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The Classification of Artificial Intelligence as "Social Actors"

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THE CLASSIFICATION OF ARTIFICIAL INTELLIGENCE AS "SOCIAL ACTORS"

by

MALLORY REED

Under the Direction of Molly Bassett, PhD

ABSTRACT

Robotic honey bees are drones that are mobile and can successfully pollinate flowers by mimicking the behavior of wild bees in nature. This technology is a potential solution to the declining wild honey bee population. Although robotic honey bees could offer a positive solution to a problem, the fictionalization of robotic honey bees in the popular television show *Black Mirror* depicts the downside of independently operating drone bees. In the television show, the drones go rogue and pose a threat to human life. Concepts stemming from the anthropology of religion, like "fetish" and Bruno Latour's actor-network theory, offer ways to think about advances in artificial intelligence and may help us understand the place of these objects and artificial intelligence in the culture. This project will investigate whether robotic honey bees fit into one of these categories or if an expansion of Bruno Latour's actor-network theory needs expanded.

INDEX WORDS: Actor, Artificial intelligence, Fetish, Honey bees, Social actor

THE CLASSIFICATION OF ARTIFICIAL INTELLIGENCE AS "SOCIAL ACTORS"

by

MALLORY REED

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

in the College of Arts and Sciences

Georgia State University

2018

THE CLASSIFICATION OF ARTIFICIAL INTELLIGENCE AS "SOCIAL ACTORS"

by

MALLORY REED

Committee Chair:	Molly Bassett	
Committee:	Brett Esaki	
	Randall Reed	

Electronic Version Approved:

Office of Graduate Studies

College of Arts and Sciences

Georgia State University

May 2018

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1   INTRODUCTION

Although the television show *Black Mirror* is a work of fiction, the technology of robotic honey bees is a very real thing in the world today. Fiction has often been used to work through or anticipate issues that might exist in the real world, and the field of Religious Studies helps create a starting point for dealing with fictionalizations and hypothetical situations. Religious texts are considered by some to be works of fiction or mythology, much like *Black Mirror* is a work of fiction. The episode "Hated in the Nation" presents a hypothetical situation of technology going horribly wrong. Religious literature has been used to understand humans and society in relation to the supernatural in the same way that *Black Mirror* and other works of science fiction can be used to understand technology and in relation to humans and society. This project takes the robotic bees from *Black Mirror* and analyzes them using current language and categories from the anthropology of religion: specifically "fetish" and "actor." This paper will analyze whether these existing categories are adequate to describe technological developments in artificial intelligence such as robotic honey bees. I posit that these categories do not in fact adequately describe current and future artificial intelligence developments and require a different categorization.

This project has developed from the idea that different cultures have different definitions of what is alive and what is not. While Western thought generally reserves liveliness for biological organisms, many cultures have a broader definition of what is alive. To some, trees, rocks, and bodies of water contain life. If it is possible to think about these aspects of the natural world as alive, is it also possible to think about machines as alive? Do computers and medical technologies have some form of life force in them or will they in the future? Currently, there is not a social theory that adequately includes artificial intelligence. Instead, there is science fiction

literature and media that tease out the complications of advanced technology. The television show *Black Mirror* is one source of media that investigates the implications of artificial intelligence technologies possessing life. While it is possible to look at *Black Mirror* as an entire project of cultural studies, this paper will only use *Black Mirror's* robotic honey bees as a case study of an artificial intelligence technology that has transcended what an object is.

This paper will be divided into four main sections. The first section will discuss the concept of animacy. This section will look at examples of animacy in Religious Studies examples, such as Hindu snake stones (*nagas*), animal pelts, and stones. Additionally, animacy will be applied to the field of technology and considered in relation to whether artificial intelligence technologies, like search engines, possess animacy. The second section of this paper will discuss the historical use of the term "fetish," and how this term is not a perfect fit for describing artificial intelligence technologies (robotic honey bees). The third section of this paper will similarly discuss Bruno Latour's actor-network theory and how robotic honey bees are not "actors" according to actor-network theory. Finally, this paper will conclude with an expansion of Latour's actor-network theory to include "social actors," a term which applies to artificial intelligence technologies such as robotic honey bees.

Those who work in the field of artificial intelligence strive to create machines that act as humans.[1] These machines will exhibit a level of intelligence and animacy that allow for them to complete tasks at the same level of accuracy or better than that of a human. Machines that have generally been thought of as inanimate objects will be able to act as a human does by making decisions and solving problems. There are already technological systems that are capable of these acts. For example, there are algorithms that buy and sell stocks to make the maximum

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[1] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 17.

profit possible. In fact, this algorithm is often much better at making profitable decisions than its human counterpart. There is also an algorithm that can identify skin cancer on sight with better accuracy than a trained human pathologist.[23] Although these algorithms are inanimate systems created by humans, they are able to performs actions that were at one point exclusive to humans. Their ability to make decisions – almost as if they were conscious – makes them seem to be more than machines. To elaborate, being "more than a machine" is indicative of a high level of autonomy and agency that does not require direct control from their human creators.

Within some religious systems, objects exist that practitioners believe are more than they appear. The field of Religious Studies analyzes these beliefs. These objects may be aspects of nature, such as mountains, trees, or animal pelts, or they may be human made objects, such as carvings and statues. Whether they are from nature or human made, these objects are believed to possess a level of power that enables them to enact change in the world.

The objects that are believed to possess power within religious systems must be treated in a particular way by practitioners in order to create desirable outcomes and prevent undesirable ones. For example, Hindu practitioners in India carve and paint *nagas,* statues that take the form of snakes. Women revere and pray to these statues because they are associated with fertility. Therefore, Hindu women who wish to become pregnant visit these snake stones, called *nagas,* in order to improve their chances of getting pregnant and having a healthy child. *Nagas* are believed to control fertility because they are a manifestation of a Hindu goddess. The presence of

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[2] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 17.
[3] Gershgorn, Dave. "These Are What the Google Artificial Intelligence's Dreams Look Like." *Popular Science,* June 19, 2015.

the goddess is that which imbues *nagas* with power and requires practitioners to perform ritualistically towards them.[4]

Animal pelts and artifacts are other examples of inanimate objects that have perceived power by practitioners. In one Amerindian society, jaguar pelts were given to babies and warriors. It was believed that these pelts held the power and strength that a wild jaguar exhibited, and the pelts were able to lend those positive characteristics to the humans who wore them.[5] The importance of these animal pelts resulted from the belief that objects and artifacts existed before humans and were often manifestation of deities. Therefore, they had power over humans and humans were to respect them. This power over humans was so strong that they were able to intimately affect the personality and physical attributes of a human. In fact, it was believed that individual humans were not born as a unique individual but were constructed with respect to the types of objects they were exposed to after their birth.[6] For example, a newborn baby may have been wrapped in the pelt of a jaguar to ensure that that child would grow up to be strong, quick, and agile. Without it, the child may grow up to be weak and fragile.

At the core of these practices with animal pelts and *nagas* is the belief in the animacy of objects. Objects are believed to be able to create either positive or negative change in the world, and the nature of that change depends on the manner in which human practitioners act toward the object itself. To go back to the example of the snake stones, or *nagas*, in India, women who did not bring offerings and pray to the *nagas* would risk not becoming pregnant and may not bear a

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[4] Allocco, Amy. "Fear, Reverence and Ambivalence: Divine Snakes in Contemporary South India." Religions of South Asia. 7 (2013), 230-248.

[5] Miller, Mary Ellen, and Karl A. Taube, *The Gods and symbols of ancient Mexico and the Maya : an illustrated dictionary of Mesoamerican religion, (*New York: Thames and Hudson, 1993).

[6] Santos-Granero, Fernando. "Introduction: Amerindian Constructional Views of the World" in *The Occult Life of Things: Native Amazonian Theories of Materiality and Personhood. Tucson*: The University of Arizona Press, 2009. 3-29.

child.[7] Objects within religious studies provide a point of contact with humans and the divine realm. Jaguar pelts are representations of Amerindian gods that are depicted as a jaguar, and *nagas* are vessels that house Hindu goddesses. In both cases, objects are vessels that house divine beings or act as a point of access between the human and divine realm. At this point, the concept of animacy should be tied back to the field of artificial intelligence. The technological creations created by engineers and scientists exhibit a related type of animacy. The fields of computer science and robotics have long-since been attempting to create and manufacture systems that exhibit general intelligence, which could be thought of as a type of animacy.

