3D Game Programming
2D game

Ming-Te Chi
Department of Computer Science,
National Chengchi University

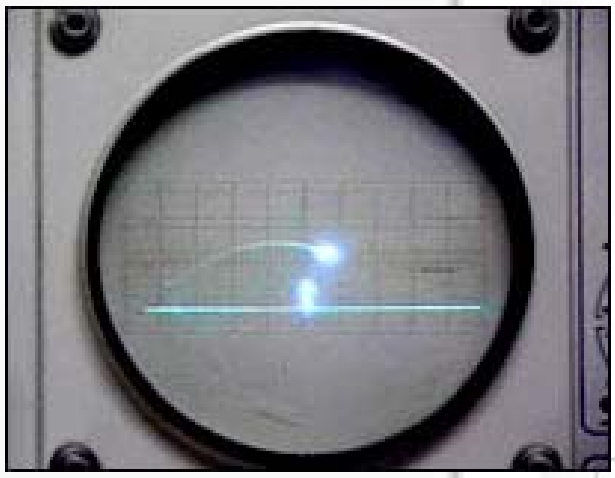
Outline

- 2D game history
- Coordinate system
- Simple 2D game example

2D VIDEO GAME HISTORY

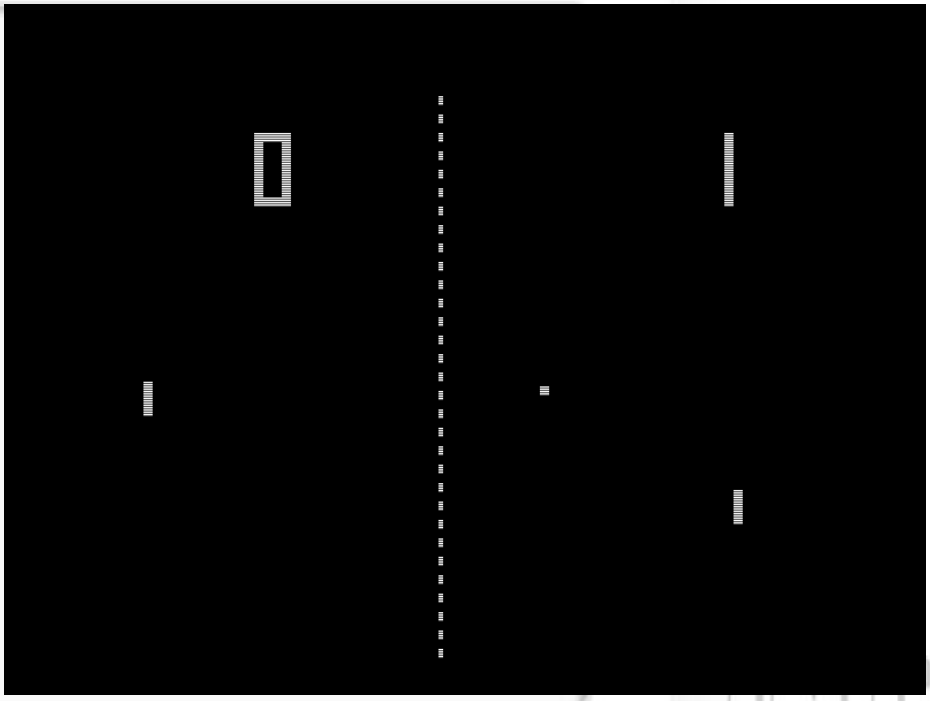
The first video game

- **Tennis for Two** was a game developed in 1958 on an analog computer, which simulates a game of tennis or ping pong on an oscilloscope.



