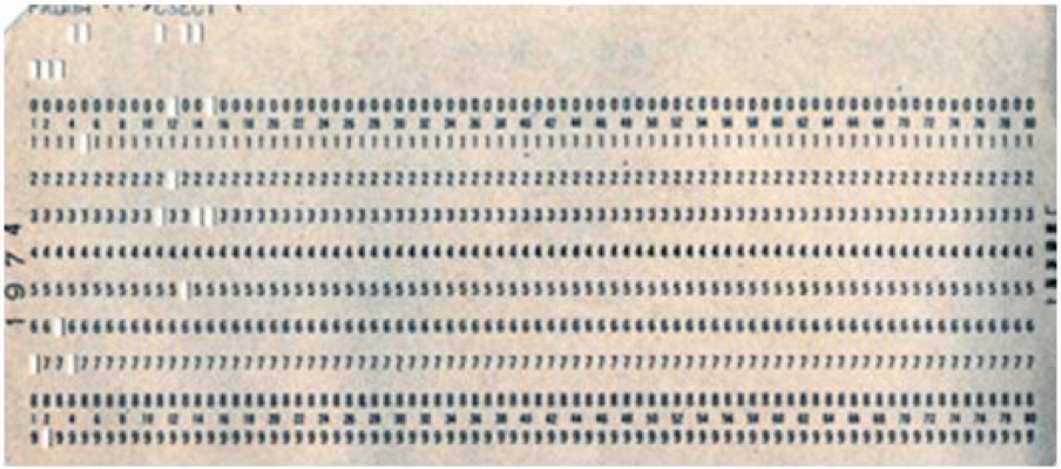
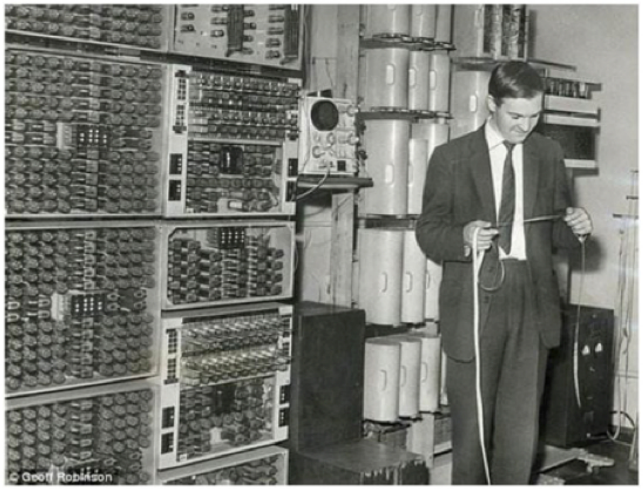
Animal interaction

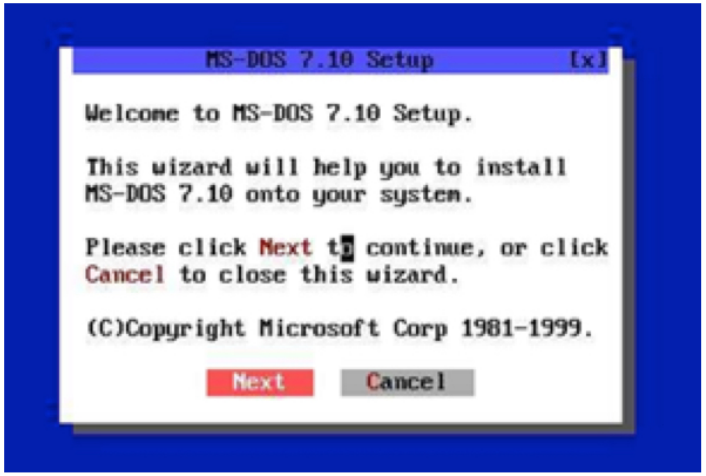
Xinyue Yu

Interaction history





The earliest human-computer interaction is the cassette type. Eniac (1943)



In the mid-1960s, the command line interface appeared, and the way of human-computer interaction became a question-and-answer style. The programmer inputs instructions through the command line interface. After the computer receives the instructions, it sends feedback to the programmer through a single character.

