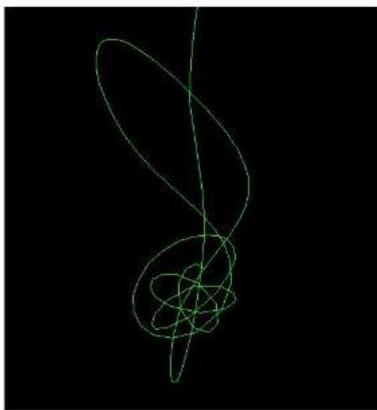


This is a participatory and experiential installation research project examines the possibilities and the outcome through combine magnetic pendulums with Calligraphy writing.

Background

The initiated idea was initiated by Dr. Andreas Schiffler’s experimental project(s) in relation to Magnetic pendulums – a magnetic pendulum bob moving over multiple stationary magnets – are chaos generators. Certain digital images in result was shows the fractal that can be generated by virtually tracing the motion of a pendulum bob to its final resting spot over one of 3 magnets, which is by tracing every possible starting position of the pendulum (the 2D image) and coloring the pixel based on the magnet that is nearest after some time (or when the pendulum stops moving). Even the motion of the pendulum is highly chaotic – that is, one cannot predict the path or final resting spot in many cases – due to the nature of such a dynamic physical system. However, our research team discover the hidden value in terms of aesthetic quality of the path the pendulum show in line shape can be treated as an conceptual calligraphy, which is close to the path of Chinese calligraphy writing. treated as an conceptual calligraphy, which is close to the path of Chinese calligraphy writing. This will be a new directionand the way of this investigation is undervalued and hasn't been discussed and dealt with before.



A



B

(Left: A) Andreas Schiffler’s visualization;
(Right: B) : Chinese character calligraphy: 有 (English: has/have)

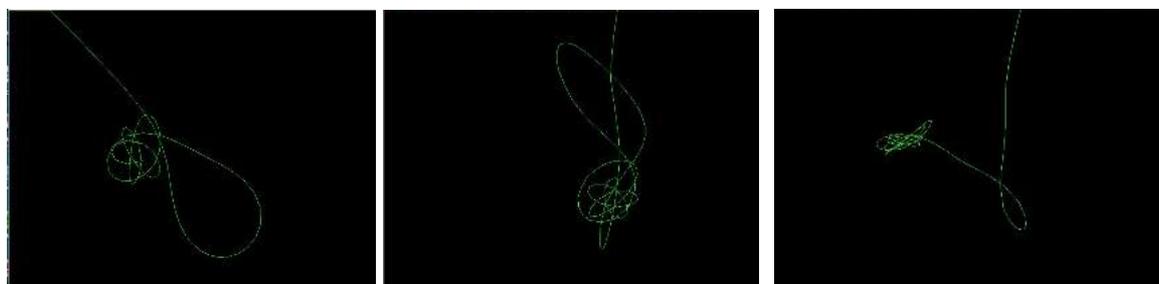
Calligraphy (Character writings), literally “the method or law of writing” is the art of writing in China, and Asia culture, with artistic value in nature. Our research team applied e a pendulum to

calligraphy. The goal is to build a system that acts like a magnetic pendulum system (physically or simulated), and has a mechanism that allows the pendulum to “draw” on demand – an artist controls the starting position of the pendulum and the time when things are being drawn. Magnetic pendulum calligraphy is thus the art of writing with a magnetic pendulum. Figure (1) is a “Photoshop” simulation (middle) of this method against a path (left) to illustrate how this could be visualized.

Research question: Could magnetic pendulums be combined with calligraphy? The question was sparked by Dr. Andreas Schiffler of a magnetic pendulum fractal and the further follow up by Hung Keung who had been working with Chinese characters and calligraphy in his practice.

