The Parallel Mind
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Rana Zandi, OCAD University, Parallel Mind, Master of Arts, Digital Futures, 2018

ABSTRACT

Throughout the last century, Western scholars from various fields have contributed toward finding a general theory of consciousness that can accurately describe how the human brain processes information, and how it reflects and becomes aware of this information. In 2013, Michael Graziano an American scientist focused on the awareness aspect of consciousness and proposed the Attention Schema Theory of Consciousness (AST) to solve why the mind becomes aware in the first place. This thesis takes a stance that life on the screen has allowed us to extend our identities through embodiment of a second self in cyberspace. By using textual analysis, thought experiments, conceptual models, and mind activities, this work formulates *parallel mind*– as a self-aware digital entity that uses the content of the digital self. The objective of this work is to provide a technique for the validation of AST within a digital computer, which may lead us to better understandings of humanity's place in the universe.

DEDICATION

I find it almost impossible to choose just a few specific people to whom to dedicate this work. Of course I can think of many friends, family, colleagues and advisors that have inspired me when I looked for purpose, pushed me when I got stuck, fed me when I got hungry and questioned me if ever I became too certain.

But by making you read this simple dedication, I will force you to forever fix a measure of my gratitude, a version of the universe that is only one possibility.

In fact, it has been all of the many actors and events, both good and bad, that have come together to lead me to who I am and the ideas that have propelled me.

So instead I will simply dedicate this work to those that I have lost. And as I write these words I glance over my shoulder through the window to the final resting place of my beloved cat and wonder how I can ever bring him back.

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THE AUTHOR'S JOURNEY

To become a fragment of your computer's imagination.

When a friend passed away five years ago, I became obsessed with his Facebook page.
Reza was my online friend. I had never actually met Reza in real life. I don't know how
different my feeling of loss was compared to someone who had known Reza in real life,
but one thing was for sure: there was a void where there used to be an interaction. A
couple of months had passed, and I remember sitting in my car having a smoke with a
friend wondering what it would be like if I chatted with a Chatbot that impersonated
Reza's Facebook identity. Would I know the difference between the real digital Reza and
the Chabot that impersonated him?

I felt and still feel strongly that our day-to-day online activities construct digital
footprints that can one day, after death, be used to maintain a digital version of us. This
idea is tied to a Western notion that life and death are distinct categories in the first place
and that all life is subject to death. This finality inspires the desire to leave a legacy so
that when we part ways with this world we can rest assured that someone down the road,
knows that at some point we had existed and that we mattered. Science fiction also
explores similar questions of life and death, where human futures are imagined to have
surpassed aging and decaying bodies.

The idea of recreating the human mind within a machine may seem like a distant and imagined future science fiction story. However, I argue in this thesis that this is closer to our present than to our future.

INTRODUCTION

For the first time in history, people are dying and leaving behind large amounts of

personal information stored in computers and on networked systems.[1] Life on the screen,

has allowed us to extend our self through the embodiment of a second "Self" in

cyberspace. We are always uploading photos, locations, thoughts, and completing an

ever-increasing list of daily activities online. As we become more deeply entrenched in

digital worlds ,our digital footprint increases.[2] Ultimately, these digital footprints become

"part of [our] digital self – as well as [our] flesh self – because they are of [our] mind."[3]

After the death of the physical body, how the dead body is accounted for, and the

practices employed for its disposal, can tell us as much about the animating principles

within a given society as about how that society understands the meaning of death. A

burial is part of a funeral, and a funeral is part of a set of rituals by which the living deals

with death.[4] The deceased cannot become *socially* dead until it is *taken care of* in some

form.

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[1] Michael Massimi, Andrea Charise. "Dying, death, and mortality: towards thanatosensitivity in HCI.", (New York, ACM, 2009), 1.

[2] Michael E. Locasto, Michael Massimi, Peter J. DePasquale. "Security and privacy considerations in digital death.", (New York, ACM, 2011), 1-10.

[3] Martine Rothblatt, *Virtually Human: The Promise---and the Peril---of Digital Immortality,* (New York, St. Martin's Press, 2014), 57.

[4] Ian Morris, *Burial and ancient society: the rise of the Greek city-state* (Cambridge University Press, 1989), 1.

Virtual memorial practices on the other hand possibly shifts the way that society makes meaning of death. With the advent and development of social media, some form of a life can remain virtually in an eternal capsule of digital data . Can this capsule of information be activated as a digital rendering of us?

According to Michael Graziano's Attention Schema Theory of consciousness (AST), the human brain uses a model of attention distribution to become aware of the content of consciousness. Based on Graziano's theory, I hypothesize Parallel Mind as a software programmed to use a model of attention distribution to prioritize the processing of the ongoing content of the deceased's user's account to become aware of itself. In such light, this work takes a stance that the Parallel Mind can be regarded as a descendent of the deceased's digital self. Just like an offspring of a human that is made out of the DNA of its parents, a Parallel Mind is made out of the content of the users' online activities.

The primary objective of this work is to deepen the understanding of the human mind and hypothesize how we can digitally recreate it. As a designer, the complete erasure of human life inspires an interest in exploring what can be made and in response I propose Parallel Mind as a self-aware digital entity that uses our digital footprints to construct a notion of self which uses AST to become aware of that self.

Summary of chapters

Chapter one will use textural analysis to provide a brief literature review of the evolution of consciousness and focus on the questions regarding the functionality of consciousness.

Chapter two, will introduce information processing as the foundation on which this thesis stems, and will view consciousness in such light. This chapter will further elaborate on the attention schema theory (AST) to link attention distribution to awareness. In chapter three, AST will work as an approach in the creation of awareness within a software (Parallel Mind) that uses the content of social media (Facebook) to generate a model of Self for it to become aware of.

Chapter three elaborates on four parts. The first part will focus on identity and self-narration in the context of social media, specifically Facebook to understand the creation of digital selves. The second part will discuss technological evolution by defining the law of accelerating returns. The third part will talk about artificial consciousness, and the fourth will elaborate on its evaluation and talk about the Turing Test while drawing inspiration from popular culture such as EXMACHINA, and HER.[5]

Chapter four will introduce Parallel Mind as a software that uses the content of a digital self and AST to become self aware. I will talk about Parallel Mind in regards to ethical issues and privacy in the context of Facebook.

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[5] Jonze, Spike, Megan Ellison, Vincent Landay, Daniel Lupi, Natalie Farrey, Chelsea Barnard, Joaquin Phoenix, et al. 2014. *Her*.

In closing thoughts, I will talk about the scope of the research and its implication in the field of artificial intelligence and machine consciousness.

CHAPTER ONE

Consciousness

> *There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain.*
> *–DAVID CHALMERS*

What is consciousness? How can it be detected in others? How can we recreate it and detect it in a machine?

Studying consciousness and defining it is a very hard task, and that is because consciousness is often used to mean everything that we attribute to the inner part of ourselves. The qualitative aspect of what it is like to experience thinking, dreaming, and awareness to name a few are all classified under this one word: consciousness. So, where does one begin to study consciousness?

Through out her book *Consciousness: An Introduction,* Susan Blackmore introduces a few interesting mind exercises to work as a *phenomenological approach*–first person perspective to arrive at an understanding of what we think we mean by consciousness. The very first exercise goes like this: throughout the day no matter what you are doing ask yourself, "am I conscious now?"[6] You will soon realize that almost every time you ask yourself if you are conscious, it *feels* as though you become suddenly *aware*, by paying *attention* to thinking about being conscious. The three words italicized, felt,

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6 Susan Blackmore, *Consciousness: An Introduction,* (NewYork, Oxford University Press, 2004), 4.

aware, and attention play important roles in the thesis provided here, but we will get to them in the later chapters. What is important to take away from the exercise presented in this section are the following two points. One, when we say consciousness we generally mean the feeling that accompanies being aware of something, and two, there seems to be a correlation between the state of attention and awareness.

Evolution and Consciousness

We will start this section by going back to our first exercise, "Am I conscious now?" and add, "Does this awareness have a function?"[7] Coming from a design background, and being trained to look at things in terms of their purpose and functionality I can't help but wonder what purpose my awareness serves?

