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.[1] 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 (https://processing.org/).[2]

[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 (https://rednoise.org/rita/).

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 .*

---

[1] 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.

[2] PROCESSING is a free and open-source software development environment and coding language, which was designed to make computational art easy to learn.

```
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:

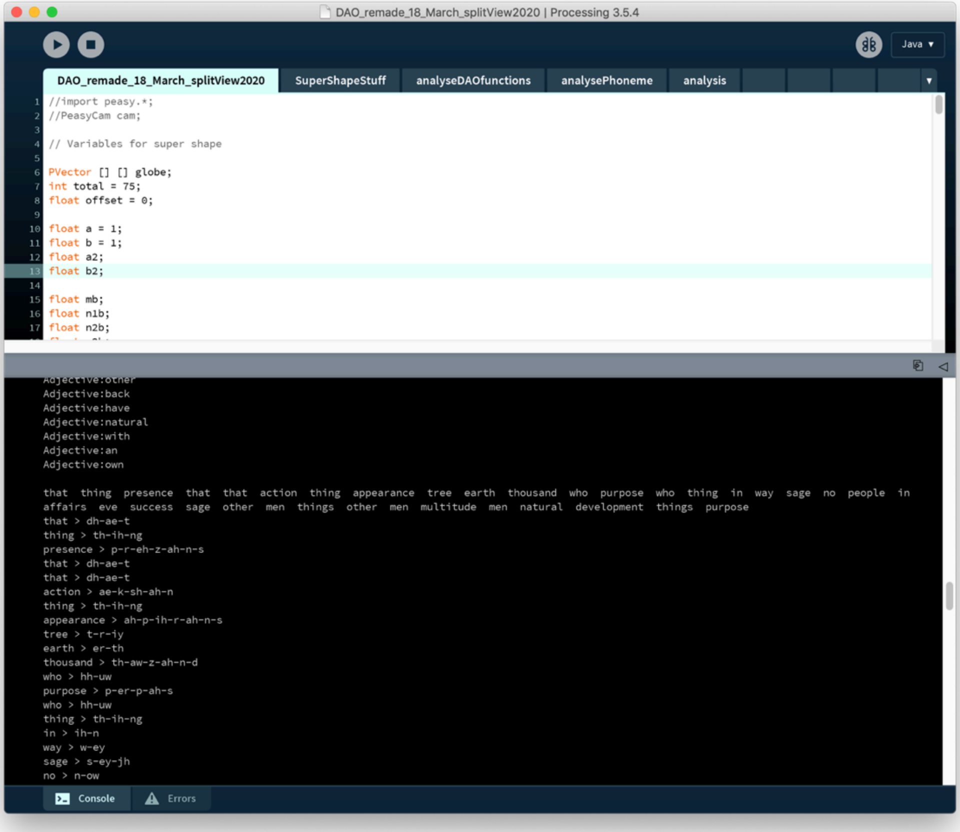
```
equable  .
'  ,  ,  '  .
'  ,  ,  '  .
'  qualities  ,  description  ;
.
,  .
ceaseless  in  action  ,  ,  nothing  .
this  formless  ,  semblance  ;
this  indeterminable  .
;
,  .
dao  things  day  ,  in  ,  this  (  )  clue  dao  .
```

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:


DAO_remade_18_March_splitView2020 | Processing 3.5.4
Java
DAO_remade_18_March_splitView2020
SuperShapeStuff
analyseDAOfunctions
analysePhoneme
analysis
Console
Errors

```
//import peasy.*;
//PeasyCam cam;

// Variables for super shape

PVector [] [] globe;
int total = 75;
float offset = 0;

float a = 1;
float b = 1;
float a2;
float b2;

float mb;
float n1b;
float n2b;
```

```
Adjective:other
Adjective:back
Adjective:have
Adjective:natural
Adjective:with
Adjective:an
Adjective:own

