The Fox and the Crab

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cs102 Project 1: Specification

Our group project's goal is to make a program that will animate the Aesop's Fable, "The Fox and the Crab". This will include the animation made with vector graphics and a textbox underneath this animation narrating the story.

cs102 Project 1: Analysis

- Start with a credits title page before the main story.
- The crab, fox, and sand mites are done with vector graphics.
- The background changes according to the scenes.
- The animation of the crab and fox is done with translation, rotation, and scaling.
- The caption is added underneath the animation.
- Sand mites jitter to simulate movement.
- Use PNG images for the backgrounds, fox face, and blood.
- Load all images at the start of the program to prevent lag.

cs102 Project 1: Design - Assigned Parts

- Main and draw_cb: Alexander
  - main - set up animation timer and FLTK window
  - draw_cb - animates everything according to the animation timer
- Background: Alex
  - draw_image - loads all images the first time it is called, afterwards just displays the image selected
- Crab: drawn using vector graphics - Jiajun
  - draw_crab - draws the body circle and calls functions to draw other parts
  - draw_crab_legs
  - draw_crab_pincer
  - draw_crab_face - happy face
  - draw_crab_exciteface - scared face
  - draw_crab_sadface
- Sand Mites: draw using vector graphics - Alex
  - draw_sand_mites - alternates position by 2 pixels every time it is called, simulating movement

cs102 Project 1: Design - Assigned Parts cont.

- Textbox: Sentences describing scenes in a window - Alexander
  - draw_caption - calls draw_caption_background and draw_caption_text
  - draw_caption_background - draws a black box on the bottom of the screen to frame the caption
  - draw_caption_text - draws the text for the scene on 1 or 2 lines
- Fox: Vector graphics - Ray
  - draw_fox - calls draw_fox_body and one of the two draw_fox_legs alternating every 2 times it is called
  - draw_fox_body
  - draw_fox_legs - 2 functions for 2 different positions of the legs
- Zoom: Alexander
  - Zoom scene: zooms into scene of fox eating crab
  - Draws a fox head that eats the crab from a PNG file.

cs102 Project : Implementation : main.cpp

```
1  #include "project.h"
2
3  const int WIDTH = 800; const int HEIGHT = 600;
4  Fl_Cairo_Window mainWindow (WIDTH, HEIGHT);
5  unsigned int t = 0;
6
7  int main () {
8      mainWindow.label ("The Fox and the Crab");
9      mainWindow.set_draw_cb (draw_cb);
10     mainWindow.show ();
11     Fl::add_timeout (5.0, animate_cb);
12     Fl::run ();
13 }
```

cs102 Project : Implementation : animate_cb.cpp

```
1  #include "project.h"
2
3  void animate_cb (void*) {
4      extern unsigned int t;
5      extern Fl_Cairo_Window mainWindow;
6      t++;
7      mainWindow.redraw ();
8      Fl::repeat_timeout (0.0625, animate_cb); // 1/16 of a second
9  }
```

cs102 Project : Implementation : draw_image.cpp

```
1  #include "project.h"
2
3  void draw_image (cairo_t* cr, int imageNum) {
4      static cairo_surface_t* images[5] =
5          { cairo_image_surface_create_from_png ("images/sandy_beach_background.png"),
6            cairo_image_surface_create_from_png ("images/desert_background.png"),
7            cairo_image_surface_create_from_png ("images/meadow_background.png"),
8            cairo_image_surface_create_from_png ("images/fox.png"),
9            cairo_image_surface_create_from_png ("images/blood.png") };
10     cairo_set_source_surface (cr, images[imageNum], 0, 0);
11     cairo_paint (cr);
12 }
```

cs102 Project : Implementation : draw_cb.cpp

```
1  #include "project.h"
2
3  void draw_cb (Fl_Cairo_Window* cw, cairo_t* cr) {
4      extern unsigned int t;
5      if (t < SCENE2) {
6          draw_image (cr, 0);
7          draw_caption (cr, captions[0].c_str (), captions[1].c_str ());
8          cairo_save (cr);
9          cairo_translate (cr, 600, 300);
10         draw_sand_mites (cr);
11         cairo_restore (cr);
12         cairo_save (cr);
13         cairo_translate (cr, 150, 400);
14         draw_crab (cr, 1);
15         cairo_restore (cr);
16         if (t == 0)
17             draw_title_page (cr);
18     }
```