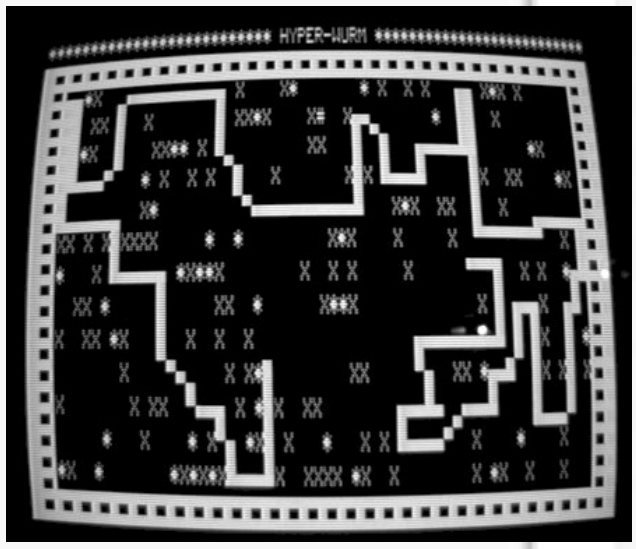
2D GAME

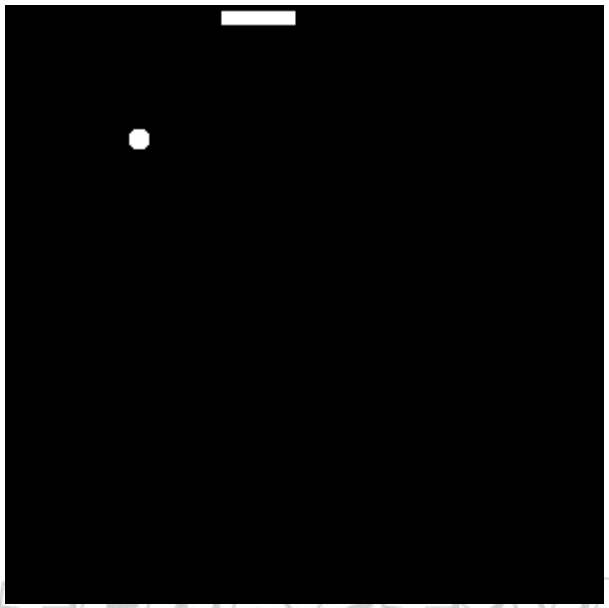
- PONG 1972.
  – earliest video game



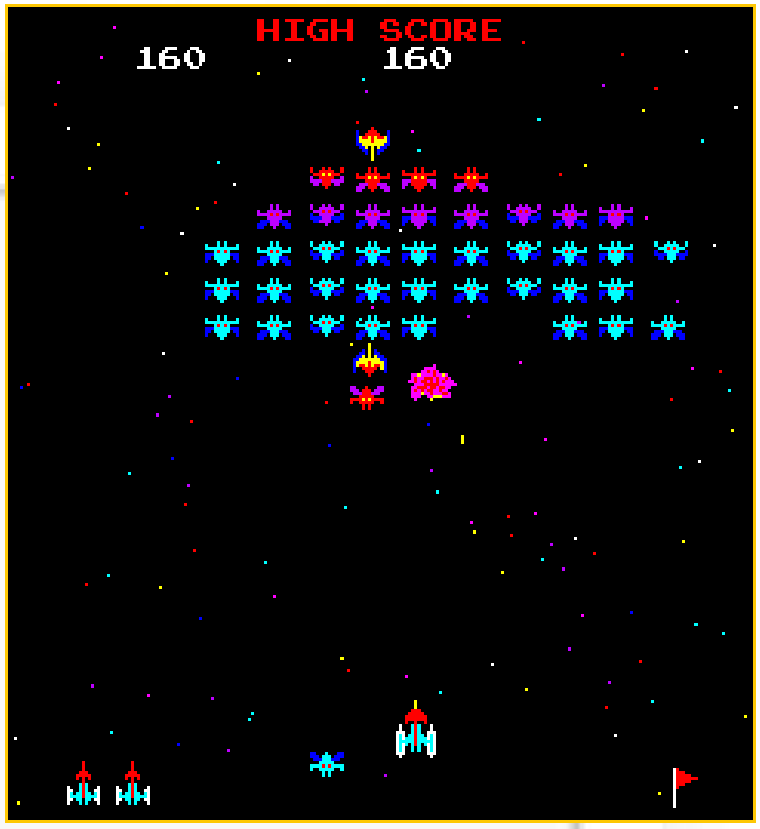
Snake (1970s)

- Control a snake to move, and avoid hitting to wall or its growing tail.



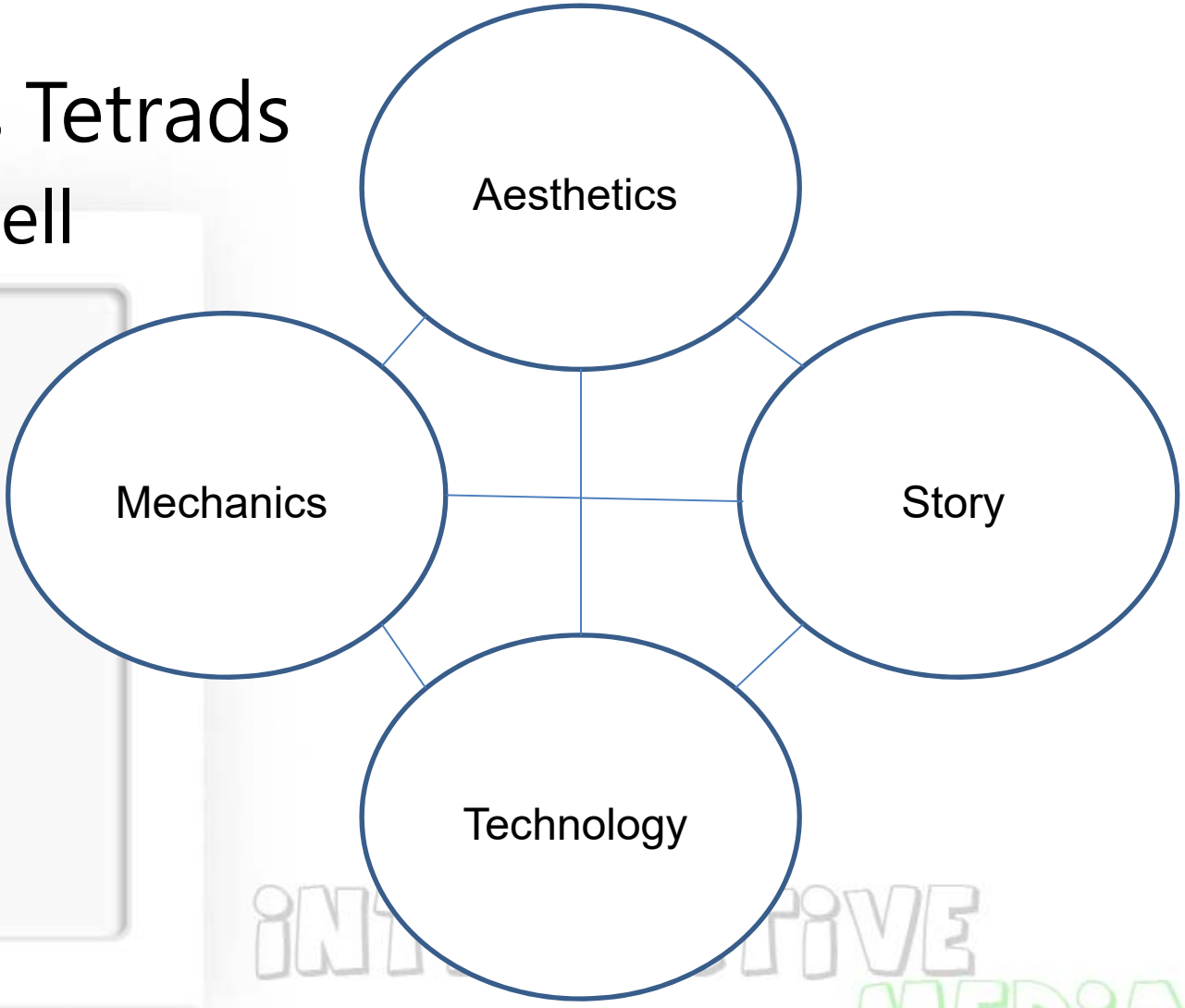


Galaxian (1979 by Namco)



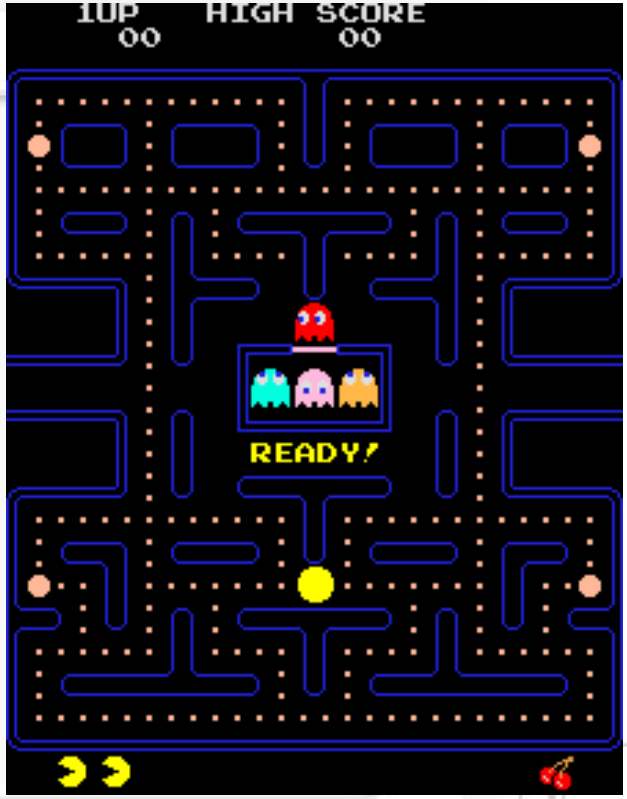
Basic elements

- Elements Tetrads
  – Jesse Schell



- **Mechanics**
  - the procedures and rules
- **Story**
  - the sequence of events that unfolds in your game
- **Aesthetics**
  - how your game looks, sounds, tastes, and feels.
- **Technology**
  - any materials and interactions that make your game possible