Research: Magnetic pendulums – a magnetic pendulum bob moving over multiple stationary magnets – are chaos generators. Picture x are the image that shows the fractal that can be generated by virtually tracing the motion of a pendulum bob to its final resting spot over one of 3 magnets. Here are a view video links¹ of a magnetic pendulum in action:

The way the above fractal images are created, is by tracing every possible starting position of the pendulum (the 2D image) and coloring the pixel based on the magnet that is nearest after some time (or when the pendulum stops moving). Here are some images of the path the pendulum can take:



PendulumPath1

PendulumPath2

PendulumPath3

Research: Calligraphy– in general terms – is the art of writing. Asian cultures have used this form of communication for centuries (書法 in Traditional Chinese, literally “the method or law of writing”) and many characters are quite artistic in nature. The idea is now, to apply a pendulum to calligraphy. The goal is to build a system that acts like a magnetic pendulum system (physically or simulated), and has a mechanism that allows the pendulum to “draw” on demand – an artist controls the starting position of the pendulum and the time when things are being drawn. Magnetic pendulum calligraphy is thus the art of writing with a magnetic pendulum.

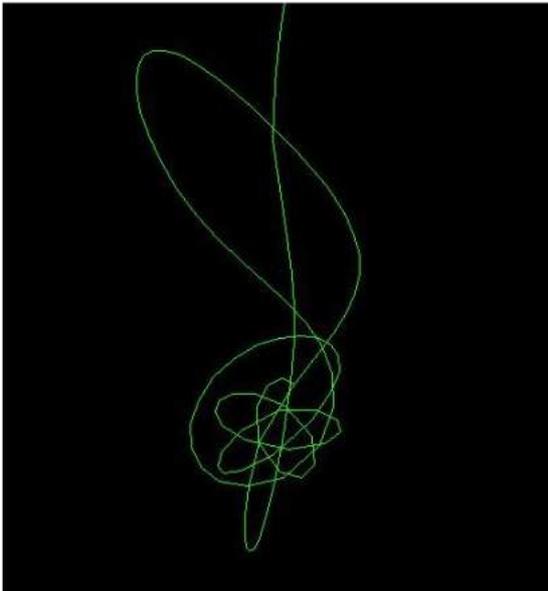
Here is a “Photoshop” simulation (right) of this method against a path (left) to illustrate how this could look like:

¹ <http://www.ferzkopp.net/Videos/Pendulum0.mp4>

<http://www.ferzkopp.net/Videos/Pendulum1.mp4>

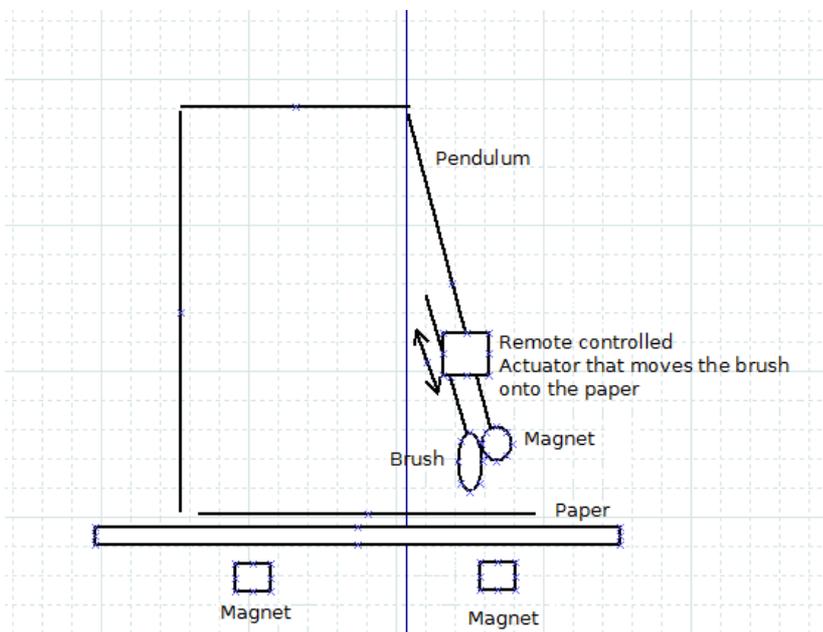
<http://www.ferzkopp.net/Videos/Pendulum2.mp4>

<http://www.ferzkopp.net/Videos/Pendulum3.mp4>



Research: Simulated Magnetic Calligraphy Drawing: Prototype (v.01).

