OpenGL Picking
The Basic Concept

• OpenGL can tell you what objects are being rendered to the viewport
  – Remember if objects fall outside the world window, they are not displayed
  – Another name for the world window is ‘clipping volume’

• How is this related to ‘picking’?
Create a tiny little clipping volume ...
Create a tiny little clipping volume ...
Create a tiny little clipping volume ...
What does OpenGL Tell You?

• If you give each object a name, then OpenGL will tell you the names of the objects that are ‘hit’
  – Here ‘hit’ means ‘being rendered to’ the window

• You need to supply a buffer for the OpenGL to store the hit objects. For example,

  GLuint selectBuffer[100];
  ...
  glSelectBuffer(100, selectBuffer);
Processing Hits

Hits will be recorded in the Select Buffer

GLuint selectBuffer[100];
glSelectBuffer(100, selectBuffer);

<table>
<thead>
<tr>
<th></th>
<th>← number of names</th>
<th>← min depth value</th>
<th>← max depth value</th>
<th>← first name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.2822e+009</td>
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<td>4.28436e+009</td>
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<tr>
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<td>4.2732e+009</td>
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<td>6</td>
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Where are the names copied from?

- From OpenGL ‘name stack’
- ‘name stack’ is an OpenGL internal data structure to store the names of the objects that are rendered to the display window
- What do I need to do to initialize the name stack?
  ```
  glInitNames();
  glPushMatrix(0);  // push 0 on stack
  ```
How do I render the objects into that tiny little window??

• In OpenGL, you change the clipping volume by manipulating the ‘Projection Matrix’, i.e., GL_PROJECTION

• Normally, you would do:

```c
glMatrixMode(GL_PROJECTION);
glLoadIdentity();
gluOrtho2D(xmin, ymin, xmax, ymax);
...
// draw objects
```
How do I render the objects into that tiny little window??

- Now, you need to specify your pick window before you specify your normal camera, i.e., gluOrtho2D()
- That is,

```c
GLint vp[4];
glMatrixMode(GL_PROJECTION);
glLoadIdentity();
glGetIntegerv(GL_VIEWPORT, vp);
gluPickMatrix(x, y, w, h, vp);
gluOrtho2D(xmin, ymin, xmax, ymax);
....  // draw objects
```
But you really want to see is not the tiny little window ...

- You have to render your objects twice
- First time render the tiny little window (not really shown to you), in GL_SELECT mode
- Second time render the objects using your normal setting, in GL_RENDER mode
  
  ```
  glRenderMode(GL_SELECT);
  ...
  // prepare name stack
  ...
  // render tiny little window
  glRenderMode(GL_RENDER);
  ...
  // render regular scene
  ```
It is something like this ...

In your mouse call back function when you try to pick

```c
glRenderMode(GL_SELECT);
gllInitNames();
glPushMatrix(0);
glSelectBuffer(100, selectBuffer); // assuming you have declared selectBuffer
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glPushMatrix();
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);

//draw your objects with names here ....
glMatrixMode(GL_PROJECTION);
glMatrixMode(GL_PROJECTION);
int hits = glRenderMode(GL_RENDER);
//resume normal drawing ....
```
Wait, how do I give names to my objects

In your drawing routine

```c
glLoadName(1);
// draw whatever you want ..... 

glLoadName(2);
// draw whatever you want ..... 
```

These names will be copied to your name stack
## Processing Hits

Hits will be recorded in the Select Buffer

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GLuint selectBuffer[100];
glSelectBuffer(100, selectBuffer);
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