cs102 Project : Implementation : draw_cb.cpp

```
19      else if (t < SCENE3) {
20          static int dx = 0;
21          draw_image (cr, 0);
22          draw_caption (cr, captions[2].c_str ());
23          cairo_save (cr);
24          cairo_translate (cr, 600, 300);
25          draw_sand_mites (cr);
26          cairo_restore (cr);
27          cairo_save (cr);
28          cairo_translate (cr, 150 + dx, 400);
29          draw_crab (cr, 1);
30          cairo_restore (cr);
31          dx += 5;
32      }
```

cs102 Project : Implementation : draw_cb.cpp

```
33      else if (t < SCENE4) {
34          static int dx = 0;
35          static int dy = 0;
36          static double scale = 1.0;
37          draw_image (cr, 1);
38          draw_caption (cr, captions[3].c_str (), captions[4].c_str ());
39          if (t < SCENE3 + 96) {
40              cairo_save (cr);
41              cairo_translate (cr, 0 + dx, 400);
42              draw_crab (cr, 1);
43              cairo_restore (cr);
44              if (t < SCENE3 + 48) dx += 4;
45          }
46          else {
47              cairo_save (cr);
48              cairo_translate (cr, 0 + dx, 400 + dy);
49              cairo_scale (cr, scale, scale);
50              draw_crab (cr, 2);
51              cairo_restore (cr);
52              dx += 2; dy -= 2;
53              scale *= 0.98;
54          }
55
56      }
```

cs102 Project : Implementation : draw_cb.cpp

```
57      else if (t < SCENE5) {
58          static int dx = 0; static int dy = 0;
59          draw_image (cr, 2);
60          draw_caption (cr, captions[5].c_str ());
61          if (t < SCENE4 + 44) {
62              static double scale = 0.4111;
63              cairo_save (cr);
64              cairo_translate (cr, 280 + dx, 260 + dy);
65              cairo_scale (cr, scale, scale);
66              draw_crab (cr, 0);
67              cairo_restore(cr);
68              dx -= 2; dy += 2;
69              scale /= 0.98;
70          }
71          else if (t < SCENE4 + 76) {
72              static double rotate = 0.0;
73              cairo_save (cr);
74              cairo_translate (cr, 280 + dx, 260 + dy);
75              cairo_rotate (cr, rotate);
76              draw_crab (cr, 0);
77              cairo_restore (cr);
78              rotate -= PI / 16;
79              if (t < SCENE4 + 60) dy -= 5;
80              else dy += 5;
81          }
82          else {
83              cairo_save (cr);
84              cairo_translate (cr, 280 + dx, 260 + dy);
85              draw_crab (cr, 0);
86              cairo_restore (cr);
87          }
88      }
```

