Matrices & Quaternions

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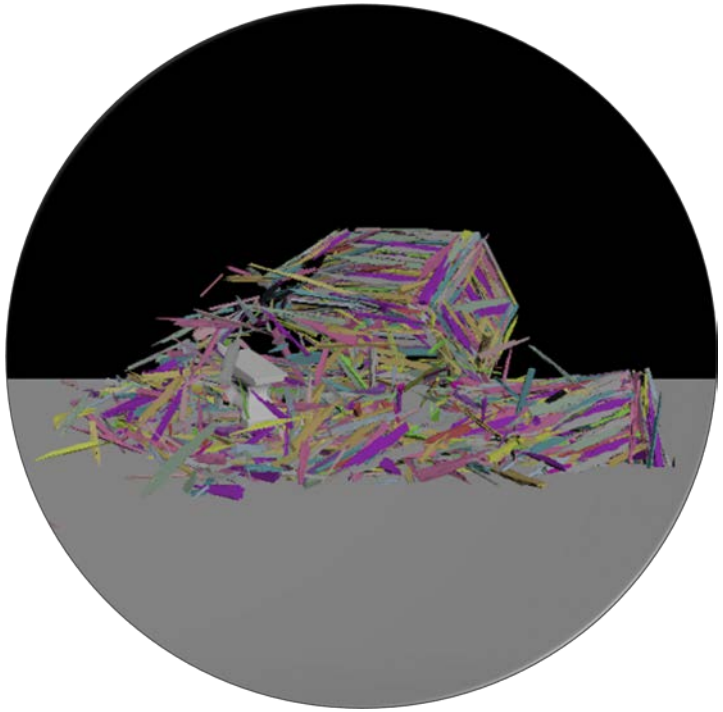
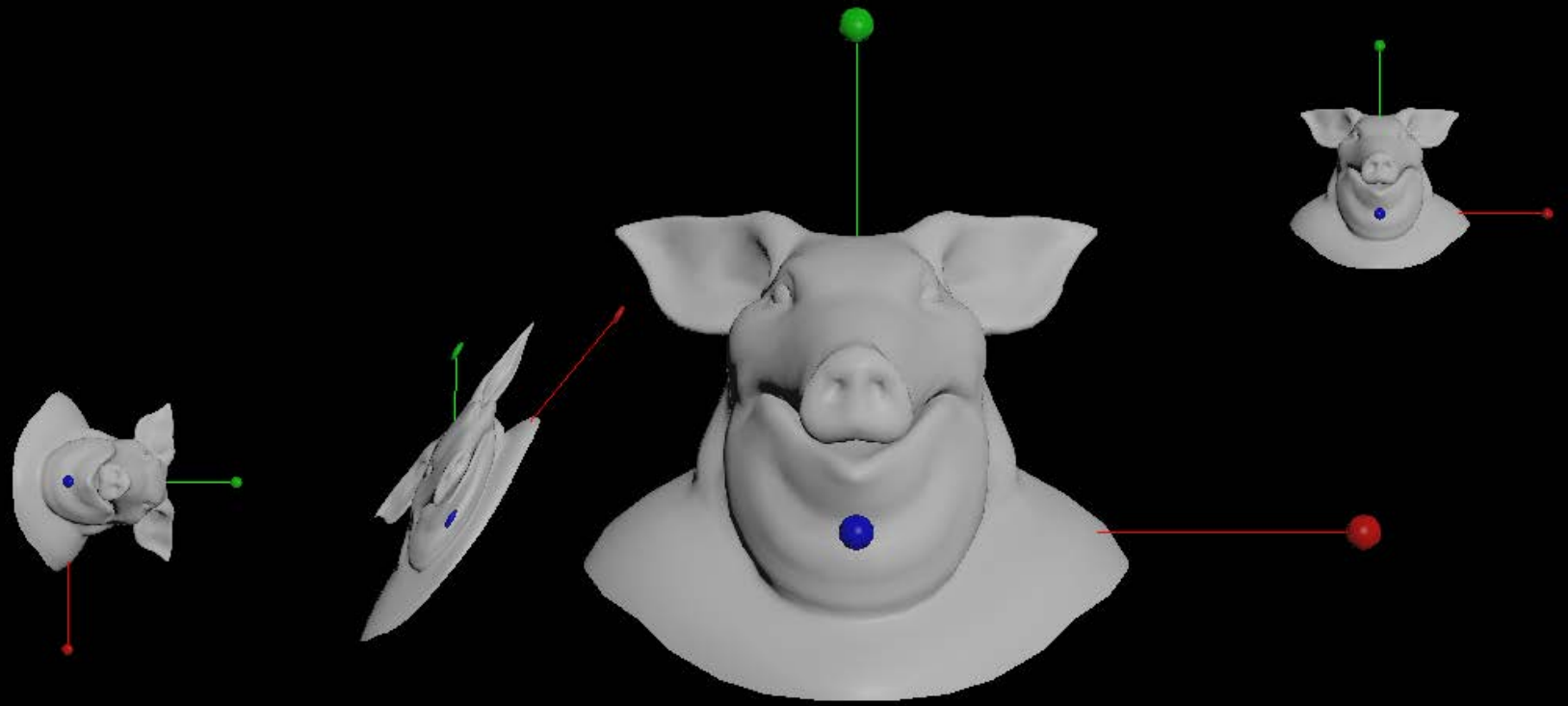


