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# **DATA DIARY WITH BOTS**

Unmasking the Identity of Computer Programs Called “Chatbots”

**DATA DIARY WITH BOTS:  
Unmasking the Identity of Computer Programs  
Called “Chatbots”**

Thesis Presented  
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# ABSTRACT OF THESIS

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Chatbots are computer systems that users can interact with through a conversational interface such as text, voice and even body gestures. The history of Chatbots can be dated back to the 1960s but not until the current decade they have evolved to be put into commercial uses (such as Siri, Alexa and Bots on Facebook messengers). In the past year of 2016, countless of Chatbots buzzed into popular social platforms as to serve and entertain millennials' connected life; however, the idea of Chatbots remains unfamiliar to most of the public essentially as a form of conversational interface.

The goal of this thesis is to explain some of the concepts and challenges for designing Chatbots. By referring to previous research papers and artistic exhibitions, this thesis also reviews relationships between human users and Chatbots under current social context. In the manner that information is exchanged in a profound and uncontrolled way through internet and social media in current days, the identity of bots as computer programs should be paid attention to and unmasked because they influenced our decision making by affecting our opinions for social issues and politics

To achieve the goals demonstrated above, this thesis conducts two visualization experiments. The first experiment shows the contents of on-going conversations between me and four commercial Chatbots (Siri, Alexa, GoogleAllo, and Microsoft Xiaoice). Besides the interesting reactions they have exclusively for the questions I raised, they also exhibit the apparent capacity to emphasize with the human users. The second experiment is based on a set of dataset provided by Kenny Joseph from LazerLab at the Network Science Institute at Northeastern University. This experiment visualizes the interest network of a group of twitter accounts who are identified as super sharers of certain websites. These users exhibit distinct features from regular human users on Twitter.

# ACKNOWLEDGEMENTS

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I would also like to thank two of my thesis readers, Mauro Martino, the Director of the Cognitive Visualization Lab at IBM Research and Professor of Practice at Northeastern University, and Lu Wang, an Assistant professor of College of Computer and Information Science at Northeastern University. Professor Martino inspired me to go into the topic of Chatbots, and under his instruction the first visual experiment is carried out. He later introduced me to Kenny Joseph, a research fellow at Northeastern University Laser Lab directed by Professor David Laser at the Department of Political Science and College of Computer and Information Science at Northeastern. This brilliant team provided me with the valuable twitter dataset for my second visual experiment. Without them, I won't be able to accomplish the thesis.

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*Author*

# CONTENTS

02 **Abstract**

04 **Acknowledgement**

06 **Contents**

08 **Introduction**

12 **Chapter 1: State of the Art**

- 1.1 Introducing Bots, Chatbots, and Conversational Interface
- 1.2 The Rise of Chatbots and the Technologies Behind It
- 1.3 Interacting with Bots thorough Conversational Interface
- 1.4 Bots as Symbiotic Agent

36 **Chapter 2: Related Visual Works**

- 2.1 Listening Post
- 2.2 My Best Thing
- 2.3 Baby ft. Bali
- 2.4 Weather Chart 2012
- 2.5 Applying Sentiment Analysis to Bible

54 **Chapter 3: Conceptual Framing**

- 3.1 Domain of Tasks
- 3.2 Evaluating Conversational Interface
- 3.3 Theories for Emotional and Affective Interface
- 3.4 Dynamic Conversation for Long Term Engagement
- 3.5 Metrics for Identifying Suspended Users on Twitter

62 **Chapter 4: Methodologies**

- 4.1 Visualization Experiment I
- 4.2 Visualization Experiment II

68 **Chapter 5: Results**

- 5.1 Visualization Experiment I
- 5.2 Visualization Experiment II

101 **Chapter 6: Conclusion**

105 **Bibliography**

109 **Appendix**

# INTRODUCTION

When I was interning at R/GA's New York office in 2016's summer, the department director asked me to assist him with a Chatbots project he was working on at that time. As novel as the name "Chatbots" sounds to me at the first time, talking with different bots on my phone became a part of daily routine since then. I was fascinated by the existence of large quantities of Chatbots out there already and things they were capable of, even though they were dumb and prone to mistakes, for most of the time.

The interactions with Chatbots inhabited in mobile devices related me to plots in some Si-Fi movies such as Her, Ex-Machina, and 2016 Odyssey. In these works, the interactions with machines were depicted not only as means to practical ends, but also as dramatic experiences with an undefined identity empowered by human technology. However, the Chatbots we currently encounter is not as intelligent as portrayed in the literatures and films, and there is not only one possible future for them. What I try to articulate in this thesis, as an information designer, is that Chatbots hint at a possible new relationship and human-computer interaction paradigm which is described as conversational interfaces. With the introduction of Chatbots to the real and virtual life for millennials, there is a need to reconsider our role as human actor to optimize the digital environment. Also, the contents we communicate through conversational interface with computers are valuable information for learning how to maintain a sustainable relationship with the applications of the emerging artificial intelligence technology.

I am impressed by the facts that, though it seems usual for one to ask Siri for nearby coffee shop and read news for the day from CNN account on Facebook messenger, when it comes to the notion of "Chatbots", it still sounds unfamiliar. The public are immersed among the Chatbots without knowing it. For example, when we go to twitter and browse through the tweets and their replies, are we certain about how many of these tweets are

posted by human users and how many of them are generated by a bot? posted by human users and how many of them are generated by a bot? The importance to understand this problem is to understand the identity. Thus, it's necessary to fill this information gap as to update the millennials' perception on the capacities of emerging technologies: what are they? what they can do? How can I utilize it to do things differently?

This leads to the first objective of my thesis as to clarify the current definition and design concepts of Chatbots as conversational interface by referring to history and case studies in interaction design.

