

EXPRESSIVE SIMULATION OF SOCIAL COMPLEXITY

A THESIS

PRESENTED TO

THE EDP GRADUATE COMMITTEE

UNIVERSITY OF DENVER

IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE

MASTER OF ARTS

BY

CHRISTINE J. DE CARTERET

NOVEMBER 2014

ADVISOR: CHRISTOPHER COLEMAN

ABSTRACT

Humanity can be viewed as a complex system: many independent agents interact with one another according to sets of rules that vary by the individual. Over the passing of time as these independent agents interact, patterns and structures may start to emerge. These patterns, structures, and collective forces can be viewed as human culture. Individualism is so widespread in Western society that it can be difficult to envision oneself as an independent agent in a complex system; we tend to privilege our own actions and intentions over the intentions of other individuals or of a group. However, there may be many social benefits to understanding that we are contextualized in a complex system. It may be easier to understand how social forces help perpetuate social ills even without anyone having bad intentions. It may also be easier to understand how our own identities can fluctuate based on our position within these systems, how we project different information depending on context. Computational tools give us the power to create simulations of these kinds of interaction. Many contemporary digital artists such as Robert Hodgkin, Dan Shiffman, and Craig Reynolds already work with the modeling of collective animal behavior using simulated forces of repulsion, attraction, and alignment. While human interactions may involve more variables and potentially more nuance, I believe that rudimentary, low-resolution simulations of these interactions may still prove useful as a means of visualizing forces which may be hard to conceptualize otherwise. I intend to harness the capabilities of computational media to create expressive web-based simulations of human social behavior in order to better understand the complexity of human relationships.

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INTRODUCTION

Advances in communication technology tend to come with noticeable changes in human culture, and this has absolutely proven to be the case with the rise of computers and the internet. Internet technologies have made it possible to connect with people all over the world practically instantly. This increased connectivity allows us to understand each other in ways that were never before possible. Because connecting with other people is so much easier, happens on a much larger scale than ever before, and leaves digital information trails that are easy to follow, it becomes increasingly helpful to view humanity as a complex system. Simply put, a complex system is made of many independent agents that interact according to simple sets of rules followed by each agent. As agents within a complex system interact according to their own rules, patterns begin to emerge, which is a phenomena known appropriately as emergence. If we conceptualize humanity as a complex system, then we can view our culture as the patterns that emerge out of our complexity. This is hardly a novel perspective on humanity in the scientific community, but it has yet to become a common perspective culturally.

It would be socially beneficial to promote the widespread conceptualization of humanity as a complex system. Human beings in Western society tend to conceive of themselves as independent agents, which is a good first step, but often fail to fully understand how their identities emerge as a result of their context amongst other human and non-human actors. The process by which we form, understand, and perform our identities is referred to in philosophy as subjectivation. This is an important concept in post-humanism and post-structuralism, particularly for feminists and other scholars of difference within those fields. Anyone whose identifying features are othered, or somehow marked as different from the “normal” or “standard” identity (women, racial minorities, sexual minorities, etc.), are perceived within the way those identities have been represented by culture at large. They are objectified; their identities are attached to labels that come with

a preconceived set of attributes which then becomes their responsibility to override. Promoting the concept that human culture is emergent could help people conceive of all individuals as independent actors making choices within their own contexts, which in turn could help us empathize with people we perceive as different to us. If we can understand how people are products of their human and non-human circumstances, we can understand that, were we in someone else's position, we might make similar decisions.

My objective is to create media that promotes this conceptualization of human identity and relationships. Human beings have a long history of using artistic and expressive media to initiate conversations, examine cause and effect, and make arguments about the world. Similar to advances in communication technologies, the development of new expressive media allows creators to explore ideas in new ways. For instance, the advent of photography allowed for the wide-spread dissemination of images that reflect actual moments in time. Film allowed for artists to create visual narratives and to play with concepts of chronological time through the cutting and pasting of film strips. Both of these developments changed both the way we understand artistic intention as well as the way we conceive of our world. Similarly, computational tools allow for new means of expression that were never before possible. Many new artists are using the algorithmic capabilities of these tools to create generative and performative media, developing artistic pieces with the ability to vary based on input of different data.