Dr. Andreas Schiffler argued that a physical implementation of such a system would be quite interesting as an experimental playground, as it combines the deliberate action of writing with the chaotic action of the pendulum . The pendulum should probably large enough so the bob swings over a 1x1m base with a paper on it (magnets are below the paper). It would need a brush system that can be lowered by user action or remote control on demand. We entitle this as Prototype (v.01). Something like this:



MagneticPendulumConstructionDiagram: Prototype (v.01).

In Prototype (v.01), the interactions of the artist and calligrapher with the system would proceed in the following way:

- the magnets below the paper can be modified; number of magnets (1 or more) and position
- once the plane magnets are set, the pendulum could be modified (if designed that way) for example in length, weight or strength of magnet
- next the user would need to experiment with the motions of the pendulum – the basic control is the position of where the pendulum is launched from (and theoretically an initial speed) – and follow the path to see if there are interesting patterns
- at this point, the user will find that certain positions are highly stable (always the same path) and others are highly unstable (always random path, unpredictable switch between certain patterns) and that due to the nature of the manual launch which prevents an exact repeat, the whole thing is often a guessing game at this point
- next the user would prepare for painting, maybe with a choice of brush, ink and paper
- then the actual calligraphy would start as the user would swing the pendulum, and would trigger the brush to deposit ink with a remote while the pendulum swings around;
- the attempt to paint different “characters” could be repeated multiple times while the paper is being moved between each attempt in an effort to create a sentence
- the process of depositing ink will cause friction to the pendulum and changes its path – so even if the user had found a starting position that creates an interesting and stable path, once the brush painting is turned on, the path may turn into an unstable path

Creating a 2D simulation could reference to – the magnetic pendulum formula is published ² and the simple “brush on canvas” processing can be triggered using a mouse-click. Something similar has been done before ³, but we found the outcome is not creative and without human interaction since a traditional pendulum makes primarily predictable periodic paths. One could also make a full 3D simulation, but that would require much more work but could be a way to create this system for VR. However, the difference between a simulation and a real physical pendulum are very fundamental, and in my view reality wins.

1. The tactile nature of a physical pendulum is not present in a simulation and very hard to model with current input devices, even in VR.
2. A physical simulation that takes into account the influence of mechanical factors (hinges, friction, air) and the magnetic forces (non-uniform fields, magnet shapes) on the final motion is quite a challenge.
3. To recreate the subtlety of the brush-sliding-over-paper-to-draw, all with stroke subtleties and friction influence on how much ink is deposited, is another difficult simulation problem.
4. The performative nature of an artist writing “pendulum calligraphy” is mostly lost in a simulation.

Research: Making Prototype (v.01).

Dr. Andreas Schiffler designed and made the Prototype (v.01) in 2016 who constructed a magnetic pendulum with movable brush – a simple v1 hack based on his idea for a physics based calligrapher. The basic structure and construction of the model is as follows:

- a ring magnet glued to a vinyl tube as pendulum attached to some fishing line and suspended from a board
- a plywood board with some metal sheets glued to it as magnet base, and a few more rare-earth magnets as attractors
- a acrylic sheet placed flat above the magnets to hold the rice paper

² <http://www.codeproject.com/KB/recipes/MagneticPendulum.aspx?display=Print>

³ Here is a more traditional pendulum painting setup: <http://gizmodo.com/5503600/the-paint-and-the-pendulum>

- a brush suspended from more fishing line with a manual pulley control to lower it onto the paper while the pendulum swings

The steps to use the pendulum were as follows:

1. height align the pendulum
2. setup magnets in a pattern and experiment with pendulum motion
3. cover magnets with acrylic sheet and place paper
4. dip the brush into the ink
5. let pendulum swing and lower brush using the string holding the brush when there are interesting patterns, repeat

Evaluation after Prototype (v.01) making and testing:

- It feels like this thing has potential to make some very interesting graphics. We don't know much about Chinese characters or Calligraphy, so for me this is all just cool physics-inspired "graphics" at the moment.
- The rare-earth magnets can stick together so much, that one needs a putty knife and a lot of force to get them apart. High powered magnets are a must though to scale the pendulum up in size (and a larger scale is needed to lower the pendulum frequency).
- The pendulum in its current v1 size is too fast; it needs to be longer to lower the frequency of the swings.
- The v1 rope construction tangles and the fishing line is too stretchy. To make this work, the pendulum suspension needs to be more rigid.
- The brush control in v1 was too simple and very hard to control. One needs to move the brush height very quickly, because one needs to be able to make short stroke segments to be able to compose characters. One probably needs to use an electro-mechanical linear actuator for good brush control.
- Dr. Andreas tried to compare the paths with the ones from the digital simulation with my pendulum, and it totally did not match. The mechanics of the real pendulum have nothing to do with the simplified simulated physics. However, when building the pendulum, I would have like to have a calibrated simulation to be able to predict what happens when sizes are changed.
- The physical texture of the ink brushed on the paper is so much nicer than the computer images Dr. Andreas tried made in his earlier research.

Result of the Prototype (v.01) testing:



Further idea generation:

1. Could one paint with light onto photo-sensitive paper or using a long-exposure digital camera picture? A light source is the ultimate in toggle “speed” as light can be switched on an off very quickly.
2. the placement of magnets could align with a Chinese character. I only have 5 magnets at the moment, so could take any graphics of a character with 5 marked magnet positions, print it out, and place it on the metal as a template for positioning the magnets.

We then target idea 2, with further implementation with Prototype (v. 02) making.

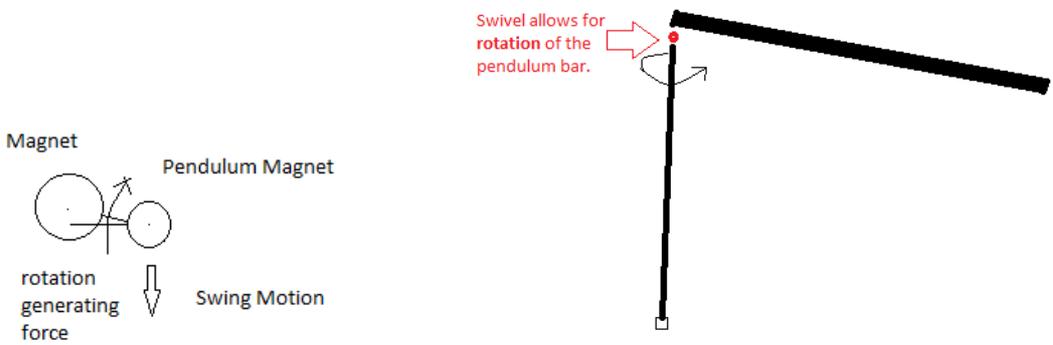


Magnetic Pendulum Calligraphy (v2)

The improved second generation magnetic pendulum calligrapher with electronic remote-control brush. We decided to improve and build “Magnetic Pendulum Calligrapher v2” by adding a RC car servo with controller for about \$80, and re-configuring the pendulum construction and hinge. The final construction and prep shows as follows:



The pendulum uses a 1.2m solid wood rod. I've experimented initially with a suspension made from a bunch of hooks, but settled on a more flexible suspension made from fishing gear so it can rotate when needed. It is one of these physical facts that are omitted from the computer simulation. The magnets have a physical extend, and this causes the pendulum bar to "roll" around its axis in certain configurations.



The result reflected that the model (v.02) worked very well – with the exception of the spinning motion the head tends to develop (see video linked below) since it is not symmetric in weight at all. Still, Dr. Andreas was able to write something that resembles Chinese characters.



A 3min video of the v2 pendulum in action is here:
<http://www.ferzkopp.net/Videos/MagneticPendulumCalligrapherV2.m4v>

Evaluation after Prototype (v.02) making and testing:

- the servo control and the solid pendulum rod was the key to get the drawing mechanism working well

- it is a lot of fun to draw with this contraption; I got better over time controlling the machine
- it is very easy and relatively cheap to build something that is usable for experimentation
- it is hard to build something that works really well (i.e. an even bigger pendulum that generates smooth stable motion and has accurate brush controls, and also looks good) – great extended project again, as long as one has a workshop and some resources to play with!
- placing the magnets as indicated in the diagram did not always generate the strokes needed for the characters – one may need to place the magnets in quite different locations (maybe the spaces between strokes) or experiment also with smaller magnets or reverse polarity (repulsive force).



