SANTIAGO LOMBEYDA

METHODS OF COMPUTATIONAL SCIENCE

INTRO TO VISUALIZATION

2020 ADDENDUM

OVERVIEW

SECTION 1 WHAT IS VISUALIZATION?

SECTION 2 UNDERSTANDING THE LANDSCAPE

SECTION 3 A TOOL TOOL TAXONOMY

SECTION 4 PRINCIPLES OF DATA REPRESENTATION

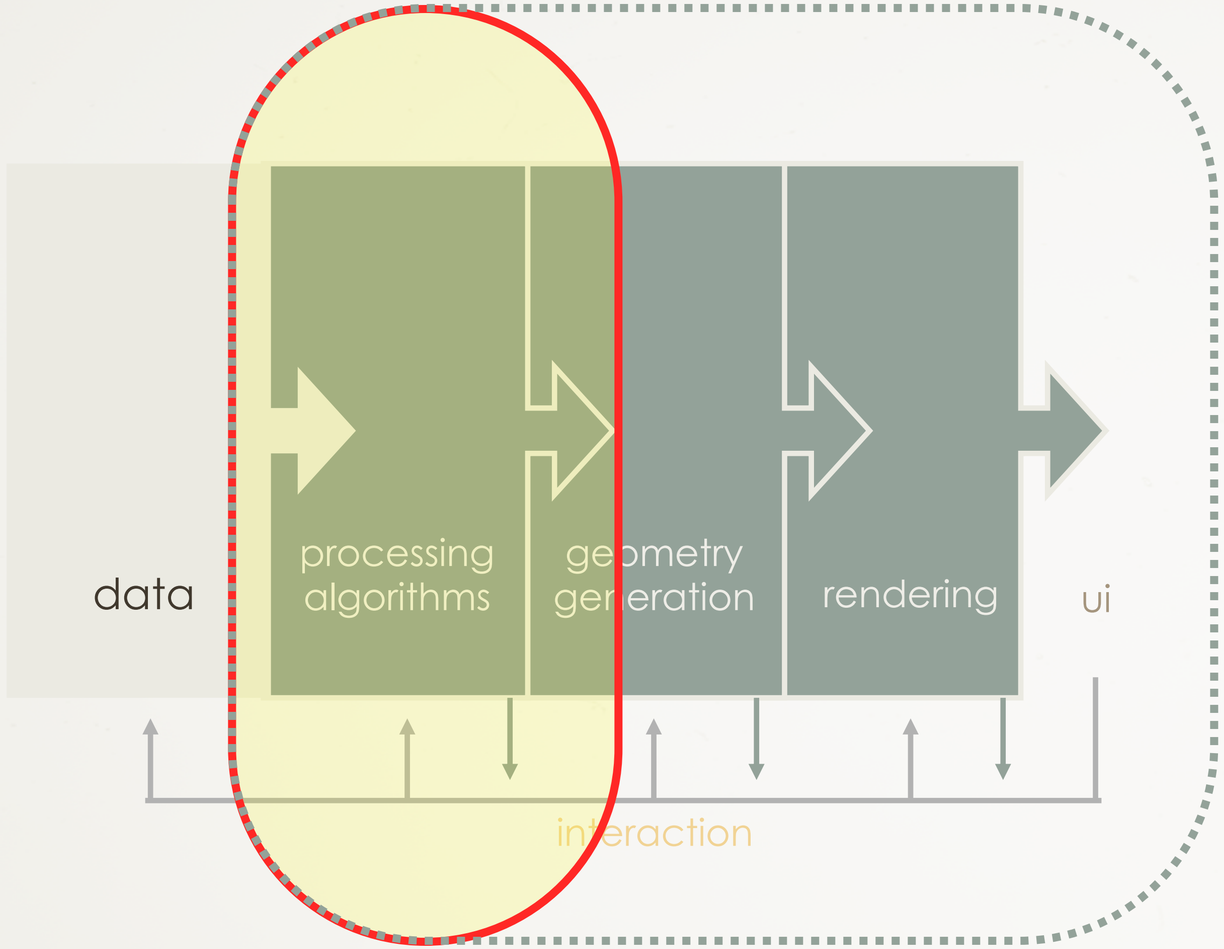
NOTES ..ON COLOR

NOTES ..ON MAPPING MULTIPLE DIMENSIONS

SECTION 5 ADDRESSING BOTTLENECKS

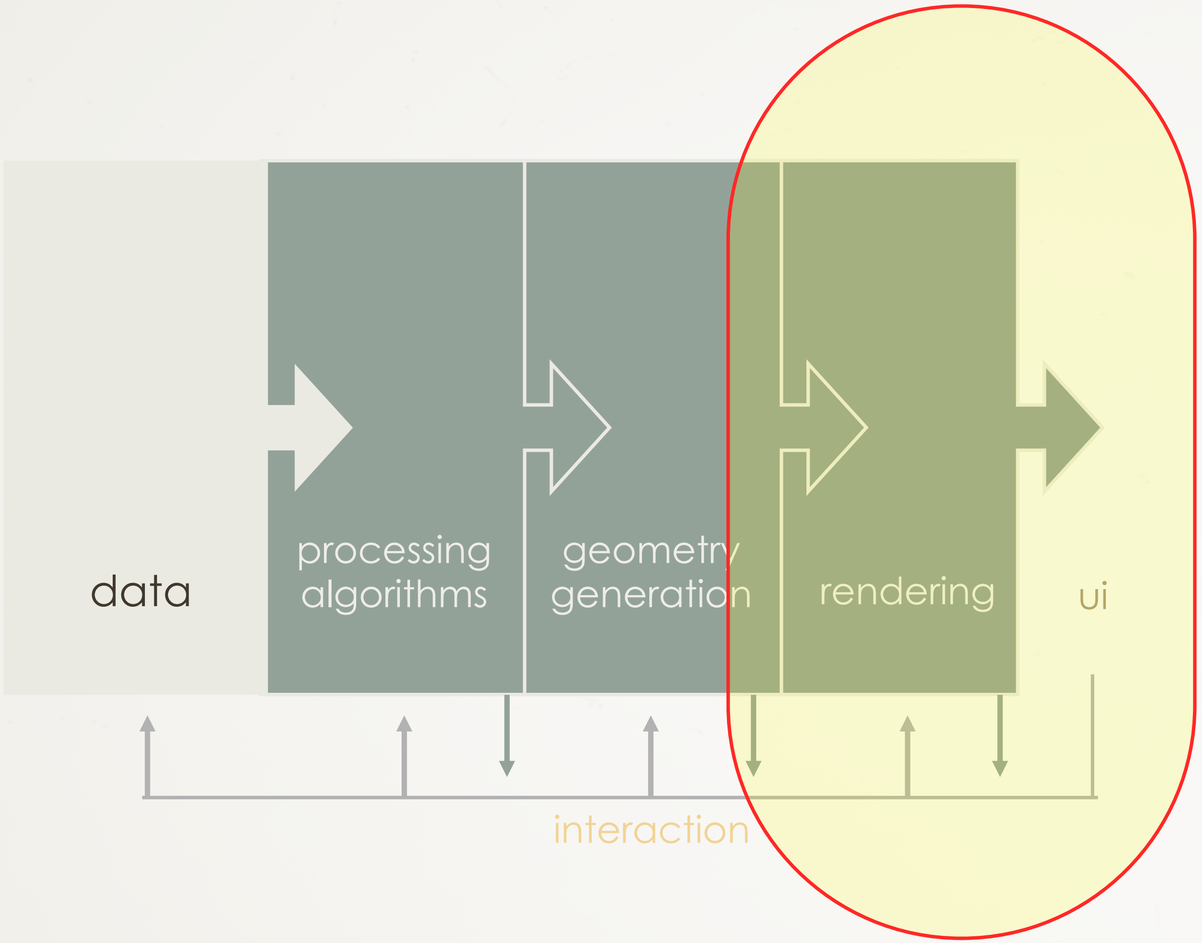
SECTION 6 PUTTING IT ALL TOGETHER

"THE" VISUALIZATION TOOLKIT



- VTK
  - c/c++
  - tcl/tk
  - python
  - java
- R

INTERACTIVE RENDERERS

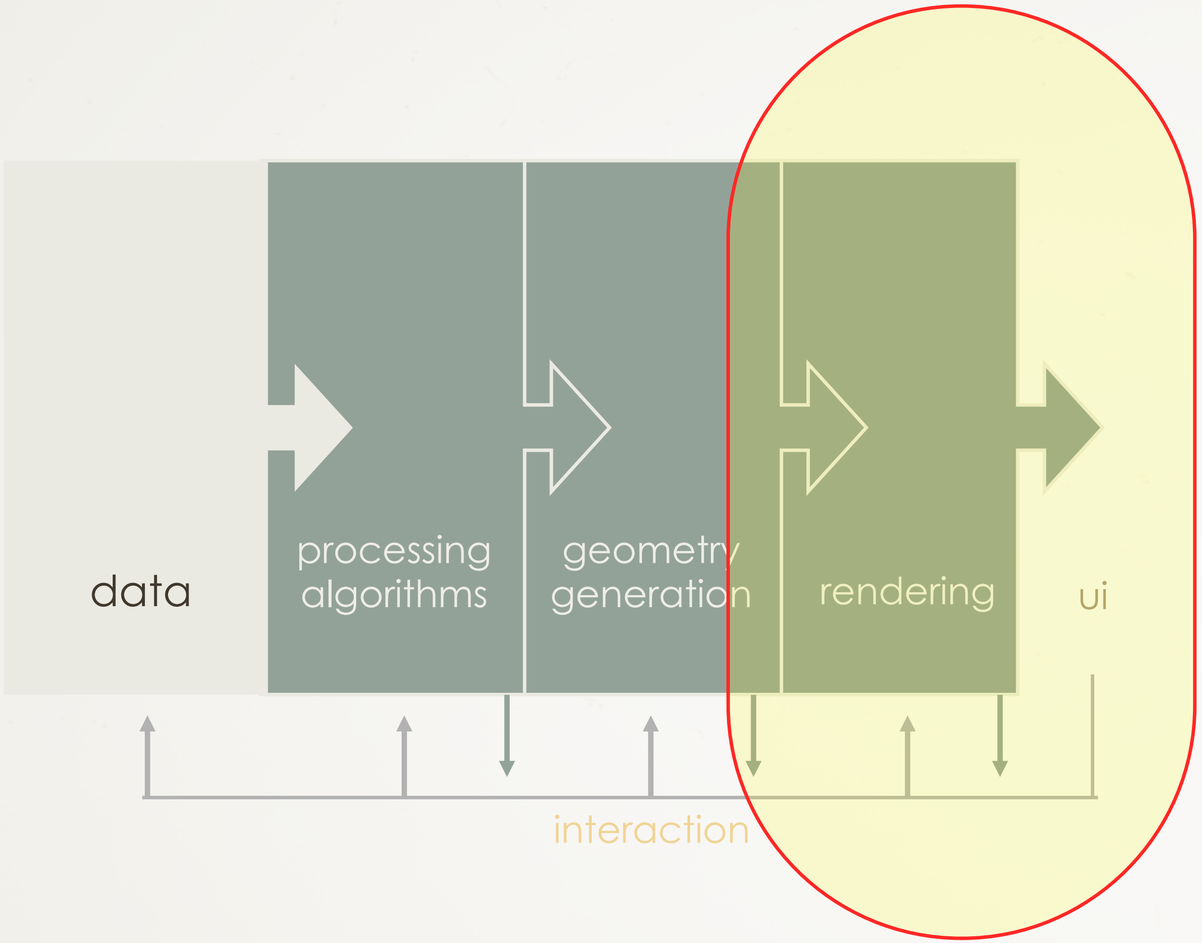


- OpenGL
  mesaGL
  direct3D
  openGL ES

HIGHER LEVEL:

- OpenInventor
  - C++/GL
  - COIN
- Java3D
  - Java/GL
- *WebGL*
  - ➔ three.js

INTERACTIVE RENDERERS



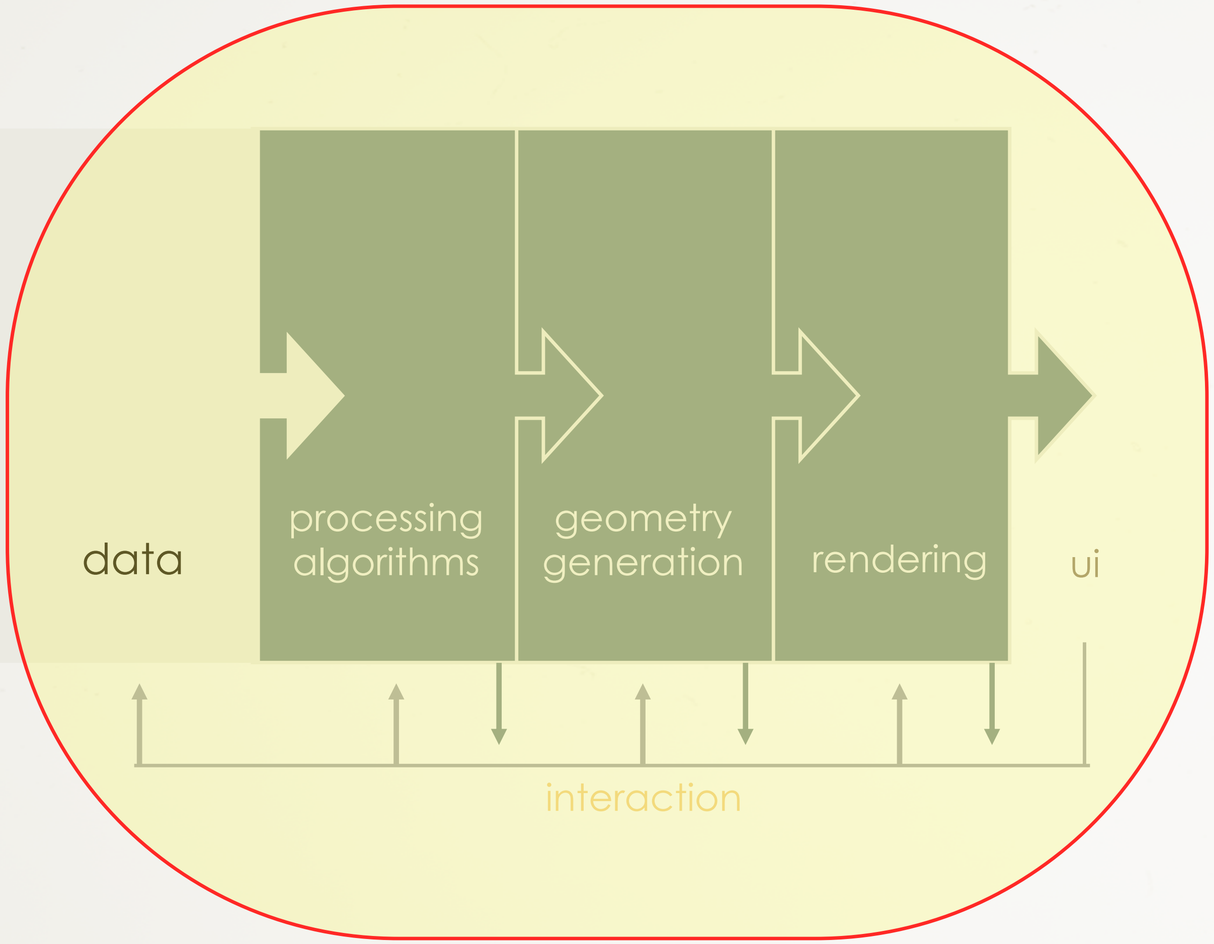
- OpenGL
  mesaGL
  direct3D
  openGL ES

HIGHER LEVEL | DESKTOP

- cross-platform
  - OPEN FRAMEWORKS
  - CINDER, PROCESSING (P5.js)
- gaming
  - UNITY
  - UNREAL
- web based
  - three.js
  - babylon.js

★ 2020 ★

VISUALIZATION SYSTEMS



- Paraview[VTK]
- LLNL VisIt[VTK]
- Ensight[$]

- tableau[$]
  - D3[WWW]
- Many Eyes[WWW]
  - *Wiki based*
- Modrian[R],
  TomCat,
  Mollegro

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SECTION 7 — 3D VIEWING AND VIRTUAL REALITY