I intend to harness the capabilities of computational media to create expressive web-based simulations of human social behavior in order to better understand the complexity of human relationships. I am particularly interested in exploring how humans attract, repulse, and align with one another. For instance, can I simulate occurrences of bigotry in order to illustrate how perception of the problem differs throughout a network? Let's say I created an environment populated by dots, 90% of which were red and 10% of which were blue. Then let's say that I program 10% of dots to be repelled by dots of another color, and endow each dot with the ability to witness repulsions in action if they are within a certain distance. The blue dots in this system

would witness many more instances of repulsion by virtue of the fact that they are the minority in this system. Many red dots, on the other hand, could go throughout the life cycle of the simulation without witnessing any instances of repulsion. This simulation could help illustrate real world instances of racism and how people who occupy privileged positions within a system are less likely to have witnessed bigotry in action and therefore less likely to believe it is a problem. Another potential simulation could explore the way social networks hierarchize and the result that has on identity. We are all familiar with the trope of rating potential sexual partners on a scale of one to ten. If I created an environment in which all agents were assigned a numerical value, and only allowed agents to become aware of their rank through comparison to other agents (for each interaction, either being informed that you are higher or lower than the agent you are interacting with) then each agent would develop an identity relative to other agents (“I am better than 70% of other agents”) rather than understanding it’s numerical value as an inherent attribute. This would help to illustrate how our identity reacts to context. In a room full of twos, a three feels much better than it does in a room full of tens.

For my tools, I will be exploring the existing set of network simulation and complexity simulation software as well as expressive coding libraries in order to determine which sorts of algorithms will allow me to make arguments about the nature of human interaction while also granting me control over the aesthetic result. I am particularly interested in the flocking libraries for Processing discussed by Dan Shiffman in his book *Nature of Code* as they already employ algorithms for attraction, repulsion, and alignment for simulating collective behavior. I will be attempting to create additional layers to these libraries to allow for the integration of more social variables. I will also be looking into network simulation tools such as Netlogo and Gephy. The final project will consist of around 3 to 5 web-based applications that will be publicly accessible on the internet.

LITERATURE REVIEW

COMPLEXITY AND EMERGENCE

As is clear from my introduction, a goal of my project is to explore the ways we conceptualize complex information: Can we develop ways of visualizing complex systems such that patterns of emergence, especially within human culture, are easier to understand? For this reason, the concepts of complexity and emergence are crucial to this project. I therefore find it fitting to begin my literature review with a discussion on what I mean by complexity and emergence.

Especially in today's interconnected world, complexity and emergence are important terms because they deal with abundance of information. Let's begin with complexity. There are two avenues through which complexity is theorized: the first is through chaos theory, and the second is through the aptly named complexity theory. Chaos theory is popularly represented by the example of the butterfly effect. Something so seemingly small as the flapping of a butterfly's wings on one side of the world can initiate a chain of cause and effect that lead to a hurricane on the other side of the world. It can be hard to conceptualize the process that leads to such an enormous shift in scale, but at its core, chaos theory is about how small differences can compound iteratively to create enormously complex results.

Complexity theory incorporates chaos theory to examine this relationship from the other angle. Simple patterns can emerge from complex systems of input. As mentioned before, a complex system is one comprised of many interacting independent agents. Given a complex system full of agents with small differences in their rules of interaction, what patterns will emerge out of the many interactions that occur within this system? This theory can be visualized with a different insect metaphor: an ant colony. Although ants are by and large

regarded to be unintelligent creatures, they each follow sets of internal rules, from which emerges a highly organized ant colony (Williams 2012, 28).

The resulting patterns, both the complex patterns resulting from simple inputs as well as the simple patterns that result from complex systems of input, are examples of emergence. Conceptually, emergence can be applied to a wide variety of disciplines, including hard sciences like math, physics, chemistry, as well as more humanistic studies like geography and sociology. Emergence, for my purposes, is most useful when describing the results of the interactions between large systems of independent agents. The concept is often applied to biological and ecological systems, as illustrated with the ant colony example, given that life itself can be viewed as an emergent property of complex chemical systems. To offer yet a third insect derived example, a hive of bees can collectively determine the shortest path to the best food based on the way their simple behaviors compound within the group. I find this to be an accessible example because it is easy for humans to conceptualize a bee as partially informed while simultaneously understanding that a hive of bees is much more intelligent collectively. This same notion applies to human behavior as well, even if it can be more difficult to understand our place as an individual within the complex system of all humanity. Robert Sapolsky describes the findings of a statistician at a state fair as an example of how a system of partially informed human agents can deliver much more intelligent solutions than one well-informed expert.