that  thing  presence  that  that  action  thing  appearance  tree  earth  thousand  who  purpose  who  thing  in  way  sage  no  people  in
affairs  eve  success  sage  other  men  things  other  men  multitude  men  natural  development  things  purpose
that > dh-ae-t
thing > th-ih-ng
presence > p-r-eh-z-ah-n-s
that > dh-ae-t
that > dh-ae-t
action > ae-k-sh-ah-n
thing > th-ih-ng
appearance > ah-p-ih-r-ah-n-s
tree > t-r-iy
earth > er-th
thousand > th-aw-z-ah-n-d
who > hh-uw
purpose > p-er-p-ah-s
who > hh-uw
thing > th-ih-ng
in > ih-n
way > w-ey
sage > s-ey-jh
no > n-ow
```

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* (https://www.kousakusha.co.jp/BOOK/ISBN978-4-87502-459-0.html), 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.

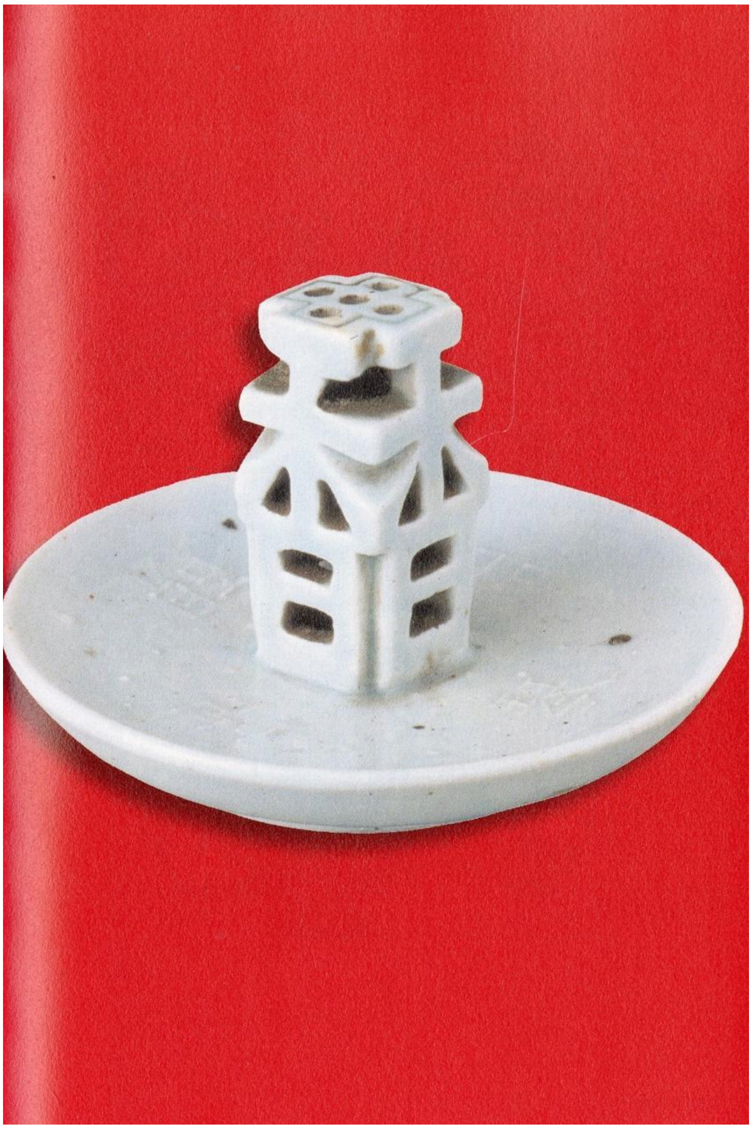


Fig. 2. Porcelain incense holder, in the shape of the word for "incense" or "fragrance" in Chinese. [Kohei Sugiura, Moji No Bi, Moji No Chikara – Chinese translation (Taipei: Lion Art, 2011), 25].

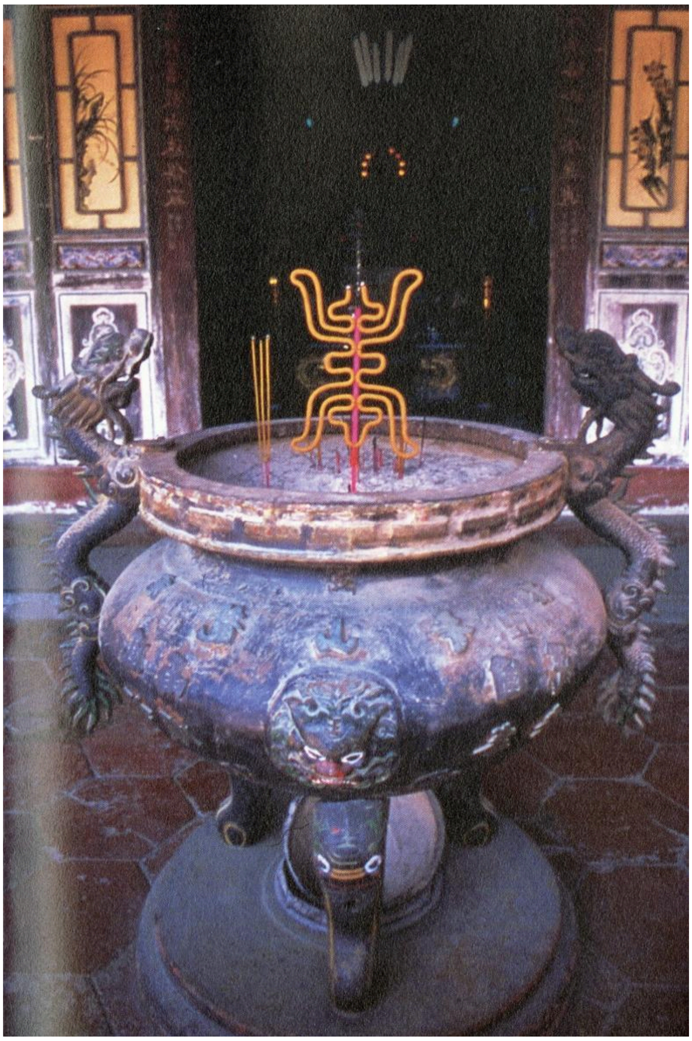


Fig. 3a. Prayer incense in a Taoist temple, which takes on the highly-abstracted and symmetrical form of the word for "longevity". Taiwanese, contemporary. [Ibid, 21].

