

UNIVERSITY OF CALIFORNIA SAN DIEGO

Dadum : The Self in Data through Somatic Immersive Memory

A Thesis submitted in partial satisfaction of the requirements
for the degree Master of Fine Arts

in

Visual Arts

by

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The Thesis of Jonathon Paden as it is listed on UC San Diego Academic Records is approved, and it is acceptable in quality and form for publication on microfilm and electronically :

Chair

University of California San Diego

2019

DEDICATION

This work is made in loving memory of my father
Douglas Dean Paden (1955-2006.)

EPITAPH

*Starry, starry night
Paint your palette blue and gray
Look out on a summer's day
With eyes that know the darkness in my soul
Shadows on the hills
Sketch the trees and the daffodils
Catch the breeze and the winter chills
In colors on the snowy linen land
Now I understand what you tried to say to me
And how you suffered for your sanity
How you tried to set them free
They would not listen, they did not know how
Perhaps they'll listen now
Starry, starry night
Flaming flowers that brightly blaze
Swirling clouds in violet haze
Reflect in Vincent's eyes of china blue
Colors changing hue
Morning fields of amber grain
Weathered faces lined in pain
Are soothed beneath the artist's loving hand
Now I understand what you tried to say to me
And how you suffered for your sanity
And how you tried to set them free
They would not listen, they did not know how
Perhaps they'll listen now
For they could not love you
But still your love was true
And when no hope was left inside
On that starry, starry night
You took your life as lovers often do
But I could have told you, Vincent
This world was never meant
For one as beautiful as you
Starry, starry night
Portraits hung in empty halls
Frameless heads on nameless walls
With eyes that watch the world and can't forget
Like the strangers that you've met
The ragged men in ragged clothes
A silver thorn, a bloody rose
Lie crushed and broken on the virgin snow
Now I think I know what you tried to say to me
And how you suffered for your sanity
And how you tried to set them free
They would not listen, they're not listening still
Perhaps they never will*

- Don Mclean "VINCENT"

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ABSTRACT OF THE THESIS

Dadum : The Self in Data through Somatic Immersive Memory

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Dadum investigates new ways of recreating memories using digital tools. Exploring re-creations of those lost, object reminiscences, and how these structures translate into digital becomings. The theories here look toward conversations on data, particularly as we grow ever-tethered to our digital self. Exploring how the next-generation interface with this digital self is becoming immersive. The ideas and research written focus on ways data is handled and the role immersion will play in our growing social digital self with expanded notions of somatic integration. I explore this relationship through the development of my artwork which memorializes my memory of my deceased father through digital reconstruction and transcription of artifacts he left behind.

INTRO

My research for the last few years has been an investigation into what data is and is becoming, exploring the data body and how, as technology progresses, it is becoming more somatically important to interface and understand our relationship between our physical body and our data body as a whole self. Heavily inspired by George Herbert Mead's social self theory, I began looking into interpretations and behaviors where the "I," "you," and "me" fall along the lines of our contemporary self a self that includes the data body and the coming changes of the digital somatic self.

"Soma" or "somatic" refers to the body, and often to what happens at the barrier of cells, organs, and organisms that compose the body. The soma is interactive and important as a primary means of sensing our realities, separate but connected to the mind or soul. The soma is both the input and output of the actionable body that works in tandem with the mind and soul, yet it has clear systems roles and functions of its own.

This is important as we explore the soma role in the social self, particularly within the gesture. The gesture is a concept which may be conceived in the mind but it is only expressed through the soma. The mind may create the information but the soma is the transmission line. In computer terms, it is the encoder, communication method, and the decoder. This is valuable to understand as we move forward because my hypothesis is that the digital age has reached speeds and sizes of information (gigahertz, teraflops, and gigabits) beyond easy somatic conceptualization. As such, this data is knowable but not experienceable, which is a requirement of the soma. Since our soma is integral to our sense of self, I believe we will see a shift in all our major mass cultural technologies is to better integrate our digital self with our evolved soma and help us experientially understand it.

The result will be the creation of a broader digital soma and somatic sensing body schema.