cs102 Project : Implementation : draw_cb.cpp

```
89      else if (t < SCENE6) {
90          static int fdx = 0; static int fdy = 0;
91          draw_image (cr, 2);
92          draw_caption (cr, captions[6].c_str ());
93          cairo_save (cr);
94              cairo_translate (cr, 192, 348);
95              draw_crab (cr, 0);
96          cairo_restore (cr);
97          cairo_save (cr);
98              cairo_translate (cr, 1125 + fdx, -650 + fdy);
99              cairo_scale (cr, -2, 2);
100             draw_fox (cr);
101         cairo_restore (cr);
102         fdx -= 4; if (t < SCENE5 + 32) fdy -= 2;
103     }
```

```
104     else if (t < SCENE7) {
105         cairo_save (cr);
106             cairo_translate (cr, -200, -200);
107             cairo_scale (cr, 1.5, 1.5);
108             draw_image (cr, 2);
109             if (t < SCENE6 + 32) {  // draw crab
110                 cairo_save (cr);
111                 static int dx = 0; static double scale = 1.0;
112                 cairo_translate (cr, 192 + dx, 380);
113                 cairo_scale (cr, scale, scale);
114                 draw_crab (cr, 2);
115                 dx += 10; scale *= 0.96;
116                 cairo_restore (cr);
117             }
118             cairo_save (cr); // for drawing fox image
119                 cairo_translate (cr, 400, 130);
120                 cairo_scale (cr, 0.75, 0.75);
121                 draw_image (cr, 3);
122             cairo_restore (cr);
123         cairo_restore (cr);
124         draw_caption (cr, captions[7].c_str ());
125         if (t >= SCENE6 + 32) { // blood
126             cairo_save (cr);
127             cairo_translate (cr, 200, 100);
128             draw_image (cr, 4);
129             cairo_restore (cr);
130         }
131     }
```

```
132     else {
133         static int fdx = 0;
134         draw_image (cr, 2);
135         cairo_save (cr);    // fox
136             cairo_translate (cr, 565 + fdx, -714);
137             cairo_scale (cr, -2, 2);
138             draw_fox (cr);
139         cairo_restore (cr);
140         draw_caption (cr, captions[8].c_str ());
141         cairo_save (cr);    // blood
142             cairo_translate (cr, 200, 100);
143             draw_image (cr, 4);
144         cairo_restore (cr);
145         fdx -= 2;
146     }
147 }
```

cs102 Project : Implementation : draw_caption.cpp

```
1  #include "project.h"
2
3  void draw_caption (cairo_t* cr, const char* line1, const char* line2) {
4      draw_caption_background (cr);
5      draw_caption_text (cr, line1, line2);
6  }
```

cs102 Project : Implementation : draw_caption_background.cpp

```
1  #include "project.h"
2
3  void draw_caption_background (cairo_t* cr) {
4      double xpos = 0; double ypos = 500;
5      cairo_device_to_user (cr, &xpos, &ypos);
6      double dx = 800; double dy = 100;
7      cairo_device_to_user_distance (cr, &dx, &dy);
8      cairo_set_source_rgb (cr, 0, 0, 0);
9      cairo_rectangle (cr, xpos, ypos, dx, dy);
10     cairo_fill (cr);
11 }
```

cs102 Project : Implementation : draw_caption_text.cpp

```
1  #include "project.h"
2
3  void draw_caption_text (cairo_t* cr, const char* line1, const char* line2) {
4      cairo_text_extents_t extents;
5      cairo_set_source_rgb (cr, 1, 1, 1);
6      cairo_select_font_face (cr, "Georgia", CAIRO_FONT_SLANT_NORMAL, CAIRO_FONT_WEIGHT_BOLD);
7      cairo_set_font_size (cr, 24);
8      int line1Height = 100;
9      if (std::string(line2) != "") {
10         cairo_text_extents (cr, line2, &extents);
11         cairo_move_to (cr, (800 - extents.width) / 2, 570 + (50 - extents.height) / 2);
12         cairo_show_text (cr, line2);
13         line1Height = 50;
14     }
15     cairo_text_extents (cr, line1, &extents);
16     cairo_move_to (cr, (800 - extents.width) / 2, 520 + (line1Height - extents.height) / 2);
17     cairo_show_text (cr, line1);
18 }
```

cs102 Project : Implementation : draw_sand_mites.cpp

```
1  #include "project.h"
2
3  void draw_sand_mites (cairo_t* cr)
4  {
5      static int m = 0;
6      double angle = 2 * PI;
7      cairo_set_source_rgb (cr, 0, 0, 0); // black paint
8      cairo_arc (cr, 0 + m, 0, 4, 0, angle);
9      cairo_fill (cr);
10     cairo_arc (cr, 19 + m, 10, 4, 0, angle);
11     cairo_fill (cr);
12     cairo_arc (cr, 0 + m, 15, 4, 0, angle);
13     cairo_fill(cr);
14     cairo_arc (cr, 30 + m, 32, 4, 0, angle);
15     cairo_fill (cr);
16     cairo_arc (cr, 20 + m, 25, 4, 0, angle);
17     cairo_fill (cr);
18     cairo_arc (cr, 40 + m, 17, 4, 0, angle);
19     cairo_fill (cr);
20     cairo_set_source_rgb (cr, 0.36, 0.25, 0.2); // brown paint
21     cairo_arc (cr, 24 + m, 45, 4, 0, angle);
22     cairo_fill (cr);
23     cairo_arc (cr, 30 + m, 0, 4, 0, angle);
24     cairo_fill (cr);
25     cairo_arc (cr, 40 + m, 36, 4, 0, angle);
26     cairo_fill (cr);
27     cairo_arc (cr, 50 + m, 55, 4, 0, angle);
28     cairo_fill (cr);
29     cairo_arc (cr, 0 + m, 30, 4, 0, angle);
30     cairo_fill (cr);
31     cairo_arc (cr, 50 + m, 15, 4, 0, angle);
32     cairo_fill (cr);
33     m = (m + 2) % 4;
34 }
```

