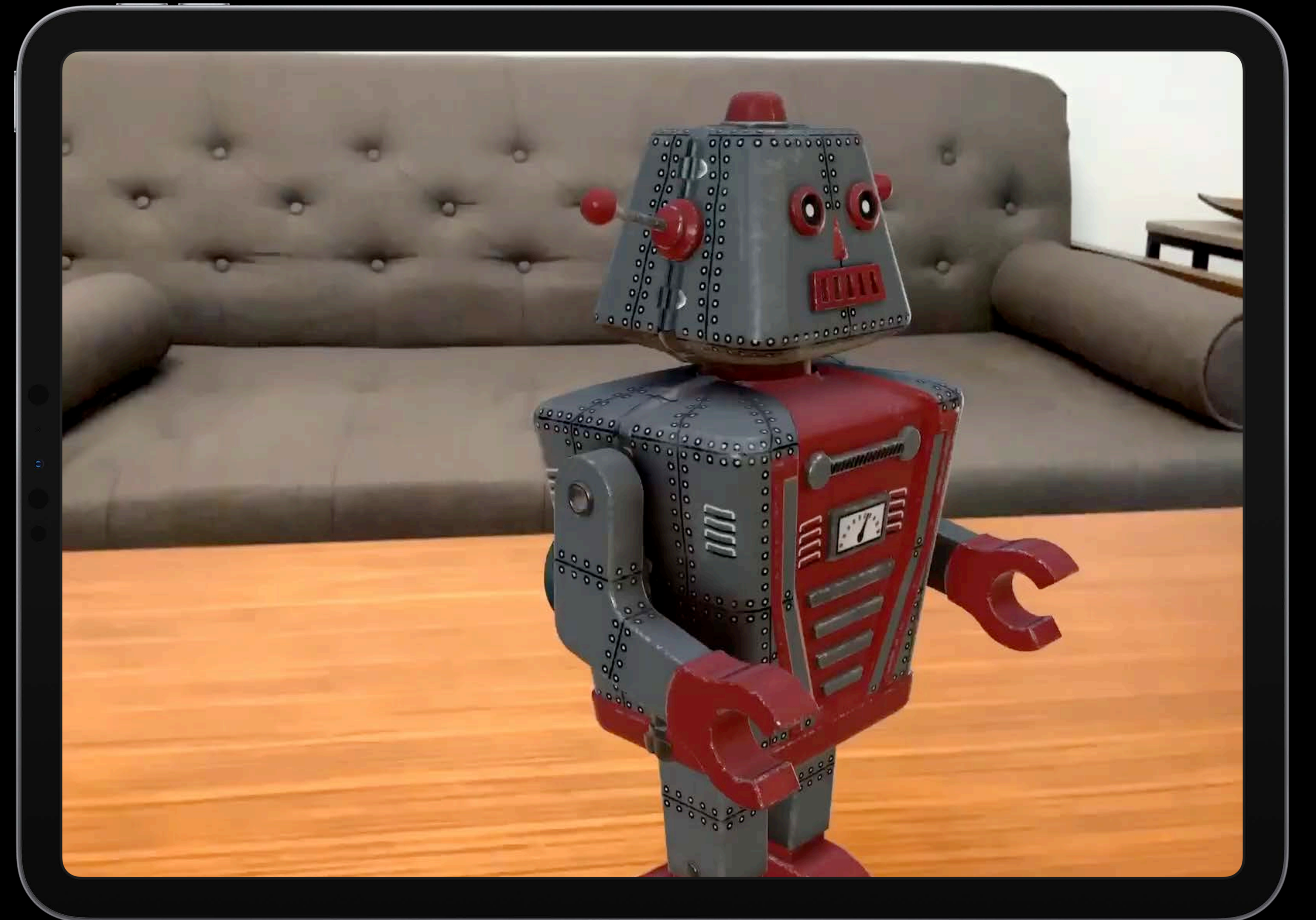
Matches blur of content to focal distance of camera

Available on A12X devices



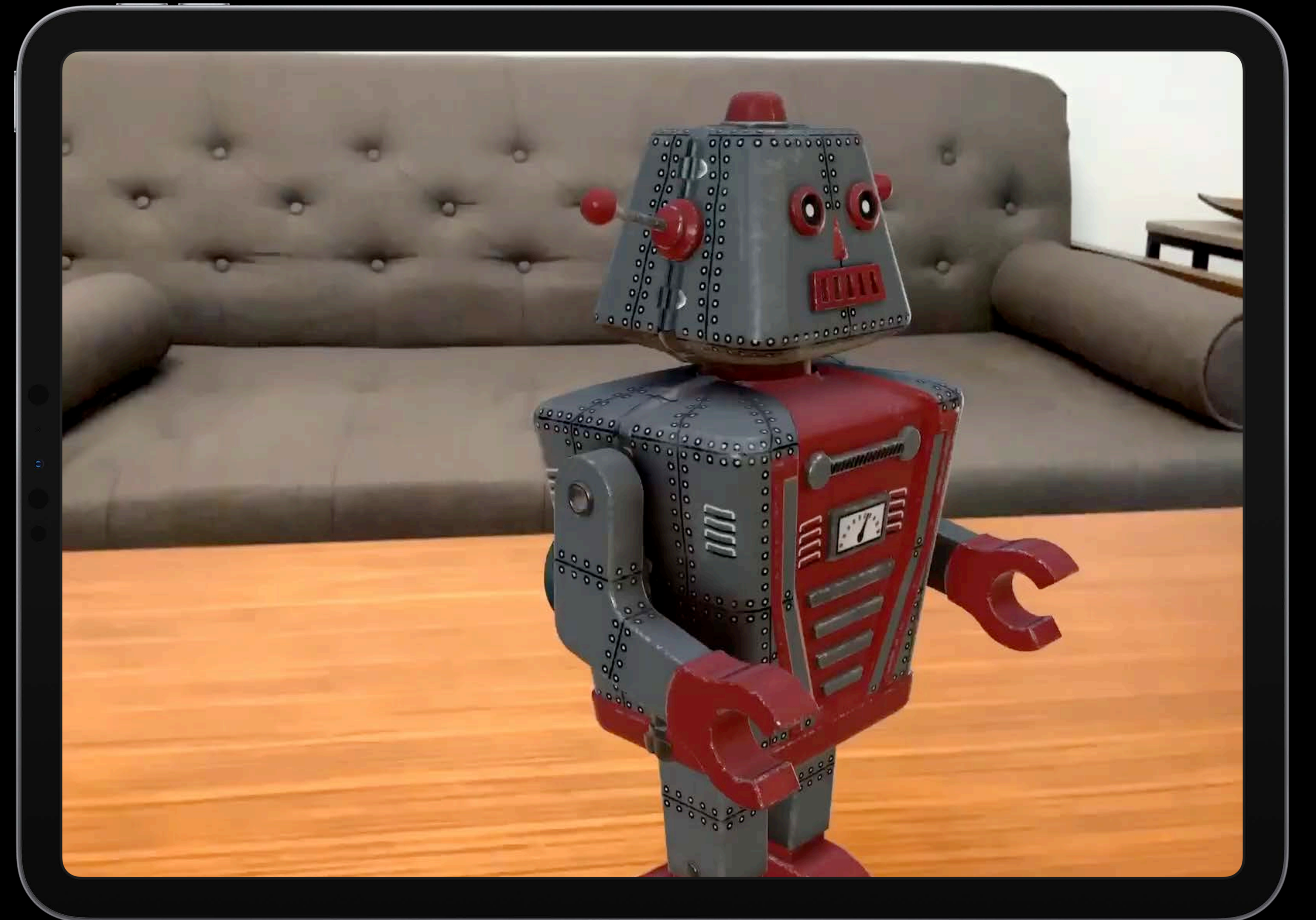
Motion Blur

Simulates effects caused by rapid movement



Motion Blur

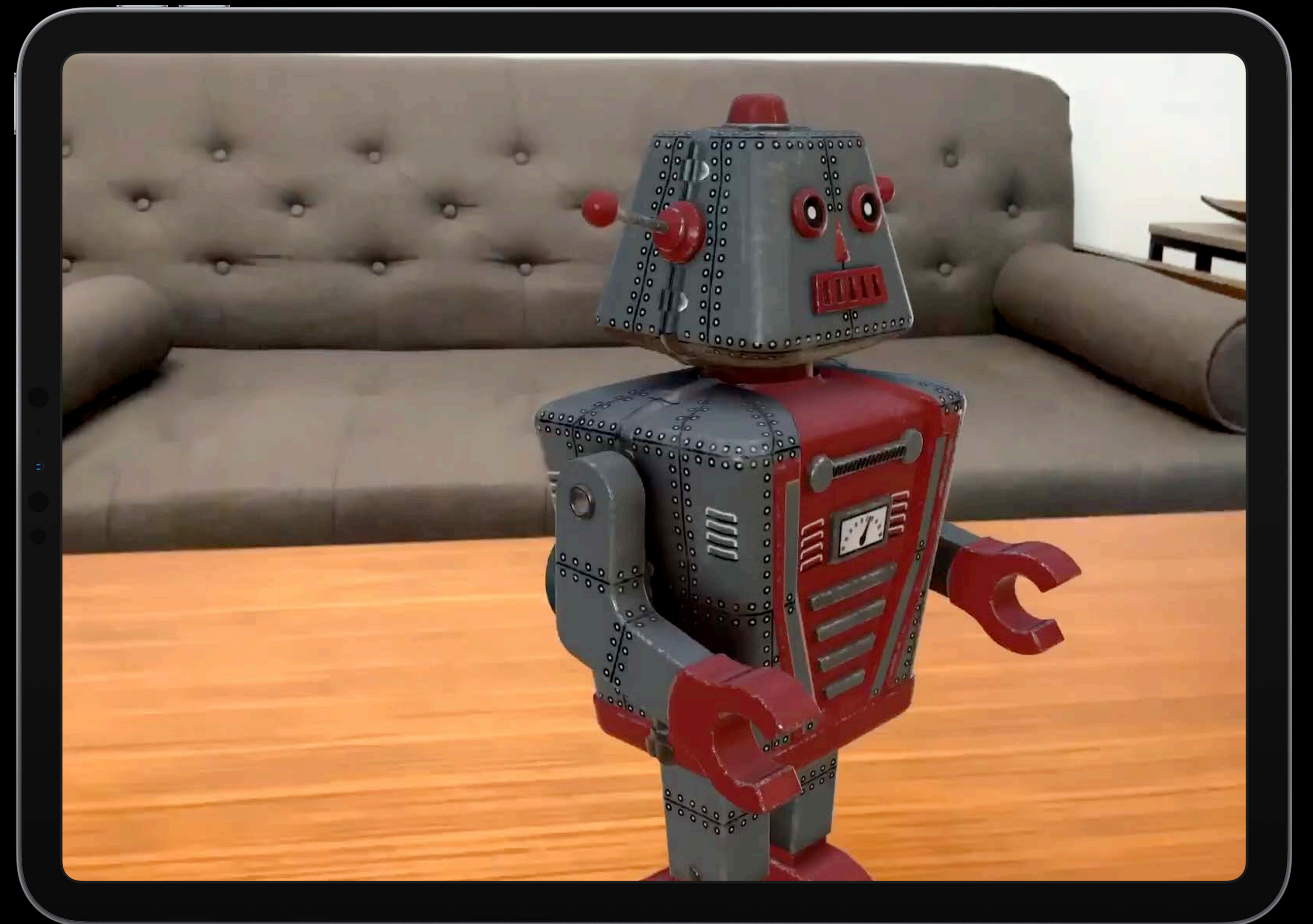
Simulates effects caused by rapid movement