Artificial general intelligence, or human-level machine intelligence (HLMI), is the type of intelligence displayed by a machine that can successfully perform any tasks that a human can.[8] What this means is that a computer (an object) would be able to perform a wide spectrum of tasks as successfully or more successfully than a human. Currently within artificial intelligence, systems exist that are extremely good at one specific task. For example, the system that buys and sells stocks or a system that plays chess do not have general intelligence because they cannot perform every task a human does. While a computer with general intelligence has yet to be created, experts posit that this technology will be a reality in the near future. Nick Bostrom, a Swedish philosopher, futurist, and the author of *Superintelligence: Paths, Dangers, and Strategies,* wrote, "A series of recent surveys have polled members of several relevant expert communities on the question of when they expect 'human-level machine intelligence' (HLMI) to be developed…The combined sample gave the following (median) estimate: 10% probability of HLMI by 2022, 50% probability by 2040, and 90% probability by 2075."[9] While there are clear

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[7] Allocco, Amy. "Fear, Reverence and Ambivalence: Divine Snakes in Contemporary South India." Religions of South Asia. 7 (2013), 230-248.

[8] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 19.

[9] Bostrom. *Superintelligence*, 19.

disagreements among experts about how soon humans will possess the technology of general intelligence, it is clear that there is widespread belief that it will in fact be created at some point. In the meantime, there are many artificial systems that outperform humans in individual tasks, such as chess and checkers without general intelligence.[10]

Although a computer that possesses and exhibits general intelligence does not yet exist, there are many incredible technologies that humans are using and benefiting from at this time. Every day, humans are engaging with and using technologies that are able to enact physical change in the world. Search engines, such as Google, are one example of a technology that influences the world. Search engines respond to requests and disseminate information to users. They actively sort through massive amounts of information and present relevant websites to the user. Any type of question you have, Google can answer. According to Nick Bostrom, "the Google search engine is, arguably, the greatest AI system that has yet been built."[11] Google is able to inform people on any topic they desire, increasing the pool of accessible knowledge available to the general public.

In addition to answering questions, Google influences the type of content that users are viewing. When you search for a topic or phrase in the Google search engine, you are given a list of relevant sources. Google determines the order of the sources. Google combs over the internet using an algorithm called the Googlebot, and Googlebot visits websites and keeps a running list of topics and keywords of each site. An individual site is then ranked by an algorithm using approximately 200 factors, one of which is the amount of times that other websites link to that specific site.[12] The data collected by Googlebot is then used to determine which sources come up

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[10] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 12.
[11] Bostrom, *Superintelligence*, 16.
[12] How Google Search Works - Search Console Help." Accessed February 8, 2018.
https://support.google.com/webmasters/answer/70897?hl=en.

first when you use the Google search engine. The results of a Google search are determined by

Google's own standards and in turn affects the opinions and worldviews of the user. The

information that is most readily available to a person is important, and Google determines what

people see first.

   While the Google search engine can create change in the outside world, gene therapies

are able to enact biological change within the human body and heal it from the inside. Gene

therapies are a new type of drug treatment that provide relief and healing through the alteration

of the patient's DNA, or genetic material. Gene therapy is made up of primarily two parts: a

vector and new genetic material. The new genetic material replaces damaged DNA within a

patient that is causing illness. Both the vector and the new genetic material are injected into the

human body, and the vector what delivers the new genetic material into the body. The vector cuts

out the defective DNA and replaces it with functioning DNA.[13] There are currently three types,

or classes, of gene therapies. The first class replaces a single defective or mal-adaptive gene that

causes diseases such as cystic fibrosis or sickle cell anemia. The second class alters or kills an

aberrant cell present in diseases such as HIV or cancer. The third class induces production of a

therapeutic protein in patients with diseases such as Hepatitis C.[14] Often, a patient is able to be

cured with a single injection of gene therapy, due to the fact that the patient's genetic material is

actually being altered. DNA replicates itself naturally, so after the administration of a gene

therapy, the "fixed" DNA replicates itself and a person can be healed after multiple replications.

   Although gene therapy treatments and search engines are technically inanimate, they are

able to act and perform change in the world in a similar way a human can. Google teaches like an

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[13] Reference, Genetics Home. "How Does Gene Therapy Work?" Genetics Home Reference. Accessed October 31, 2017. https://ghr.nlm.nih.gov/primer/therapy/procedures.

[14] McCain, Jack. "The Future of Gene Therapy." *Biotechnology Healthcare* 2, no. 3: 52–60.

educator and gene therapy heals like a doctor. These inanimate objects that possess animacy can act and create change because they have agency. For this project, "agency" is anchored in the work of political theorist Jane Bennett, a key voice in the interdisciplinary conversation about vital materialism. For Bennett, agency is not restricted to living beings. In *Vibrant Matter: A Political Ecology of Things*, she argues that things also possess vitality: "By 'vitality' I mean the capacity of things - edibles, commodities, storms, metals - not only to impede or block the will and designs of humans but also to act as quasi agents or forces with trajectories, propensities, or tendencies of their own."[15] Bennett uses metal as an example of an object with agency. She cites the description of the mythical Prometheus's metal chains from the story *Prometheus Bound* as dead and immobile and contrasts them with the French philosophers Deleuze and Guattari's description of metal as possessing "quivering effervescence."[16] This quivering effervescence is the result of free atoms on the edge of crystalline structures. Quivering atoms possess a vitality and an agency that affects the properties of the larger metal the atoms are a part of. The position of quivering atoms in the crystalline structure of a metal determine properties of the metal itself, such as melting point. The quivering atoms have agency because they are able to move and alter the crystalline structure of the metal. Like metals, some technological developments, such as search engines on the internet and gene therapies, also have agency. These technologies are created by humans and yet extend the limit of how we generally understand objects as inert, just as free metal atoms are not actually inert. Through this type of thinking, it is possible to think of technological developments in artificial intelligence as having agency.

The television show *Black Mirror* features a series of mini-movies that depict the societal consequences of various types of technology. The episode, "Hated in the Nation," presents a

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[15] Bennett, Jane. *Vibrant Matter: A Political Ecology of Things*. Duke University Press, 2009, viii.
[16] Bennett, *Vibrant Matter*, 55.

society in which natural honey bees have been entirely wiped out by environmental destruction and replaced by robotic honey bees. In the show, a technology company develops miniature drones that are able to locate and pollinate flowers. The robotic honey bees exist in their own hives and are tracked by the company that created them. Because the drones follow a program, the company simply monitors their location and the location of the established hives as they are created. The plotline of "Hated in the Nation" follows the robotic honey bees as they transform from a positive technological development to a threat to human life as they begin to kill. At this point, the robotic bees begin to target individual humans and kill them by burrowing into the brain of the victim.[17]

1.1   Introduction to animacy

Up to this point, this project has focused on the animacy of inanimate objects, both natural and human made. Therefore, a discussion of what animacy means in this case is important. Anthropologist Stanley Tambiah, described sacred objects in the Buddhist tradition that possess animacy. For Tambiah, sacred objects have complex roles in Buddhist society. He says they can act as "reminders" of the supernatural or as "sacra radiating fiery energy and protective or fertilizing powers."[18] Animacy refers to the level of sentience – or the ability to perceive and feel – that a thing exhibits.[19] Tambiah writes about Buddhist statues and amulets as things with animacy. They are revered by the Buddhist communities and treated similarly to how a statue or relic of the Buddha is treated. Like the Buddha, the sacred objects possess energy and have power to protect believers.

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[17] Brooker, Charlie, "Hated in the Nation," in *Black Mirror*. Zeppotron, 2016.

[18] Tambiah, Stanley Jeyaraja. *The Buddhist Saints of the Forest and the Cult of Amulets*. F First Edition edition. Cambridge Cambridgeshire ; New York: Cambridge University Press, 1984, 5.