cs102 Project : Implementation : draw_crab.cpp

```
1  #include "project.h"
2
3  void draw_crab(cairo_t* cr, int faceNum)
4  {
5      const int HEIGHT = 600;
6      int x = -25;int y = 550;int r = 40;
7      int a1 = 0; double a2 = 2*PI;
8      cairo_set_source_rgb(cr,.184,0.310,.310);
9      cairo_arc(cr,x+25,HEIGHT-y-50,r,a1,a2);
10     cairo_fill(cr);//body
11     draw_crab_legs(cr,x,y,r,a1,a2);
12     draw_crab_pincer(cr,x,y);
13     if (faceNum == 0) {
14         draw_crab_face(cr,x,y,r,a1,a2);
15     }
16     else if (faceNum == 1) {
17         draw_crab_sadface(cr,x,y,r,a1,a2);
18     }
19     else {
20         draw_crab_exciteface(cr,x,y,r,a1,a2);
21     }
22 }
```

cs102 Project : Implementation : draw_crab_face.cpp

```
1  #include "project.h"
2  void draw_crab_face(cairo_t* cr, int x, int y, int r, int a1, double a2)
3  {
4      const int HEIGHT = 600;
5      cairo_set_source_rgb(cr,1,1,.310);
6      cairo_arc(cr,x+45,HEIGHT-(y+60),r-35,a1,a2);
7      cairo_arc(cr,x+5,HEIGHT-(y+60),r-35,a1,a2); //eyes
8
9      cairo_scale(cr,1,0.6);
10     cairo_move_to(cr,x+5,(HEIGHT-(y+40))*1.6667);
11     cairo_arc(cr,x+25,(HEIGHT-(y+40))*1.6667,r-15,0,a2/2);// mouth
12
13     cairo_close_path(cr);
14     cairo_fill(cr);
15     cairo_stroke(cr);
16
17 }
```

cs102 Project : Implementation : draw_crab_legs.cpp

```
1  #include "project.h"
2  void draw_crab_legs(cairo_t* cr, int x, int y, int r, int a1, double a2)
3  {
4      const int HEIGHT = 600;
5      cairo_set_source_rgb(cr,.184,0.310,.310);
6      cairo_move_to(cr,x+2,HEIGHT-(y+25));
7      cairo_line_to(cr,x+2-25,HEIGHT-(y+25-5));
8      cairo_arc(cr,x+2-80,HEIGHT-(y+25-10),r,0.25,0.25);
9      cairo_line_to(cr,x+2-25,HEIGHT-(y+25-10));
10     cairo_line_to(cr,x+2,HEIGHT-(y+25-7));//left leg
11
12     cairo_move_to(cr,x+2,HEIGHT-(y+40));
13     cairo_line_to(cr,x+2-25,HEIGHT-(y+40-2));
14     cairo_arc(cr,x+2-80,HEIGHT-(y+40-2),r,0.25,0.25);
15     cairo_line_to(cr,x+2-25,HEIGHT-(y+40-7));
16     cairo_line_to(cr,x+2,HEIGHT-(y+40-7));//left leg
17
18     cairo_move_to(cr,x-5,HEIGHT-(y+55));
19     cairo_line_to(cr,x-3-25,HEIGHT-(y+55-2));
20     cairo_arc(cr,x-3-80,HEIGHT-(y+55-2),r,0.25,0.25);
21     cairo_line_to(cr,x-3-25,HEIGHT-(y+55-7));
22     cairo_line_to(cr,x-3,HEIGHT-(y+55-7));//left leg
23
24     cairo_move_to(cr,x+48,HEIGHT-(y+25));
25     cairo_line_to(cr,x+48+25,HEIGHT-(y+25-5));
26     cairo_arc_negative(cr,x+48+2,HEIGHT-(y+25-10),r,0.25,0.25);
27     cairo_line_to(cr,x+48+25,HEIGHT-(y+25-10));
28     cairo_line_to(cr,x+48,HEIGHT-(y+25-7));//right leg
```