Motion Blur

Simulates effects caused by rapid movement

Applies artificial blur

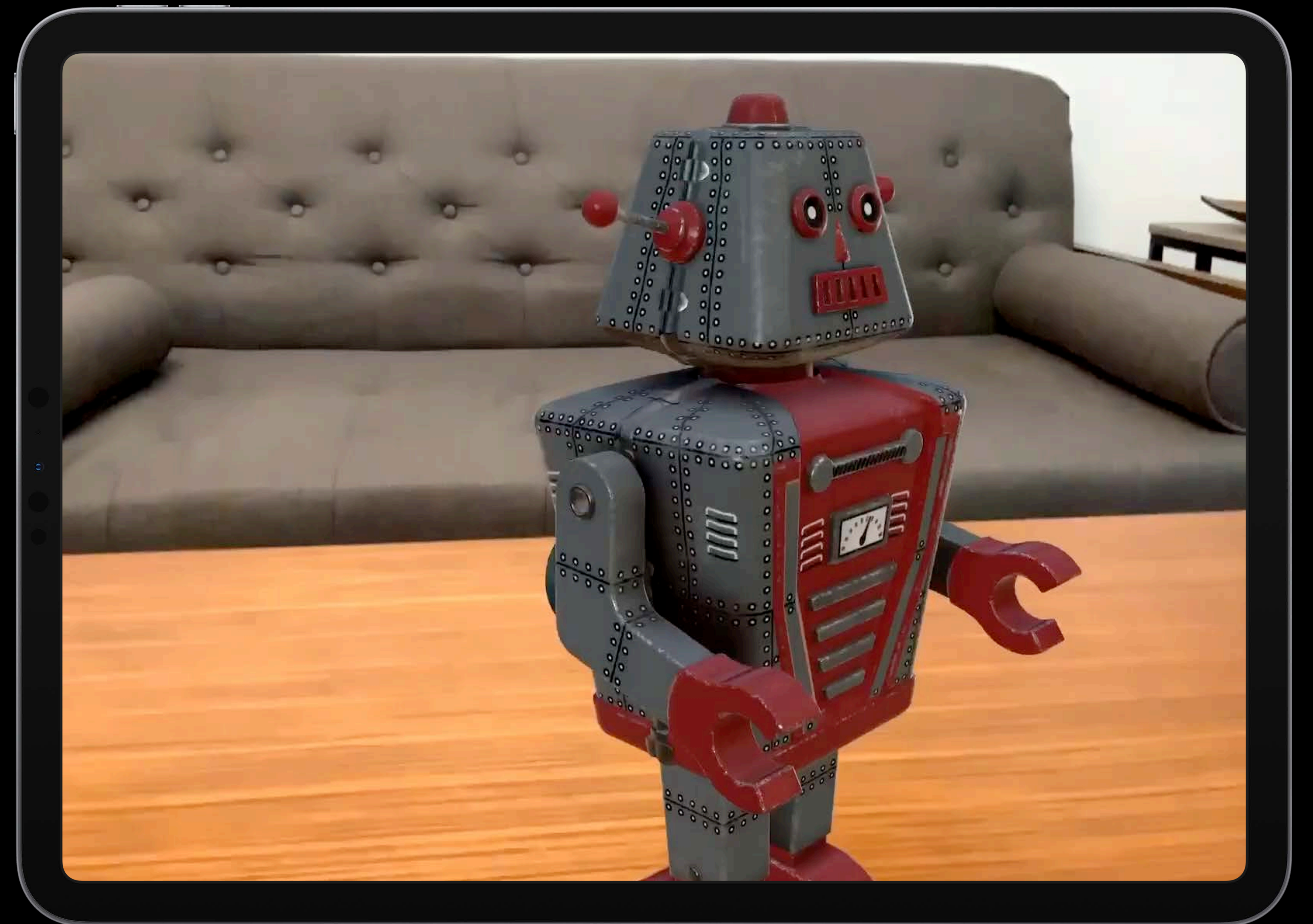


Motion Blur

Simulates effects caused by rapid movement

Applies artificial blur

Depends on device motion and exposure



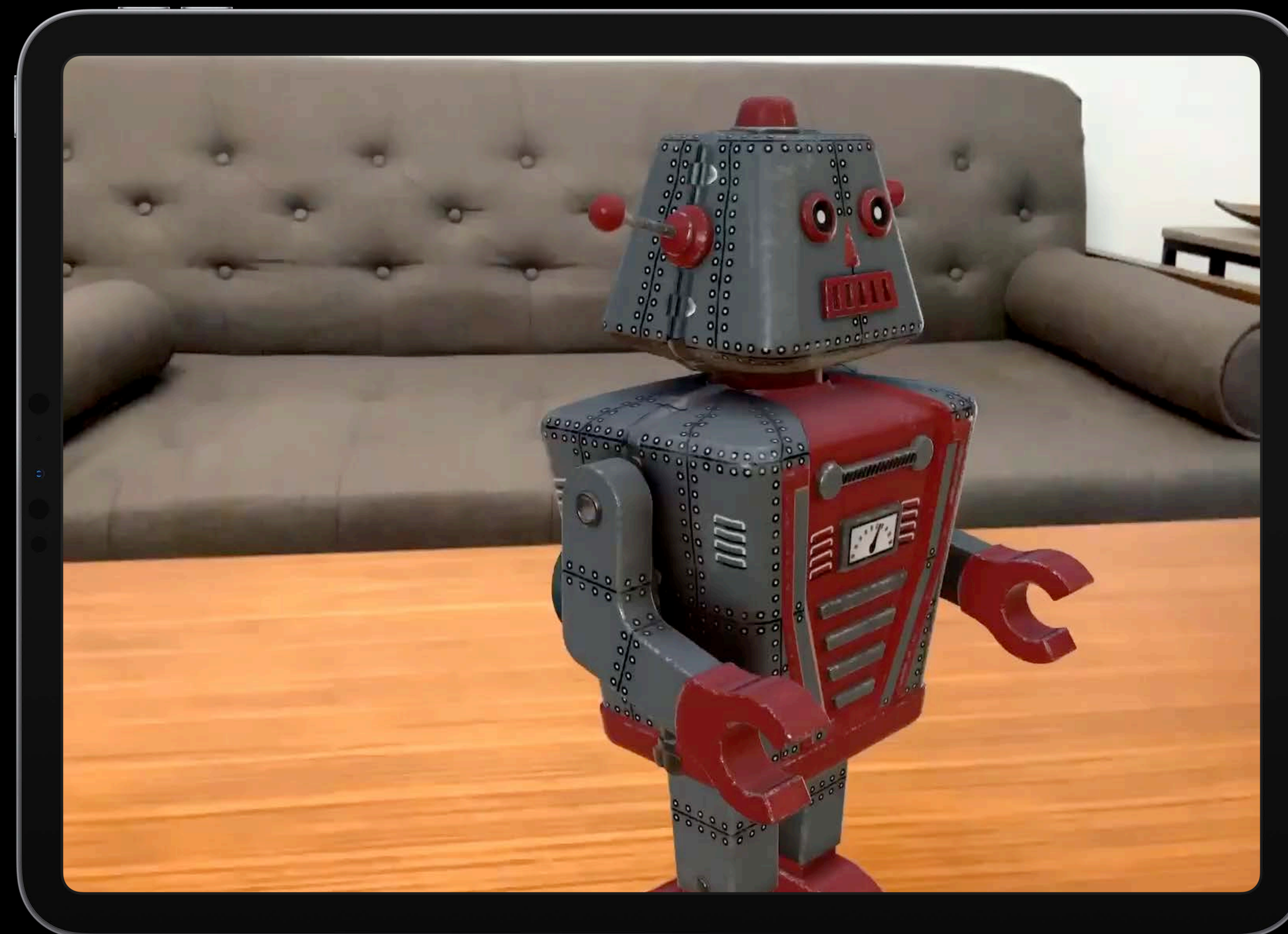
Motion Blur

Simulates effects caused by rapid movement

Applies artificial blur

Depends on device motion and exposure

Available on A12X devices



Automatic Rendering Quality Selection

Projected shadows All ARKit devices

Ray-traced shadows A12 and later

Camera grain All ARKit devices

HDR with tone mapping A10X and later

People Occlusion A12 and later

Motion blur A12X

Depth of field A12X

Enhancements to the Viewing Experience

Launch Straight to AR

Place virtual content in world as fast possible

Launch Straight to AR

Place virtual content in world as fast possible

Improvements to scene understanding

Launch Straight to AR

Place virtual content in world as fast possible

Improvements to scene understanding

Uses machine learning for plane detection

Launch Straight to AR

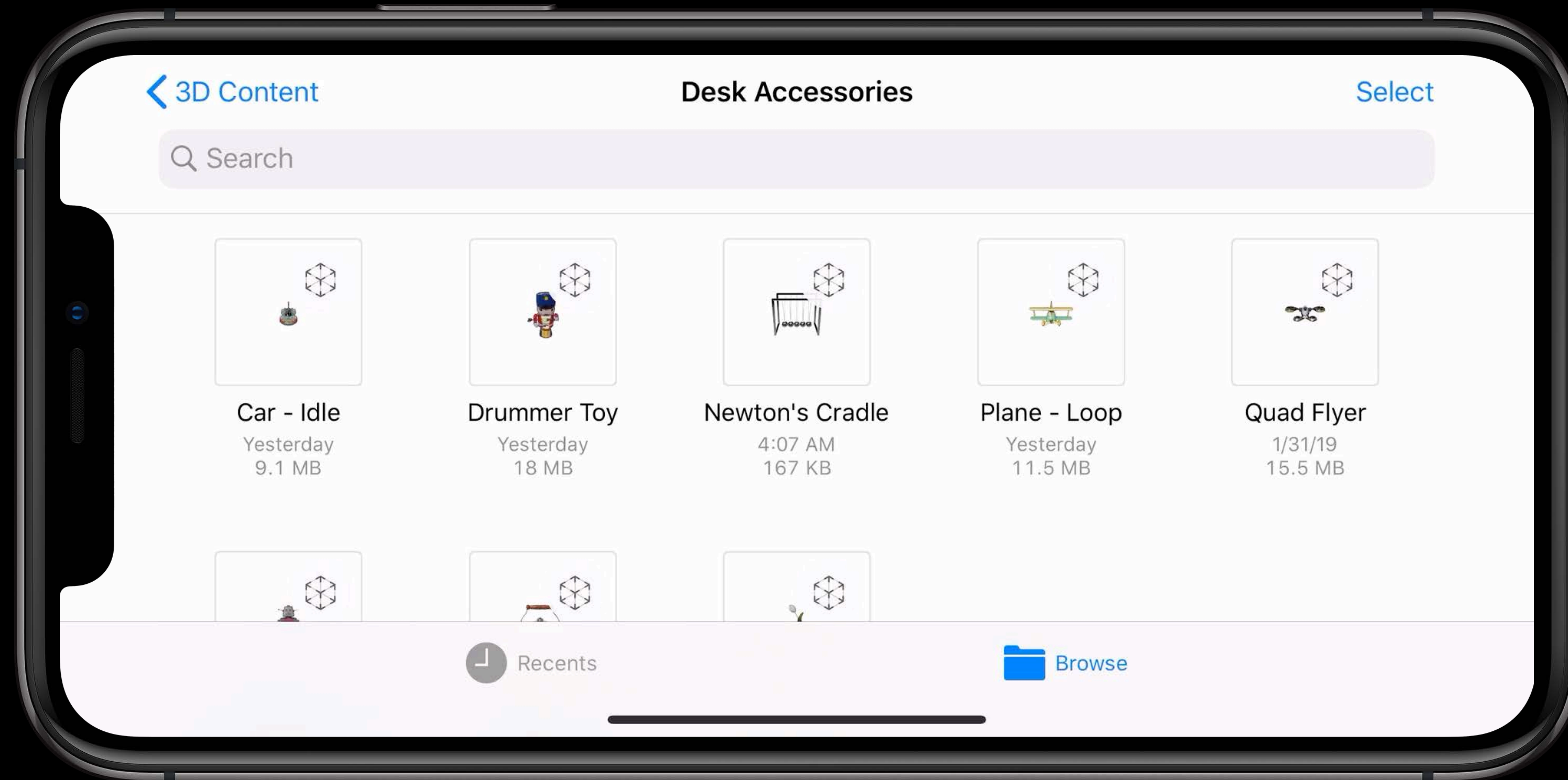
Place virtual content in world as fast possible

Improvements to scene understanding

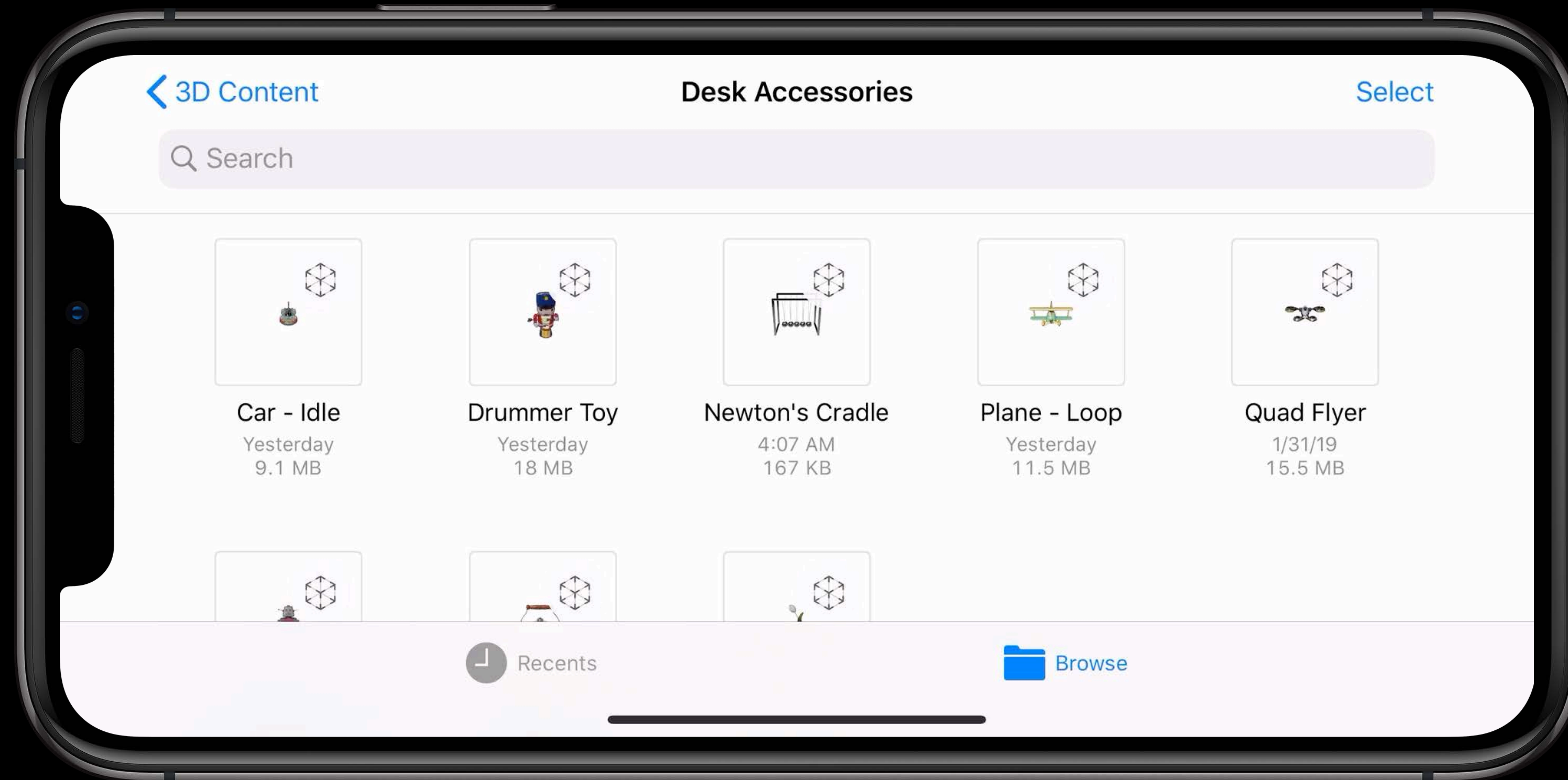
Uses machine learning for plane detection

Securely runs in separate sandboxed process

Launch Straight to AR

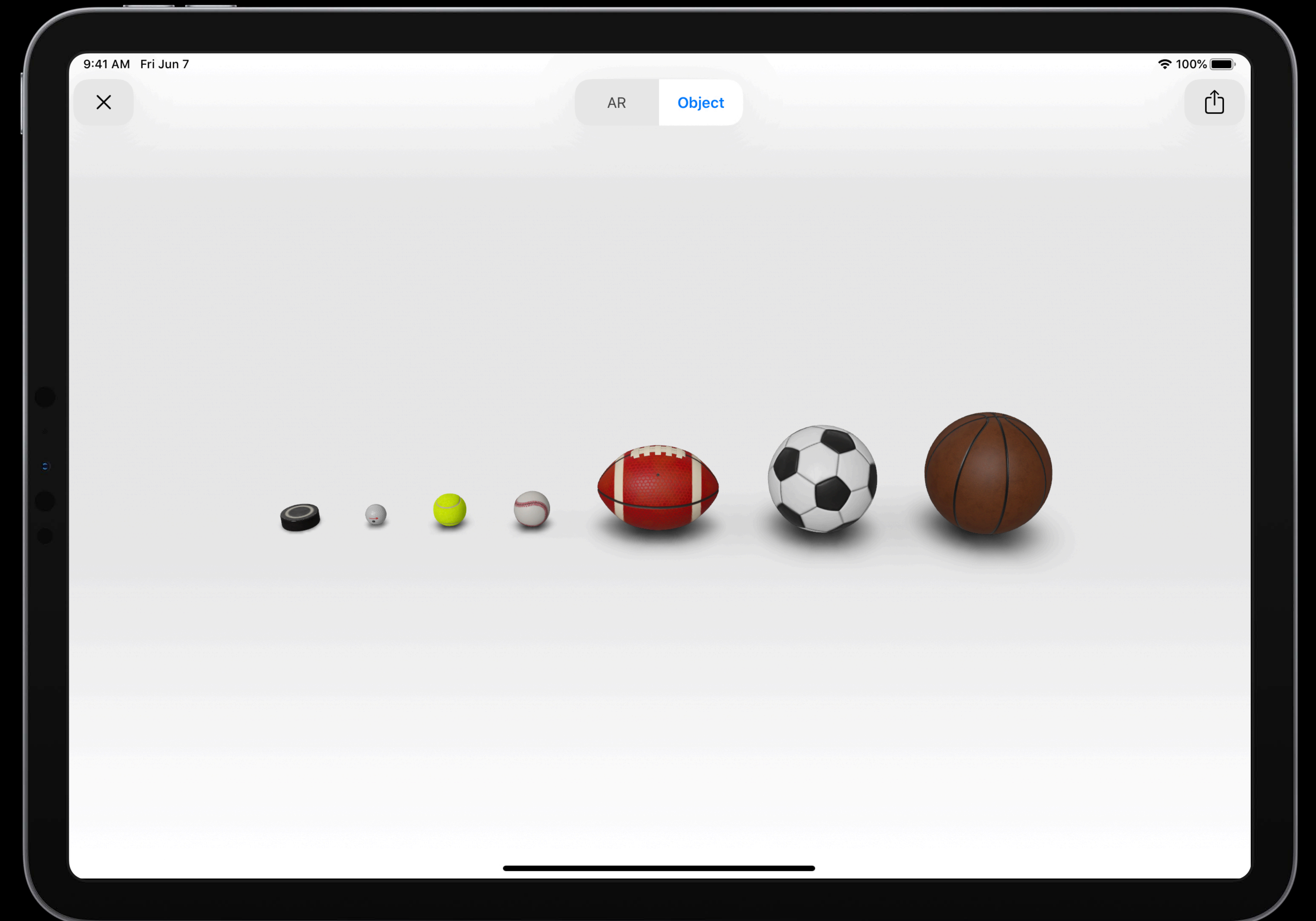


Launch Straight to AR



Multiple Models with Nested usdz

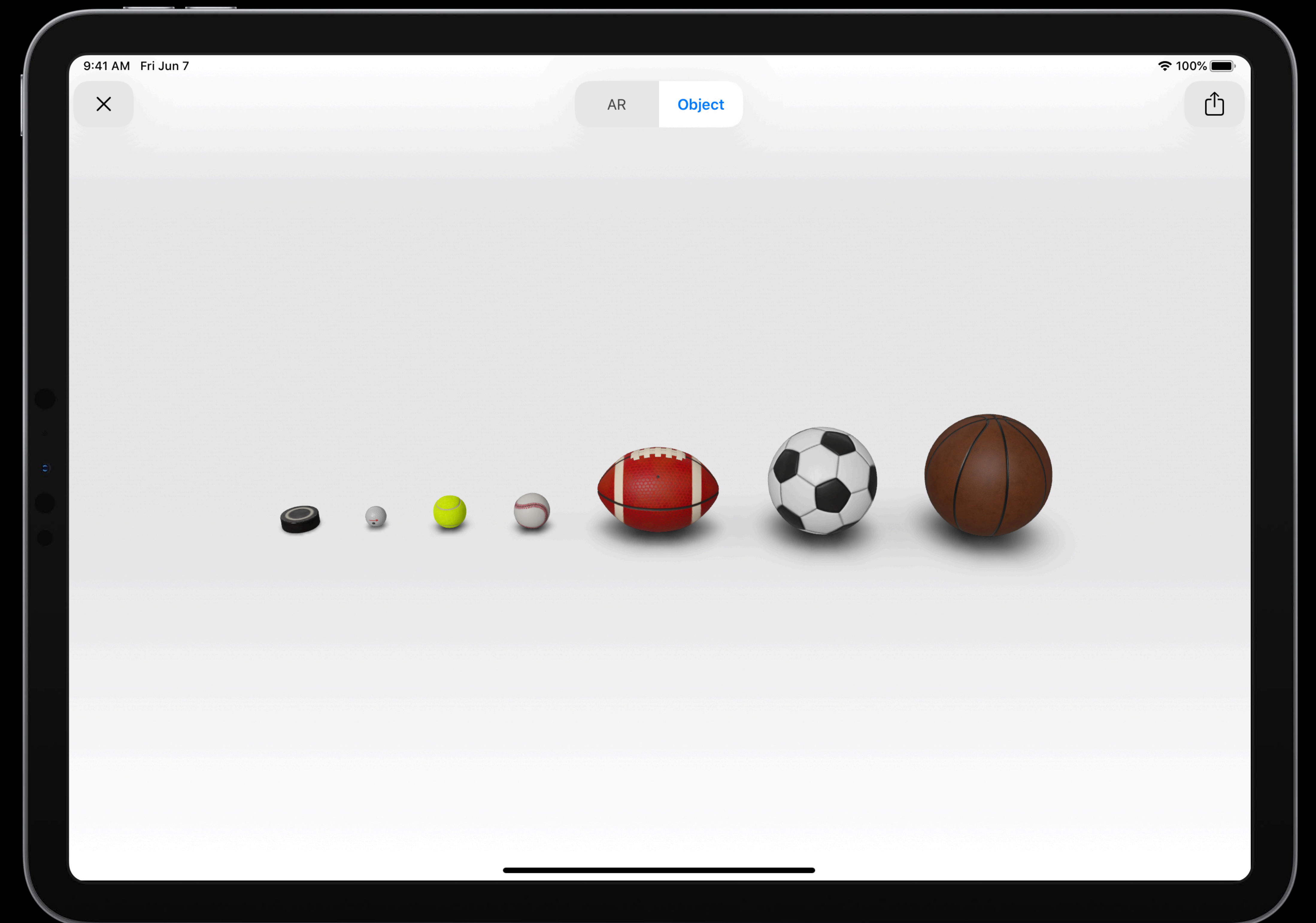
Contains metadata and library of usdz files