For example: Drawing Machine in 1960s

Ivan Sutherland's SketchPad-1963 PhD

Sophisticated drawing package

introduced many ideas/concepts now found in today's interfaces

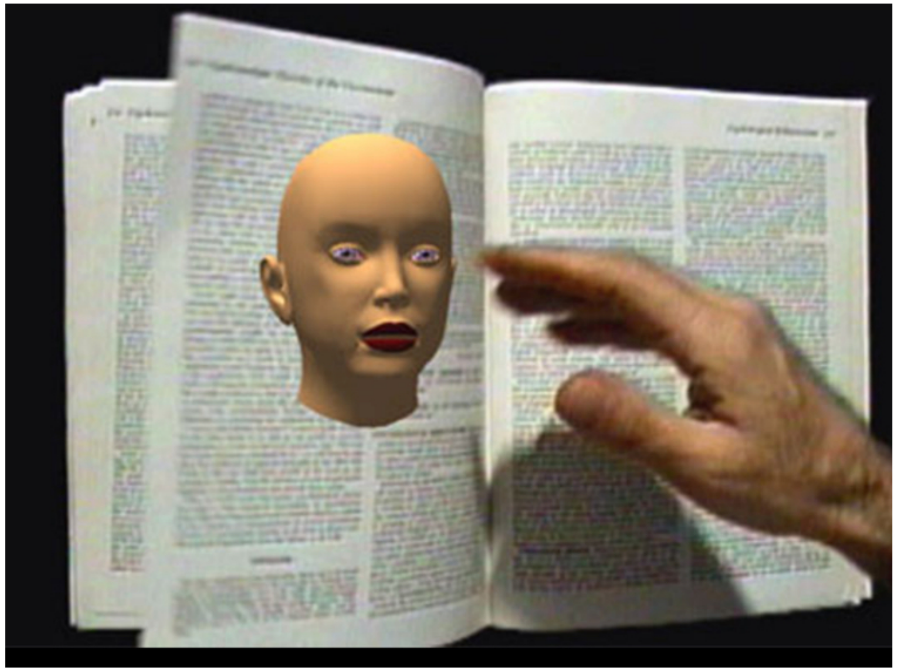
- **hierarchical structures** defined pictures and sub-pictures
- **object-oriented programming**: master picture with instances
- **constraints**: specify details which the system maintains through changes
- **icons**: small pictures that represented more complex items
- **copying**: both pictures and constraints
- **input techniques**: efficient use of light pen
- **world coordinates**: separation of screen from drawing coordinates
- **recursive operations**: applied to children of hierarchical objects

from.https://pages.cpsc.ucalgary.ca/~saul/hci_topics/pdf_files/history.pdf

Now:

graphical user interface interaction
In the stage, the computer is still input and output through the hands and eyes, but the computer receives the input of the user in many forms like touching the screen; and the forms of output to the user are also more and more, like chart/image feedback.

Still developing:
1. Gesture tracking
2. Eye tracking
3. Voice control.
4. Interactive touch
5. Natural interaction, brain-computer interface
6. Body interaction



"Pressure to Speak (House of Cards)“ 2002

My project

The theme of my project is to make a **visual garden that interacts with cats**, which I call the Cat Garden. A beautiful garden existing in a picture frame is projected onto the drab interior wall . And when the **cat walks** into the painting and **touches** the garden image, through the **real-time cat recognition and location tracking technology,** the surveillance camera will calculate the coordinates of the wall location that the cat touches and transmit the **data** to the interactive animation software.