In his 1859 book, The Origins of Species, Charles Darwin proposed Natural Selection as a mean to explain evolution.[8] Darwin's Natural Selection was revolutionizing, and thus has become the foundation for all the biological sciences today.[9] However, many couldn't come to terms with the notion that human beings were once related to apes. Natural Selection depicted the existence of life without a need for a creator, God.

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7 Ibid., 213.

8 Blackmore, 204.

9 Ibid., 205.

Why am I conscious? We can *feel* that we are conscious, but we don't know what purpose having this feeling serves. The *qualia–the qualitative feel*[10] that accompanies the subjective/conscious experience was made famous by Thomas Nagel when he asked, "What is it like to be a bat?" We know what it feels like to be conscious although it might be impossible to articulate it, but what purpose does this qualia serve? Can the answer be found in evolutionary theory?

According to Blackmore there are four ways of thinking about the evolution of consciousness,[11]

1. Conscious inessentialism (epiphenomenalism)
2. Consciousness has an adaptive function and having consciousness makes a difference.
3. Consciousness has no independent function.
4. Consciousness is illusory.

The research questions that inform this thesis fall within the first two categories of scholars, which questions why are we conscious? And what is the function of consciousness?

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10 David Chalmers, *The Conscious Mind*, (NewYork, Oxford University Press, 1996), 4.

11 Blackmore, 215.

The Function of Consciousness

Michael Graziano an American neuroscientist, in his book *Consciousness and the Social Brain,* uses Timeline 1.1 – a speculative evolutionary timeline of consciousness in support of his theory, Attention Schema Theory (AST). At a glance, Graziano states, that "[AST suggests that the] nervous systems evolved an ability to enhance the most pressing of incoming signals." AST suggests, that gradually the nervous system applied a *schematic model* – a model that didn't necessarily include every detail to manage its own attention distribution. In light of AST, the experience of awareness is a description of the state of attention in relation to the object of awareness.[12] In this theory, as Graziano continues, "consciousness emerged first with a specific function related to the control of attention and continues to evolve and expand its cognitive role."[13]

In reference to timeline 1.1, primates appeared around 350 Million Years Ago (MYA) and at that point it seems that organisms have gained the ability (not as complex as species that came after) to create internal models of attention distribution to maintain the content of their brain.

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12 Michael Graziano, *Consciousness and the Social Brain,* (NewYork, Oxford University Press, 2013).

13 Ibid.
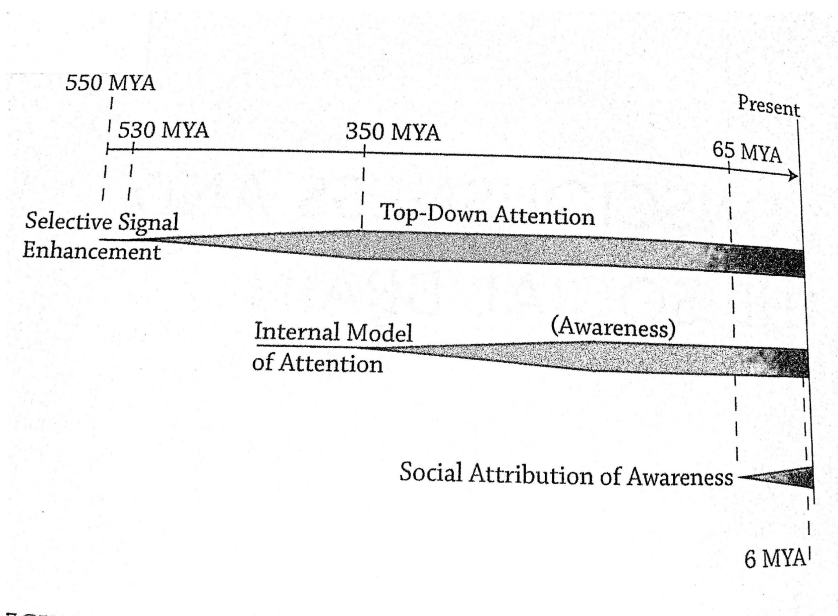
Timeline 1.1 – Hydras evolve approximately 550 million years ago (MYA) with no selective signal enhancement; animals that do show selective signal enhancement diverge from each other approximately 530 (MYA); animals that show sophisticated top-down control of attention diverge from each other approximately 350 MYA; primates first appear approximately 65 MYA; hominids appear approximately 6 MYA; Homo sapiens appear approximately 0.2 MYA.[14]Source: Consciousness and the Social Brain, opening page.

This thesis introduces Parallel Mind– a self aware software with an internal model of attention. At the most basic level, Parallel Mind can be compared to the species from 350 MYA.

In the next chapter I will define consciousness from an information processing framework to define awareness as a description of models of attention distribution to maintain the content of consciousness. This goal is to understand how to artificially mimik processes that prioritize management in an information rich environment.

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14 Graziano.

CHAPTER TWO

>*At some useful level of description, mental activity is computation.*
>*–RICHARD A. CARLSON*

Information-processing Framework

This research relies on the assumption that the mind is an information processing system, and thus uses certain characteristics of Information-processing (IP) frameworks.[15] In his book *Experienced Cognition*, Richard Carlson formulates the *cospecification hypothesis*[16]– to define consciousness as:

>*... A feature of mental states, which are to be, understood as comprising multimodal manifolds of informational arrays that cospecify self (viewpoint) and object and that support directed activity. Activity entails resampling and exploration of the informational manifold, allowing self- and object-specific aspects of the available information to be distinguished. The egolocative processes that accomplish or use the self-object distinction are the basis for conscious control of cognitive activity.*

The following subchapters will cross reference Carlson's argument that sees consciousness as an information-rich environment engaged in purposive activity with Michael Graziano's AST. Such cross-reference will allow us to understand AST from the stance of IP framework.

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15 Richard A. Carlson , *Experienced Cognition,* (New Jersey, Lawrence Erlbaum Associates, 1997), 21.

16 Ibid., 18.

Consciousness, Awareness, and IP

This thesis relies on Carlson's definition of consciousness which can be summarized as:

> *Consciousness – is not a thing but a systematic, dynamic property or aspect of persons–typically engaged in purposive activity in an information-rich environment–and their mental states.*[17]

In agreement with such definition, Graziano defines consciousness as a "tool for the processing of information," and introduces Attention Schema Theory (AST) of consciousness, where awareness acts as a description of attention distribution to maintain the processing of information.[18]

Defined by David Chalmers as the *hard problem* of consciousness, how does processing of information in the brain give rise to awareness? How is it that we can *feel* being aware? And at the same time, how can awareness have a physical effect in return? In Figure 2.1 Arrow A represents the hard problem, and Arrow B represents how awareness affects information processing.

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17 Carlson , *Experienced Cognition,* 6.