“They were having a contest that if you could guess the exact weight of the oxen you would get to milk it, or something...What he discovered at the end was that nobody got the answer right...but he then did something interesting, he collected all the little slips of paper and he averaged all of them and it came out to the correct weight within an ounce. In other words, no individual in that group had enough knowledge to be able to truly accurately tell what this thing was, but put them together in a crowd and out comes the right answer.” (Sapolsky 2010, 46:10)

On the individual scale in which we necessarily live our lives, it can be difficult to see how our behavior compounds to create emergence, but the patterns are there. Perhaps there is much understanding to be gained by promoting a greater understanding of emergence.

I am interested in exploring emergence as applied to human culture, particularly in the spread of ideas. While we all tend to operate under the assumption that we are arbiters of free will, I want to advocate for the recognition that we are all contributing to the human culture which emerges from our complexity and subsequently shapes and reinforces the way we live our lives. This endeavor becomes more important to me within the frame of computational media. Computers are without a doubt capable of analyzing and simulating complex systems, but with regards to expressive media are more often used as systems of representation. Interactions between the various simulated agents is not nearly as important as the way any particular simulated agent interacts with the player character, the only character with real agency. In a presentation for Indiecade East 2014, Paolo Pedercini argues that video games, as closed systems and products of rational machines, promote the same sort of modular and hyper-efficient thinking as other rational systems that value result over input, such as capitalism. He argues that the low cost of data and materials in these systems come at high social costs. The systems he describes are top-down blueprints for efficiency.

“When we produce artful depictions of our world using computers, we inevitably carry over cybernetic bias. It’s a bias that reinforces certain assumptions and certain mindsets. From the eyes of a computing machine everything is mathematically defined and susceptible to rational calculation... Since games are typically goal oriented, all of their elements tend to be reduced to means and ends.” (Pedercini 2014, 6:15)

While I do not think it is inherently wrong to utilize systems of rationalization to increase efficiency, reliance on and overexposure to such systems encourages the human brain, which learns from repetition, to adopt these modular ways of thinking and to lose valuable insights that can emerge when data-rich complexity is left intact.

POST-STRUCTURALISM

The philosophical roots of my project lie primarily in post-structuralism, a term applied to the collection of philosophers and academics who criticized the tenants of structuralism. Structuralism, as it is applied to cultural studies like linguistics and anthropology, argues that human culture can be conceptualized in structures, similar to the way a structure of grammar is applied to language. An understanding of both schools of thought feels like an important basis for the work that I plan on undertaking, but because both philosophies are so broad and apply to so many different disciplines, I will for now limit my exploration of the two schools to a few key points of distinction: the way each school of thought addresses and defines **relationships** and **identity**. In other words, how do we model our conceptualization of the world and the actors in it? How do we create boundaries between objects and ourselves, and how do we relate to those objects? Some of the biggest influences to address this line of thought in structuralism were Ferdinand de Saussure and Claude Levi-Strauss, who asserted that there existed certain universal structures of the mind that used binary oppositions and contrasts to create meaning.

My interest in post-structuralism lies in its rejection of these binary systems, which lead to defining the world by a sense of “otherness”. When the world is broken into oppositions, it reinforces the objectification of the “other” and promotes systems of representation, which create labels and preconceptions. Brian Massumi summarizes this point of view in his work, *A User’s Guide to Capitalism and Schizophrenia: Deviations from Deleuze and Guattari*. He starts his book by offering an example: a woodworker examining a piece of wood for indications of its quality and potential.

“At first glance, this example might seem to reinforce traditional philosophical dualities: nature on the side of the sign culture on the side of the interpreter; objective on one side, subjective on the other; matter, mind; raw material, production. None of these distinctions hold. The forces that brought the wood to the worker and the worker to the wood are a mixture of the cultural and the natural. A human body is a natural object with its own

phylogenesis; from the point of view of the social forces that seize it, it is as much a raw material to be molded as is the wood from another perspective.” (Massumi 1992, 11)

Massumi mentions the distinctions upheld by traditional philosophy, which is especially pertinent with regards to the structuralists. “Traditional philosophy” would argue that we gain an understanding of the world by making lines of division and categorization, but with any shift in perspective or scale, those delineations become reductive and prohibitive. Instead of defining by difference, I want to argue for definition by association.