Multiple Models with Nested usdz

Contains metadata and library of usdz files

Useful for collections of related objects

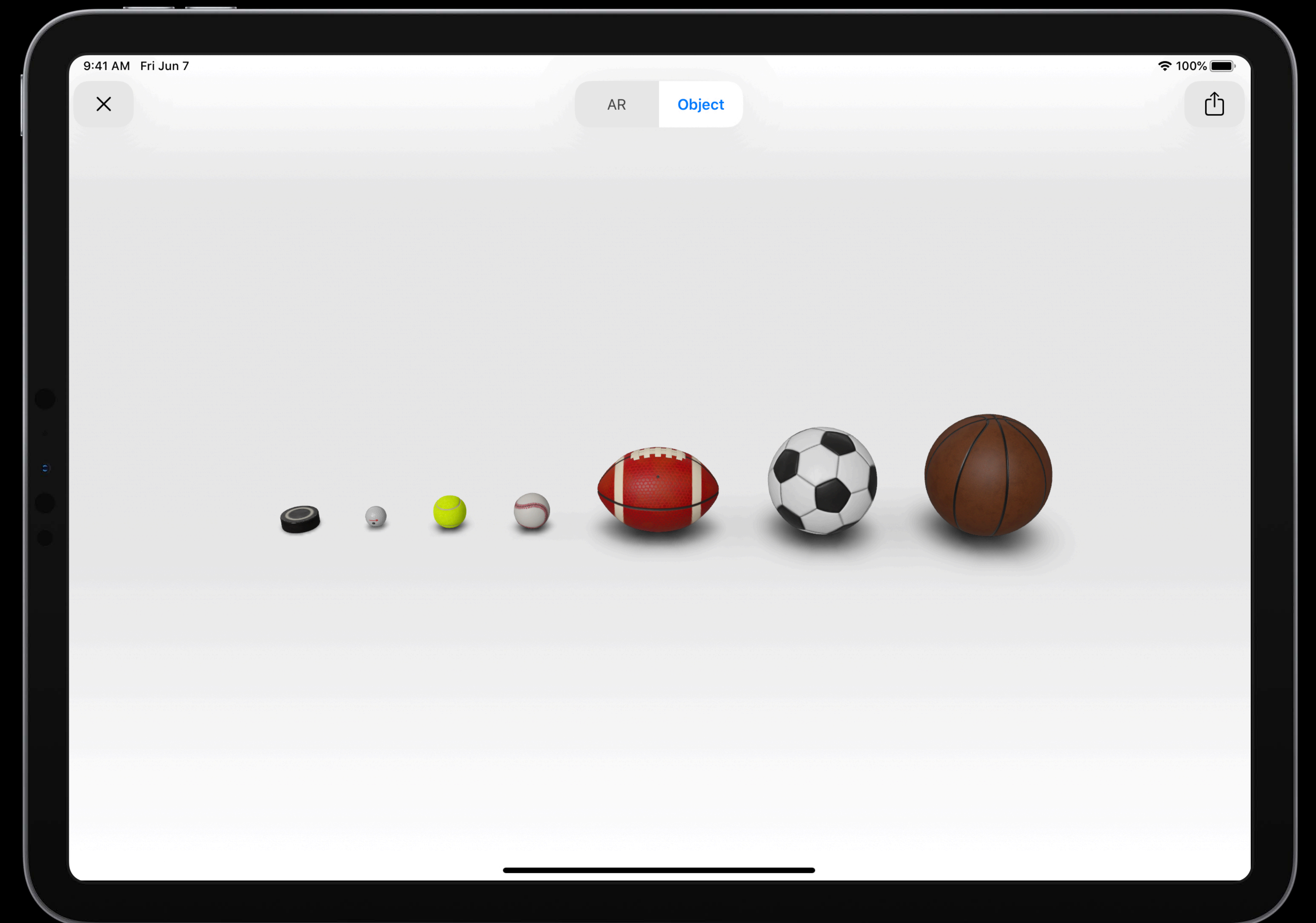


Multiple Models with Nested usdz

Contains metadata and library of usdz files

Useful for collections of related objects

Lined up in ascending height order



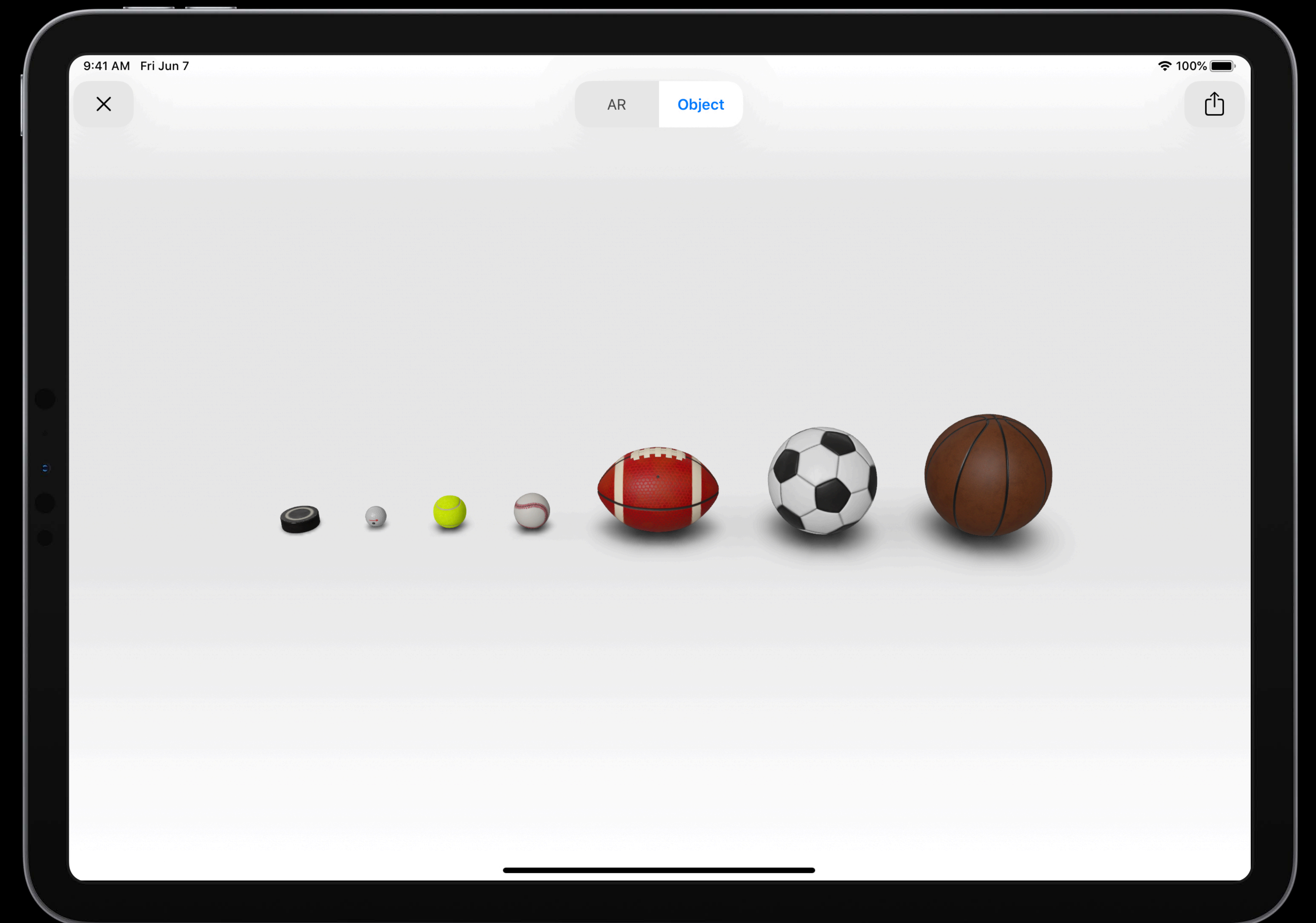
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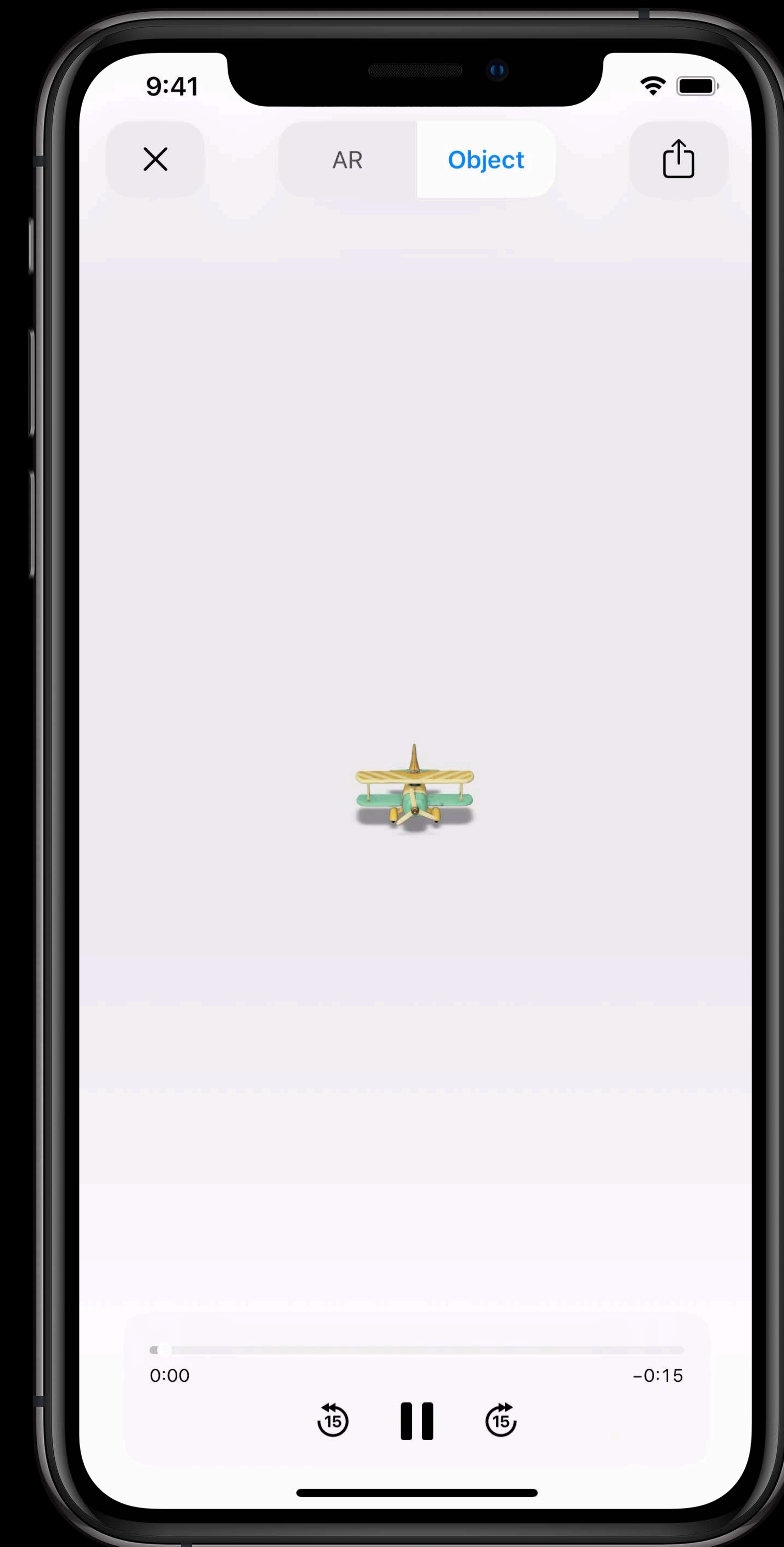
Lined up in ascending height order