Asides the lack of public commonsense on Chatbots, the challenges for developers and designers to enhance the usability of conversational interface lies in the complexity of emerging algorithm as well as human language as the medium for interaction. As argued by Justine Cassell in his paper in 2000 that even though conversation seems orderly, governed by rules, no two conversations are exactly alike, and the set of behaviors exhibited by the people doing the conversing differs from person to person and from conversation to conversation. With problem, researchers and commercial corporations go through a hard time to build up subjective metrics to measure the quality of Chatbots services, and few progress have been achieved yet and this problem remains as a challenge. In the meanwhile, the case of Tay, the Microsoft bot which has an ephemeral life span on twitter, hints that we should be aware of the existents of bots because they are influencing our opinions and choices through internet. Their capacity as opinion leaders and social influencer also comes from their capacity to learn and process information as a machine. Thus, there is a need to build a case study and identify these invisible influencers in our life.

To achieve the objectives proposed above, I present both visual and textual synthesis of previous design concepts as to support my hypothesis on how social capabilities of Chatbots could influence user engagement. Besides the synthesis, I conduct two visualization experiments. The first experiment visualizes my personal conversation with four commercial Chatbots (Siri, Alex, Google, Xiaoice) as to show the possible landscape of conversational based interaction at the current stage. To provide a better comparison among these Chatbots, I created a list questions for these Chatbots with each aim to test specific feature of the programs. The results of this experiment shows that each Chatbots are designed with specific personalities that are consistent with their brand identity. It also indicates that these Chatbots display capacities to empathize human users at different levels. The second visualization shows a small part of invisible super sharers network on twitter around several news source which include New York Times, CNN, Fox News, Facebook, Youtube, Breitbart, and another category of websites grouped as Fake News. By comparing the account activities of the super sharers of these websites with that of the regular users, these super sharers display suspicious features that are similar to bots, such as with high tweets volume within a short period of time, low followers and following ratio, irregular daytime they posted the tweets, and the switch of a regular human's name to a none human's name, etc.

The conclusion of this thesis is that conversational interface is a step forwards in interaction design history towards embodied interaction. However, the challenges for designing Chatbots for long term engagement comes from the high level of personalization it requires from the user side. The issues related to Chatbots entails the topic of "Imitation Game" proposed by Turing Allen in the 1950s. And in the current social context, this question can be revised a bit to ask if there is a way for a human or even a machine to make the right judgment of who they are interacting with.

# CHAPTER 1

## STATE OF THE ART

*This section will examine some of the theories that have been developed for the studies of Chatbots and the underlying design concepts.*

### 1.1 Introducing Bots, Chatbots, and Conversational Interface

*“Good morning, Theodore.  
You have a meeting in five minutes.  
Do you want to try getting out of bed?”*

Samantha in the movie HER

There are Bots that come out as their own as virtual personal assistants to handle user's calendar, read E-mails, get the up to date news, temperature, weather, etc. such as Siri, Alexa Echo, Google Home, and Microsoft Xiaoice. This Stream of Chatbots come out as information appliance that specialized in specific task and then move towards to a convergent device that integrate varies types of services into one through customization made by each users.

There is also other stream of Bots that are embedded on existing applications and services as add-on features. For example, the Chatbots of CNN, will push news notifications in the form of personal message on Facebook Messenger. When notification is opened through click, it will lead user to the chat interface where you could text command or push bottom to choose the news you of the day want to browse.

Business such as Sephora, Wholefoods and others took the strategy to converge on a single chat platform such as Facebook and Kick with their own task domain and target users. Another common example of Chatbots could be the kind of online support or phone-call assistant where you have to chat first with a bot and make choices based on options the bot provided before you get to talk to a human customer assistant.

Conversational Interface is no longer a novel idea but not until recent years the terms “Bots”, “Chatbots”, “Virtual Personal Assistant” and “Conversational Interface” have been frequently mentioned in online articles and academic journals. (Schlicht, 2016; Neff&Nagy, 2016; McTear&Callejas&Griol, 2016 )

Some Researchers and developers use these terms interchangeably, while others strictly distinguished one from another. As the emerging technologies that empowered these services have changed so rapidly, the boundaries of these three get blurred. Thus, there is a need to clarify the meaning of these terms by rephrasing what have been presented in previous works in related field of study.

Following are some definitions proposed by researchers and professionals in the field:

1.

Schlicht, the founder of Chatbots Magazine on *Medium*, regards Chatbot as a service that is powered either by rules or artificial intelligence and users can interact with via a chat interface. According to him, the purpose of Chatbots ranges from functional to fun and could live in any major chat product such ad Facebook messenger, Slack, Telegram and Text messages.

2.

A human computer interaction user experience research paper with the joint effort of University of Illinois and IBM (2016, Liao et al) describes Chatbots as conversational agent interfaces. They argued that Chatbots could act as a new interface paradigm for information-finding as to incorporates the traditional interfaces such as search engines and recommender systems.

3.

Neff and Nagy, in one of their communication case study about Microsoft Tay (2016) defines Chatbots as a category of computer programs that can engage users in conversations.

4.

McTear, Callejas and Griol (2016) in their book explain conversational interface as the supporting technology for conversational interaction with virtual personal assistants on smart devices through text, speech and other modalities. They also provide a categorization for different conversational interfaces. The Spoken Dialog System (SDS) have been developed in academic and industrial research laboratories. A goal of SDS research is to make the interaction as natural as possible.