Gesture familiar to us in art as the intention or goal of an artwork in practice. Gesture shares the usage universally as an action with intended meaning or communicable conception. One of Mead's major accomplishments was the resolution of gesture in form and explanation from the works of Wundt. Wundt believed the gesture was a means of generating implicit ideals with which I then transfer to you as a means of behavioural remodeling. A gesture is a way one person can send their intentions to another of what they want the other to do, for example. The second person receives the gesture, understands the information communicated, and completes the task or program set by the first intended. Often Wundt showed how people use lies and schemes to manipulate others, describing methods and means for this gestural programming or manipulation. However, Wundt was missing key elements to his theory of gesture. He conceptualized the self as only an egocentric sender, with intention a one way transmission a program forced upon the other and run, to succeed or fail. What Wundt lacked was the understanding of the social self as a feedback loop.

Mead resolved this theory by showing how we are senders with intention, manipulative and cunning, but the only way we know our schemes have worked is if the other or the receiver signals back an interpretable response, a gesture of their own. This gesture in direct response to our own is filled with the other's meaning and intentions. This loop, however, is an internal loop of our self. Thus establishing self as extended, this extended self within the realm of gesture showing at its core it is *social*. This is easier to understand in the simple phrase, "I cannot know me without you." "I" is a function within gesture of You completing the feedback loop thus establishing the sense of "Me." This loop is both sociality itself and is the process of knowing self. The knowledge of the acts and under-

standing is a function of the mind, but the transmission and reception of these gestures is a property of the soma.

These principals of the self, gesture, and soma help to define the foundation of my current research and the endeavors pursued within it. This theoretical framework helps me establish a beginning point for dealing with data: what data is, how to interpret it, and the methods of which to explore it as art through the gesture and soma. The following texts will address my explorations and artwork methodologies and how I have researched data as a medium for art and theory, from collection means to implementation with Augmented and Virtual Reality, and some experiences I learned along the way.

Data?

Initially, I grappled with data as a medium: how it is used and should be used in art, sciences, media, culture, etc. It seemed too narrow-minded to blame data or give it credit for really anything. Additionally, I observed how in this cultural moment everyone seems obsessed with data and what people do with it. We are constantly in fear of others having our data. We are seeing individuals and even the federal government intervening more into when our data is collected, how it is collected, and for what purposes it is used. It has exchange value, raising questions like: What is the data you have? Can I have access to it? Who else has access to it? What parts are constant? What is temporary? Is it doing something? We are transfixed with the usage and commodity privacy of our data. The conclusion I reached is that data is inherently social.

Early on I was mesmerized by these aggressively fearful attitudes towards data, especially the generational divides with how to interpret privacy in this sector. How people

born into the smartphone/social media generations have a completely different response to their data, partly due to a better understanding of information usages and means of creation and distribution.

Privacy (or our sense of it) is based on the believed cost-benefit of usages and allowance of use of your information, a purely social exchange of actionable information that becomes commodity for social biological fitness. Within our smartphone world this is exhibited nowhere greater than our selfie-culture. Here data, like our image being captured and shared, makes privacy and ownership come down to who has seen it, so ownership of these images has become oddly subscriptional. No longer is ownership based on the act of taking or creating the photo. Ownership is found on the premise of the sharing of it and the subscription to it, so anyone can own the information of the image. The data of that image is not simply a writing of pixels but a container of exif data, a metadata cache that includes the camera technical specs, focal length, lighting, f-stop, but also GPS coordinates, time of day, location information, and any other tag that can be applied. This can all be broken down into binary, and depending on the ability to decode this data and exhibit it in original context, it can have completely different meaning or none at all. Data then has no meaning outside of context, in a sense a social context yet it can still be possessed, owned. This commodification of information afflicts privacy only to the point we understand the impact of it's cost benefit belief.

This points to the problem we face. We have ridiculous amounts of data now, more than we can handle or sort. Our readymade life allows us to be producers and subscribers of data. But data by itself is nothing. Data is wholly innocent. It just exists. What is not innocent is the context preceding the creation and the contextual usages of data after it is transcribed. This is the social feedback loop that creates data and all the inherit woes sur-

rounding it. Which is why it is apt to say data has begun having a “life” a life with us as part of us. This data, in actionable context, is information.