Pac Man 1980 by Namco



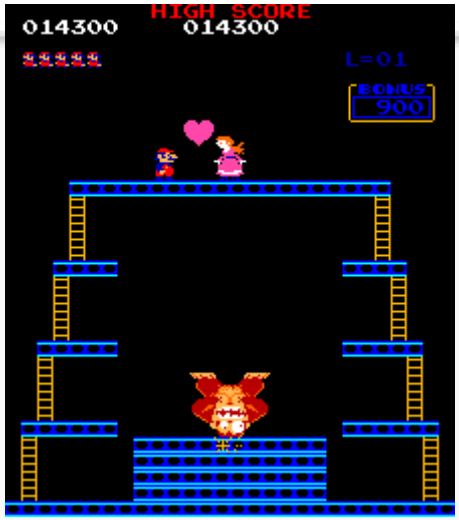
Game & Watch 1980

Game & Watch is a line of handheld electronic games produced by Nintendo from 1980 to 1991.

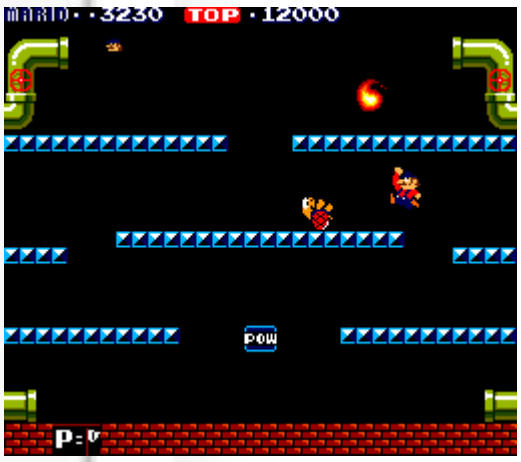
Ball: the first game & watch game

Family Computer(FAMICOM)

- Mario series. By Nintendo



Donkey Kong
1981

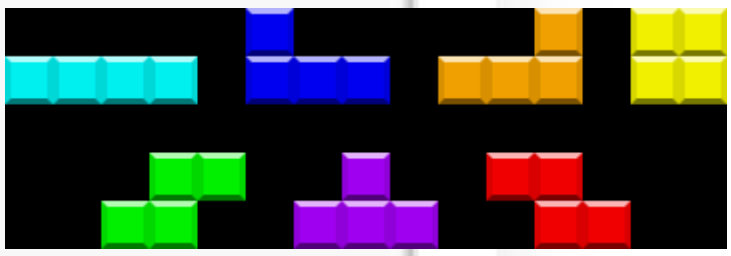


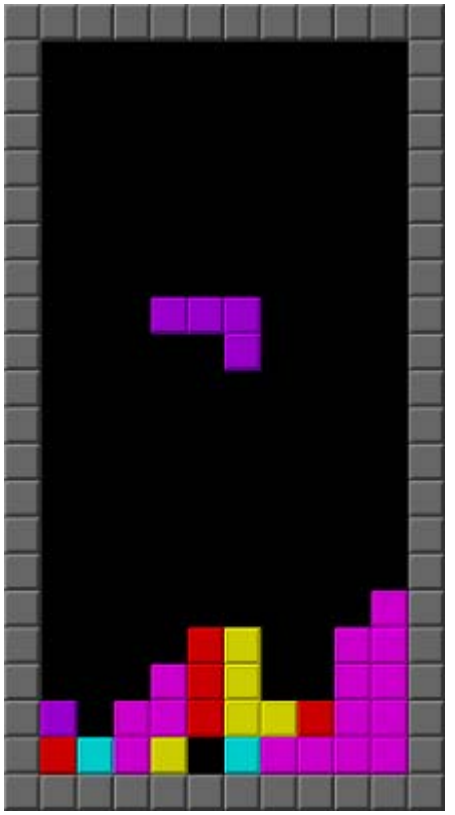
Mario Bros.
1983

Super Mario Bros.
1985

Tetris

- Design by 阿列克謝·帕基特諾夫
- （Алексей Леонидович Пажитнов）in 1984
- Puzzle game



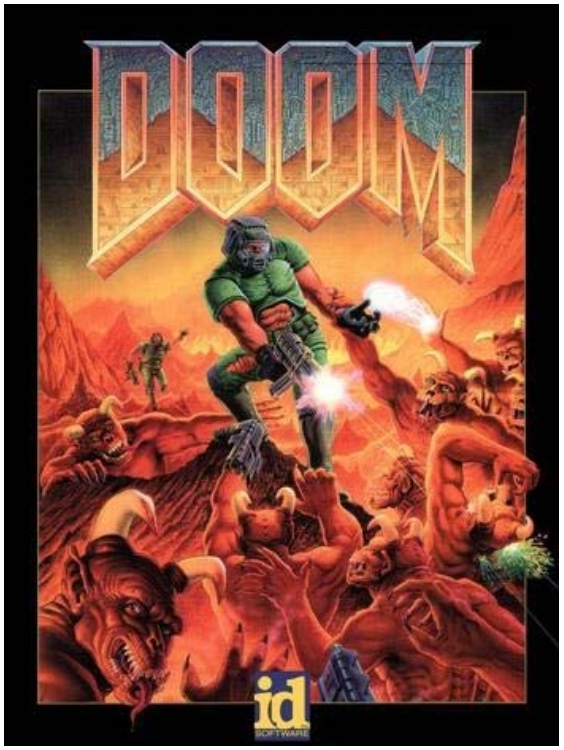


Super Mario World. 1990

- Rich color, Parallax scrolling, zoom and rotate sprite.

Doom 1993

- A landmark 1993 first-person shooter (FPS)video game by *id Software*.



