

# Touch national monument: web-based AR application of *Taniwhasaurus mikasaensis*

Kumiko Matsui<sup>1</sup> and Tomiki Karasawa<sup>2</sup>

<sup>1</sup>The Kyushu University Museum, Kyushu University

<sup>2</sup>The Mikasa City Museum

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## Abstract

Mosasauroidea is a group of aquatic lizards living in the Late Cretaceous sea. They are found worldwide. *Taniwhasaurus mikasaensis* Caldwell et al. 2008 is a species of Mosasauridae and was found from the Kashima Formation, the Santonian-Campanian boundary interval, the Upper Cretaceous. This type specimen was chosen for the Japan's National monument on July 16th, 1976 for the first discovery of a terrestrial carnivorous dinosaurs (at the time of discovery of the specimen, it was identified to *Tyrannosauroides*). Including the holotype of *T. mikasaensis*, only four fossils are registered as Japan's National Monument. In addition, the other fossils of National Monuments are registered with its localities. Namely, the holotype of *T. mikasaensis* is an only fossil alone registered National Monument. Therefore, there are no opportunity to touch by non-experts and to see in another museum for special exhibition or fossil replica because the change of existing condition is strongly restricted by the law. In addition, the Holotype of *T. mikasaensis* is housed in a local museum of Japan and then it is difficult to touch or research that for "foreigners". To change this situation, firstly, we made 3D data of *T. mikasaensis* for the original specimen available for various uses such as research and educational outreach. We made some types of outreach tools of *T. mikasaensis*. First, we made some sizes of replicas by using 3D printer (AFINIA). These replicas were changed "untouchable" situation of the national monument. Second, we made web-based AR application using this 3D model and surface texture data. Web-based system does not need special equipment or APP for display AR model. We used A-frame and AR.js for making AR system. AR.js are generally used marker for showing 3D model in smartphones. Then, we verified the educational effect of these 3D data of *T. mikasaensis*. In July 13th, 2019, we carried out a hands-on education program for *T. mikasaensis*. Experiment peoples were general visitors from teens to 50s. First, they viewed an exhibition room where the holotype of *T. mikasaensis* was putted in, and then they moved to the hands-on booth. In this booth, the followers were exhibited; a photo of *T. mikasaensis*, two 3D printed replicas, a whole-body skeleton and a reconstruction illustration of *T. mikasaensis*, and some sets of a QR code and a maker for the web-based AR application. Visitors experienced AR with their own smartphones or the arranged tablet PC. A curator explained the outline and importance of *T. mikasaensis* and then, visitors touched models and AR freely. The holotype of *T. mikasaensis* was one of the rare mosasaurid skulls in Japan. This specimen was difficult to move because of legislatively and physically. In contrast, 3D printed models or AR enable to observe accurately everywhere. Therefore, in the future, it was expected to provide more research chance to worldwide researchers with our digital contains.

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Kumiko MATSUI 1, Tomiki KARASAWA 2

1. The Kyushu University Museum, Kyushu University, Fukuoka, JPN,
2. The Mikasa City Museum, Mikasa, Hokkaido, JPN



PRESENTED AT:



## JpGU - AGU Joint Meeting 2020

For a Borderless World of Geoscience  
Japan Geoscience Union, American Geophysical Union

# WHAT'S TANIWHASSAURUS MIKASAENSIS

音声 (<https://www.dropbox.com/s/dl6q2ub47yzeb6o/Project%20-%207%3A11%3A20%2C%2021.33.mp3?dl=0>)

# What's *Taniwhasaurus mikasaensis*

- A species of marine reptile, Mosasaurid (Caldwell et al. 2008)
- Range of *Taniwhasaurus* = Santonian-Maastrichtian (863-660 Ma; Jiménez-Huidobro and Caldwell, 2019)
- founded by Kikuo Muramoto on 21st, June, 1976
- Japan's-designated natural monuments (16th, July, 1977)
- The first fossil specimen for designation of natural monument
- Housed in the Mikasa City Museum, Mikasa, Hokkaido, JPN
- Specimen number MCM-M-0009



