20th International Conference on 3D Web Technology

Webized 3D experience by HTML5 annotation in 3D Web

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KIST Korea Institute of Science and Technology

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- Previous work
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Motivation

Motivation

- With the development of 3D Web technologies, 3D objects are now handled as HTML markup without plug-ins on web pages

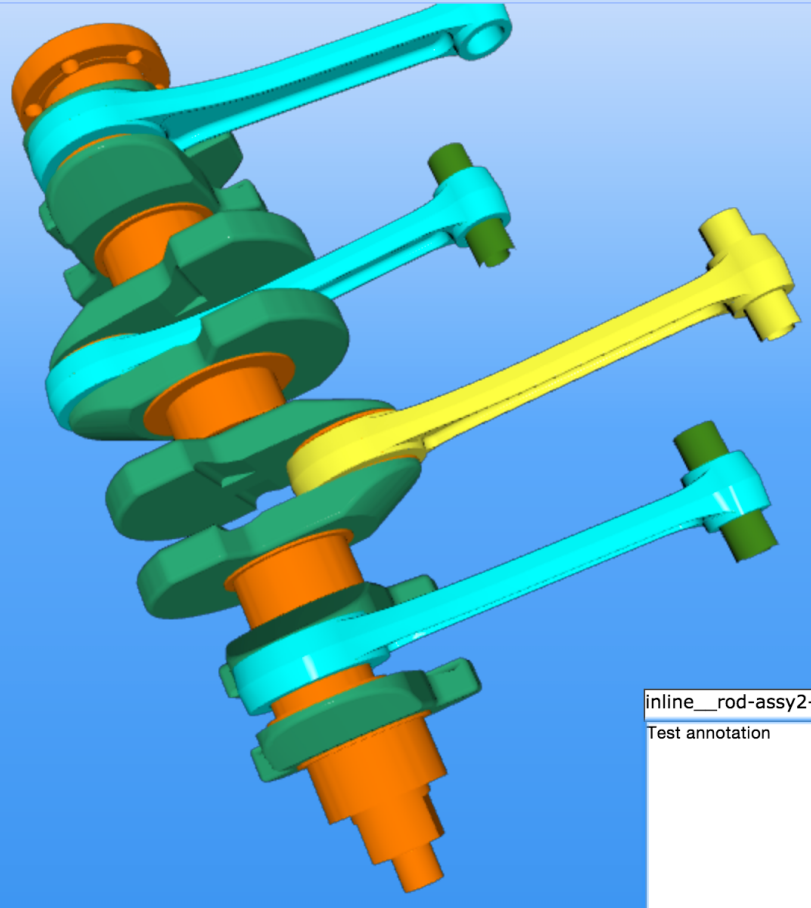
- However, although declarative 3D objects are physically integrated into web pages, the 3D objects still involve the same separation of the HTML element from the perspective of the 3D layout

examples.x3dom.org/cadViewer/sceneGraphConrod/index.html#

Views Visibility Navigation Modes Debug Annotation Suche:

Expand - Collapse - Toggle

- scene
  - test_jt
    - test_jt-1
      - inline__conrod
        - inline__conrod-1
          - inline__rod-assy4
          - inline__rod-assy3
          - inline__rod-assy2
            - inline__rod-assy2-1
              - inline__rod-assy2-1-1
              - inline__rod-assy2-1-2
          - inline__rod-assy1
          - inline__crank
            - inline__crank-1
              - inline__end_1
              - inline__crank-1-2
              - inline__crank-1-3
              - inline__crank-1-4
              - inline__crank-1-5
              - inline__crank-1-6
                - inline__crank-1-6-1
              - inline__crank-1-7
              - inline__crank-1-8
                - inline__crank-1-8-1
                  - inline__crank-1-8-1-1
                    - inline__crank-1-8-1-1-1
              - inline__cyl_3
              - inline__crank-1-10
              - inline__crank-1-11
              - inline__crank-1-12
              - inline__cyl_2
              - inline__crank-1-14
              - inline__cyl_1



inline__rod-assy2-1

Test annotation

examples.x3dom.org/cadViewer/sceneGraphConrod/index.html#

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- scene
  - test_jt
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            - inline__rod-assy2-1
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              - inline__rod-assy2-1-2
          - inline__rod-assy1
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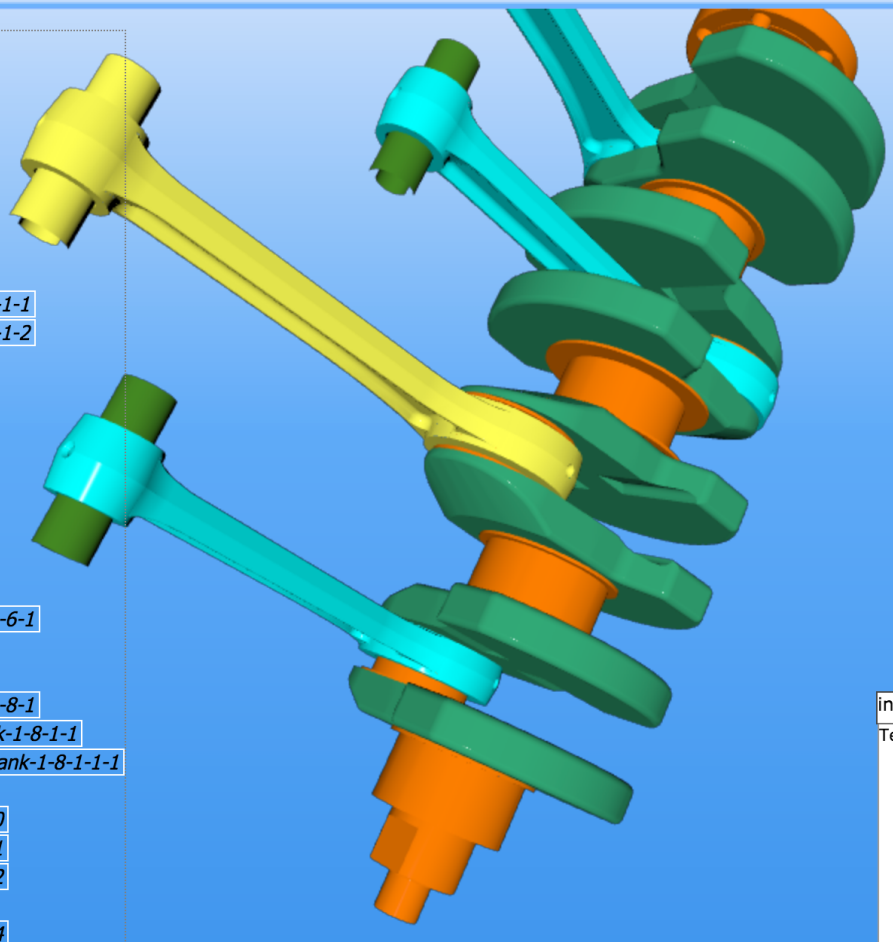
              - inline__crank-1-4
              - inline__crank-1-5
              - inline__crank-1-6
                - inline__crank-1-6-1
              - inline__crank-1-7
              - inline__crank-1-8
                - inline__crank-1-8-1
                  - inline__crank-1-8-1-1
                    - inline__crank-1-8-1-1-1
              - inline__cyl_3
              - inline__crank-1-10
              - inline__crank-1-11
              - inline__crank-1-12
              - inline__cyl_2
              - inline__crank-1-14
              - inline__cyl_1