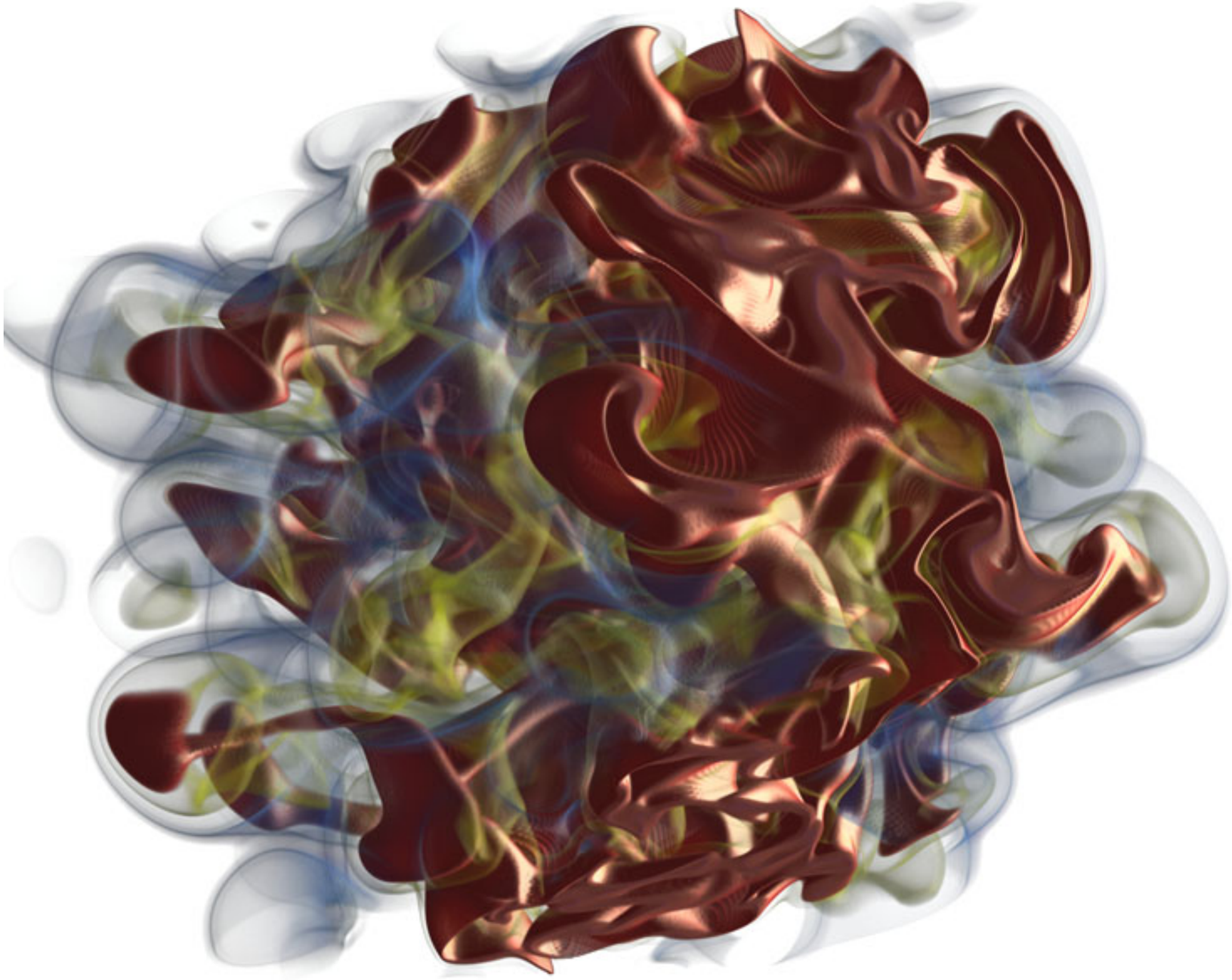
SECTION 7

why 3D?

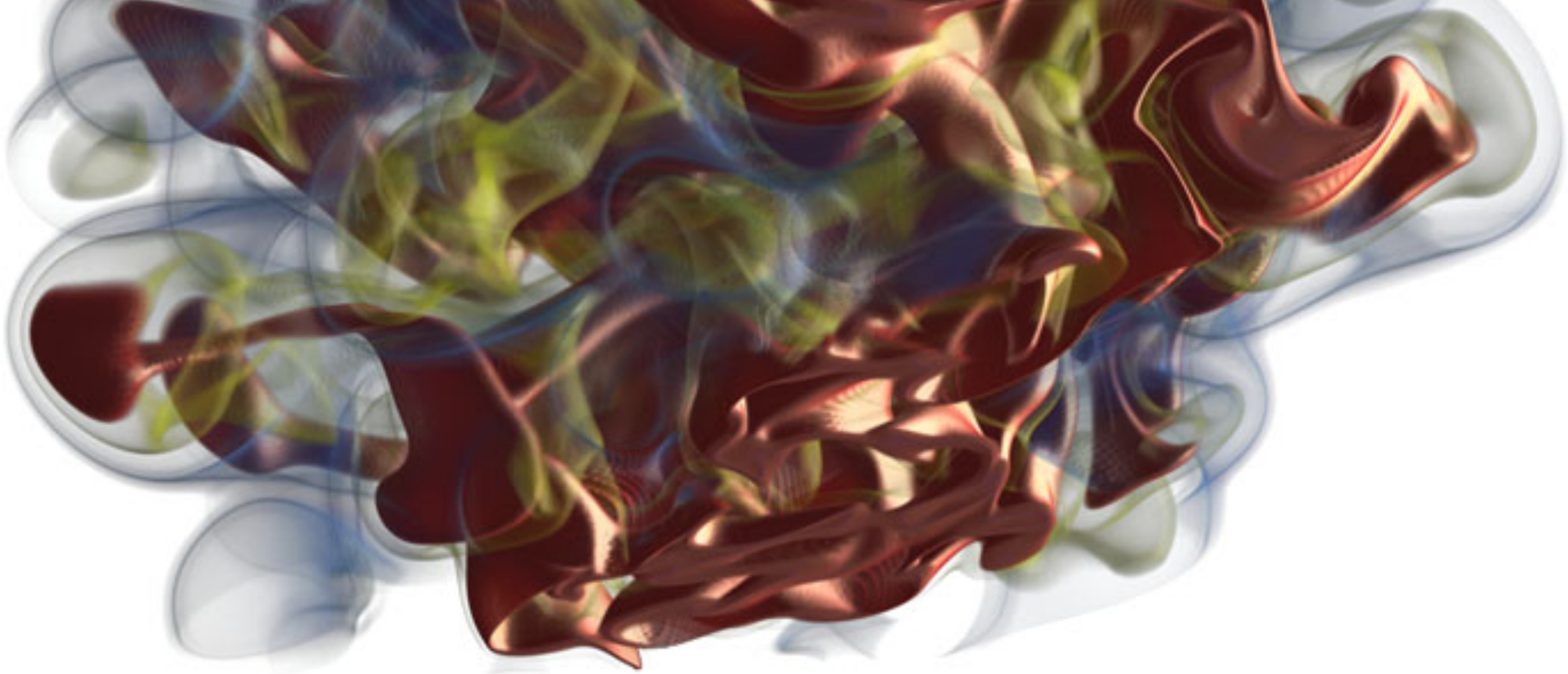
"WE KNOW **NEXT TO NOTHING** ABOUT HOW COLLECTIVE COGNITION WORKS, OR WHEN IT WORKS, OR HOW TO MAKE IT WORK BETTER; WE HAVE SOME IDEAS ABOUT IT, BUT **AT BEST** THEY'VE THE STATUS OF **ARTISANAL RULES OF THUMB**."

- **BACTRA REVIEW** BY COSMA SHALIZI OF EDWIN HUTCHINS'S BOOK COGNITION IN THE WILD

quote stolen from Colin Ware's Vis2009 keynote



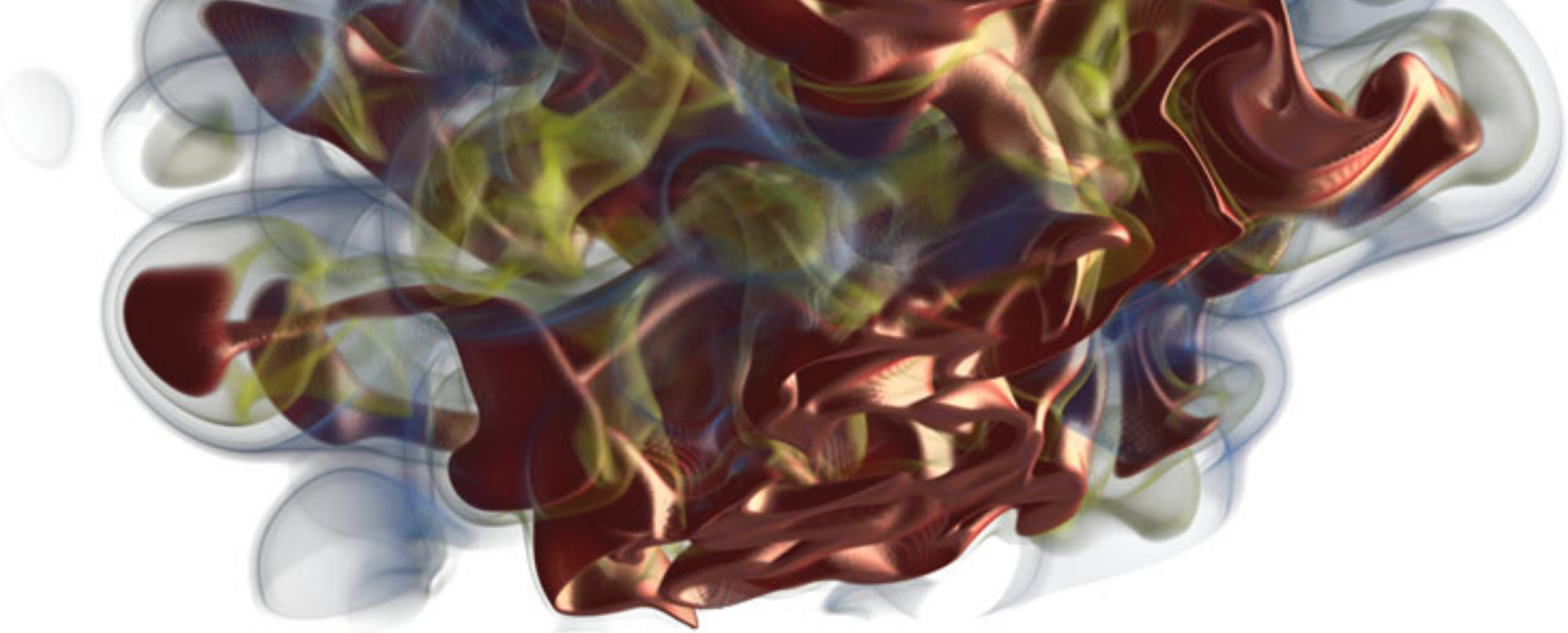
THE VOLUMEPRO VOLUME RENDERING CLUSTER | SANTIAGO LOMBEYDA & JOHN MCCORQUODALE | CALTECH | 2003



THE VOLUMEPRO VOLUME RENDERING CLUSTER | SANTIAGO LOMBEYDA & JOHN MCCORQUODALE | CALTECH | 2003

WHY 3D

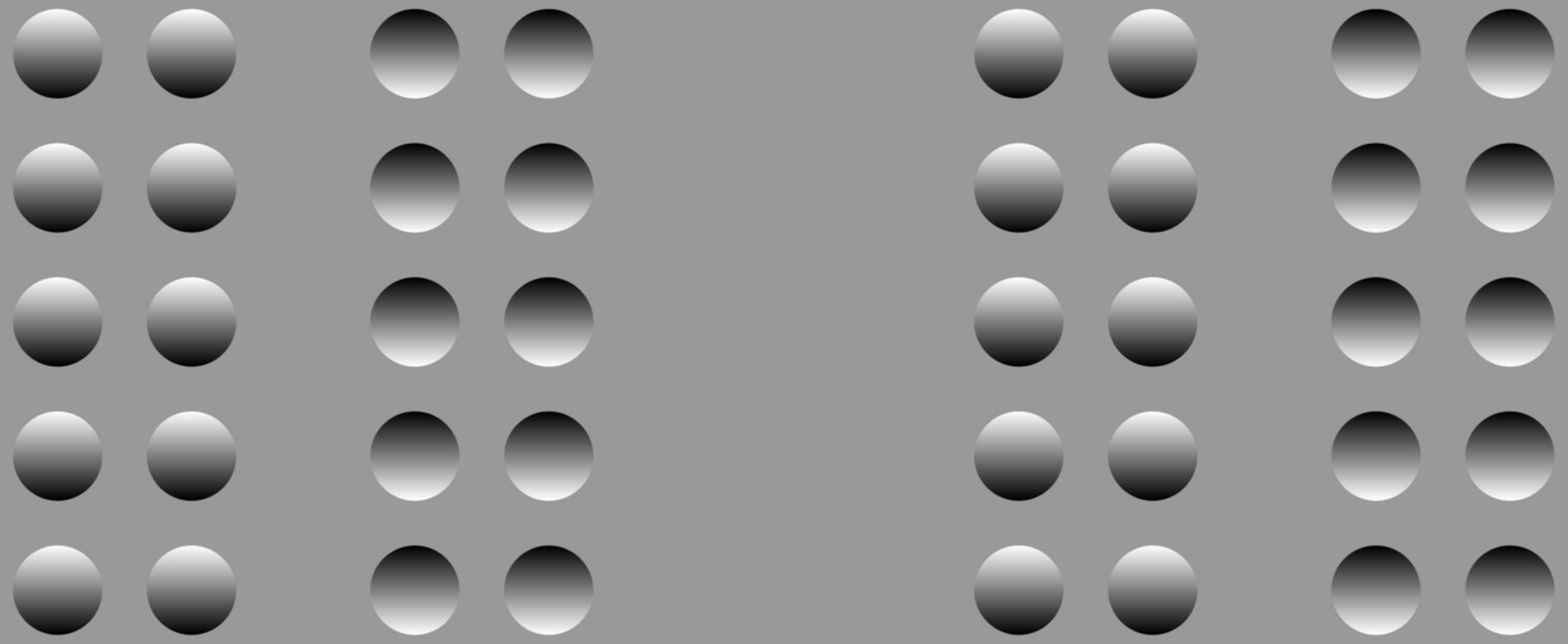
- phenomena is in 3D
- spatial relationships meaningful in 3D
- we understand 3D world



THE VOLUMEPRO VOLUME RENDERING CLUSTER | SANTIAGO LOMBEYDA & JOHN MCCORQUODALE | CALTECH | 2003

WHY NOT 3D

- spatial relationships more difficult to understand
- our displays are 2D
- we abstract in 2D or 1D



_OCCLUSION
_PERSPECTIVE
_MOTION PARALLAX

_SIZE: RELATIVE | FAMILIAR | ABSOLUTE
_LIGHTING AND SHADING

_DEFOCUS BLUR
_DEPTH FROM MOTION
_KINETIC DEPTH EFFECT
_ATMOSPHERIC PERSPECTIVE
_ACCOMODATION
_CURVILINEAR PERSPECTIVE
_TEXTURE GRADIENT
_ELEVATION

_BINOCULAR PARALLAX
(STEREOPSIS)