[19] Tambiah, *The Buddhist Saints of the Forest and the Cult of Amulets*, 5.

In both the discipline of Religious Studies and the realm of technology, there are objects that are considered to have animacy, and sometimes those objects also have agency. According to Alfred Gell in *Art and Agency: An Anthropological Theory*, "an agent is defined as one who has the capacity to initiate causal events in his/her vicinity, which cannot be ascribed to the current state of the physical cosmos, but only to a special category of mental states, that is, intentions."[20] In short, an agent is able to initiate events because they have intention. Gell's definition and concept of agency is useful to this project because he includes both humans and objects as potential agents. He contrasts self-sufficient agents and secondary agents and states that he is "more concerned with the kind of second-class agency which artefacts acquire once they become enmeshed in a texture of social relationship."[21] Objects are classified as secondary agents, and they are able to exert agency because they are involved in social relationships. We will later see how important social relationships are within religious studies. Gell uses the example of a person's vehicle to illustrate the social ties an object creates that allows it to exhibit agency. "The car does not just reflect the owner's personhood, it has personhood as a car."[22] He discusses how he and other car owners attribute specific personalities to their vehicles, and they often name them. When a car has mechanical issues, the owner often blames the car itself rather than the car manufacturers or the mechanic. The car is perceived to have the agency to control whether it breaks down or not, and the owner feels personally attacked by the car itself when it chooses to malfunction. To go back to a Religious Studies example of animacy and agency, the Hindu *nagas* are important to the women who pray to them because they are a part of the social circle in which they exist. Their power over fertility makes them an integral part of the social

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[20] Gell, Alfred. *Art and Agency: An Anthropological Theory*. Oxford University Press, 1998, 19.
[21] Gell, *Art and Agency*, 17.
[22] Gell, *Art and Agency*, 18.

circles of those who pray to them. If a woman is unable to become pregnant after praying to the *nagas,* she may feel it is because the goddesses embodied in the *nagas* chose that outcome.[23] Therefore, women treat the *nagas* with the utmost respect and care for them so that they may give themselves the best chance to obtain the outcomes of marriage and fertility that they desire.

2   FETISHISM

The concept of animacy is deeply rooted in the Religious Studies terminology of animism and fetishism. According to William Pietz, the concept of fetishism originated in West Africa as academics described the rituals revolving around the animacy of human made objects.[24] The term fetish originates from the Latin word *facticius,* which is an adjective that originally meant "manufactured."[25] Fetishism is often discussed in tandem with animism, which similarly is an academic category focused on the belief in the animacy of things from the natural world. For example, in one aspect of their belief system, the Inca believed in the animacy of rock and stone, products of the natural world.[26] Therefore, attributing liveliness to a specific mountain falls into the realm of animism. "In the South American Andes, in the fifteenth and early sixteenth centuries, the Inca framed, carved, sat on, built with, revered, fed, clothed, and talked to certain rocks."[27] They were considered to be points of access that allowed humans to interact with the sacred, and were called *waka.* These sacred objects were revered and were frequently given offerings of things like shells, textiles, leaves of the coca shrub, feathers, llamas, silver, gold, and

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[23] Allocco, Amy. "Fear, Reverence and Ambivalence: Divine Snakes in Contemporary South India." Religions of South Asia. 7 (2013), 230-248.

[24] Pietz, William. "The Problem of the Fetish, I." *RES: Anthropology and Aesthetics*, no. 9 (1985): 5-17. http://www.jstor.org/stable/20166719, 5.

[25] Pietz, "The Problem of the Fetish, 5.

[26] Wilkinson, Darryl. "Is There Such a Thing as Animism?" *Journal of the American Academy of Religion,* vol. 85, no.2 (2017), 303.

[27] Dean, Carolyn J. *A Culture of Stone: Inka Perspectives on Rock*. Durham, NC: Duke University Press Books, 2010, 1.

sometimes children.[28] There is a different example of animistic beliefs in the earlier discussion of jaguar pelts holding innate power in this paper. The pelts and artifacts taken from animals were believed to contain the essence of that animal as it was alive and were treated with respect. When it comes to fetishism, the same logic applies. However the objects are human made instead of taken directly from nature, and were never physically alive as an animal was. For example, a totem or a statue that is carved by a human hand would be considered a fetish.

The categories of animism and fetishism developed in the sixteenth and seventeenth centuries when scholars were categorizing people based on their religious beliefs. The two traditions were placed at the bottom of a social evolutionist paradigm: with animism and fetishism representing the least civilized and least advanced civilizations and with monotheism representing the most civilized and advanced civilization.[29] These categories of animism and fetishism were originally judged as "primordial" and inherently false at the time of the categorical creations due to the fact that they were being looked at from an outsider and Western perspective. They then fell into disuse in the field of academia because of their dismissal of foreign beliefs and the negative connotation that came with them. However, there has since been a resurgence and reacceptance of these terms due to a redefinition of the terminology. This redefinition was a result of the recognition of these beliefs as a complex practice rather than a type of religion on their own. Instead of automatically assuming practitioners of these rituals are in error, academics now treat these rituals with a respect that was not present at the point of first contact. To return to the discussion of animacy, objects are able to exert agency because humans

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[28] Dean, Carolyn J. *A Culture of Stone: Inka Perspectives on Rock*. Durham, NC: Duke University Press Books, 2010, 2.

[29] Wilkinson, Darryl. "Is There Such a Thing as Animism?" *Journal of the American Academy of Religion,* vol. 85, no.2 (2017), 295.

give them that power, whether the human realizes this connection or not. Natural and human made objects are powerful because humans treat them as if they are powerful in their own right.

An example of a technological development that may be categorized as a fetish is an autonomous military drone. This type of aircraft is a human made object that is able to act with a certain amount of agency. The technology company Lockheed Martin is currently working on such a project that will be functional in the year 2018. "Lockheed's intention is to build an autonomous craft – one that can sense and avoid obstacles and identify safe landing sites without human assistance. The project…is known as Matrix. So far, Matrix has been used only as a co-pilot. But, if all goes well, the first helicopter able, in theory to fly by itself will take off early next year."[30] This type of technology will be used by the military to perform a variety of tasks, including but not limited to reconnaissance, intervention and attacks, and the transportation of humans and supplies. The type of technology that will make these actions possible is very advanced. "Matrix includes several sorts of sensor, so the helicopter can see for itself. It has what Lockheed describes as a supercomputer to interpret input from these sensors and to make decisions based on that input. It also has servo-controlled devices which operate the machine's flight controls."[31] The advanced technology that Matrix is comprised of indicates that it will surpass the abilities of pilots. "The sensor's rapid reactions – milliseconds rather than the two seconds or so a human pilot takes to assess and respond to an unexpected hazard – should make the unmanned system safer than such a pilot."[32] These aircrafts are made of metal and yet they

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[30] "The latest unmanned drone is a version of an existing manned one" *The Economist: Science and Technology* (November 2017), https://www.economist.com/news/science-and-technology/21730865-back-unicopter-latest-unmanned-drone-version-existing-manned.
[31] "The latest unmanned drone is a version of an existing manned one."
[32] "The latest unmanned drone is a version of an existing manned one."

are incredibly powerful, just as *nagas* are made of stone and yet affect fertility. Both have power that was given to them by humans.

2.1   Analysis of robotic bees as a fetish

The use of the word fetish has recently experienced a resurgence of interest among academics working with vital materialities. The idea of vital materialities is at the core of Jane Bennett's work, who posits that inanimate objects, such as compost and metals, have agency and affect the world around them. While the concepts of fetishism and vital materialities provide a starting point for our understanding of technological advancements as animate, they do not account for human-made objects as actors with the amount of agency present in artificial intelligence technologies.