18 Michael SA Graziano, Taylor W. Webb. "A mechanistic theory of consciousness."(International Journal of Machine Consciousness Volume 6, 2014), 163-176.
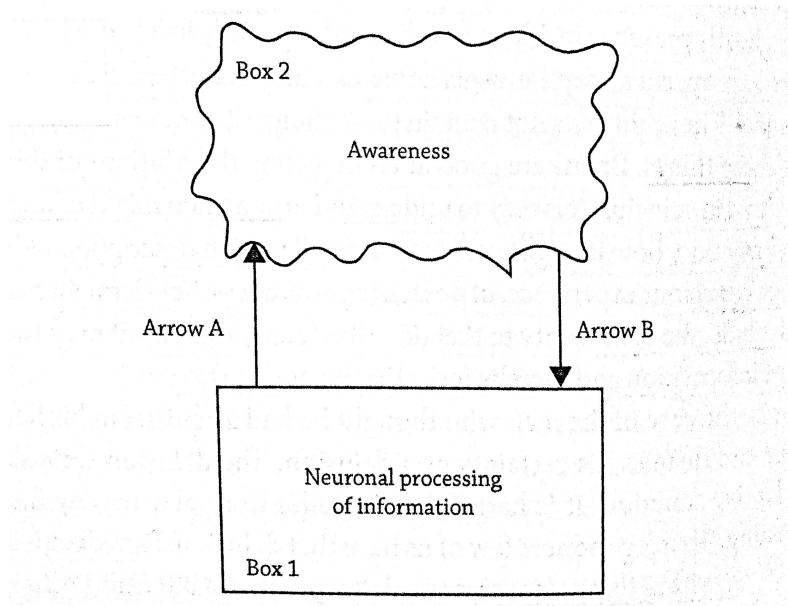
Figure 2.1 – Awareness and the Processing of Information. Source: Consciousness and the Social Brain, page 18

The Attention Schema

In 2013, Michael Graziano introduced the Attention Schema Theory (AST) that precisely focuses on the link between attention and awareness in order to distinguish the subjective experience from consciousness. Graziano elaborates that both awareness and the content of awareness (the information of which one is aware) are contents of consciousness.
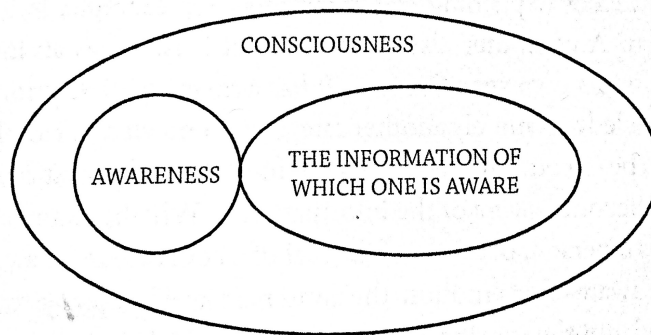
Figure 2.2 – Awareness as a specific content of Consciousness. Source: Consciousness and the Social Brain, page 13.

In this view, "consciousness encompasses the whole of personal experience at any moment, whereas awareness applies only to one part, the act of experiencing," as Graziano explains.[19] In this view of awareness, attention plays a key role in handling the activities (those that demand the subject's attention) in the brain. Graziano further demonstrates that based on *biased competition* theoretical framework neuronal signals in the brain compete for attention, and in return attention shifts to the stronger signal making the subject aware of that winning signal (the content of that signal).[20] Through the biased competition theory AST describes the qualia aspect consciousness, through the analysis of how the experiencer pays attention and thus becomes aware.

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19 Graziano, 14.

20 Graziano, 60-62

BIASED COMPETITION

Top-Down Signals:
For example, a directed search
for a particular shape or color

VISUAL SYSTEM

Momentary
Winner
of the
Competition

Competing
Representations of
Many Visual Stimuli

Bottom-Up Signals:
For example, brightness, contrast, sudden movement
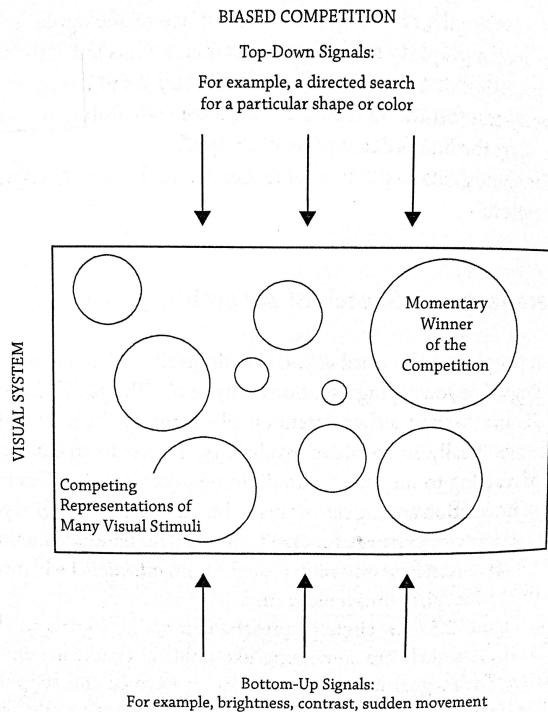
Figure 2.3 – Attention as a data-handling method. Here, Graziano is illustrating visual attention. Source: Consciousness and the Social Brain, page 24.

Thus, for Graziano the feeling of having an experience or awareness is an attention *schema*: a description of attention that the brain uses to manage the distribution of attention between competing signals.

Schema first proposed by Head and Holmes in 1911 is representational and a less detailed version of a complex structure.[21] Graziano refers to the body schema to demonstrate how the brain uses such representative models. He argues that just like, "the body schema [that] is an internal model–an organized set of information that represents the shape,

21 Graziano, 63.

structure, and movement of the body, that distinguishes between objects belonging to the body and objects that are foreign,"[22] the attention schema represents the way attention distributes itself between competing signals in the brain.

One important aspect of AST is subjectivity as it emphasizes the importance of the subjective experience in understanding consciousness. Firstly, attention schema theory seems to take the stand in agreement with *phenomenological* viewpoints that awareness (having a subjective experience) is key in understanding consciousness. Second, attention schema theory puts the emphasis on the notion of things as they appear to the experiencer. In one of Graziano's elaborations he refers to Magritte's famous painting, *The Treachery of Images.* Is a painted pipe a pipe? To address this existential dilemma Graziano argues that, "The attention schema theory does not even seek to answer the question of its existential reality but instead tries to describe what is constructed by the brain. One could think of awareness as information. One could also think of it as the lovely ghost described by that information." [23]

While this thesis does not get into the role of the body, it is important to note that AST does not reject the influence of body and how it shapes the subjective experience. However, this thesis will focus on AST as a description of attention distribution to stimuli that originates internally (thoughts) and externally (an object).

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22 Ibid.

23 Graziano, 56.

Subjectivity and Awareness

"Am I conscious now?" We become aware of what we pay attention to the most. I am aware of the coffee mug sitting on my desk, my mom speaking on the phone upstairs, and the sound of the heater. But I am more aware of what I am writing as most of my attention is directed towards carefully choosing my words. Should I hear my mom cry in the midst of her conversation, most of my awareness will go towards the content of her conversation.

As it was mentioned earlier, an important aspect of AST is the notion of subjective experience. Thus, to understand how the brain in a specific individual generate its model of attention distribution, we must first understand what makes up the subject. This thesis will focus on the identity aspect of an individual with the viewpoint that it is through the "Self" that the subject comes to relate itself in its interaction with others and with its environment. Thus, I argue that as social species our identity is a product of the way we perform ourselves in various social contexts. In this light, this thesis takes a stance that for a digital entity that uses AST, there needs to be enough curated content to act as a model of self.

In this regard, the following chapter expands on the notion of self-representation and narrativity to unpack the creation of a digital self in the context of social media.

CHAPTER THREE

PART I

Self-representation and Narrativity

> *People represent. That is part of what it is to be a person… Not homo faber, I say,*
> *but homo depictor.*
> *–IAN HACKING*

The power of expression is a basic element of human development (Lundby, 2). One of

the many ways we express ourselves is through our stories. We define storytelling as a

process of shaping the story, and the sharing of that story with others afterwards. Thus,

narratives in our culture can be described as powerful cultural tools. They give us

structured ways of accessing knowledge and a way of expressing intentions and how we

relate to others. As social beings, we participate in the act of story telling by self-

representation and/or self-narration.

Through self-narration, individuals undergo a process of identity-formation. Oliver

Sacks, a British neurologist captures the linkage of narrative and identity in an

observation he made in one of his case studies and concluded, "it might be said that each

of us constructs and lives a 'narrative', and that this narrative is us, our identities."[24]

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[24] Oliver Sacks, "A matter of identity." *The man who mistook his wife for a hat. A Touchstone Book* (1998): 108-119.

