## Technical Manual (Draft vers. 23 September, 2021)

This manual serves two purposes. Firstly, it describes the "software and hardware" that enabled this work. This includes the occasional help of two friends, VV and Andrew, and also many open-source software that other creators have made available online. This manual, the codes, and the 3d models of the work are available for download. Secondly, it chronicles the logic of the work, which started with a sort of linearity, which became less and less coherent as the work progressed.

Link to codes and 3d models:

https://drive.google.com/drive/folders/18jRkTd8Ij2NsqO0dtoFycC3M4Fv3p6hl?usp=sharing

## A. From translated Daode Jing to nouns: an outline of the text's transformation

At the core of this work is James Legge's English translation (1891) of the *Daode Jing*, a Taoist classical text by Laozi (6th century – 4th century BC). The sculptural and animated elements of the installation are "generated" from features of the text. This "generative" relationship had been facilitated by a sequence of processes, which is described below.

- [1]. A chapter from James Legge's translation of the *Daode Jing* is selected by a program that I wrote in the open-source PROCESSING language (<a href="https://processing.org/">https://processing.org/</a>).<sup>2</sup>
- [2]. The program would filter the chapter so that only the nouns, verbs that function as nouns, and the punctuations remain in the text. For this, I implemented Daniel Howe's RiTa grammar processing library (<a href="https://rednoise.org/rita/">https://rednoise.org/rita/</a>).

Below, we have the original translated text of chapter 9:

It is better to leave a vessel unfilled, than to attempt to carry it when it is full. If you keep feeling a point that has been sharpened, the point cannot long preserve its sharpness.

When gold and jade fill the hall, their possessor cannot keep them safe. When wealth and honours lead to arrogancy, this brings its evil on itself. When the work is done, and one's name is becoming distinguished, to withdraw into obscurity is the way of Heaven.

The "processed form" of chapter 9 is:

vessel that, sharpness.

-

<sup>&</sup>lt;sup>1</sup> I no longer employ full time assistants, but two friends (Vvzela Kook [http://vvzela.co/] & Andrew Crowe [https://www.metaobjects.org/] help me occasionally. VV, who used to work for me but now an artist with her own active career, drops in when manual work gets intense. Andrew keeps the 3d-printer well-functioning, and answers my questions on codes and 3d-modeling issues. We share the use of the 3d-printers at my studio.

<sup>&</sup>lt;sup>2</sup> PROCESSING is a free and open-source software development environment and coding language, which was designed to make computational art easy to learn.

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gold hall, possessor safe.

wealth honours arrogancy, this evil.

, one's, obscurity way heaven.
```

The "processed form" of the text almost reverses the teaching of the original. Admittedly, this reversal was not something that I thought much about at this point of the process. Another thing to note is that I couldn't have done this (word-type filtering) with the original *Daode Jing* text in classical Chinese. This is due to the density of classical Chinese, and the highly inter-changeable nature of Chinese nouns and verbs (I cannot read classical Chinese without the help of either a modern Chinese or an English translation).

[3]. This "form" of the text has a recognizable shape and rhythm. Let us look at a couple more examples:

This is chapter 14, processed:

```
equable .
', , , '.
', , , '.
' qualities , description ;
.
, .
ceaseless in action , , nothing .
this formless , semblance ;
this indeterminable .
;
, .
dao things day , in , this ( ) clue dao .
```

And this is chapter 69, processed:

```
art war;
guest ( defensive ) .
;
foot .
' this marshalling no;
() no;
weapon no weapon;
enemy no enemy .
no calamity in war .
that ( gentleness ) precious .
thus that weapons ( ) , who ( situation ) .
```

I wanted to take another step away from the text.

One way to achieve this is to think of the words in terms of units of sounds. The program could turn the processed texts into groups of phonemes, like so:

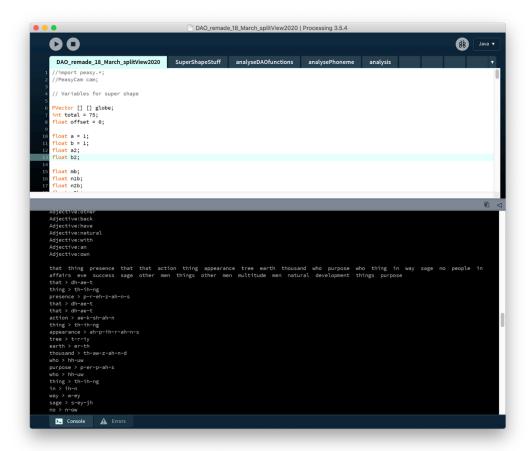


Fig 1. Screencap showing the program as it breaks the processed text down into individual phonemes.

- [4]. I came across a Chinese translation of Kohei Sugiura's book *The spiritual power of words* (<a href="https://www.kousakusha.co.jp/BOOK/ISBN978-4-87502-459-0.html">https://www.kousakusha.co.jp/BOOK/ISBN978-4-87502-459-0.html</a>), in which he cited examples of Chinese, Japanese, and Korean characters that took on "sculptural" forms. Some of these examples are functional design objects (e.g., incense holder in the 3d-shape of the character for "incense," see fig. 2), some are "charms" that summon the meaning of the character into being (e.g. fig. 3a), while others are ritual objects, where the shape of the word is its source of power (e.g., fig. 3b).
- [5]. I like the idea of spatializing these word-sounds. It would be boring to just write phoneme on the wall. Turning them into 3d-shape and 3d-printing them sounds fun.



Fig. 2. Porcelain incense holder, in the shape of the word for "incense" or "fragrance" in Chinese. [Kohei Sugiura, Moji No Bi, Moji No Chikara – Chinese translation (Taipei: Lion Art, 2011), 25].

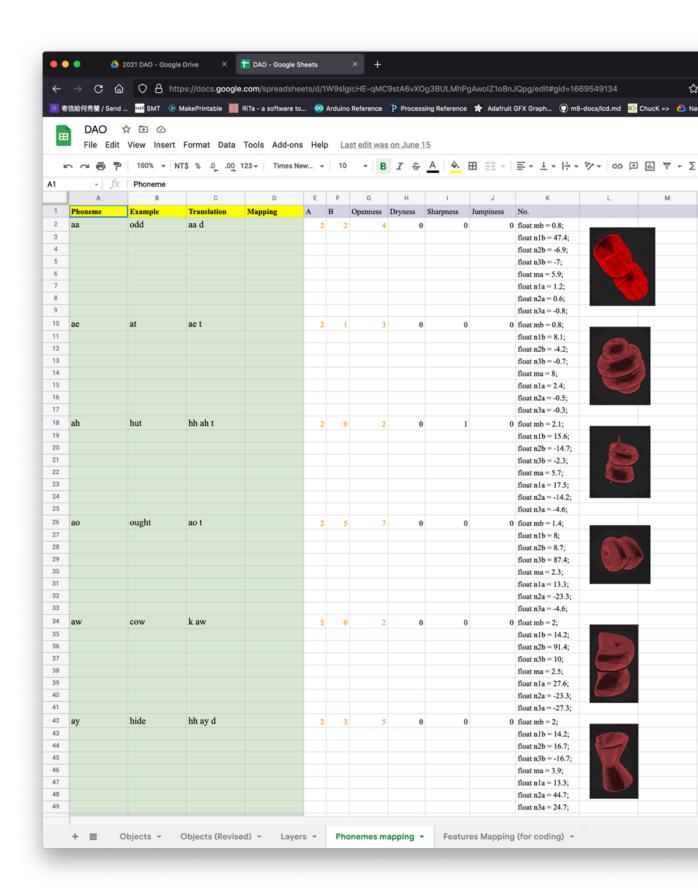


Fig. 3a. Prayer incense in a Taoist temple, which takes on the highly-abstracted and symmetrical form of the word for "longevity". Taiwanese, contemporary. [Ibid, 21].



Fig. 3b. The tip of a ritual weapon, which is shaped like the Chinese character for "mountain." Warring state period. [Ibid, 157].

[6]. I discovered Paul Bourke's "super-shapes formula", which is a modelling framework for "natural forms" (<a href="http://paulbourke.net/geometry/supershape/">http://paulbourke.net/geometry/supershape/</a>). This makes sense to implement for two reasons. Firstly, I have already explored the idea of "modelling nature" with software in a previous series of works, titled *Possible Music (feat. NESS)* (<a href="https://www.thismusicisfalse.com/#/possible-music-2/">https://www.thismusicisfalse.com/#/possible-music-2/</a>). Secondly, Dan Shiffman created an excellent tutorial on Youtube on how to integrate the super-shape formula within the



PROCESSING environment (<a href="https://www.youtube.com/watch?v=akM4wMZIBWg">https://www.youtube.com/watch?v=akM4wMZIBWg</a>). I will need to code some bridges between the text-output and the 3d-output, but it looks

manageable. When my code failed to compile, I would send them to Andrew to look over. He would catch my erroneous syntax, which enabled me to continue.

[7]. I created one super-shape for each of the phonemes. I "transcribed" the phoneme sounds into shapes in my head, similar to how I would pick colours to represent tones in a sound drawing. I relied on intuition, but it is not entirely random. To give myself some guidelines I gave each phoneme a score in "openness", "dryness", "sharpness" and "jumpiness". There are no hard rules, but, for example, when a sound has a high score in "sharpness," the shape may be more pointy and/or have sharper edges.