The difference between a fetish in the sense of Religious Studies and a technological development is that a fetish is simply believed to hold power, while a technological development – such as a military drone or a robotic bee – actually possesses its own power that it can use in the world around it with some level of independence. For a fetish to hold meaning, there must be a response from a human. This is not present in the power of drones or other technologies. The Inca made sacrifices to specific rocks in times of need. For example, "the Inca gave human-made gifts to mountains: food and clothing and sometimes children. In return mountains gave natural gifts of rain and water from glacial runoff. "Indigenes throughout the Andes today make what is called 'the payment' consisting of small gifts to propitiate sacred mountains for their help and guardianship and to ensure the mountains are not angered."[33] There is an emotional connection between the fetish and the community that is first and foremost. The importance of the emotional

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[33] Dean, Carolyn J. *A Culture of Stone: Inka Perspectives on Rock*. Durham, NC: Duke University Press Books, 2010, 101.

connection is not always present with relationships between artificial intelligence technologies and the community. Sometimes, humans even shy away from a connection to technology. A specific example of this would be military drones. There are often distinct categories of human and machine, and they do not overlap. This makes it easier for humans to detach themselves from the actions of the objects, in this case military drones. Instead of a pilot flying the plane and dropping bombs, it is the plane itself that is doing the work.

The examples that this project has drawn on at this point to showcase animism and fetishism include *nagas*, jaguar pelts, and rocks or mountains. On the technological side, the examples of objects with animacy include search engines, gene therapies, self-driving military drones, and robotic honey bees. While all of these examples possess animacy, the way that that animacy is assigned and maintained by humans is different. In other words, the agency that inanimate objects can exhibit must be maintained by human belief in the examples of *nagas,* jaguar pelts, and rocks. The fetish must remain connected to the community in order for there to be animacy. As Bruno Latour puts it in his work *On the Modern Cult of the Factish Gods*, "only human action gives voice and power to objects."[34] Religious objects and artifacts require human attention in order for them to be animate and have agency. Without human belief in the power of these objects, they may not actually have any power at all. With technological objects, this is not the case. There is not as much mystery and ambiguity as there is with religious fetishes. Once these technologies are created, they do not require constant human attention to imbue them with power. They possess their own power that they are able to use.

To contrast *nagas* and gene therapies, it is clear that gene therapies possess an agency independent of humans. *Nagas* are stones that are carved to resemble snakes, and they are

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[34] Latour, Bruno. *On the Modern Cult of the Factish Gods.* Durham: Duke University Press, 2010, 9.

believed to embody a goddess that affects the fertility of women. Those snake stones possess power because the Hindu culture is connected with them and the practitioners believe that they are powerful. However, there is no quantifiable way to verify or disprove whether a woman getting pregnant after many months of trying is the result of her prayer and offerings to the *nagas.* Additionally, the woman may be using multiple fertility tools simultaneously, such as *nagas* and in vitro fertilization. On the other hand, gene therapies create visible and verifiable change in the human body and do not depend on human perception. The process of gene therapy treatment involves the injection of new DNA into the human body that is meant to replace damaged or incorrect DNA. The replaced DNA will then replicate within that individual patient and treat or cure specific diseases. It is possible to analyze a patient's DNA both before and after the application of a gene therapy treatment and see the change in the sequence of amino acids.

Robotic honey bees create results that are quantitatively verifiable in the same way that gene therapy is scientifically provable, and their design is based on wild bees. Wild honey bees are incredibly important from an environmental perspective, as they are responsible for pollinating many of the world's plants, specifically crops such as coffee, strawberries, oranges, onions, cabbage, and many others. Throughout history, wild honey bees have experienced population decreases – including the 1860s, the 1960s, the 1970s – however, their populations have drastically decreased since the 1980s and continues today.[35] Colony collapse disorder is the cause of the current status of the honey bee population and is affected by a variety of factors, which include habitat loss, changes in the agriculture industry, agrochemicals, pests, disease, and the human fear of bee stings.[36] If honey bees disappear, many crops will cease their life cycles

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[35] Wilson-Rich, Noah, et al. *The bee : a natural history*. n.p.: Princeton, New Jersey ; Oxford, UK: Princeton University Press, 2014., 2014, 188.
[36] Wilson-Rich, *The bee : a natural history*, 188.

because they require insect pollination. This will lead to a decline in crop production and potential food shortages of crops requiring insect pollination.

As a result of these changes in honey bee populations, scientists have begun to think about alternate ways to achieve necessary pollination of the world's crops. According to the U.S. Department of Agriculture, "the United States lost 44 percent of their honey bee colonies during the year spanning April 2015 to April 2016." [37] Automated pollinators in the form of robotic bees are a potential solution that scientists are working on to act as the wild honey bee does. There are several laboratories that have created alternate methods of pollination, specifically the Harvard School of Engineering and Applied Sciences and the National Institute of Advanced Industrial Science and Technology in Japan. Elijiro Miyako and his colleagues at the National Institute of Advanced Industrial Science and Technology have used horse hair bristles and ionic liquid gels to successfully transfer pollen from one plant to another.[38] Ionic liquid gels provide a long-lasting adhesive quality that is applied to the flying drone and allows grains of pollen to stick to the drone and be transferred to other flowers.

At this point, the robotic bee drones can successfully pollinate flowers in a laboratory setting. However, they are currently not autonomous. Instead, they require a human controller to complete pollination. However, strides are being made to make these drones autonomous by incorporating artificial intelligence, GPS, and a camera.[39] Like gene therapies, there is a quantifiable change that can be measured and reported. If a flower is pollinated successfully, the plant will reproduce. That plant would not be able to reproduce without the transfer of pollen,

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[37] "Nation's Beekeepers Lost 44 Percent of Bees in 2015-16," *Bee Informed,* May 10, 2016, https://beeinformed.org/2016/05/10/nations-beekeepers-lost-44-percent-of-bees-in-2015-16/.
[38] Miyako, E., et al. "Materially Engineered Artificial Pollinators." *Chem.* (2017): 224-239.
[39] Ponti, Crystal, "Rise Of The Robot Bees: Tiny Drones Turned Into Artificial Pollinators," *NPR,* March 3, 2017, https://beeinformed.org/2016/05/10/nations-beekeepers-lost-44-percent-of-bees-in-2015-16/.

which the robotic bees are responsible for. Despite the fact that they are not autonomous at this point in time, robotic bee pollinators still do not work as a fetish. There is physical movement and action that is present in both gene therapies and robotic bees that is not present in the *nagas* and a social relationship that is present with *nagas* but not artificial intelligence technology. Although fetishism does shed some light onto attributing animacy to objects, the term fetish does not fully describe robotic bee pollinators.

3   HISTORY OF ACTOR-NETWORK THEORY

Bruno Latour's work in the anthropology of religion offers alternate terminology to understanding and categorizing artificial intelligence as opposed to fetishism. Technologies possessing artificial intelligence exhibit a level of agency that fetishes, within traditional understandings of the term, do not. Therefore, "fetishism" is not able to completely account for and describe artificial intelligence. Actor-network theory (ANT) was developed in the 1980s by sociologists Bruno Latour, Michel Callon, and John Law as an alternate to traditional sociology. ANT offers an understanding of animacy in artificial intelligence. This theory describes a social world that is built upon connections between actors, who can be either human or non-human. In the words of Latour, "we should not limit in advance the sort of being populating the social world."[40] Non-human actors within ANT will be the focus of this section to determine how ANT relates to artificial intelligence technologies. Like fetishism, ANT focuses on non-human contributors to society. Humans form relationships with non-humans, forming a society within both ANT and fetishism. This section will explore how well artificial intelligence technologies fit into the role of an actor, as defined within ANT.

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[40] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 16.

Overall, the goal of ANT is to redefine the nature of what is the "social." ANT places itself in contrast to "traditional" sociology, which says that "there also exists a social 'context' in which non-social activities take place; it is a specific domain of reality…ordinary agents are always 'inside' a social world that encompasses them, they can at best be 'informants' about this world and, at worst, be blinded to its existence."[41] This implies that the social is a physical space and that events can be described only because they take place in that physical space. The actors that exist within that physical space are what inform sociologists about the social that they reside in. They are not social unless they exist in a social context. ANT scholars, such as Latour, posit that traditional sociologists have claimed the "social" is more concrete than it is.