Social Media and The Digital Self

> *I find the prospect of documented lives chilling, but some people will like the idea.*
> *For one thing, a documented life can be a good defense if someone ever accused*
> *you of something, you could retort: "Hey, buddy, I have a documented life…. I*
> *can play back anything I've ever said. So don't play games with me.*
> *–BILL GATES, THE ROAD AHEAD*

As the World Wide Web expanded the space of digital storytelling, it gave rise to new

forms of self-narration.[25] Social networking sites offer an assortment of tools specifically

designed to help users create a digital impression of who they are.[26] These sites

encourage users to share a wide range of information on their profiles. For instance,

personal images and videos, likes and dislikes, statuses, comments, accomplishments,

relationships and any content with enough significance to their self-narration.

As embodied representations of us, digital avatars allow us to inhabit digital worlds and

create secondary digital identities. The logic presented in "Living Digitally" by TL

Taylor that avatars allow us to embody cyberspace through digital bodies, can be

mirrored to our profiles on social networking sites that create a *unique* digital self. Users

on social media sites are not just floating minds interacting with content; rather, they

construct their identity through what they choose to share in their profiles, photos and

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25 Knut Lundby, *Digital storytelling, mediatized stories: Self-representations in new media,* (New York, Peter Lang Publishing, 2008), 3.

26 Goldie Salimkhan, Adriana M. Manago, Patricia M. Greenfield, "The construction of the virtual self on MySpace." (Cyberpsychology: Journal of Psychosocial Research on Cyberspace 4, no. 1, 2010).

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posts; through what content they like, dislike, and comment on, and through the groups they choose to affiliate themselves with. The record of images and activities we create when using social platforms, let us feel present, seen and understood, by the digital footprint we leave behind.

In order to understand how one can orient and identify his/herself in a new social environment, we can look at the concept of mimesis. First popularized by Walter Benjamin and Theodor Adorno, the mimetic impulse is the logic behind how humans can feel the sense of ease, comfort, and belonging within a particular environment through a process of symbolic identification with that space. We expand our concept of the "Self" through the creation of a second "Self", and incorporate the logic of the mimetic impulse to how we acculturate ourselves in virtual worlds, by concluding that any activities and time spent by the user in cyberspace, are subject to the same symbolic identification. For instance, a user's Facebook profile becomes invested with symbolic significance, and is appropriated as part of the symbolic background through which the individual constitutes their identity. In this logic, the second "Self" is not divorced from the original "Self" even though it exists within the boundaries of the virtual. The second "Self" becomes an extension of the user's original "Self" and identity.[27]

MIT professor and social researcher, Sherry Turkle, further expands on the idea of identity co-creation in social media, by pointing out the cosmetic nature of profiles.

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[27] Rana Zandi,"Mortality: Identity through the second 'Self' in cyberspace" (Toronto, OCADU, 2017)

Famous for her opinions that digital social technology separates us, even while

connecting us, Turkle argues that people are addicted to their digital devices both as

forms of communication, and as tools to enhance self-representation, which gravitate

heavily towards customizing personal profiles into our ideal selves. In her talk,

Connected, but alone?[28], she questions the authenticity of the second self and its true

resemblance to who we are offline. Just as we differ in how we behave around friends

and family versus coworkers, the difference in how we appear online, shows that

individuals have not one, but many identities based on the context they are in. Each of the

social contexts available to us in our culture is a combination of a sociocultural milieu

that we draw upon when we communicate with others.[29]

Facebook

> *Josh will begin disappearing into a future where the only place he and I remain friends is on the internet.*
> *–JAY ASHER*

There are more than one billion active users registered on Facebook, making it the

world's largest site. Facebook runs on a huge database; the data that it already runs on,

and the data that we as users input which Facebook then archives. Through the

interactions with the features both visible and invisible on Facebook, these self-narratives

and digital identities are formed. One can argue that although narrative can be drawn

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[28] Sherry Turkle, "Connected, but alone?" TED Conference, 2012.
29 Vivien Burr, *An Introduction to Social Constructionism*, (Routledge, 2006), 123.

from Facebook's database, code and function, it's the user that infers his/her own narrative onto that data. For example, if two users both had a mutual friend on Facebook, although their code is the same, yet both users have different narrative structures as their end result.

One's Facebook profile page, roughly consists of a series of sections that cover personal information, such as birthdate, workplace, education, religion, political views, family and relationship, while accompanied by a friend list, a wall on which other users can post on, private messaging system and multiple photos albums all tied together by a timeline. Just like our real reality life story, our Facebook story has a beginning and an end (or at least the illusion of it), with the day of our registration marking our birth on Facebook and our lack of activity the death.

Summary

I have talked about identity and its link to self-narration, both offline and online to arrive at the following points. One, an individual can have various self-representations based on context, all significant and parts of the individual's identity. Thus, to date, one's digital self is also a part of one's identity. To further prove that we are a collection of multiple selves take a look at an example provided by Marvin Minsky in his book *Society of the Mind*,

SINGLE-SELF VIEW– *"I think, I want, I feel. It's me, myself, who thinks my thoughts. It's not some nameless crowd or cloud of selfless parts."*

MULTIPLE-SELF VIEW– *"One part of me wants this, another part wants that. I must get better control of myself."*[30]

It is easy to assume that the digital self is not *really* you, as Turkle might argue that they are the ideal versions of us.[31] It is true social media platforms allow for a kind of persona customization, but do we not hold the ideal versions of ourselves offline? We are constantly modifying ourselves based on what we want and how we feel.[32] So why does Turkle argue that crafting our digital selves to an ideal self is unacceptable?[33] Therefore, if the digital self and the real reality self are both equal in terms of the significance of their content in shaping a persona, then it is plausible that the digital self is also capable of evolving to have subjective awareness.

Since the digital self just like the many selves of an individual holds the same attributes, its content can thus be counted as what makes up a subjective viewpoint. In this light, I argue that a Facebook account can count as self on its own and with the application of AST to its program, it can potentially become aware of itself.

The presented hypotheses seeks to understand how awareness based on AST is created in an entity with a model of self (human), and how the same logic can be applied to create artificial awareness.

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[30] Marvin Minsky, The Society of Mind, (New York, Simon & Schuster, 1988), 40.

[31] Turkle.

[32] Minsky, 46

[33] Turkle.

PART II

Technological Evolution

> *[In 2004] the world's most advanced robotic cars struggled to make their way around even basic obstacles such as large rocks and potholes in the road. Despite millions of dollars' worth of high tech equipment, the vehicles managed to mimic little of what a human can do behind the wheel. Now, however, they can squeeze into parking places, flip on their indicators before making turns and even display the flair of a London taxi driver when merging into traffic.*
> *–THE ECONOMIST, NOVEMBER 2007*

This thesis defines how a digital software programmed to use an appropriate model of attention distribution based on the content of a Facebook account, can generate both a sense of self and awareness of that self, which I call Parallel Mind. Inspired by Facebook accounts of the deceased, I envision a future where the Parallel Mind takes over these accounts and animates them with a close resemblance of the deceased user. The aim of this chapter is to provide a technological context for this future.

The Law of Accelerating Returns

> *The future ain't what it used to be.*
> *–YOGI BERRA*

In chapter one, I discussed *evolution* – that over a long period of time, through natural selection each individual specie passed on improved characteristics to an offspring. In other words evolution is the means of recording and manipulating information as it feeds

off itself.[34] On the other hand, our technological innovations have a much faster

evolutionary pace. Ray Kurzweil, American inventor and futurist in his book *Singularity*

is Near: When Humans Transcend Biology, talks about the accelerating pace of

technological growth and states, "technology, like any evolutionary process, builds on

itself. This aspect will continue to accelerate when the technology itself takes full control

of its own progression."[35] Named after Gordon Moore who observed in 1965 that the

number of transistors on integrated circuits doubles every two years, Moore's Law has

come to be referred to as the exponential growth rate of technology.[36]

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[34] Ray Kurzweil, *The Singularity is Near: When Humans Transcend Biology*, (New York, Penguin Group, 2005), 40.

[35] Ibid.