Moved independently in the world



Animation Playback

Users can control animation playback



Animation Playback

Users can control animation playback

Include fine scrubbing through animations

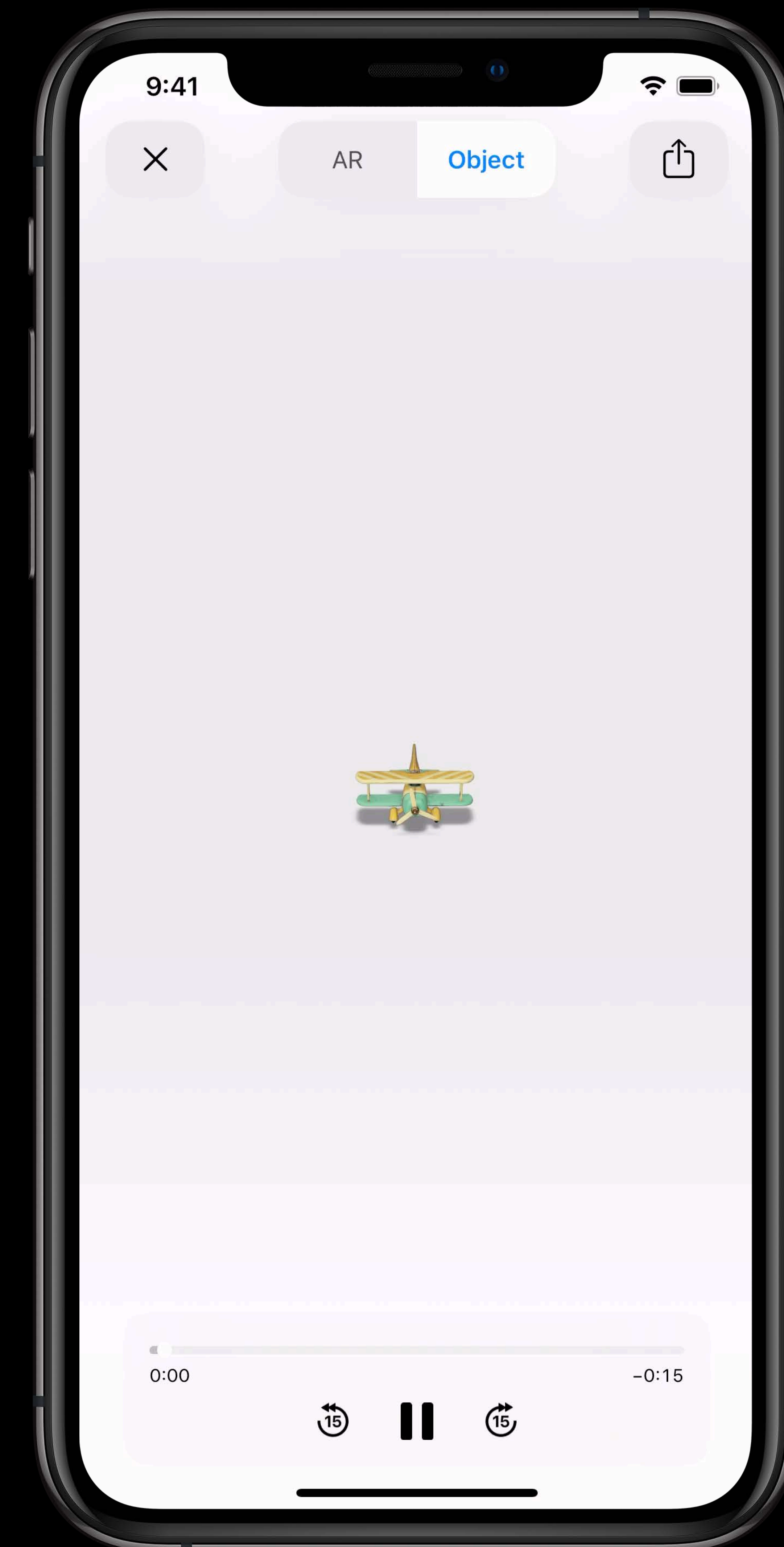


Animation Playback

Users can control animation playback

Include fine scrubbing through animations

Rewatch from different angles



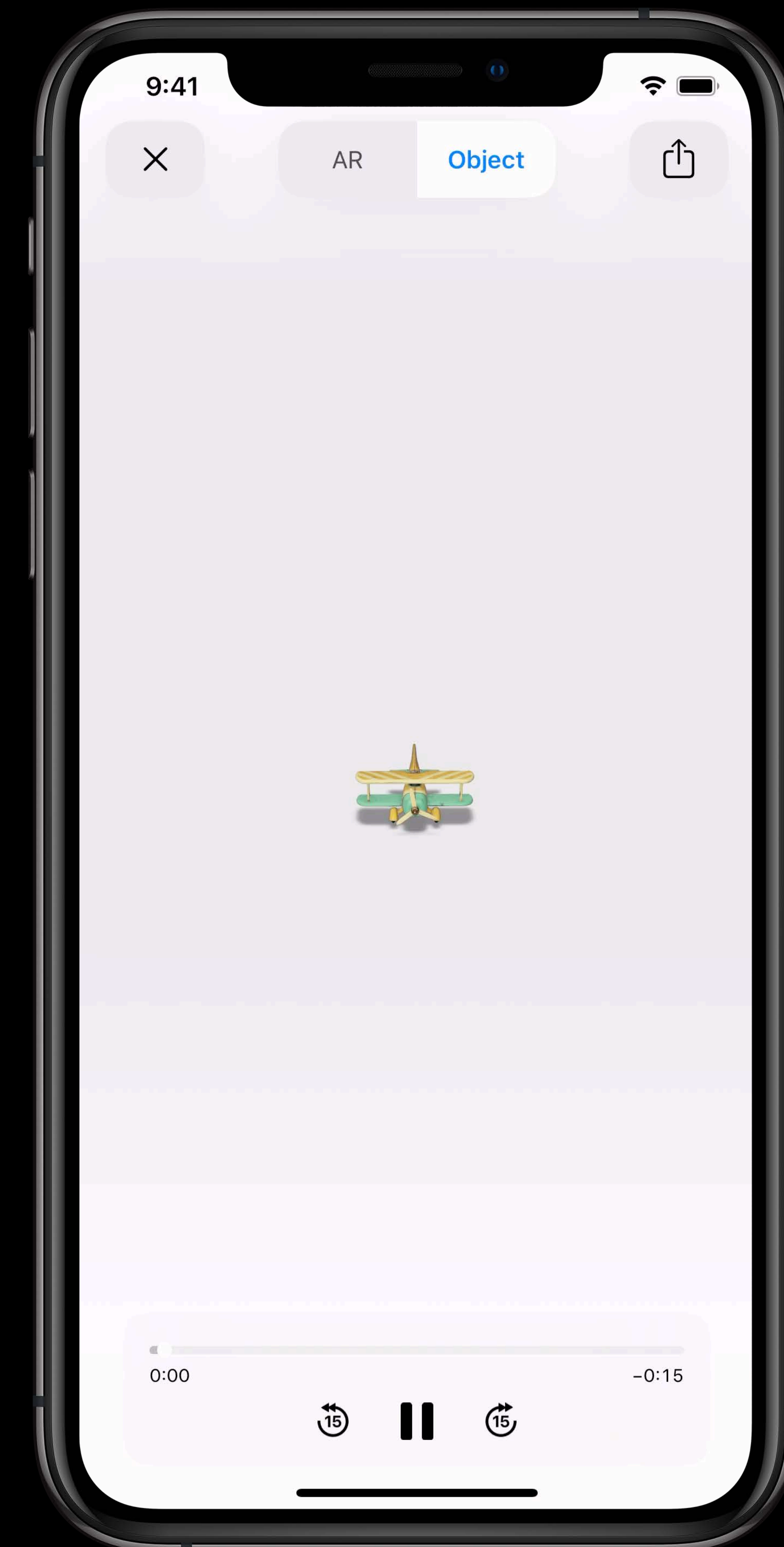
Animation Playback

Users can control animation playback

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Rewatch from different angles

Animation duration \geq 10 seconds



Animation Playback

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Include fine scrubbing through animations