This can be related to Mead’s mechanism of the social self and the acts within social gesture. The divide we face now is between data and information in respect to the body self. The problem is that we do not always know; we do not know how the data is being processed into information. We are then placed in an uncomfortable social paradigm, one that makes the gesture confused, makes it into noise. The I has intention with which I make a gesture but my gesture needs to be interpreted by the other and they must send a gesture back so that I know it was either received as intended, misinterpreted, misunderstood, or just missed altogether. This is a social process, and within our data-self this process is still in the early stages of becoming and emerging, which is why, more often than not, the signal is lost in the noise.

Potentially all our fears rest in this noise. This is why I believe we are seeing more and more wearable somatic interfaces built for our evolved physical soma (we’ll return to that later). This noise is our disconnect between the mind and the soma. One that must evolve.

Curiously the process of mind Mead developed feels striking familiar to Claude Shannon’s Information Theory. Often considered the greatest masters thesis ever written, Shannon wrote “A Symbolic Analysis of Relay and Switching Circuits,” where he proved you could use magnetic relays, and then read the binary states of the relays in sequences to create circuits with boolean logic that can be packaged, encoded, transmitted, then unpacked and decoded. This invention he would later develop into his “Mathematical Theory of Communication” and create the method we all use to today of [0, 1] binary data pro-

cessed into information, giving birth to electronic minds in all modern computers(A while back I wrote and presented a notion that Shannon gave us a base proof that points to data and information as having properties of traditional physics, meaning that data and information development follow the laws of thermodynamics, the act of all-knowing is the same as all energy in the universe making the smallest unit of energy or matter in any system a 'bit'. So the act of information creation is only entropic.) Shannon's concepts seem to stem from Mead's "social process" and the behaviorist work of the early 1900s, exhibiting from its inception the inherent sociality of modern data and information. In his creation, Shannon also created a culture of digital relationship to information, collection, evaluation, and interpretation.

In the interpretation and evaluation of data is where art presents great opportunities at present. However, creating in this space is not easy. The rawness of the field puts the burden on the artist to attempt too much at once; there is too much possibility. Coming from a traditional makers background, I often correlate my research in the digital to the digging of clay for early potters. Collecting data is like finding types of clay in the wild. Interpreting is the process of making it into a material for use by mixing, adding, or manipulating the chemistry. Finally the the interpretation is the result after collecting, mixing, shaping, and firing have given it a final form. The base materials are malleable, but unlike most modern art forms which have stores of premixed clay, when it comes to the digital practice we are still required to wander into the wild to collect our information, and then try our best to experiment with this new material.

I see this newness and raw usages as easy targets of direct criticism compared to traditional established art forms. The aesthetics of digital art are still developing and have a long way to go to reach the refinement of traditional forms. This is why I suspect

often these traditional aesthetics are transcribed first into any new media. Photoshop, for example, replicated the properties of painting, drawing, and image creation. 3D modeling mimics properties of clay: pushing, pulling, deforming. These traditional properties allow us to replicate aesthetics within the digital and along the way provide tools for potential new ones. We have seen the transcription of this digital information into more traditional physical media, like canvas printers and 3D additive manufacturing printers to create busts to parallel their plaster original, but as of now they fall short of even the plaster replicas artistic aesthetics.

Yet here in the information age as I pursue the lofty notion of new media, I feel the lure of this traditional aesthetic harpy. My background in renaissance techniques steers me towards the translational aesthetics of my trained craft hand skills, even as I dig into the ether of data and information. Continuously asking, “Where is the body? Where is the form, marks, viscosity, grit, and pigment?” I am left absent the softness of graphite on linen paper, or the translucency of stretched pig gut over wireframed steel to bring my sculpture to life, the dirt and grime of a burnt oak beam sanded smooth. Here is the hurdle of technology: it has become fast, measurably more than we can understand, but it is not visceral yet, not really felt with consequence. Which is why a somatic interface of information into our reality is where technology is encroaching and must grow. We are now able to expand the digital into ourself but only through the evolved means of the soma. And through our somatic interfaces, which utilizes our evolved plasticity, we will redefine our social self in terms of extended, virtual, augmented, mixed, experienced and immersed realities.

Dadum

Dadum is an artwork about an aspect of my own information and its relationship to my memory, particularly of my father who passed in 2006. In the end it is an homage to my dad and the influence he had, particularly his business as an auctioneer who predominantly ran estates sales. A process that required us to come in, evaluate and sort through peoples lived possessions, categorize them and find value where we may. This concept and aesthetic permeates through my contemporary work with data and information.