Matrices

- Matrix Data Type
- Transformation Matrices
- Rotation Matrices
- Coordinate spaces

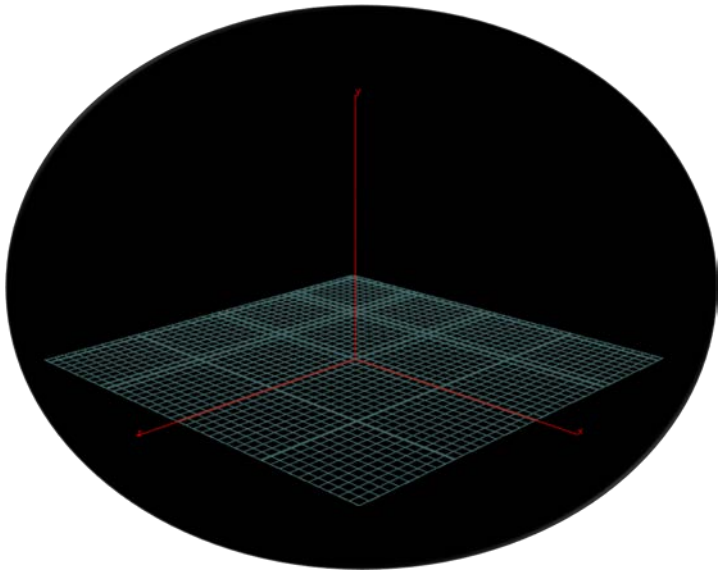
- Matrix Data Type
- 3x3 (Matrix3)
- Rows & Columns



ROT SKEW SCALE TRANSLATE

Matrix3 (3 x 3)

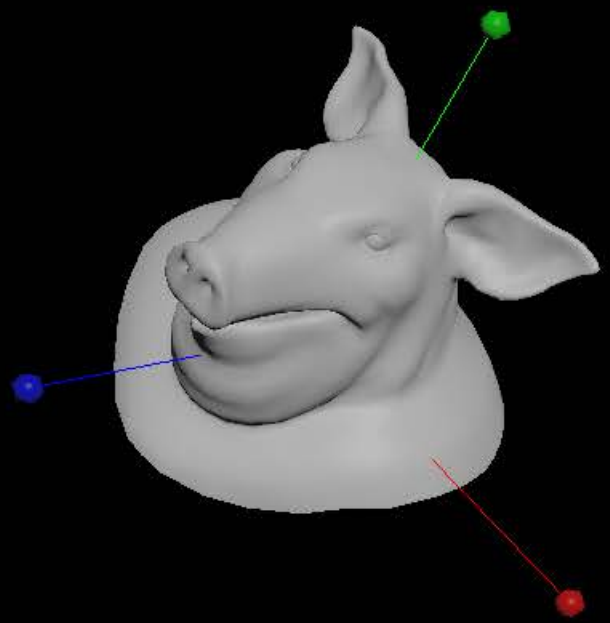
Matrix4 (4 x 4)