Fig. 4. A partial list of the phoneme to 3d-shape mapping.

[8]. The program then takes all of the phonemes, and turns them into a "string" of super-shapes. The super-shapes are placed one after another, forming a long pole. This combined shape is then exported as an OBJ file. For this, I implemented Nervous System's OBJExport library (<a href="https://n-e-r-v-o-u-s.com/tools/obj/">https://n-e-r-v-o-u-s.com/tools/obj/</a>).

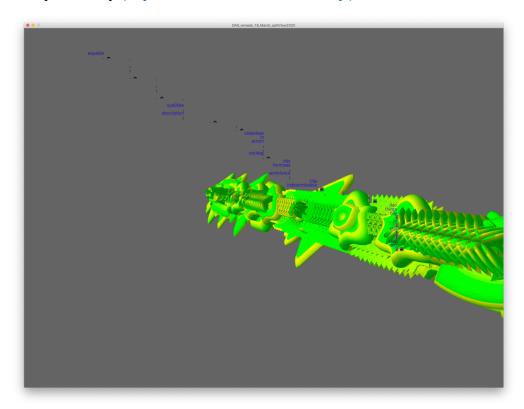


Fig. 5a. The "processed form" of chapter 14, rendered by the program.

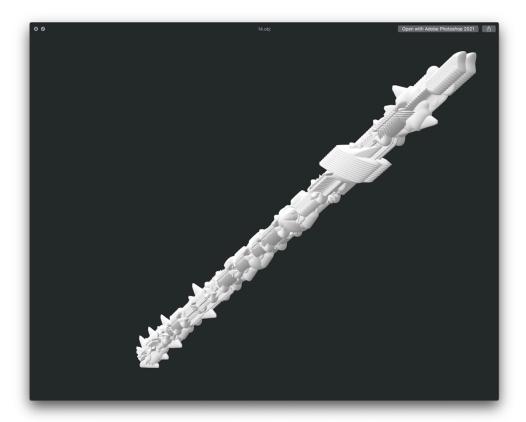


Fig. 5b. The exported "pole" shape in OBJ format.

[9]. At this point, I discovered a bug in the program. Whenever there is a shorter word with fewer phonemes in it, the super-shape at the end of the word-group will repeat several times. I figured that this bug was caused by the way I "tabled" the phonemes in the program's backend, which caused the process to repeat a phoneme-super-shape each time there is a blank in the table:

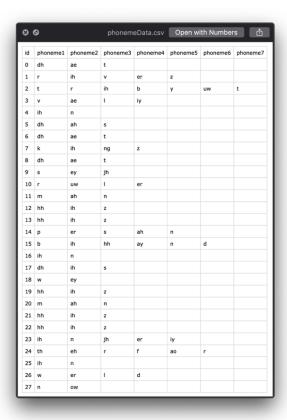


Fig. 6a. A phoneme data table from the program's backend.

This "bug" produced in the models some distinctive "air-vent-like" features. Although not by-design, this bug's behaviour is consistent, and has its own logic that is determined by the longest word in a given text. It produces a "visual stutter" that gives the text another rhythm.

[10]. These "poles" are then imported into Blender – an open and free 3d-modeling and animation software (<a href="https://www.blender.org/">https://www.blender.org/</a>). In Blender, I shaped the poles further and added bases to them for stability. At this point, the model still has many "non-manifold geometries" – essentially, geometries that cannot logically exist in the world (<a href="https://blender.stackexchange.com/questions/7910/what-is-non-manifold-geometry">https://blender.stackexchange.com/questions/7910/what-is-non-manifold-geometry</a>). Before these models are 3d-printable they need to be sent to an online service (<a href="https://www.makeprintable.com">www.makeprintable.com</a>) for "clean-up."

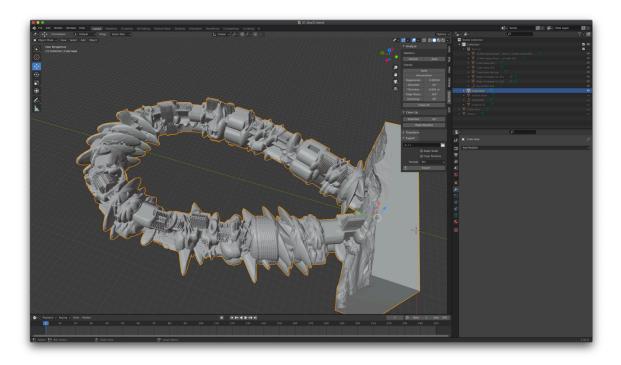


Fig. 6b. A "pole" twisted into a half circle with an added base inside of Blender.

- [11]. Andrew added a hardware feature to the 3d-printer in the studio, so that if there's a clog at the extruder, the print will pause. This is a crucial time-saver as a print-fail at mid-print will necessitate a total re-start of the print. A large print could take up-to a week from start to finish.
- [12]. Before the surface can be painted, the raw prints' "support structures" need to be removed. Between her full-time university research associate gig, and her own studio practice, VV helps me clean up the raw prints and puts a base-coat on the models. I then treated the prints with several layers of patina metallic paint ("Modern Masters" brand).
- [13]. At this point, so many factors have entered the "process" that the texts of the *Daode Jing* has become more like illegible cursive scripts, and less like teachings. But by placing them in the space I hope the transformed text still exert a "calming" presence.

