

OpenGL 3 & 4

CSCI 4239/5239

**Advanced Computer Graphics
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What is new in OpenGL 3&4

- Additional shaders
 - Geometry (OpenGL 3.2)
 - Tessellation (OpenGL 4.0)
 - Compute (OpenGL 4.3)
- New syntax for passing variables
 - “in” from previous stage
 - “out” to next stage
 - Deprecating most predefined variables
- Building objects from vertex arrays
- Deprecating OpenGL transformations

Deprecated Features

- glBegin() glEnd()
 - Use vertex buffer objects instead
- glTranslate() glRotate() glScale()
 - Use vmath or glm or roll your own
- Display lists
- *Deprecated features remain available through the compatibility profile, but are not available in the core profile which is common with OpenGL ES*

Vertex Arrays

- Pass all the vertex values to OpenGL as a single array of values rather than numerous calls to glVertex, glColor, etc.
- Draw objects using glDrawArrays() or glDrawElements()

Vertex Buffer Objects (VBO)

- Stored on the GPU
- Addressed analogous to textures
 - `glGenBuffers()` - generate unique names
 - `glBindBuffer()` - select buffer
 - `glBufferData()` - copy data to buffer
 - `glBufferSubData()` - copy partial data
 - `glEnableVertexAttribArray()` - enable array
 - `glVertexAttribPointer()` - map attribute

glVertexAttribPointer(index, size, type, normalized, stride, pointer)

- index: 0,1,.. must match layout
- size: dimension of variable (1,2,3,4)
- type: variable type (e.g. GL_FLOAT)
- normalize: if true map integers to 0-1
- stride: bytes between data values
- pointer: offset of data values (in bytes)
- *The data comes from the current vertex buffer selected using glBindBuffer()*
- *Activate glEnableVertexAttribArray(index)*

Qt Observations

- QMatrix4x4 is great for GL4 matrices
 - Projections using glu-alikes
 - Transformations using gl-alikes
- QOpenGLbuffer encapsulates VBO
 - Set using Qt methods
- Attach using QOpenGLShaderProgram methods instead of OpenGL calls
 - QOpenGLbuffer specific