Games

CS134

Chris Pollett

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Introduction

- The class cGame
- The game's timestep cycle
- The virtual methods of cGame
- The cBiota class

The class cGame

- In writing a game in the Pop framework you typically need to create a few subclasses of cCritter and a new child class of cGame.
- The most significant member of the cGame class is cBiota *_pbiota. This has a collection of pointers to all the game's active objects.
- This class is implemented as a serializable CArray, with array walking methods: draw, move, update, animate, feellistener.

Array Walking Example

```
void cBiota::update(CPopView *pactiveview,
   Real dt)
{
    for(int i=0; i < GetSize(); i++)
    {
        GetAt(i)->update(pactiveview, dt);
    }
}
```

More on cGame

- cGame's also have a cCritter *_pplayer for the player.
- This pointer is always assumed to be not NULL.
- _pplayer is also usually a member of _pbiota
- Might want to add field for other distinguished critters to the game. Ex: goals in hockey game
- A cGame also has a CRealBox _border to specify how big the world is
- The size of critters on screen depends on their radii versus border size.
- cGame's also have a _wrapFlag saying what happens where border hit. (WRAP, BOUNCE or CLAMP)

Yet More on cGame

- Critter's also have _wrapflags. So might think this is in instance of having same info in multiple places. (forgery)
- By default cCritter sets _wrapflag the same as its game's _wrapflag. But subclasses might do different things.

- cGame's also have _seedcount and _maxscore fields as well as a score() methods
- cGame's CArray<HCURSOR, HCURSOR> _arrayCursor used to say what kind of control are available for the game
- _pcollider holds pair of critters want to be able to check if collide

The game's timestep cycle

- step(Real dt) is probably the most important method of cGame.
- Not virtual as very delicate.
- Basically, it:
  - Adjusts game parameter (Game Over, Reset, etc)
  - Listens and passes user input to feellistener methods
  - Moves-- calls critters' move methods
  - Updates -- calls critters' update methods
  - Checks for collisions between pair of critters
  - Cleans up defunct critters; adds requested critters
  - Animates critter sprites
  - Draws to active views

The virtual methods of cGame

- To extend cGame you want to override the constructor and override methods like: seedCritters, initializeView, adjustGameParameters, and statusMessage

The cGame constructor

```
cGame::cGame():
    _seedcount(COUNTSTART),
    _gameover(TRUE),
    _maxscore(MAXSCORE),
    _scorecorrection(0),
    _wrapflag(cCritter::WRAP),
    _bDragging(FALSE),
    _pfocus(NULL),
    _pplayer(NULL),
    _border(cGame::WORLDWIDTH, cGame::WORLDHEIGHT),
```

...

- When override can change some of these initial values to get game you want as well as modify some of the body of constructor.

Example Modification

- For Spacewar want to change border dimension, background color and the type of player:

```
_border.set(20.0, 20.0);
_border.pcolorstyle()->setFillColor(cColor::CN_BLACK);
setPlayer(new cCritterArmedPlayerSpaceWar);
```

- You can have player which are offscreen or not member of _pbiota: setPlayer(new cCritter(), FALSE);
- If you want to have some permanent critters can initialize in constructor. See Hw1 Solution

Seeding the Game

- cGame::seedCritters() is where initialize other critters for the game
- It is also called when game restarted or reset.
- For example, in Spacewar, the player is added in the constructor, the asteroids are added in seedCritters, and as level goes up adjustGameParameters adds UFOs.
- In Ballworld, the player and basket are added in the constructor, the ball in seedCritters.

When is seedCritters() first called?

- It is called by cPopDoc::setGameClass when the particular game in Pop is set:
  setGameClass(RUNTIME_CLASS(cGameSpaceWar));
- (Aside CRuntimeClass holds a string name of class, its size in bytes, and info about parent class. Used for serialization, run time typing)
- setGameClass:
  - constructs a new game object and puts it into _pgame field of CPopDoc
  - calls _pgame->seedcritters()
  - calls the document view to adjust their displays for the new game (UpdateAllViews(NULL,CPopDoc::VIEWHINT_STARTGAME, 0);
- setGameClass is the only way cGame object are constructed.

Other ways seedCritters called

- When press enter to start new game. This generates a call to cGame::reset which in turn calls seedCritters.
  - Reset also returns player health to start value and _level to 1.
- seedCritter is called within adjustGameParameters.

Example seedCritters

```
void cGameSpacewar::seedCritters()
{
    _pbiota-
       >purgeCritters(RUNTIME_CLASS(cCritterBullet));
    /* deleted stuff .. */
    for(int i=0; i<_seedcount; i++)
          new cCritterAsteroid(this);
}
```

- purgeCritters gets rid of all critters of the given type.

How the game adjusts itself

- cGame::adjustGameParameters gets called once per game update (which is called within cGame::step.)