3D Graphics – early stage

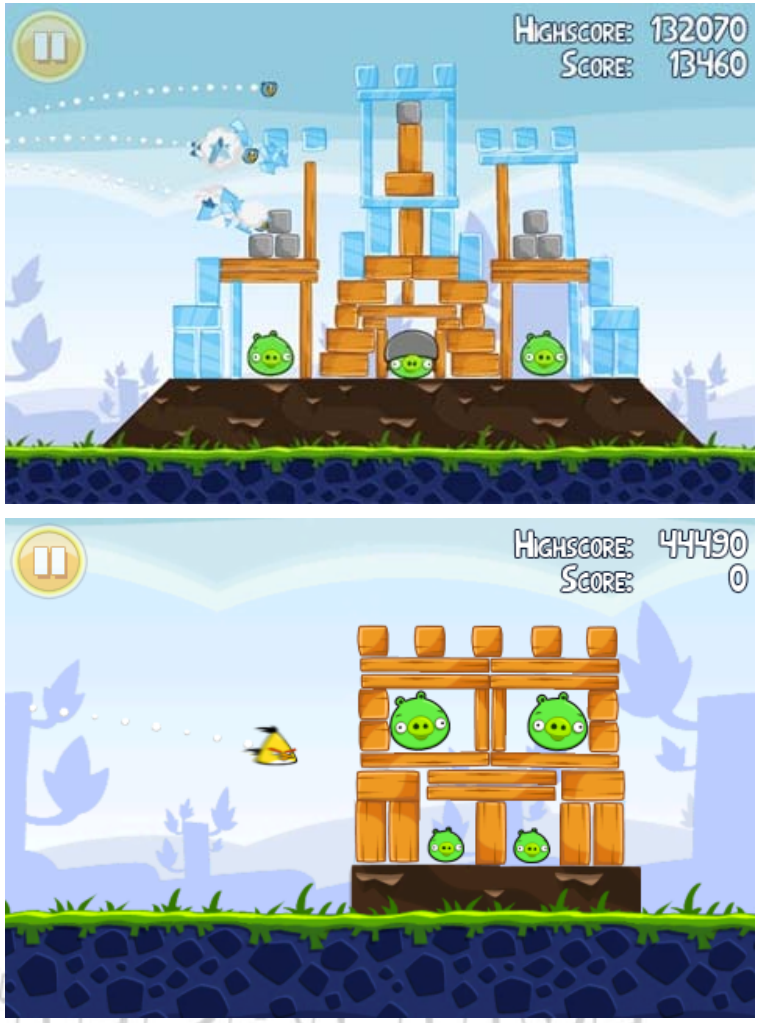
3D Graphics

Social game

Happy Farm

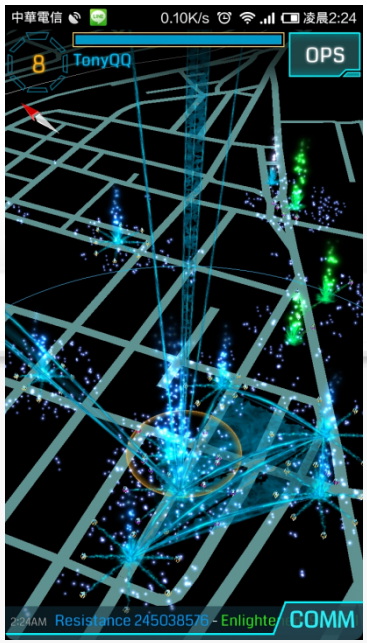
Mobile phone

flight control by Firemint



Angry Birds by Rovio

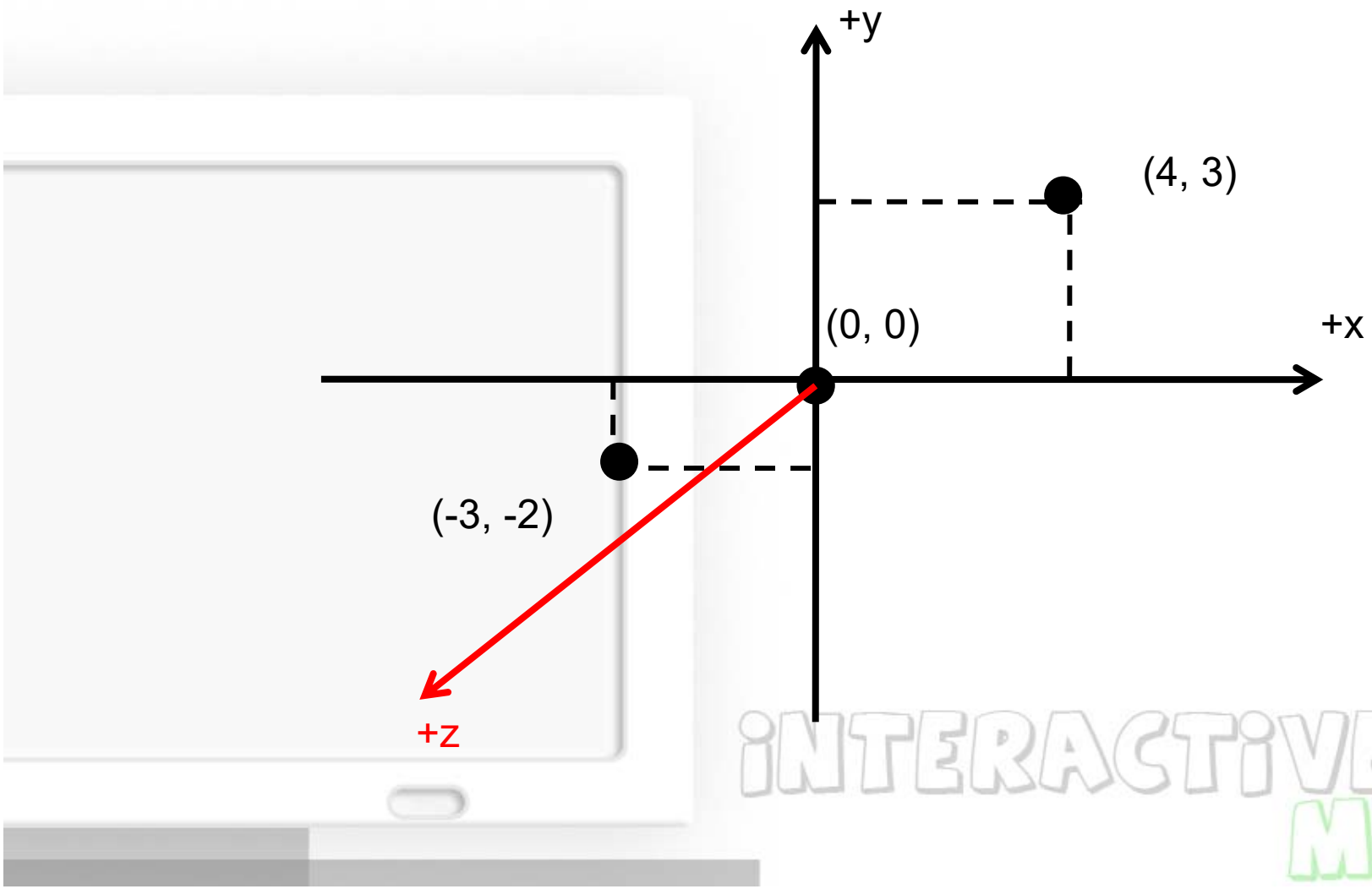
LBS & AR



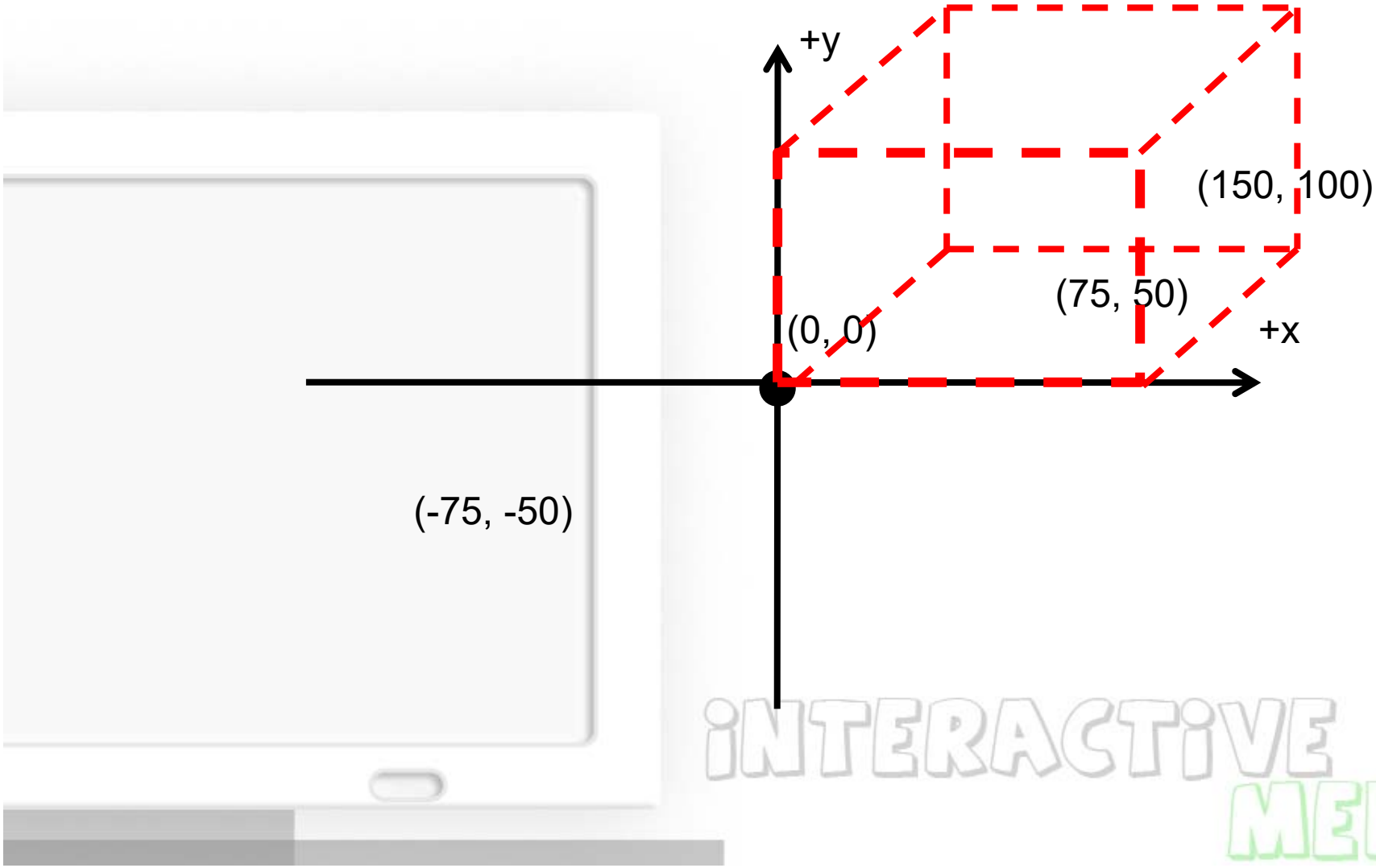
Snake in 2014

2D VIDEO GAME HISTORY