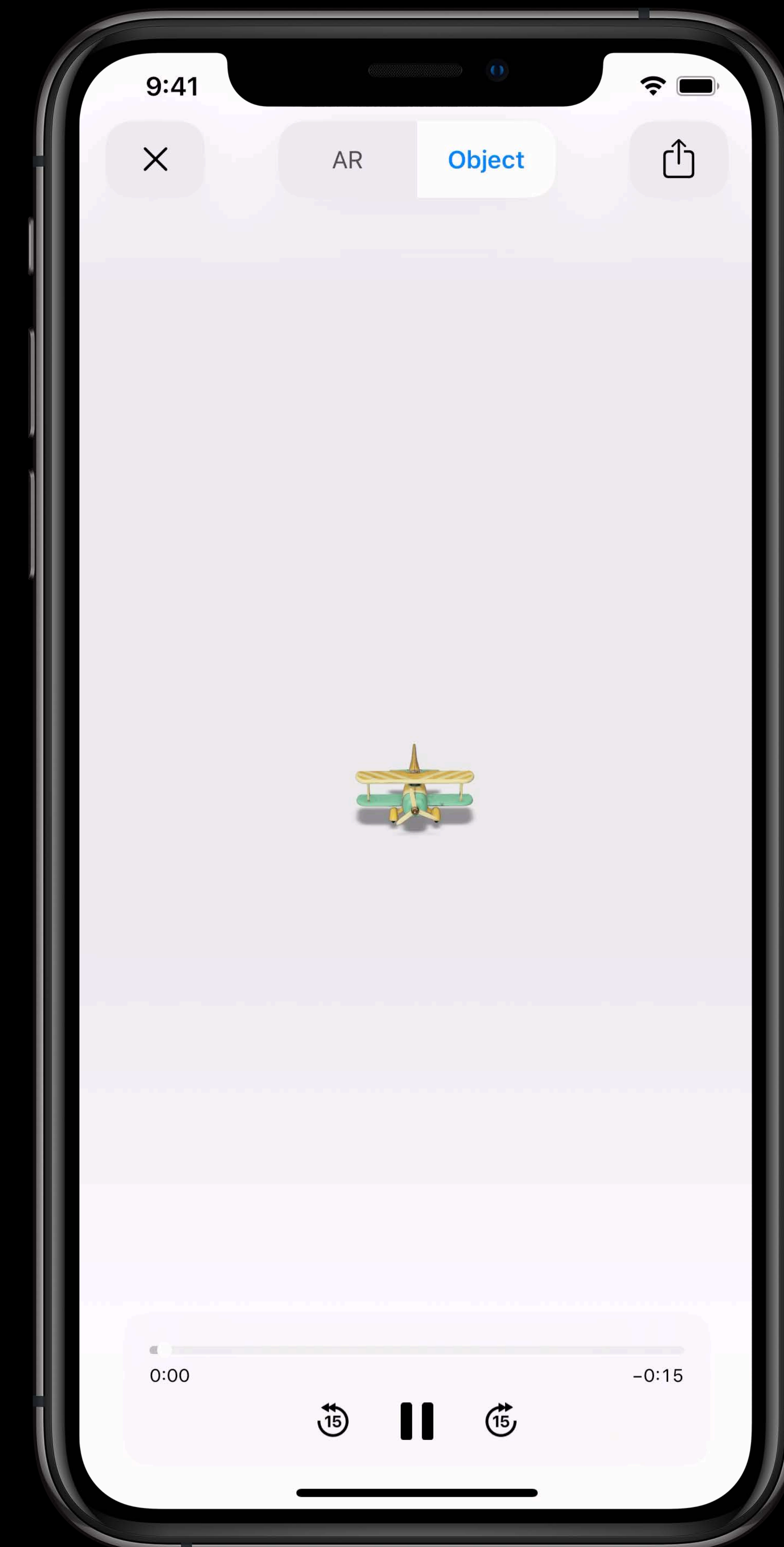
Rewatch from different angles

Animation duration \geq 10 seconds

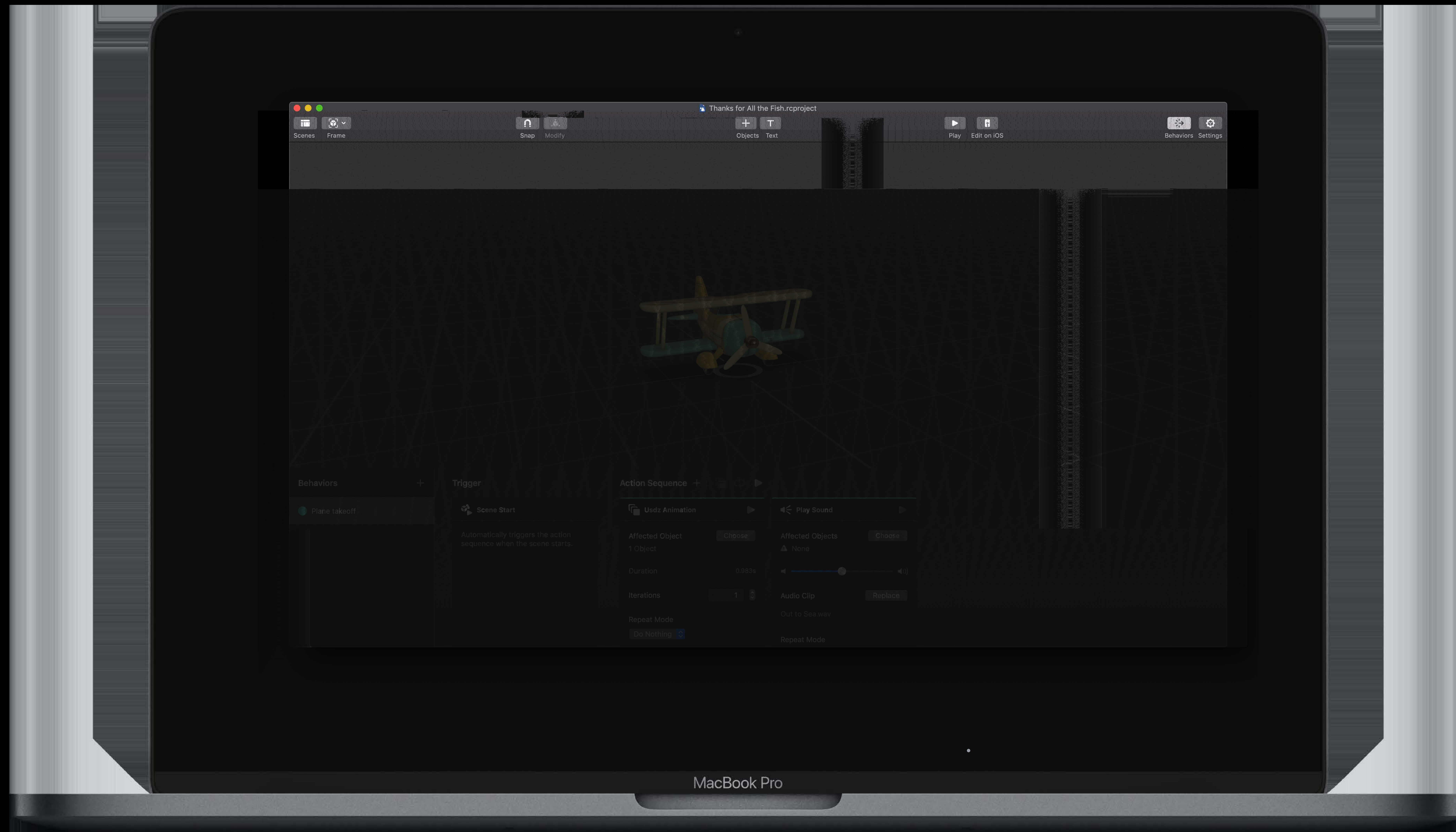


One Scene Start trigger with Animation Action

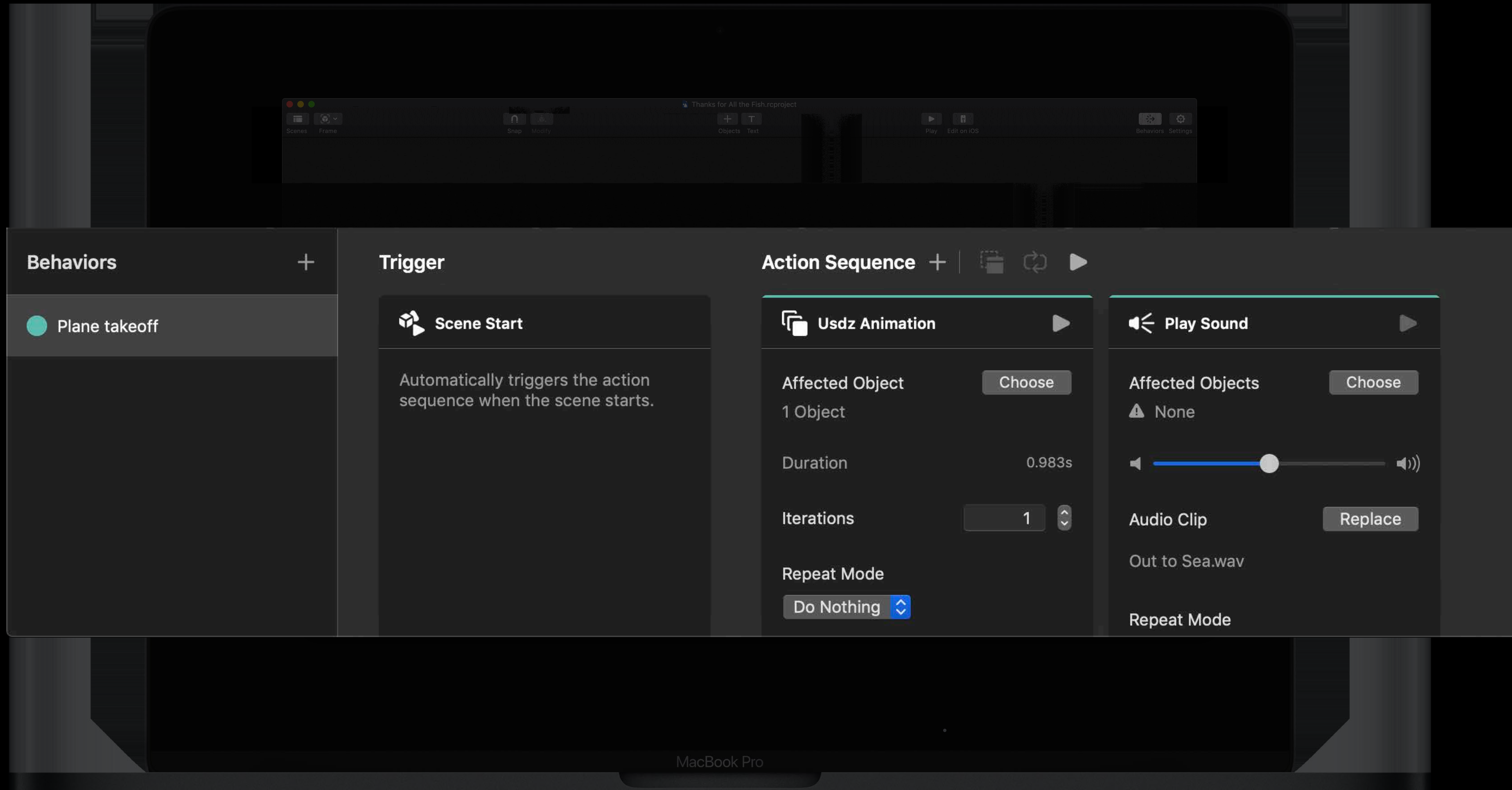
Optional Sound Action



Animation Playback

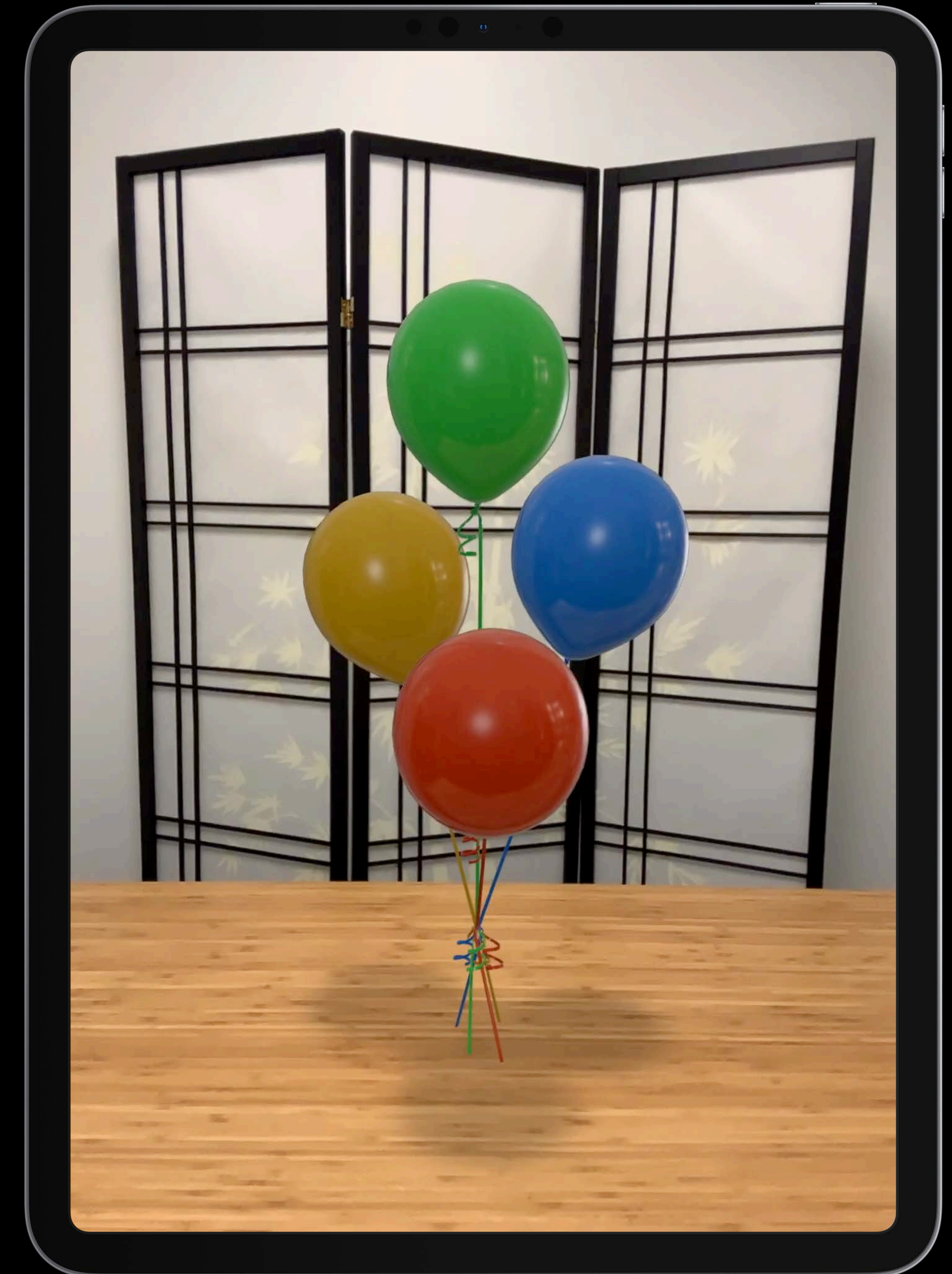


Animation Playback



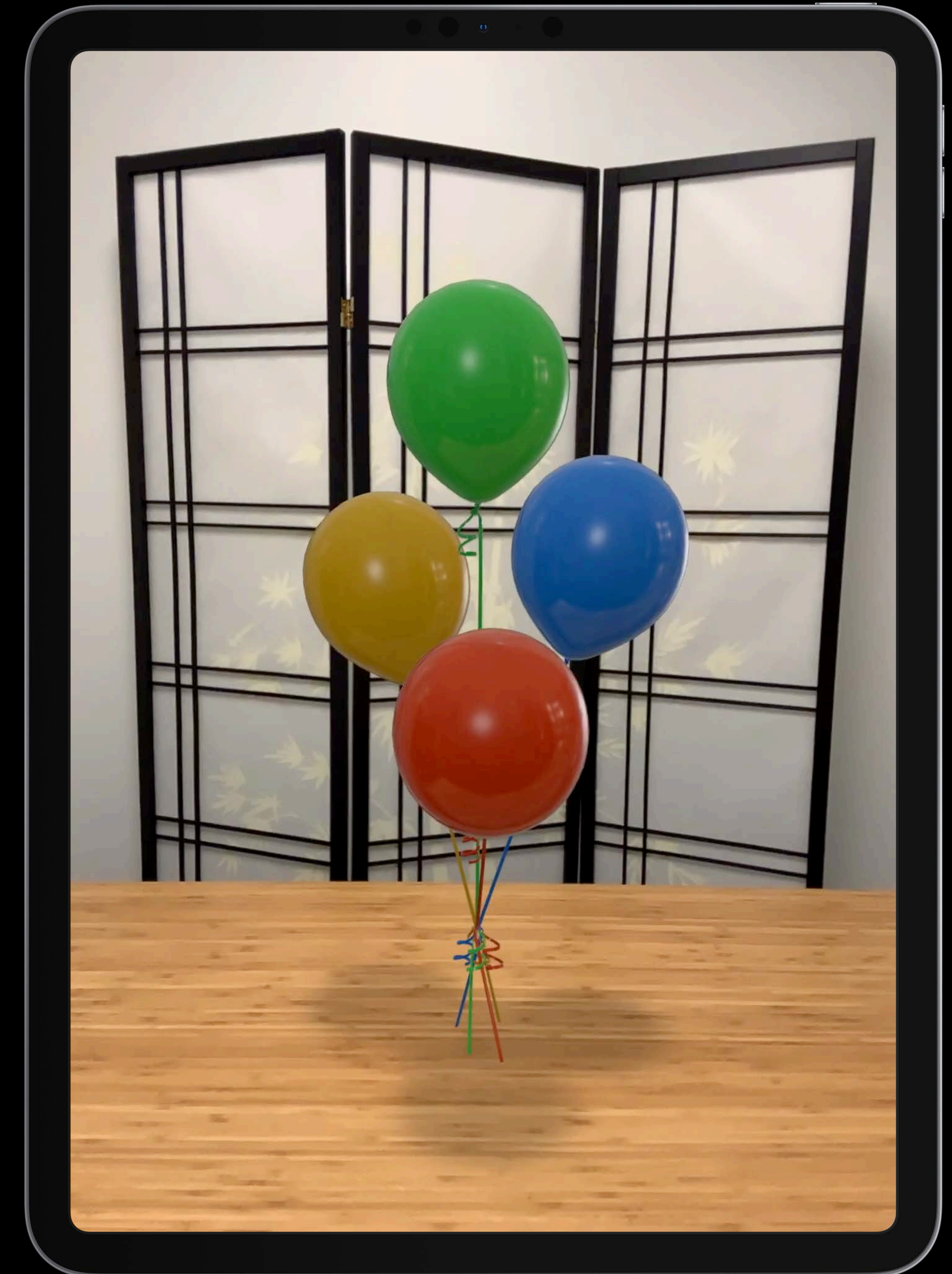
Levitation Gesture

Two-finger swipe up gesture on object



Levitation Gesture

Two-finger swipe up gesture on object



Video Recording

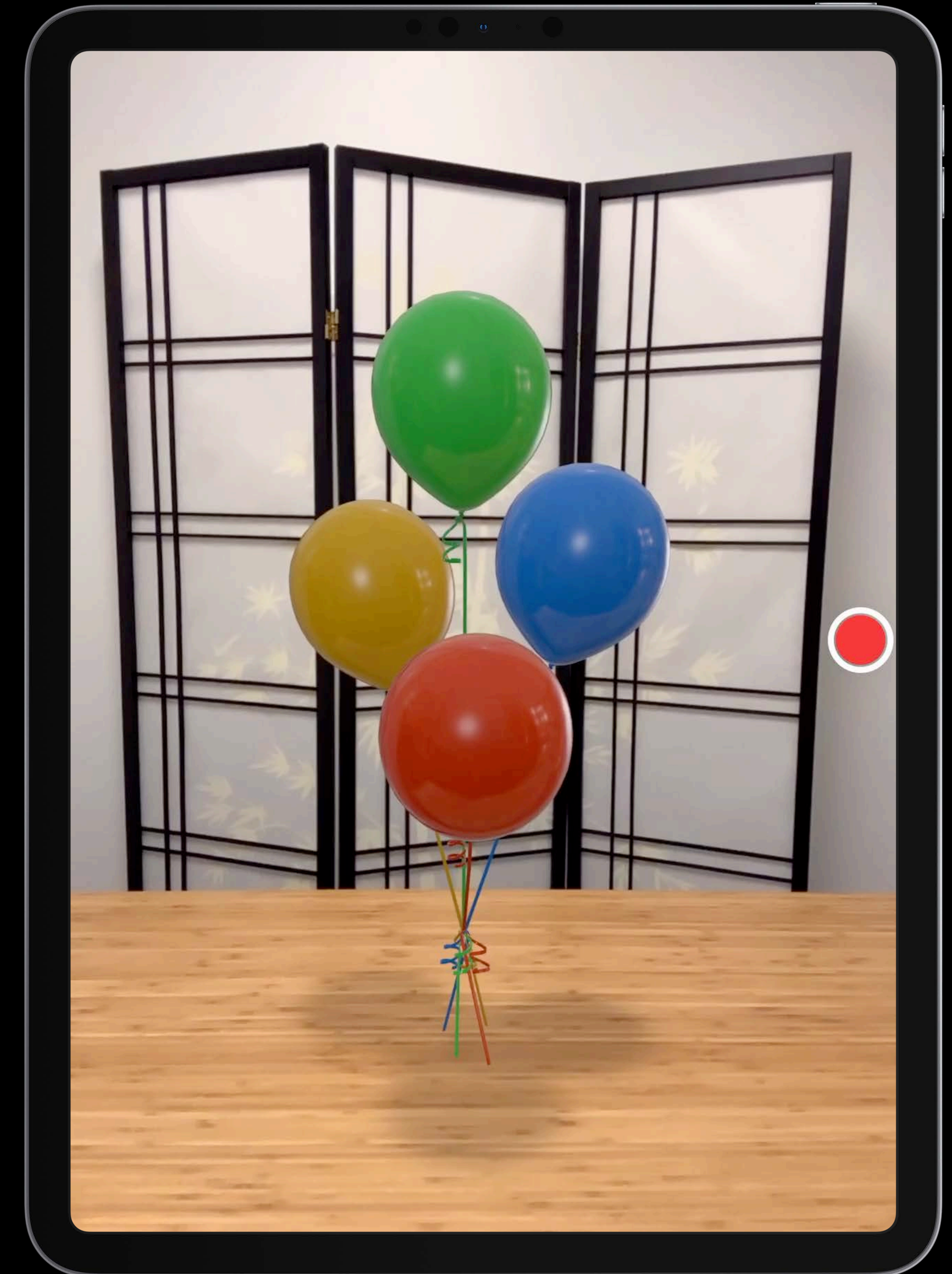
Record interactions with the world



Video Recording

Record interactions with the world

Videos saved to photos library



macOS Quick Look Viewer

Supports previewing usdz and Reality File

macOS Quick Look Viewer

Supports previewing usdz and Reality File

Supports thumbnail generation

macOS Quick Look Viewer

Supports previewing usdz and Reality File

Supports thumbnail generation

Built on RealityKit

macOS Quick Look Viewer

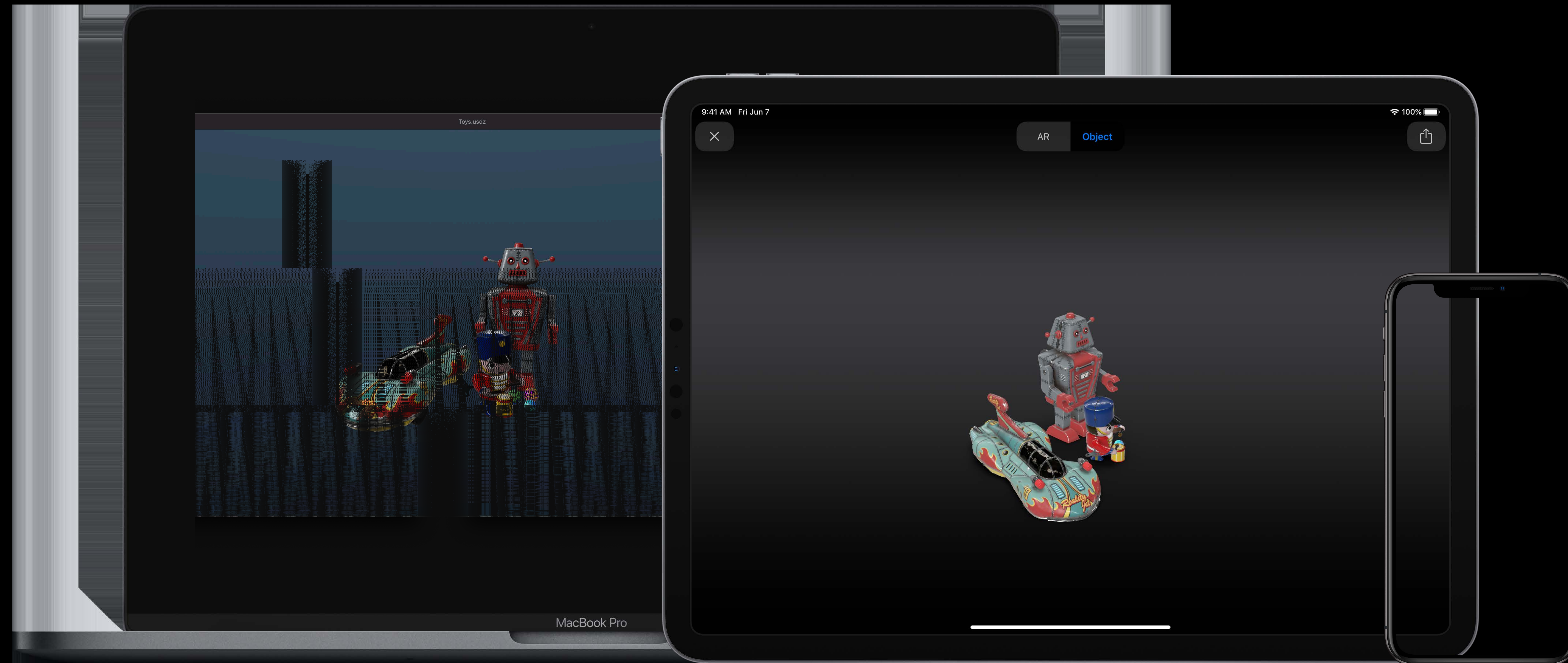
Supports previewing usdz and Reality File

Supports thumbnail generation

Built on RealityKit

Consistent experience between iOS and macOS

macOS Quick Look Viewer



Web Integration and Customization

AR Quick Look Integration on the Web

Support for viewing 3D models in Safari

AR Quick Look Integration on the Web

Support for viewing 3D models in Safari

HTML markup to launch AR Quick Look

AR Quick Look Integration on the Web

Support for viewing 3D models in Safari

HTML markup to launch AR Quick Look

Specify MIME type to serve AR content

AR Quick Look Integration on the Web

Support for viewing 3D models in Safari

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Specify MIME type to serve AR content

Thumbnail image with AR badge visible on webpage

AR Quick Look Integration on the Web

Support for viewing 3D models in Safari

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Thumbnail image with AR badge visible on webpage

Seamless experience

Previewing usdz and Reality File

HTML markup

Previewing usdz and Reality File

HTML markup

```
<a rel="ar" href="model.usdz">  
    
</a>
```


Previewing usdz and Reality File

HTML markup

```
<a rel="ar" href="model.usdz">  
    
</a>
```


Previewing usdz and Reality File

HTML markup

```
<a rel="ar" href="model.usdz">  
    
</a>
```


Previewing usdz and Reality Files

MIME type

Previewing usdz and Reality Files

MIME type

```
AddType model/vnd.usdz+zip .usdz
```


Previewing usdz and Reality Files

MIME type

```
AddType model/vnd.usdz+zip .usdz
```

```
AddType model/vnd.reality .reality
```



Loading Content Indirectly

Data URI

Loading Content Indirectly

Data URI

```
<a rel="ar" href="data:model/vnd.usdz+zip;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
usdz

Loading Content Indirectly

Data URI

```
<a rel="ar" href="data:model/vnd.usdz+zip;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
usdz

Loading Content Indirectly

Data URI

```
<a rel="ar" href="data:model/vnd.usdz+zip;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
usdz

```
<a rel="ar" href="data:model/vnd.reality;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
Reality File

Loading Content Indirectly

Data URI

```
<a rel="ar" href="data:model/vnd.usdz+zip;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
usdz

```
<a rel="ar" href="data:model/vnd.reality;base64,<base64 encoded string>"  
download="asset.usdz">  
    
</a>
```

Data URIs
Reality File

Loading Content Indirectly

Blob URL

Loading Content Indirectly

Blob URL