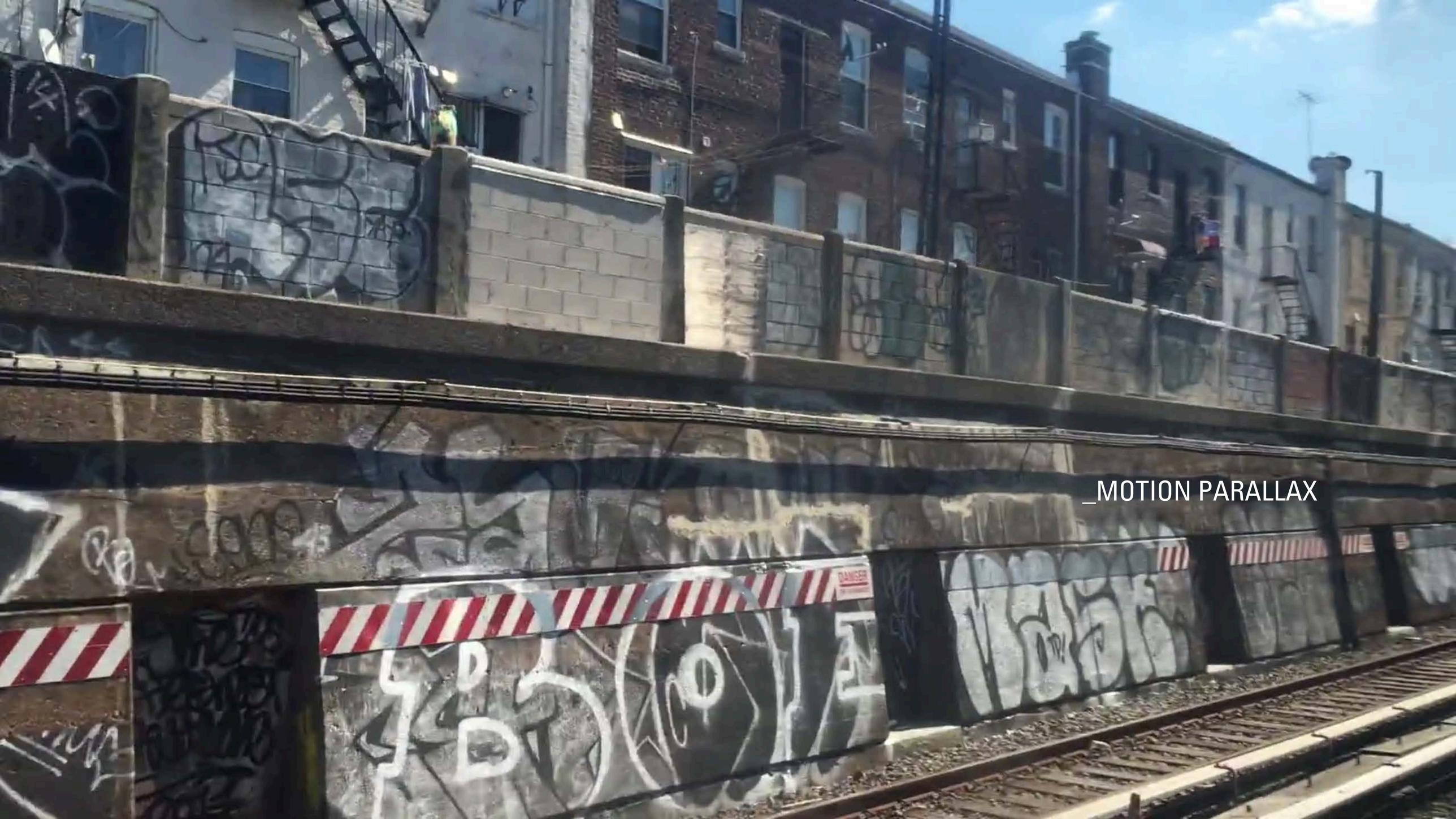
_CONVERGENCE

_SHADOW STEROPSIS

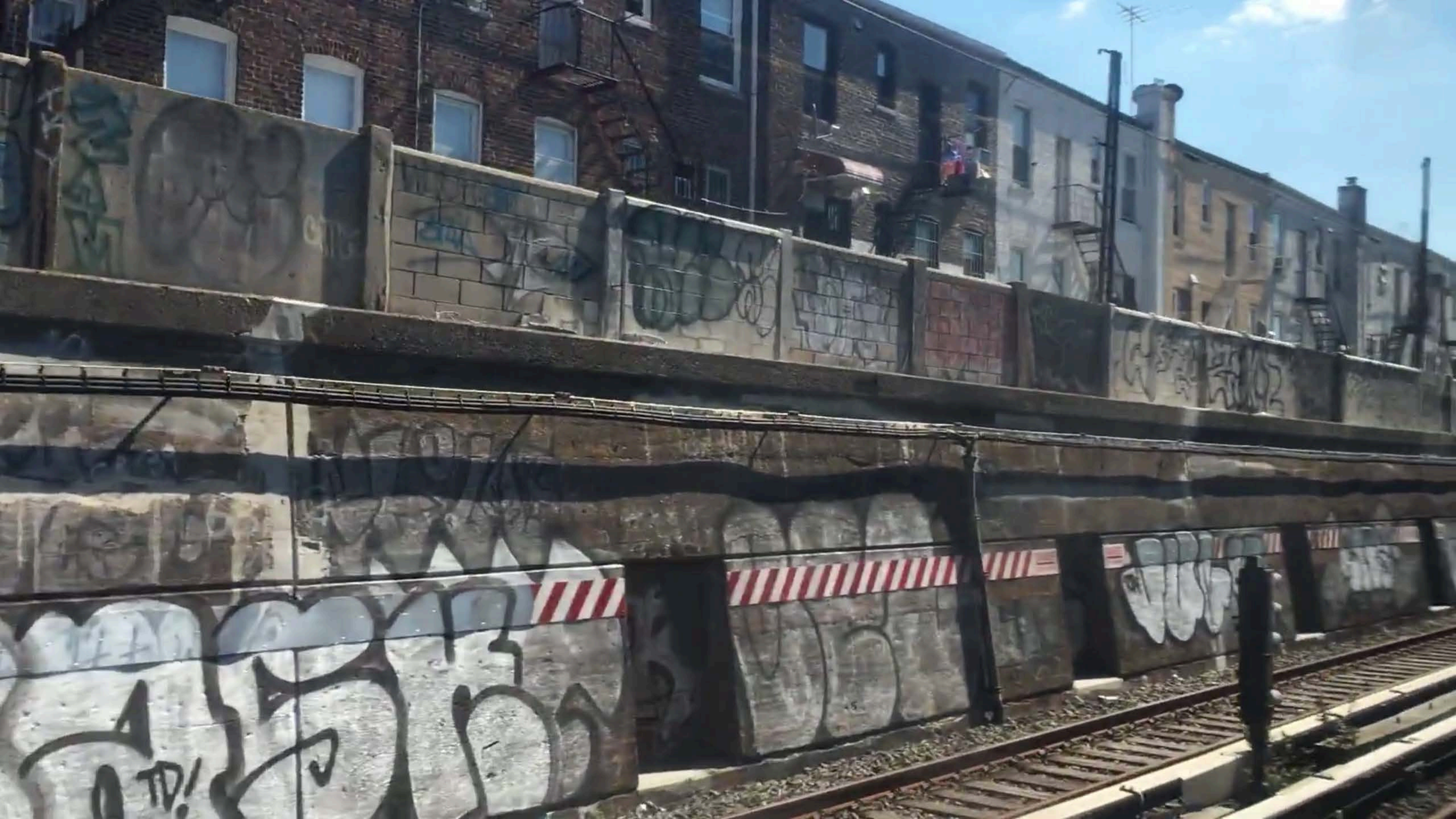
3D CUES

_OCCLUSION

_PERSPECTIVE


_MOTION PARALLAX

DANGER
NO CLEARANCE



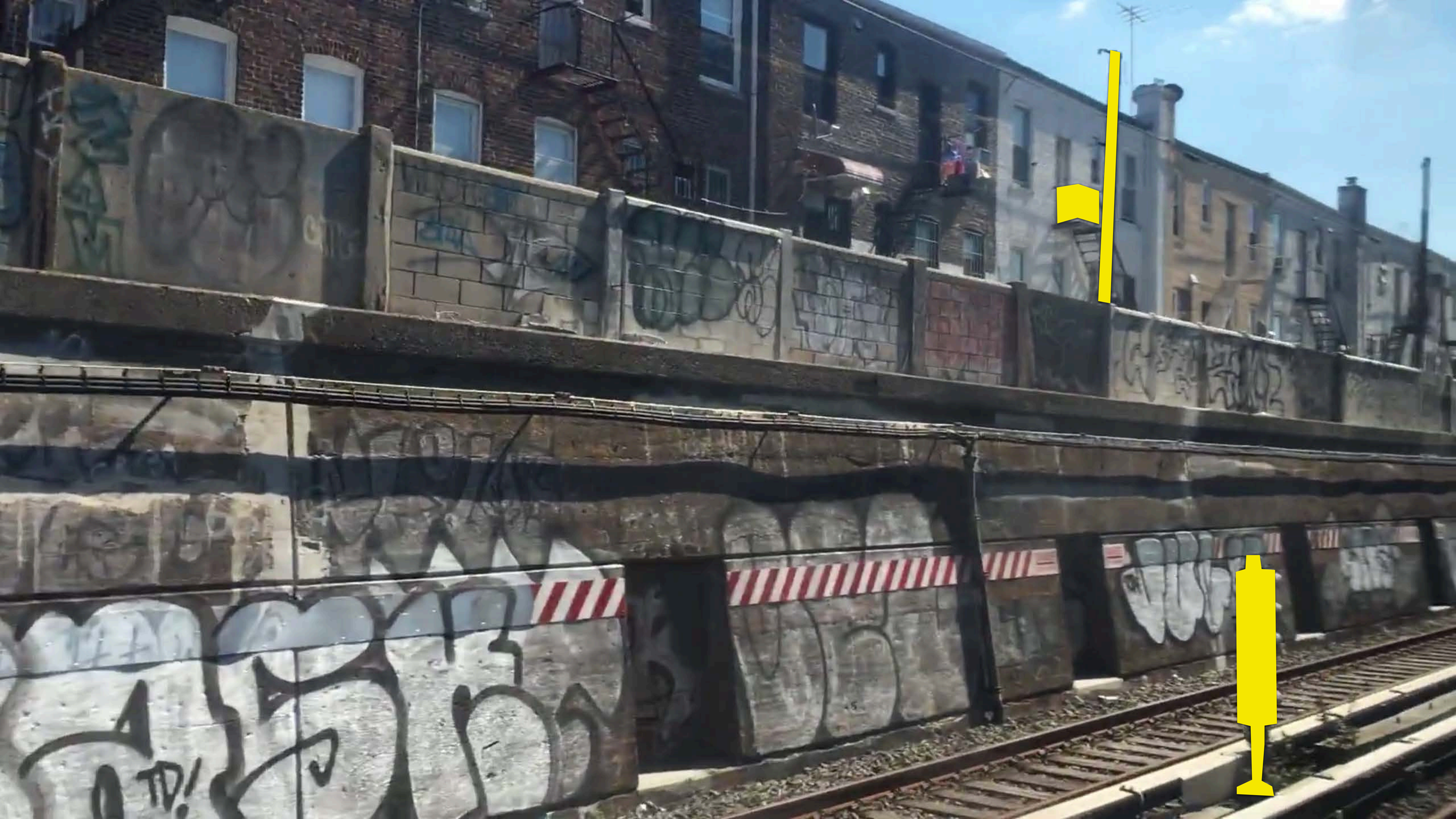
DANGER

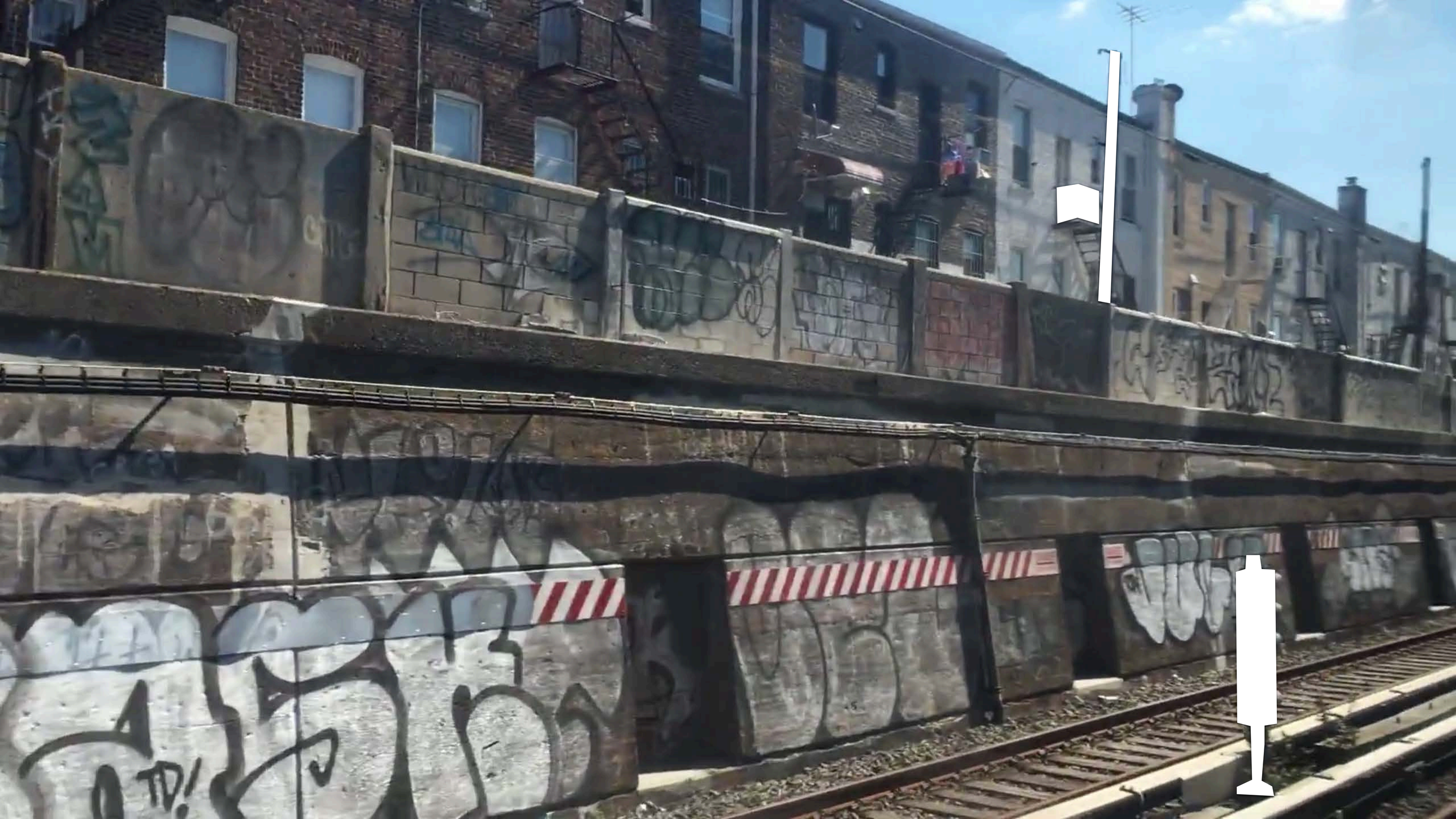
DANGER

DANGER
DANGER

DANGER
DANGER

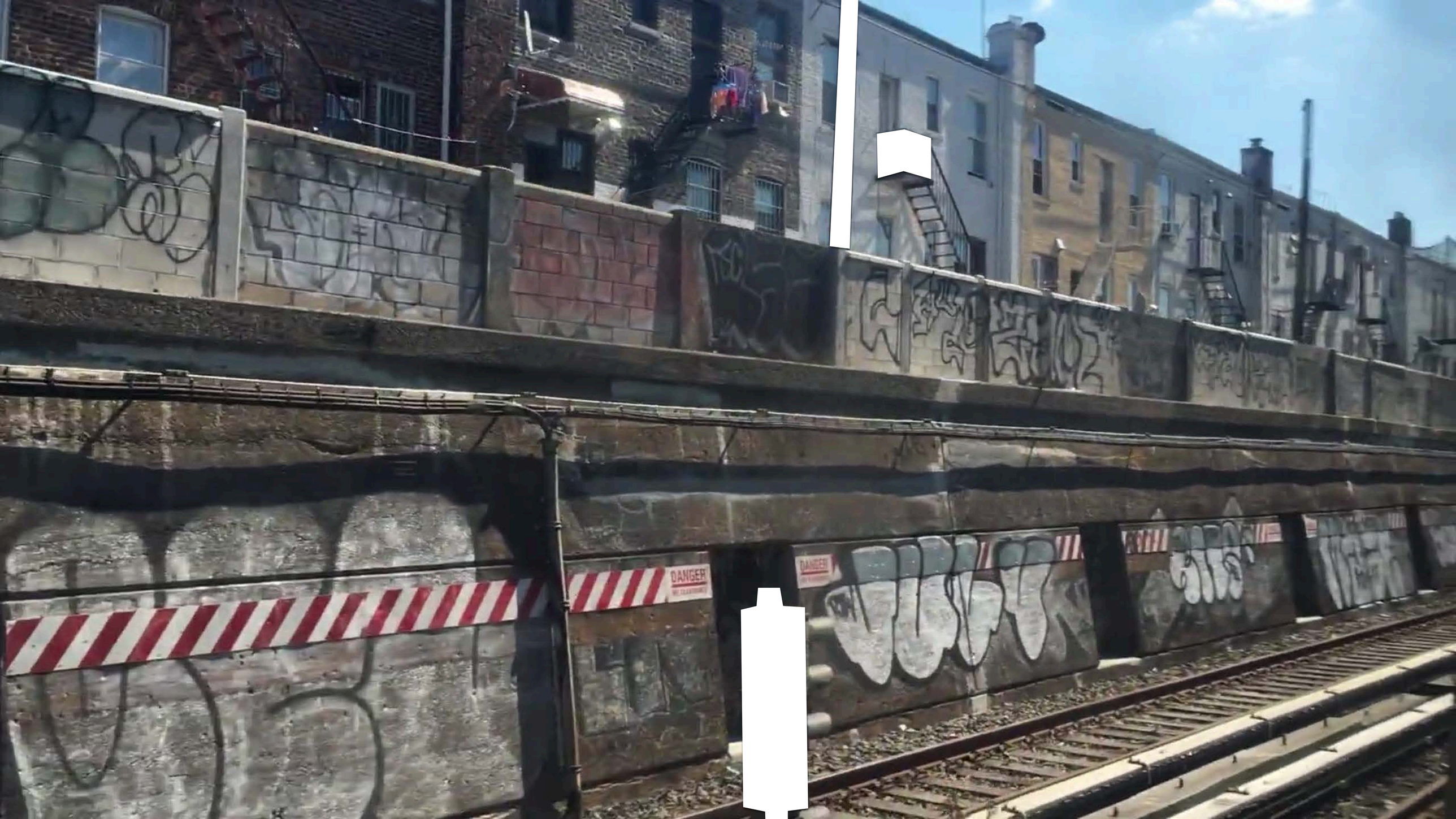
DANGER
DANGER





DANGER

DANGER


DANGER
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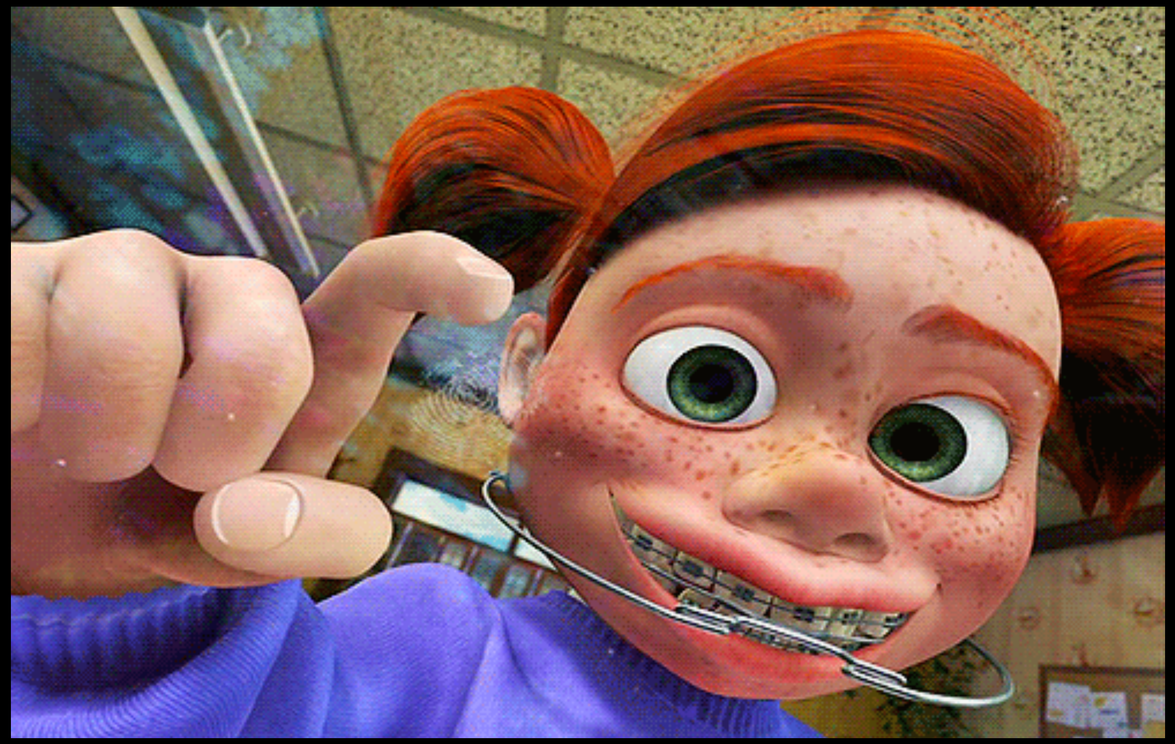

