

Title of the work  
Cangjie

Year  
2020

Authors  
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Medium:  
Interactive Projections  
Virtual Reality Experience

Dimension of the work  
TBD

Artwork website:  
[www.zhangweidi.com/cangjie](http://www.zhangweidi.com/cangjie)



## Project Description

Humans and machines are in constant conversations. Humans start the dialogue by using programming languages that will be compiled to binary digits that machines can interpret. However, Intelligent machines today are not only observers of the world, but they also make their own decisions. If A.I imitates human beings to create a symbolic system to communicate based on their own understandings of the universe and start to actively interact with us, how will this recontextualize and redefine our coexistence in this intertwined reality? To what degree can the machine enchant us in curiosity and enhance our expectations of a semantic meaning-making process?

Cangjie provides a data-driven interactive spatial visualization in semantic human-machine reality. The visualization is generated by an intelligent system in real-time through perceiving the real-world via a camera ( located in the exhibition space ). Inspired by Cangjie, an ancient Chinese legendary historian (c.2650 BCE), who invented Chinese characters based on the characteristics of everything on the earth, we trained a neural network, we have named Cangjie, to learn the constructions and principles of all the Chinese characters. It transforms what it perceives into a collage of unique symbols made of Chinese strokes. The symbols produced through the lens of Cangjie, tangled with the imagery captured by the camera, are visualized algorithmically as abstracted, pixelated semiotics, continuously evolving and composing an ever-changing poetic virtual reality.

## Methodology

The methodology of Cangjie consists of three aspects:

### 1.Intelligent System Design.

To convert images to Chinese strokes we use unsupervised learning techniques to model Chinese characters. The learned model is then used to create novel characters based on details in the images. We trained a neural network (named Cangjie) to learn from vector stroke data of over 9000 Chinese characters by using the Bidirectional Generative Adversarial Network (BiGAN) architecture. After successful training, the discriminator and the encoder/generator reach a stable state like a Nash Equilibrium. The network learns a low-dimensional latent representation of these images. Thus, when the live streaming of the real world is processed by the system, the encoder network can produce its latent representation. Then the generator network can reconstruct the image and generate novel symbols based on the given latent representation. The novel symbols are constructed by Chinese strokes but they are not carry specific meanings.

### 2. Experimental Visualization Using Neural Network Generated Image Data.

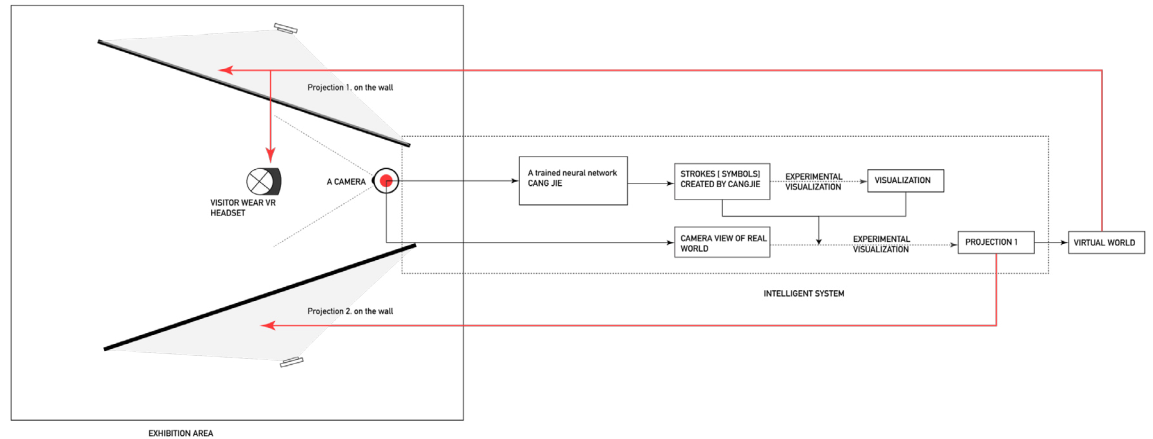
The image data is firstly manipulated with image processing techniques ( image differencing and alpha compositing ), filter design, and data transformation. Then we used OpenGL shading language (GLSL) to relocate the pixels from real-world texture to a position determined by the image generated by Cangjie. The data of RGBA channels of capture through live streaming will be used to control the movements of pixels. The goal is to create an effect like ink flow that is consistently writing new symbols that Cangjie generated in real time based on the live streaming texture.

### 3. Spatial Visualization in Virtual Reality Space Using Image Data.

The experimental visualization is used as data input to compose a virtual reality space. The data-driven world building strategies mainly consist of two parts: 1. Algorithmic Virtual World Composition: multiple mathematical algorithms are implemented to create a world structure, including the Voronoi diagram (sparse). 2. Texture Development: data-driven abstract patterns and forms are visualized to compose the world by dynamically using arrays of lines, points, curves, photogrammetry point clouds, image data-driven agency, and other image processing techniques.

The described approaches result in the two interactive projections: 1. An experimental visualization of Cangjie writing novel symbols based on its interpretation of surroundings. 2. A real-time VR projection of a virtual world constructed with the novel symbols Cangjie creates.

#### System Diagram



#### User Interaction

The user interaction is realized in two ways. Firstly, a camera is set in the center of the installation and observes the surroundings. The audiences in the installation will be captured by the camera as live streaming that is processed by Cangjie (the trained neural network) which generates the semiotic visualizations. Secondly, live streaming of the surroundings (including audiences) will be implemented as textures in the VR space and the RGBA channels of this live stream will determine the particle movements and the ink flow directions in the virtual space. The audiences will be able to see themselves captured as textures in VR space and their movements will alter the appearance of the virtual world.

Cangjie is not only a conceptual response to the tension and fragility in the coexistence of humans and machines but also an artistic imagined expression of a future language that reflects on ancient truths, a way to evoke enchantment in this artificial intelligence era. The interactivity of this intelligent visualization prioritizes ambiguity and tension that exist between the actual and the virtual, machinic vision and human perception, and past and future. By providing a visualization of the novel symbols generated by the machine, the human-machine interaction sustains users' curiosity and blurs the boundary between precise data-driven design and pure artistic experience.

#### Technical Requirements

1. A desktop with 6-Core i7 + graphic card 1080 (could be provided by us)
  2. A VR Headset (could be provided by us).
  3. Two HD Projectors or two monitors (depends on the space) / prefer a dark space with a spotlight
  4. A pedestal for placing VR headset
- We are flexible with the space. If the space provided is small, we can only present the first projection and the VR could be only viewed by wearing a headset (without the second projection of a real time VR scene). Given the Covid-19 pandemic situation, we imagine viewers will not want to wear VR devices, we are therefore flexible to only present our first interactive projection.