## *Taniwhasaurus mikasaensis*

**Diagnosis: Crest on the top of the skull**



REPTILIA Linnaeus, 1758  
 SQUAMATA Oppel, 1811  
 MOSASAURIDAE Gervais, 1852  
 TYLOSAURINAE Williston, 1897  
 TANIWHASAUROS Hector, 1874  
 TANIWHASAUROS MIKASAENSIS Caldwell et al., 2008  
 Holotype: MCM-M0009

Reconstruction model of *T. mikasaensis* exhibited in the Mikasa City Museum

Model Sculpter: Goro Furuta

Supervisor: Takuya Konishi (Ph.D)





***Taniwhasaurus mikasaensis* MCM-M-0009**

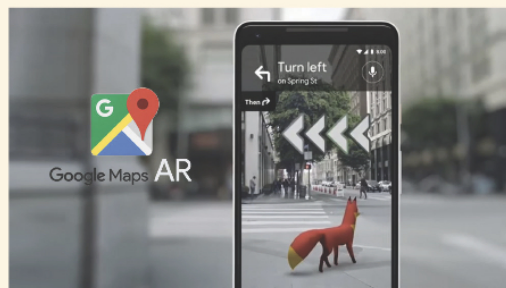


## WHAT'S AR? WHY AR?

### What's AR? Why AR?

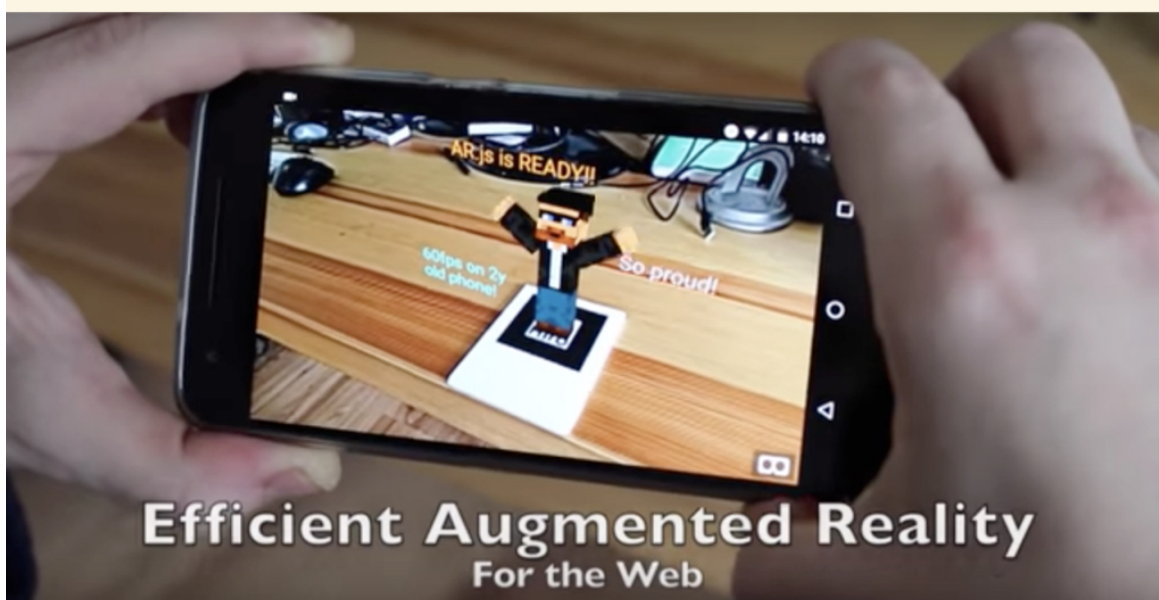


©Pokémon GO



©Google/Youtube

### Web-based AR and Marker-based AR



**Efficient Augmented Reality**  
For the Web

<https://aframe.io/>

# HOW TO MAKE 3D MODEL OF THE NATIONAL MONUMENT FOR AR

## How much is the cost?

### Major Photogrammetry Softwares

minimum cost



59\$~



Free



about 1\$  
per model

### Famous 3D scanner



cost : 3,500,000 JPY~

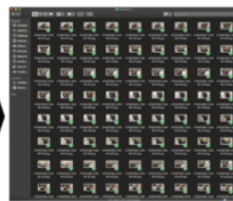
- Photogrammetry is the cheapest way to make 3D models from fossil or geological specimens .