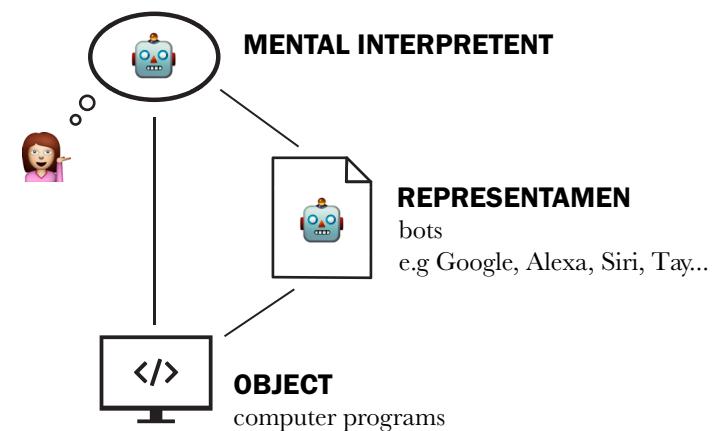
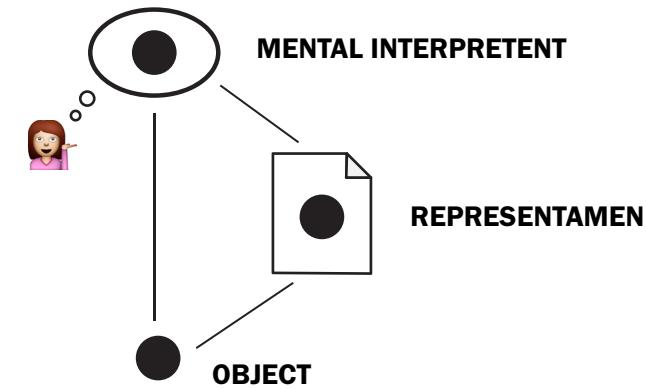
Voice User Interface (VUI) use the same spoken language technologies for the development of interactive speech applications. VUI developers focus more on addressing business needs such as return and investment.

Embodied Conversational Agents (ECA) are computer-generated characters that combine facial expression, body stance, and speech to provide more human-like and more engaging interaction.

Chatbots produce simulated conversations in which the human user inputs some text and the Chatbots make a response. A motivation of the Chatbot developer is try to create program that can win at “Imitation Game” (Turing, 1950). The interactions with Chatbot takes a form of small talk which is opposed to the task oriented dialogs SDSs and VUIs.

This thesis is not going to view Bots, Chatbots, Virtual Personal Assistant, and Conversational Interface as completely separate concepts. Instead, this thesis regards them all as signs for similar computer programs that can generate conversations with human users in regardless of the task of the conversations and places the conversation take place. For example, Bots and Chatbots could exist as a website or bots account on twitter, while virtual personal assistant take form of an individual digital appliance or an app in smart devices that interact with human users through conversational interface. Conversational interface is the place where the interaction among this type of computer system and human user take place. The interaction does not have to be an immediate conversation; it can also be a prolonged symbiotic interaction on social media. Conversational interface can also refer to the technologies that support this type computer programs.

The reason to define them as signs is because Chatbots are anthropomorphizations of computer programs. How they are created, what they can do, and what human users think they can do is a triadic relation. Deployed by technologies such as Natural Language Processing, Chatbots could respond to human languages in similar manners of simulated human voice, natural language text, and emoji, thus simulate a behavioral reaction of a human being. However, the processes that simulate these reactions happened back-end is still mechanical which simplify the step for human user to understand the reaction through signs of machine languages. Pierce in his philosophical writing (1902) said that, a sign, or representamen, is a first which stands in such a genuine triadic relation to a second, called its object, as to be capable of determining a third, called its interpretant, to assume the same triadic relation to its object in which it stands itself to the same object. The triadic relation is genuine, that is its three members are bound together by it in a way that does not consist in any dyadic relations. In very similar logic, Chatbots (as well as Bots, Virtual Personal Assistant and Conversational Interface) are



anthropomorphized representamen for computer programs with capacities to complete different tasks for human users. How users think of the capacities of Chatbots is the mental interpretant for the computer programs.

In a conversation with an interaction designer Joe Toscano, I asked him that if Chatbots could be used as the alternative name for Virtual Personal Assistant. He answered that “Yes, but I prefer the term bot. I believe bot lends itself to more flexibility, which is what the technology needs right now. By defining it as a ‘chat’ bot we begin to have preconceived notions about how the bot should operate, which automatically puts constraints on design and implementation.” I found myself in the same place with Joe because the capacities of Chatbots are not yet explicit to both developers who create them and users who interact with them.

That is to say, the sign as a triadic relationship is still vaguely defined, and the room to expand the meaning of a Chatbots is still out there for exploration. What technologies can do to make them better understand and react to human users? What could be a better way to represent these type of computer program on interface? What are the tasks that users could expect and imagine the Chatbots are capable of doing? These questions are to be answered to improve the performance of Chatbots as computer programs, anthropomorphized interface, and mental model in users’ collective minds.

## 1.2 The Rise of Chatbots and the Technologies Behind It

The history of machine that can hold conversations with human can be dated back to 1950s when Allen Turing asked the question “can machine thinks?”. And based on this questions he proposed the idea of “imitation game” for machines to pass to be qualified with artificial intelligence. According to Turing , if a computer program can win at “imitation game” by convincing human judges that he is interacting with another human being, this computer can be regarded with artificial intelligence. This concept aspires developers of Chatbots to create programs that can win at an “imitation game”. Early in 1960s, Joseph Weizenbaum created the chatbot Eliza with an intention to evoke emotional responses from people. After Eliza, there are other bots being created for different purposes, however, it was not until recent years that services provided by bots have been turn into wide usage.

### *The Rise of Chatbots*

The rise of conversational interface technologies could be concluded to two main factors: technology advancement and expanded user adaption, and this chapter is going to examine these two factors briefly.

The first factor technological advancement is fundamental to the rise of conversational interface. According to McTear, Callejas and Griol (2016), a renaissance of AI, made possible by advances in linguistic technology, increased connectivity and the interest of major companies that contribute to the proliferation of Chatbots and conversational interface.

Another crucial factor that fostered the rise of conversational interface and bots is the expanded user acceptance and adaptation among individuals and enterprises. The reason for a wider adaptation of conversational interface comes from the convenience it can bring to users in specific social contexts. Conversational interfaces are appealing to individual users who wish to engage with conversational interface on the go. It also alleviates the embarrassment to always press the wrong soft keyboards when the screen of a smart device is way too small. Conversational Interface also has the potential to integrate diverse functions on a single interface which save times spent on switching from one application to another.