I am particularly inspired by the works of Gilles DeLeuze and Felix Guattari, who both wrote heavily on the creation of subjectivity, as in the creation of the self. In his book *Chaosmosis*, Guattari argues that there are multiple layers to human culture that contribute to an individual’s sense of self:

“1. Signifying semiological components, which appear in the family, education, the environment, religion, art, sport ... 2. Elements constructed by the media industry, the cinema, etc. 3. A-signifying semiological dimensions that trigger informational sign machines, and that function in parallel or independently of the fact that they produce and convey significations and denotations, and thus escape from strictly linguistic axiomatics.” (Guattari 1995, 4)

Simply put, he attributes the creation of self to meaning transmitted directly from other humans, second level transmissions through media, and non-intentional transmissions from systems that are not intended to carry human meaning but transmit signification all the same. His third point is particularly important. By identifying a system which is capable of creating signifying information without having been created for or being aware of that process, he is identifying a force that cannot be known or categorized ahead of time. I intend to use these philosophical writings as guides in my own path of inquiry in hopes that my use of technology can help elucidate these ideas. I am particularly heartened by Guattari’s prediction for technology, which came in 1995. “Technological developments together with social experimentation in these new domains are perhaps capable of leading us out of the current period of oppression and into a post-media era characterized by the

reappropriation and resingularisation of the use of media. (Access to data-banks, video libraries, interactivity between participants, etc.)” (Guattari 1995, 5)

FEMINISM

Post-structuralism was particularly influential on feminism. This area of study, much like philosophy, is staggeringly broad and difficult to summarize in a paragraph, so I will be primarily discussing the works of Judith Butler, Donna Haraway, Karen Barad, and Lucy Suchman, whose works have been influential to me and who have particularly pertinent ideas with regards to the use of media, technology, and representation.

Judith Butler is best known for developing the theory of gender performativity in her book *Gender Trouble: Feminism and the Subversion of Identity*. In this work, she argues that gender is not a binary state attributed to biology, but rather a collection of behaviors that when executed allow one to be easily categorized as a coherent gender category by society at large (Butler 2006). Our gender is therefore not predetermined, but neither is it a free expression of will, because regulative discourses determine which sets of behaviors read as natural. Not just any gender expression will register with the masses, there are specific rules that need to be followed. Identity, then, is a product of behavior operating within externally defined categories. In her work “Imitation and Gender Insubordination,” she argues that while adopting a recognizable category of gender is helpful for acting efficiently within society, any recognizable category comes with regulation that hinders honest expression (Butler 2006). In Butler’s works, it is clear to see the influence of post-structuralism. I also find her point about political action to be especially interesting, as it seems that structural modes of thought privilege action more than post-structural modes of thought, and I am interested in exploring the implications of that.

Judith Butler’s influence can be seen in the works of Donna Haraway and Karen Barad. Donna Haraway has a particularly fascinating viewpoint as a scholar of evolutionary biology and feminism. Because

of this unique perspective, many of her works blend the lines between the humanities and the sciences. Her critique of the scientific community is two-fold. First, the way that objective science conceives of human identity and materiality is reductive and structuralist. She argues for a potential feminist objectivity or feminist empiricism. “We need the power of modern critical theories of how meanings and bodies get made, not in order to deny meanings and bodies, but in order to build meanings and bodies that have a chance to live” (Haraway 1988, 580). Second, attempts made to shift scientific discourses towards a more post-structuralist viewpoint are denied on the principal that they are not “expert” opinion, making it difficult to redirect a misguided regime. She puts particular emphasis on how “objective” scientific knowledge can be used as a tool of separation and bias. “Recent social studies of science and technology, for example, have made available a very strong social constructionist argument for *all* forms of knowledge claims... According to these tempting views no insider’s perspective is privileged, because all drawings of inside/outside boundaries in knowledge are theorized as power moves, not moves toward truth” (Haraway 1988, 576) Here she argues for epistemological pluralism, the idea that there is more than one way to get at the truth, and that claims of objectivity by “experts” can be seen as power moves that shut out potential new ways of thinking.