Magnetic Pendulum Calligraphy (v.03)

Control Freak (ver.01) is a participatory and experiential installation research project started from 2017, which is an idea to use the Chinese character (心 'heart') character and "pre-programming" the calligraphy strokes with the magnets to symbolize real "love". The loss of control and the chaos in the motion is a great allegory of the loss of control that sometimes occurs in a relationship. Dr. HUNG, the artist & researcher of this project proposed to build a magnetic pendulum system to simulate the act of Chinese character and calligraphy writing, allowing audiences to have new experience of write and read Chinese characters through their bodily engagement. Control Freak (ver.01) was commissioned by the Asia Society, as part of the 2018 exhibition LOVE Long: Robert Indiana and Asia. Taking the form of a calligraphy machine with which the audience can interact, constantly between states of control and a loss of control, the installation intersects the physical act of Chinese writing with the emotional acts connected with human love. Throughout the exhibition period, the artist has collected and re-created six versions of the animated (心 'heart') from all participants' work in the exhibition venue, and urged the audience to experience (1st step) and see (2nd step) similarity through complexity; that is, the value of their participatory experience is - no matter how differently we treat and view love as individuals, we are always connected by certain elements in the experience as a whole, be them fleeting feelings or lasting beliefs.

Introduction

Control Freak involves different research stages. In the first stage of producing Control Freak, we call it as Control Freak (ver.0A), which is about the combination of magnet and brush. In Control Freak (ver.0A, 0B, 0C and 0D) (2016 -2018), HUNG places magnet on different spots of a sheet, with a pendulum bob hung above it. The pendulum is attached to a costumed design Chinese brush, which is called "magnetic brush". The audience is allowed to control the motion of the pendulum using an electronic joystick, attracting the brush to the magnets to produce different Chinese characters. The artwork involves setting up a real time video projection to record the outcome of each written Chinese characters /calligraphies – as a motion sequence in a separate chamber. In the second stage, HUNG and his research team has decided a new combination of robotic magnetic

machines and manual magnetic brush, entitled Control Freak (ver.01), which is a commissioned project for the exhibition LOVE Long: Robert Indiana and Asia (2018) at Asia Society (Feb – July 2018), in which presents works by the American artist Robert Indiana, renowned for his ‘LOVE’ series of public art, with eight well selected Asian artists and collectives creating pieces in response to the themes of love and language.

Love & Heart

Considering the Chinese character for ‘love’ (traditional Chinese: 愛), HUNG realised that a core part of the character, as well as the concept of love itself, is the ‘heart’ (traditional Chinese: 心). This character, ubiquitous in daily use, is extremely simple to write and repeat, much like saying ‘love’ out loud, yet most of the time very little attention is paid towards the emotional truths behind such an act of writing. The artist attempted to create a piece that directs focus on the physicality of writing the Chinese (心 ‘heart’), in a way that challenges the viewer’s ideas about calligraphy and sheds light on our shared struggles surrounding love and relationships. As philosopher Eric Fromm (1900-1980) so aptly writes in *The Art of Loving*, "There is hardly any activity, any enterprise, which is started with such tremendous hopes and expectations, and yet, which fails so regularly, as love." (*The Art of Loving*, 1956), which might be the core value that Control Freak (ver.01) would like to bring back to the audience for experience through their bodily engagement in the exhibition.



Fig 1. The machines moving path installed under the rice paper. Artwork: Control Freak (ver.01), 2018, HUNG Keung, Electronic installation, magnetic brush, ink, rice paper and digital animation.