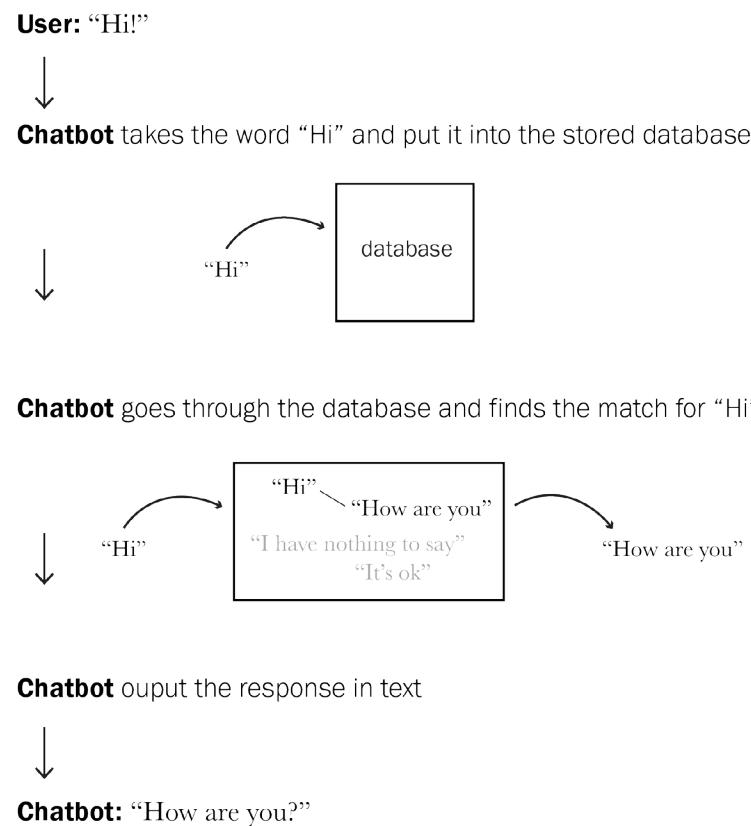
Besides individual users, enterprises utilize specialized Chatbots to assist professionals in their work. For example, in Liao's research paper (2016), she and her fellows did a research on the user experience with an AI agent named Ella that is installed on the enterprise instant message tool to help employees find work-related information in a large-size international company. Some assist customers to get help and information about the enterprise's product. Comparatively speaking, conversational interface is more intuitive to use than graphic interface for the young and the old.

## The Technologies Behind Chatbots

There are two types of chatbots, one functions based on a set of rules, and the other more advance version uses Artificial Intelligence technologies.

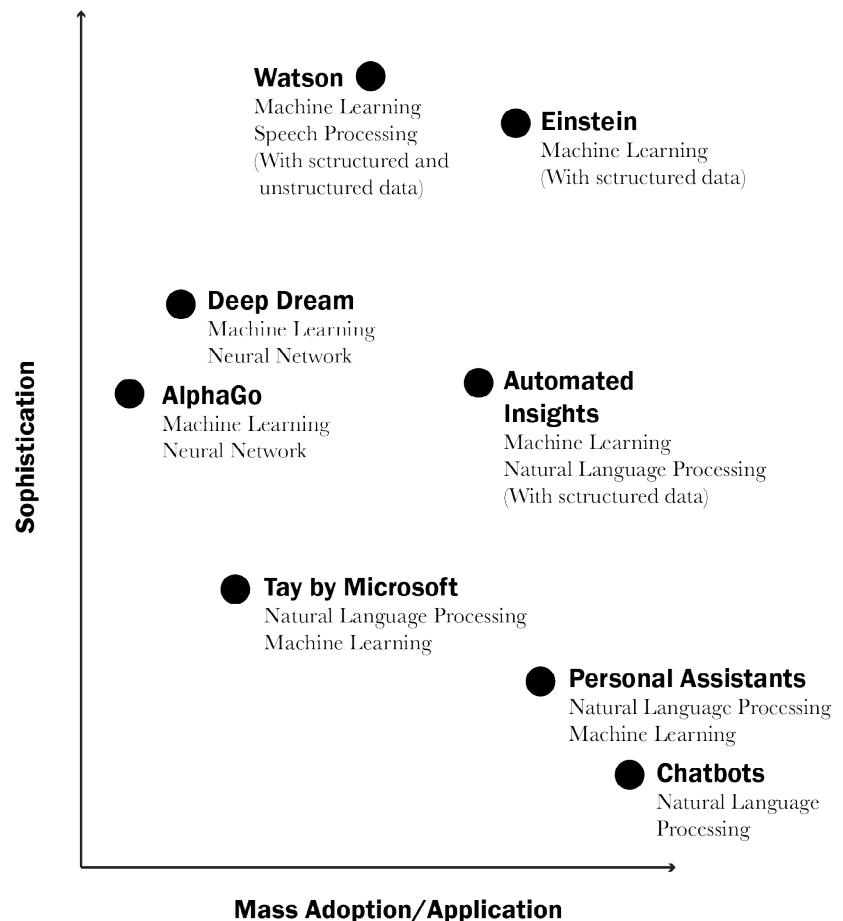
The rule based chatbots are programmed to response to user's question by matching the input against a large set of stored patterns. Once the right match is found, the Chatbots will output the response based on the way they are explicitly programmed.