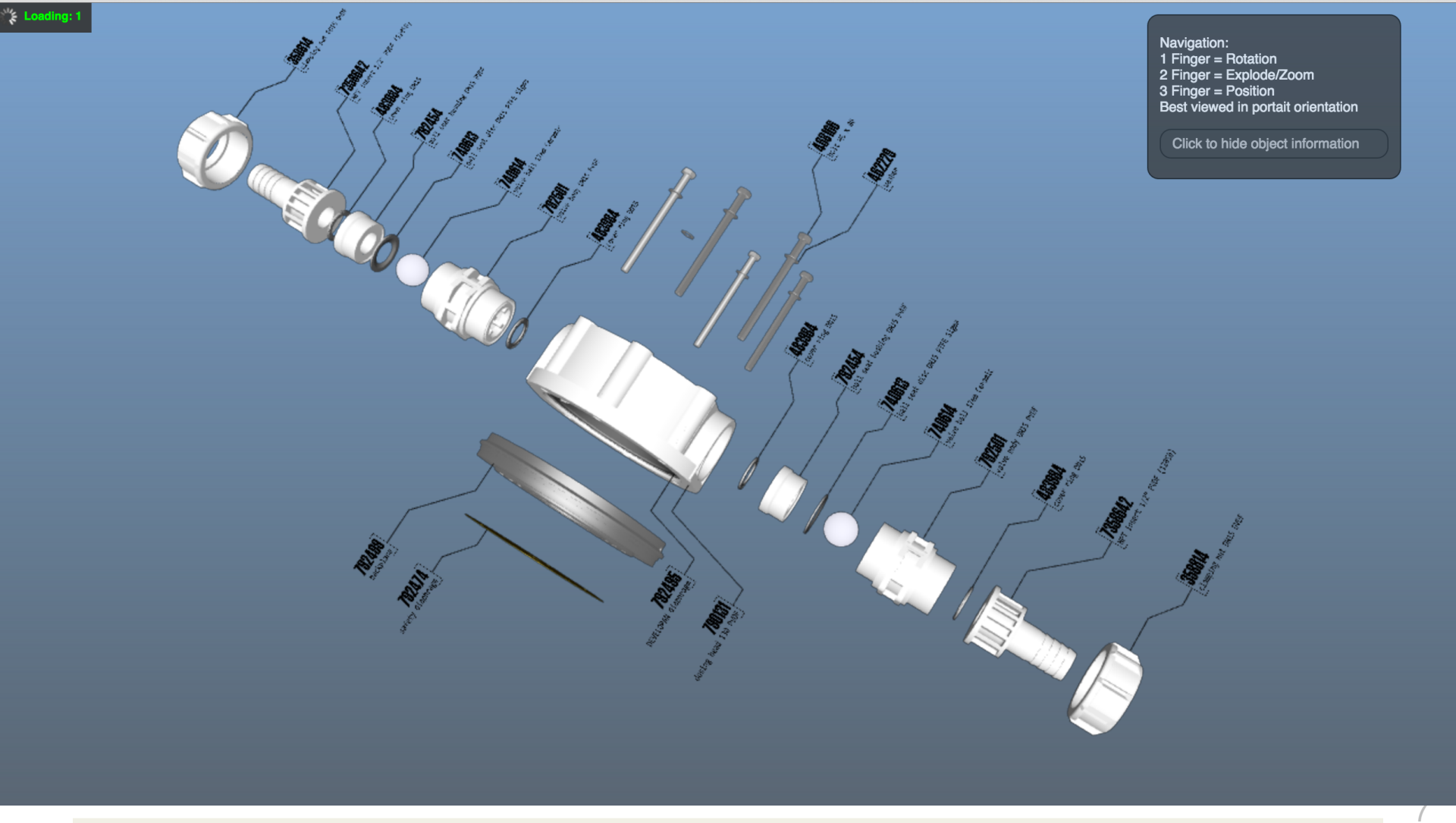


inline__rod-assy2-1

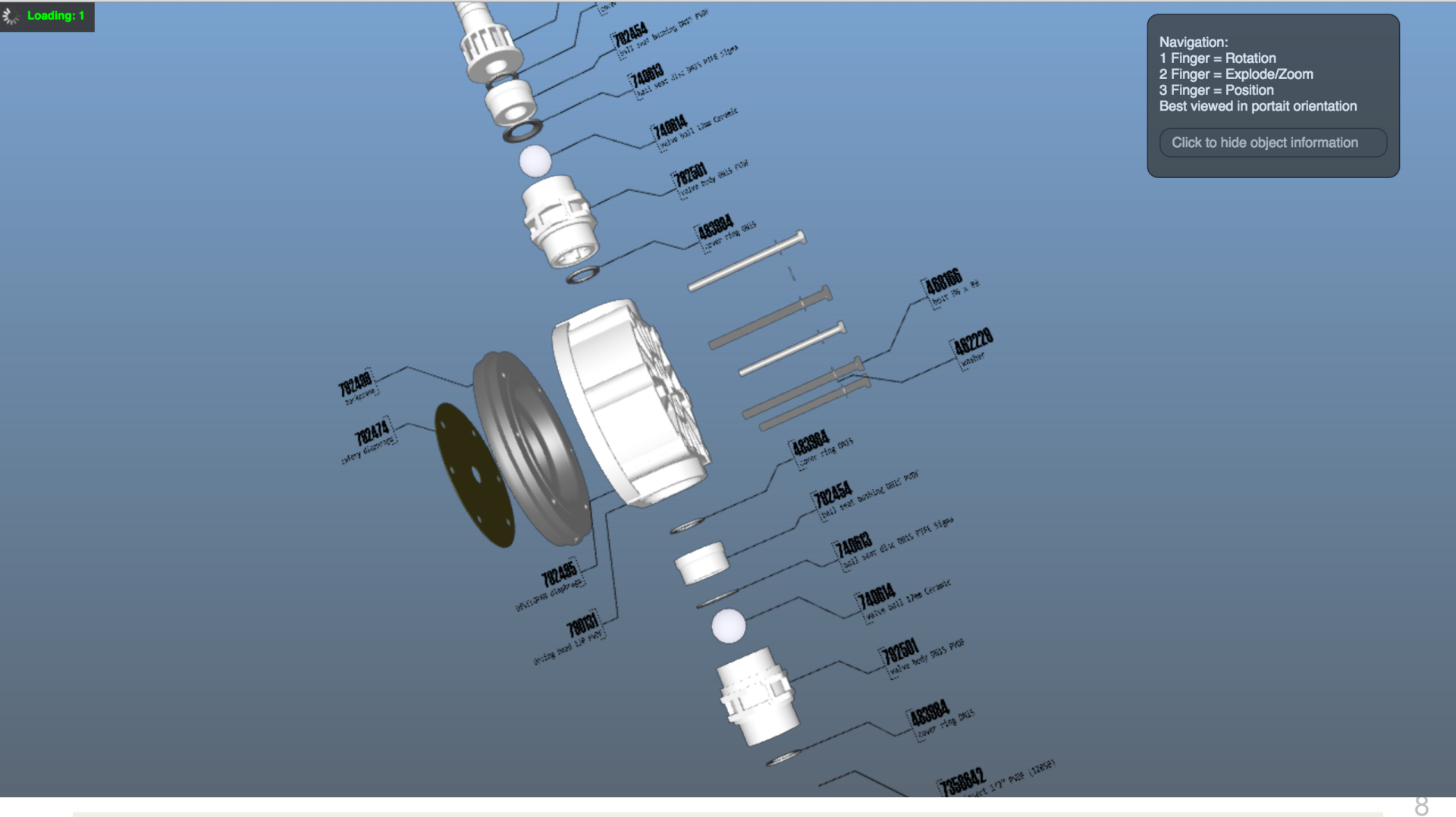
Test annotation

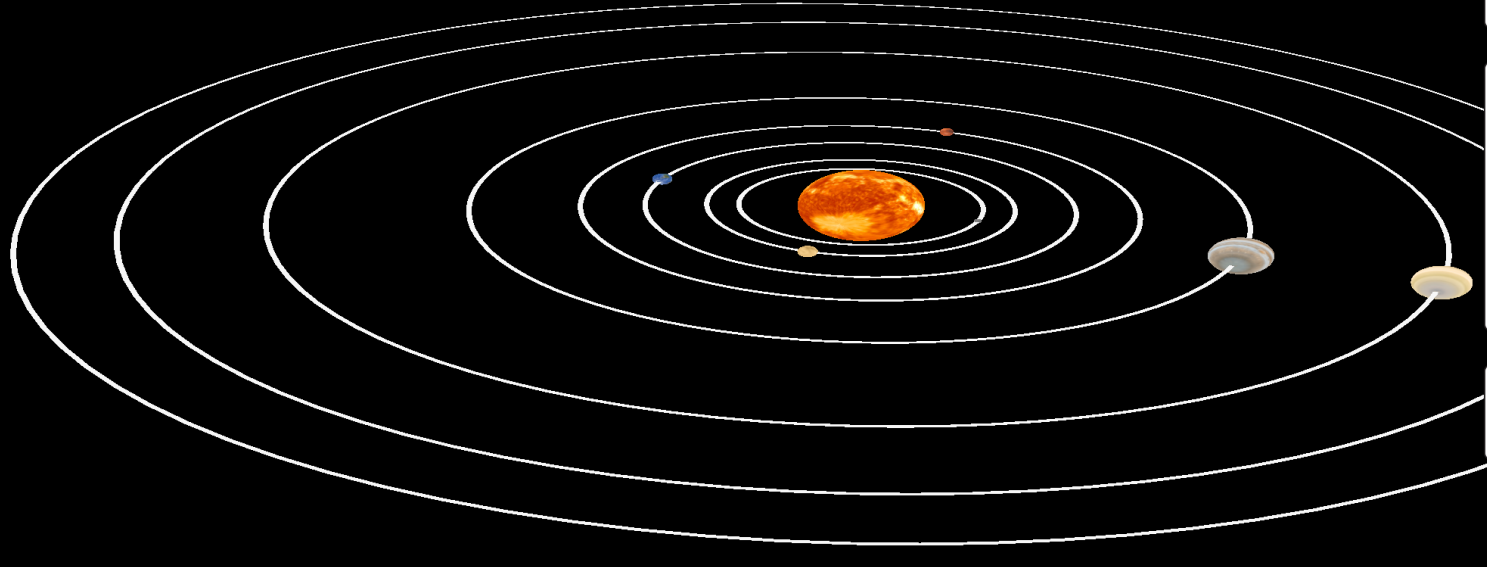
examples.x3dom.org/CAD_Explosion/

Loading: 1



examples.x3dom.org/CAD_Explosion/





Sun

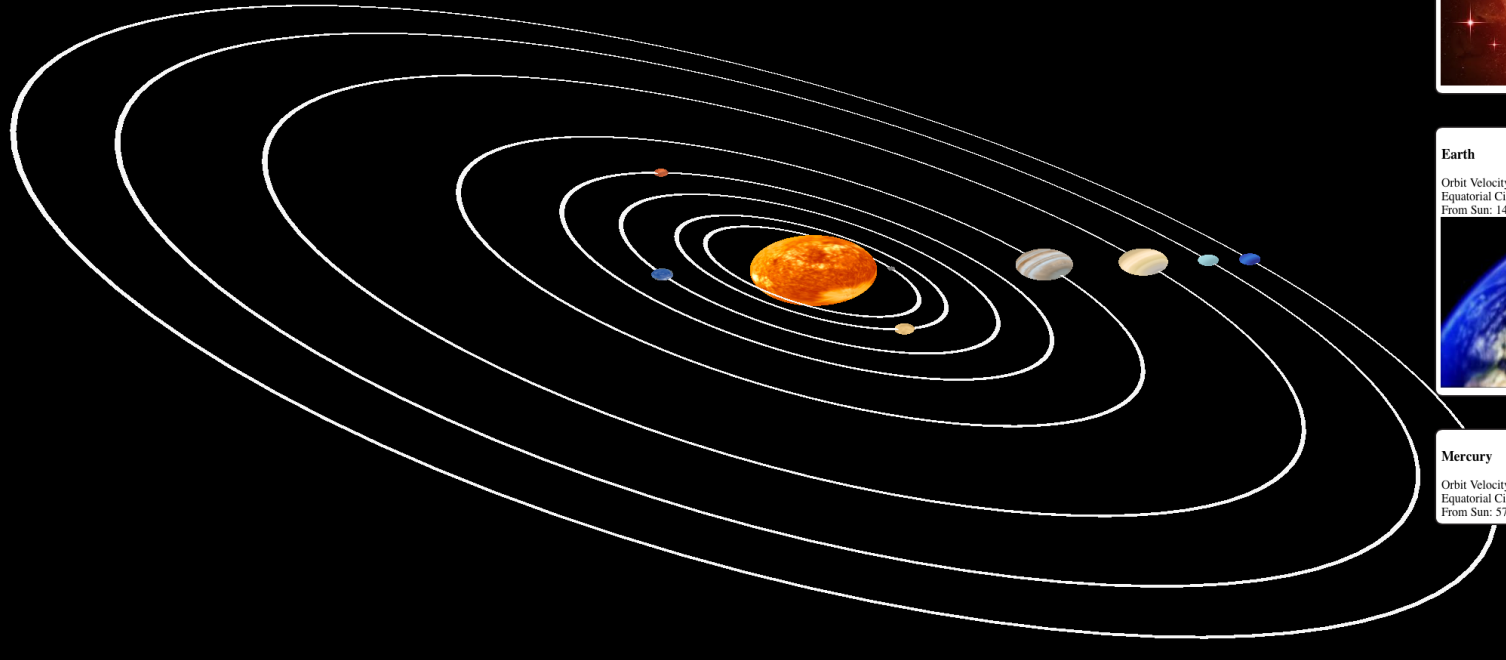
Orbit Velocity: 0 km/h
Equatorial Circumference: 4,370,005 km
From Earth: 149,598,262 km

Earth

Orbit Velocity: 107,218 km/h
Equatorial Circumference: 40,030 km
From Sun: 149,598,262 km

Mercury

Orbit Velocity: 170,503 km/h
Equatorial Circumference: 15,329 km
From Sun: 57,909,227 km