Ex:

```
void cGameStub::adjustGameParameters()
{
    if(!health() && !_gameover)
    {
        _gameover = TRUE;
        pplayer->addscore(_scorecorrection );
        playSound("Tada");
        return
    }
    //might reseed characters etc
}
```

Initializing the view

- There are many things you might want to adjust about views: 2D versus 3D, initial viewpoint, what looking at, etc.
- Views are managed by CPopView::OnUpdate which is called from CPopView::onCreate when Pop is first launched or is called by CPopView::setGameClass

Thinking about coordinates

- x-axis goes left to right horizontally across screen
- y-axis goes bottom to top of screen
- z-axis points out of screen
- So might want to look at world from a location like: (0.0, 0.0, 5.0) in a 2D game…Or might want to change where viewing world from

What OnUpdate does

```
if(lHint == CPopDoc::VIEWHINT_STARTGAME)
{
    pgame()->initializeView(this); //says the kind of view
    pgame()->initializeViewpoint(_pviewpointcritter);
        //says where to look within this view
    pgraphics()->installLightingModel(pgame()-
       >plightingmodel()); /*this for now only can toggle
    lighting calculations in OpenGL, by default do calc.
    Only PickNPop doesn't have on */
    //Call invalidate to show stuff now
}
```

Example view

```
void cGame::initializeView(CPopView *pview)
{
    pview->setCursor(((CPopApp*)::AfxGetApp())->_hCursorArrow);
    pview->setUseBackgroundBitmap(FALSE);
    pview->setUseSolidBackground(TRUE);
    pview->setGraphicsClass(RUNTIME_CLASS(cGraphicsMFC));
        //might change in subclass
    pview->pviewpointcritter()->setTrackplayer(TRUE);
    /* Could set listener in subclass with:
    pview->pviewpointcritter()->setListener(new
        cListenerViewerRide()); //works only in 3D
    */
}
```

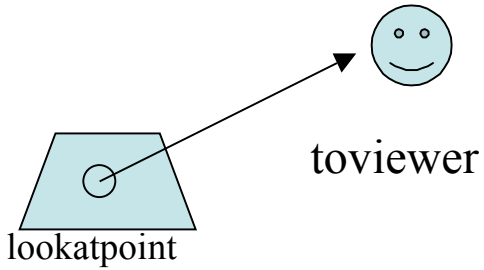
Initializing the viewpoint critter

- Once have set the view can set up the viewpoint within this view:

```
void cGame::initializeViewpoint(cCritterViewer
   *pviewer)
{
    if(pviewer->is3D())//for now this check if using OpenGL
        pviewer->setViewpoint( cVector3(0.0, -1.0, 2.0), _border.center());
    else //2D case
        pviewer->setViewpoint(cVector::ZAXIS, _border.center);
    /*
        If want to, can override and change and also set a zoom:
        pviewer->zoom(1.5)
    */
}
```

Interpreting the previous slide

cCritterViewer::setViewpoint(cVector toviewer, cVector lookatpoint)



The above call will position the viewpoint just far enough away so that every corner of the world's _border box is visible. This method is implemented by calls to moveTo and lookAt

If you want to see half this much change the zoom from 1 to 2.

In 2D, the toviewer is always the z-axis

The status message

- This is the message in the status bar at the bottom of the Pop window.
- It is set by the line:

```
cMainFrame->SetMessageText(pDoc->pgame()-
    >statusMessage());
```

- The method cGame::statusMessage can be overriden by you. It returns an MFC CString object.

Example of something can put in status message

```
CString cStrUpdates,  cStrCount;
int count = _pbiota-
   >count(RUNTIME_CLASS(cCritters));
int nUpdatesPerSecond =
   int(((CPopApp*)::AfxGetApp())-
   >_timer.updatesPerSecond());
cStrUpdates.Format("Updates/Sec: %d",
   nUpdatesPerSecond);
cStrCount.Format("Num critters: %d", count);
return cStrUpdate + " " + cStrCount;
```

The randomSprite factory method

- A factory method constructs an object of a certain kind and returns pointer to it.

  An example in the cGame class is:

  cSprite* randomSprite(int spriteindex);

  /* Some allowable spriteindex's:

  cGame::ST_SPRITETYPENOTUSED

  cGame::ST_SIMPLEPOLYGONS, etc */

- To use this factory method, one could within cCritter's constructor call:

  setSprite(pownergame->randomSprite(cGame::ST_ASTEROIDPOLYGONS);

- One can override this class

The cBiota class

- cBiota is based on the class CTypedPtrArray with a few special methods added. (So Add adds a critter)
- Pointers are used to store cCritter's so that one can use polymorphism when subclass cCritter methods.
- Arrays are a little faster than linked lists to iterate through, so that's why arrays rather than lists used.
- cBiota's have a _pgame pointer so that cCritter pgame() method can find the parent game.

Important methods of cBiota

- cBiota as mentioned before has a number of array walking methods: draw, move, udate, animate, render, and listen.
- Except for draw these are called by cGame::step
- draw is called by CPopView::draw

  Aside: draw traverses array backwards so that the player is drawn on top. (The player is the first element of array)
- cGame::_pfocus is used by PickNPop and DamBuilder to point to the critter being handled by the cursor. This creature is highlighted by cBiota::draw

Service Requests

- cBiota has a CArray<cServiceRequest, cServiceRequest> _servicerequestarray,
- A cServiceRequest holds a critter and a string request.
- A request might be generated when we walk through our array at some point. Don't want to change the array size on the fly so make request.
- A typical request is to add/delete/replicate/move in array a critter.
- Deleting a critter requires a delete pcritter call and requires us to remove the invalid pointer from cBiota.
- Note ignore delete requests for player critter.