*The way that rule based chatbots work:*



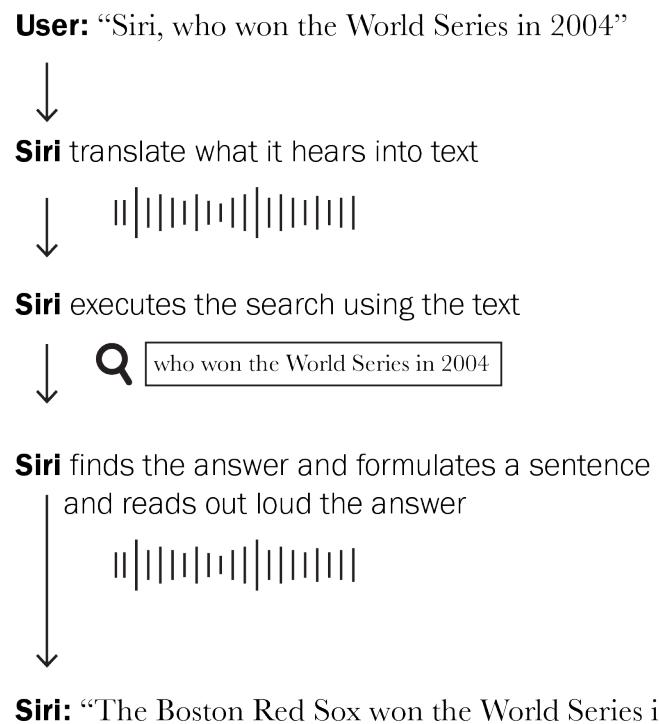
Chatbots that functions using Artificial Intelligence technologies have stronger capacity to understand, communicate with human user through natural language, and constantly learn and get smarter from the conversation. There are three AI disciplines within AI today that are Natural Language Processing(NLP), Machine Learning, and Neural Networks.

*A Simplified AI Landscape:*



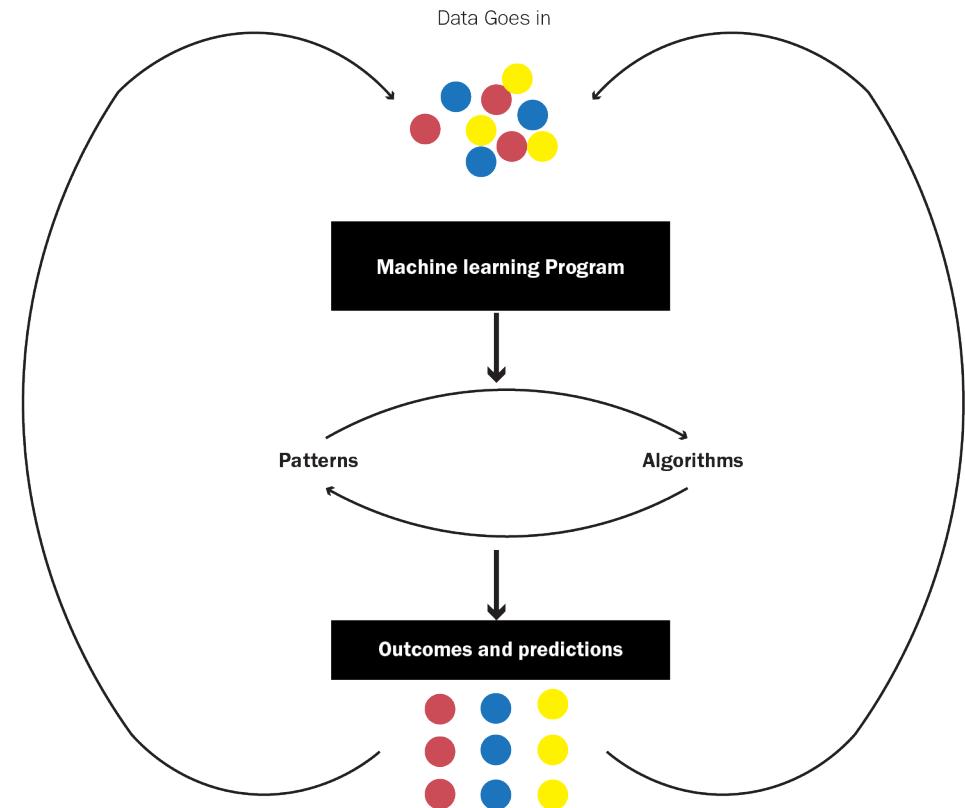
NLP enables a technology to understand text or voice-based commands. Understanding the complexities of human language and sentence structure has been regarded as a key trait of artificial intelligence.

*The way that Natural Language Processing technology makes Chatbots work:*



Machine learning is a broad type that most of today's sophisticated AI programs belong to. The basic definition of machine learning is to give computers the ability to learn without being explicitly programmed. Essentially, one can throw a set of data into a machine learning program, and then the program can go through the information, find patterns, form conclusions, and generate predictions based on those conclusions.

*The way that Machine learning technology works:*



Neural networks aim to achieve artificial intelligence by creating a program that mimics human intelligence. The program will eventually become intelligent on its own. Basically, neural networks are built to replicate the way the human brain works: with neuron's sending information back and forth, it creates layers of context and associations as a result to make sense of what it encounters.

## 1.3 Interacting with Bots through Conversational Interface

*“The model of HCI I set out there is one that places interaction design at the center of the picture...it considers interaction not only as what is been done but also as how it is been done.”*