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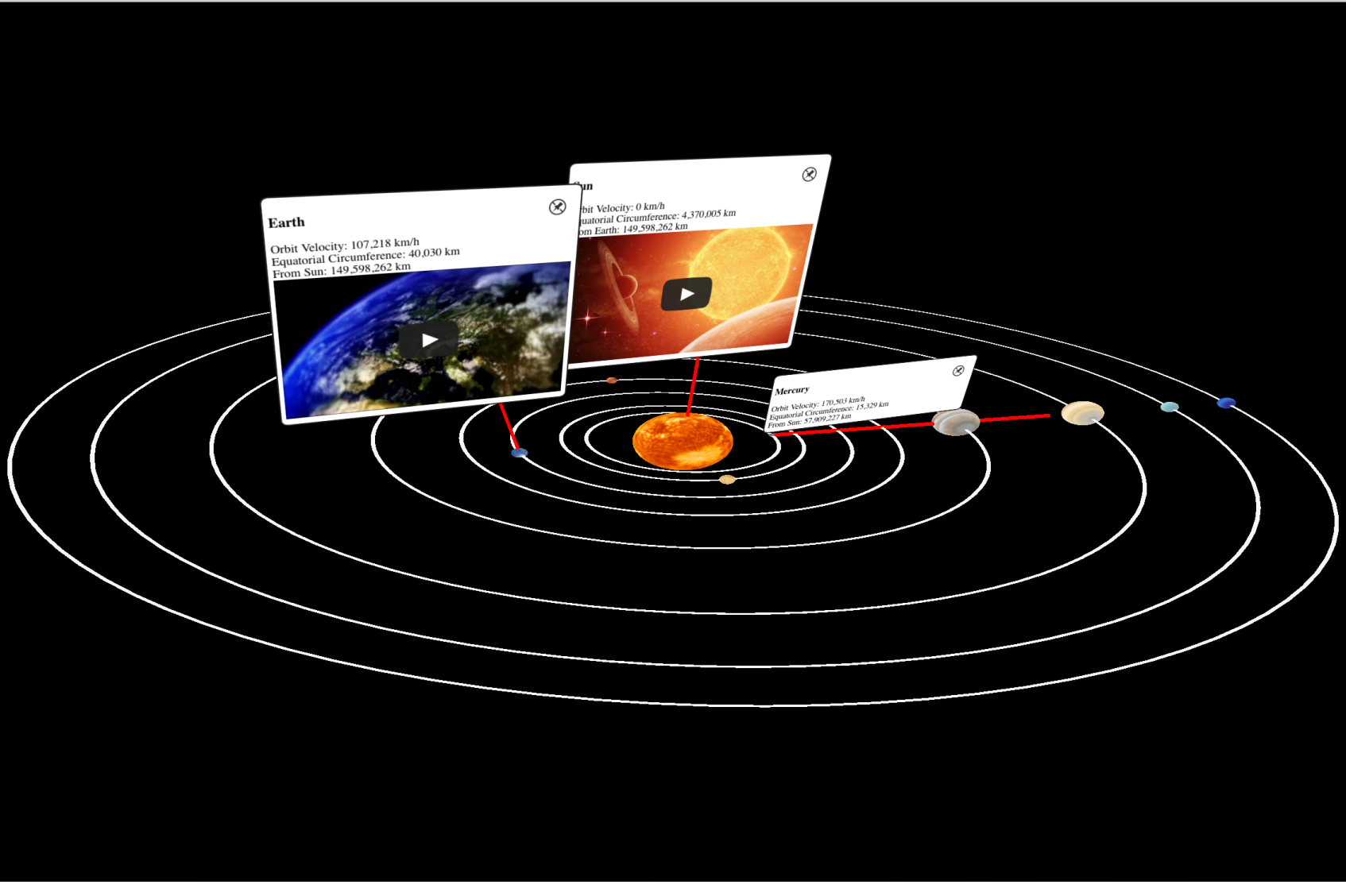
Earth
Orbit Velocity: 107,218 km/h
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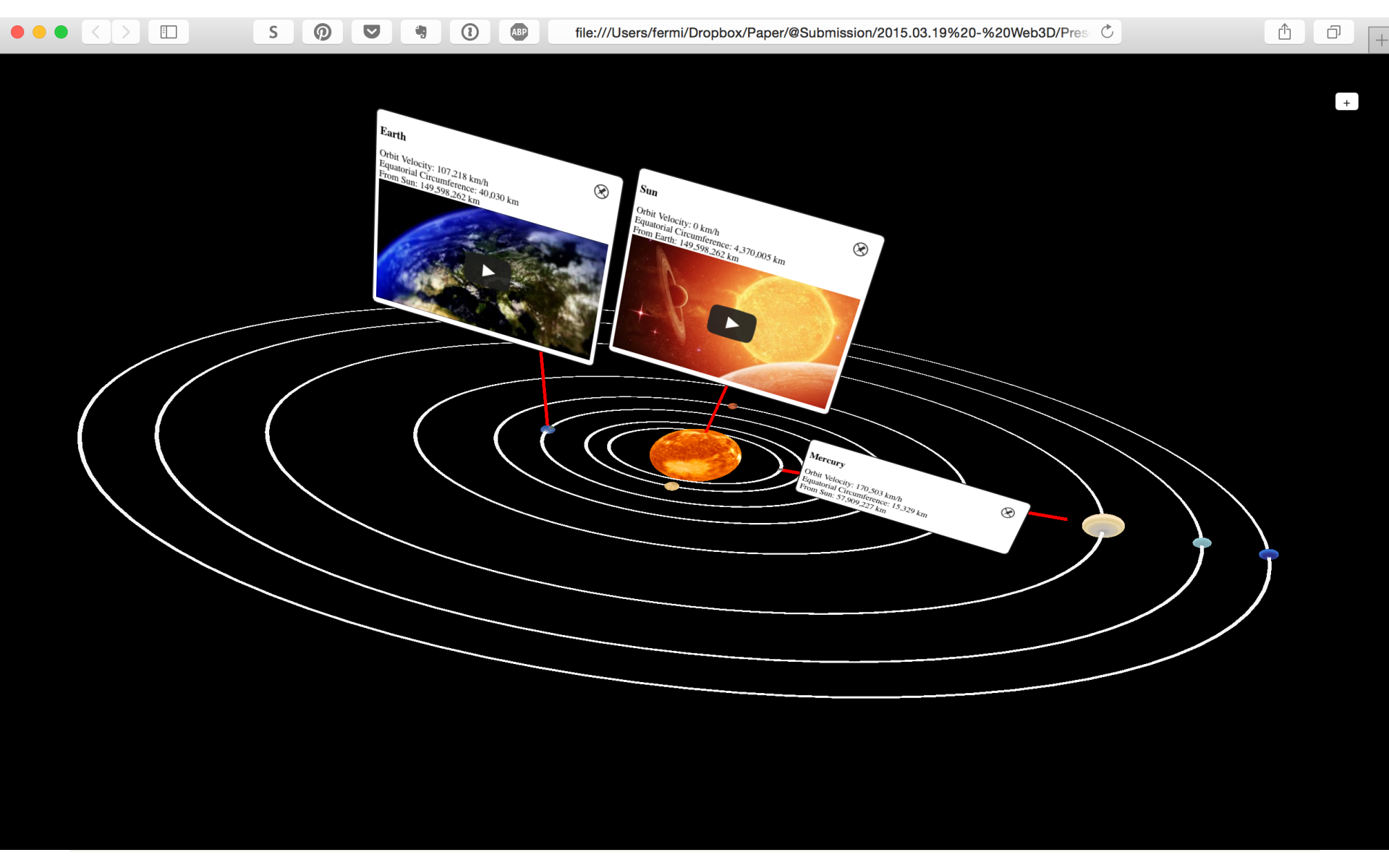
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Previous work

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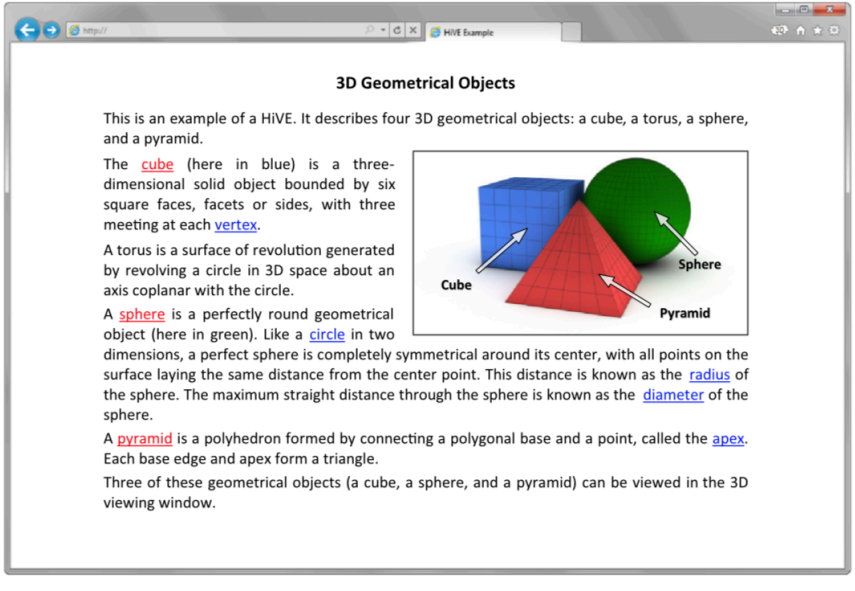
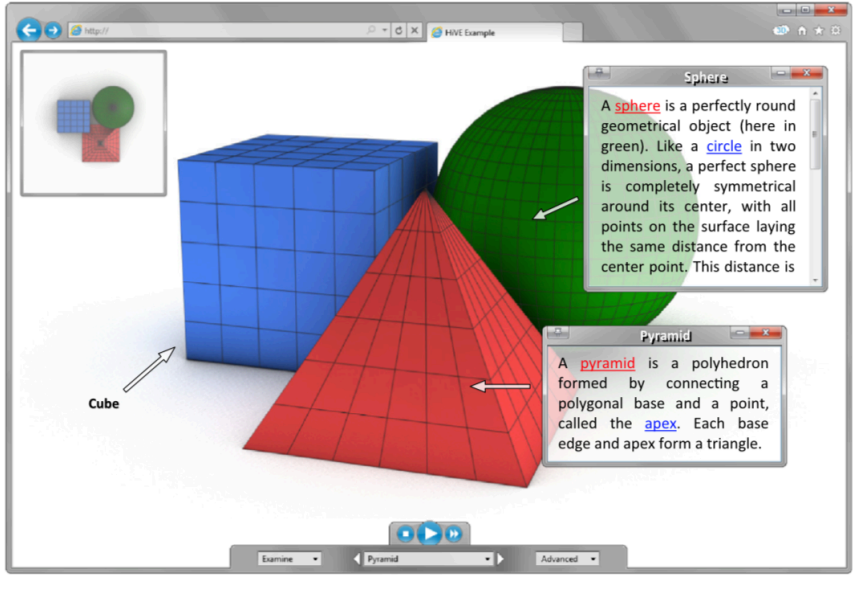
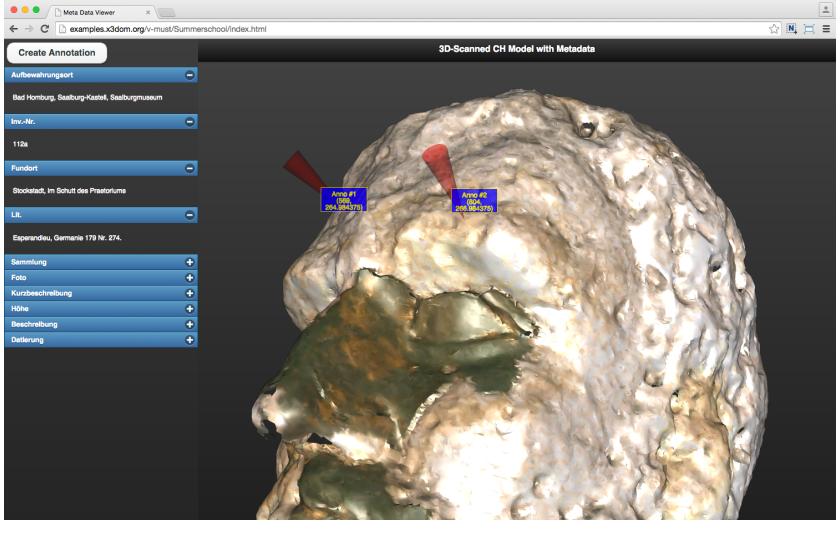