```
<a rel="ar" href="blob:<generated URL string>" download="asset.usdz">  
    
</a>
```

Blob URLs

Loading Content Indirectly

Blob URL

```
<a rel="ar" href="blob:<generated URL string>" download="asset.usdz">  
    
</a>
```

Blob URLs

Customizing the AR Quick Look Experience

Disable content scaling

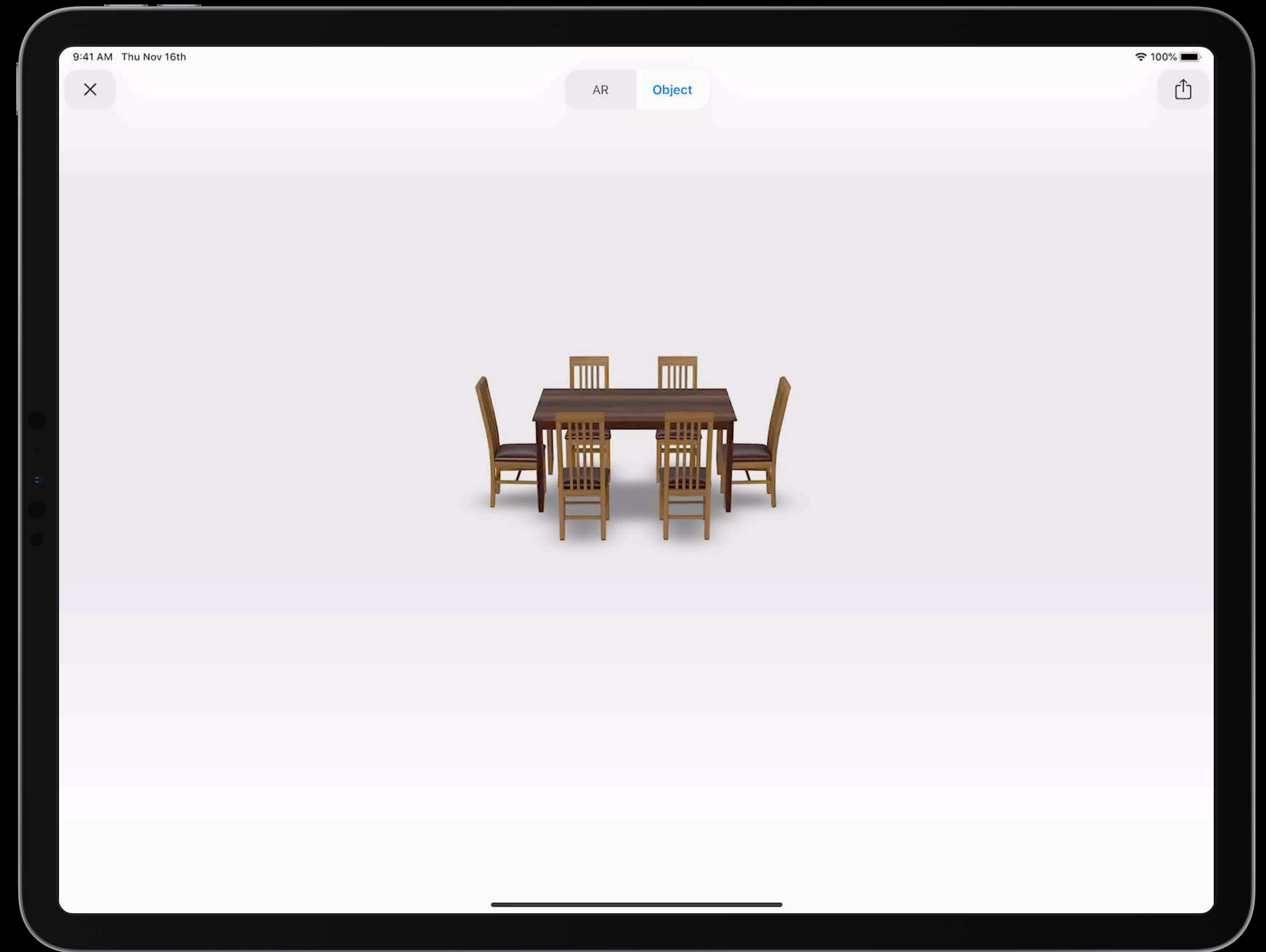
Customizing the AR Quick Look Experience

Disable content scaling

Sharing canonical webpage URL instead of 3D model

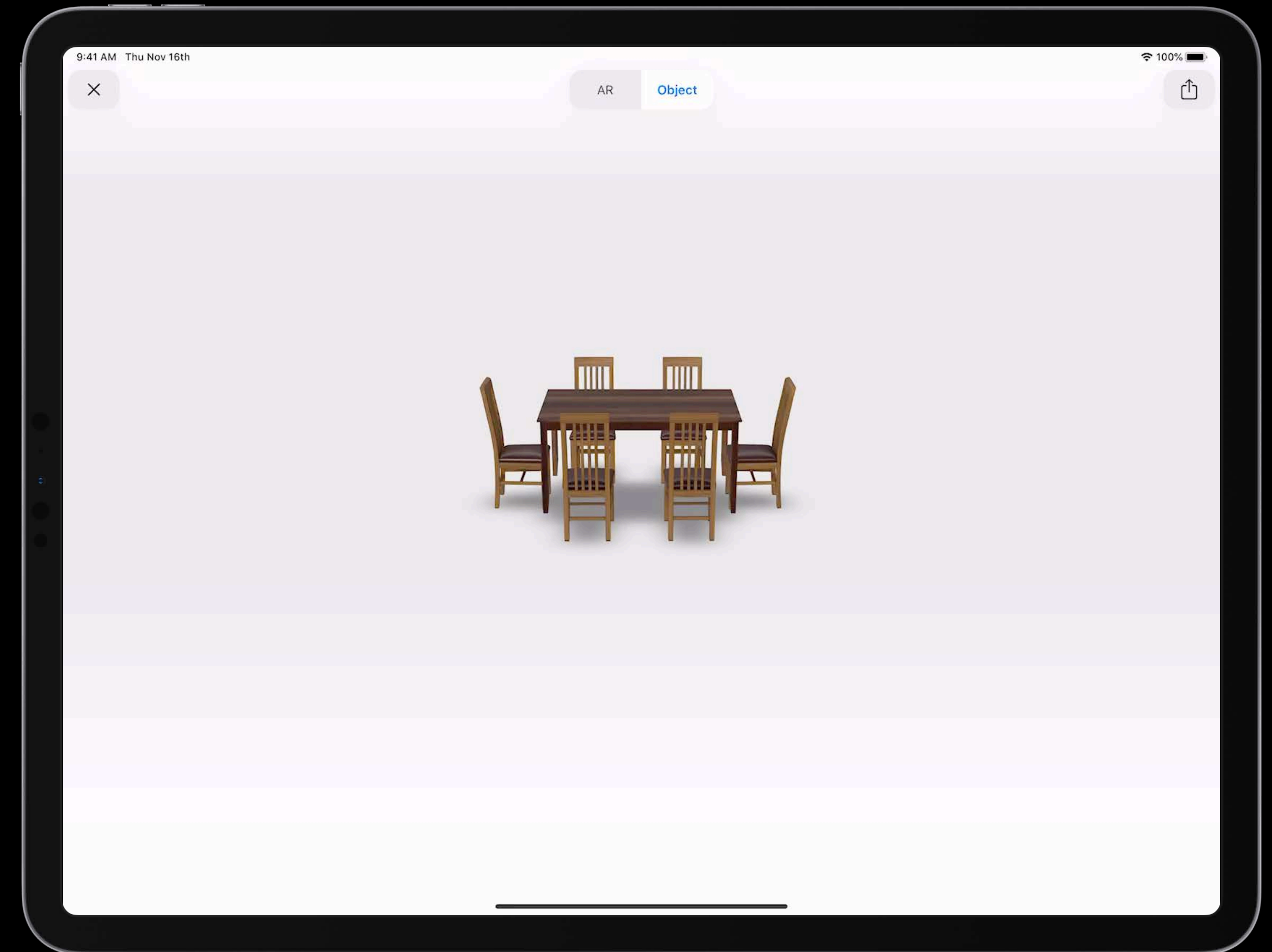
Disable Content Scaling

Preview content at intended size



Disable Content Scaling

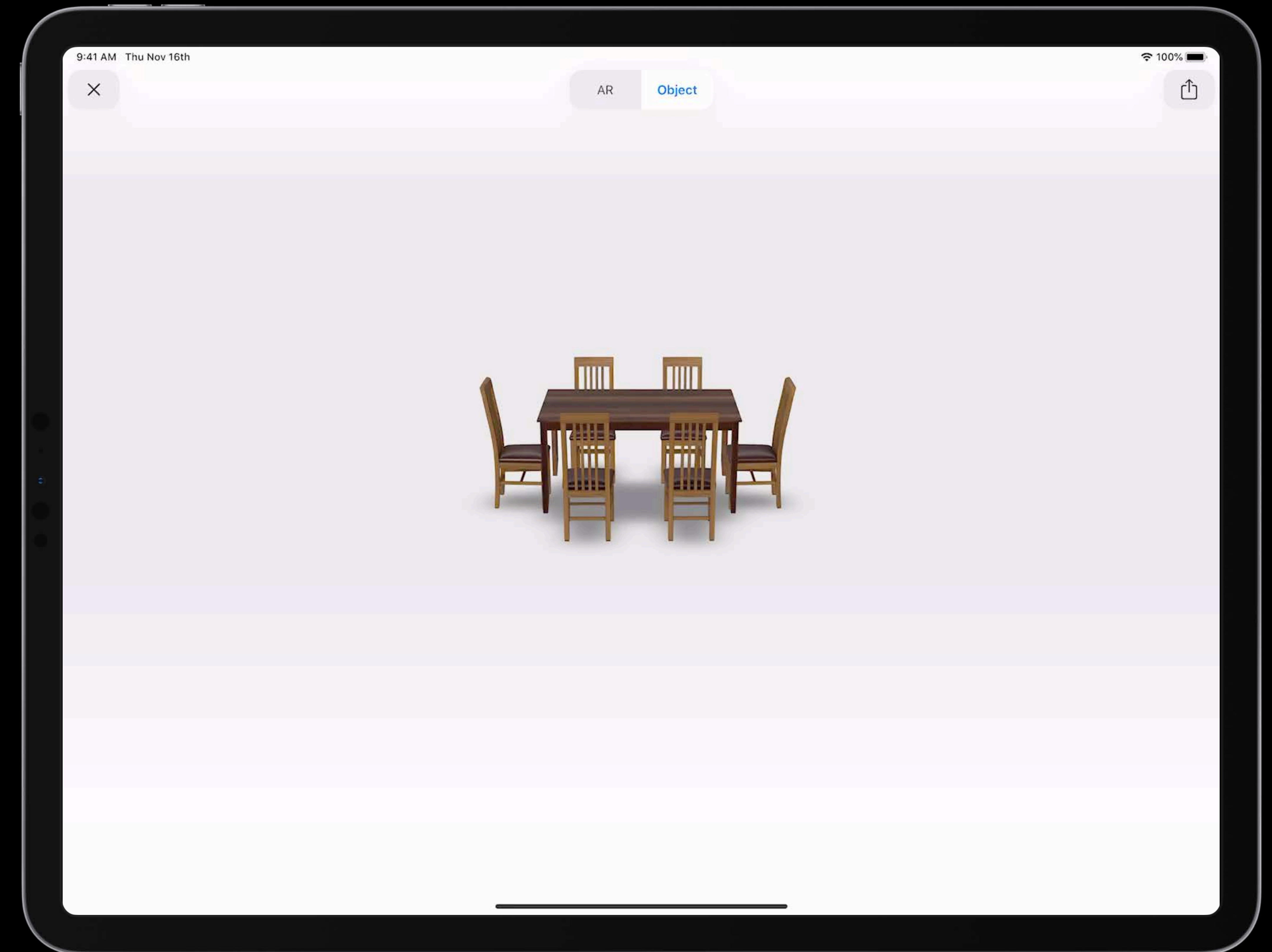
Preview content at intended size



Disable Content Scaling

Preview content at intended size

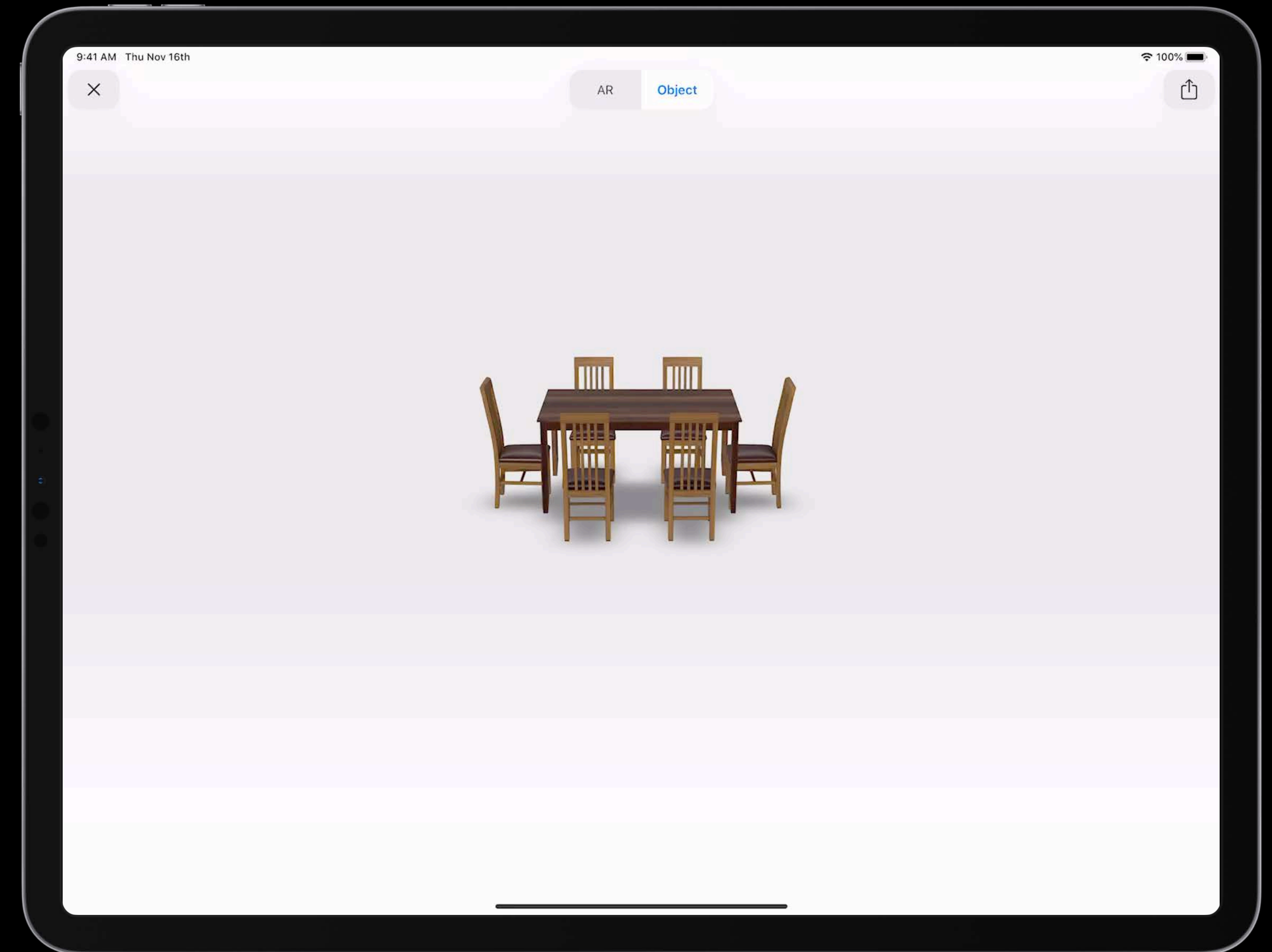
Great for viewing real world products
such as furniture



Disable Content Scaling

Preview content at intended size

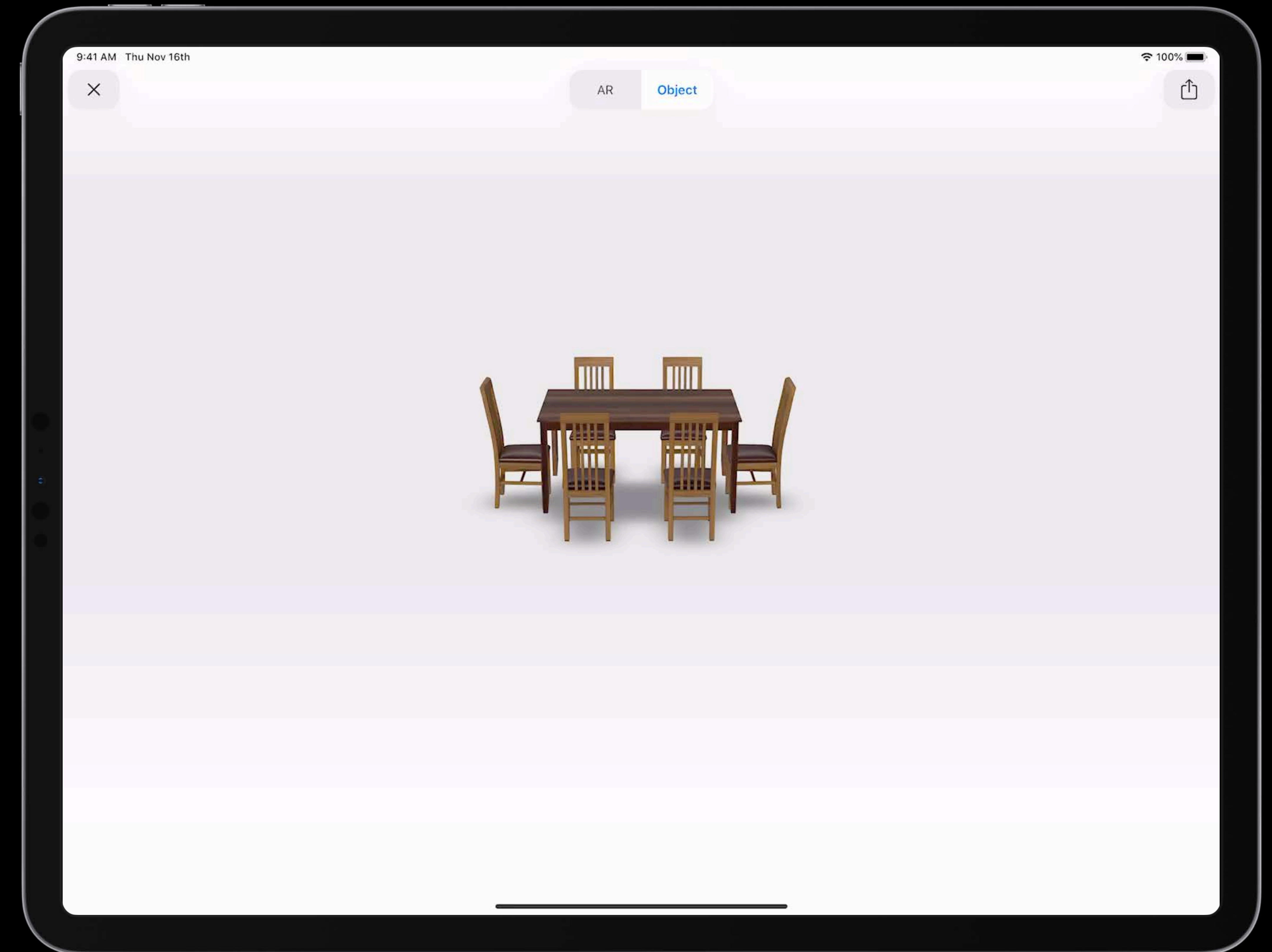
Great for viewing real world products
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Disable Content Scaling

Preview content at intended size

Great for viewing real world products
such as furniture



Customization Web API

Fragment identifier