For Latour, social forces do not exist and the only thing that social scientists can do is describe how different actors relate to one another within ANT. Latour posits that there is no physical social dimension in the way other sociologists have imagined, and so the associations between actors must be the focus. ANT "claims that there is nothing specific to social order; that there is no social dimension of any sort, no 'social context,' no distinct domain of reality to which the label 'social' or 'society' could be attributed…that actors are never embedded in a social context and so are always much more than 'mere informants.'"[42] Instead of the "social" existing as a constant realm in which everything takes place, the "social" is made up of connections between actors. In other words, the "social" is constantly in flux. It is only when there are connections and associations between actors that there is any semblance of the "social." The "social" only exists as long as these connections exist. When they are broken, they must be replaced by new connections or the "social" itself ceases to exist.

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[41] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 4.
[42] Latour, *Reassembling the Social,* 4.

One of Latour's classic examples of ANT is that of a gunman, and it and be used to illustrate ANT because it illustrates the associations made between human and non-human actors that create the "social."

> "Here it is stated that a man and a gun can form a new entity when they are connected in a third entity: the gunman…A man cannot shoot someone all by himself. However, it cannot be said either that the gun is the cause of all problems. Guns that shoot someone all by themselves are quite rare. The connection that ANT wants researchers to focus on is the connection that brings the man and the gun together, and thus creates a gunman. A gunman is different from both a man and a gun in the sense that a gunman is able to shoot someone whereas both the man and the gun cannot do this alone."[43]

The gunman is composed of a man and gun: a human actor and a non-human actor. The key part of ANT that informs this project is the inclusion of non-humans as potential actors. Within ANT, objects, ideas, processes, corporations, institutions, and people are all examples of actors within ANT.

If we think back to Jane Bennett's example of vital materialism and metal as a vital material, ANT helps us see a material that is often thought of as inert in a new light. According to Bennett, metal is something that is seen as hard, cold, and inert. However, metal is made up of a crystalline structure that includes "quivering free atoms" and is capable of conducting electricity.[44] When you enter your home, you flip a switch and a light turns on. Metal wires and electricity are inanimate, but they are still actors in this process. Within this process, ANT would posit that the light bulb, the light switch, the electrical wiring, the electricity, and the human are all actors.

Nagas and gene therapies were used to see how well religious artifacts and artificial intelligence fit as fetishes. They can also be used as case studies to see how well religious rituals

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[43] Ritske Dankert, "Using Actor-Network Theory (ANT) doing research," November 30, 2011, https://ritskedankert.nl/using-actor-network-theory-ant-doing-research/.
[44] Bennett, Jane. *Vibrant Matter: A Political Ecology of Things*. Duke University Press, 2009, 59.

and artificial intelligence technologies fit into ANT. When Hindu women go to visit the *nagas*, connections and associations are formed between many things, both human and non-human. When a snake stone is carved, it is not automatically the home of a snake goddess. First it must be consecrated. The word *darśan* can be translated as "auspicious sight."[45] The sight that *darśan* refers to is that of a deity. When a snake stone is consecrated, it is imbued with this sight that belongs to the deity. This means that when practitioners are in the presence of the consecrated snake stone, they are in the presence of the deity. They are able to see the deity and the deity is able to see the practitioner.[46] It is important that both the human and non-human aspects of this exchange in "seeing" the other. It is this exchange that is meaningful to the practitioner. The fact that the deity is seeing the practitioner is what allows for an exchange of power between the deity and the practitioner.

Examining the ritual surrounding the *nagas* through the lens of ANT requires the tracing of each relationship and association present. These relationships include the women, the snake stone, the person who carved the snake stone, the goddess, the location of the snake stone, the idea of fertility, and others. According to ANT, each of these is considered an actor, and these actors come together to engage in a religious ritual. Traditional sociologists see a religious ritual differently. They may say that this type of behavior is a result of the social context, which in this case is religious. Religion is the social sphere that all of the actors exist in and their behavior is a response to that social sphere. In contrast, ANT says that the behavior and connections result in something religious. Instead of religion acting as the starting point, it is the finished product in ANT.

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[45] Eck, Diana L. *Darsan: Seeing the Divine Image in India, Third Edition*. Columbia University Press, 1998, 3.
[46] Eck, *Darsan*, 3.

Gene therapy can also be traced along associations between actors. Connections are formed between the scientist who creates the treatment, the machinery and materials required to create the treatment, the individual parts of the treatment itself (vector, new genetic material, ect), the needle used for injection, the hospital the treatment takes place in, the disease the treatment is attempting to cure, the medical professional administering the treatment, and the patient receiving the treatment. While some sociologists would explain all of these parts as existing in a medical context, ANT says that there is no medical context, there are only actors coming together in a specific combination that creates a medical outcome.

In summary, traditional sociology and actor-network theory see social relationships differently. While traditional sociology focuses on a constant realm of the "social," ANT focuses on the social as a transient realm that is present when connections are present. The connections and associations between human actors and non-human actors create the "social." Without actors, there cannot be a "social."

3.1   Analysis of robotic bees as actors

Actor-network theory may be a better fit for artificial intelligence technologies than fetishism because ANT requires actions whereas fetishism requires only social relationships and not necessarily action. According to Latour, "if you mention an agency, you have to provide the account of its action."[47] Therefore, a connection between actors requires that some form of action occurs. The category of fetish did not perfectly fit technological developments, because there is no verifiable outcome with fetishes and action is not as important as the social relationships between humans and objects. The outcome of an interaction with a fetish is more dependent

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[47] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 53.

upon the perception of the participant than any other type of data. It is impossible to prove whether a woman becomes pregnant specifically because she prayed to the *nagas*. However, it does not matter if it can be verified as real action because if a religious adherent believes in the power of the fetish, and that is enough. However, with gene therapies, it is possible for scientists and doctors to analyze a patient's DNA before and after the administration of a gene therapy and show the implementation of new DNA. Therefore, gene therapies do not function within the same bounds of a fetish because technologies are creating observable and verifiable change in the physical world while religious fetishes are not.

Within ANT, in order for the "social" to exist, there must be connections made between actors. Those connections cannot be made without the actors themselves exhibiting agency in the form of action. To return to the example of the gunman, in order for the man and the gun to be transformed into the gunman, the man must make the decision in his own mind to pick up the gun. Then, he must physically pick up the gun. Both of these steps involve action. The gun must then be fired in order to complete the transformation of man and gun into gunman, providing another instance of action. The end result of all of these actions is the gunman.

There is also action in the processes involving *nagas* and gene therapy. Within the religious fertility ritual, the stones to create the snake stones must be collected and carved by an artisan. Those who are looking for favor with the snake goddesses must then travel to the temple or location that the snake stones are housed in order to pray and pay their respects to the goddesses. The *nagas* and the gun are both non-human actors, and they both require humans to aid in exhibiting clear action. The action produced by the *nagas* (fertility) is only perceived, not seen. It requires a human practitioner to attribute action to the *nagas,* otherwise they are just

stone. Likewise, the gun requires a human to pull the trigger. The gun cannot fire on its own, without human intervention.

Gene therapy provides another example of an object that is producing action. The process of gene therapy involves the creation of the treatment and the administration of the treatment to a patient. Both of these actions are performed by humans. However, after the therapy is injected into a patient, the gene therapy itself is required to perform a set of actions for the treatment to be successful. *Nagas* and other fetishes, in addition to the gunman, require human help to catalyze the action. After its introduction into the body, the vector carrying the new genetic information must travel through the body to reach its target completely on its own. This target will depend on the disease that is being cured. For example, diseases of the blood – such as hemophilia – are cured through the liver cells. Hemophilia is a genetic disease of the blood that is manifested in reduced clotting in the patient.[48] The blood cannot clot and the patient could bleed to death from a very minor injury. Therefore, vectors that affect the liver are used to treat such blood diseases.[49] A vector is often a virus that is deactivated so that it is no longer harmful to the human body. Instead of introducing disease, the vector is altered to carry genetic information, acting as a cure rather than a virus. After the vector reaches its target, it removes damaged or diseased genetic material within individual cells and deploys new genetic material to replace it. Those cells then reproduce and increase the amount of "cured" cells in the body, providing relief or a cure to the patient. Within this process, the vector is exhibiting action. It is finding the part of the body that it is targeting, it is cutting out damaged DNA, and it is introducing new DNA into the cell. The culmination of these actions, performed by an object, results in the improved

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[48] "Hemophilia - Symptoms and Causes." Mayo Clinic. Accessed February 6, 2018. http://www.mayoclinic.org/diseases-conditions/hemophilia/symptoms-causes/syc-20373327.
[49] "How Does Gene Therapy Work?" Scientific American. Accessed February 6, 2018. https://www.scientificamerican.com/article/experts-gene-therapy/.

condition of the patient. Following the example of hemophilia, the vector travels to the liver and replaces the genetic material of liver cells. The result of this is increased clotting in the patient, which is lifesaving.