Karen Barad’s article “Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter” introduced me to a new way of conceptualizing physical matter and was the article that sent me down this rabbit hole of academic inquiry in the first place. She builds on Butler’s idea of performativity, contrasting it with established systems of representation. She questions the belief that we have better access to an understanding of our representations of things than we do the ability to understand the thing itself. Succinctly, she argues that “matter matters.” We are not separate from the “things” we encounter in our world, but rather part of a system of intra-acting phenomena. “...[P]henomena do not merely mark the epistemological inseparability of ‘observer’ and ‘observed’; rather, *phenomena are the ontological inseparability of agentially intra-acting ‘components.’*” That is, phenomena are ontologically primitive relations - relations

without preexisting relata” (Barad 2003, 815). Barad’s work is pretty intellectually dense. Boiled down, to the best of my understanding, she is arguing that there is a process of intra-action with our surroundings that leads to our creating cognitive boundaries between things that are interior, and therefore part of ourselves, and things that are exterior to our selves, but that these boundaries do not exist objectively and may obfuscate a more inclusive understanding of material agency.

Lastly, I will discuss the work of Lucy Suchman, who worked in human-computer interaction in the 1980s. Her work is particularly interesting to read from the viewpoint of someone living in 2014, because human-computer interaction has clearly come a long way since then. In her book *Plans and Situated Actions: The Problem of Human-Machine Communication*, she describes two different ways of programming a computer: plans versus situated actions. To differentiate the two, she offers an analogy describing the navigation techniques of European navigators versus Trukese navigators. A European navigator has a course of action for his journey that is charted out before he ever steps on a boat. If he is met with obstacles, he must develop a new course before acting. A Trukese navigator begins with an objective and makes periodic decisions about where to go based on his current set of circumstances. Suchman states that the European method is seen as the “correct” way to model the way human beings undertake purposeful action, and therefore the correct way to program computers to do the same. This way is the way of plans: the actions undertaken by a computer were decided ahead of time by a simulation of what the circumstances *might* be at the time of their undertaking. This, Suchman argues, is the weak point of this method that can be ameliorated through a better understanding of the Trukese method, or situated action. “...[A]s students of human action we ignore the Trukese navigator at our peril, because while an account of how the European navigates may be ready-at-hand, the essential nature of situated action, however planned or unplanned, is Trukese” (Suchman 1987, 1). She argues for a reevaluation of our assumptions about both human behavior and computing. To ignore our current circumstances in favor of what ideal circumstances might be is to

privilege our intentions over reality. It denies agency to literally any other dynamic system we may encounter as a human being. With my work, I hope to help illustrate the importance of context.

ETHICO-AESTHETICS

I mentioned in my introduction that many contemporary artists have adopted computational tools in order to create generative and variable works of art. I draw inspiration from many of these artists, but particularly from those who are working to further the understanding of the ethico-aesthetic paradigm, a term developed by Felix Guattari. Brunner, Nigro and Raunig summarize the concept in their article “Towards a New Aesthetic Paradigm: Ethico-Aesthetics and the Aesthetics of Existence in Foucault and Guattari.” “Guattari’s aim is to grasp subjectivity in the dimension of its processual creativity, instead of objectifying, reifying, or ‘scientifizing’ it. Guattari and Foucault use aesthetics as a way to hint at the creative potential of expression and enunciation that has been silenced by the dominant force of signs and signifiers” (Brunner et. Al. 2012, 41). While Guattari does not refer to aesthetics explicitly in terms of art, Brunner et al propose that art is a way of accessing aesthetics that allows us to escape structuralist viewpoints by dissolving binary oppositions like inside/outside, self/other, etc. The concept of the ethico-aesthetic paradigm has inspired artists to create works with many layers of information in order to explore ideas like materiality and embodiment.

I am particularly interested in the works of Anna Munster and Sha Xin Wei, who both explicitly explore the ethico-aesthetic paradigm. Munster’s book, *An Aesthesia of Networks*, seeks to find new means of simulating/representing/performing highly connected sets of information in such a way that patterns within the information can be perceived and meaningful. As much of the aesthetic of my work will have to center around established forms of network simulation, her work will be extremely pertinent, and I plan on thoroughly examining it when developing the aesthetic for my own work. Sha Xin Wei explores a wide range

of computational media in his book *Poeisis and Enchantment in Topological Matter*. I had originally intended to create a variety of objects in a variety of media, both physical and digital, which had been inspired by Sha's exploration of haptic media. Due to time and scope limitations, I will be restricting my work to primarily visual media. However, I continue to draw inspiration from these artists and plan on incorporating more sensory information in my future work.