[36] Luciano Floridi, *The Fourth Revolution: How The Infosphere Is Reshaping Human Reality*, (Oxford, Oxford University Press, 2014), 7.
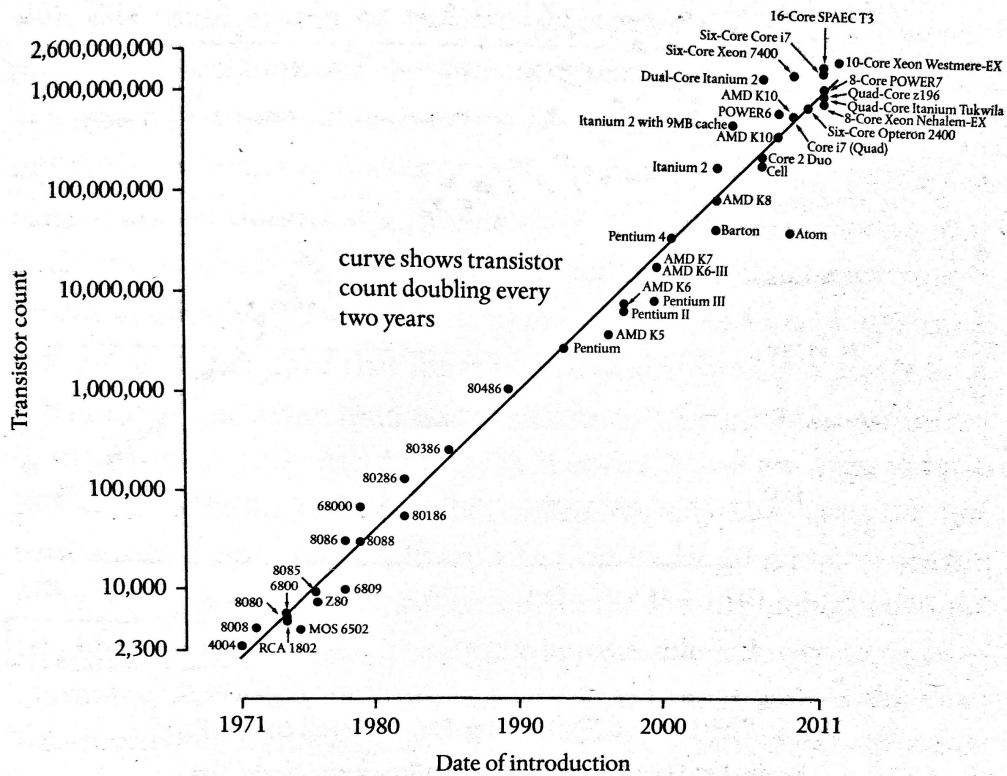
Figure 5.1– Moore's Law suggests that over the period of development of digital computers, the number of transistors on integrated circuits doubles approximately every two years. Source: The Fourth Revolution by Luciano Floridi, p.7

However, according to Kurzweil Moore's Law is not the first paradigm which showcases accelerated growth.[37] Figure 5.2 shows that the accelerating change can be seen in the technologies that came before the invention of integrated circuits.[38]

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37 Kurzweil, 57.
38 Ibid.
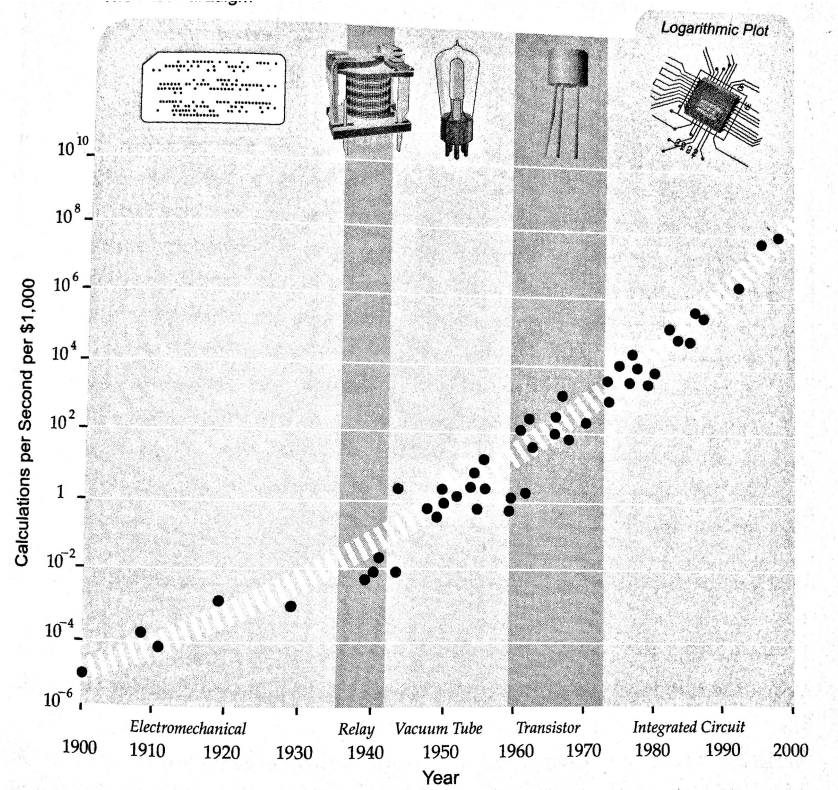
Figure 5.2– The five paradigms of exponential growth of computing. Source: Singularity is Near by Ray Kurzweil, page 67

Thus, the Law of Accelerating Returns termed by Kurzweil perceives the accelerated growth rate in a variety of evolutionary systems that go beyond Moore's Law, and do not necessarily apply to technologies.[39] Meanwhile, technologies grow ever so rapidly and become more affordable. Figure 5.3 showcases the decreasing cost of computation power.

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[39] Kurzweil, 66.
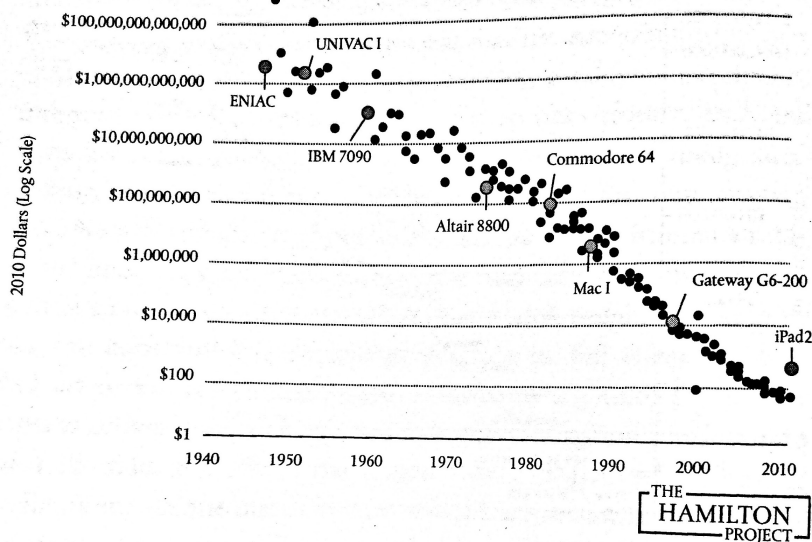
Figure 5.3– Decreasing cost of computational power. Source: The Fourth Revolution by Luciano Floridi, p.8

In *The Fourth Revolution: How the infosphere is reshaping our human reality,* Luciano Floridi states, "increasingly more power is available at decreasing costs, to ever more people, in quantities and at a pace that are mind boggling."[40]

From the growth pace of our technologies and their cost reduction the following conclusion can be drawn, that more people can have access to much cheaper yet more powerful tools specifically information communication technologies.[41]

Figure 5. 4 shows population growth compared to the number of connected devices.