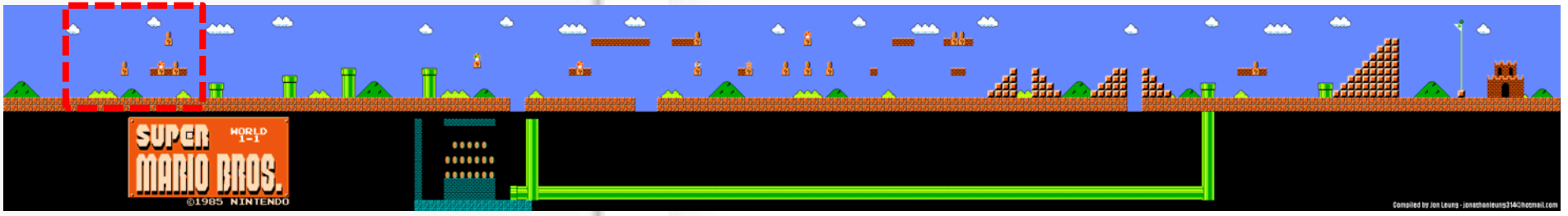
Cartesian Plane



Coordinate Clipping



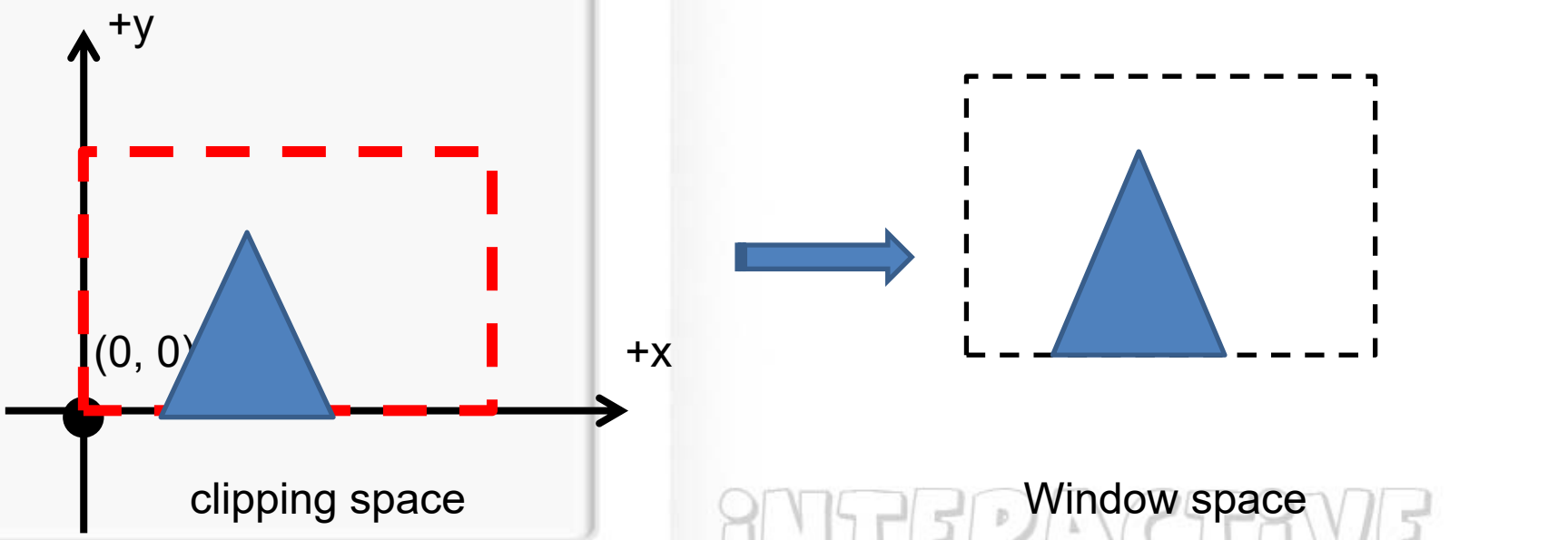
Game world



Super Mario Bros.　Nintendo

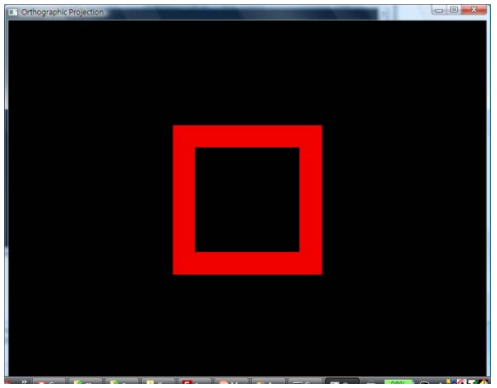
Viewport

- Mapping drawing coordinates to windows coordinates

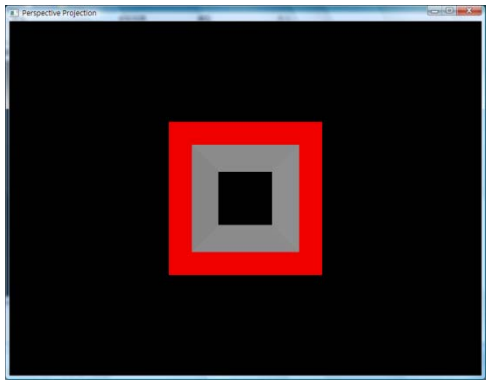


Projection

- Getting 3D to 2D
  - Orthographic projections