TIMELINE

I am currently working full time in Boulder. Because of this, I will not be attempting to finish my thesis project in time to graduate in June. Instead, I will be spreading out my remaining course credits to bleed into the summer and fall, with hopes of defending my thesis project in September and graduating in November. My proposed timeline is as follows:

Winter quarter (January – Mid March): I will be taking an independent study with Professor Laleh Mehran. I have two main goals for this independent study. First, I would like to thoroughly research social phenomena in order to decide which issues specifically I would like my project to tackle. While I know that all the issues will deal with ideas of identity and relationships, I will need to pin down which aspects of society might be best critiqued through a lens of identity and relationships. My second goal is to develop an aesthetic sensibility for my projects. I want to make sure that my ideas are coming across the way I intend them to and that people find my work accessible.

Spring quarter (Mid March – end of May): Starting in spring, I will begin taking my actual thesis credits. It is during this time that I will carry out most of the execution of my simulations. I intend to tackle each one separately to make sure that they are complete independent works and so that I do not fall into my habit of multi-tasking and turning it all into one massive simulation. If during this time I find that my ideas or process need to be tweaked, I will reevaluate and adjust as needed.

Summer quarter: I would like to take the rest of my thesis credit hours over the summer so that I have the option of defending my thesis early in the fall. If I need to, I will continue work into the fall, which should not disrupt my schedule since I am banking on a November graduation as is.

MATERIALS AND METHODS

PRELIMINARY STUDIES/SCHOLARLY METHODS

Most of my thesis preparation has thus far been conceptual in nature. I have primarily been exploring the philosophical and scholarly roots of my ideas, developing academic objectives for my work, and identifying the major concepts that I want to explore. The ideas that I am examining are far reaching, as human social behavior is a rather large category. It is therefore important to note that I do not intend to empirically prove anything about human interaction. My work is not scientific in nature, it is exploratory and speculative. With my project, I am hoping to find alternative ways of conceptualizing the world, and that includes in part the liberation from believing the world can or must be modeled concretely. Therefore, I will be promoting “soft models”, which may be used as cognitive tools to shed light on systems without making hard scientific claims about their nature. I see my work occupying the same role that narrative plays in human expression, somewhere between aesthetic experience and expressive/rhetorical use. It attempts to persuade without needing to prove and yet narratives can somehow be so much more persuasive than a chart full of empirical data. Watching a narrative unfold, watching as one event follows another, one feels a sense of satisfaction. However, the progression of a narrative has been said to be inherently linear and not well suited for the variability that comes with digital media (Manovich 2002, 190). I consider complexity and emergence to be another form of cause and effect. Rather than one singular event acting as the entire precursor to another event, decisions made by a large amount of independent agents result in a collective pattern. For that

reason, the media I am proposing to make can be considered a form of storytelling as opposed to a scientific model or simulation.

Additionally, while my work undoubtedly draws a lot of inspiration from the work of feminist scholars, I will not be framing my work with hard gender delineations. My work is absolutely based in the observation that the current landscape of popular computational media organizes the world in modular ways, which can encourage an overly-rational and capitalistic view of the world and can come with high social costs. Compounding the problem is the fact that this overly-rational model of the world is something which may feel foreign and inaccessible to members of the population who tend to compartmentalize less (statistically more likely to be women). However, I do not intend for my project to be *for* women or *against* men. I do not wish to promote division, create a hierarchy, or alienate anyone. My goal is to create ways of using digital tools that promote an understanding of distributed agency as an alternative to subject/object representations.

TOOLS/METHODS

The tools that I will use for my thesis will all be forms of software and programming languages. Because I am dealing with simulating interactions between many independent agents, any software I use will have to be capable of carrying out such simulations, preferably with the allowance that each agent can have sets of attributes and methods, or functions, that vary per individual assigned to them so as to make the interactions feel more natural. At this point, I have by no means exhausted my research into all of the softwares and languages out there, but I have a few starting points.

In terms of network visualization softwares, I plan on looking at NetLogo and Gephi to start off. NetLogo already has many models available in its model library, some of which deal with issues in the social sciences similar to the issues I would be exploring. For instance, the Ethnocentrism model included with the

NetLogo library simulates how settlements of different colored agents may emerge depending on the proportion of agents that trusted other colored agents versus similarly colored agents (Wilenski 2003).