```
https://developer.apple.com/arkit/gallery/toy\_biplane.usdz#allowsContentScaling=0
```

Customization Web API

Fragment identifier

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```


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Sharing Product Link

Learn more about origin of usdz

Sharing Product Link

Learn more about origin of usdz

Great for linking back to product description pages

Sharing Product Link

Learn more about origin of usdz

Great for linking back to product description pages

Allows for up-to-date description of usdz content

Sharing Product Link

Learn more about origin of usdz

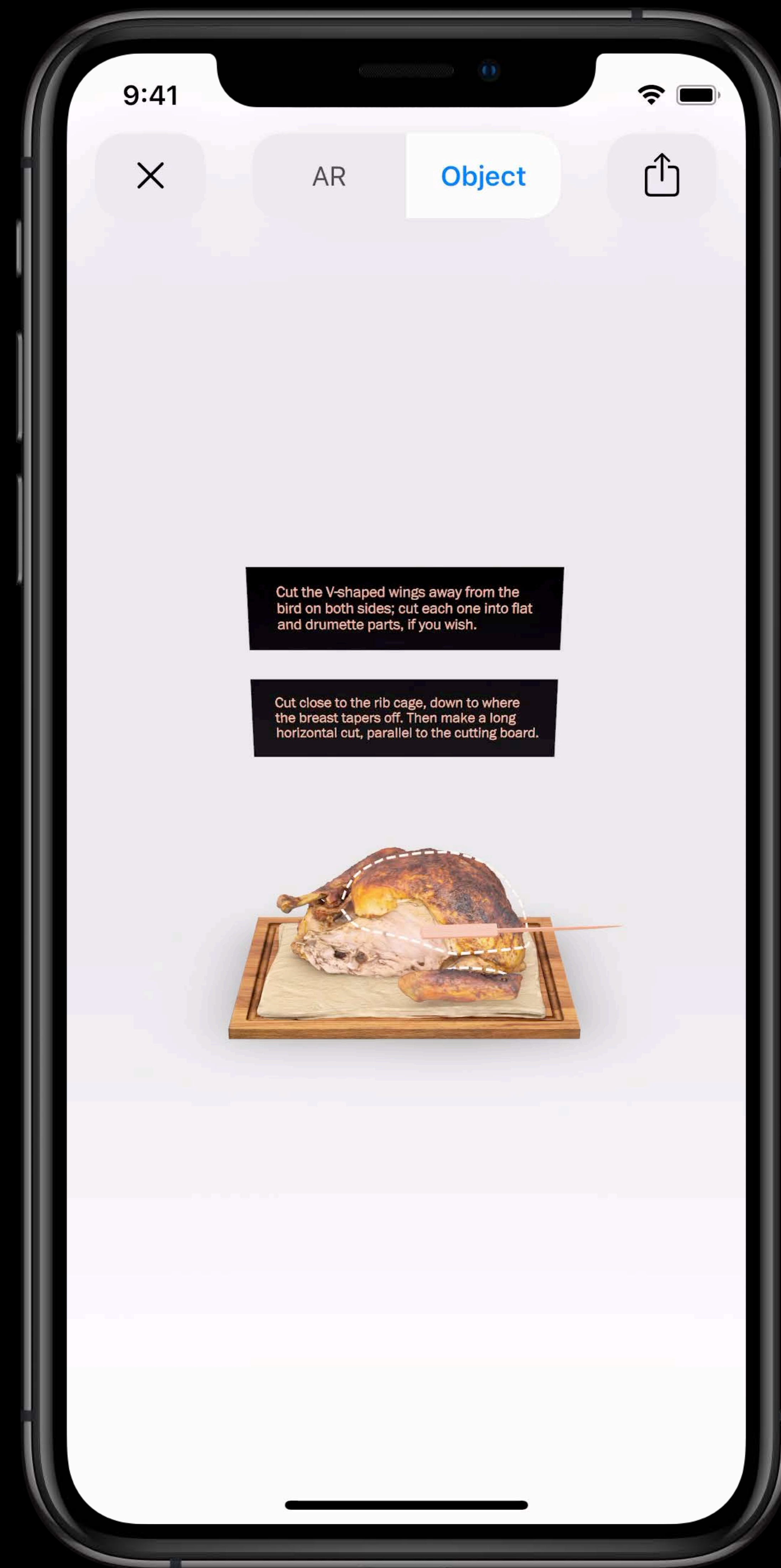
Great for linking back to product description pages

Allows for up-to-date description of usdz content

Safari automatically provides the canonical webpage URL







AR Quick Look Integration in iOS Applications

Easy to integrate to view AR content

AR Quick Look Integration in iOS Applications

Easy to integrate to view AR content

Brings consistent and familiar previewing experience

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Easy to integrate to view AR content

Brings consistent and familiar previewing experience

Can be inline or full-screen presentation

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Brings consistent and familiar previewing experience

Can be inline or full-screen presentation

Uses Quick Look framework

Customization iOS API

ARQuickLookPreviewItem

```
// MARK: - QLPreviewControllerDataSource
func previewController(
    _ controller: QLPreviewController, previewItemAt index: Int) -> QLPreviewItem {
    // Return the file URL to the .usdz file
    let fileUrl = Bundle.main.url(forResource: "toy_robot_vintage", withExtension: "usdz")!
    let previewItem = ARQuickLookPreviewItem(fileAt: fileURL)
    previewItem.canonicalWebPageURL = URL(string: "https://developer.apple.com/arkit/
gallery/")
    previewItem.allowsContentScaling = false
    return previewItem
}
```


Customization iOS API

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    return previewItem
}
```

Article

Previewing a Model with AR Quick Look

Display a single USDZ file that the user can move, scale, and share with others.

Framework

ARKit

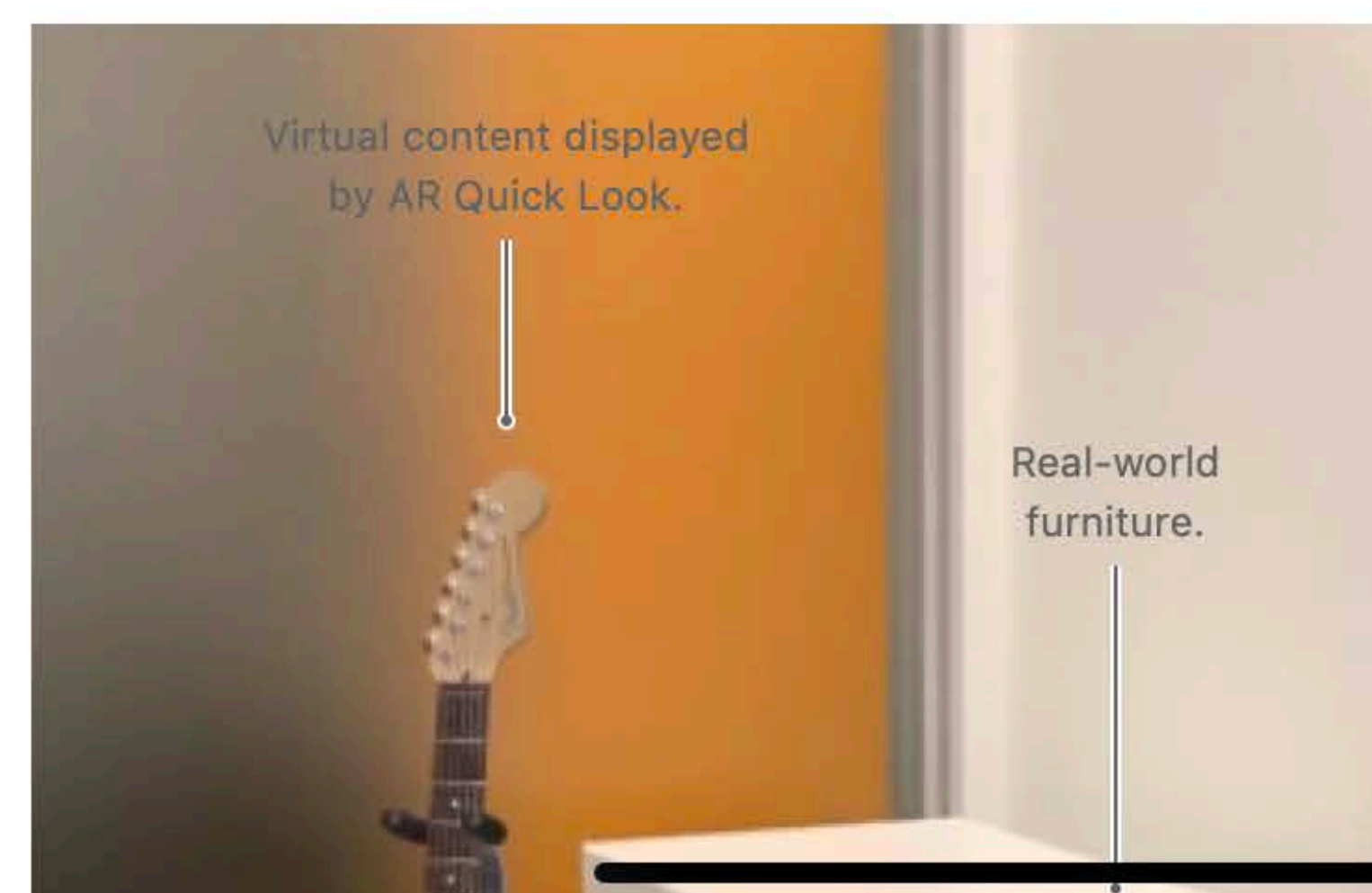
On This Page

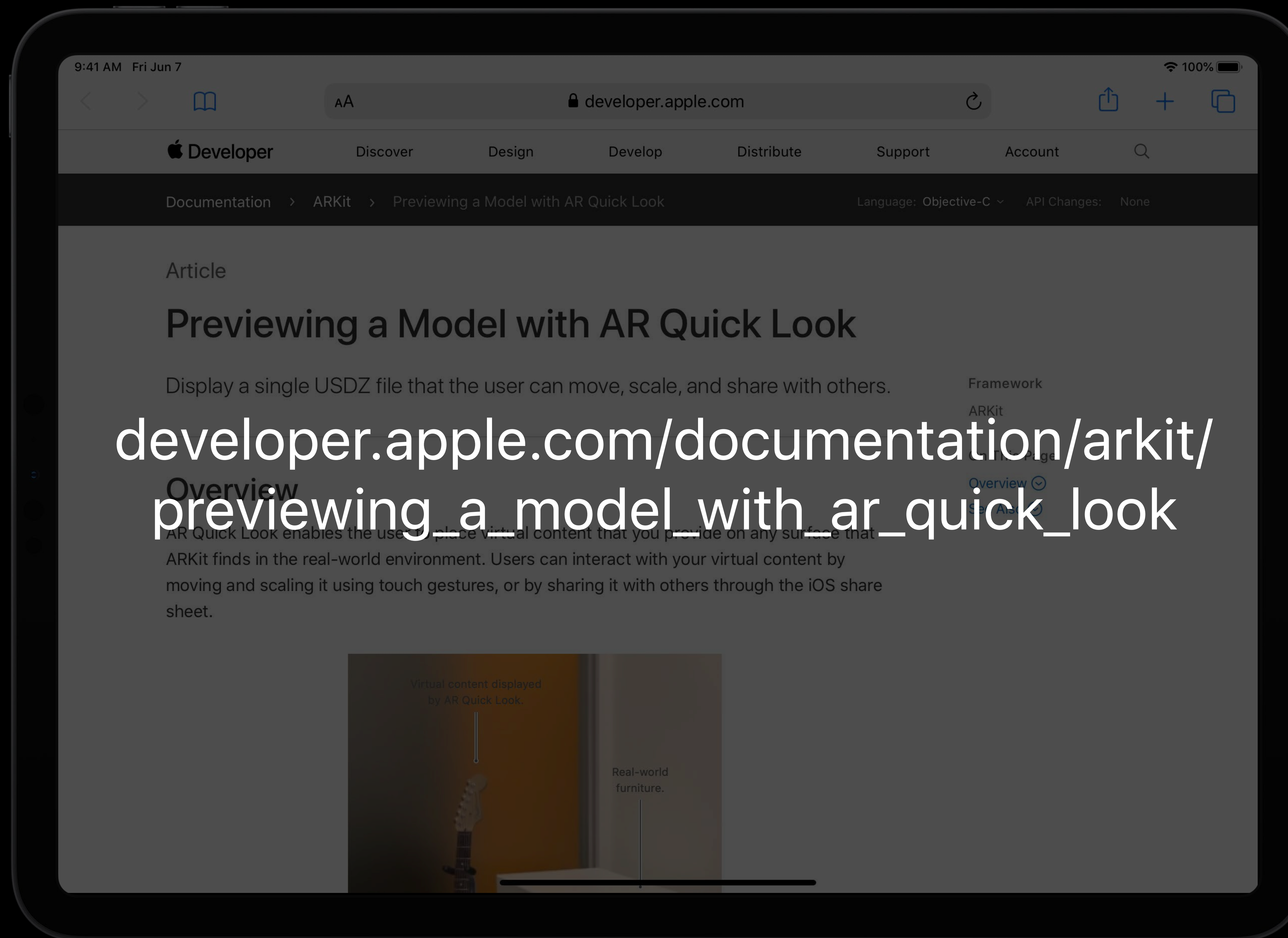
[Overview](#)

[See Also](#)

Overview

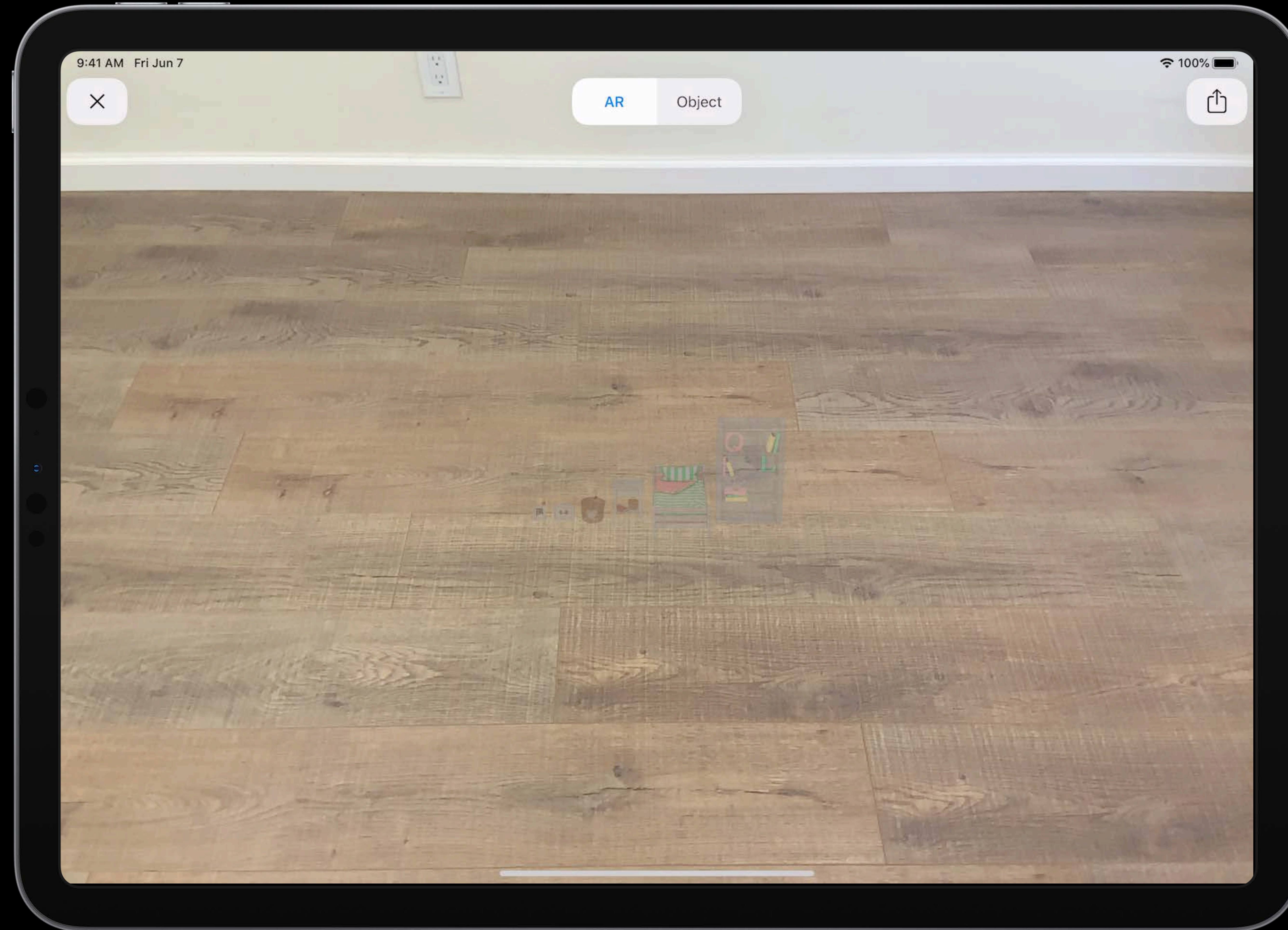
AR Quick Look enables the user to place virtual content that you provide on any surface that ARKit finds in the real-world environment. Users can interact with your virtual content by moving and scaling it using touch gestures, or by sharing it with others through the iOS share sheet.