  - Perspective projections



Representing Visuals

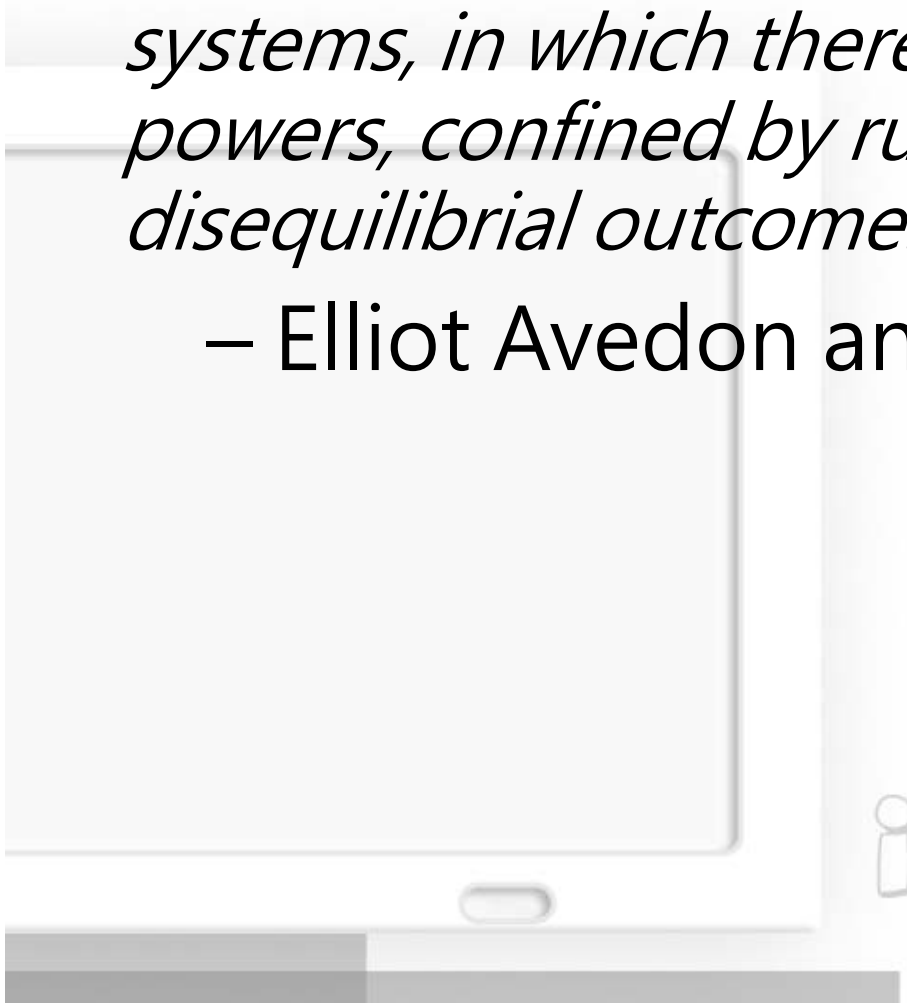
- 3D objects
  - Mesh: geometry
  - Materials
  - Texture maps
- Lighting
- Shader

2D GAME

What is a Game?

Games are an exercise of voluntary control systems, in which there is a contest between powers, confined by rules in order to produce a disequilibrial outcome.