Integration of the 3D Web:
(a) 3D object on the Web and (b) a 3D object with HTML annotations

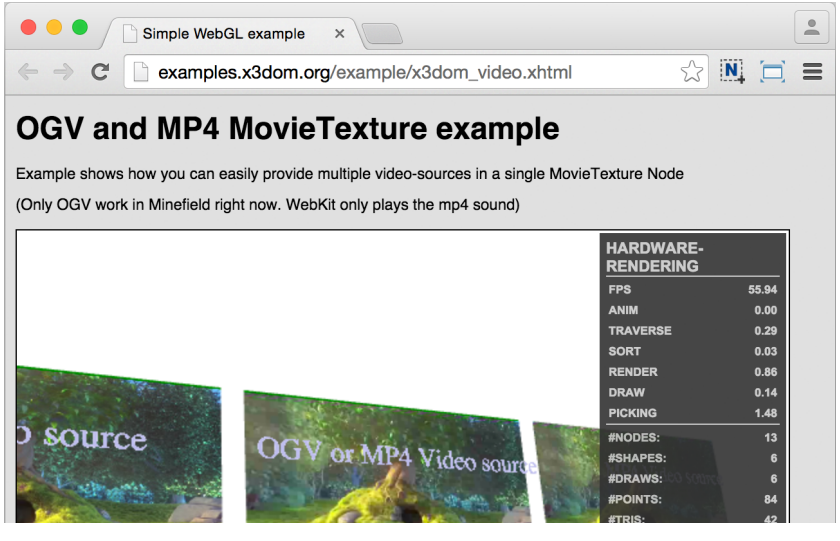
JANKOWSKI, J. AND DECKER, S. 2013. On the design of a Dual-Mode User Interface for accessing 3D content on the World Wide Web. International Journal of Human-Computer Studies 71, 838-857.

Previous work



X3DOM example of 3D-Scanned CH model with metadata

http://examples.x3dom.org/v-must/Summerschool/index.html



X3D *MovieTexture* example

http://examples.x3dom.org/example/x3dom_video.xhtml

Our approach

Webizing 3D experience

- Webizing
  - A means of bootstrapping the Web using a large amount of legacy information [Berners-Lee 1998]

- Our Method
  - Web annotations to declare the relationship between 3D target object and HTML annotation elements to share the 3D layout context on the 3D Web using web technologies

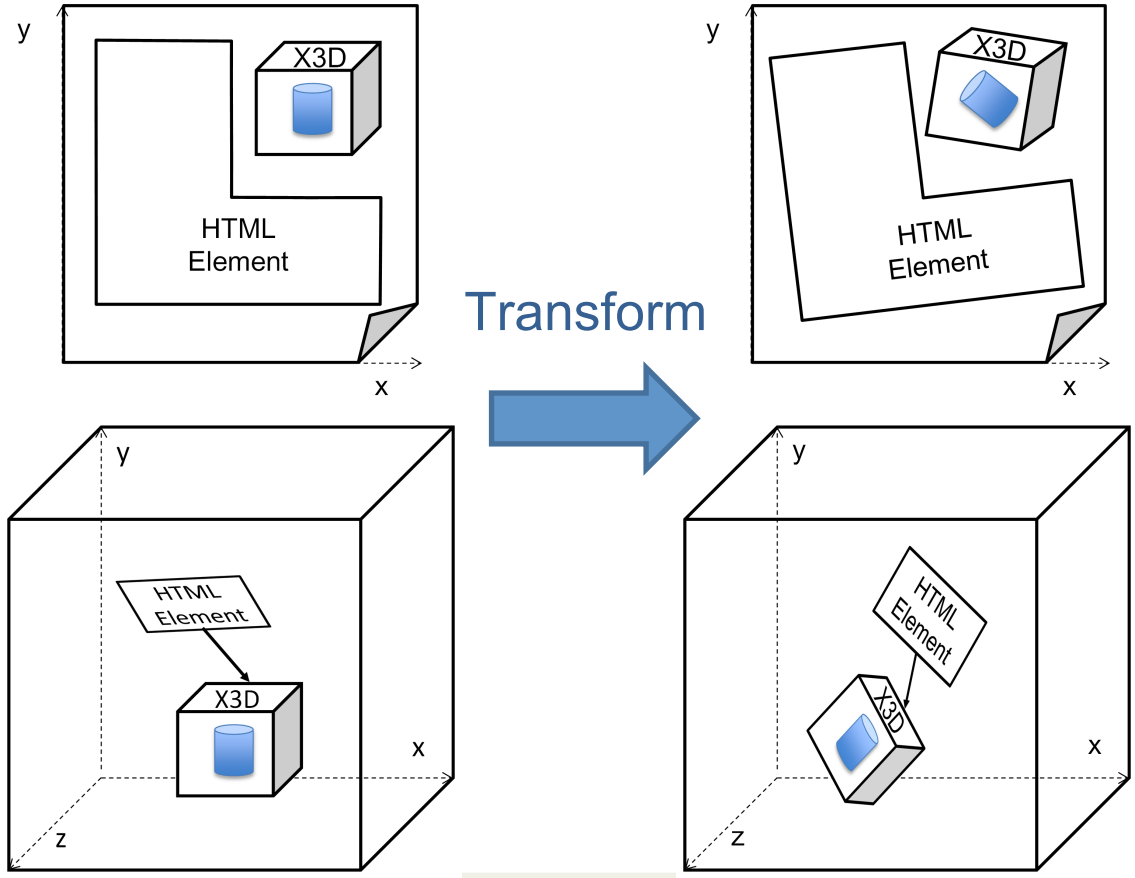
BERNERS-LEE, T. 1998. Webizing existing systems. In World Wide Web Consortium, personal notes on: Design Issues - Architectural and Philosophical Points, Last chage date: March 9, 2010.

3D Web annotation

	Legacy 3D Web content	Declarative 3D	Webized HTML5 annotation
Mechanism	MIME	DOM integration	3D context sharing
Examples	X3D	X3DOM, XML3D	Proposed
Annotation schema	?	?	Schema.org
Rendering model		Separate Canvas	Sharing 3D context of 3D scene and HTML annotation
Media type	2D page media	2D page media	3D place media (CSS extension)
Limitations	Separation of 3D context between contents (3D and HTML resources)	Separation of 3D context between contents (3D and HTML resources)	Depth buffer sharing issue (not resolved yet)
Advantage		No-plugins	Any HTML5 resources