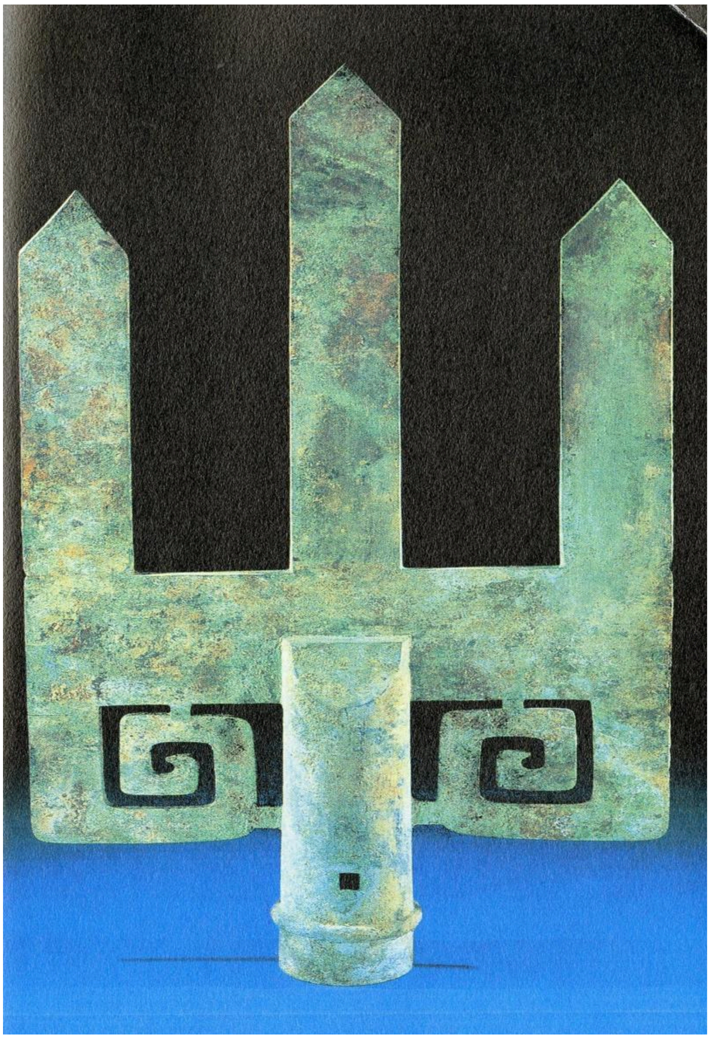
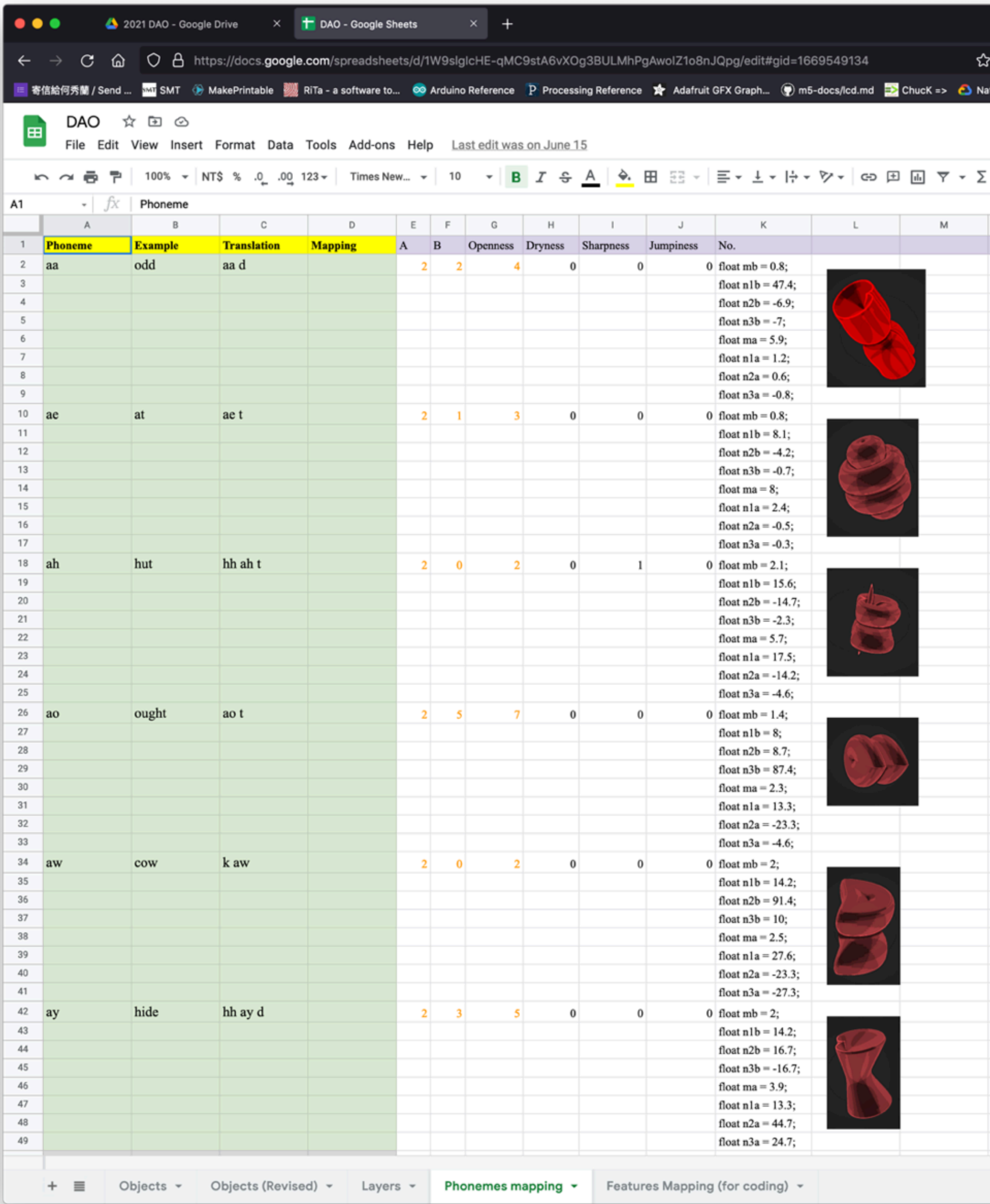


Fig. 3b. The tip of a ritual weapon, which is shaped like the Chinese character for “mountain.” Warring state period. [Ibid, 157].

[6]. I discovered Paul Bourke’s “super-shapes formula”, which is a modelling framework for “natural forms” (http://paulbourke.net/geometry/supershape/). 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)* (https://www.thismusicisfalse.com/#/possible-music-2/). Secondly, Dan Shiffman created an excellent tutorial on Youtube on how to integrate the super-shape formula within the


2021 DAO - Google Drive
DAO - Google Sheets
https://docs.google.com/spreadsheets/d/1W9slglcHE-qMC9stA6vXOg3BULMhPgAwolZ1o8nJQpg/edit#gid=1669549134
寄信給何秀蘭 / Send ...
SMT
MakePrintable
RiTa - a software to...
Arduino Reference
Processing Reference
Adafruit GFX Graph...
m5-docs/lcd.md
ChucK =>
DAO
File Edit View Insert Format Data Tools Add-ons Help
Last edit was on June 15
100%
NT$
%
.0
.00
123
Times New...
10
A1
Phoneme
Objects
Objects (Revised)
Layers
Phonemes mapping
Features Mapping (for coding)

	Phoneme	Example	Translation	Mapping	A	B	Openness	Dryness	Sharpness	Jumpiness	No.