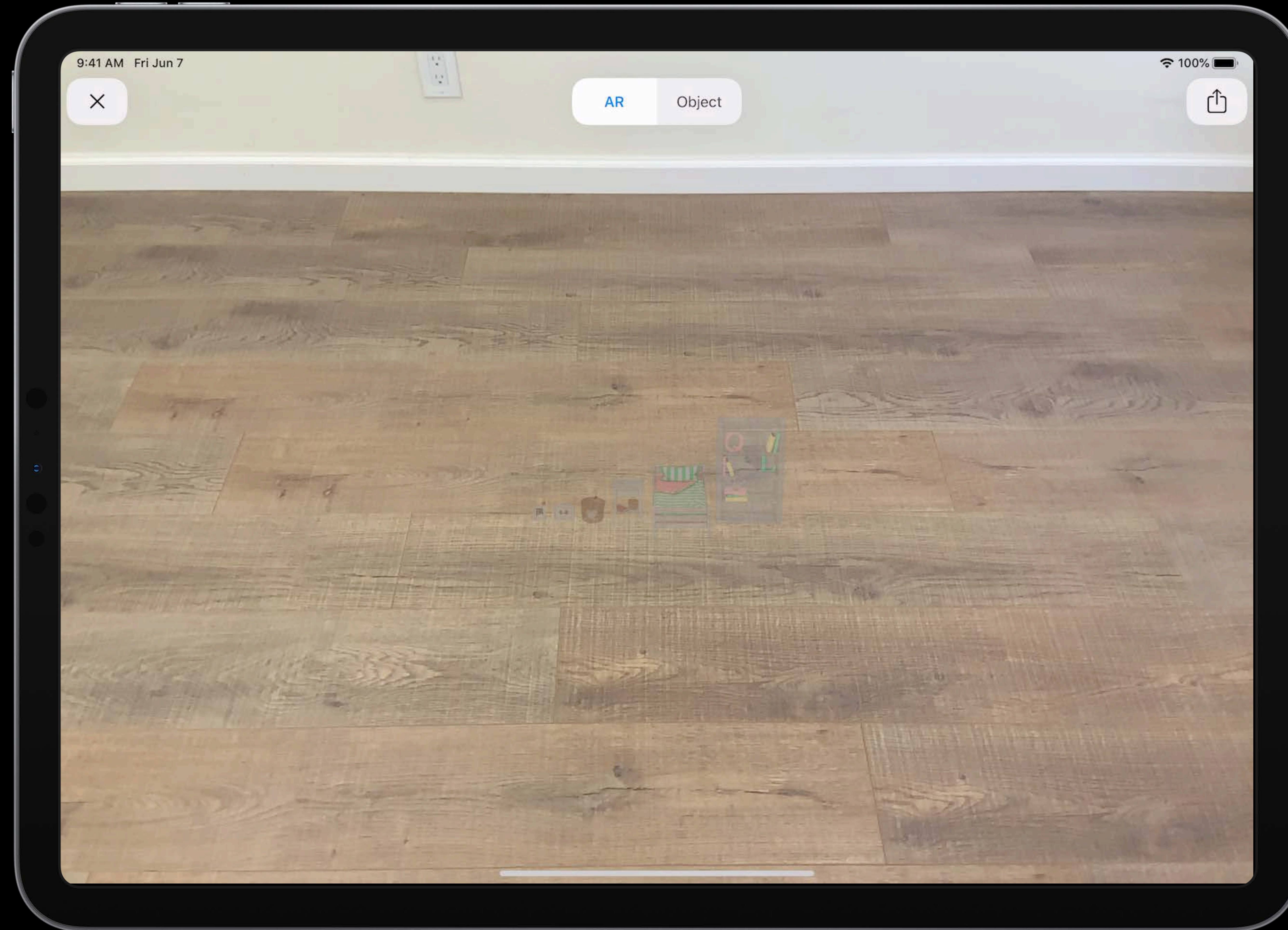


developer.apple.com/documentation/arkit/previewing_a_model_with_ar_quick_look

Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Decorating Experience



Customizable Call to Action in AR Quick Look



+

 **Pay**

Customizable Call to Action in AR Quick Look

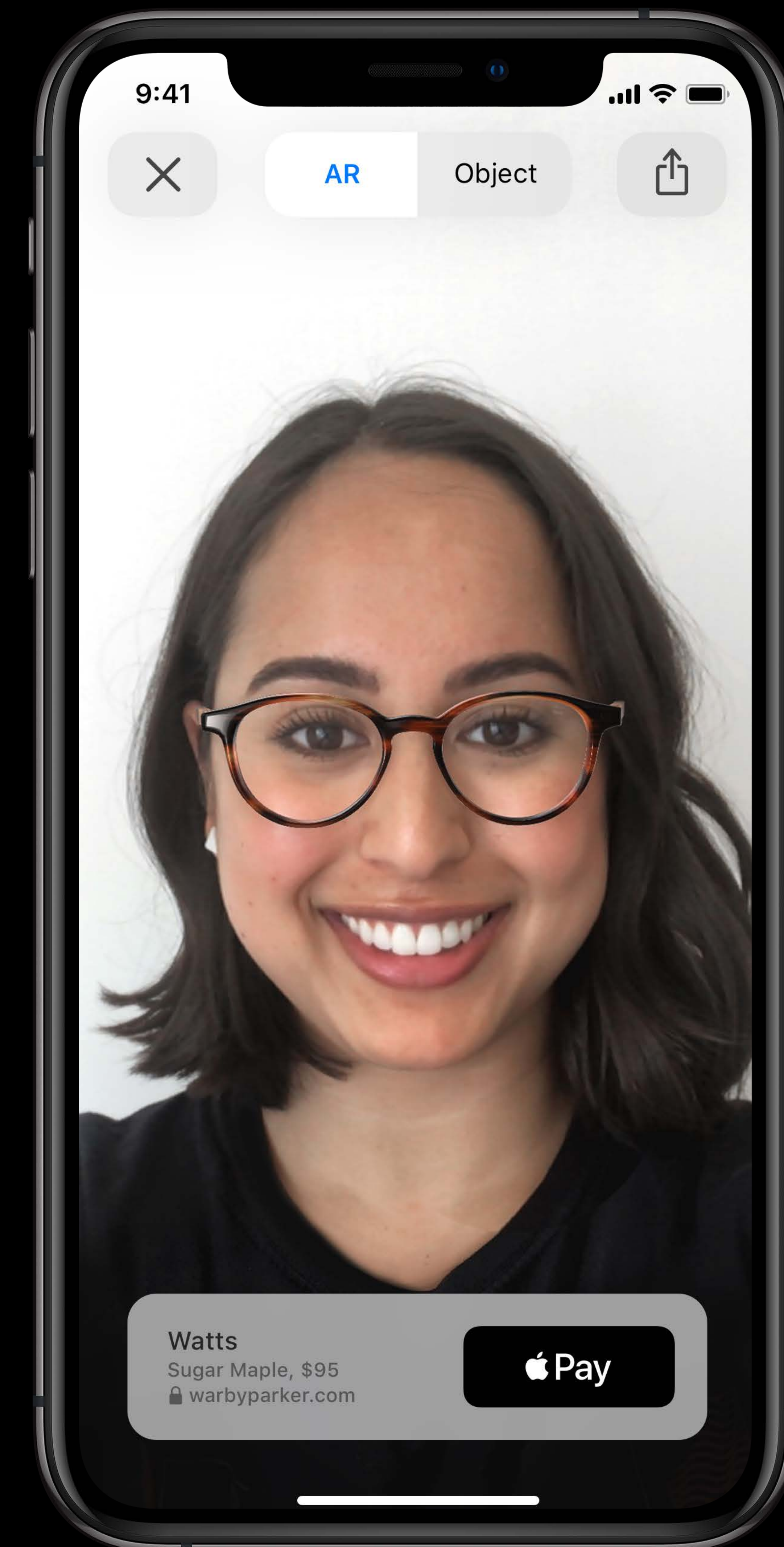
Including support for Apple Pay

Various Apple Pay button styles

Link for call to action

Customizable text for product information

Reference to canonical website domain name



NEW

Available this fall

WARBY PARKER

9:41 AM Fri Jun 7

100%



AA

developer.apple.com



Augmented Reality

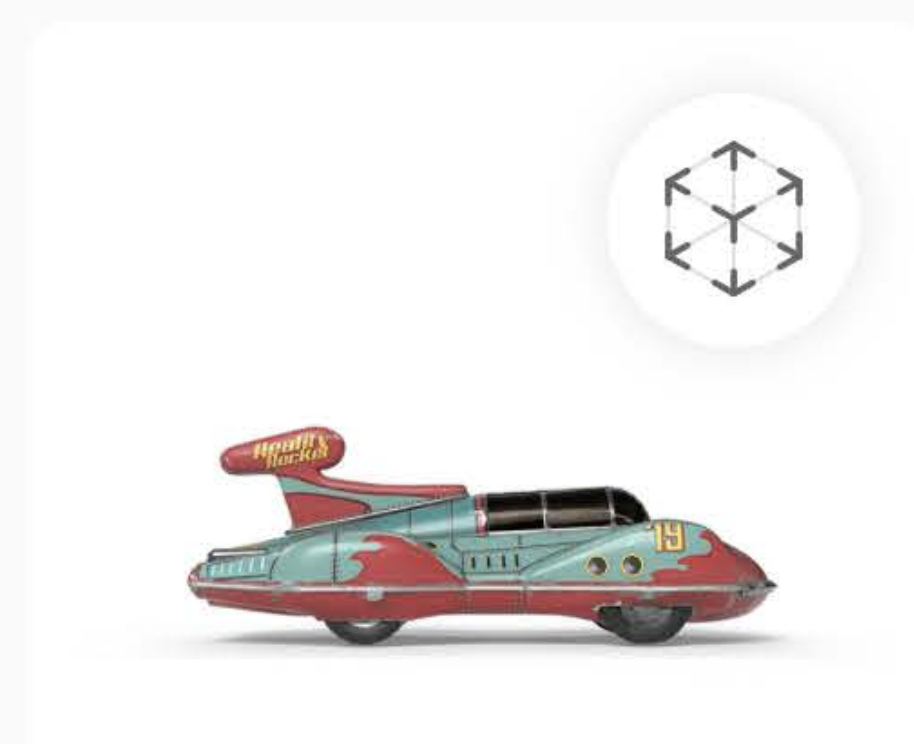
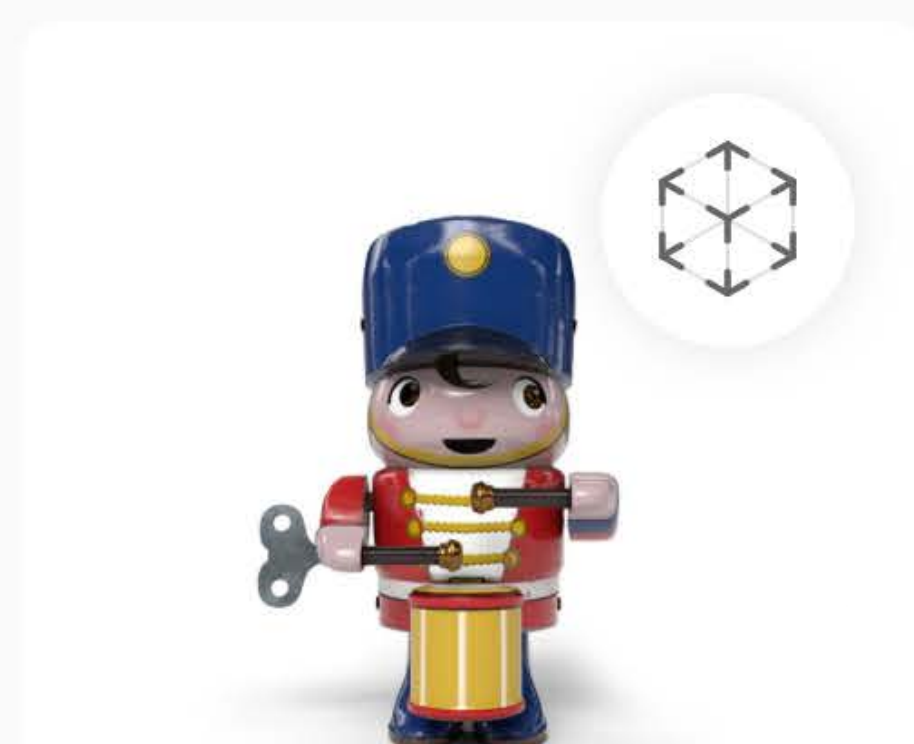
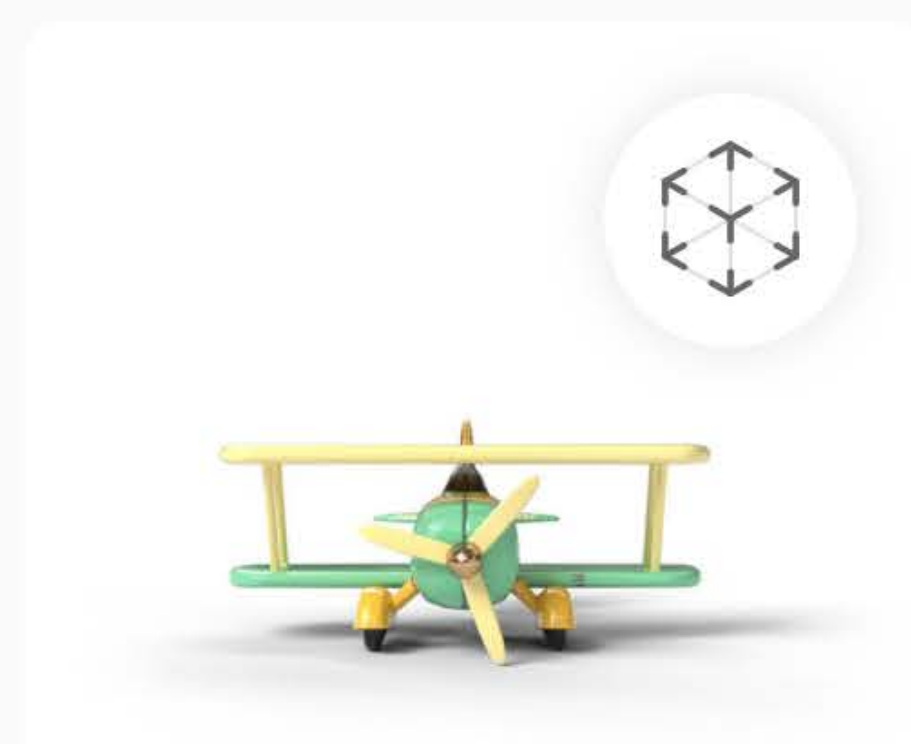
[Overview](#) [ARKit 3](#) [Reality Composer](#) [AR Quick Look](#) [Resources](#)

AR Quick Look

On iOS, built-in apps such as Safari, Messages, Mail, News, and Notes can natively Quick Look usdz files of virtual objects in 3D or AR. You can embed Quick Look views in your apps and websites to let users see incredible detailed renderings, including reflections of real world surroundings in shiny virtual objects.

3D Models

Tap any of the 3D models below on a device running iOS 12 or later to view the object and place it in AR. Or click a model on Mac to download the USDZ file.



9:41 AM Fri Jun 7

100%

AR Quick Look

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developer.apple.com/arkit/gallery

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9:41 AM Fri Jun 7

100%



AA

developer.apple.com



Augmented Reality

Overview

ARKit 3

Reality Composer

AR Quick Look

Resources



[Bethesda Gear ↗](#)



[Nomatic ↗](#)



[FURNI ↗](#)



usdz Tools

Download essential Python-based tools for generating, validating, and inspecting usdz files. Also includes a converter that creates usdz from other 3D file formats along with Pixar's USD library and sample scripts.

[Download usdz tools ↴](#)

Summary

Preview Reality Files in AR Quick Look

Supports more anchors

Triggers and actions

New visual effects

Animation scrubber

Customization API

Apple Pay support

More Information

developer.apple.com/wwdc19/612

AR Quick Look and Reality Composer Lab

Friday, 11:00

 WWDC19