## How to make 3D model?



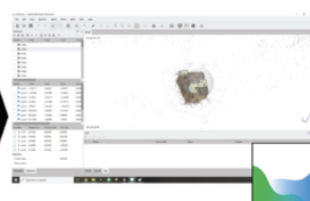
### Video recording by iPhone 6 (.mov)

Record video from multiple  
directions and save.  
Dorsal and ventral view.



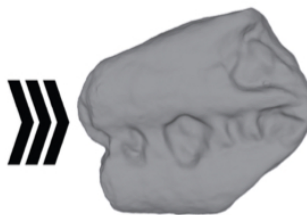
### Convert to JPG images

By using Free Video to JPG  
Converter. Making 300  
images from one video.

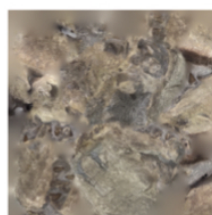


### 3D model construction

Construct the 3D data from the  
output images by using  
Agisoft Metashape (Agisoft LLC).



3D mesh data(.obj)



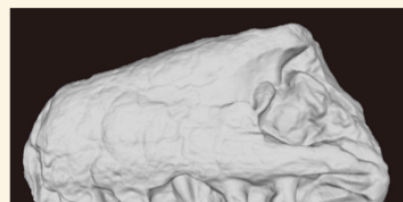
Texture image (.png)



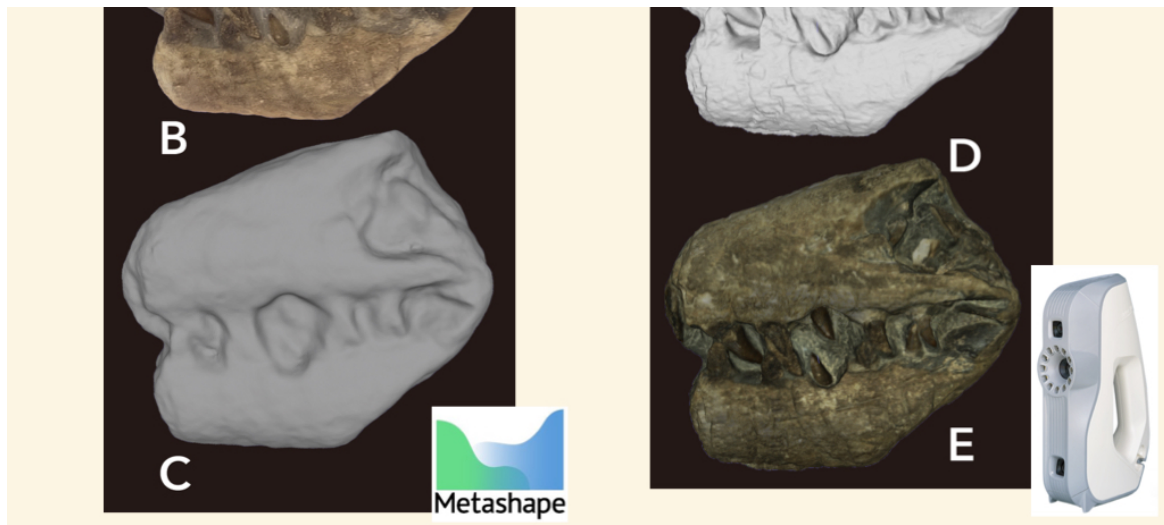
### 3D + texture

The mtl file connect the obj  
data and png image data.