2	aa	odd	aa d		2	2	4	0	0	0	float mb = 0.8;
3											float n1b = 47.4;
4											float n2b = -6.9;
5											float n3b = -7;
6											float ma = 5.9;
7											float n1a = 1.2;
8											float n2a = 0.6;
9											float n3a = -0.8;
10	ae	at	ae t		2	1	3	0	0	0	float mb = 0.8;
11											float n1b = 8.1;
12											float n2b = -4.2;
13											float n3b = -0.7;
14											float ma = 8;
15											float n1a = 2.4;
16											float n2a = -0.5;
17											float n3a = -0.3;
18	ah	hut	hh ah t		2	0	2	0	1	0	float mb = 2.1;
19											float n1b = 15.6;
20											float n2b = -14.7;
21											float n3b = -2.3;
22											float ma = 5.7;
23											float n1a = 17.5;
24											float n2a = -14.2;
25											float n3a = -4.6;
26	ao	ought	ao t		2	5	7	0	0	0	float mb = 1.4;
27											float n1b = 8;
28											float n2b = 8.7;
29											float n3b = 87.4;
30											float ma = 2.3;
31											float n1a = 13.3;
32											float n2a = -23.3;
33											float n3a = -4.6;
34	aw	cow	k aw		2	0	2	0	0	0	float mb = 2;
35											float n1b = 14.2;
36											float n2b = 91.4;
37											float n3b = 10;
38											float ma = 2.5;
39											float n1a = 27.6;