– Elliot Avedon and Brian Sutton-Smith



Game architecture

Asset Management

loading

saving

caching

Game Loop

Start()

Update(delta)

Display(delta)

I/O System

Keyboard, mouse

audio

storage

Glut and game loop

Asset Management

Loading & saving

Game Loop

Start()

Update(delta)

Display(delta)

I/O System

Keyboard, mouse

audio

storage

```
main()
{
   initglut()
   init();
   RegisterCallback()
   update(0);

   glutMainLoop()
}
```

```
update(int i){
    //update state
  glutTimerFunc(delta,
update, ++i);
  glutPostRedisplay();
}

display() {
   //draw something
}
```

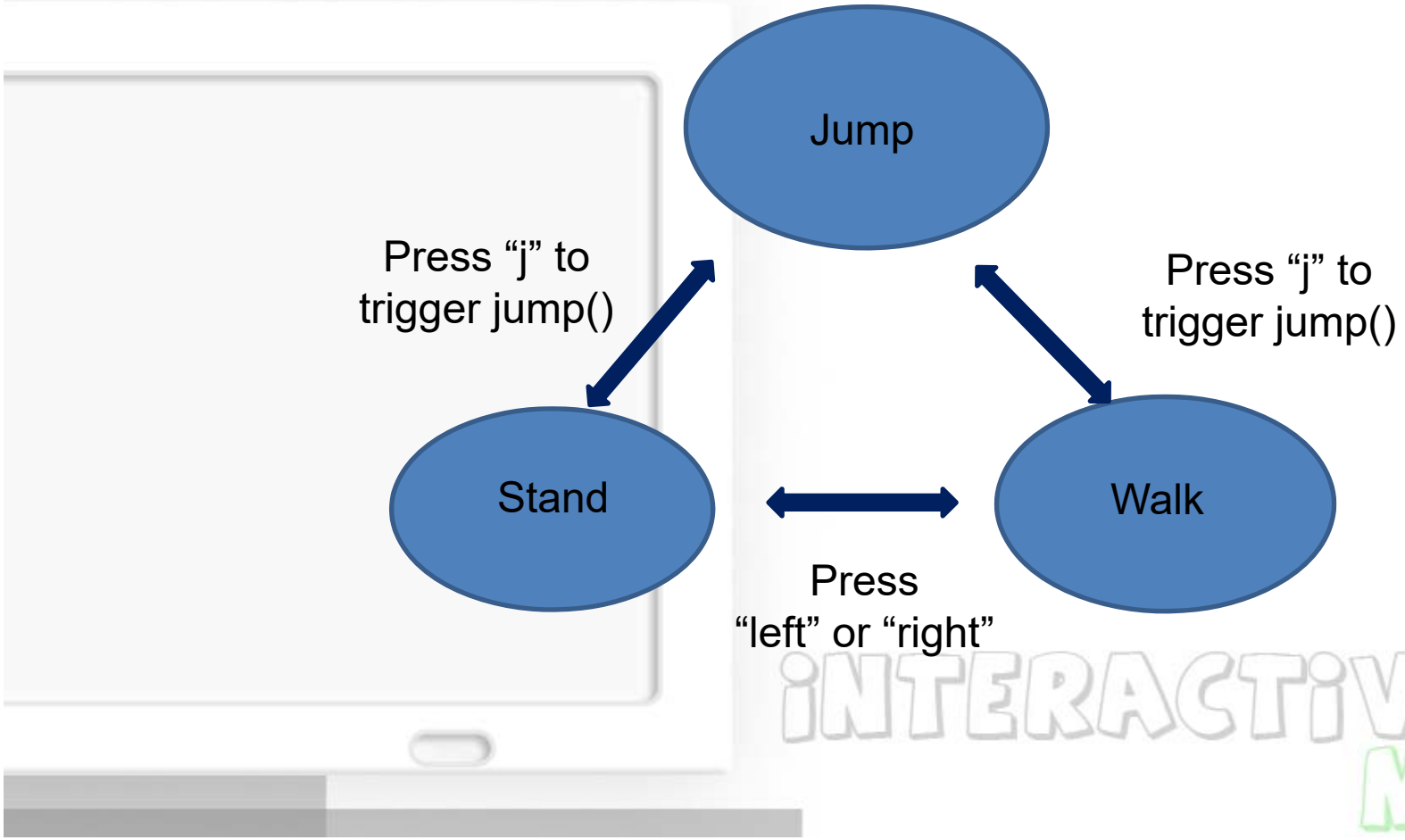
```
keyboard(key) {
  switch(key) {
    case 'j':
       jump()
       break;
  }
}
```

A simple example

- A character has three states: **stand, walk, and jump**
- Use “left” and “right” key to move the character
- When press “j”, the character will jump, and the score will increase by 1.