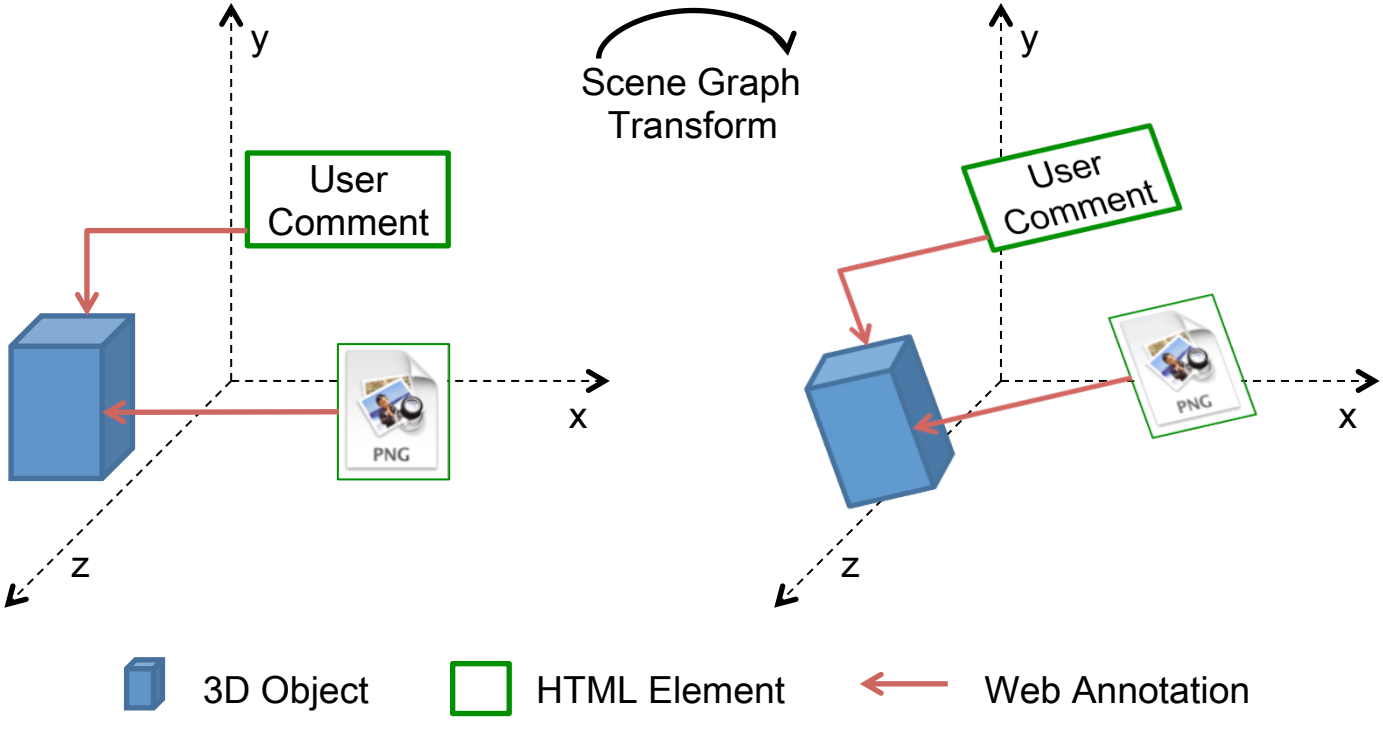
Integration of HTML and 3D Web

- Previous
  - CSS Paged Media
  - 2D Space
- Proposed
  - CSS Place Media [Ahn 2014]
  - 3D Space



AHN, S., KO, H. AND YOO, B. 2014. Webizing mobile augmented reality content. New Review of Hypermedia and Multimedia 20, 79-100.

Webizing 3D experience with annotation



Semantic

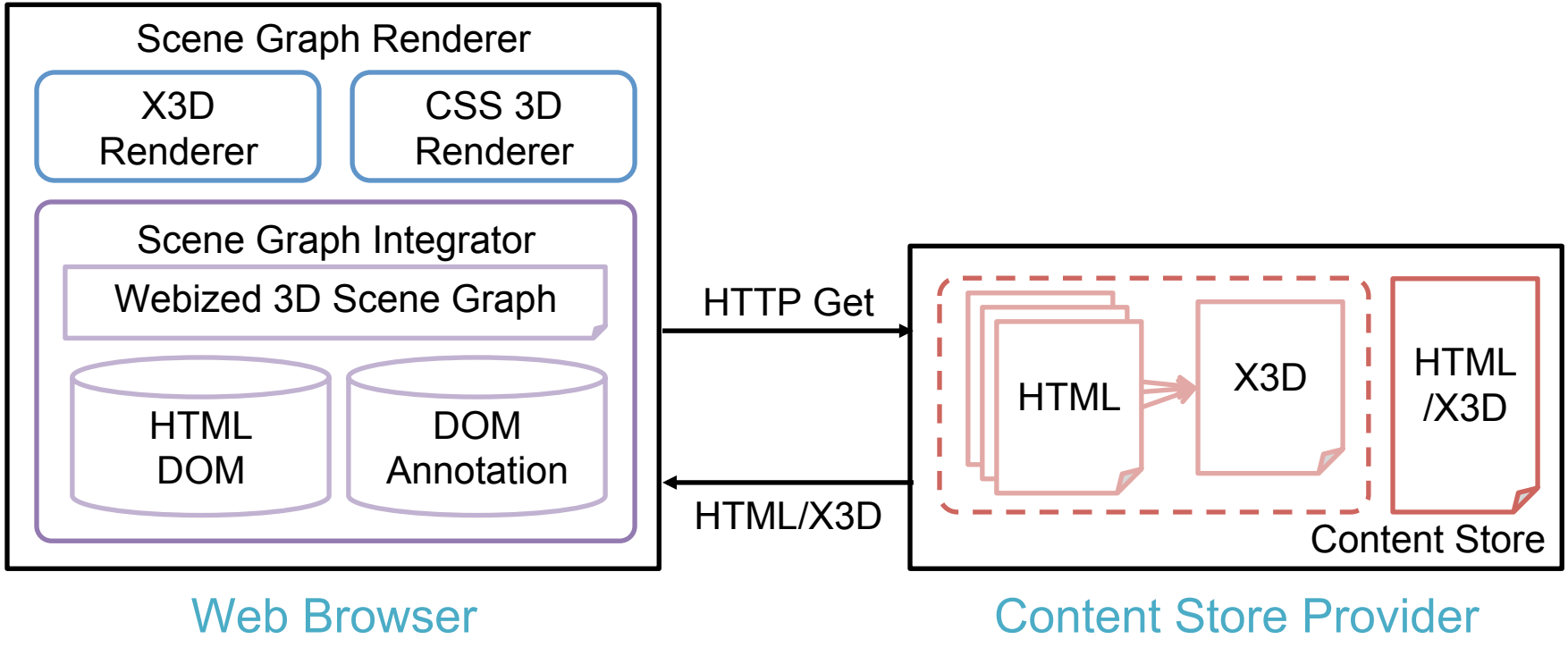
Webizing annotation for the 3D Web exp

Property	Range	De
target	URL	3D val
translate	Integers	De
rotate	Integers	De
scale	Integers	De
contentURL	URL	UR to

```
<x3d>
    <Transform translation='81 0 0'>
        <Scene>
            <Shape DEF='earth'>
                <Sphere radius='3.9'/>
                <Appearance>
                    <Material diffuseColor='1 1 1'/>
                    <ImageTexture url='images/texture_earth_clouds.jpg' />
                </Appearance>
            </Shape>
        </Scene>
    </Transform>
</x3d>
<div vocab="http://schema.org" typeof="AnnotationObject" id="earth_annotation">
    <div property="translate" class="annotation_property">0, 0, 150</div>
    <div property="rotate" class="annotation_property">0, 0, 0</div>
    <div property="scale" class="annotation_property">1, 1, 1</div>
    <div property="target" class="annotation_property">#earth</div>
    <p>
        <h2>Earth</h2><br>
        Orbit Velocity: 107,218 km/h<br>
        Equatorial Circumference: 40,030 km<br>
        From Sun: 149,598,262 km<br>
        <iframe src="https://www.youtube.com/embed/thuViaxRd_w?....."></iframe>
    </p>
</div>
```