cs102 Project : Implementation : draw_crab_legs.cpp

```
30      cairo_move_to(cr,x+50,HEIGHT-(y+40));
31      cairo_line_to(cr,x+50+25,HEIGHT-(y+40-5));
32      cairo_arc_negative(cr,x+50+2,HEIGHT-(y+40-10),r,0.25,0.25);
33      cairo_line_to(cr,x+50+25,HEIGHT-(y+40-10));
34      cairo_line_to(cr,x+50,HEIGHT-(y+40-7));//right leg
35
36      cairo_move_to(cr,x+53,HEIGHT-(y+55));
37      cairo_line_to(cr,x+53+25,HEIGHT-(y+55-5));
38      cairo_arc_negative(cr,x+53+2,HEIGHT-(y+55-10),r,0.25,0.25);
39      cairo_line_to(cr,x+53+25,HEIGHT-(y+55-10));
40      cairo_line_to(cr,x+53,HEIGHT-(y+55-7));//right leg
41
42      cairo_close_path(cr);
43      cairo_fill(cr);
44      cairo_stroke(cr);
45  }
```

cs102 Project : Implementation : draw_crab_pincer.cpp

```
1  #include "project.h"
2  void draw_crab_pincer(cairo_t* cr, int x, int y)
3  {
4      const int HEIGHT = 600;
5      cairo_set_source_rgb(cr,.184,0.310,.310);
6      cairo_move_to(cr,x,HEIGHT-(y+70));
7      cairo_line_to(cr,x-25,HEIGHT-(y+70+5));
8      cairo_line_to(cr,x-27,HEIGHT-(y+70+28));
9      cairo_line_to(cr,x-31,HEIGHT-(y+70+44));
10     cairo_line_to(cr,x-30,HEIGHT-(y+70+47));
11     cairo_line_to(cr,x-26,HEIGHT-(y+70+35));
12     cairo_line_to(cr,x-20,HEIGHT-(y+70+43));
13     cairo_line_to(cr,x-22,HEIGHT-(y+70+28));
14     cairo_line_to(cr,x-22,HEIGHT-(y+70+7));
15     cairo_line_to(cr,x+2,HEIGHT-(y+70+6)); //left pincer
16
17     cairo_move_to(cr,x+48,HEIGHT-(y+70));
18     cairo_line_to(cr,x+48+25,HEIGHT-(y+70+5));
19     cairo_line_to(cr,x+48+27,HEIGHT-(y+70+28));
20     cairo_line_to(cr,x+48+31,HEIGHT-(y+70+44));
21     cairo_line_to(cr,x+48+30,HEIGHT-(y+70+47));
22     cairo_line_to(cr,x+48+26,HEIGHT-(y+70+35));
23     cairo_line_to(cr,x+48+20,HEIGHT-(y+70+43));
24     cairo_line_to(cr,x+48+22,HEIGHT-(y+70+28));
25     cairo_line_to(cr,x+48+22,HEIGHT-(y+70+7));
26     cairo_line_to(cr,x+48-2,HEIGHT-(y+70+6)); //left pincer
27
28     cairo_close_path(cr);
29     cairo_fill(cr);
30     cairo_stroke(cr);
31
32 }
```