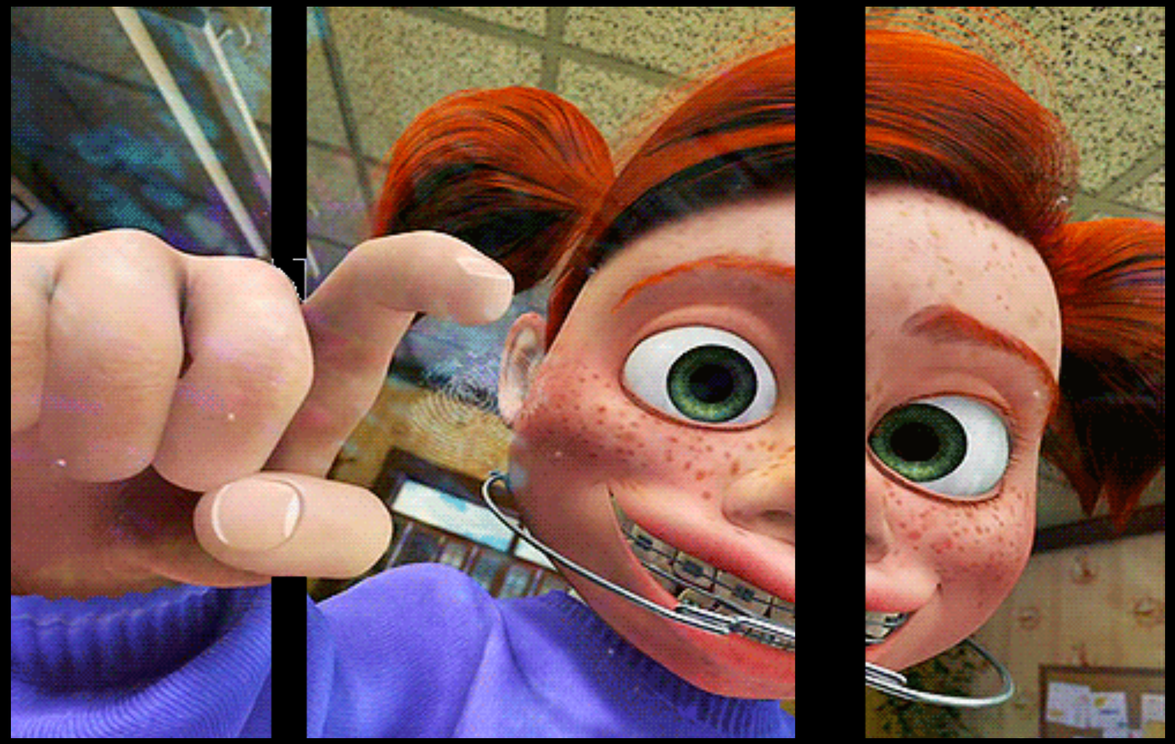

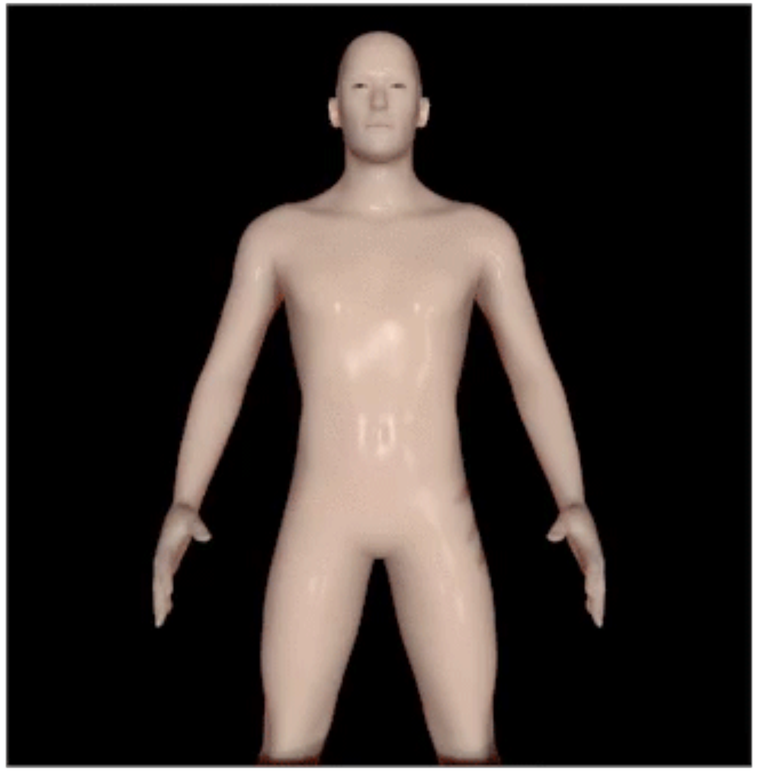

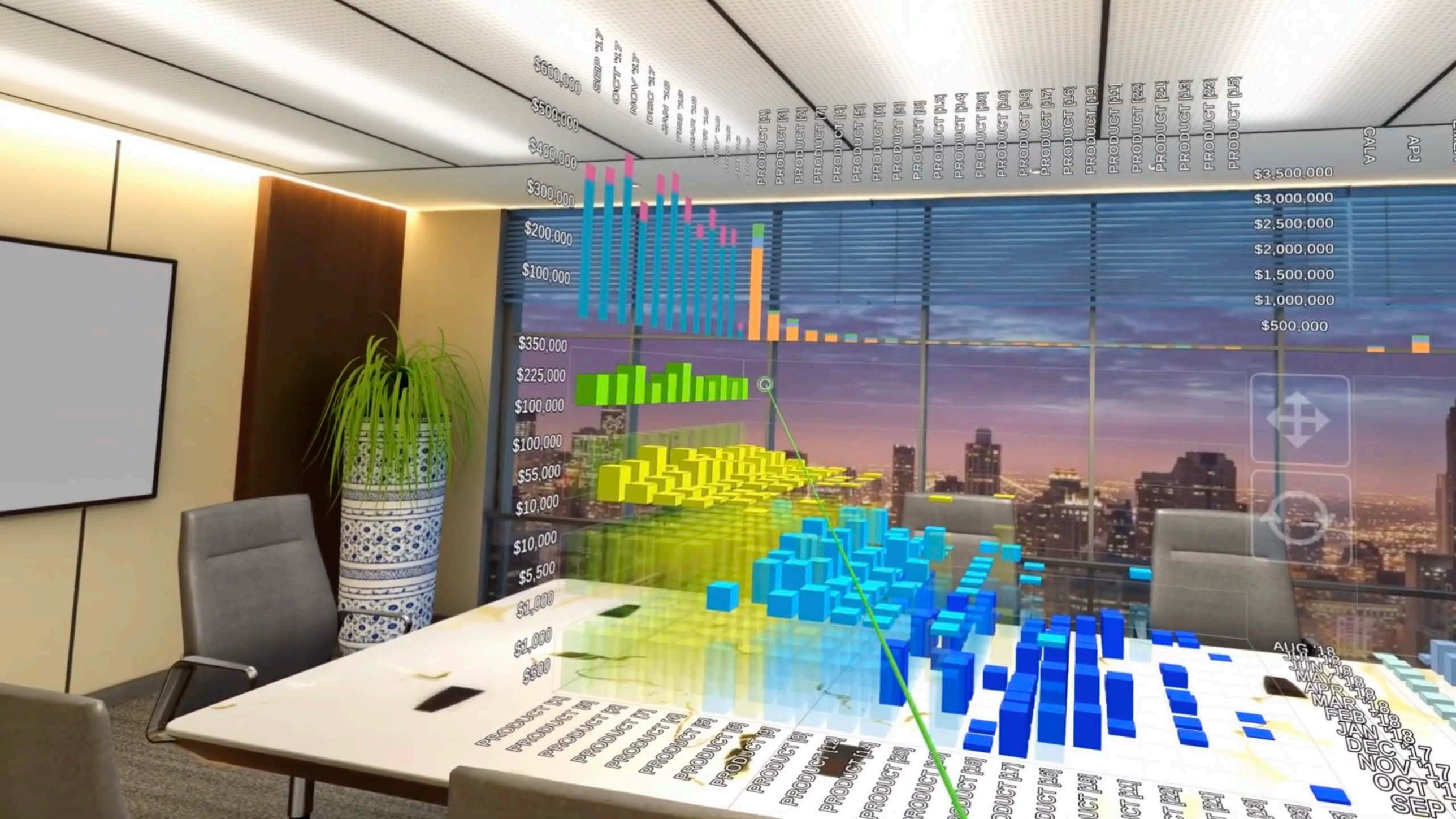
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
SEP '17
OCT '17
NOV '17
DEC '17
JAN '18
FEB '18
MAR '18
PRODUCT [1]
PRODUCT [3]
PRODUCT [2]
PRODUCT [7]
PRODUCT [4]
PRODUCT [5]
PRODUCT [9]
PRODUCT [8]
PRODUCT [12]
PRODUCT [14]
PRODUCT [20]
PRODUCT [10]
PRODUCT [18]
PRODUCT [17]
PRODUCT [16]
PRODUCT [19]
PRODUCT [11]
PRODUCT [22]
PRODUCT [21]
PRODUCT [13]
PRODUCT [23]
PRODUCT [15]
CALA
API
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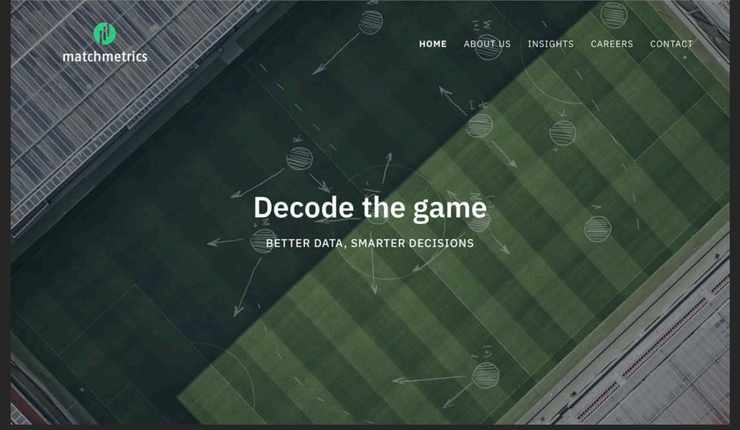
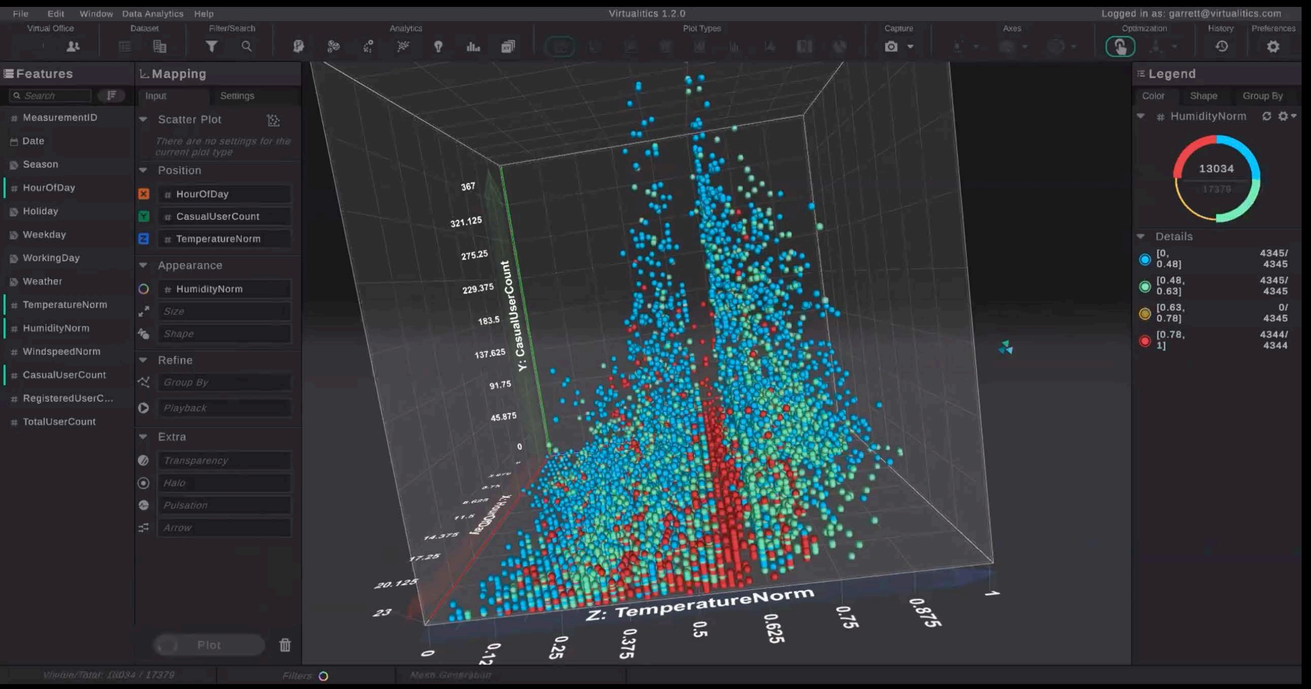
$500
AUG '18
JUL '18
JUN '18
MAY '18
APR '18
MAR '18
FEB '18
JAN '18
DEC '17
NOV '17
OCT '17
SEP '17

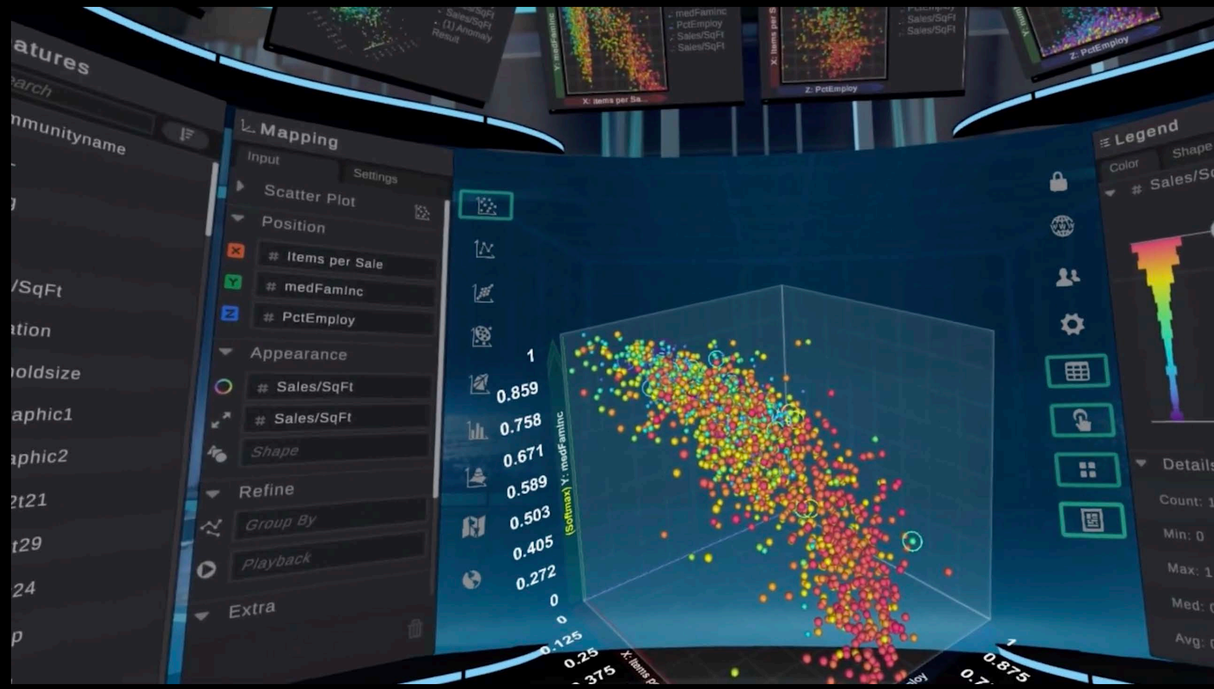

matchmetrics
HOME
ABOUT US
INSIGHTS
CAREERS
CONTACT
Decode the game
BETTER DATA, SMARTER DECISIONS

http://lab.datadesign.studio/scatterplottAR/

http://lab.datadesign.studio/scatterplottAR/

Our results also suggest that users feel more satisfied and successful when using VR data exploration tools


File Edit Window Data Analytics Help
Virtualitics 1.2.0
Logged in as: garrett@virtualitics.com
Features
MeasurementID
Date
Season
HourOfDay
Holiday
Weekday
WorkingDay
Weather
TemperatureNorm
HumidityNorm
WindspeedNorm
CasualUserCount
RegisteredUserC...
TotalUserCount
Mapping
Input
Settings
Scatter Plot
Position
HourOfDay
CasualUserCount
TemperatureNorm
Appearance
HumidityNorm
Refine
Extra
Plot
Y: CasualUserCount
X: HumidityNorm
Z: TemperatureNorm
Legend
Color
Shape
Group By
HumidityNorm
13034
17379
Details


Mapping
Input
Settings
Scatter Plot
Position
Items per Sale
medFamInc
PctEmploy
Appearance
Sales/SqFt
Sales/SqFt
Refine
Group By
Playback
Extra
Legend
Color
Shape
Details

WHY/WHY NOT VR FOR DATA VISUALIZATION?