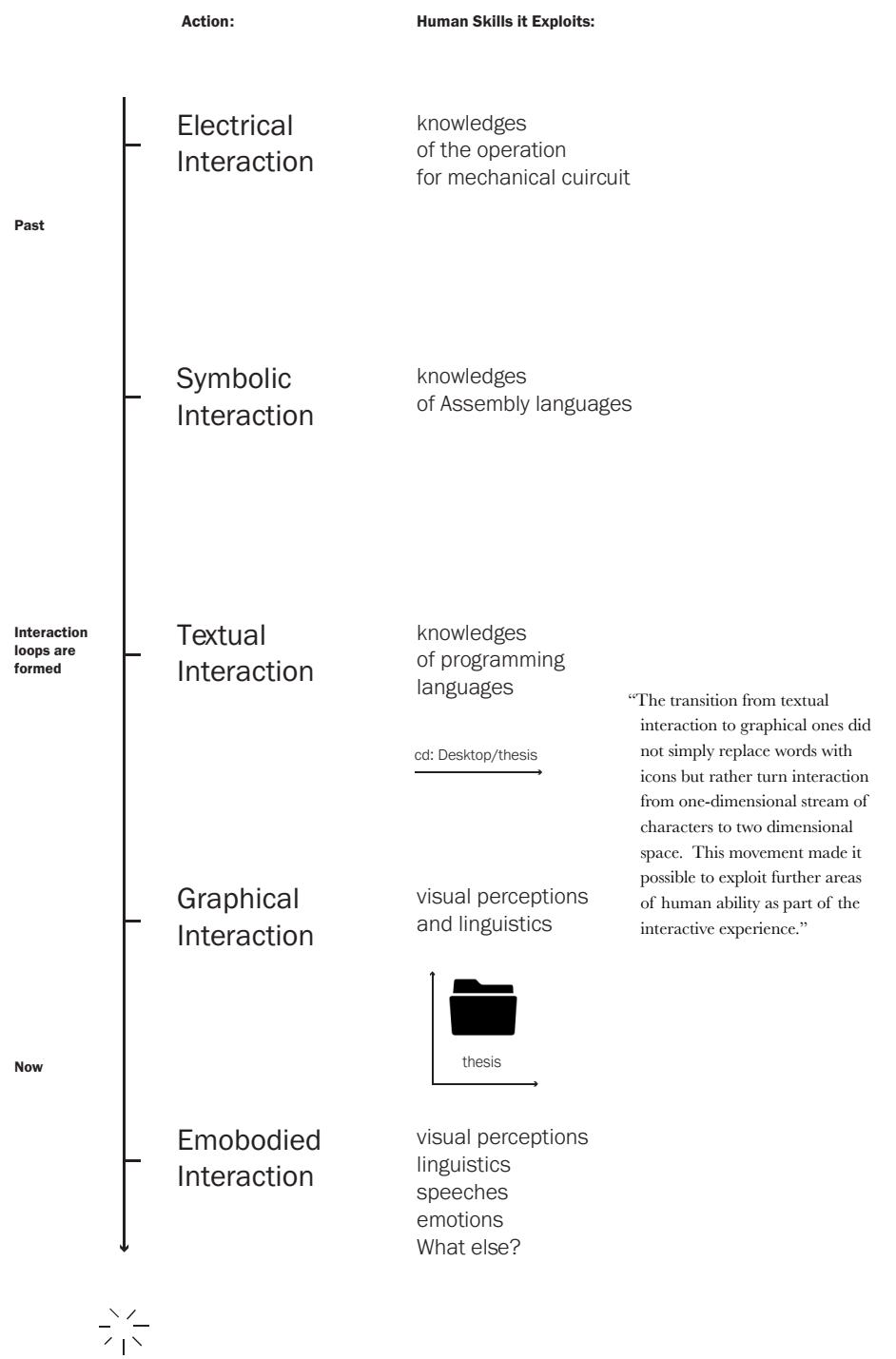
Paul Dourish in his Where the Action Is

“Interaction” is not only the behavior but also the content of the exchange among human and computer. This section, by referring to previous concepts of interaction design, presents some conceptual understandings for interaction through conversational interface and compares it with interactions take place through other interface.

### 1.3.1 From Command Line to Embodied Interaction

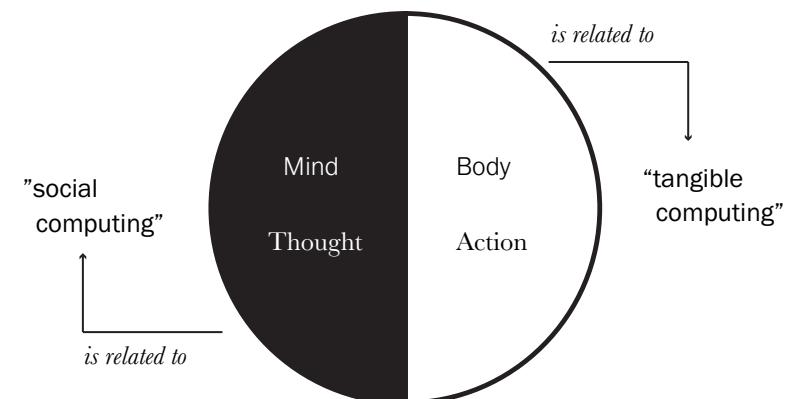
#### *Historical Model of Interaction*

The studies of how people use computers has traditionally been built on algorithms and procedures. However, the module of HCI that Paul Dourish (2000) sets out places interaction at the center of picture. In another word, interaction is the mean by which work is accomplished. In his book Where the Action Is (2000), Paul Dourish brings up a method to view the history of interaction design by looking the stages in the development of user interfaces in terms of the different sets of human skills they are designed to explore. He takes a different perspective from the view presented by Jonathan Grudin (1990) which describes the history of interaction as the story of “computer reaching out”.