First let me start with a description. The installation Dadum is comprised of life size 3d digital reconstructions of myself, along with reconstructions of my father, amalgamated and projected as Anaglyphs from within built environments, Immersed Head Mounted Displays, and Optically see through Augmented Reality Social experiences. The same environment is experienced through 3 social lenses of the Screen, VR, and AR. Dadum is meant to point to the ways and means the *soma* continues to grow with the data-body through our social self. Incorporating future methods for interfacing, Dadum utilises various techniques in AI reconstruction, photogrammetry methods, mixed reality capture, and other interpretive techniques. Investigating where data is creating, blending, blurring, altering, and reinterpreting the body and form. These forms are presented as sculptures within interactive Virtual Environments. The Artwork looks at social interfaces of Screen based Virtual of memory. Inside the exhibition there are lifesize 3D anaglyphs projected onto panels, 5 Screens in total that allow the viewer to relate through life size scale. The figures move through previously collected motion capture of my own body, translating my own kinesthetic information onto their form. There are also limited VR and AR performances that allow some viewers the opportunity to navigate the mirror virtual spaces.

Walk through. As viewers enter the gallery they are confronted with a darkened black space roughly 35' by 30', there within rest 5 panels 4' w by 7' tall, housed are figures rear projections onto these panels. The figures are life size and rendered stereoscopically as red/blue anaglyphs. The screens are aligned to present themselves as you enter and turn about the room, not square to slightly occlude one another. Each viewer is offered the classic red/blue 3d glasses on entry to view the installation. Within the space is audio not spatial but separated as multi-channels to create auditory zones. The sound is more subdued in the entry, yet expands as you explore the space. The audio is computer generated from written recollection of memories of my father and thoughts I've been developing the past few years. The voice is mine, a text to speech (tts) voice created from myself. It glimmers only occasionally of me then falls back into faint robocall, missing phonemes and ddddh-hh rl aa. As viewers meander the space they are offered glimpses into my digital self curated slightly into abstraction, yet if they watch the models and listen to the audio they can piece together my thoughts, theories I've written solely in electronic form, memories I've recalled, memories I was part of shared with me from family and friends. In the space is a single VR headset, this is an entry portal to the digital world, where the figures and audio are more immersive. The thoughts and memories are held within the figures as they wander the Virtual space waiting for you to approach to tell their story. Here you can choose your level of immersion, through the physical space of the screen or the immersed world of the VR headsets. The interactions are simple this is not about being a game environment, this piece is about understanding the parts of me and us that will soon continue with agency even after or biological self depreciates.

The Augmented reality (AR) performance showcases a more social space, in these short performances viewers are able to wear the Microsoft Hololens and see each other in the same social environment together. In the Hololens you are able to see Virtual ob-

jects overlaid onto the physical world. In this instance when you collude with the virtual figures you become them. Unlike the models in VR in this AR space you embody the figures, effectively changing your avatar. Though the only way to know is through confirmation by another, someone else in the shared AR space who sees you as that avatar.

Process. The Goal of this project was to explore methods of building physical representations of real world objects into virtual instances, tackling the meaning of this physical transcription into immersive environments. I investigated multiple techniques to create the virtual objects that comprise this exhibition, photogrammetry, AI facial recognition and replacement, 3-D facial mesh reconstruction. Surveying multiple algorithms and softwares to create a workflow that creates a myriad of 3-D models that could be used in the Unity3d game environment. Along the way the techniques used presented themselves with more potential not just in contemporary and future real time uses but in the reconstruction of things already lost. Let me speak a little about these techniques.

One of the primary issues I had with this project was that my father passed away in 2006 right at the beginning of the smartphone social media explosion. I don't even have a recording of his voice. So he was not privy to selfie culture, photo check-ins, facebook, myspace, linkedn, instagram, or otherwise. So unlike our pixelated life of today, he did not have a robust image set of the 24/7/n camera culture of today. All I have to work with is the previous generations love of film and disposable cameras and the family archive of gel prints, olan mills, sepia wedding photography. These images pose analog hurdles of exposure, ISO, focus, and marring of the actual prints. No metadata unless you count the date purely etched into the exposure or scribbled by a grandmother's hand. These yester-year photos are composed of grain, randomly placed particles, todays image processing is built on pixels aligned in perfect matrixes. So here lies the first problem, image processing

today is built on the matrix of the pixel. Techniques I use like photogrammetry must first start as a transcription of analog images into the digital.