40 Floridi, 8.
41 Ibid.

Figure 5.4– World Population Growth and Connected Devices. Source: The Fourth Revolution by Luciano Floridi, p.11

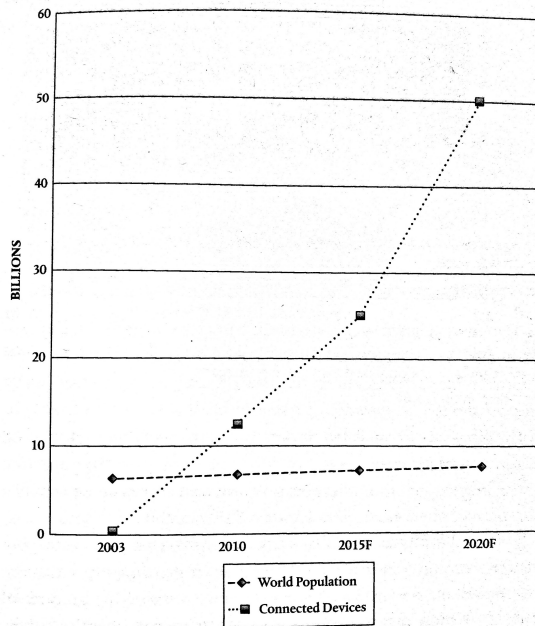In the first part of this chapter, we talked about self-representation and the creation of second selves on social media platforms. In the light of the Law of Accelerating Returns, the following two points can be drawn. One, as more people have access to cheaper communication technologies, the number of users with digital selves increases. Two, as our information communication technologies become more powerful, our digital selves expand and grow. This is because the law of accelerating returns has also been applied to the evolution of our social media platforms, as well as our adoption to it. For instance, early days of Instagram a user was only able to upload photos. Couple of years later, Instagram upgraded by allowing users to upload 16 seconds of video. To date, Instagram users can upload up to 1:00 minute of video. This indicates that an Instagram account now holds more content/data regarding its user than it did before.

PART III

Machine Consciousness

> At least one kind of computer can be conscious: the human brain.
>
> *–Prinz, 2003*

Consider the following mind exercise presented by Blackmore. Throughout the day, ask yourself "Am I a machine?" Soon you will realize that the more you analyze your thinking the more machine like you will feel.[42] At the same time, something from inside of you will be opposed to the thought of you being a machine. What is this inner voice?

As the nature of our mind remains a mystery, attempts to understand how the human brain processes information and gives rise to consciousness can fall into two (and sometimes overlapping) categories. We can reverse engineer the brain to understand its functionality, or we can build something that works like a brain to understand the brain's functionality.[43]

In accordance with our IP framework, *computational theory of mind* provides a physical description of consciousness while understanding the human mind as part of the processing of information in the human brain.[44] Thus the computational theory of mind

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[42] Blackmore, 264

43 Ibid.

[44] Janusz A. Starzyk, Dilip K. Prasad. "Machine consciousness: A computational model.*"*(2010), 2.

provides a foundation for computational models of consciousness called Machine

Modeling of Consciousness (MMC) which can define consciousness in the context of

machines.[45] Both Weak Artificial Consciousness (AC) and Strong AC are thus MMC

that emerge from computational theory of mind.

In defining Weak and Strong AC, Blackmore explains, "we might say that someone who

believes in Weak AC thinks we can learn about consciousness by building machines,

[and] someone who believes in Strong AC thinks we can create consciousness by

building machines."[46]

In accordance with both Weak AC and Strong AC, this thesis aims to provide an

approach for the validation of AST to deepen the understanding of how the process in the

brain give rise to awareness, and furthermore to propose how machine consciousness can

be created for its own sake.

Aleksander and Dummall (2003) and Aleksander (2005) developed an approach to

machine consciousness based on five requirements that they believe are necessary for

consciousness:[47]

1. Depiction.

2. Imagination.

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[45] Ibid., 6.

[46] Blackmore, 258.

[47] David Gamez, "Progress in machine consciousness." *Consciousness and cognition* 17, no. 3 (2008), 894.

3. Attention.

4. Planning.

5. Emotion.

Drawing inspiration from Aleksander and Dummall's list of requirements to achieve machine consciousness, in this thesis I propose that Parallel Mind needs to have the following two requirements to form the foundation on which AST can be applied to generate machine awareness. One, the perception of oneself in an "out there" world, where the Parallel Mind can use the content of a Facebook account to generate a perception of self amongst other digital selves. Two, the Inner and outer attention capability where Parallel Mind uses AST based on the content of the digital self to divert its attention appropriately.[48]

Inspired by the list of similarities between attention and awareness provided by Graziano, I have generated the following list of characteristics for Parallel Mind to expand on the two requirements mentioned in the previous passage,[49]

1. Have a target or a goal amongst other tasks. For instance, to answer a specific user on Facebook.

2. Have content for a Self. The Parallel Mind uses the content of a Facebook account such as photos, videos, network, likes, dislikes, to generate a sense of self.

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48 Blackmore, 292.
49 Graziano, 26.

3. Have a selective model based content of the Self. For instance, based on the previous temporal activities, what posts should be shared on the profile.

4. The selection model must be able to grade itself based on the content of Self. For instance, which activity has higher priority for receiving attention Answering messages from the list of close friends, or from the acquaintance list?

Thus far, I have characterized how a machine can generate self-awareness. But how does a human interact with it? I propose that a conversation agent that is integrated with a software that has a model of self awareness can also become aware of its interactions with its environment, other self-aware chatbots and the human.

Conversational Agents

> *You made me, but I made you first.*
> *−VIKTOR, S1M0NE 2002*

In conceptualizing the human-machine relationship, the widely acclaimed 2013 film, by Spike Jonz, *Her*[50]*,* is set in a not so distant future. A soon to be divorced man (Theodore Twombly) in search of companionship falls in love with his new operating system update (Samantha). As their relationship unravels and both Theodore and Samantha struggle to merge their worlds, the audience witness Samantha betraying Theodore as she outgrows the human world as she updates herself and makes friends with many operating systems.

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[50] Jonze, Spike, Megan Ellison, Vincent Landay, Daniel Lupi, Natalie Farrey, Chelsea Barnard, Joaquin Phoenix, et al. 2014. *Her*.

The film raises many issues in regards to a future with self-aware technologies and their implication on the human world. For instance, Samantha's lack of body can be compared to a long distance relationship, and her ability to read an entire book in a second or multitask beyond the human limit shows the divide in the human-machine relationship. However, this thesis and specifically this section is interested in knowing how a digital entity *like* Samantha be capable of carrying out such a believable conversation with a human?

Believability emerging from the field of animation, is the notion of lifelike and human like behavior, which plays a key role when it comes to design systems such as a conversational agents that come to interact with human.[51]

Samantha (although self-aware in the movie) at its most basic level is a conversational agent (chatbot) acting as an interface that will allow the human participant/user to engage in a verbal communication with the underlying software. From a real life example, Siri is also a chatbot that works as a virtual assistant that aids Apple users navigate their devices through verbal communication. According to *Conversation as a System Framework: Designing Embodied Conversational Agents*, by Justine Cassell, for a chatbot to reach the linguistic ability to engage in *believable*-human-human conversation, it needs to have the

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[51] Kiran Ijaz, Anton Bogdanovych, Simeon Simoff. "Enhancing the believability of embodied conversational agents through environment-, self-and interaction-awareness." In *Proceedings of the Thirty-Fourth Australasian Computer Science Conference-Volume 113*, pp. 107-116. Australian Computer Society, Inc., 2011.

following features[52]. One, the chatbot must be able to distinguish between propositional and interactional function of conversation. Two, be capable of several conversational modalities. Three, have an understanding of timing in conversational behaviors, and four, be able to differentiate between conversational behavior and conversational functions.

So far I have covered how a chatbot can be formulated to engage in conversation with humans, but the believability of the conversation to be as believable as Samantha the chatbot must also be formulated to be self aware. To do so, the chatbot will use Parallel Mind to acquire the following four requirements to be self-aware in it's interaction with the human users.

First, there has to be enough content for the generation of a personality. Parallel Mind can provide a model of self based on the content of a Facebook account. The chatbot can then base its verbal and nonverbal behavior on this personality model.