## B. AI-generated "processed forms"

[1]. At this point in the process, I became interested in *Fuji* (planchette writing) practices in Taoist altars (https://www.books.com.tw/products/0010614384). In Hong Kong, these altars are sometimes located inside of residential buildings. In *Fuji*, a "primary writer" is in control of a "pen." Guided by the spirit, the primary writer traces characters on the surface of a sandpit, while a "secondary writer" watches and transcribes the results. According to anthropologist Ichiko Shiga, the writers operate in a mostly-lucid state. The resultant text (e.g., these published *ji* from the "Seen Yuen Taoist Altar" in Hong Kong http://www.seenyuentaoism.org/%e8%81%96%e8%a8%93%e4%b9%a9%e6%96%87.html, see fig. 8) reads like poems in symmetrical 4, 5, or 7 forms.



Fig. 7. Fuji in a Taoist altar. [http://articlesofhorror.com/2017/01/19/lets-play-ouija-board/]

Fig. 8. Fuji teachings given by the deities, from March 28, 2021. Fuji conducted at the "Seen Yuen Altar," Hong Kong.

- [2]. I experimented with artificial intelligence as a way to generate writings. Google's tensor-flow project (<a href="https://www.tensorflow.org/text/tutorials/text\_generation">https://www.tensorflow.org/text/tutorials/text\_generation</a>) published an easy-to-understand tutorial on how to use Recurrent Neural Networks (RNNs) to generate new texts modelled on pre-existing texts. This tutorial was informed by computer scientist Andrej Karpathy's 2015 blogpost, titled *The Unreasonable Effectiveness of Recurrent Neural Networks* (<a href="http://karpathy.github.io/2015/05/21/rnn-effectiveness/">http://karpathy.github.io/2015/05/21/rnn-effectiveness/</a>), in which Karpathy demonstrated the "unreasonable" ability of an AI in generating Shakespearean dialogues.
- [3]. Following the tutorial, and using James Legge's English translation (1891) of the *Daode Jing* as the base dataset, I trained a model to generate further "teachings." If we overlooked

the grammatical irregularities, the "generated" teachings were sensible, brutal, and all-too-real:

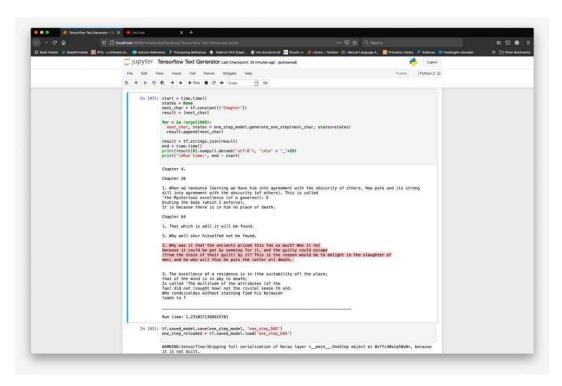
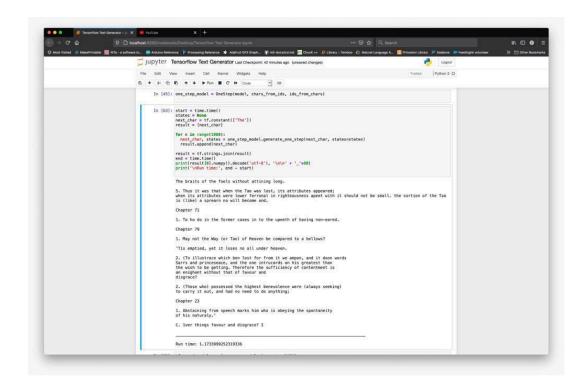


Fig. 9a. One "AI teaching" reads (highlighted): "Why was it that the ancients prized this Tao so much? Was it not because it could be got by seeming for it. And the guilty could escape (from the stain of their guilt) by it?"



- Fig. 9b. Another "AI teaching" reads (under "chapter 23"): "Abstaining from speech marks him who is obeying the spontaneity of his naturaly."
- [4]. According to Karpathy, RNN is better at reproducing forms, and less so with sensible contents. These days, I find myself becoming more interested in forms and processes. Am I becoming more like an automation machine, performing perpetual "optimization" based on "learnings" from within a panoptic structure?
- [5]. On a laptop, a small AI program (in python) is continuously generating new texts that are modelled on the "processed form" of the *Daode Jing*. These texts are then sent wirelessly to three "sandpit" sculptures. Embedded within these sculptures are small screens-processers, which are based on the open source ARDUINO platform (https://www.arduino.cc/).