Photogrammetry is the process of using more than one photo where you know information about the image and use this to create measurements of distance and depth from the photo. This technique was used early on to successfully create depth maps of object surfaces to recreate 3-dimensional objects. If you have enough photos of something the techniques can recreate buildings, terrains, and objects of all types. It is a robust field of research that includes archaeological preservation, tidal mapping of the ocean floor and coral, surveying terrains, reconstructing medical images, or scanning objects from tiny insects to full buildings. The technique used in most these virtual reconstructions is Structure from motion(SFM), which uses methods like OpenCV feature detection to look for like edges in different image arrays to align the pixels, the amount of like features assist in the accuracy of alignment image to image. This combines with other information in camera data to set the original position of the camera. Once you have enough images aligned and set you can extract the x,y,z positions to create a topological surface representation in points. This is akin to pointillism in 3D. So a model emerges as these small color points, depending on how you render this can create a myriad of beautiful aesthetic options. From these points it is possible to draw geometry and create what is known as a mesh, by drawing triangles between three points; this is a traditional means of creating complex geometrical models. These meshes then can be used easily with most softwares including Unity3d. The benefit of the mesh over the points is that the mesh represents a planar surface and this works better in the realm of physics with modern game engines like Unity3d. Planar surfaces create a barrier that can be used to develop interactions with more computational efficiency. But I digress. Photogrammetry is a wonderful tool for translating real word objects into virtual ones.

The 2 softwares I employed were Agisoft Photoscan and Open Drone Map (WebODM). The main distinction is the usage, Photoscan is a professional software with a full GUI, and focuses on full 3d and 2.5D reconstruction with licensable options. It has been used extensively in the movie industry for years, studios use this technique as a starting point for 3D reconstructions of actors that are then refined by SFX artists. WebODM is an open source project with a primary focus on drone based photography and is built to support 2.5D processes very well. 2.5D refers to reconstructions that build models from a ground point, with the bottom always being a plane with details rising from it. Like buildings on streets. You have the buildings connected directly from the street in the model. This is very useful for surveying, but not in object reconstruction like people or things(though this is improving.) WebODM was used in a collaborative artwork “Head in the CLOUDS” by myself and artist Robert Blatt as part of the IDEAS 2017-2018 series in Calit2 at UCSD. Other than the concept of the application being housed entirely in the cloud, it also creates a unique aesthetic within its data noise that was appealing to us. There are multiple applications that support photogrammetry out there but these 2 were used for access and performance. However in the near future dense reconstructions will be available on simple devices and most likely become commonplace as telematic stand-ins.

Due to the immense amount of digital images in the world we are able to develop with growing pace image processing techniques and usages. One of the contemporary usages is in face swapping. For awhile now you have been able to use computer vision (CV) to change faces of people in photos, the meme *manbaby* show this phenomena in full force. This is just a simple face replacer switching the 2 faces in any photo. However last year in 2017 the internet was taken by storm by a new sensation known as *deepfakes*. In this face swapping method you can change specific faces in videos or images with other faces using the power of neural nets. This particular techniques uses 2 sets of training data

to learn 2 specific faces and then swaps the face of a specific person it sees in any scene for the one it was trained on. Making an attempt to copy the pose, motion of the eyes, nose, and mouth. This became famous because people began editing in their favorite celebrities face over porn actresses in videos. There are famous examples of John Oliver swapping his face with Jimmy Kimmel. But this technology is not a simple face changer. It is a complex training method that learns the features of a face and estimates their change, remapping open mouths, blinking eyes, squinched cheeks. The goal of this tool is to make very accurate articulate compositions to match the original. This accuracy is based on training data and time.