Preliminary investigations into Gephi suggest that it may be more useful to use with preexisting datasets. For instance, rather than simulating interactions between simple virtual agents, one could upload data about their Twitter or Facebook networks to visualize the connectivity that already exists in the real world (or at least the real virtual world). It is not my intention to delve too deeply into modeling existing social networks, but it may be a useful option for modeling interactions that may arise out of simulations undertaken in a software like NetLogo.

I am more strongly considering the use of programming languages. Dan Shiffman's book *Nature of Code* examines multiple simulations of collective behavior that may prove useful. As I already have experience modeling particle systems in Processing, this seems like a good place to begin my investigation into these libraries.

DEVELOPMENT

I plan on developing each simulation separately from the other simulations in order to let each one breathe as its own project. This is not to say that I will not be incorporating lessons learned from one simulation into the others. That would be dumb, However, I have the tendency to multitask, and so to combat my natural propensity to want to do everything all at the same time, I will be consciously breaking down my timeline into sections to make sure that each simulation I create is getting the attention it deserves.

Prior to beginning work on the simulations themselves, however, I would like to spend some time processing the overall cohesive effect that I would like my thesis as a whole to give. I will be completing an independent study with Professor Laleh Mehran in the winter quarter, during which I intend to explore the various aesthetic decisions I might make within my project as well as the social issues that I would like to

simulate. I want to make sure that I have considered to the best of my ability the impact that my work might make and the messages it might send before disseminating it out to the world with my identity attached to it.

INTENDED OUTCOMES

There are a handful of results that I intend to see result from my work. Primarily, my hope is that by visualizing the way we interact with each other in an accessible way, it may shed light on behaviors that seem mystifying. For instance, certain behaviors persist even though they have been vilified by society-at-large. What are the forces that lead to that? By treating my work as instances of expressive media, I am hoping that people will approach it with a sense of openness rather than scientific scrutiny.

This next point seems contrary to my last point, but I also see potential utility for the field of digital humanities. Many scholars have been employing network analysis tools to study interconnected texts and social networks in literary circles. Particularly interesting to me is the work of Sarah Horowitz, who studied the role that women played in Post-Revolutionary French politics by helping to mitigate the social circles of male politicians (Horowitz 2012). This work helps to shine light on aspects of humanity that have been overlooked for whatever reason (probably sexism) and demonstrates that including more contextual information in one's studies may reveal a more complete picture. Because my work also seeks to promote a better understanding of context, especially with regards to human interaction, I can see it having a useful visualizing application to work such as that of Horowitz. However, it bears repeating that I intend my work to be primarily expressive, so any future scholar intending to build on my work for analytical purposes would do well to keep in mind that I do not care about empirical truth and to modify my work accordingly.

DISSEMINATION

The issues I intend to explore in my master's thesis are broad, as I've admitted. Once more considering the broad reach implied by the category of "human social behavior", many of the facets of my project could be spun out into their own independent projects and still not come close to exhausting all the potential implications. I therefore necessarily consider this project to be a gateway into further exploration. Because I can envision my work branching off into many different applications, it will be important that I make my process and my outcomes as accessible as possible.

The most important means by which I will be spreading my work far and wide is through the magic of the internet. I plan on creating a well-designed and easily accessible website as a home for my project. This website will include all resources necessary for understanding and replicating my work. I envision breaking down the website into multiple sections.

The first will be documentation of the final product itself. Each simulation application would get its own page detailing the intent behind the object, the processes used to create it, the scholarly and artistic inspiration behind it, and documentation (photos, code files, construction instructions) of the objects themselves. The simulations themselves will also be hosted on this site, and each documentation page will link out to the simulations. However, each simulation page itself will stand alone and exist as a sort of external entity. This is for the purposes of being able to share links to the simulations themselves without having to contextualize it within my academic work. I want for my applications to feel native to the internet, and I feel that framing the applications as academic work may make them feel less approachable, or at the very least would color someone's expectations upon interacting with it.

Aside from documentation of the media objects, I will also use this website to host my thesis materials. This will include the final written thesis, a complete bibliography, all process work created

throughout the research process, and links to resources that may help to shed light on my project. This is partially so that others may be able to benefit from as much of the work I have undertaken as possible but it is also selfishly for my own organizational and promotional purposes. It seems like a good idea to keep all my thesis material in one accessible place should I ever need to reference myself or to show off to potential employers.

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