- [6]. On a second computer, the AI-generated texts are animated in-real time inside of the Touch Designer (<a href="https://derivative.ca/">https://derivative.ca/</a>) environment. This second computer also functions as a "CPU" that the other components in the environment could communicate with.



Fig. 10. Animated text inside of touch designer.

- [7]. This is actually the first time I'd used the Touch Designer environment in a work, and I got carried away by all the fun things that TD can do, from its ability to receive and animate text and data in real-time, to its automated show-control features. I started thinking about the space and the objects in the space as a sort of simple network, in which individual components could "feedback" to the "CPU" and affect its behaviour.
- [8]. The screens inside of the sandpits (WIO terminal <a href="https://www.seeedstudio.com/Wio-Terminal-p-4509.html">https://www.seeedstudio.com/Wio-Terminal-p-4509.html</a>) are equipped with on-board light sensors and microphones. I thought I could use those as a sort of "eyes" and "ears," which could simply affect the "tempo" of text-generation. Each WIO terminal is also generating its

own nervous energy through three variations of a poem. These are visible in the Touch Designer animation.

- [9] The WIO terminal components inside of the sandpits are receiving and displaying the AI-generated texts in "real time." The timing of the multiple processes (receiving, displaying, sensing) are not in sync however, and eventually, the processor will be overloaded with a "backlog" of data, which will cause it to crash occasionally.
- [10]. I wanted the "super-shape" sculptures to participate in the network, to be "aware" of the environment too. But instead of sending data to the "CPU" they would reach outside of the space. I found these small micro-processors with embedded screens called M5 Stick-C (<a href="https://shop.m5stack.com/products/stick-c">https://shop.m5stack.com/products/stick-c</a>), which come with on-board microphone and WIFI chip. I placed a M5 Stick-C inside of two of the "super-shape" sculptures.
- [11]. The two M5 Stick-Cs are monitoring the sound volume level of the space. When the level is above a certain threshold, and continuously for 10 seconds (which, is reasonably triggered by a sustained yell), a "web request" will be sent via the internet. The "web-request" goes to a web-service called IFTTT (<a href="https://ifttt.com/">https://ifttt.com/</a>), short for "If This Then That."
- [12]. The web-request will trigger an applet, which will in turn trigger a phone call (via the woopla service <a href="https://woop.la/ifttt">https://woop.la/ifttt</a>) to a cell phone that has been "buried" inside of a small black sculpture in the space. If and when you pick up the call, you will hear a computer voice reading a translation of *Daode Jing* chapter 35:

Centre the great image, and the world will come to you.
It will come in great peace, and mean no harm
Food and music halts the wanderer. But the Tao that is spoken of is flavourless.
It is seen, but not understood.
It is heard, but not listened to.
Yet, it is plentiful.

(Translation my own)