cs102 Project : Implementation : draw_crab_sadface.cpp

```
1  #include "project.h"
2  void draw_crab_sadface(cairo_t* cr, int x, int y, int r, int a1, double a2)
3  {
4      const int HEIGHT = 600;
5      cairo_set_source_rgb(cr,.3,1,.310);
6      cairo_arc(cr,x+45,HEIGHT-(y+60),r-35,a1,a2);
7      cairo_arc(cr,x+5,HEIGHT-(y+60),r-35,a1,a2); //eyes
8
9      cairo_scale(cr,1,0.6);
10     cairo_move_to(cr,x+5,(HEIGHT-(y+30))*1.6667);
11     cairo_arc_negative(cr,x+25,(HEIGHT-(y+30))*1.6667,r-15,0,a2/2);// mouth
12
13     cairo_close_path(cr);
14     cairo_fill(cr);
15     cairo_stroke(cr);
16
17 }
```

cs102 Project : Implementation : draw_crab_exciteface.cpp

```
1  #include "project.h"
2  void draw_crab_exciteface(cairo_t* cr, int x, int y, int r, int a1, double a2)
3  {
4      const int HEIGHT = 600;
5      cairo_set_source_rgb(cr,1,0.310,.310);
6      cairo_arc(cr,x+45,HEIGHT-(y+60),r-35,a1,a2);
7      cairo_arc(cr,x+5,HEIGHT-(y+60),r-35,a1,a2); //eyes
8
9      cairo_move_to(cr,x+5,(HEIGHT-(y+40)));
10     cairo_arc(cr,x+25,(HEIGHT-(y+40)),r-30,0,a2);// mouth
11
12     cairo_close_path(cr);
13     cairo_fill(cr);
14     cairo_stroke(cr);
15
16 }
```

cs102 Project : Implementation : draw_fox.cpp

```
1  #include "project.h"
2
3  void draw_fox(cairo_t* cr)
4  {
5      static int legs = 0;
6      cairo_set_source_rgb(cr,1,0,0);
7      int x = 100;  int y = 100;  int r = 20;
8      draw_fox_body(cr,x,y,r);
9      // draw_fox_legs(cr,x,y,r);
10     if (legs < 2) draw_2_fox_legs (cr, x, y, r);
11     else draw_3_fox_legs (cr, x, y, r);
12     legs = (legs + 1) % 4;
13 }
```

cs102 Project : Implementation : draw_fox_body.cpp

```
1  #include "project.h"
2
3  void draw_fox_body(cairo_t* cr, int x, int y, int r)
4  {
5      const int HEIGHT = 600;
6      int a1 = 0;  double a2 = PI * 2;
7
8      cairo_move_to(cr,x+20,HEIGHT-y+15);
9      cairo_line_to(cr,x-50,HEIGHT-y+15);
10     cairo_line_to(cr,x-53,HEIGHT-y+18);
11     cairo_line_to(cr,x-53,HEIGHT-y+40);
12     cairo_line_to(cr,x-6,HEIGHT-y+40);
13     cairo_line_to(cr,x+8,HEIGHT-y+30);
14     cairo_move_to(cr,x+20,HEIGHT-y+18);
15     cairo_fill(cr);//body
16
17     cairo_arc(cr,x+25,HEIGHT-y,r,a1,a2);
18     cairo_fill(cr);//face
19
20     cairo_arc(cr,x+25,HEIGHT-(y+r/2),r/10,a1,a2);
21     cairo_arc(cr,x+35,HEIGHT-(y+r/2),r/10,a1,a2);
22     cairo_set_source_rgb(cr,0,0,0);
23     cairo_fill(cr);//eyes
24
25     cairo_move_to(cr,x+20,HEIGHT-y-15);
26     cairo_line_to(cr,x+6,HEIGHT-y-30);
27     cairo_line_to(cr,x+5,HEIGHT-y);
28     cairo_set_source_rgb(cr,0,0,0);
29     cairo_fill(cr);//left ear
```