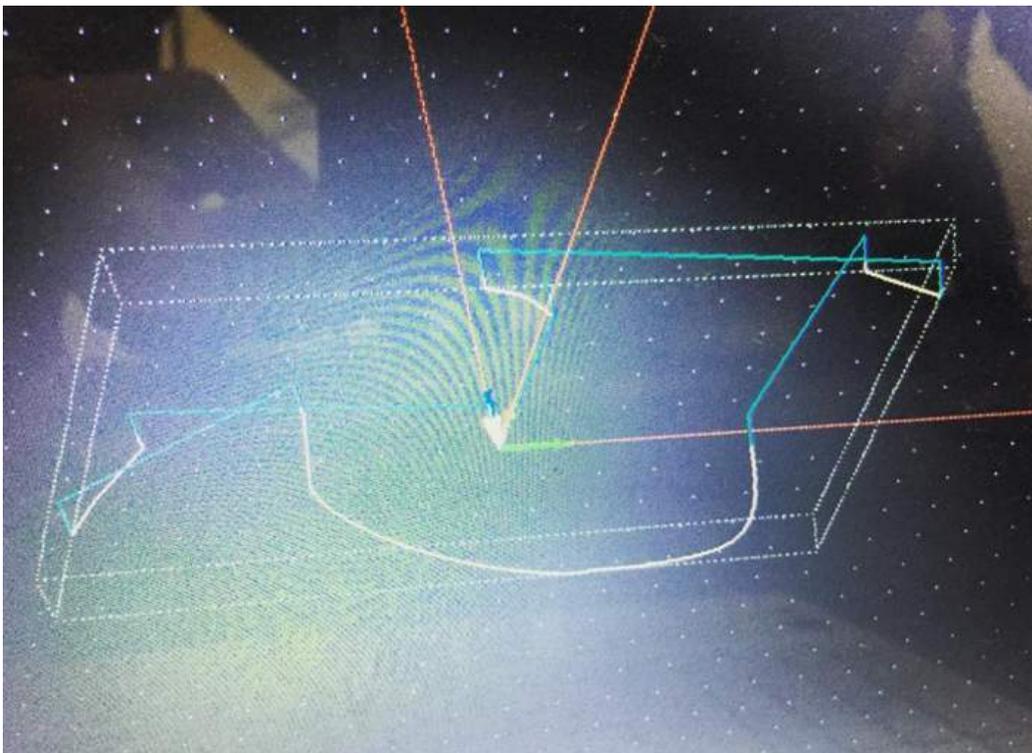


Fig 2. The machines moving path learnt from the writing pattern of Chinese 'heart', installed under the rice paper. Artwork: Control Freak (ver.01), 2018, HUNG Keung, Electronic installation, magnetic brush, ink, rice paper and digital animation.

Control Freak (ver.01)

The title 'Control Freak' particularly refers to the human tendency to attempt to gain as much control as possible, over events and relationships in personal life. Many people are so used to this constant, often irrational or freakish struggle, that they don't really notice it. We might not like to think of ourselves as control freaks — but what if we already are? The piece, in the form of a minimalistic wooden structure, consists of several main components: A covered table, Chinese rice paper, a custom made magnetic Chinese calligraphy brush, ink, and a system of magnetism-based machinery. While the former four are traditional calligraphy staples, the latter provides an element of unpredictable interaction. Fixed underneath the table is a magnetic device programmed to move according to the four consecutive strokes in the 'heart' character. The brush, altered with magnets, hangs above the table and paper from a hinge. As the viewer moves the specially designed hinge by pulling or pushing a lever, they indirectly move the brush with some amount of control; magnetic forces between the hidden device and the brush then causes attracting or repelling reactions, which leads to unpredictable (though recognisable) ink strokes on paper. The current machine on display is the latest product of five experimental variations tested and prototype making in Germany, US and Hong Kong with two different research teams over two years (2016-2018). Control Freak (ver.01) is the final version in 2018. This art project attempted to bring a new experience to audience about the ambivalent dynamics of human love and relationships through the conflict of human and machine movement. In fact, as the four strokes in 'heart' in Chinese writing are very simple, basically forming a pictogram, viewers can attempt to shape their writing better by anticipating the magnetic reactions over time. Non-Chinese language viewers can also refer to a printed writing guide on the wall. The processes are nevertheless always chaotic, as loss of control is inevitable; after much struggle, each viewer produces a unique piece of 'heart' calligraphy on a square piece of paper. The squares are then displayed as part of the installation, which grows into a rich collection of personal 'hearts', similar in form yet wildly different from each other.