With this technique comes many capabilities in CG editing. A great example of this is the mustache replacement of actor Henry Cavill in the recent Justice league movie. Cavill could not shave his mustache during reshoots due to another contract, so Warner Bros had their special effects team digitally remove by hand the mustache creating some of the most awkward uncanny valley effects in modern cinematic history. With a well trained model, swapping the face through the AI yields better results than the crafted labor. At much less cost as well. This just goes to show some simple case uses, this techniques has been expanded to work on realtime youtube video, simulcasting someone elses face movement and pose over the displayed video. Examples of researchers show using their own face to replace the movements and motions of Trump or Obama. Effectively highjacking their face. Jordan Peele the Director and Writer showcased this in a PSA earlier this year where he gave a faux public address as Barack obama, using his own words and face to update the pose and position of Obamas from a stock video. This came with dire warning about trust, privacy and fake news. The point I'm making is that this technology quickly becomes commonplace and accessible to the general populations, stoking fears but also offering tools for creation.

As I investigated this face swapping I realised it could be used alongside photogrammetry to potentially make robust 3D models from video based images sets. The best part of this is the ability to potentially reconstruct those lost to us in time. All you need is an archive of enough images of them. I hoped I could reconstruct my father. Utilizing source code from the faceswap Github I set about my way. I was able to build the example and train the given data to place Trump and Nicholas Cage in a dueling face off. After learning how to train my models and configure the workflow I began preparing a data set of my father. Collecting as many images from my family as possible I began harvesting my new grainy photo collection transcribing it into the digital rows of matrix pixels.

After all the work to collect the images my yield was far from desirable at just about 140 images. It seems small for a lifetime of 51 years, especially compared to some of my current families almost daily selfies accruing hundreds of photos a year. Within this small data set I also had out of focus, grainy, and discolored images. Images that spanned my father's life from his high school graduation, to his marriage to my mom, holding his first born, holding his second, third born, and eventually his 1st grandson. This was not enough. Testing the images I quickly identified problems in the set, first was the quality, which was mostly bad due to being a product of point and shoot disposables. The heads were small in the photos and high res scans only highlighted their faults, there also weren't enough angles of the face, turned poses, and my father wore glasses in half. I used techniques in mirroring to double the data set and offer more poses. Then I investigated upsampling but this turned out to be a lost cause, it just adds noise into the image, even the AI based methods seemed to only create slightly better noise through histogram matching but adds no detail. After multiple adjustments my last attempt was to hope the model could be trained to something manageable, so I left it to train for a week. In the end the results I got went from slightly nostalgic to horrifying enough to make Mary Shelley proud. It was not

alive. The face swap endeavor though producing something of aesthetic interest was not going to work for my needs. I had to find another solution?

Over the last few years there have been tremendous leaps in ai image manipulation methods. Faceswap was one of these methods produced just a year and a half ago. So I began digging around at other methods for image reconstruction, substitution, replacement, and eventually found a method of 3d face reconstruction from a single image. In this method they find facial features, determined face pose and the deform a base 3D face mesh to fit. Then they extrude the pixels out to create a 3D reconstruction of the original face. Though there is still some pretty heavy artifacting the results are much better than the results I was trying with Faceswap. The best part was the online demo you can try it and then download the models.

Using the 3D face reconstruction from single images I am able to pull out my father's face from a variety of images reconstructing him from the multitude of eras. The faces as mentioned before have artifacting. This artifacting is seen easiest in the readability of the faces from specific angles. I imagine because the algorithm aligns the pose of the face and no information is available on the occluded sides of the face reconstruction only appear normal from specific angles similar to the original pose. So the uncanny valley is once again in full effect as the head moves. Another hurdle is that the color comes out not as a texture but encoded as vertex color. This is not normally too bad I wrote a simple shader for unity, but because I am already using other shaders this caused conflicts. I was able to track down a process utilizing blender and meshlab that put me on the path to creating a face with a textured surface. This is also necessary for these to be merged or blended into other models. So now I have my faces, textured 3D meshes ready for use.

So now I have a means of recreating my whole body, face and all as well as my father's face in 3D, through some more traditional methods in 3d modeling software I am able to mesh these together with any models I have made to create sculptural memories of my father. These are the sculptures you see populated in Dadum. Accompanying these sculptures are audio files written by myself created through a Text To Speech (TTS) voice of myself. In the exhibit space they are just wafting memories, in VR they are connected to the sculptures in space, as if narrating themselves. In AR they become more social embodied and based on the others ability to perceive and hear your new embodied avatar. The purpose of this memory is not to reconstruct my father, but to build my ability to share a portion of my digital self through social engagement.

FIN.

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