cs102 Project : Implementation : draw_fox_body.cpp

```
31      cairo_move_to(cr,x+32,HEIGHT-y-15);
32      cairo_line_to(cr,x+20,HEIGHT-y-32);
33      cairo_line_to(cr,x+18,HEIGHT-y-17);
34      cairo_set_source_rgb(cr,0,0,0);
35      cairo_fill(cr);//right ear
36
37      cairo_move_to(cr,x+38,HEIGHT-y-2);
38      cairo_line_to(cr,x+58,HEIGHT-y-2);
39      cairo_line_to(cr,x+58,HEIGHT-y+3);
40      cairo_line_to(cr,x+28,HEIGHT-y+21);
41      cairo_fill(cr);//mouth
42
43      cairo_move_to(cr,x-52,HEIGHT-y+17);
44      cairo_line_to(cr,x-60,HEIGHT-y+7);
45      cairo_line_to(cr,x-60,HEIGHT-y-10);
46      cairo_line_to(cr,x-50,HEIGHT-y-10);
47      cairo_line_to(cr,x-50,HEIGHT-y+7);
48      cairo_fill(cr);
49      cairo_move_to(cr,x-60,HEIGHT-y-10);
50      cairo_line_to(cr,x-58,HEIGHT-y-17);
51      cairo_line_to(cr,x-50,HEIGHT-y-10);
52      cairo_set_source_rgb(cr,1,0,0);
53      cairo_fill(cr);//tail
54  }
```

cs102 Project : Implementation : draw_2_fox_legs.cpp

```
1  #include "project.h"
2
3  void draw_2_fox_legs(cairo_t* cr, int x, int y, int r)
4  {
5      const int HEIGHT = 600;
6      int a1 = 0;  double a2 = PI * 2;
7
8      cairo_arc(cr,x-48,HEIGHT-y+40,r/4,a1,a2);
9      cairo_set_source_rgb(cr,1,0,0);
10     cairo_fill(cr);
11     cairo_move_to(cr,x-53,HEIGHT-y+40);
12     cairo_line_to(cr,x-53,HEIGHT-y+58);
13     cairo_line_to(cr,x-43,HEIGHT-y+58);
14     cairo_line_to(cr,x-43,HEIGHT-y+40);
15     cairo_fill(cr);
16     cairo_arc(cr,x-48,HEIGHT-y+58,r/4,a1,a2);
17     cairo_fill(cr); //front left leg
18
19     cairo_arc(cr,x-1,HEIGHT-y+40,r/4,a1,a2);
20     cairo_set_source_rgb(cr,1,0,0);
21     cairo_fill(cr);
22     cairo_move_to(cr,x-6,HEIGHT-y+40);
23     cairo_line_to(cr,x-6,HEIGHT-y+58);
24     cairo_line_to(cr,x+4,HEIGHT-y+58);
25     cairo_line_to(cr,x+4,HEIGHT-y+40);
26     cairo_fill(cr);
27     cairo_arc(cr,x-1,HEIGHT-y+58,r/4,a1,a2);
28     cairo_fill(cr); //front right leg
29 }
```

cs102 Project : Implementation : draw_3_fox_legs.cpp

```
1  #include "project.h"
2
3  void draw_3_fox_legs(cairo_t* cr, int x, int y, int r)
4  {
5      const int HEIGHT = 600;
6      int a1 = 0;  double a2 = 2 * PI;
7
8      cairo_arc(cr,x-48,HEIGHT-y+40,r/4,a1,a2);
9      cairo_set_source_rgb(cr,1,0,0);
10     cairo_fill(cr);
11     cairo_move_to(cr,x-52,HEIGHT-y+37);
12     cairo_line_to(cr,x-61,HEIGHT-y+53);
13     cairo_line_to(cr,x-52,HEIGHT-y+59);
14     cairo_line_to(cr,x-44,HEIGHT-y+43);
15     cairo_fill(cr);
16     cairo_arc(cr,x-57,HEIGHT-y+56,r/4,a1,a2);
17     cairo_fill(cr); //front left leg
18
19     cairo_arc(cr,x-1,HEIGHT-y+40,r/4,a1,a2);
20     cairo_set_source_rgb(cr,1,0,0);
21     cairo_fill(cr);
22     cairo_move_to(cr,x-6,HEIGHT-y+40);
23     cairo_line_to(cr,x+1,HEIGHT-y+56);
24     cairo_line_to(cr,x+10,HEIGHT-y+51);
25     cairo_line_to(cr,x+3,HEIGHT-y+35);
26     cairo_fill(cr);
27     cairo_arc(cr,x+5,HEIGHT-y+54,r/4,a1,a2);
28     cairo_fill(cr); //front right leg
29 }
```