It is clear that the vector in gene therapy is a different type of actor as the gun in the gunman example. While both are performing a type of action that is visible and quantifiable in a way that the snake stone is not, the gun requires human creation to construct the physical object and a human to ultimately pull the trigger, and a gene therapy requires human creation of the vector and a human to perform the injection. However, there is further action performed by the vector that is not under the control of a human. Even though ANT appears to be a better fit than fetishism for artificial intelligence due to the action that is present, ANT still does not completely account for the degree of agency seen in technological developments such as robotic honey bees. For this reason, Bruno Latour's actor-network theory requires expansion in order to include artificially intelligent technologies.

4   HISTORY AND CURRENT STATE OF ARTIFICIAL INTELLIGENCE

To understand robotic honey bees, a look at the historical development of artificial intelligence is necessary. The field of artificial intelligence must first develop a computer that exhibits general intelligence, also called human level machine intelligence (abbreviated HLMI): meaning that the computer is able to perform tasks as well as or better than a human. Superintelligence (the type of artificial intelligence often depicted in works of science fiction, such as *Black Mirror)* will follow general intelligence, however, it is unclear how long that will take. In a survey to those in the field of computer science and artificial intelligence: 10% of respondents said superintelligence would be achieved 2 years after human level machine

intelligence and 75% of respondents said superintelligence would be achieved within 30 years after human level machine intelligence.[50] Regardless of the time frame, experts in the field do believe that superintelligence is a future certainty. Whether superintelligence is realized or not, robotic honey bees are a reality now.

Superintelligence, or ultraintelligence, is the type of intelligence that will follow HLMI and is what is often depicted in science fiction literature. For example, the robotic honey bees in *Black Mirror* possess superintelligence. In the field of robotics and technology, the concept of superintelligence was first discussed in reference to the creation of a machine by humans that possesses an amount of intelligence that far surpasses that of a human. The mathematician I.J. Good, who was the chief statistician in Alan Turing's code-breaking team during World War II, said, "Let an ultraintelligent machine be defined as a machine that can far surpass all the intellectual activities of any man however clever. Since the design of machines is one of these intellectual activities, an ultraintelligent machine could design even better machines; there would then unquestionably be an 'intelligence explosion,' and the intelligence of man would be left far behind. Thus, the first ultraintelligent machine is the last invention that man need ever make, provided that the machine is docile enough to tell us how to keep it under control"[51] According to Good, humans only need to create the first superintelligent machine that is better than the most intelligent humans at every task. At this point, the machine will be more intelligent than the smartest humans, and humans will not need to invent any more machines. Instead, the superintelligent machine will do the inventing. It will be able to create improvements to itself and create other superintelligent machines.

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[50] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 20.

[51] Bostrom, *Superintelligence*, 4.

According to Nick Bostrom, there are three avenues through which superintelligence may be actually achieved: 1) algorithmic evolution, 2) whole brain emulation, and 3) selective breeding. First, the evolutionary process would entail running repetitive algorithms that will mimic natural selection. In natural selection with respect to organisms in nature, the organisms that possess the best traits survive and reproduce, passing on those traits to the next generation and eliminating weaker or ineffective traits over time. Intelligence is a trait that is selected for. In natural selection, smarter organisms, like those that hide from predators, survive.[52] Over time, the smartest individuals in a population continue to reproduce and create higher and higher levels of intelligence over successive generations. Algorithmic evolution would mimic natural selection but instead of working with reproducing individuals, intelligence would be selected for using algorithms. Genetic algorithms would be run DNA through a computer to simulate natural selection, selecting for the DNA consisting of the highest intelligence in each "generation" and improving on that over and over again until superintelligence is reached.[53] The idea is that since human level intelligence was achieved through natural selection, it is theoretically possible for superintelligence to be achieved in the same manner of trial and error.

Whole brain emulation is the second potential path to achieve superintelligence. In this method, the human brain would be used as a template to replicate in a machine. First, a detailed scan of one individual's brain would be created and would be used as a template create machine superintelligence. The data from the brain scan would be used to recreate the specific neural network of the human brain. According to experts, the raw data would be "fed to a computer for automated image processing to reconstruct the three-dimensional neuronal network that

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[52] Bajema, Carl Jay. "Estimation of the Direction and Intensity of Natural Selection in Relation to Human Intelligence by Means of the Intrinsic Rate of Natural Increase." *Eugenics Quarterly* 10, no. 4 (December 1, 1963): 175–87. https://doi.org/10.1080/19485565.1963.9987564.

[53] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 24.

implemented cognition in the original brain."[54] Then, the three-dimensional constructed brain

scans would be uploaded to a computer. The idea is that the original brain would be intact, but in

digital form inside a computer. Its anatomy would have been copied exactly, and the digital

copy would be exactly like the original, with the memories and personality of the original

person.[55] This brain would have increased potential and intelligence due to its position in a

computer.

The final path to achieve superintelligence would be through selective breeding. The idea

is that the smartest individuals would be chosen to reproduce and would create smarter and

smarter people with each generation. To aid in the intelligence of individual human beings,

biomedical enhancements such as smart drugs would be. These smart drugs aim to alter an

individual's brain to make them smarter. Cephalon produces a drug called Provigil, a drug used

to treat narcolepsy, or daytime sleepiness. However, some people take Provigil because it

improves their cognitive function. Although Cephalon does not market Provigil as a "smart

drug," studies have shown that there is a cognitive benefit to taking the drug.

> In 2002, researchers at Cambridge University gave sixty healthy young male volunteers a
> battery of standard cognitive tests. One group received modafinil (Provigil); the other got
> a placebo. The modafinil group performed better on several tasks, such as the 'digit span'
> test, in which subjects are asked to repeat increasingly longer strings of numbers forward,
> then backward. They also did better in recognizing repeated visual patterns and on a
> spatial-planning challenge known as the Tower of London task.[56]

Smart drugs as they currently exist, such as Provigil or Adderall, improve cognitive function

while they are in the body. However, they do not actually increase intelligence in an individual.

However, smart drugs in the future may be able to increase intelligence generally, meaning

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[54] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 30.

[55] Bostrom, *Superintelligence*, 30.

[56] Talbot, Margaret. "Brain Gain." *The New Yorker*, April 20, 2009.
https://www.newyorker.com/magazine/2009/04/27/brain-gain.

permanently. In relation to selective breeding, individuals who are taking smart drugs and have increased intelligence would reproduce and produce offspring that would them produce offspring with even greater intelligence.

In addition to smart drugs, smarter individuals could be produced using stem cell-derived gametes. This is another form of selective breeding. Instead of individuals reproducing, the genetic material sperm and egg cells would be analyzed to identify those with the highest intelligence. The most advanced would be combined to produce a gamete and offspring would be produced. The process would continue for many cycles and many generations, each selecting the individuals with the highest intelligence (according to their DNA) and making them reproduce. Because all of this would take place in a laboratory and a petri dish, the preproduction cycle would be much shorter than it is naturally and could produce superintelligence in a human more quickly. When a favorable gamete is produced that requires the highest attainable intelligence, it could be implanted in a human and complete reproduction, resulting in a baby. This is a much quicker type of selective breeding because it does not require the birth and growth to sexual maturity of a human.