_ POSITIONAL ACCURACY:

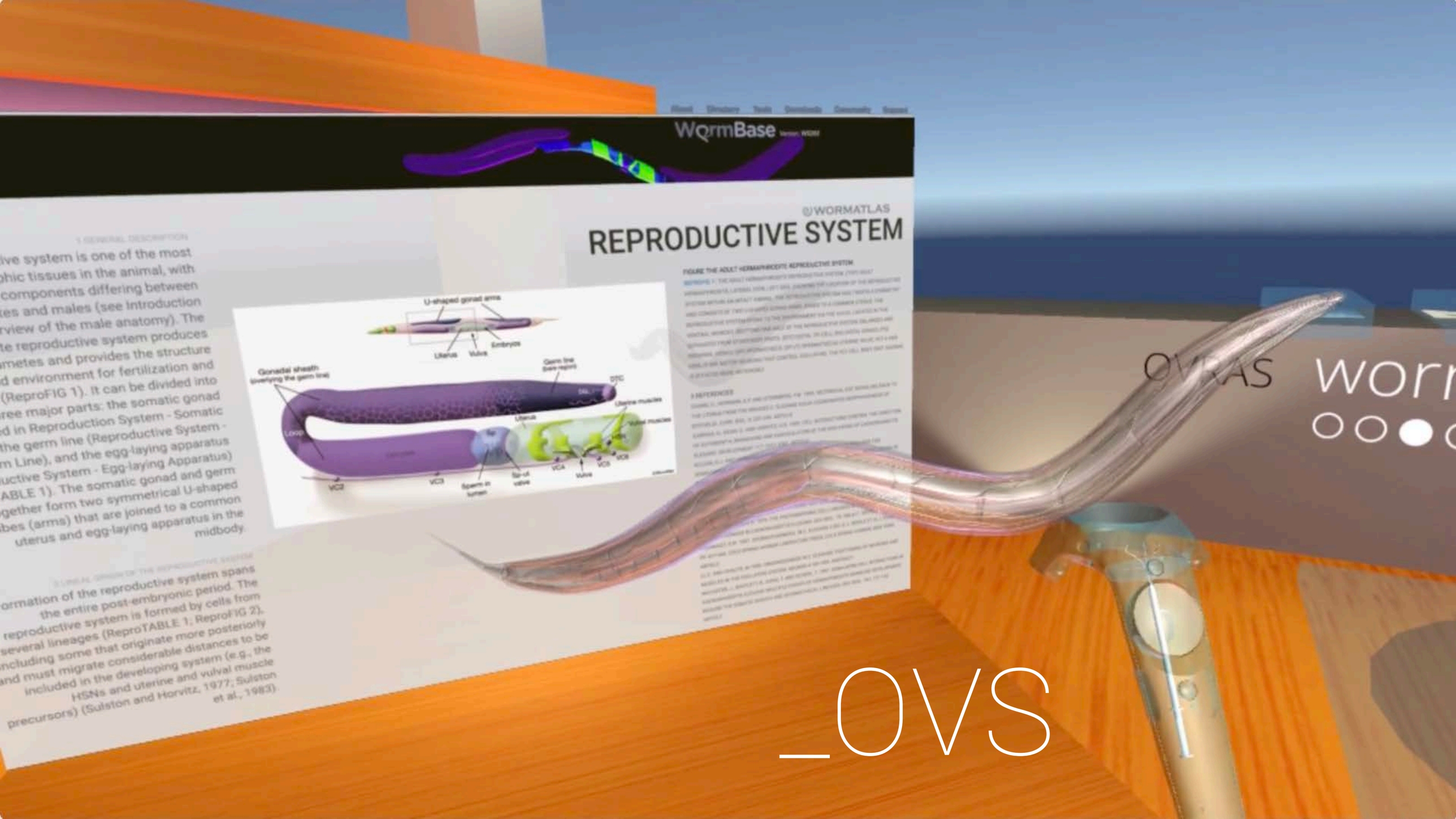
absolute?	no
relative size?	yes

_ DATA RETENTION:

physical models?	no
engagement of senses?	yes

_ ERGONOMICS:

space gesturing?	no
direct manipulation?	yes


WormBase
@WORMATLAS
REPRODUCTIVE SYSTEM
U-shaped gonad arms
Uterus
Vulva
Embryos
Gonadal sheath
Germ line
DTC
Uterine muscles
Vulval muscles
Uterus
Vulva
VC2
VC3
VC4
VC5
VC6
Sp-ut valve
Sperm in lumen
_OVS

GOAL

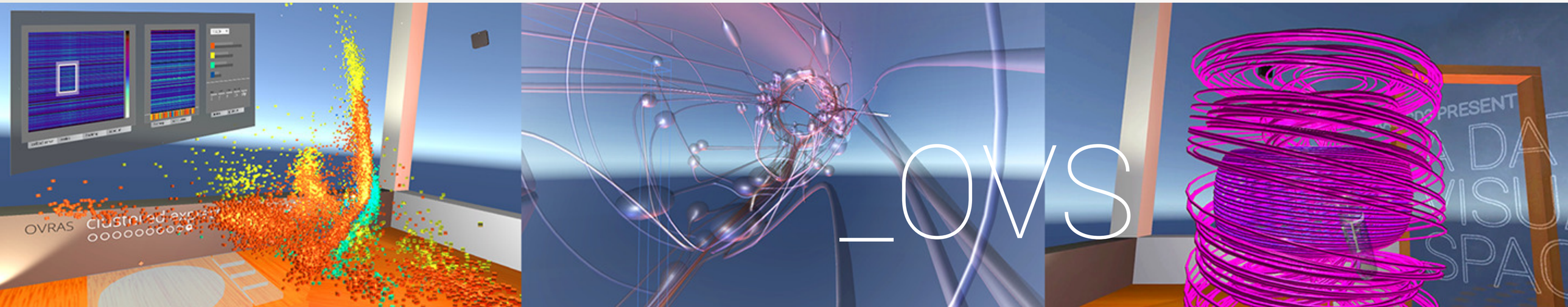
_ experience 3d information
_ Intuitive
_ least intrusive manner

☞ INMMERSIVE 3D

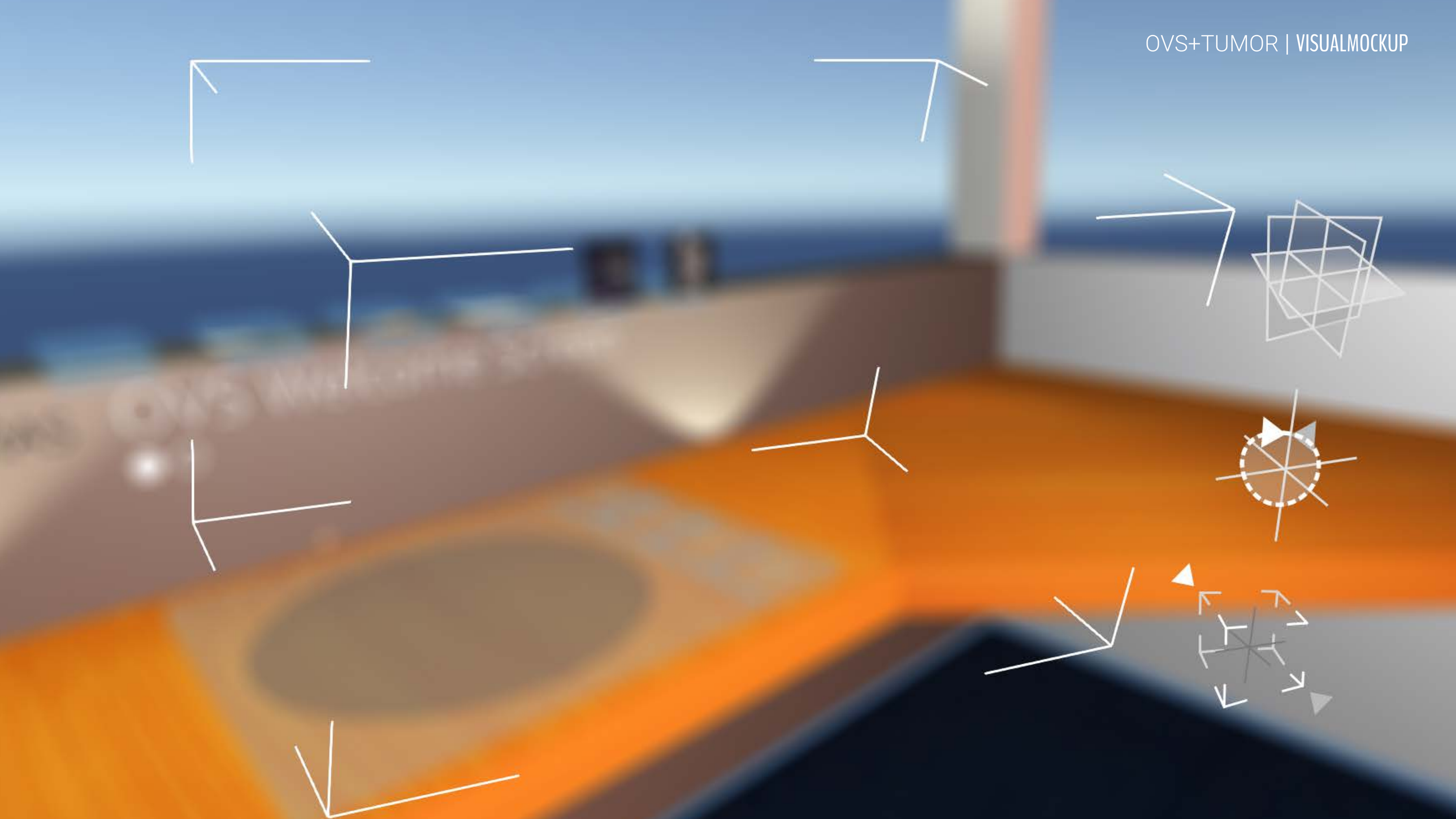
_ better tracking of complex 3d structures
_ better tracking of small 3d structures

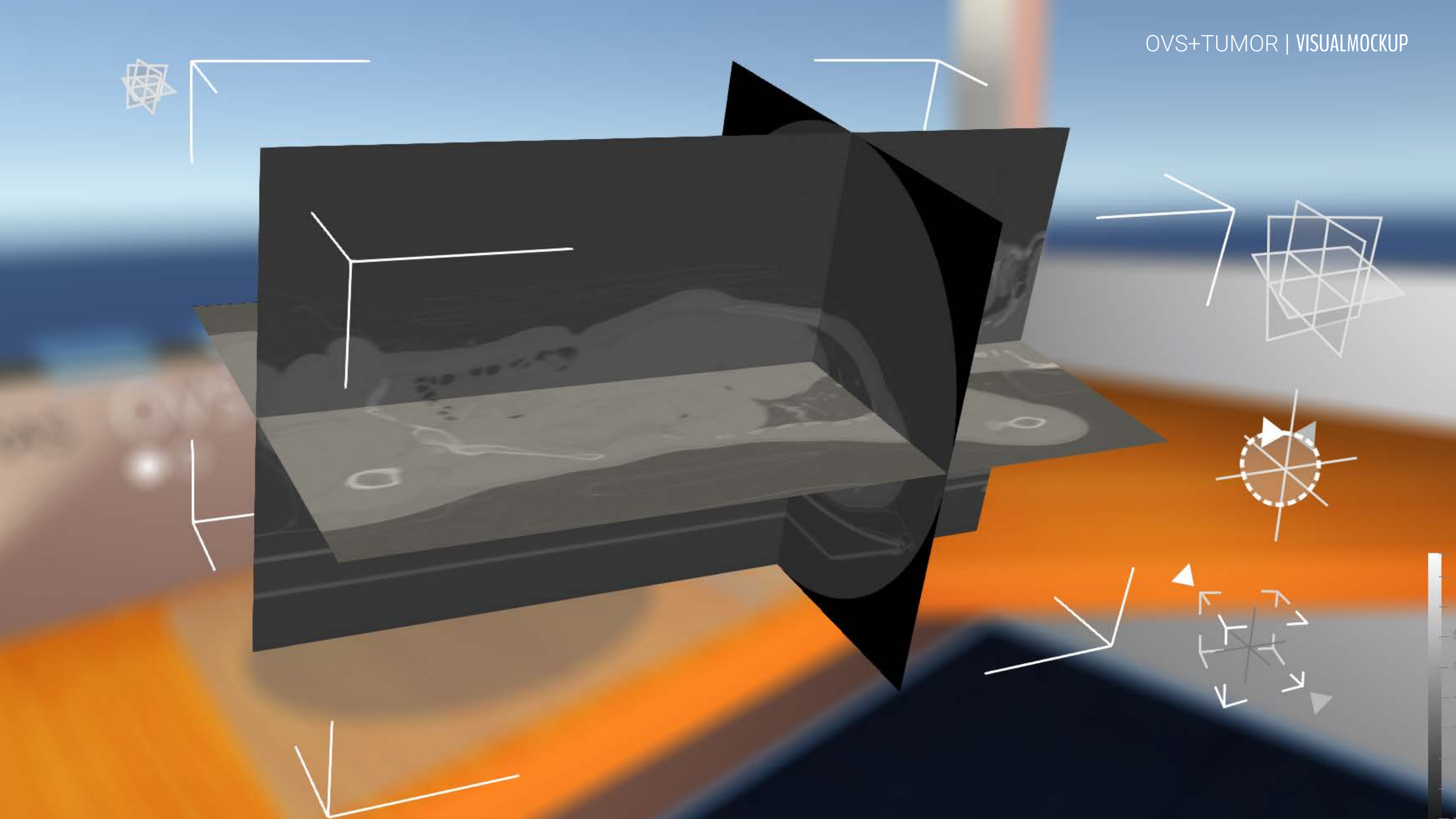
☞ VIRTUAL REALITY

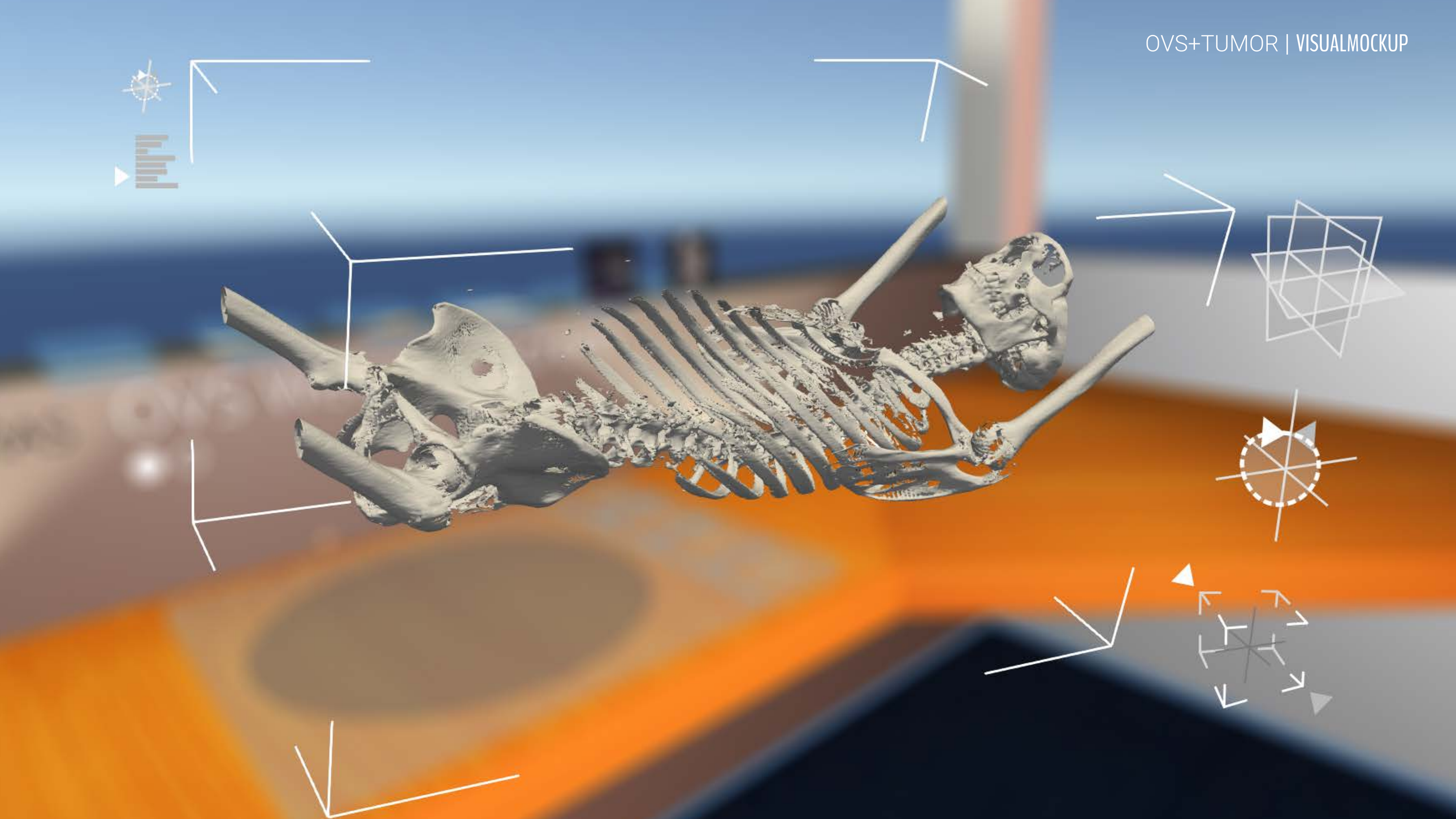
_ direct interaction
_ intuitive manipulation
_ easy selection/annotation