cs102 Project : Implementation : draw_title_page.cpp

```
1  #include "project.h"
2
3  void draw_title_page (cairo_t* cr) {
4      cairo_set_source_rgb (cr, 0, 0, 0);
5      cairo_rectangle (cr, 100, 100, 600, 300);
6      cairo_fill (cr);
7
8      cairo_set_source_rgb (cr, 1, 1, 1);
9      cairo_select_font_face (cr, "Georgia", CAIRO_FONT_SLANT_NORMAL, CAIRO_FONT_WEIGHT_BOLD);
10     cairo_set_font_size (cr, 36);
11     cairo_move_to (cr, 175, 150);
12     cairo_show_text (cr, "The Fox and the Crab");
13     cairo_set_font_size (cr, 24);
14     cairo_move_to (cr, 350, 200);
15     cairo_show_text (cr, "By");
16     cairo_move_to (cr, 150, 250);
17     cairo_show_text (cr, "Alex Nguyen, Alexander Shtov");
18     cairo_move_to (cr, 150, 275);
19     cairo_show_text (cr, "Jiajun Liang, and Raymond Zerulla");
20 }
```

```
1  #include <config.h>
2  #include <FL/Fl_Cairo_Window.H>
3  #include <string>
4
5  const double PI = 3.14159265358979323846;
6  enum SCENE {SCENE1 = 1, SCENE2 = 60, SCENE3 = 180, SCENE4 = 320, SCENE5 = 420, SCENE6 = 560, SCENE7 = 640, SCENE8 = 720};
7  const std::string captions[9] = {"A Crab one day grew disgusted with", \
8                                   "the sands in which he lived.", \
9                                   "He decided to take a stroll to the meadow not far inland.", \
10                                  "There he would find better fare", \
11                                  "than briny water and sand mites.", \
12                                  "So off he crawled to the meadow.", \
13                                  "But there a hungry Fox spied him . . .", \
14                                  ". . . and in a twinkling, ate him up, both shell and claw.", \
15                                  "Be content with your lot."};
16 void draw_cb (Fl_Cairo_Window*, cairo_t*);
17 void animate_cb (void*);
18 void draw_image (cairo_t*, int);
19 void draw_caption (cairo_t*, const char*, const char* = "");
20 void draw_caption_background (cairo_t* cr);
21 void draw_caption_text (cairo_t*, const char*, const char*);
22 void draw_sand_mites (cairo_t*);
23 void draw_crab(cairo_t*, int);
24 void draw_crab_exciteface(cairo_t*, int, int, int, int, double);
25 void draw_crab_face(cairo_t*, int, int, int, int, double);
26 void draw_crab_legs(cairo_t*, int, int, int, int, double);
27 void draw_crab_pincer(cairo_t*, int, int);
28 void draw_crab_sadface(cairo_t*, int, int, int, int, double);
29 void draw_fox (cairo_t*);
30 void draw_fox_body (cairo_t*, int, int, int);
31 void draw_fox_legs (cairo_t*, int, int, int);
32 void draw_2_fox_legs (cairo_t*, int, int, int);
33 void draw_3_fox_legs (cairo_t*, int, int, int);
34 void draw_title_page (cairo_t*);
```

cs102 Project : Problems

- Loading PNG images from hard drive every frame caused lag
  - Fixed by loading images only once when the program starts
- Fox, crab, and sand mites were not drawn at the origin originally
  - Crab and sand mites were modified to be drawn at the origin for easy translation
  - Did not have time to fix fox; worked around it
- Repeated problem with vector graphics for some reason having “int a2 = PI * 2”
  - PI is not an integer
  - Caused graphical glitches (lines drawn to other parts of the scene)
  - Fixed by changing all occurences to “double a2 = PI * 2”

cs102 Project : Unimplemented Ideas

- Crab walking animation - didn't realize we did not have a crab animation until the end
- Backgorund pictures of animals- did not like the idea, so was scratched out
- Moving water and sun
- Crab thought bubble in scene 3 - did not have time
- Bush for fox to hide behind - not practical