Through the animation software, a virtual flower will be projected into the garden, **sprouting and growing at the location touched by the cat.** The whole growth process of the flower will be represented by stop-motion animation, and finally the flower will become part of the cat garden. In addition to flowers, many things, such as human eyes, butterflies, etc will also appear in this garden, appearing and changing with the cat's touch. All interaction between the cat and the garden will be recorded as the final presentation of the project. I used this whole installation to **build a cat garden in cat's mind.**

My inspiration comes from the situation of cats in different countries. Cats raised in China cannot go outside freely like German cats. They stay in the room for their whole life. When I went to study in Germany, my neighbor asked me why I didn't put the cats in the garden downstairs. I was very surprised because I had never think about such thing in China and I was afraid that the cat would run away. But my cats seem to really like the small garden downstairs. I try to put them in the cat bag and put them in the garden. They make satisfying sounds in the cat bag, so I want to move the garden downstairs to my appartment. Then cats can have a small garden that they can create by themselves in the room.

Some details about my project

Human View
(No UV Sensitivity)

Dog View
(Some UV Sensitivity)

Human's view

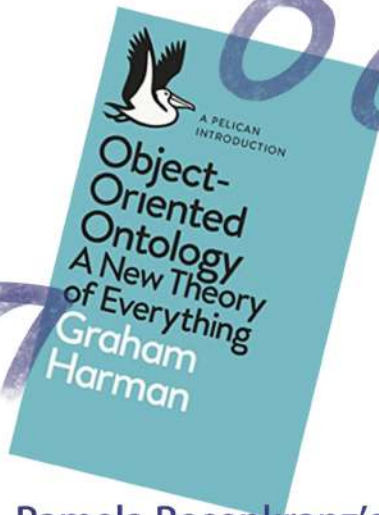
Cat's view

Human's view 120°

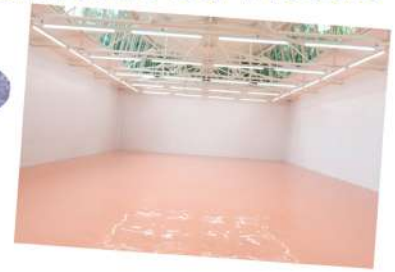
Cat's view 200°

Color

My idea



Pamela Rosenkranz's Our Product



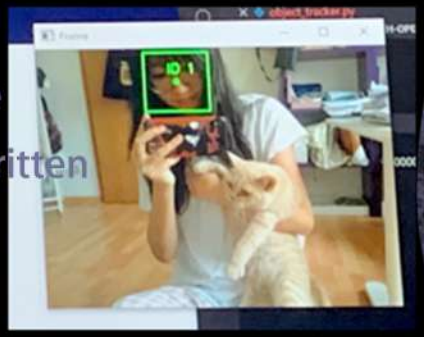
In order to make this installation, first of all I had to understand the vision of cats. I read a lot of research from livescience about cats. In a 2014 article by studying the eyes of a large number of dead animals, I found that cats and dogs, as well as many other mammals, may be able to see ultraviolet light. This means that when our cat is staring at a certain place in the house, there may not be any ghosts there, but because there is a strange light frequency world that you can't see. During the day, cats' eyesight is not so good, but at night it is different. The retina of cat' s eyes is not larger than that of humans, but compared with human eyes, they can collect and percieve abnormally low amounts of light.

Cats have a very superficial understanding of color, but they are definitely not color blind. They can understand blue, green, purple, and yellow. And their dynamic vision and night vision capabilities are very strong

Background with the color of cat's view

I drew the background of the garden from the perspective of cats, and I used the colors which the cats can see.

Then I had to work on cat recognition and real-time tracking technology. I used a camera to detect the target wall area in real time, and if the cat was very close to or touching the wall, the cat's movement was detected and information about the position of its head or paw was fed into the computer and used to generate an interactive animation. I used a deep neural network to identify the cat in the live video and track it in real time using object-tracking technology to output the location data. The whole software was written in python.