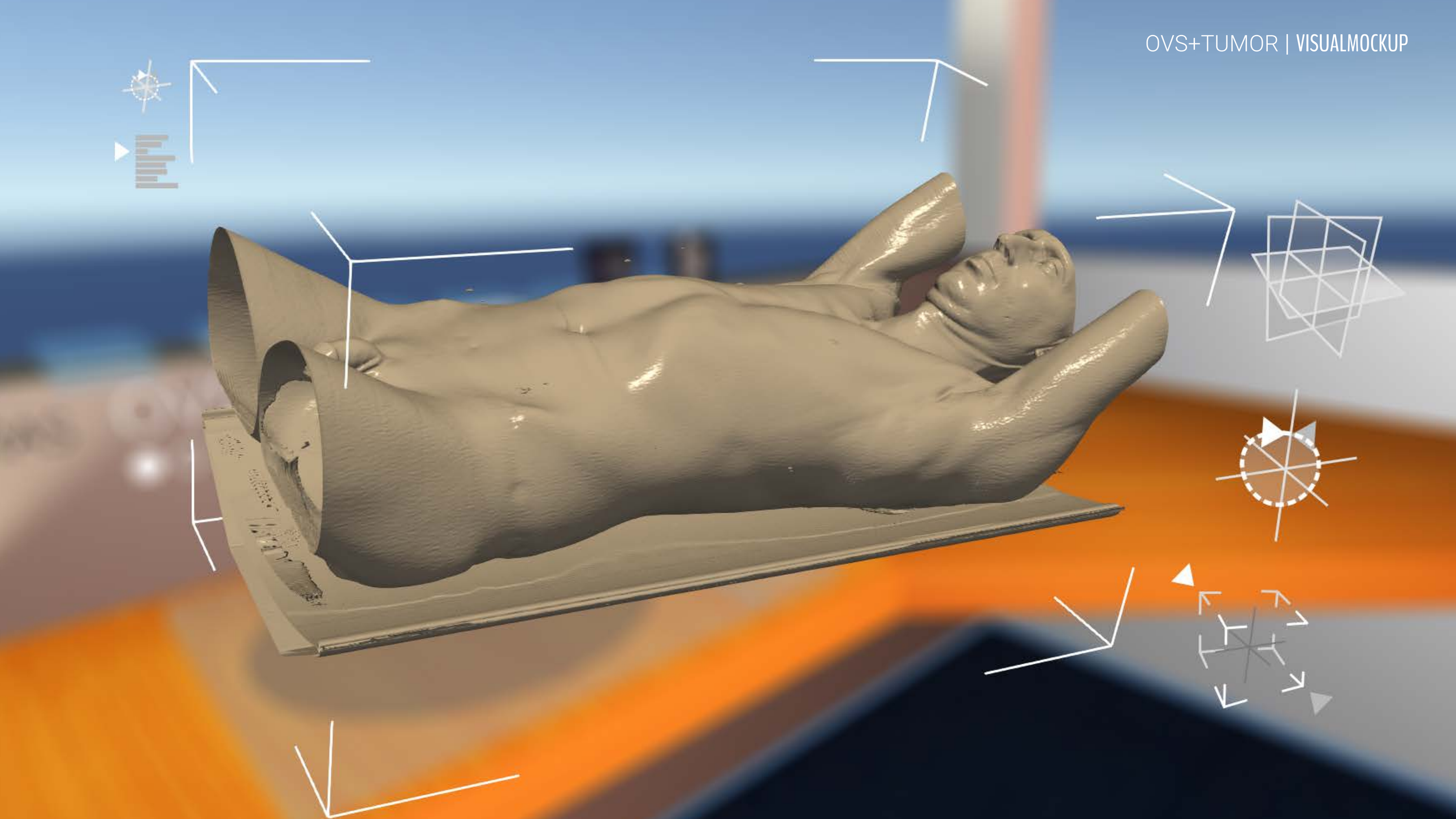


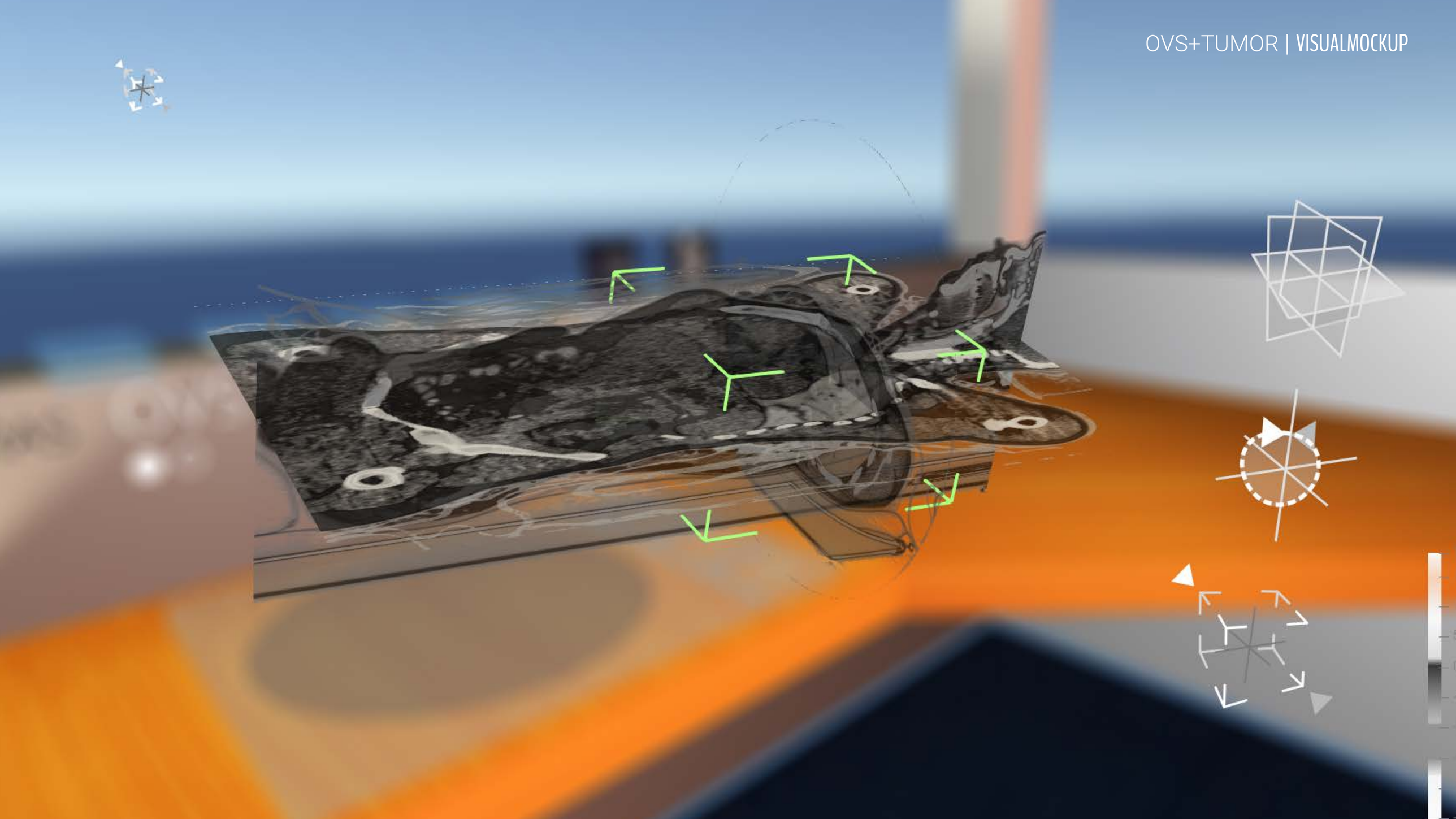
_walkthrough

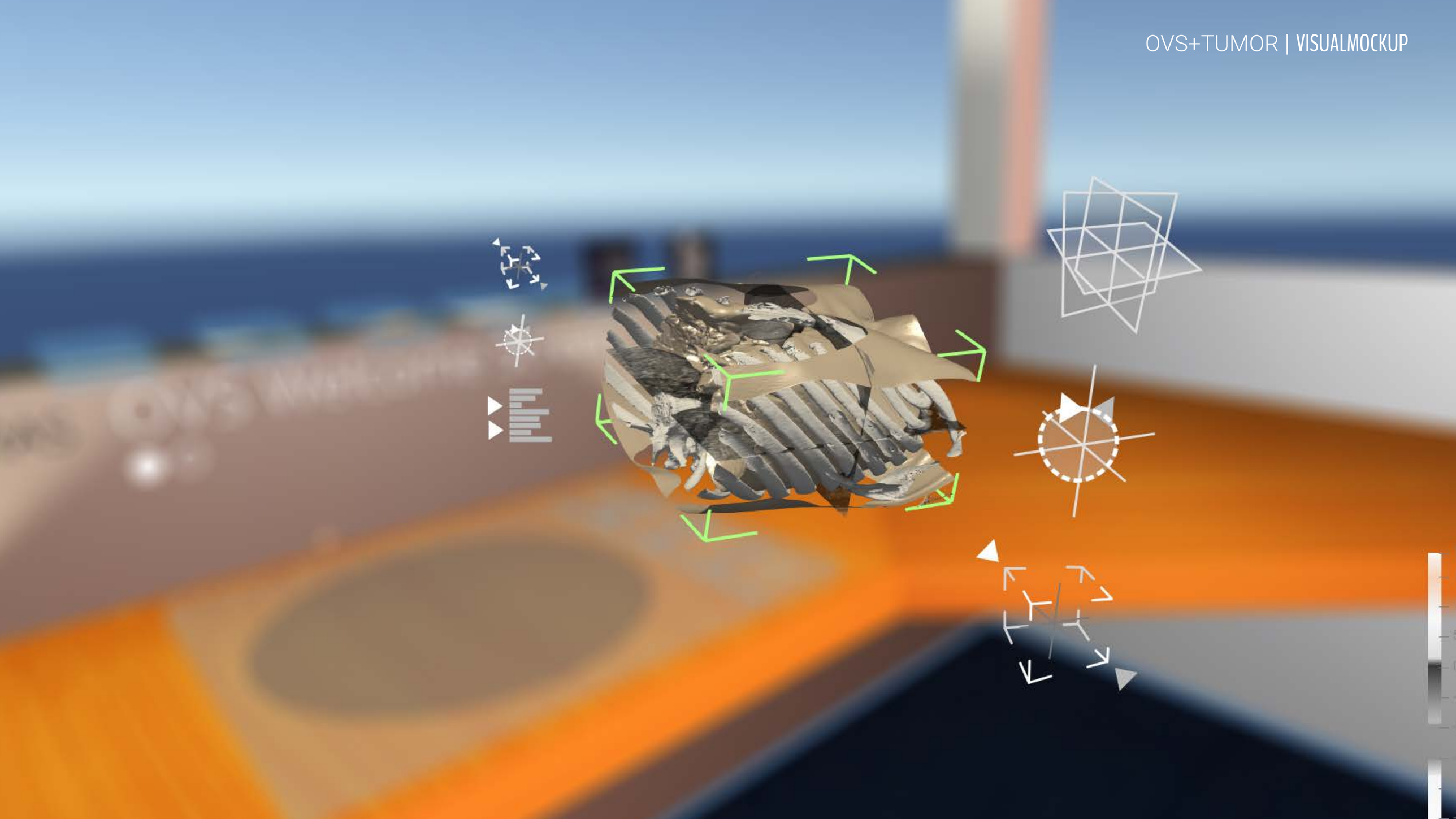


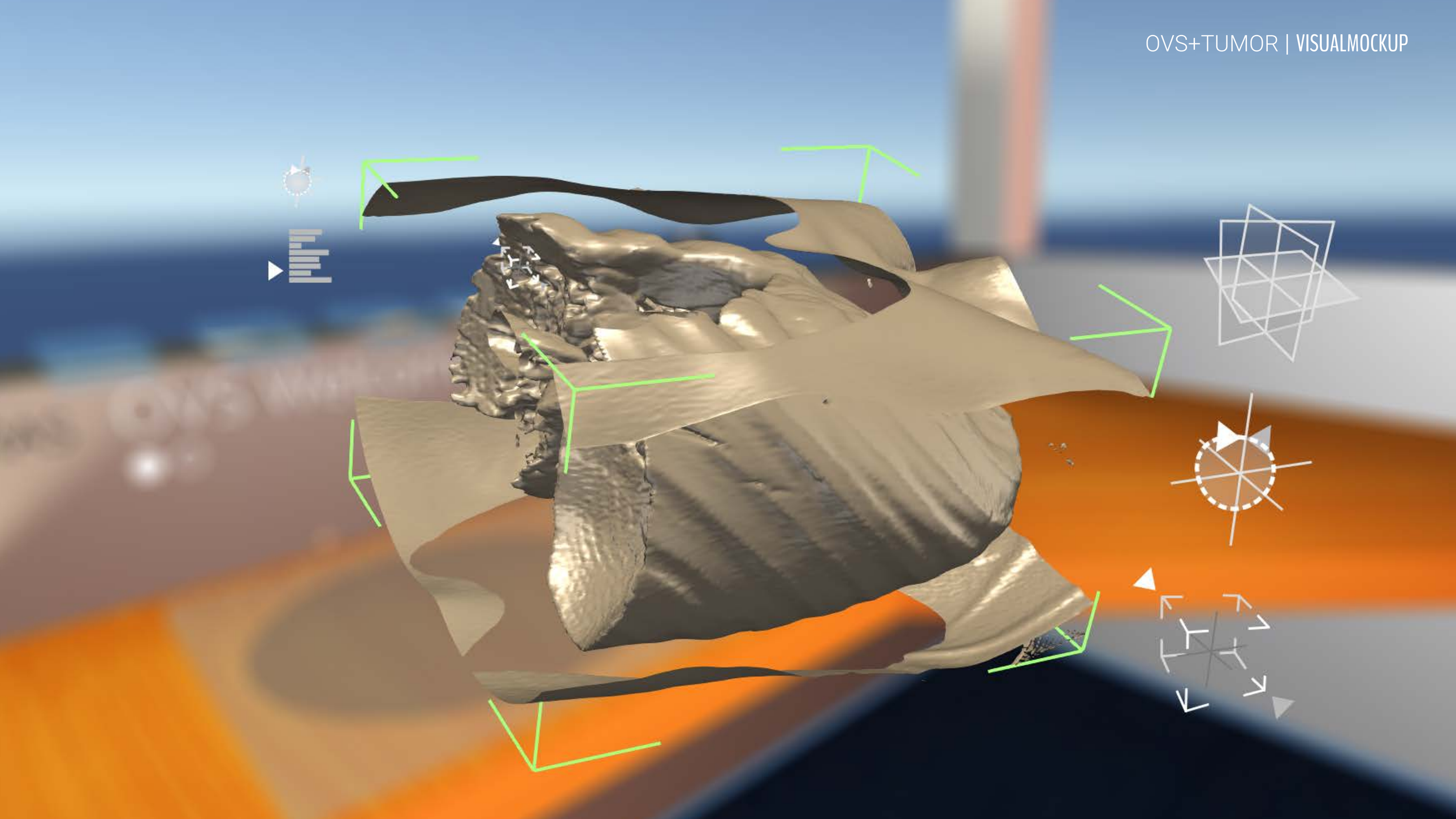


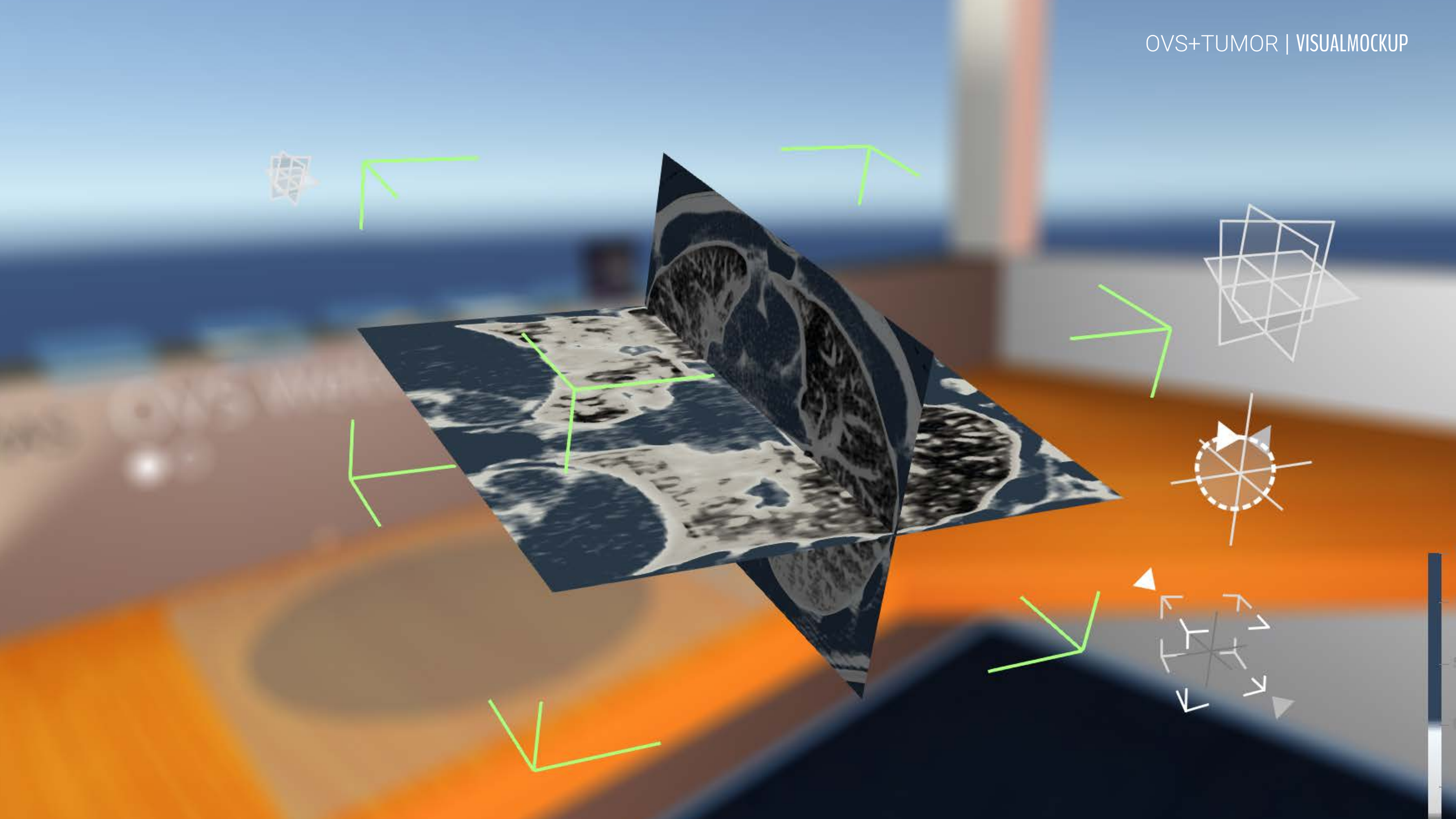