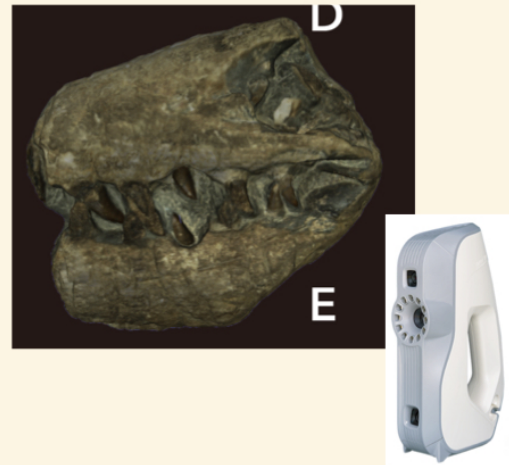
## Photogrammetry vs 3D surface scanner





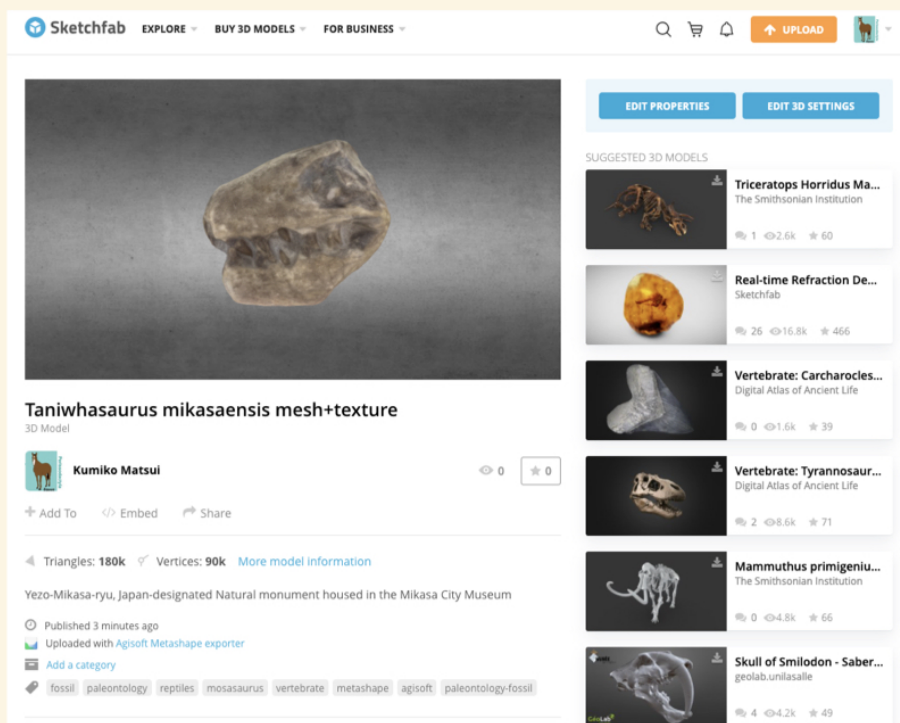


## Not big differences in these two methods



- **Photogrammetry-based 3D model with texture data looks better than 3D scanner based one.**
- The 3D scanner is excellent for research applications where fine surface features are required

## You can see this model in Skechfab!!



(<https://sketchfab.com/3d-models/taniwhasaurus-mikasaensis-meshtexture-a13e10d702fc4abca388e0b8d3942fce>)

# AR IS VERY EASY TO MAKE AND USE!

## Web-based AR Application

Branch: gh-pages 3d / WebAR / index.html Find file Copy path

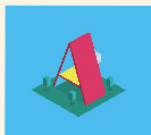

taniwhasaurus Update index.html 9fa1913 11 minutes ago 1 contributor

33 lines (29 sloc) 1.4 KB Raw Blame History

```

1 <!DOCTYPE html>
2 <html>
3   <head>
4     <meta charset="utf-8">
5     <meta name="viewport" content="width=device-width,initial-scale=1">
6     <title>The Mikasa City Museum</title> Title of this App
7   </head>
8   <body style="margin:0px; overflow:hidden;">
9     <script src="https://aframe.io/releases/1.0.0/aframe.min.js"></script>
10    <script src="https://raw.githubusercontent.com/jeromeetienne/AR.js/2.1.3/aframe/build/aframe-ar.js"></script>
11    <a-scene arjs="detectionMode: mono_and_matrix; matrixCodeType: 5x5; sourceType: webcam; trackingMethod: best; debugUITEnabled: false">
12
13      <a-assets>
14        <a-asset-item id="3DModel3" src="tanipha2.obj"></a-asset-item> connect 3D & mtl data
15        <a-asset-item id="Material3" src="tanipha2.mtl"></a-asset-item>
16      </a-assets>
17
18      <a-marker type="barcode" value="5"> recognition of the marker
19        <a-obj-model src="#3DModel3"
20          mtl="#Material3" position="0 0.5 0" scale="10 10 10" rotation="0 0 0">
21        </a-obj-model> 3D model definition position size rotation
22      </a-marker>
23
24      <a-marker type="barcode" value="6">
25        <a-obj-model src="#3DModel3"
26          mtl="#Material3" position="0 0.5 0" scale="0.2 0.2 0.2" rotation="0 0 0">
27        </a-obj-model>
28      </a-marker>
29
30      <a-entity camera></a-entity> open camera App
31    </a-scene>
32  </body>
33 </html>