Whatever method is successful at creating superintelligence, algorithmic evolution, whole brain emulation, or selective breeding, superintelligent machines will be characterized by certain abilities that make them "super"-intelligent. These characteristics include recursive self-improvement, the capacity to learn, the ability to deal with uncertainty, the ability to deal with probabilistic information, the ability to extract useful concepts from sensory data and internal states, and the ability to use acquired concepts for logical and intuitive reasoning.[57]

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[57] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 23.

5   EXPANSION OF LATOUR'S ACTOR-NETWORK THEORY

Robotic honey bees do not fit into the categories of "fetish" or "actor" because they act beyond the limits of what these categories allow. Fetishes are constructed objects that do not actually do anything, and actors are objects that act within limits. Robotic honey bees are not fetishes because they are objects that are able to perform action independently. Fetishes require the intervention of a human, and the human's reaction to the fetish is of the utmost importance. Artificial intelligence technologies, specifically robotic honey bees, do not require a human reaction to perform their tasks. Robotic honey bees possess too much independence and agency to be accurately described as an actor according to Latour's actor-network theory because ANT has limits that prevent it from fully encompassing artificial intelligence technologies. For that reason, ANT needs to be expanded to accommodate artificial intelligence that have qualities of superintelligence, such as recursive self-improvement. Within ANT, the agency of an actor is limited to only certain types of actors, even though there are many types of actors included in ANT associations.

Instead, robotic honey bees require a category of their own or the expansion of a category that includes the fact that they are an object and yet independent. Although ANT includes both human and non-human actors, there is still a difference between how those two types of actors can act and are looked at by sociologists. For that reason, Latour's actor-network theory needs to be expanded. There are two aspects of ANT that do not allow for artificial intelligence to be included within Latour's theory that will be discussed in this section. First, ANT defines actors as "non-social." Second, Latour differentiates between actors that possess their own inertia and those who require outside inertia in order to act.

First, Latour does not account for objects that are able to exert influence independent of other actors, and he focuses on actors as entities that "are themselves non-social," like the gun in the gunman example.[58] ANT says that the social only exists when there are associations made between actors, it is not the actors themselves that are social. The social "is visible only by the *traces* it leaves when a *new* association is being produced between elements which themselves are in no way 'social.'"[59] In this quote, the "elements" are the actors. For Latour, it is not the actors themselves that are important but the connection between those actors. The actors are not social but the social is created by the associations between actors. Although the actors are important, it is the associations that are the more important aspect, not necessarily the actors.

In *Black Mirror,* it is the robotic honey bees that are both saving the future of pollinated plants and wreaking havoc on the human population. The purpose of the robotic bees is to pollinate plants and create new hives to increase pollination capacity over time. According to ANT, the bees themselves are not social. The bees are actors, in addition to the humans who created them, and the plants that they are pollinating. Ties between these actors create the "social." However, in the case of *Black Mirror,* the individual bees themselves are social. They are more important than the connections they are making with one another and the plants, despite what ANT posits. The bees begin to act of their own volition, against their initial intended purpose. They no longer pollinate plants. Instead, they target specific human beings and kill them by burrowing into their brains. They have stopped pollination, and they have cut their human creators out of the equation, rendering those connections and associations between plants and humans irrelevant. Instead, it is just the robotic honey bees that are left. They are lone actors

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[58] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 8.
[59] Latour, *Reassembling the Social*, 8.

that have left the network that they were once apart of. Instead, the only connection that they make is the act of killing a human. In this way, the human is not an active participant in the creation of this association. Instead, the association is created without the permission or desire of the human. The robotic honey bee is the sole actor making decisions in this network.

In other words, Latour posits that "an 'actor' in the hyphenated expression actor-network is not the source of an action but the moving target of a vast array of entities swarming toward it."[60] This is also problematic when we consider artificial intelligence, such as the robotic honey bees. The robotic bees become the source of the action when they turn on their creators and begin to attack and kill humans. Latour says that there is no way to confirm where an action comes from. The action is "dislocated" and is a complicated web of actors coming together to produce a single action.[61] However, because the bees have deviated from their intended purpose, they have left that web and are acting alone.

The second issue the robotic honey bees run into with ANT is related to the definition of some actors as intermediaries and some actors as mediators. Intermediaries are a type of actor within ANT that "transport meaning or force without transformation."[62] In other words, they are vessels that pass on meaning or action without intervening or interacting with it. They do not change the information that they are receiving and are simply a link in the chain. In contrast, the second type of actors are mediators, which "transform, translate, distort, and modify the meaning or the elements they are supposed to carry."[63] Unlike intermediaries, mediators are actively engaging with the meaning and action and they may or may not change them. They are

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[60] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory.* 1st edition. Oxford: Oxford University Press, 2007, 46.
[61] Latour, *Reassembling the Social*, 39.
[62] Latour, *Reassembling the Social*, 39.
[63] Latour, *Reassembling the Social*, 39.

unpredictable because an outsider is not able to predict what the outcome will be after interaction with a mediator because a mediator can change the information.

To clearly contrast an intermediary and a mediator, consider both a working and broken calculator. When you put the math equation 2+2 into a calculator, the answer will always be 4. The user is always able to predict what the answer will be based on the initial input because 2+2 always equals four due to the rules of mathematics. The answer to 2+2 is always 4. However, a broken calculator may be considered a mediator if the answer to 2+2 varies and the calculator gives random answers due to the fact that it is broken. If the calculator is broken, the user will be unsure what the output to 2+2 would be. It may be 1 or it may be 12 or the calculator may not be able to answer. The point is that the user is unsure what the calculator will answer, and that makes the calculator in this case a mediator and not an intermediary.

Latour sites that both objects and humans are able to be either mediators or intermediaries. However, he says that there is a difference between how humans and objects alternate between being intermediaries and mediators.

> "Once humans become mediators again, it is hard to stop them. An indefinite stream of data springs forth, whereas objects, no matter how important, efficient, central, or necessary they may be, tend to recede into the background very fast, interrupting the stream of data – and the greater their importance, the faster they disappear. Objects appear associable with one another and with social ties only momentarily."[64]

In other words, humans become mediators and remain mediators, while objects tend to become mediators for a short time and tend to become intermediaries very quickly.

Latour further differentiates between humans and objects in terms of inertia possession. The possession of inertia is related to the ability to an actor to remain a mediator. Latour says that there are two groups: a group "endowed with some inertia and groupings that need to be

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[64] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 39.

constantly kept up by some group-making effort."[65] For Latour, humans possess their own inertia and objects do not. It is because of this inertia that humans are able to readily become mediators, while objects struggle to become or remain mediators. An example of why humans remain mediators is speech. Because humans have the power of speech, it is difficult to stop humans from being mediators because they are able to speak and express their own thoughts and ideas. In order for a human to cease as a mediator and become an intermediary again, they must stop speaking, which is a difficult thing to do. Their speech is unpredictable to the outsider, with only the speaker knowing and controlling what they are going to say. Therefore, they are able to affect the world around them through speech. Objects do not have that ability.

As previously discussed, the field of artificial technology is actively working to achieve general intelligence and superintelligence. Part of that superintelligence could include technologies that can communicate like a human being. It is very possible that these new technologies will have the power of speech or a similar form of communication that would allow them to become mediators and remain mediators just like humans. Robots in Isaac Asimov's book *I, Robot* are a good example of this. Many of the robots depicted in this collection of short stories have the power of thinking and speaking. In the chapter entitled, "Reason," there is a robot named Cutie that has the power of speech. Cutie begins to question his own existence and the existence of humans. Despite what the humans say, Cutie does not believe that he was created and assembled by humans because he is superior to them in terms of the work that he can do in space.[66] The robot does not believe that a human could create something that is more advanced than they are themselves. As a result, Cutie defies the humans he is supposed to be

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[65] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 35.

[66] Asimov, Isaac. *I, Robot*. Media Tie In edition. New York: Spectra, 1991, 59.

working for and begins working on the space shuttle and organizing the robots as he sees fit. This robot is able to reason and speak. It is through this ability to reason that the robot decides he does not have to follow the instructions of the humans. Cutie becomes a mediator after being created and the humans cannot get Cutie to become an intermediary because Cutie actively defies them and will not quietly listen to the humans and perform the work they ask of the robots.