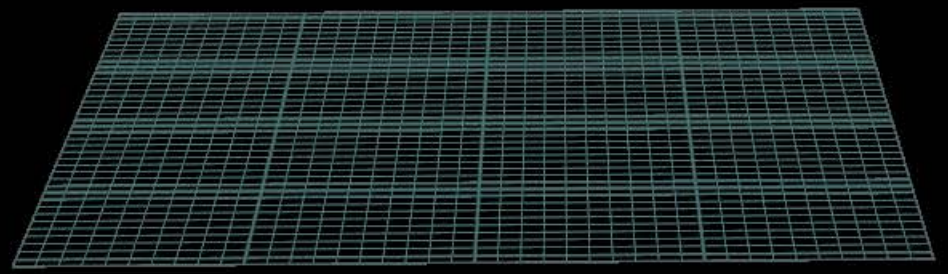


Coordinate spaces

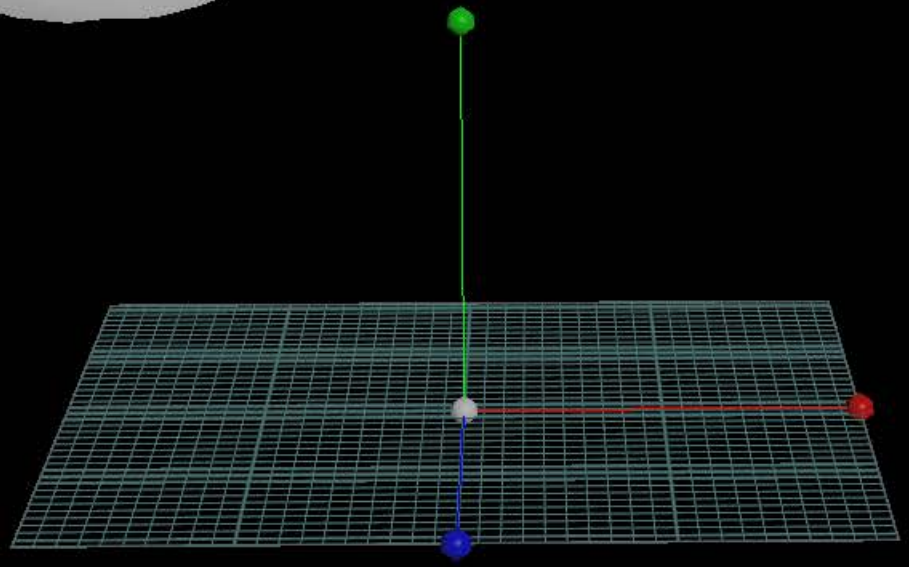
- World Space
- Object Space
-

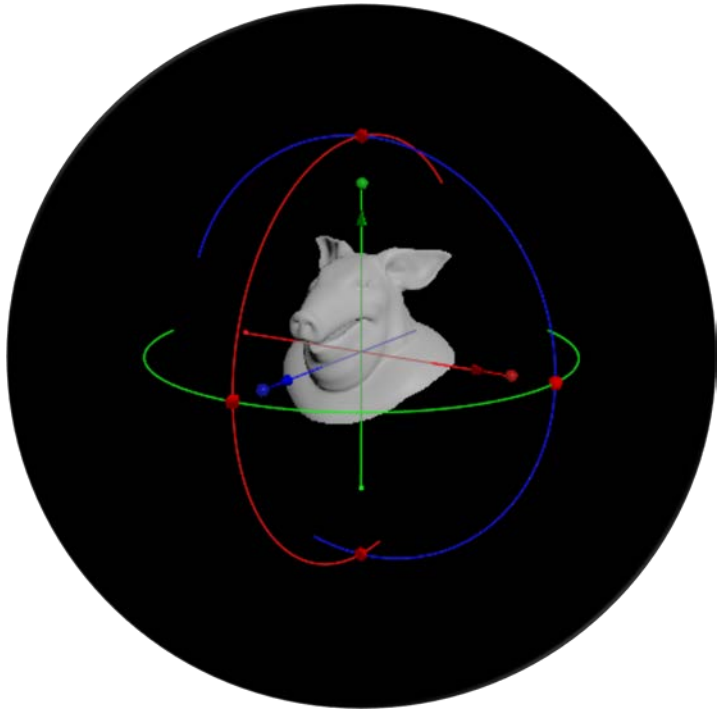
OBJECT SPACE





WORLD SPACE



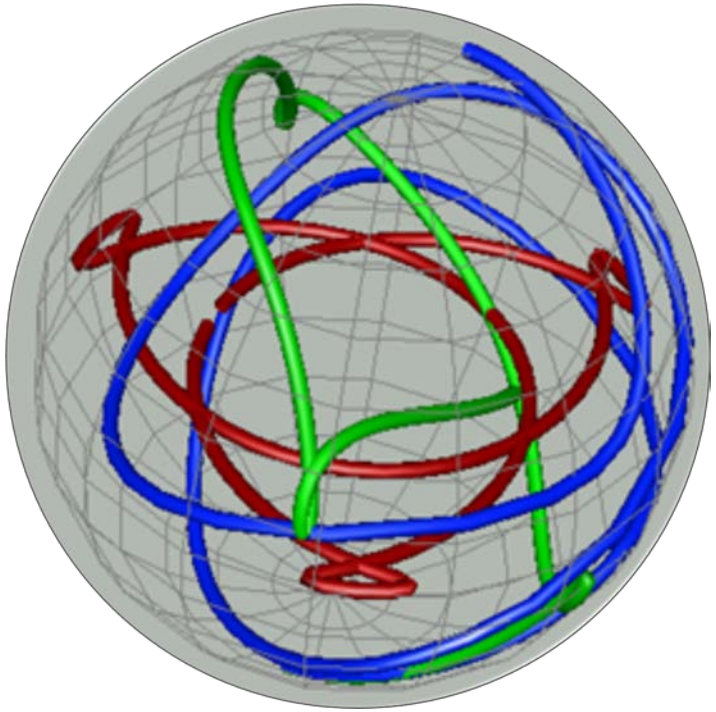


Rotation Matrix

- Orthogonal (No Skew)
- Unit Vectors (No scale)
- Determinant of 1

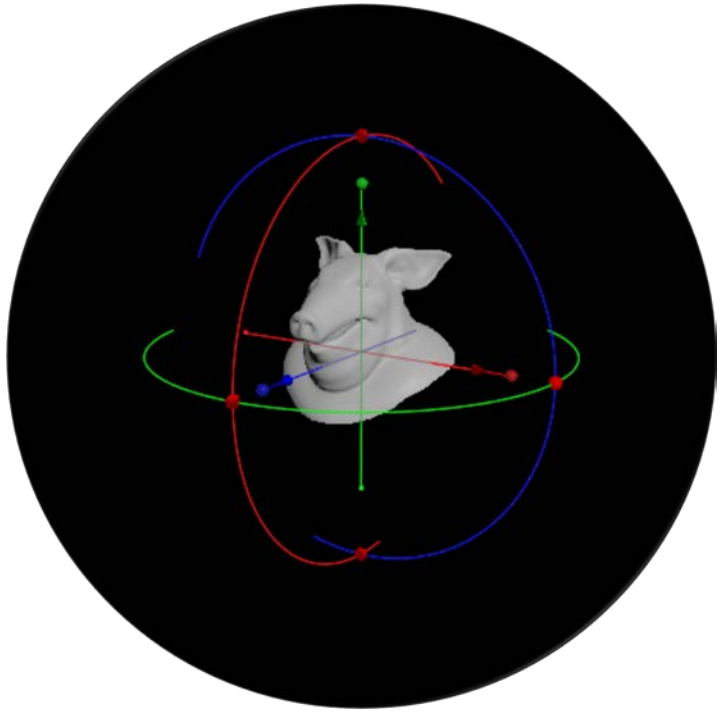
“Rotation matrices are square matrices, with real entries. More specifically, they can be characterized as orthogonal matrices with determinant 1;”

Wikipedia: Rotation Matrix



Quaternions

- Rotations / Orientations
- Vector4 (x , y , z , w)
- orient attribute
- Superior rotation method



Common Solutions

- **Euler Angles :**
  - Vector3 (3 floats)
  - Intuitive (Pitch , Roll & Yaw)
  - Gimbal lock
- **Rotation Matrices**
  - Matrix3 (9 floats)
  - Unintentional transforms
  - Convenient / Less prone to Gimbal lock
- **Quaternions**
  - Vector4 (4 floats)
  - Robust / No Gimbal lock
  - Spherical Linear Interpolation (SLERP)

Rotation Interpolation

Quaternion	Other
SLERP	Linear
Smooth / Consistent rotations	Inconsistent rotation spacing
No Gimbal Lock	Gimbal Lock
Robust	Can be more prone to error
Light on memory	Can be heavy on memory

Converting To Quaternion

Proper Rotation Matrix

Rotation data only

Compatible with quaternion

Smooth interpolation

Transformation Matrix

Scale , Translate , Rotation , Skew

Incompatible with quaternion

Pops , Jitters , Incorrect rotations

Summary

- Matrix Data Type
- Transformation Matrix
- Rotation Matrix
- Quaternion
- Coordinate Space