```

 **A-Frame**
 **AR.js**

**Read A-frame and AR.js**  
**definition of a marker and 3D data and related materials**

## Let's try!!



**You can see the national monument on your hand!**

- QR code was made by Unitag ([www.unitag.io](http://www.unitag.io))



# INFLUENCE FOR THE MUSEUM VISITORS

## Influence for the museum visitors

We attempted hands-on education event in the Mikasa City Museum in 13th July 2019 to verify educational effect of AR and 3D printed models of *Taniwhasaurus mikasaensis*.

In the hands-on corner of *T. mikasaensis*, we prepared skeleton and reconstruction images, 3D printed models of the holotype, and the QR cord and the makers for AR view. Participators can use own smartphones or tablet computers or iPad that we prepared for AR view.

Participators first learned the outline of *Taniwhasaurus mikasaensis*, the importance of the holotype of *T. mikasaensis*, and making of AR and 3D printed models. Then, participators experienced AR view of *T. mikasaensis*.

We survey educational effect of AR and 3D printed models by questionnaires. That result shows that;

1. AR view and 3D printed models makes more participators' interested in *T. mikasaensis*.
2. Many participators had known AR and 3D printing technology but hadn't used actually before. This event provides experience of state of the art.
3. Participators made more interested in joining to museum outreach events.

Age				
10s	20s	30s	40s	Over 50s
2	2	1	5	1

Habitat		
Mikasa City	Hokkaido (except for Mikasa City)	Others
3	9	0

Question / Answer	yes	no	Non-answer / others
Q1: Had you known "3D printer" before participate in this event?	9	2	
Q1-2: Had you used any 3D printer?	0	9	
Q2: Had you known "AR" before participate in this event?	7	4	
Q2-2: Had you used any AR?	3	4	
Q3: Have been to any museum frequently?	6	3	2
Q4: Had you known <i>Taniwhasaurus mikasaensis</i> before participate in this event?	6	5	
Q5: Does this event make you more interest in <i>Taniwhasaurus mikasaensis</i> ?	6	5	
Q6: Will you want to join to any event like today in future?	11	0	

The number of person  
the number of person

# THE USEFULNESS OF AR FOR MUSEUMS UNDER COVID-19 SITUATION

## The usefulness of AR for museums under COVID-19 situation

Under the pandemic of COVID-19 in 2020, museums all over the world were forced to be closed. If prevalence of COVID-19 are barely controlled, museums should suspend touching exhibitions.

In this situation, many museums provide video programs in web. AR might become a further alternative exhibition because of avoidance of contagion.



**Restriction of hands-on exhibition in the Mikasa City Museum**

We are sorry to inform you that the content of your iPoster has changed in our database since your last save.

The probable reason is that there are multiple people logged into your account, you are logged into your poster at multiple locations, that you have multiple tabs open with your iPoster or that you have requested help from our support staff and they have made corrections/adjustments to your iPoster.

To avoid losing any content, we recommend you open a new tab/window and access your iPoster again, and copy any missing content from this view to the new view. You will see the latest content saved in our database for your iPoster in the new view.

Because of maintenance we have just saved your content and will within a few minutes logout all users and restart our server. We will be back in a moment.

Sorry for the inconvenience!

Because of maintenance we will within a few minutes restart our server. We will be back in a moment.

Sorry for the inconvenience!



## AUTHOR INFORMATION

Kumiko Matsui, PhD

JSPS Cross-border postdoctoral Fellow

The Kyushu University Museum, Kyushu University

6-10-1, Hakozaki, Higashi-ku, Fukuoka, 812-8581, JPN

<https://kumikomatsui.wordpress.com>

[kumiko\\_matsui@me.com](mailto:kumiko_matsui@me.com)

[kumiko.matsui.jp@gmail.com](mailto:kumiko.matsui.jp@gmail.com)

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# LIVE SESSION

**Meeting time:**

*Please note that the time and date displayed here is Central European Summer Time – UTC +2 hours. If you need help in converting to your local time, please click [here](https://www.thetimezoneconverter.com/).*

**GO TO SESSION**