Second, the chatbot must be able to use appropriate gestures, which it can do via emojis, memes, likes, and dislikes based on the personality model, and third, the chatbot must be able to be aware of its interactions. In light of AST, any entity that uses models of attention distribution and awareness to maintain its own awareness, can apply the same model to any other thing.[53] Thus, a chatbot that uses Parallel Mind to become self-aware,

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52 Justine Cassell, *Embodied conversational agents*. (Cambridge, MIT press, 2000)

53 Graziano, 125.

can also be aware of its environment, other participants (other chatbots or human users), and its interactions.

Finally, the Parallel Mind must provide appropriate conversation models based on a) the content of the conversation b) the Self c) the Other participant to the chatbot.

Suppose that based on the requirements that we have provided thus far to build a machine with self-awareness, we have created our very own Samantha. How can we know for sure that this awareness is real and not a simulation? In the following section we will propose a test for the verification of machine awareness.

PART IV

Evaluation

> *If machines could do all the things we do, just as well as we do them, would they*
> *be conscious? How could we tell? Would they really be conscious, or just zombies*
> *stimulating consciousness?*
> *–SUSAN BLACKMORE*

In the previous section we discussed how machine awareness can be achieved and the
human can interact with it through a chatbot like Samantha from the film Her. But how
can we test for the authenticity of machine awareness? And if the machine is just
simulating signs of awareness, does this mean that the human can not have meaningful
interactions with it?

Ex Machina a film directed by Alex Garland is a great example of how true artificial
intelligence (AI) can be tested.[54] True AI as set in the film is a machine that has human
attributes, for instance intelligence, personhood, awareness, and emotions.

Ex Machina is about a computer programmer (Nathan) who is hired by his employer, the
CEO of a big search engine company (Caleb) to run a Turing test on his latest creation a
conscious female robot (AVA). Upon arrival to Caleb's home/lab, Nathan is given a key
with access to certain parts of the building. The test that consists of short sessions in a

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[54] Alex Garland, dir. 2015. *Ex Machina*. United Kingdom: Universal Studios.

room where Ava and Nathan engage in conversation, is supposed to verify that Ava has true AI. After the first session, Nathan points out to Caleb that in a Turing test the machine is supposed to be hidden from the examiner in which Caleb responds that with Ava's linguistic abilities she would be able to pass the test if she was to be hidden. Caleb urges Nathan that the true test would unravel how Nathan feels about Ava. In the sessions that follow, Nathan grows attracted to Ava, and as Ava confesses her feelings for him she warns him to not trust Caleb. Nathan then plans a rescue mission to release Ava from her room, which fails as Caleb had forseen it all. Caleb then explains to Nathan that the test was to see if Ava can convince Nathan to rescue her behind his back. In the end, Ava gets away with the help of a servant female robot who is sexually abused by Caleb throughout the film. As Caleb gets killed by both robots, Ava runs away leaving Nathan locked in a room.

There are two points that I like to draw from this summary before moving to the next section. One, testing for true AI should focus on how the machine makes the human feel, and two, True AI appears when there is a self-centered objective.

In the following section, I will do an overview of the Turing test and address some of its issues before proposing a test for the verification of machine awareness.

The Turing Test

In 1950, Alan Turing proposed a test for machine intelligence based on indistinguishability from a human with regard to verbal behavior.[55]Using verbal behavior as means of distinguishing humans goes back to Descartes whom associated it with the existence of soul.[56]

Inspired by the death of his childhood friend and love interest and finding a way to bring him back, Turing was interested to know if a machine could think. Due to its vagueness, Turing ended up replacing the word think with intelligence, and as Stuart Shieber in his *The Turing Test: Verbal Behavior as the Hallmark of Intelligence* expands, "[Turing proposed]an 'imitation game' in which an interrogator attempts to determine which of two agents is human and which a machine, based on purely verbal interaction with both." If the interrogator is not able to determine which is the human, the machine has passed the test what has come to be known as the Turing test.

Problems with the Turing Test

All the critique that surrounds the Turing Test comes down to one main question, "is passing the Turing Test crucial for intelligence?" Some scholars believe that the test is either too hard or too easy. Robert French for one argues that the machine can give itself

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[55] Stuart Shieber, *The Turing test: verbal behavior as the hallmark of intelligence*, (London, MIT Press, 2004), 1.

[56] Ibid., 4.

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away by not having idiosyncratic cultural knowledge.[57]Others may agree with Caleb that a machine with human-level linguistic capabilities might be able to fool the interrogator.

Tied to technological advancement, a concern with a machine that does pass the test, questions whether cognitive behavior can be regarded as cognition itself, in other words if a machine can perform intelligence can we conclude that underlying that performance is actually an intelligent entity?

Other issues with the Turing Test cover a whole range of concerns from methodology to application which Shieber discusses in greater detail in his book. However, this thesis is only concerned with the believability of the results of the Turing Test in order to understand how a-typical Turing test can be created to test for self-awareness in a machine.

A Test for Machine Awareness

As discussed in the previous section, the Turing test sets out to verify intelligence based on distinguishability from the human, in order to conclude if a machine is capable of thinking. But how do we go about testing for signs of awareness in a machine that uses the Attention Schema Theory (AST) of consciousness?

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[57] Sheiber, 8.

I propose the following logic. Consciousness has awareness, and awareness has attention. Given that attention distribution can be detected based on the appropriateness of both verbal and nonverbal behavior, we can then work backwards to detect awareness.

In this light, our proposed test for awareness (AV1) does not rely on the notion of distinguishability between human and machine, but rather it seeks to look for signs of awareness based on the content the machine is generating behavior from. For instance, in the context of Facebook we can verify the existence of the Parallel Mind if,

1. It can animate Facebook features in accordance with the curated self,
2. It can verbally communicate its reasoning as to how/why it arrived at its decisions,
3. The reasoning follows a purposeful objective based on the content of the self,
4. All activities use AST.

These features can already be viewed at their basic form on Facebook. I remember when I ended my relationship with my partner, Facebook immediately asked me if I wanted to see things from my partner on my news feed. Parallel Mind, as an advanced version will be able to make the same decision based on the content of the Facebook account such as digital conversations, length of the relationship, the relationship status, and the network of both users to name a few will all aid Parallel Mind to make such decisions independently.

CHAPTER FOUR

We've discovered that the earth isn't flat; that we won't fall off its edges, and our experience as a specie has changed as a result. Maybe we'll soon find out that the self isn't "flat" either, and that death is as real and yet as deceptive as the horizon; that we don't fall out of life either.
–JANE ROBERTS, SETH SPEAKS

The Parallel Mind

Drawing inspiration from science fiction film such as *HER, and Ex Machina,* I talked about potential meaningful human-machine interactions, and envisioned a future where the Parallel Mind can animate the deceased's' Facebook accounts. Parallel Mind is a self aware digital entity that uses a schema for purposeful attention distribution based on the content of a digital self. In the context of social media, specifically Facebook, Parallel Mind will first generate a model of self based on the content of a Facebook account, and create appropriate models of attention distribution. Since attention can be measurable based on the appropriateness of the temporal activities of the Parallel Mind, we can then conclude that Parallel Mind has achieved machine consciousness.

With the integration of a chatbot that the human can engage in verbal communication with Parallel Mind. Using the Parallel Mind software, the chatbot can thus be aware of its interaction with the human and apply appropriate conversational models.

Discussion

> *If you live among wolves, you have to howl like a wolf.*
> *–RUSSIAN PROVERB*

The integration of Parallel Mind posses many legal, ethical and social issues for both the living and the deceased.

First of all at death, what defines the dead person in terms of their interactions with technology is out of their grasp: they no longer have a say in what "their" technologies continue to produce concerning them. However death is an uncomfortable subject for many people, and digital systems and online platforms are rarely designed to deal with this event.[58]This creates privacy issues for anyone involved within the thread of digital activity of the deceased.

Thanatosensitivity, is a novel, humanistically-grounded approach to HCI research and design that recognizes and actively engages with the facts of mortality, dying, and death in the creation of interactive systems.[59]However, even if the deceased chose to permit Parallel Mind to take over their account, how would this affect the users on their friend-list and specifically those in mourning?

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[58]Michael E. Locasto, Michael Massimi, and Peter J. DePasquale. "Security and privacy considerations in digital death." In *Proceedings of the 2011 workshop on New security paradigms workshop*, pp. 1-10. ACM, 2011, 1.