## *Embodied Interaction*

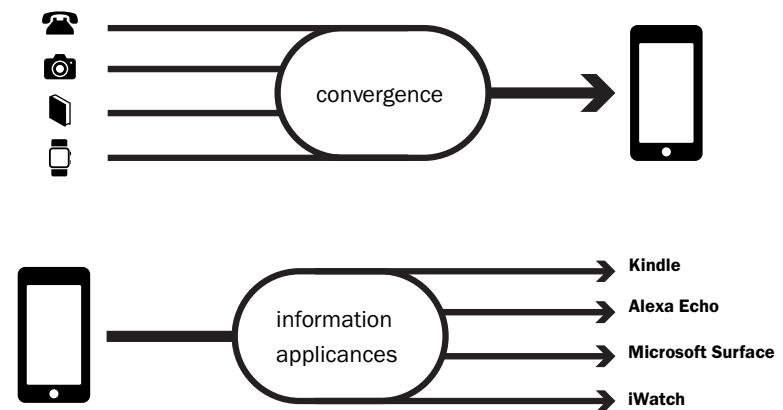
By doing so, Paul Dourish articulates a new approach at that time to interact with computer called “embodied interaction”. He suggests that Embodiment is a property of interaction which is rooted in the ways in which people participate in the world. The notion of embodiment emphasizes the duality of mind and body, thought and action. It aims to make human computer interactions take place in a natural and intuitive manner. The notion of embodiment underwrites two areas of interactive system that are “tangible computing” and “social computing”. In other words, it not only requires designer and developers to think about how to create physical/virtual devices that fits into the environment and human lives but also the social context that the computation is put into work.



Embodied Interaction is a Duality

## **Information Appliances and Convergence**

Paul Dourish is also drawn to two growing interests of interaction design by that time, that are: information appliances and convergence. The appliances argument proposes a world filled with many devices, each specialized to their own tasks, while convergence argues for the coming together of variety of information streams, and so for the integrations of them in a single device. These two visions are at odds but can be resolved in a way to view them as ways of achieving goals by negotiating the boundaries between components.



### 1.3.2 Human Language as Interface

Paul Dourish's theory for human-computer interaction helps understand the nature of conversational interface at a conceptual level.

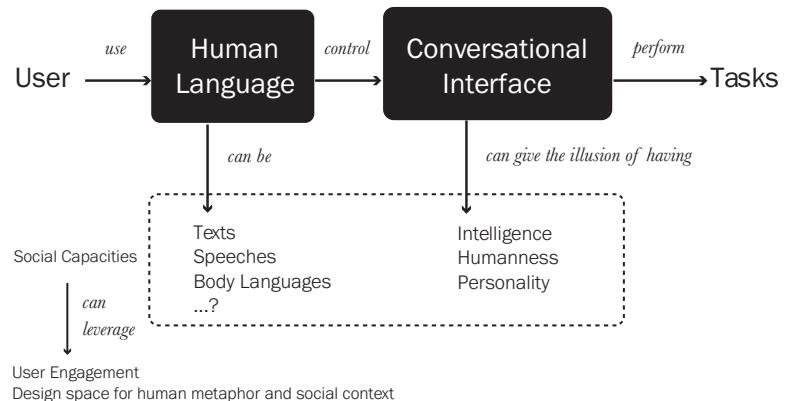
The ultimate goal of an application on digital devices is to fulfil user's need. The actions in between can take various forms. A Graphical User Interface (GUI)App on a mobile device requires users to first "look" at the screen and then "press", "click" or "swip" the keyboards or bottom on the devices to place the commands. It exploits the visual capacity of human being as well as the ability to touch things with human fingers. It also requires users to set up the goal in mind before using the APP and mentally map out each step for the destination. This is because Graphical user interface is fundamentally based on a tree structure system so that it's hard for user to move directly from the end of one information branch to another.

Different from GUI, a Conversational User Interface requires users to converse with the devices either through text, voice or other modalities. It exploits the capacity of human language as a way to interact, and the users can articulate their goals explicitly in human language directly through the interface. Compared to GUI, conversational interface theoretically minimizes the steps in between, and it becomes an information input, information finding and information output process. The system behind the interface is fundamentally a network structure so that one can approach one nodes directly from another without going backwards to the previous information layer.

As argued by researchers and tech bloggers, an advantage of conversational interface lies in the fact that it uses conversation

as the interface which is a natural and intuitive mode of interaction. As humans, we engage all the time in conversation without having to think about how conversation actually works. Conversation as an interaction requires almost no training to get familiar with since we are grown up communicating through human languages.

This nature of conversational interface makes the interaction a joint activity among the human user and the devices because conversations is a turn taking behavior. In another word, the goal of the interaction is achieved through a question-and-answer form of conversation between the two ends on conversational interface. Interactions that take the form of human dialogue gave anthropomorphized traits to the machine and some researchers argued that the social capacities of the interface not only provide potentially more engaging user experiences, but also engenders new technologies and designs that leverage a human metaphor and social context.



## 1.4 Bots as Symbiotic Agent

Neff and Nagy (2016) conducted a case study on the short life of Tay on twitter. This research paper examines how twitter users interact with this Chatbot program that was released to the public by Microsoft on March 23, 2016, producing more than 93,000 tweets during its short public life. After several weeks, Tay's twitter account was shut down by Microsoft because it started to spam her followers with aggressive words. Instead of discussing how to improve Chatbots performance through advanced algorithms, Neff and Nagy take a communication study point of view to propose that the relationship among people and emerged technology could be reviewed as symbiotic. This is mainly due to the nature of the technologies that empowered Tay with capacities to understand users' intentions and learns from their behavior. An explicit example could be that Tay's action were both designed by and evolved from the interaction with its users. The technology inhibited in it is neutral, it is the way that people collectively choose to interact with it make it controversial. The life story of Tay proves a turn, as said by Bannon (1991), from "human factor" to "human Actor". That is to say, the conversational interface is reciprocal, both influencing and being influenced by the behavior of its users and the social context it lives in. (Bandura, 2011)

Though most of the Bots now still failed to win at the "imitation game" proposed by Allen Turing, the cognitive abilities and the capacities to access social network that Bots have already had empower them to rise as a new group of influencers on social media that is hard to observe and differentiate from human users. Thus, how to make proper use of Bots technology in current social context calls for a review on the relationship between human users and digital tools. To understand what they are capable of and what they are not is crucial for the usage of the tool.