Experience other than 'write'

Apart from a refreshing look at the writing of a familiar character, such a challenging physical process subtly mirrors our universally lived reality of love and its many complex faces: Attempts at control and certainty despite uncontrollable circumstances; trial and failure mixed with anticipation and disappointment; surprising moments of frustration and triumph, to name a few — To try writing a perfect 'heart' with this machine is to experience intensely the ambivalent dynamics of human love and relationships, on paper and within the heart. When the participants complain that it is rather hard to write a heart in the most appropriate way, and go through a journey of struggle and uncertainty, this precisely illustrates the genuine human experience of love. Such is a new direction which the artist wants the general public to experience through bodily engagement. On another level, through this installation, the artist attempts to address the current state of writing words and text, which seems in this digital era to be seen merely as a tool for presenting messages. As text becomes a straightforward matter of information, increasingly stripped of the human touch, there is a loss in the uniqueness and emotional quality associated with physical writing. The artist believes that the act of personally interacting with a writing tool is a deeply emotional process; feeling can be found in insignificant moments such as the movement of rice paper, the filling of ink, the beginning soft touch of a brushstroke, and the subtle shifting of weight during writing. The artist wishes to give such forgotten sensations the attention they deserve, and prompt the audience to rediscover them in daily life.

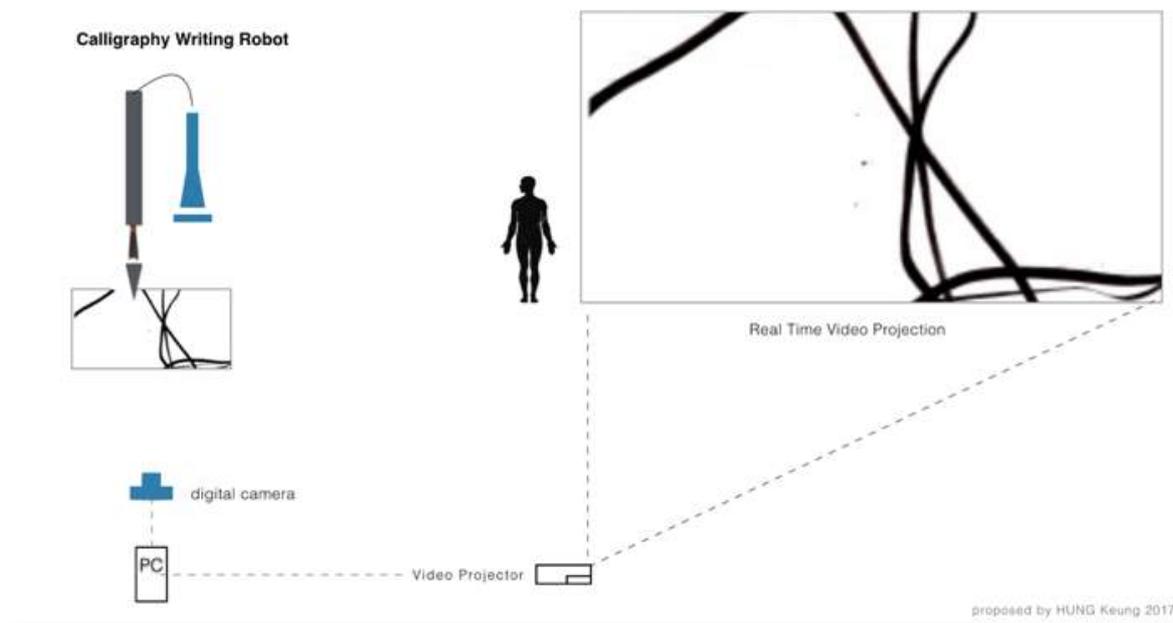


Fig 3. The visualization of the installation setting. Control Freak (ver.01), 2018, HUNG Keung, Electronic installation, magnetic brush, ink, rice paper and digital animation.