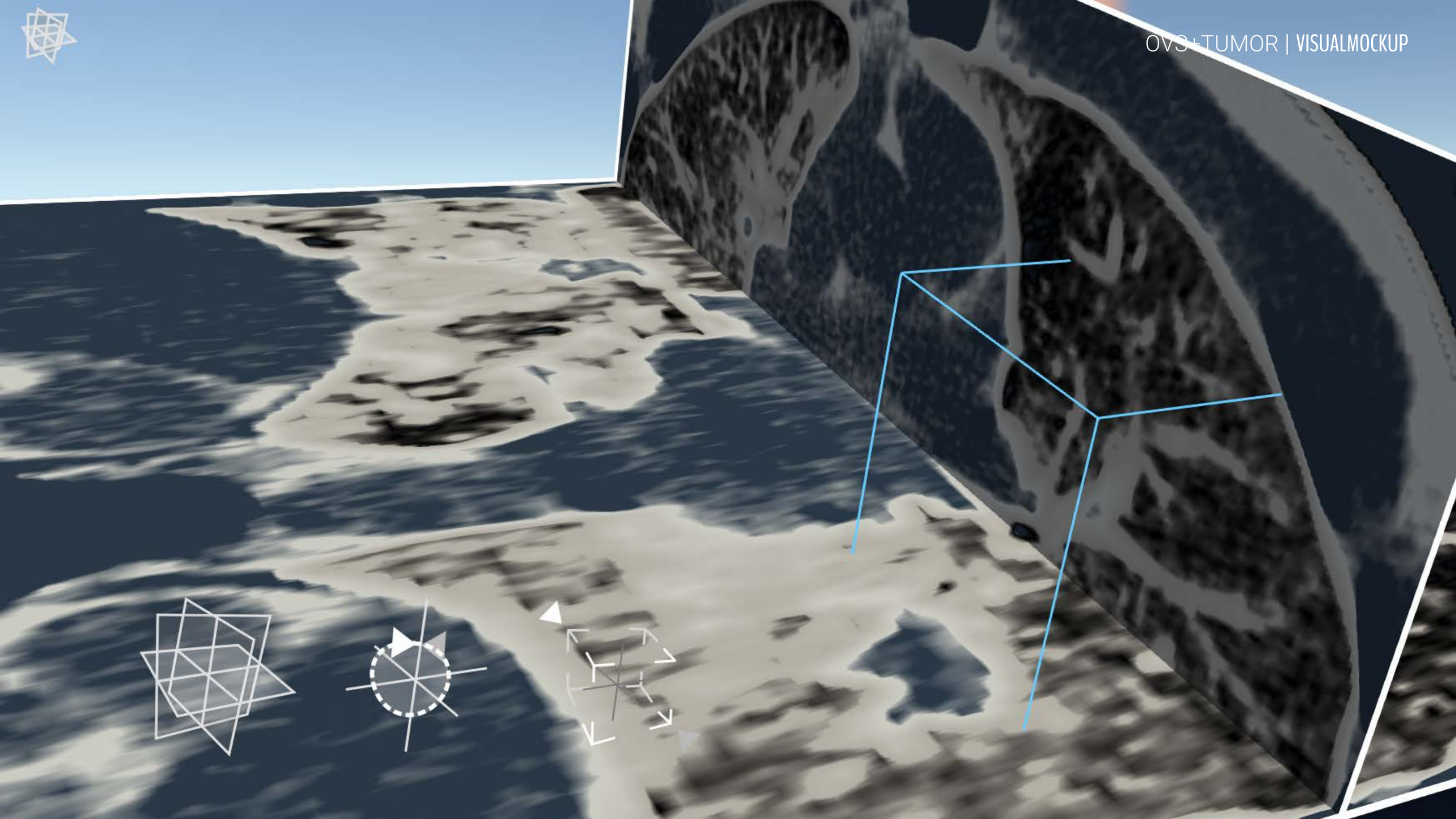


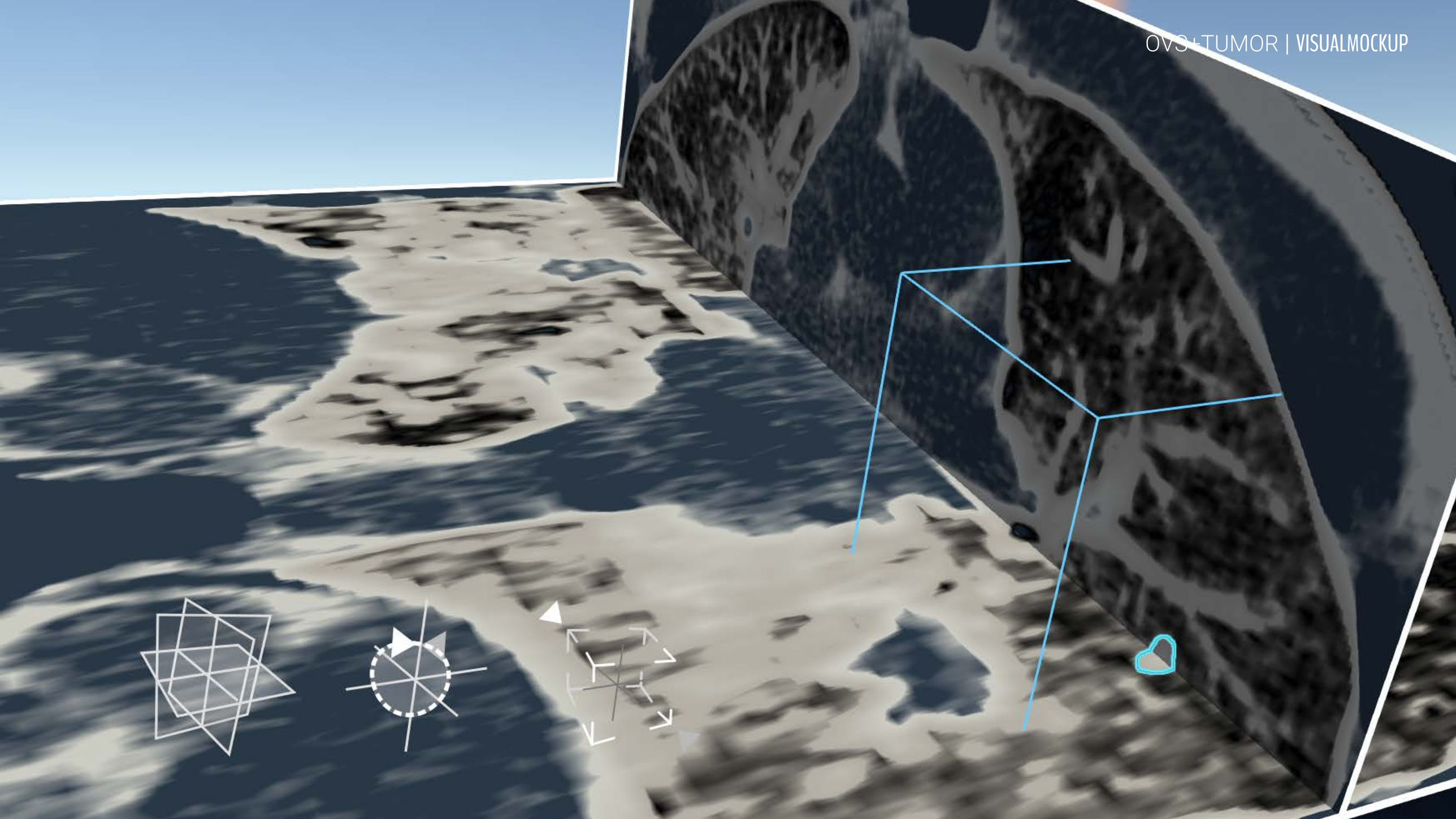


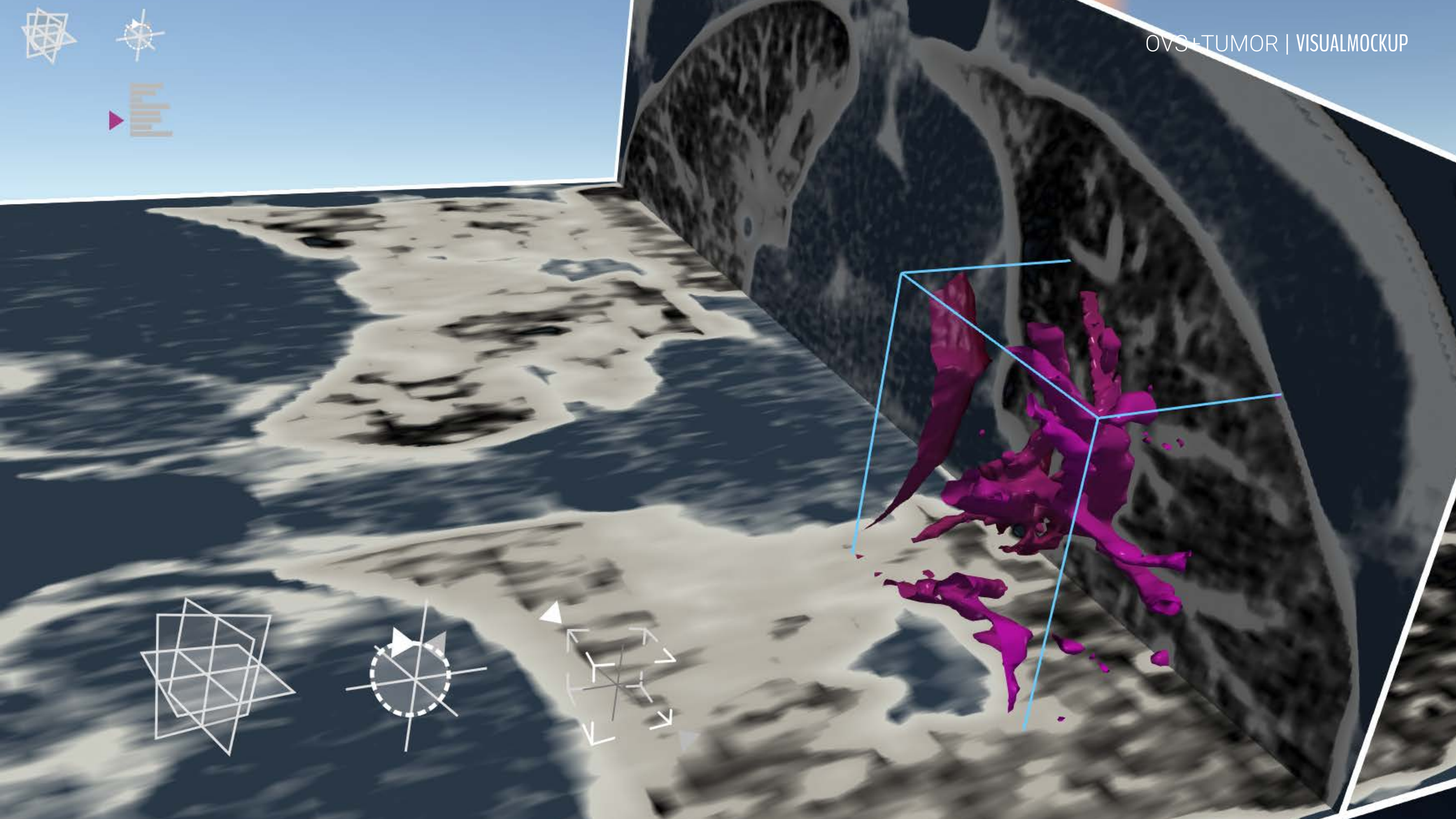


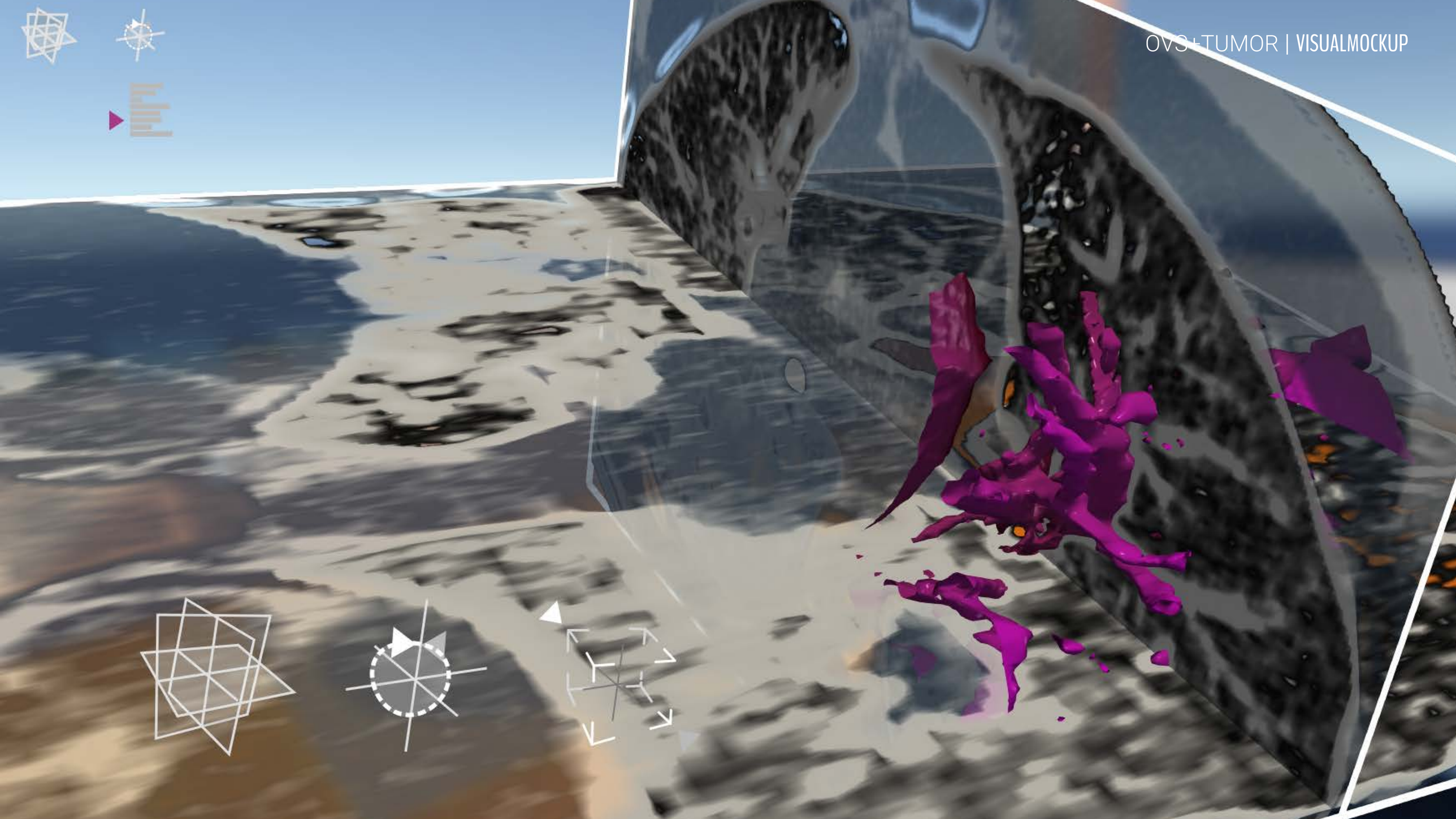









OVS+TUMOR | VISUALMOCKUP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