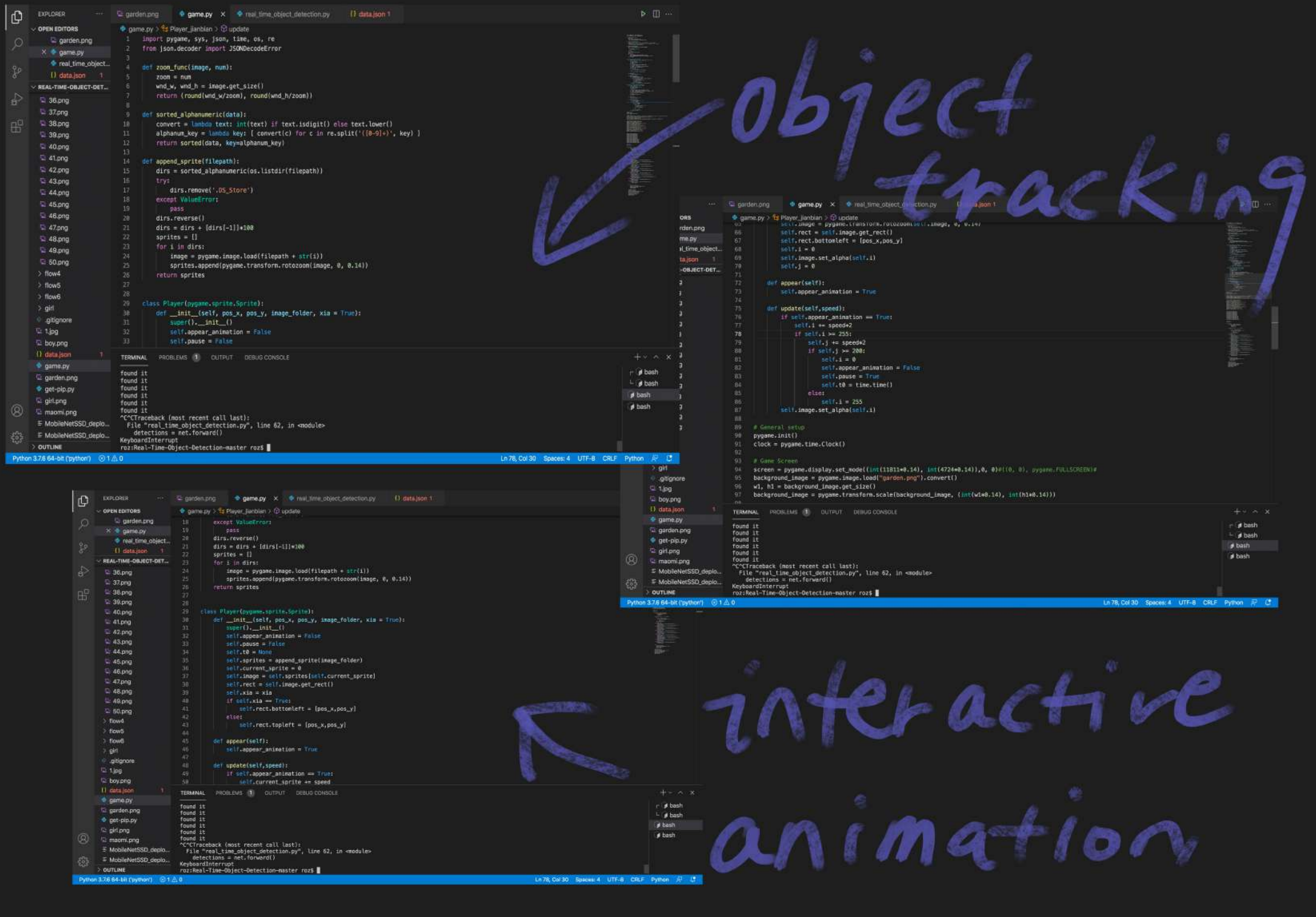


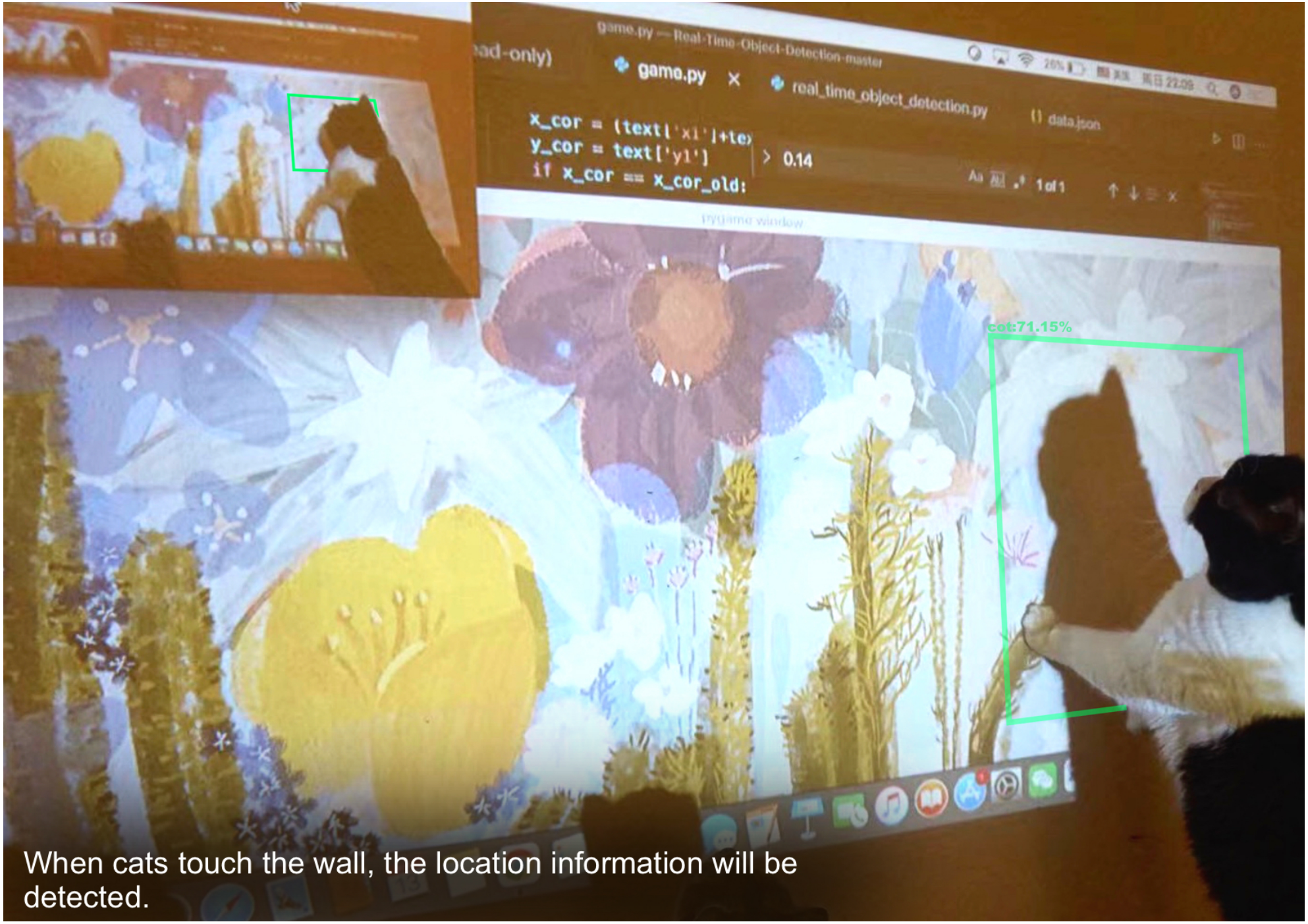
The tracking program using the neural network for detecting human faces