State

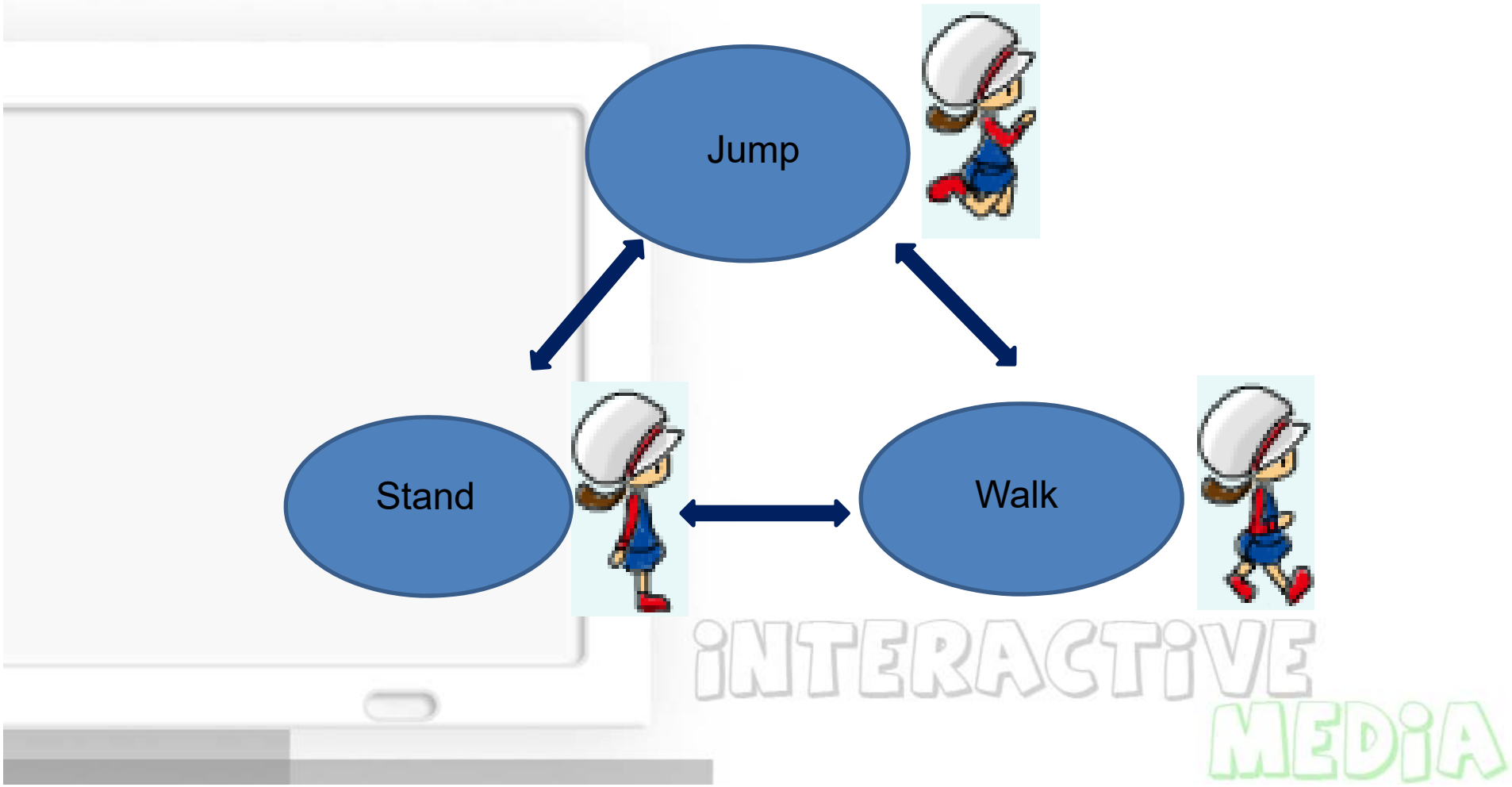
- Position, direction, Gamesocre



class RGBApixmap

```
RGBApixmap pic;
pic.readBMPFile( “stand.bmp” );
pic.setChromaKey(232, 248, 248);

// draw
pic.blendtex(picX, picY, 1.0, 1.0);
```

State and Image



State

int whichpPic;

RGBApixmap pic[3];

Pic[2].readBMPFile(“ fly.bmp");

Jump

Stand

Walk

Pic[0].readBMPFile(“stand.bmp");

Pic[1].readBMPFile(“walk.bmp");

Change State

```
void SpecialKeys(int key, int x,
int y)
{
    switch(key) {
        case GLUT_KEY_LEFT:
                picX -= 5;
                if (whichPic==0)
                        whichPic=1;
                else
                        whichPic=0;
                DirectState=1; //left
                break;

        case GLUT_KEY_RIGHT:
                picX += 5;
                if (whichPic==0)
                        whichPic=1;
                else
                        whichPic=0;
                DirectState=0; //right
                break;
    }
}
```

```
void display() {
        …
        if (DirectState==0) {    //向右
                pic[whichPic].blendTex(picX, picY, 1, 1);
        } else {                        //向左
                int offset = pic[whichPic].nCols;    //圖的
寬度
                pic[whichPic].blendTex(picX+offset, picY,
-1, 1);
                //調整x位置，並以x=0為軸翻轉影像
        }
        …
}
```

Font rendering

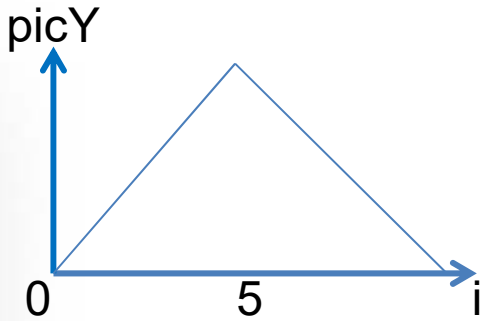
```
//Font
        char mss[30];
        sprintf(mss, "Score %d", Gamescore);



        glColor3f(1.0, 0.0, 0.0);     //set font color
        glRasterPos2i(10, 550);    //set font start position
        void * font = GLUT_BITMAP_9_BY_15;
        for(int i=0; i<strlen(mss); i++) {
                glutBitmapCharacter(font, mss[i]);
        }
```

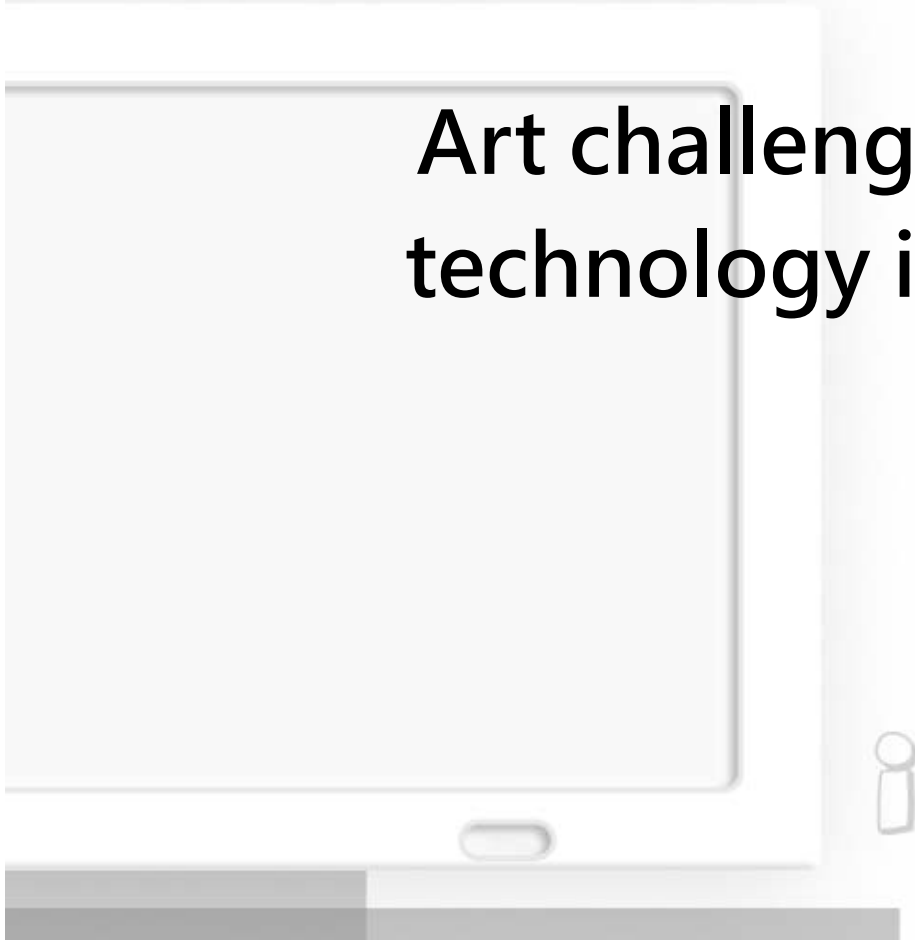
Press J to Trigger jump()

```
void myKeys(unsigned char key, int x, int y)
{
        switch(key)
        {
                case 'J': case 'j':
                        if(jumpState==0) {
                                jumpState=1;
                                Gamescore++;
                                jump(0);
                        }
                        break;
        }
        glutPostRedisplay();
}
```

Jump motion

```
void jump(int i)
{
        whichPic=2; //switch state

        if(i<=10) {
                if (i<5) picY+=4;
                else picY-=4;

                i++;
                glutTimerFunc( 100, jump, i);

        }else {
                whichPic=0;
                jumpState=0;
        }

        glutPostRedisplay();
}
```





Art challenges technology;
technology inspires the art.
- John Lasseter