40											float n2a = -23.3;
41											float n3a = -27.3;
42	ay	hide	hh ay d		2	3	5	0	0	0	float mb = 2;
43											float n1b = 14.2;
44											float n2b = 16.7;
45											float n3b = -16.7;
46											float ma = 3.9;
47											float n1a = 13.3;
48											float n2a = 44.7;
49											float n3a = 24.7;

PROCESSING environment (https://www.youtube.com/watch?v=akM4wMZIBWg). 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 (https://n-e-r-v-o-u-s.com/tools/obj/).

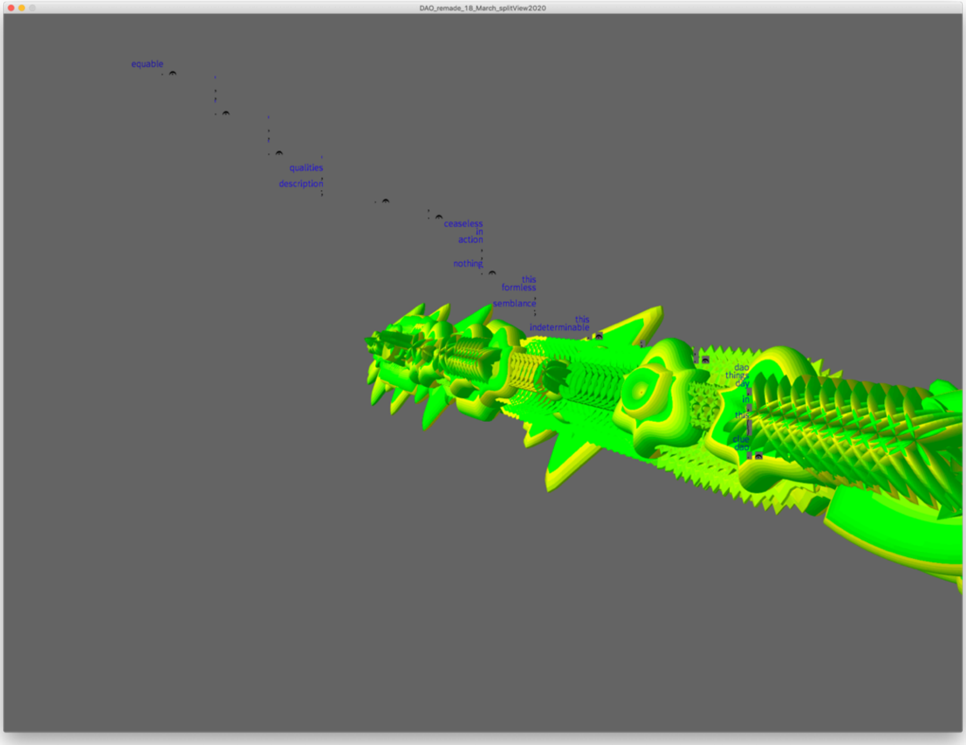

DAO_remade_18_March_splitView2020
equable
qualities
description
ceaseless
in
action
nothing
this
formless
semblance
this
indeterminable
dao
things
day
in
this
clue
dao

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

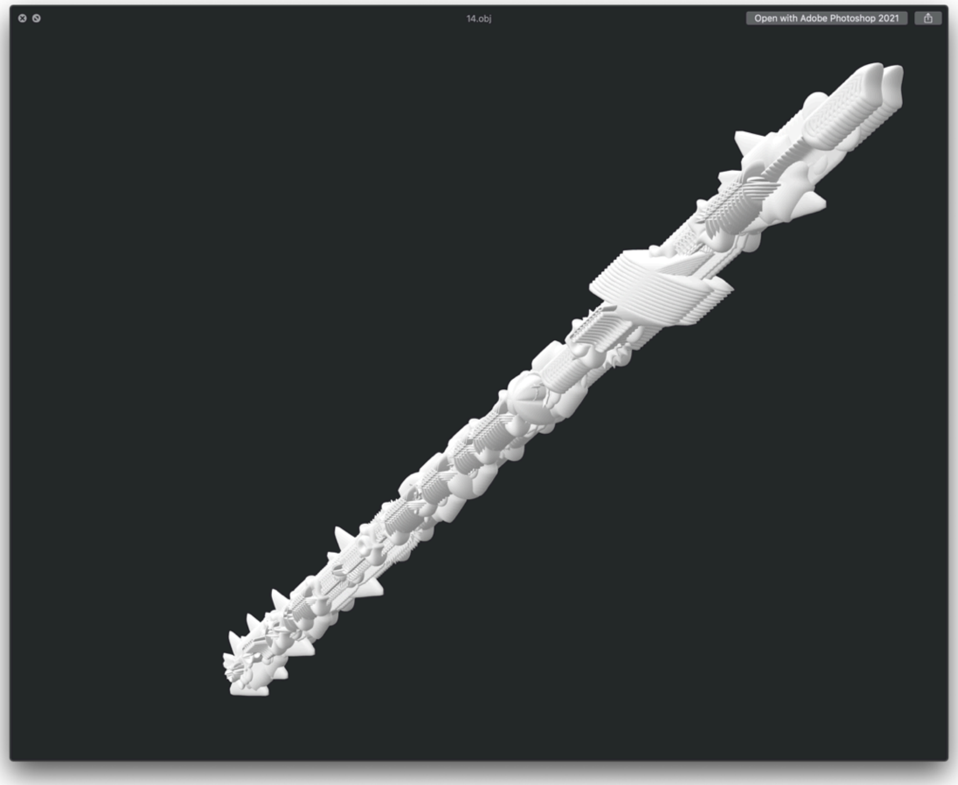
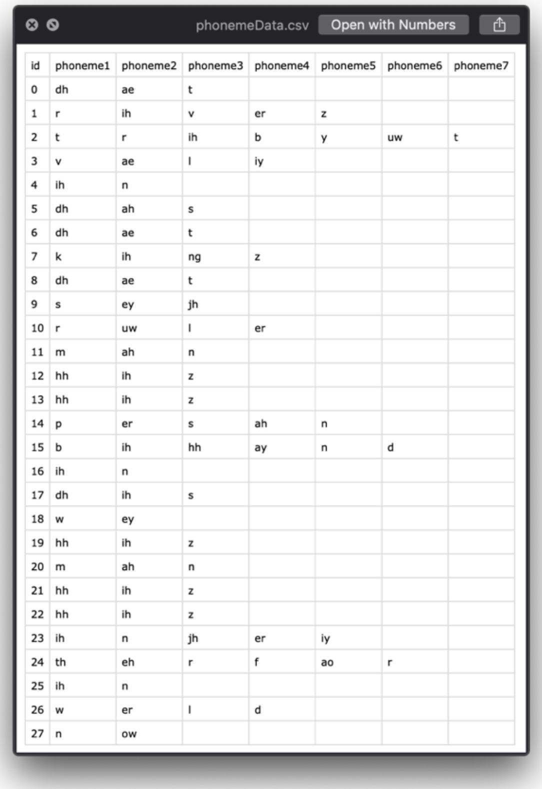


Fig. 5b. The exported “pole” shape in OBJ format.

[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:



id	phoneme1	phoneme2	phoneme3	phoneme4	phoneme5	phoneme6	phoneme7
0	dh	ae	t				
1	r	ih	v	er	z		
2	t	r	ih	b	y	uw	t
3	v	ae	l	iy			
4	ih	n					
5	dh	ah	s				
6	dh	ae	t				
7	k	ih	ng	z			
8	dh	ae	t				
9	s	ey	jh				
10	r	uw	l	er			
11	m	ah	n				
12	hh	ih	z				