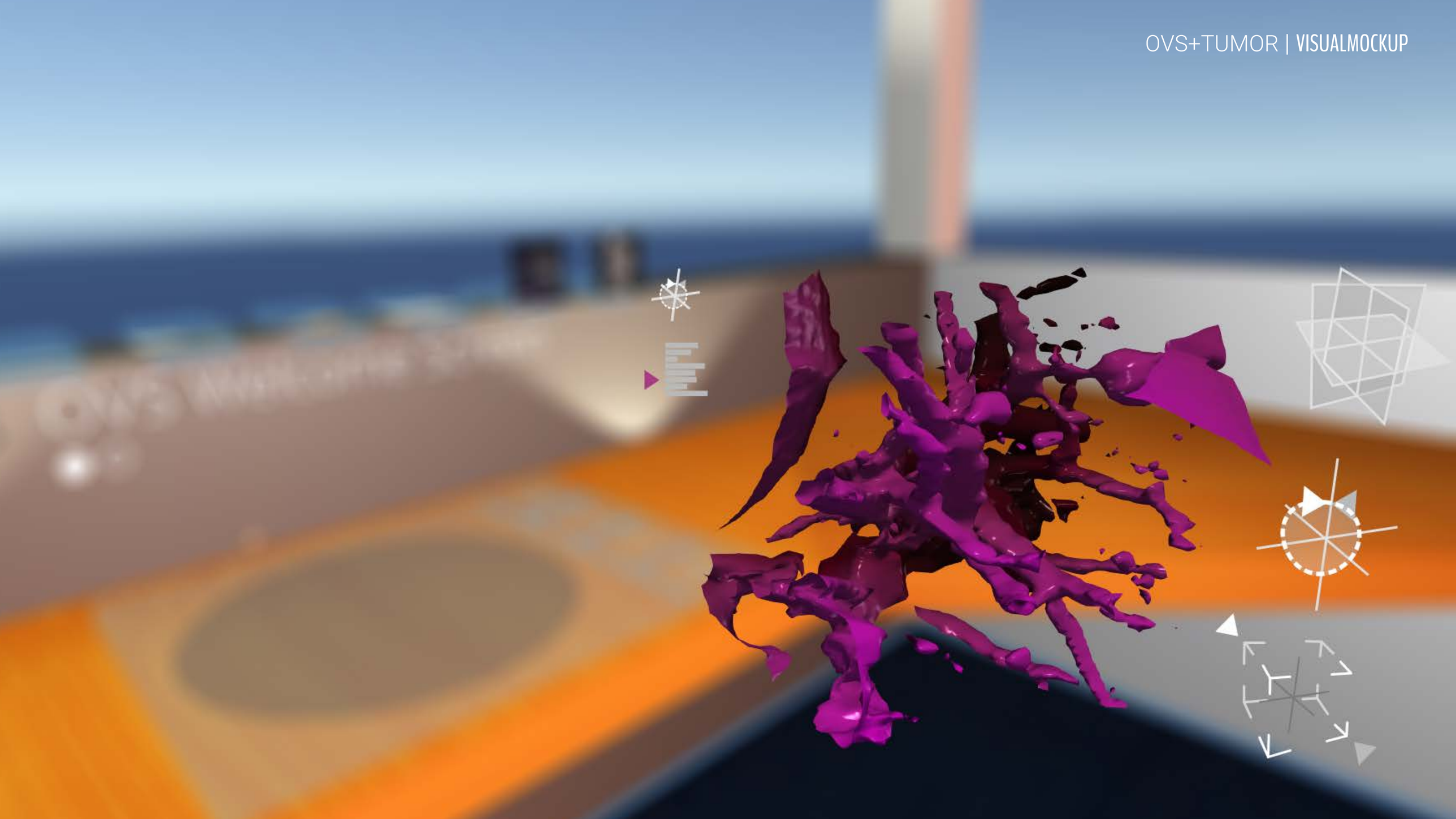

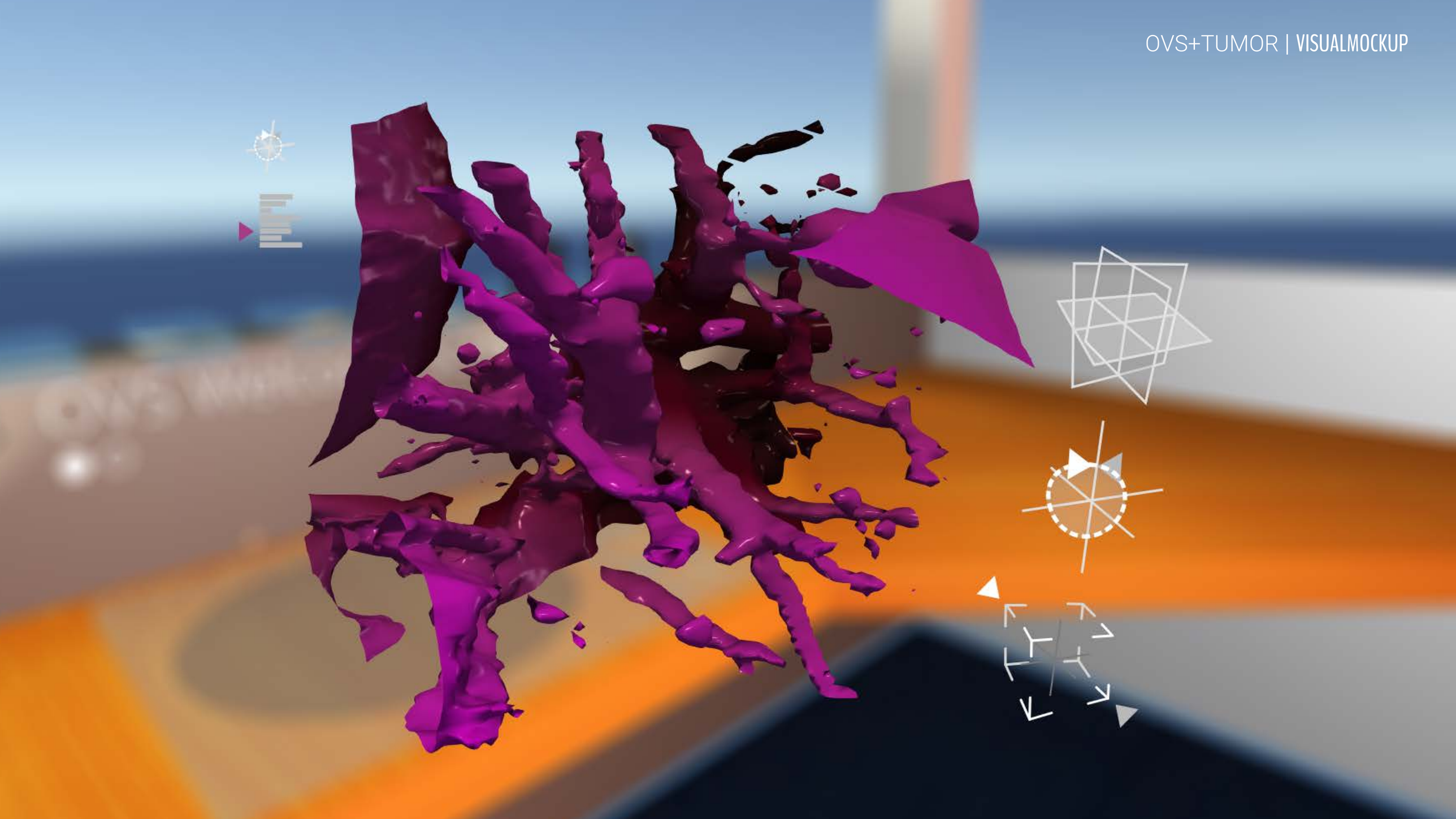

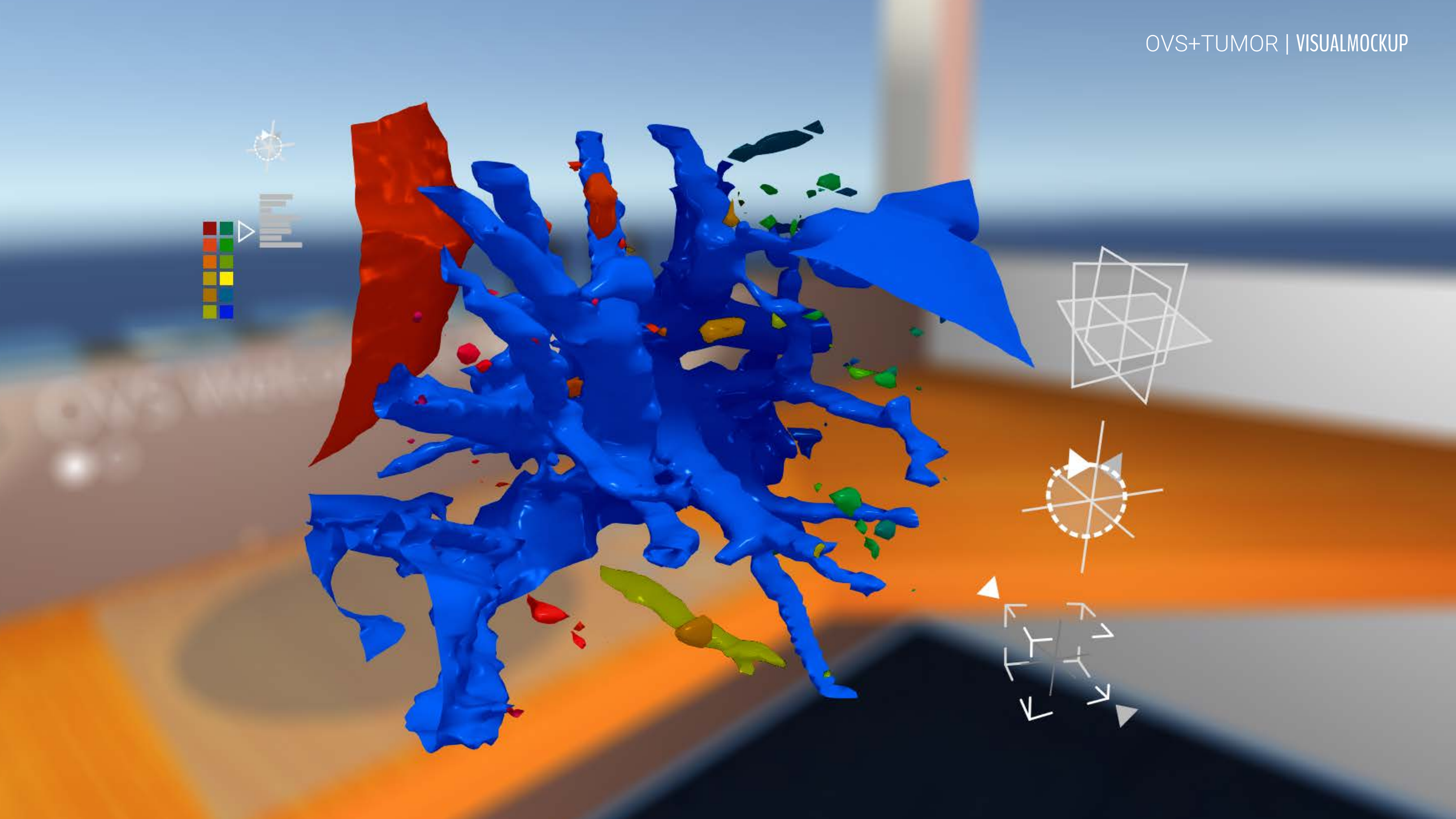

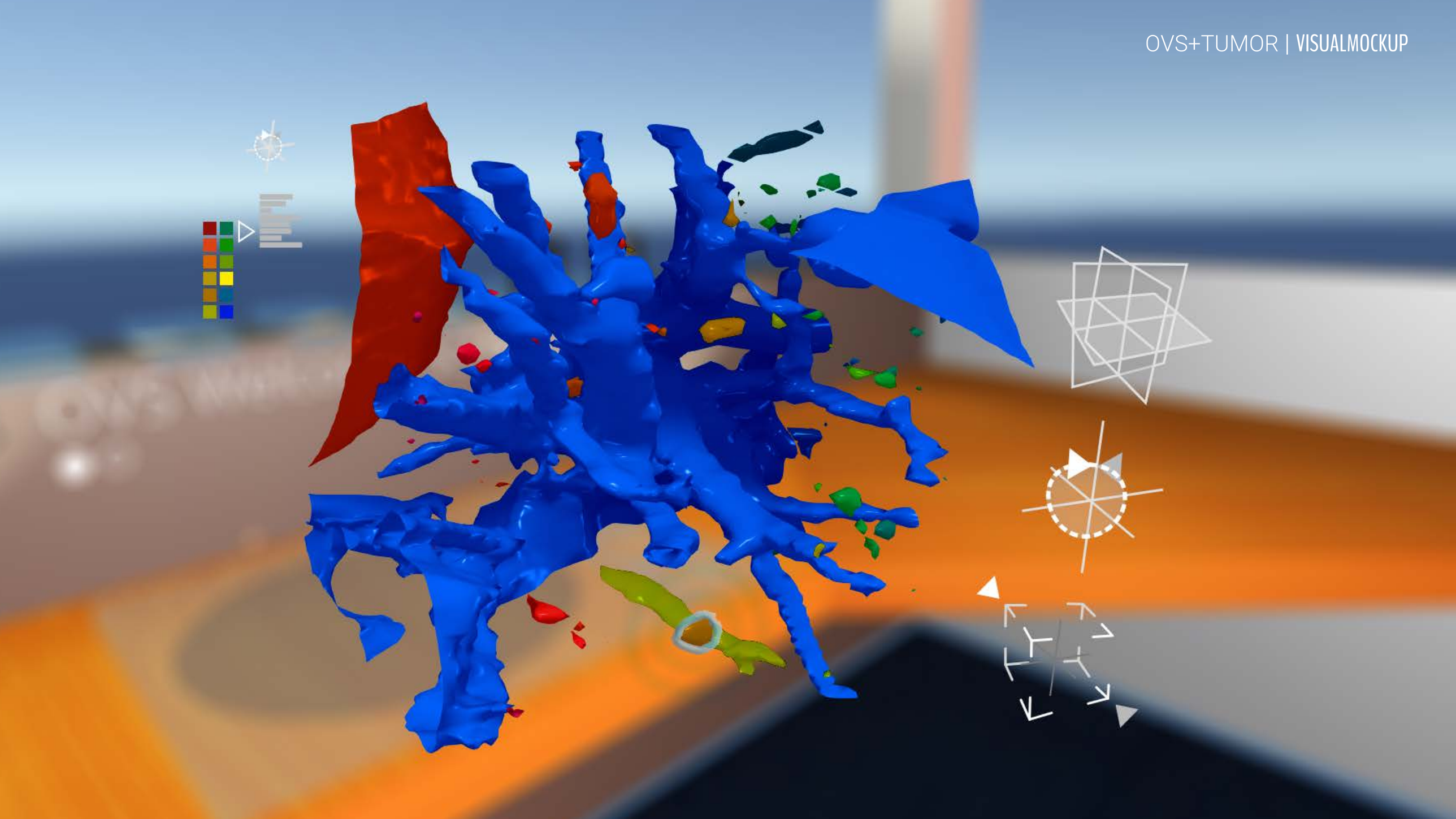

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