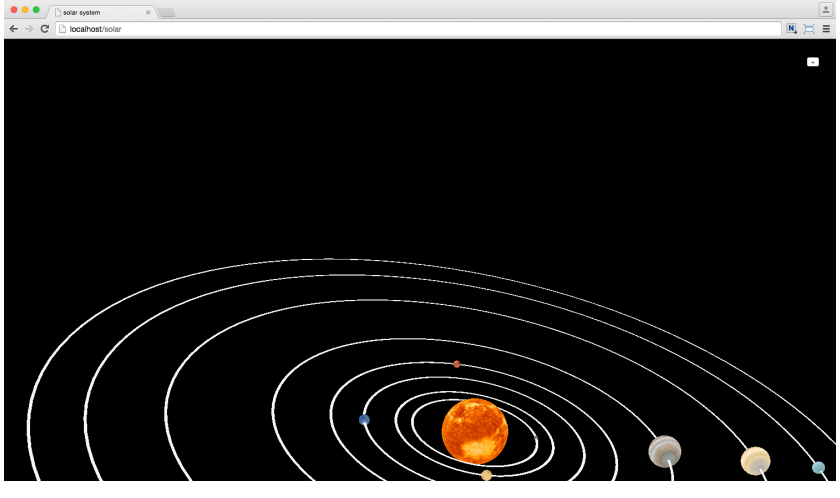
Prototype implementation

Prototype implementation

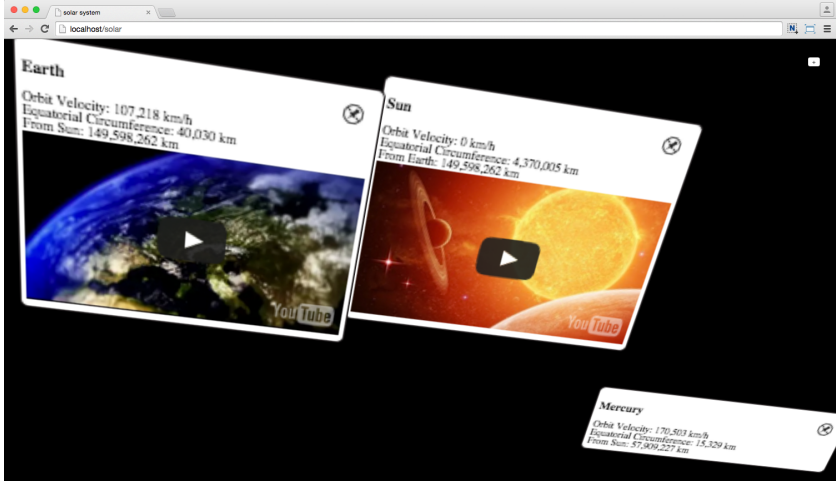


Experimental results

- Separate rendering results of the 3D Web

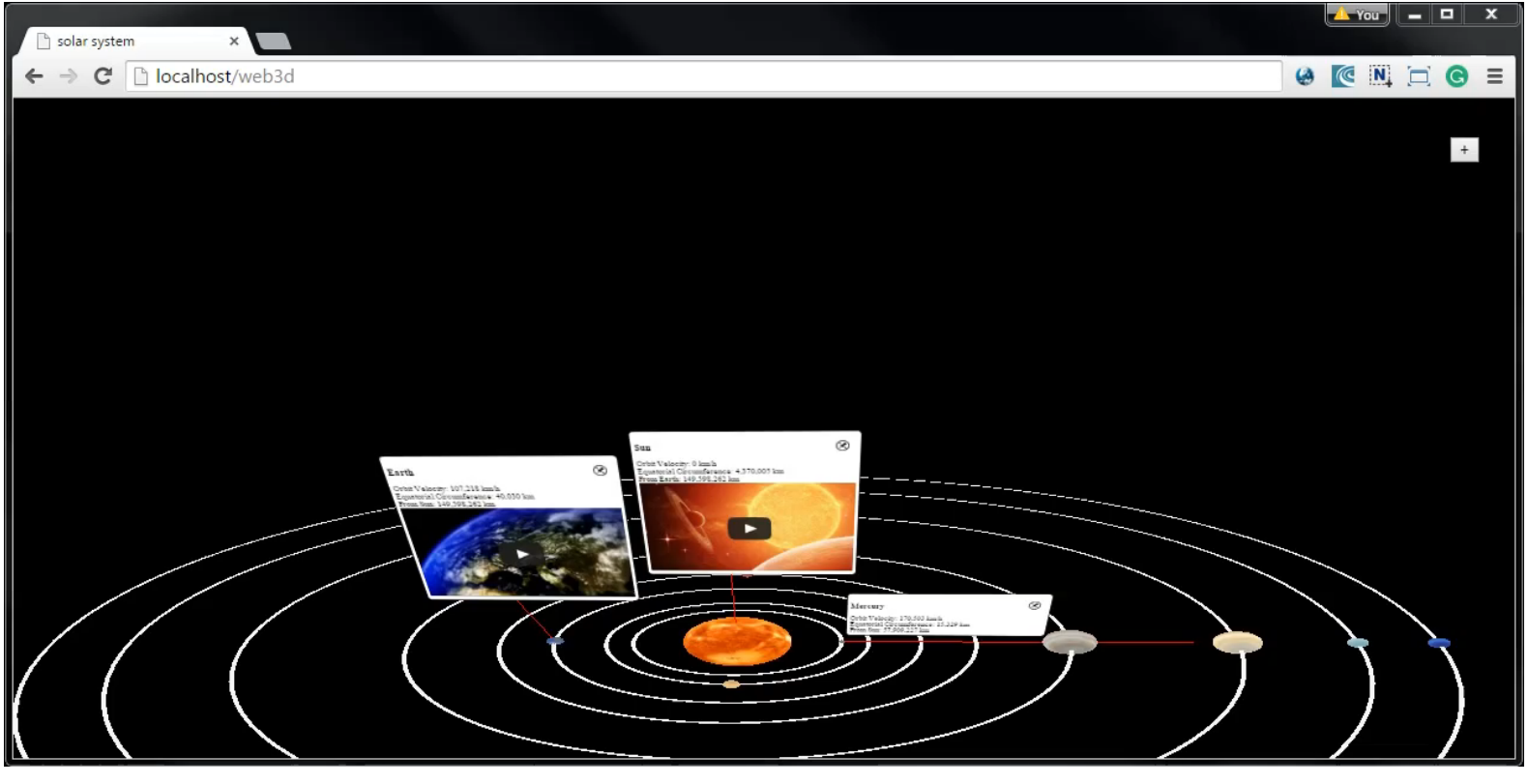


3D object rendering on the 3D Web



Web annotation rendering on the 3D Web

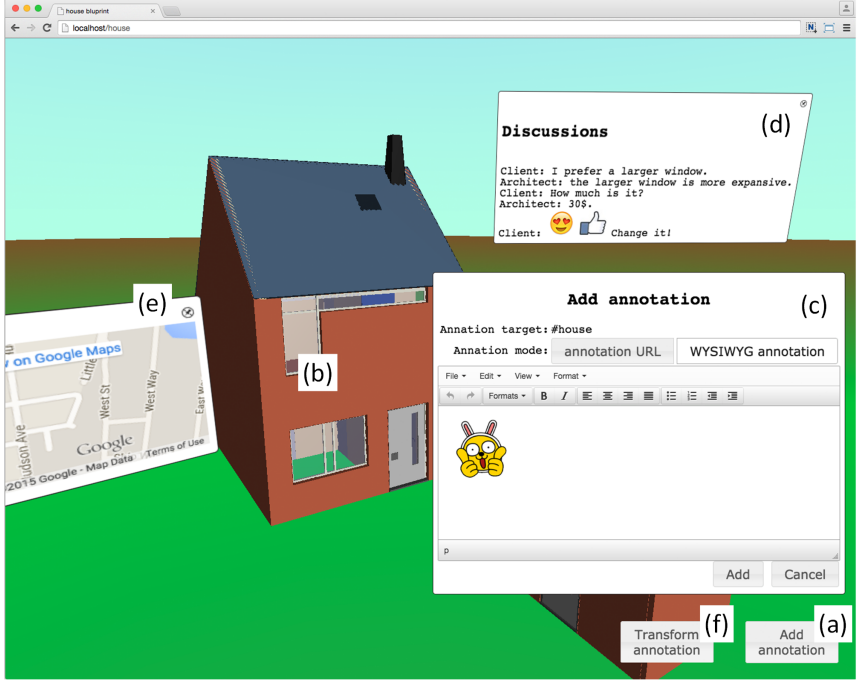
Experimental results



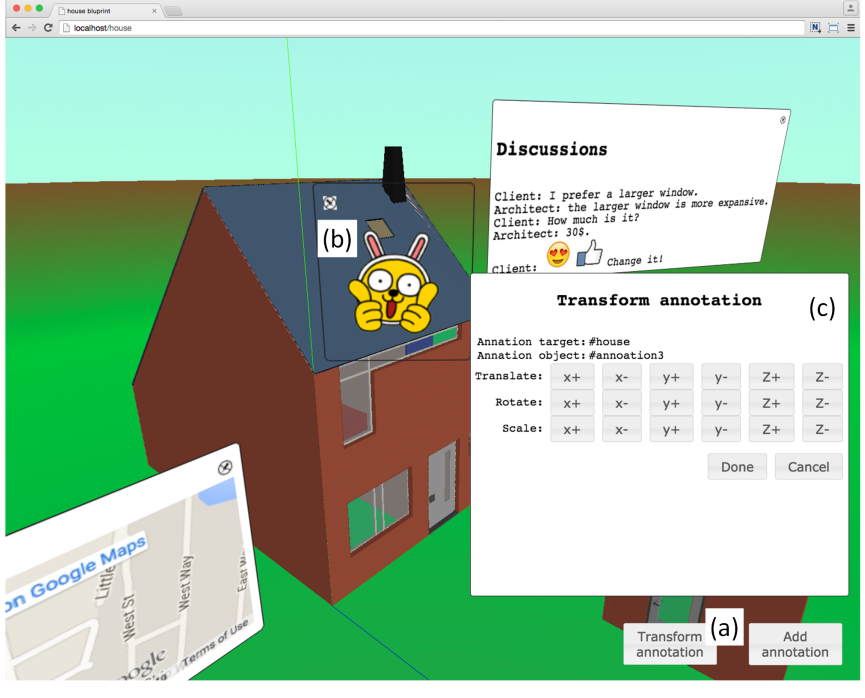
3D planet objects in solar system

Experimental results

- 3D architectural CAD model of a house



User experience annotation on 3D model



Transforms web annotation of user experience on 3D model

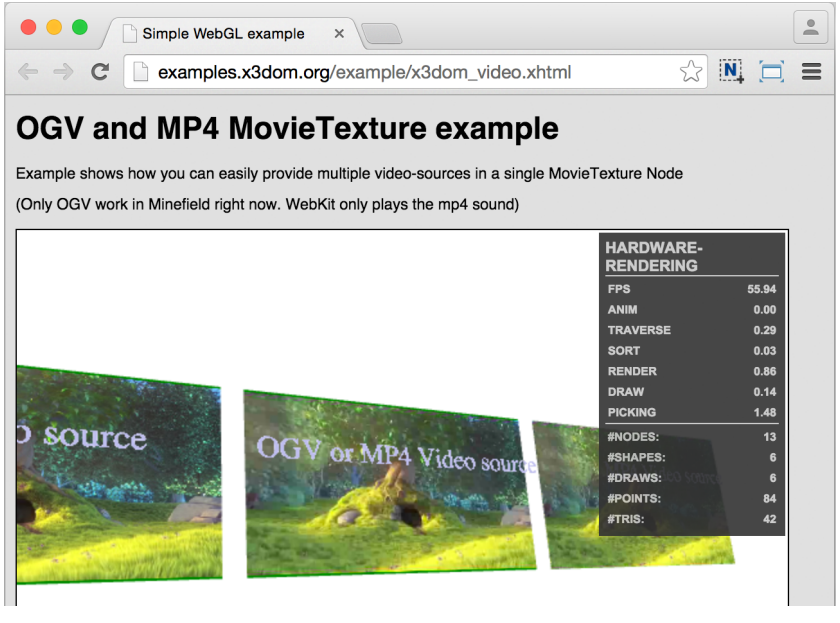
Discussion and future work

Summary

- In this study, we proposed a method for webizing 3D experience by web annotation to express user experience on 3D Web
  - Uses web annotation model to declare relationship between user experience and 3D objects
  - Renders them based on the relationship to share layout and camera perspective in 3D context