Human

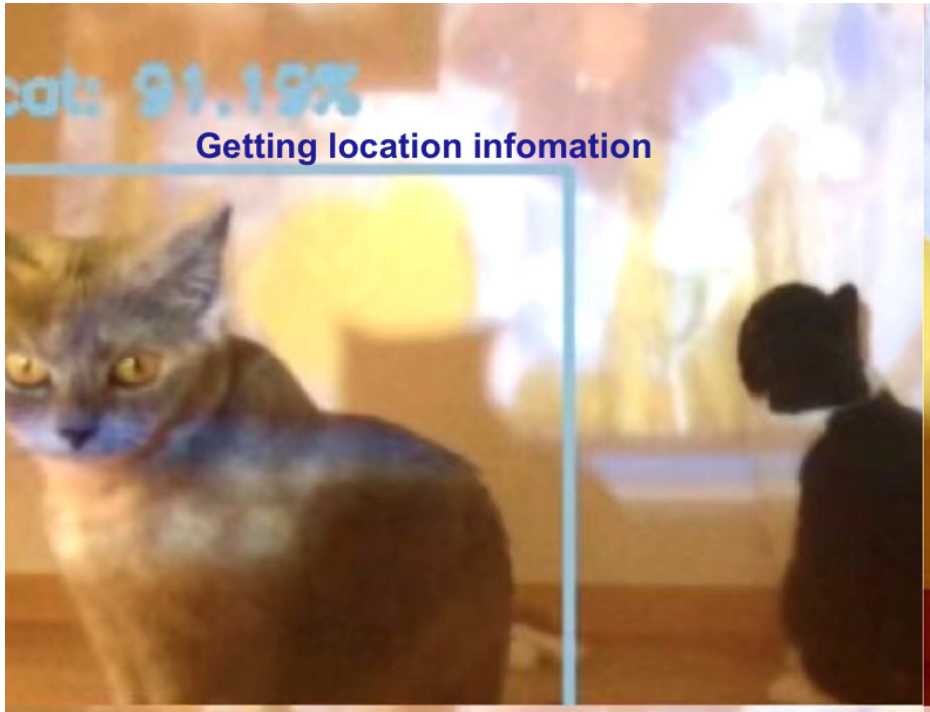
Cat

The tracking program using the neural network for detecting cats


object tracking
interactive animation



When cats touch the wall, the location information will be detected.



Getting location infomation

When the back of cats touch the wall, the specific animation appears in the corresponding area


Cats can design/build their own garden as they like based on this technology
I created interactive animation software and drew a frame-by-frame animation of each interactive element, then I combined the previous location data and created an interactive animation software in python so that these elements could be triggered by interaction and generated in the cat's garden.
When cats touch the flower, the flower will grow and sprout, and the other creatures hidden in the garden will appear as well. Cats can control their own digital garden.
Now according to my study, I can only track the movement of their body and the contact of the body, but not the touch of front paw. I am still trying.

Problem

The first thing was that I wanted to do too much interactive design, but I **drew too slowly.** This was the most troublesome thing for me.
on the other hand, In the process of proceeding, I encountered technical difficulties when passing real-time tracking location data to the interactive animation program. This is because the flowers in the garden needed the cat to actually interact with the wall projection before they could bloom. To achieve such an effect, it was necessary to control the **video detection range.**

For example
– If the cat could be detected when it was lying on the ground or not close to the wall, the interaction was lost (too easy to be detected)
– The cat could only be detected when most of its body appeared, so the detection range could not be too small. Because if only the head/paw that entered the projection was detected, the detector could not determine that the target object was a cat. Only when most of the cat's body was seen, the system could automatically identify the target as a cat and thus output the position data. So body parts that did not enter the projected wall also needed to be detected.