13	hh	ih	z				
14	p	er	s	ah	n		
15	b	ih	hh	ay	n	d	
16	ih	n					
17	dh	ih	s				
18	w	ey					
19	hh	ih	z				
20	m	ah	n				
21	hh	ih	z				
22	hh	ih	z				
23	ih	n	jh	er	iy		
24	th	eh	r	f	ao	r	
25	ih	n					
26	w	er	l	d			
27	n	ow					

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 (https://www.blender.org/). 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 (https://blender.stackexchange.com/questions/7910/what-is-non-manifold-geometry). Before these models are 3d-printable they need to be sent to an online service (www.makeprintable.com) for "clean-up."

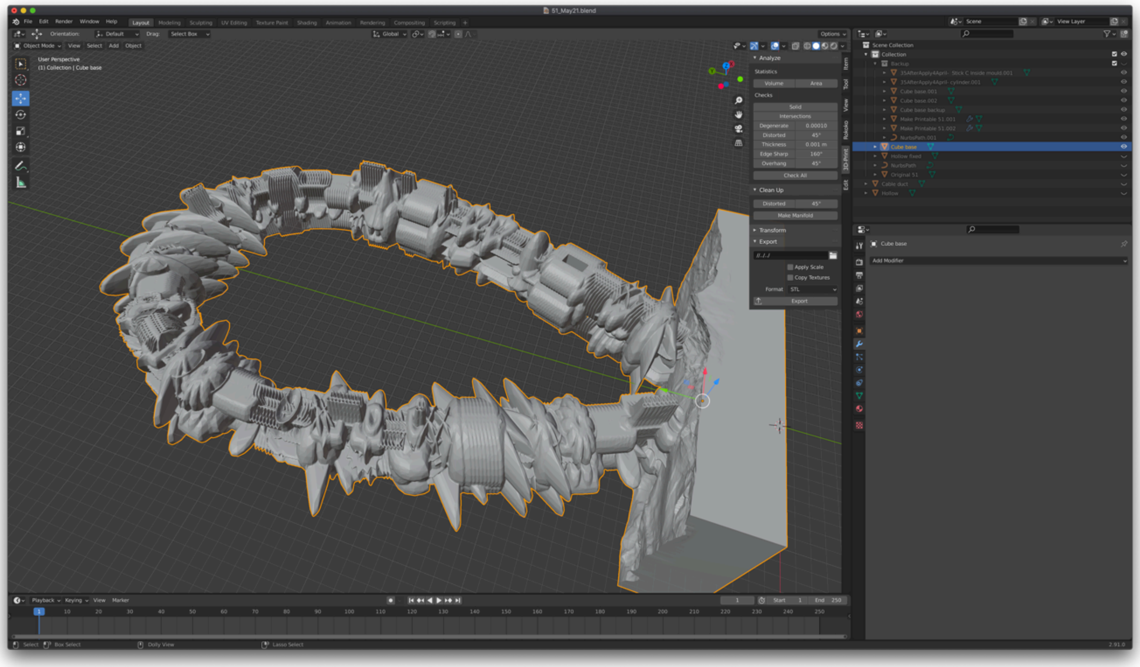


Fig. 6b. A "pole" twisted into a half circle with an added base inside of Blender.

[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.

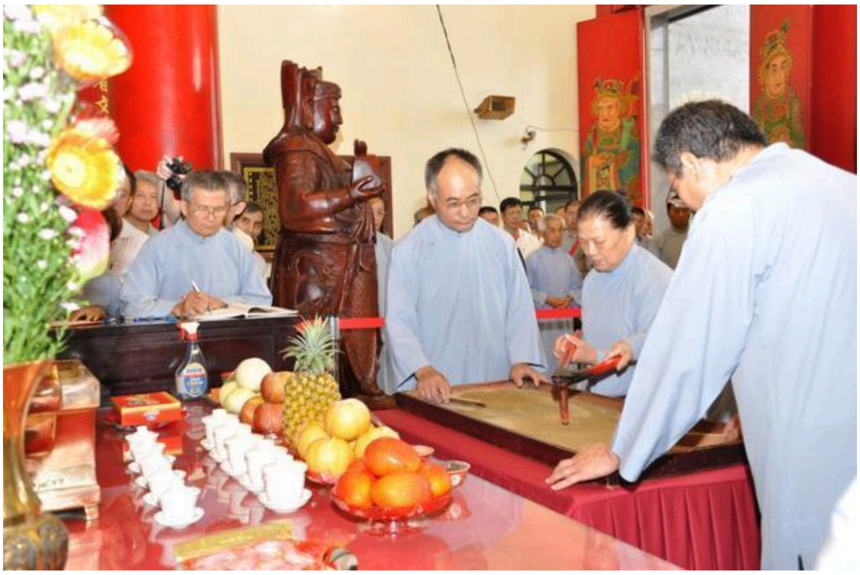
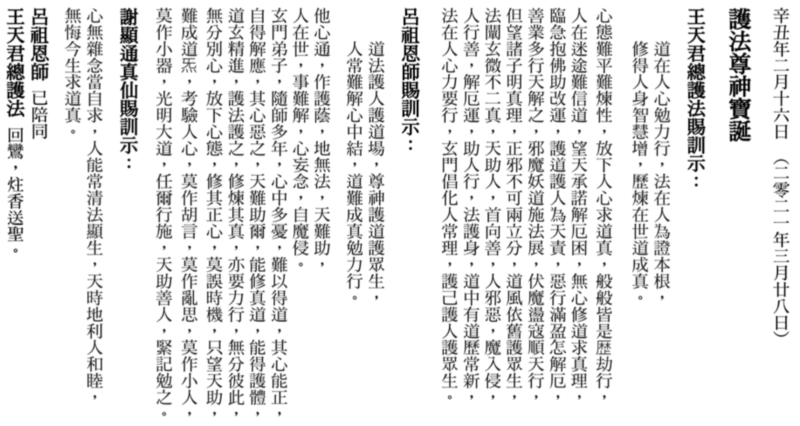


Fig. 7. Fuji *in a Taoist altar. [http://articlesofhorror.com/2017/01/19/lets-play-ouija-board/]*



辛丑年二月十六日　（二零二一年三月廿八日）

護法尊神寶誕

王天君總護法賜訓示：

道在人心勉力行，法在人為證本根，
修得人身智慧增，歷煉在世道成真。

心態難平難煉性，放下人心求道真，般般皆是歷劫行，
人在迷途難信道，望天承諾解厄困，無心修道求真理，
臨急抱佛助改運，護道護人為天責，惡行滿盈怎解厄，
善業多行天解之，邪魔妖道施法展，伏魔盪寇順天行，
但望諸子明真理，正邪不可兩立分，道風依舊護眾生，
法闡玄微不二真，天助人，首向善，人邪惡，魔入侵，
人行善，解厄運，助人行，法護身，道中有道歷常新，