  - Has advantage to use existing sophisticated media and application library resources of current web technologies on the 3D Web

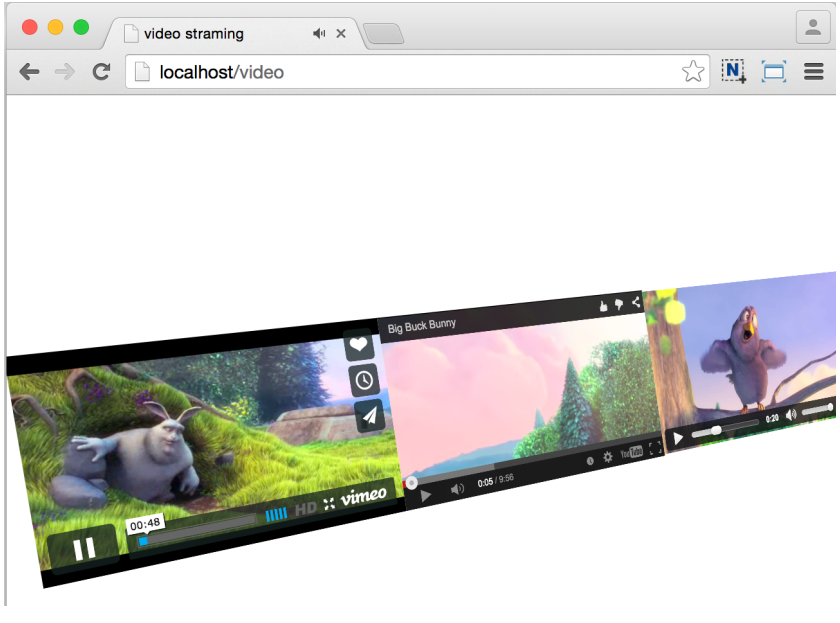
Discussion

- Interaction with HTML element on 3D Web



X3D *MovieTexture* example

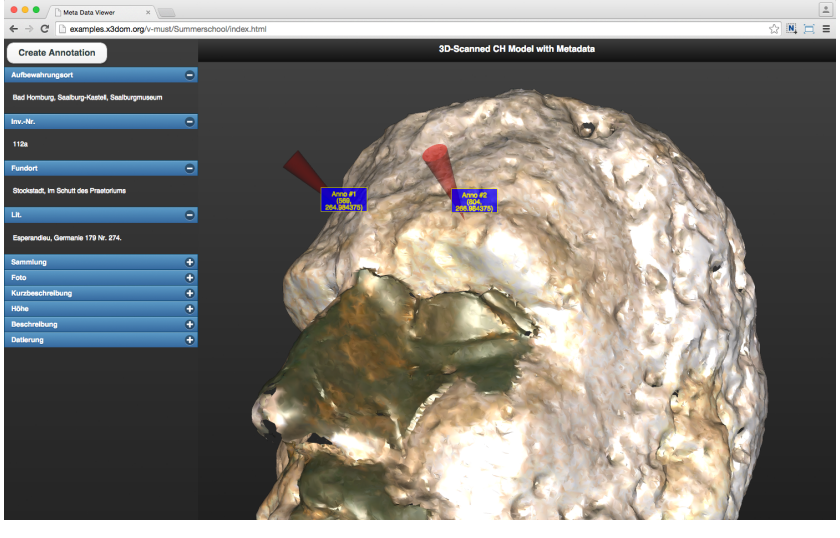
http://examples.x3dom.org/example/x3dom_video.xhtml



Webized annotation on the 3D Web using Video, YouTube, and video tag of HTML

Discussion

- Rendering 3D objects with annotation on 3D Web



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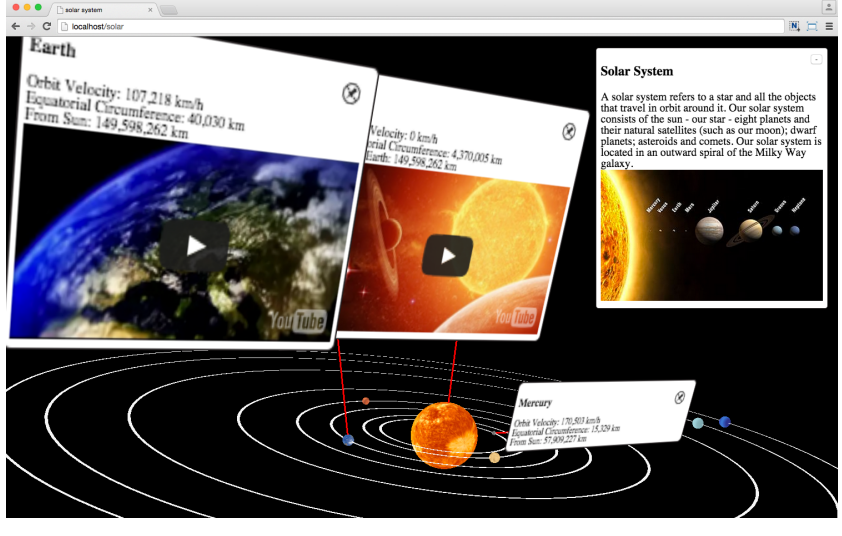

Webized annotation on the 3D Web with 2D and 3D layout annotated objects

http://examples.x3dom.org/v-must/Summerschool/index.html

Limitation and Future work

- Limitation
  - Our prototype implementation is limited to sharing the context of 3D layout and the context of the annotated content
- Future work
  - Applying our method to 3D CAD system

Thank you

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