Animated Heart

“Animated Heart from Control Freak” as alternative platform and result of participatory and experiential installation. Apart from the installation setting, the audience can also assess the video works ‘multiple hearts series’ through scanning the bar code printed in the exhibition venue. This Control Freak ‘multiple hearts series’ produces a new and personal ‘心’ (English: ‘heart’) through each participant’s interactions with the installation.



Fig 4. Participant's interactions with the installation. Control Freak (ver.01), 2018, HUNG Keung, Electronic installation, magnetic brush, ink, rice paper and digital animation.

As the exhibition continues, all of the written calligraphy characters are building up to a numerous collection. The artist collected these pieces on a monthly basis, and to transform them into an animated, morphing 'heart' showing all the writing variations created by exhibition participants, through a platform for digital moving images. Throughout the exhibition period, the artist will create six versions of the animated (心, 'heart') from pieces (done by the participants) collected in February, March, April, May, June, and July, 2018.

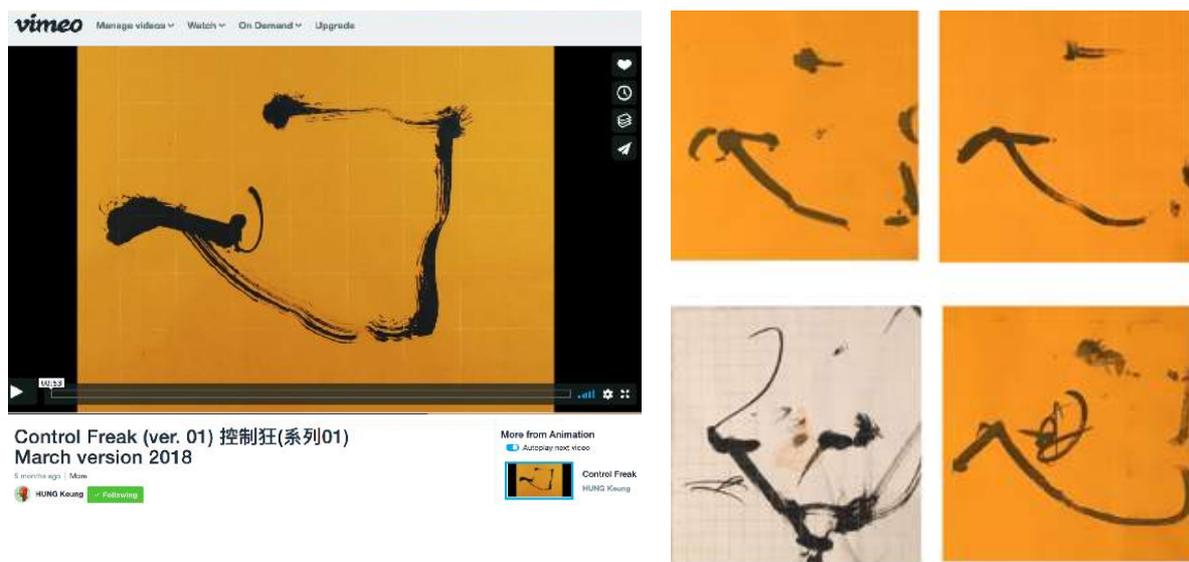


Fig 5. The video footage of the 'heart (s)'. Control Freak (ver.01), 2018, HUNG Keung, Electronic installation, magnetic brush, ink, rice paper and digital animation. Video link: <https://vimeo.com/260181796>

Conclusion

The core value behind this animation series is that despite the wildly varied outcomes to have been generated by the participants interacting with Control Freak, there is something that connects them all — a shared similarity not only in brush expression, but also in the people's lived experiences. Easily overlooked in individual 2D images, such subtle visual patterns emerge when compressed in time, presenting another way of seeing the 'heart's: as a morphing, throbbing, temporary manifestation of our universal experiences with love. Through the animation series, the artist urges the audience to see similarity through complexity; that is, no matter how differently we treat and view love as individuals, we are always connected by certain elements in the experience as a whole, be them fleeting feelings or lasting beliefs.