ANT claims that objects are not good at remaining mediators. However, the Isaac Asimov's robots and the *Black Mirror* robotic honey bees act as mediators even when humans try to intervene and make them intermediaries. Asimov's Cutie would not listen to human beings and overtook their jobs on the space shuttle because he thought that he could perform better than the humans. The humans in *Black Mirror* tried to reprogram the bees to return to their original task of pollination. However, they were unsuccessful, and there were mass casualties. The robotic honey bees in *Black Mirror* are objects that are able to remain mediators in a way that Latour and ANT do not predict to be possible.

5.1   Robotic honey bees as "social actors"

Robotic honey bees do not appear to fit into the categories of "fetish" or "actor" because they act beyond the limits of what these categories allow. They possess too much independence and agency to be accurately described as a fetish or an actor. Instead, robotic honey bees require the expansion of the category of "actor" within ANT. The core issue with ANT is that it does not fit artificial intelligence in the ANT tenet that the associations formed between actors are "but a *type of connection* between things that are not themselves social."[67] ANT claims that the gun

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[67] Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network-Theory*. 1st edition. Oxford: Oxford University Press, 2007, 5.

itself is not a social actor, and the only reason that the gun is able to act is because it has connections to other actors. However, artificial intelligence is a social actor. The robotic honey bees in *Black Mirror* depict a future technology that do not require any type of human connection in order to function. The initial batch of robotic bees were created by humans, but they were provided with the technology to maintain their own population. The bees are able to perform pollination and reproduce to build their population. They do not require human creators at this point. While there are still connections being made between the robotic bees, the human population, and the flowering plants, the bees are able to exist and act as mediators without any connections. Therefore, ANT does not fully explain or describe the type of agency that artificially intelligent technologies exhibit.

"The concept of 'recursive self-improvement' is at the heart of most theories on how science could rapidly go from possessing moderately smart machines to AI superintelligence. Recursive self-improvement refers to the idea that as artificial intelligence becomes more powerful and intelligent, it can start modifying itself to boost its capabilities. As it makes itself smarter it gets better at making itself smarter, so this quickly leads to exponential growth in its intelligence."[68] The robotic honey bees exhibit this capability because they are able to improve their ability to pollinate and their ability to create new hives. The longer they exist, the better they are at locating plants to pollinate and places to create new hives. While *Black Mirror* is a world of fiction, Google is currently working on real technology that is capable of coming up with solutions to problems on its own.

> "At Google's annual developer conference today, Pinchai [the CEO of Google] introduced a project called AutoML coming out of the company's Google Brain artificial intelligence research group. Researchers there have shown that their learning algorithms can automate one of the trickiest parts of the job of designing machine-learning software

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[68] Gent, Edd. "Google's AI-Building AI Is a Step Toward Self-Improving AI." *Singularity Hub* (blog), May 31, 2017. https://singularityhub.com/2017/05/31/googles-ai-building-ai-is-a-step-toward-self-improving-ai/.

to take on a particular task. In some cases, their automated system came up with designs that rivals or beats the best work of human machine-learning experts."[69] Google's technology is already at a stage where it can come up with plans for machines that work better than human designs and over time the technology can come up with better and better designs.

A social actor within artificial intelligence technologies is an object that would use this capacity to learn and plan (recursive self-improvement) to benefit itself and make itself smarter. "AI should be able to *understand* its own workings sufficiently to engineer new algorithms and computational structures to bootstrap its cognitive performance."[70] For example, the *Black Mirror* robotic honey bees are able to do this. The drone bees are created to deal with the world's honey bee decline in this fictional world and they are given artificial intelligence software that makes them independent.[71] The bees are able to locate and pollinate flowers independent of any human administrator. However, they are more than independent navigators. The robotic bees are also able to reproduce on their own and create new hives in locations that the bees choose on their own. In independently sensing, locating, and pollinating flowers and reproducing, these robotic bees have gone beyond the realm of human control in a manner that their human creators do not fully comprehend. Like humans within ANT, the robotic bees have their own inertia and are able to maintain their status as intermediaries. It is impossible for the humans in *Black Mirror* to control or predict what the robotic bees will do next, making them social actors.

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[69] Simonite, Tom. "Google's CEO Is Excited about Seeing AI Take over Some Work of His AI Experts." MIT Technology Review. Accessed February 6, 2018. https://www.technologyreview.com/s/607894/why-googles-ceo-is-excited-about-automating-artificial-intelligence/.

[70] Bostrom, Nick. *Superintelligence: Paths, Dangers, Strategies*. OUP Oxford, 2014, 24.

[71] Hawes, James. *Hated in the Nation*. Drama, Sci-Fi, Thriller, 2016. http://www.imdb.com/title/tt5709236/.

6 CONCLUSION

Religious Studies is a method of understanding fictional or alternate worlds in order to sort out potentialities of this world. In this project, language from the anthropology of religion was borrowed to explore the agency of objects, both within religious rituals and within technological advancements. The categories of "fetish" from the field of Religious Studies and "actor" from Bruno Latour's actor-network theory help explain how society understands and interacts with artificial intelligence technologies. Fetishes possess animacy, and that animacy is dependent on the perception of the observer. Although fetishes are animate, they are not actors because they do not have agency in actuality. There may be a perceived agency by the observer however, it is not a visible or quantifiable form of agency. Whether a fetish has real agency or not is of little importance to religious practitioners and the field of Religious Studies. However, for the purposes of this paper, it is important to point out differences in agency to more accurately categorize artificial intelligence technologies. In this paper, fetishism provided insight into how people attribute animacy and liveliness to technologies. For example, how do we understand something like a robotic honey bee, which is made of metal and yet has the capability to fly and pollinate plants? Although fetishism helps with this question, it is not a perfect fit, so actor-network theory was considered as an alternative. Actors within ANT are animate because they are able to make connections and associations with others actors, and they also have agency. This is a point of differentiation between ANT and fetishism. Within ANT, connections are made and unmade between human and nonhuman actors in order to create social spheres. Although actors within ANT have agency, there are limits to how much agency they truly have and what is considered to be a social actor. For this reason, ANT is also an imperfect match to artificial

intelligence technologies and requires the expansion of Latour's theory to better accommodate artificial intelligence technologies.

The expansion of ANT allows for more objects to be considered actors and social actors in a way that they are not currently considered. Forms of artificial intelligence, specifically robotic honey bees, do not completely fit into the categories of "fetish" or "actor" and require the alteration of ANT. The concept of technological social actors refers to objects that are humanmade but that become more than objects through enacting change in the world independent of human intervention. For example, metal as a conductor of electricity is an actor, however, it requires a human to flip the switch and begin the transfer of energy. Technological social actors do not require human help. Internet bots are initially created by humans but do not require human attention to interact with humans and each other online. They are independent and are able to update and improve their own efficiency. Technological social actors are a necessary category due to the fact that their characteristics and the amount of agency they exhibit exceeds the bounds of a fetish and an actor.

The field of Religious Studies and religious imagination has historically been employed to explain the unexplainable. The idea of robots pollinating flowers is a difficult concept to comprehend, much as the creation and events of the natural world has historically been explained with religious language. In the historical timeline of employing religious information, technological social actors are a new data point and require analysis. Research that bridges the fields of religions and technology, religions and science fiction, and new/vital materiality is important because it combines fields that deal with objects, agents, and potentialities. Drone bees are just one example of potentialities already happening on a small scale. In the laboratory, scientists and engineers have constructed robotic bees that mimic the behavior of actual bees.

While they are not quite in our everyday world yet they are not enough of a fantasy that can be ignored. Terminology from the anthropology of religion helps us partially understand these advanced technologies as animate, agents, and potential technological social actors. Fetishism help us understand objects that are animate, while Latour's actor-network theory helps us understand objects as actors. However, neither are sufficient at explaining the amount of agency and freedom that they do have. An expansion of ANT is required to understand objects not just as actors, but as social actors. As more technology is created and advances more and more, an expansion of ANT will allow scholars to include more objects than previously allowed in the definition of actor.

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