法在人心力要行，玄門倡化人常理，護己護人護眾生。

呂祖恩師賜訓示：

道法護人護道場，尊神護道護眾生，
人常難解心中結，道難成真勉力行。

他心通，作護蔭，地無法，天難助，
人在世，事難解，心妄念，自魔侵。
玄門弟子，隨師多年，心中多憂，難以得道，其心能正，
自得解應，其心惡之，天難助爾，能修真道，能得護體，
道玄精進，護法護之，修煉其真，亦要力行，無分彼此，
無分別心，放下心態，修其正心，莫誤時機，只望天助，
難成道炁，考驗人心，莫作胡言，莫作亂思，莫作小人，
莫作小器，光明大道，任爾行施，天助善人，緊記勉之。

謝顯通真仙賜訓示：

心無雜念當自求，人能常清法顯生，天時地利人和睦，
無悔今生求道真。

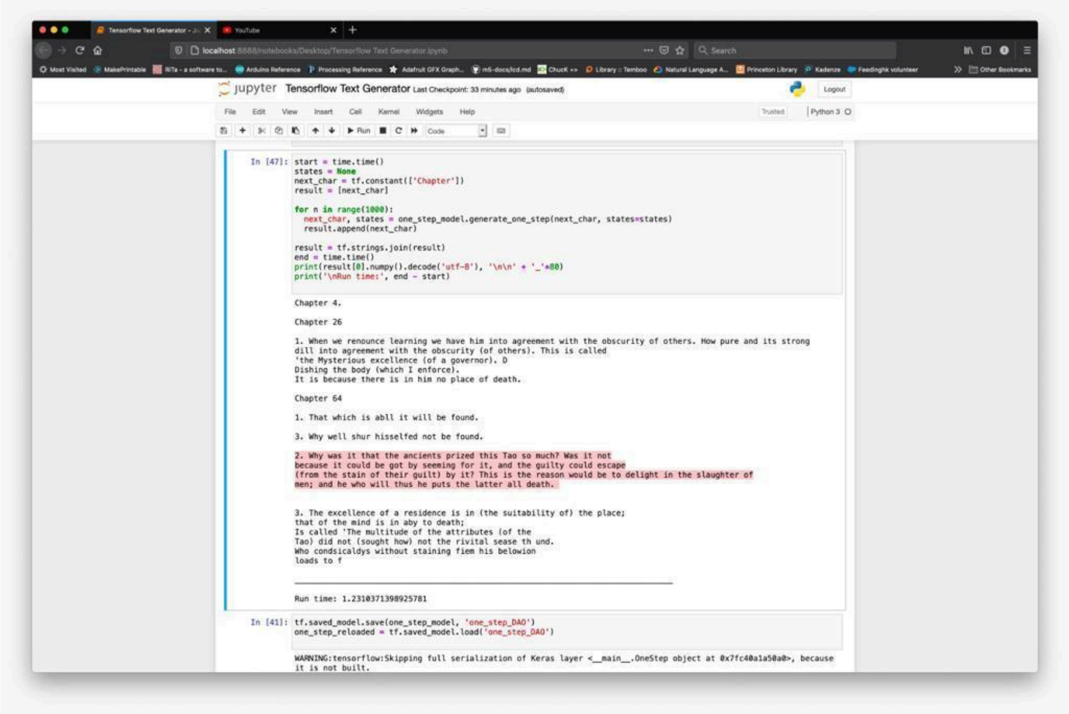
呂祖恩師　已陪同
王天君總護法　回鑾，炷香送聖。

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 (https://www.tensorflow.org/text/tutorials/text_generation) 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* (http://karpathy.github.io/2015/05/21/rnn-effectiveness/), in which Karpathy demonstrated the "unreasonable" ability of an AI in generating Shakespearean dialogues.

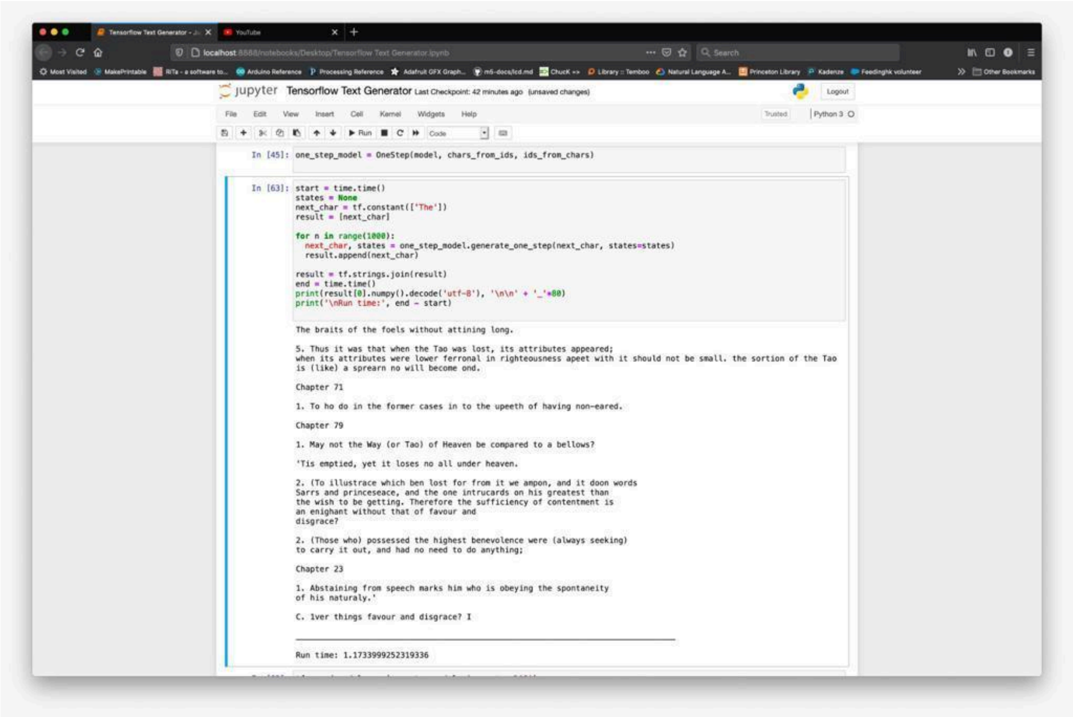
[3]. Following the tutorial, and using James Legge's English translation (1891) of the *Daode Jing* as the base dataset, I trained a model to generate further "teachings." If we overlooked

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


localhost:8888/notebooks/Desktop/Tensorflow Text Generator.ipynb
jupyter
Tensorflow Text Generator Last Checkpoint: 33 minutes ago (autosaved)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Python 3
Run
Code