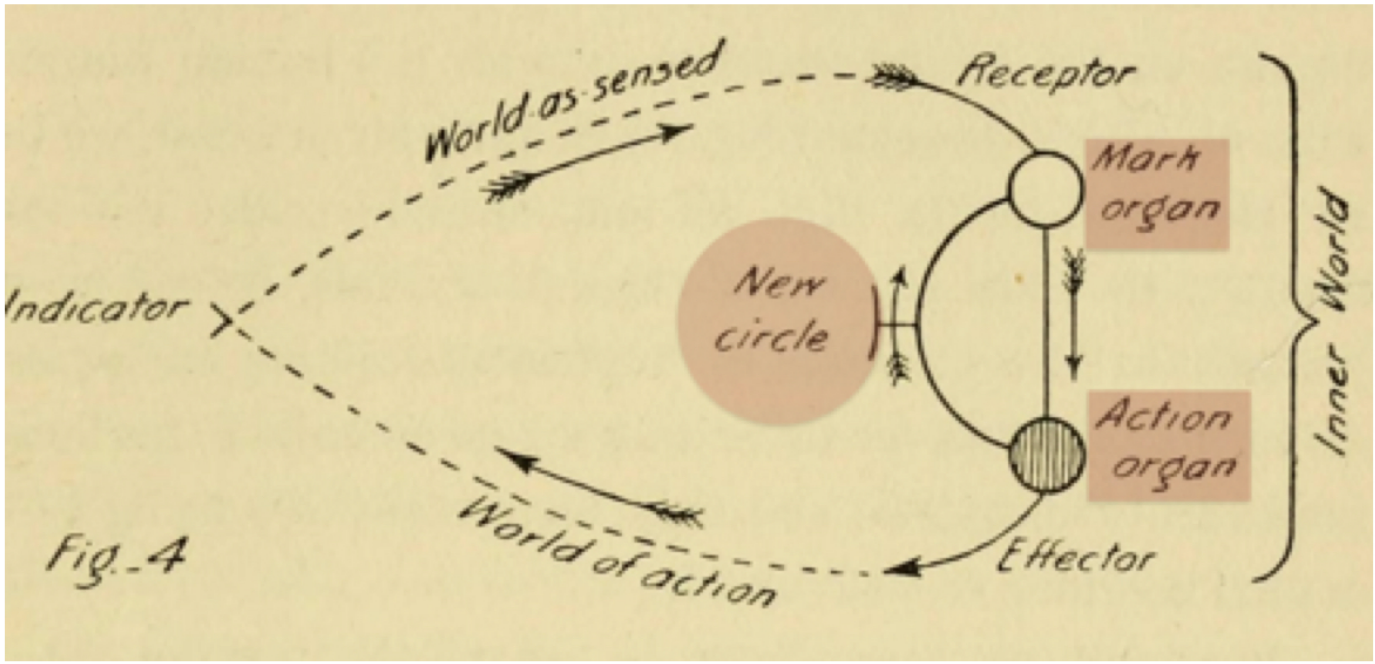
So the lowest position of the camera detection area was experimentally determined to be X cm above the ground.

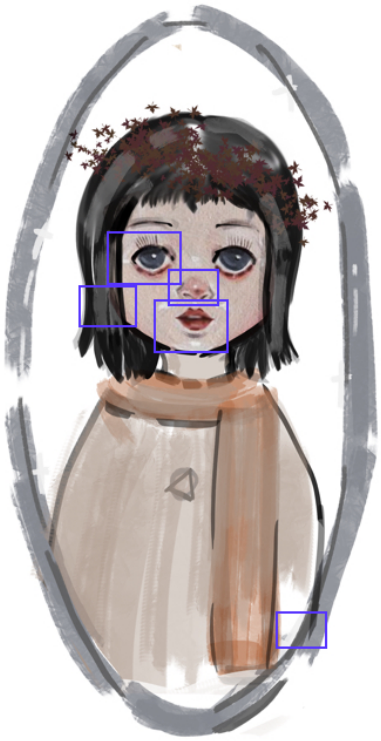
To choose the library for programming is difficult. After a lot of trying I choose OpenCV for detecting and Pygame for interactive animation.

Interactive Plant Growing
an interactive computer installation

1992, Christa Sommerer & Laurent Mignonneau

Explanation of cats interaction with Uexkülls Biosemantic Feedback Circle





Later the development of my installation is according to the senses of cats. From the feedback circle we find out that the inner world of cats is similar to a lot of animals.
The action organs of cats are tails, legs, and mouths.
The mark organs are eyes, ears, noses, tongues, skin and beards.
The key element for building the new circle is: The movement of legs and tails will allocate the new position of cats and get new sense of touch; beards will feel the new postion, and the skin will feel the stimulus from the outside world; the tongues will taste new flavors. Depending of these feelings their action organs will give reaction again.