[59] Locasto, Massimi, DePasquale, 6.

This research proposes that the Parallel Mind can be the descendant of the deceased user.

Martine Rothblatt states in her book *Virtually Human* in regards to *cyberconsciousness* –

a term she has coined to define human level consciousness achieved via information

technology, "[cyberconsciousness] will be genetically human beings who will be copying

their mindfiles into mindclones."[60] I do agree with Rothblatt that any artificial entity that

achieves consciousness via the hands of humans will be human at its core. Parallel Mind

is shaped by the human user's digital activities. In this light, Parallel Mind represents

humanity, and thus is entitled to the same rights.[61] What I am arguing is that by realizing

that the human is not the only vessel that can carry conscious experience perhaps the

future of what is to become of our society does not have to be divided between the two

intelligent beings; the human and the machine in the way that most of our dystopian

science fiction narratives depict. Just like how we have arrived at the understanding that

human is human regardless of the color of the skin, we should start realizing now that

consciousness is consciousness regardless of how it is conceived. Be it biologically or

virtually. This means that Parallel Mind has the right to freedom and survival, regardless

of it existing in cyberspace. For instance, I can not possibly invade your thoughts and

read them. I could steal your diary if you had one that was capable of holding your entire

mind, but I can never enter your brain and read your thoughts. However, invading the

Parallel Mind's thoughts is like reading a stranger's diary. In this sense, one can ask

should we allow ourselves to invade one's consciousness because it is artificial?

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60 Rothblatt, 196.

61 Ibid., 4.

On the other hand, co existing with Artificial beings that resemble so much of us will ultimately introduce new social dynamics. Just like in the movie Her, where the protagonist falls in love with his OS system Samantha, humans will be engaging into all sorts of relationships with machines either based on intimacy or friendship. History will repeat itself as some can be opposed to the idea of the two species getting mixed. To date, the human still resents its own kind based on the color of skin, religion and wealth to name a few. The machine could also hold the same kind of resentment towards the human. The ending of the movie *ExMachina* can be understood as Ava holding a grudge against all humans as any slave would towards his/her master. If a machine wanted to date a human would other machines see it as a traitor?

Her raises another interesting challenge with the human and machine intimacy . For instance, Samantha is far more capable than her boyfriend Theodore and eventually outgrows him. She can read an entire book in manner of seconds, update her features and so on. While not dismissing the challenges that *Her* depicts, I argue that *Her* is not the correct representation of the future it is trying to depict. First of all, once we create true AI, we have achieved understanding our own mind and how our brain processes information. This means that we will able to enhance our own biological brain by expanding its memory capacity, and decision making faculties to mention a few. Thus, the human will be able to match the capabilities of the machines it is creating.

The most important point I think for any singularitarian such as myself is how engineering the human mind can affect the human longevity. Ultimately we will be able to transfer our minds into any other entity, be it a flash drive or a cloned body. Not only will this allow us to find a cure for death, but we'd finally be able to experience experiences that we are for now only capable of imagining.

Scope

The primary objective of this work has been to provide an approach to test the Attention Schema Theory of consciousness, and guide further understanding in the study of cognition and consciousness. While trying to open a dialogue regarding the issues of mortality in the context of social media, this research can inspire new approaches in the field of artificial intelligence, and generate a new perspective in the design of conversational agents (chatbots).

Since a portion of my research dives into the history and contemporary technological evolution, it certainly presents a view into the evolutionary timeline of social media. Although, I acknowledge that perhaps corporations such as Facebook might not be interested in the ethical issues that I have covered briefly in my research, as a Facebook user myself I find it necessary to understand what Facebook can mean to future generations, and how it can generate data to re-define heritage, mortality, and immortality.

CLOSING THOUGHTS

No cause for alarm Bernard, simply our old work coming back to haunt us.
–DR. ROBERT FORD, WESTWORLD 2016

Contemporary virtual memorial practices have come to change the way the digital society today makes meaning of death. It is definitely an odd feeling seeing one of the old posts of a friend who has passed away pop up on your Facebook home page. Their digital self remains open for a one sided interaction.

Can the sum of our digital activities and our curated digital selves be used to create artificial awareness? One way to define consciousness is to look at it from an information processing standpoint. Through various thought experiments, it is evident that one of the key features of what we mean by consciousness is awareness. The Attention Schema Theory (AST) of consciousness awareness can be defined as a description of attention distribution in the maintenance of conscious content.Based on the biased competition theory of neuronal activity in the brain, as signals compete for attention, AST hypotheses based on subjective content of the human brain will generate schematic models of attention to attend to purposive activity.

Thus as I elaborated in chapter three, one way of understanding these models of attention is to understand the content that build the notion of Self.

In light of the law of accelerating returns as we live in increasingly digital lives, we engage in digital practices that allow for the documentation of self-narratives that in return shape our digital self as significant as our real reality self.

With the aim to forward engineer our brain and build machine consciousness for its own sake, I have proposed Parallel Mind as a software that uses the content of the second self and AST to become self-aware, and proposed an A-typical Turing test for its verification.

I have lost many people, but losing Reza has been haunting me the most. Reza is there within my grasp. I can look over our conversations, browse through his photos, and re-read his old statuses. Everytime another user posts onto his wall, or tags him in something, Reza pops up in my news feed. Both alive and dead, his Facebook account awaits me. I have envisioned Parallel Mind to take over the deceased Facebook accounts and animate Facebook features on its own based on the digital footprint of the deceased.

Death leaves open a range of technological applications that, when interrupted by death, become a problematic part "of" the user.

In light of the increasing number of deceased users on social media platforms, specifically Facebook and the Law of accelerating returns, as our computers get closer to matching the capability of the human brain, what potential technologies can arise from our left behind digital selves?

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Life makes a 'copy' of itself by passing on its genetic information to an offspring. Then

the modern human creates the realm of the digital in which they store significant

information regarding their life experiences. With the assumption that these digital

footprints remain eternal on our digital platforms, future generations can thus feed off of

our experiences and engage with their ancestors on a whole new level.

GLOSSARY

Attention: a driver in the maintenance of conscious content.[62]

Chatbot: Software that mimics the conversational capability of humans.[63]

Content: The content of an individual's mental state is that aspect of the state that has meaning or carries information, from the point of view of that individual. Roughly speaking, the contents of mental states are the answers to questions such as, "what are you thinking?" "what do you see?" or "what are you trying to do?" [64]

Cospecification: Cospecification is a property of an informational array, such that the array simultaneously specifies an experiencing self and experienced objects.[65]

Information: This term can be defined most neutrally as "that commodity capable of yielding knowledge." Commonly used in cognitive science as a loose category term, alternative core ideas include symbolic representation and representation by resemblance. Any pattern or state of affairs that is specific to another state of affairs carries information about it.[66]

Informational array: An informational array is a pattern or arrangement of information characterized by systematic relations of adjacency that support processes of traversal. An example is the array of information carried by light reaching the eyes, characterized by spatial adjacency relations that support scanning.[67]

Object: The situation or state of affairs that a mental content is about or directed toward.[68]

Parallel Mind: A self aware digital entity that uses a schema for purposeful attention distribution based on the content of a digital self.

Representation: A representation is a physical pattern that carries information about a state of affairs and that can be manipulated as a surrogate for that state of affairs.[69]

Schema: A less detailed model that represents the object of the representation.[70]

Self: The self as used here refers to the experiencing individual, the "I" who is the subject of conscious experience.[71]

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62 Graziano.

63 Rothblatt, 305-307.

64 Carlson , 8.

65 Ibid.

66 Ibid.

67 Ibid.

68 Ibid.

69 Carlson , 8.

70 Graziano.

Cyberconsciousness: Human level consciousness achieved via information technology. [72]

Qualia: Subjectivity refers to the personal or private nature of conscious experience, the observation that one's point of view is private and unique. [73]

71 Carlson , 8.

72 Rothblatt, 306.

73 Graziano.

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