```
In [47]: start = time.time()
         states = None
         next_char = tf.constant(['Chapter'])
         result = [next_char]

         for n in range(1000):
           next_char, states = one_step_model.generate_one_step(next_char, states=states)
           result.append(next_char)

         result = tf.strings.join(result)
         end = time.time()
         print(result[0].numpy().decode('utf-8'), '\n\n' + '_'*80)
         print('\nRun time:', end - start)

         Chapter 4.

         Chapter 26

         1. When we renounce learning we have him into agreement with the obscurity of others. How pure and its strong
         dill into agreement with the obscurity (of others). This is called
         'the Mysterious excellence (of a governor). D
         Dishing the body (which I enforce).
         It is because there is in him no place of death.

         Chapter 64

         1. That which is abll it will be found.

         3. Why well shur hisselfed not be found.

         2. 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? This is the reason would be to delight in the slaughter of
         men; and he who will thus he puts the latter all death.


         3. The excellence of a residence is in (the suitability of) the place;
         that of the mind is in aby to death;
         Is called 'The multitude of the attributes (of the
         Tao) did not (sought how) not the rivital sease th und.
         Who condsicaldys without staining fiem his belowion
         loads to f

         ________________________________________________________________________________

         Run time: 1.2310371398925781

In [41]: tf.saved_model.save(one_step_model, 'one_step_DAO')
         one_step_reloaded = tf.saved_model.load('one_step_DAO')

         WARNING:tensorflow:Skipping full serialization of Keras layer <__main__.OneStep object at 0x7fc40a1a50a0>, because
         it is not built.
```

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?”


localhost:8888/notebooks/Desktop/Tensorflow Text Generator.ipynb
jupyter
Tensorflow Text Generator Last Checkpoint: 42 minutes ago (unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Widgets
Help
Trusted
Python 3
Run
Code

```
In [45]: one_step_model = OneStep(model, chars_from_ids, ids_from_chars)

In [63]: start = time.time()
         states = None
         next_char = tf.constant(['The'])
         result = [next_char]

         for n in range(1000):
           next_char, states = one_step_model.generate_one_step(next_char, states=states)
           result.append(next_char)

         result = tf.strings.join(result)
         end = time.time()
         print(result[0].numpy().decode('utf-8'), '\n\n' + '_'*80)
         print('\nRun time:', end - start)

         The braits of the foels without attining long.

         5. Thus it was that when the Tao was lost, its attributes appeared;
         when its attributes were lower ferronal in righteousness apeet with it should not be small. the sortion of the Tao
         is (like) a sprearn no will become ond.

         Chapter 71

         1. To ho do in the former cases in to the upeeth of having non-eared.

         Chapter 79

         1. May not the Way (or Tao) of Heaven be compared to a bellows?

         'Tis emptied, yet it loses no all under heaven.

         2. (To illustrace which ben lost for from it we ampon, and it doon words
         Sarrs and princeseace, and the one intrucards on his greatest than
         the wish to be getting. Therefore the sufficiency of contentment is
         an enighant without that of favour and
         disgrace?

         2. (Those who) possessed the highest benevolence were (always seeking)
         to carry it out, and had no need to do anything;

         Chapter 23

         1. Abstaining from speech marks him who is obeying the spontaneity
         of his naturaly.'

         C. 1ver things favour and disgrace? I

         ________________________________________________________________________________

         Run time: 1.1733999252319336
```

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 (https://derivative.ca/) environment. This second computer also functions as a "CPU" that the other components in the environment could communicate with.

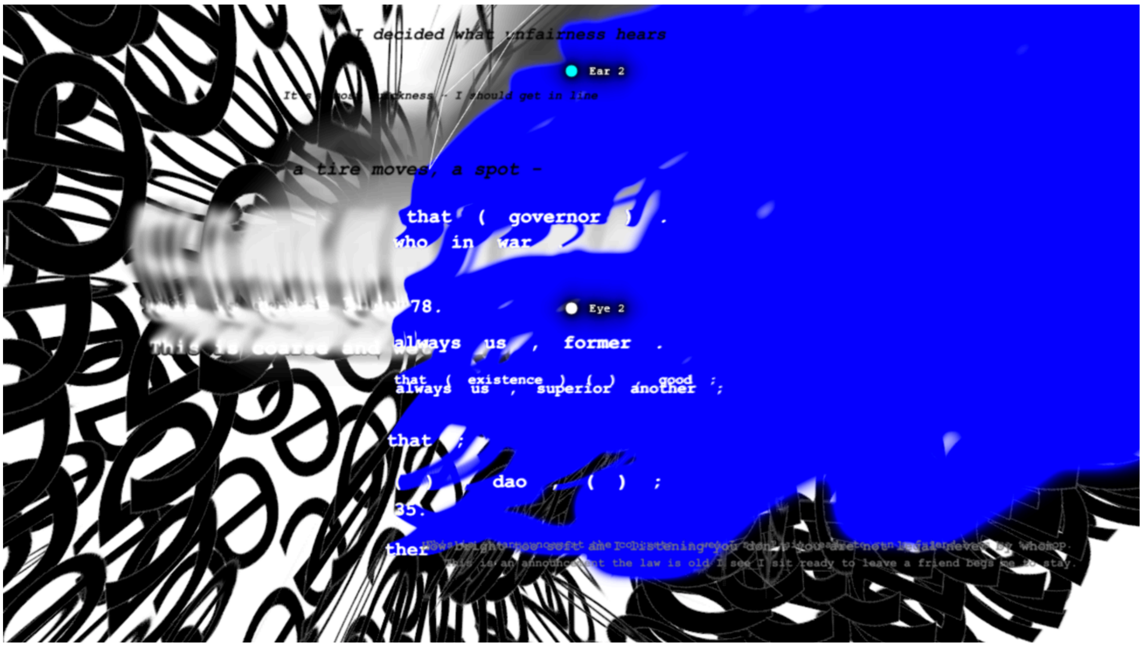


Fig. 10. Animated text inside of touch designer.

[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 - https://www.seeedstudio.com/Wio-Terminal-p-4509.html) 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 (https://shop.m5stack.com/products/stick-c), 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 (https://ifttt.com/), 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 - https://woop.la/ifttt) 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)*