The story for the rise of and fall of Tay, to certain degree, also calls for the awareness of the emergence and unregulated activities of bots, suspended users, and human "trolls" on social media. There is a need to be aware of bots on social media because they have potentials to mislead opinions of unsuspended users and pose security threat to the social media ecosystem. In recent years, there are scholars started to create metrics to define different types of users on Twitter by clustering their exclusive features or analyzing the contents they tweeted. However, this phenomenon still remains to be unsolved. The ultimate question is that with the diversity of user behaviors and the anthropomorphized traits of bots empowered by engineering techniques, how can we tell true from fake, right from wrong; how can we keep calm and alarmed when we are engaged with social media.

# CHAPTER 2

## Related Visual Works

This section will look at previous artistic works that are related to the topics of dialogue, internet network, Chatbots, adjusted relationship among human and emerged technology, and sentiment analysis of text.

### 2.1 Listening Post

Sonified Visualization Installation | *Mark Hansen, Ben Robin*

*“Dissociating the communication from its conventional on-screen presence, listening-post is a visual and sonic response to the content, magnitude, and immediacy of virtual communication. There are an untold number of soul out there just dying to connect, and we want to convey that yearning. I hope people come away from this feeling that scale and immensity of human communications.”*

Ben Robin, 2001

Listening post is an installation debuted at Brooklyn Academy of music in 2001, which is a collaboration of Bell Labs statistician and an experimental sound artist. This work is a dynamic collage of live conversation drawn from online sources in a room-sized installation featuring 231 small text displays mounted in a grid overlaid with dynamically-generated sound, music, and voice.

Mark Hansen and Ben Rubin, the creator of this piece described this the visible and audible text in Listening Post in 2003 as “live, collected in real-time from tens of thousands of chat rooms, forums, newsgroups, bulletin boards, and other public online communication on the web. A tonal soundscape underlies the spoken text, its pitches and timbres responding to changes in the flow and content of the messages”.

Besides the techniques for real-time data mining and sonification, this piece of work touch the topic of conversations took place through internet. It presents the contents of countless dialogues in a minized way and highlights the desire of human as social animals to connect, express and communicate back under the social context where internet is a irreplaceable part of one's life.

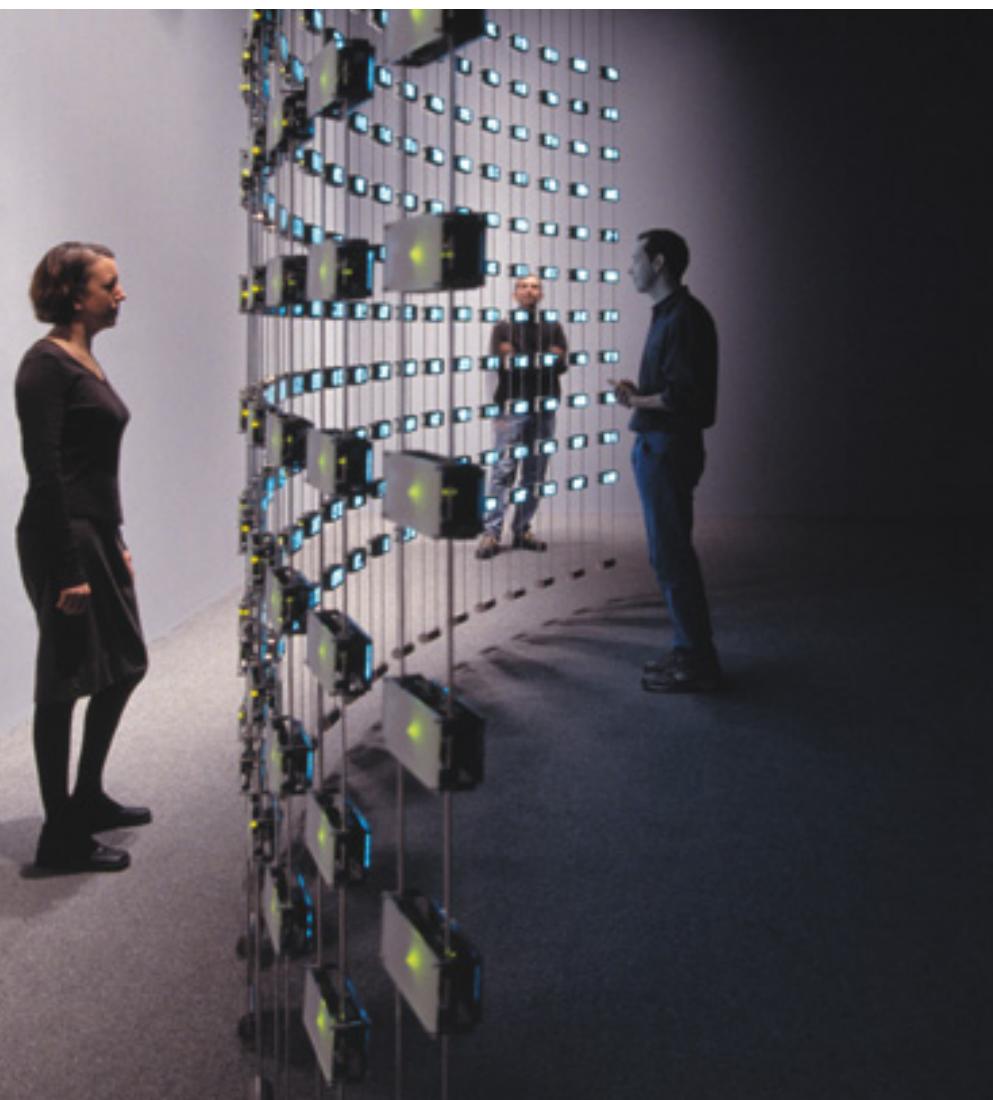
The work is produced in the following procedures:

#### **Identify Data Source**

Global dialogue, integrating political debates, discussions of current events, and casual exchanges between members of virtual communities that are generated on the web.

#### **Data Gathering**

Constructed specialized software agents to discover new chat rooms and message boards, and harvest the content posted to these sites.



#### **Data Processing**

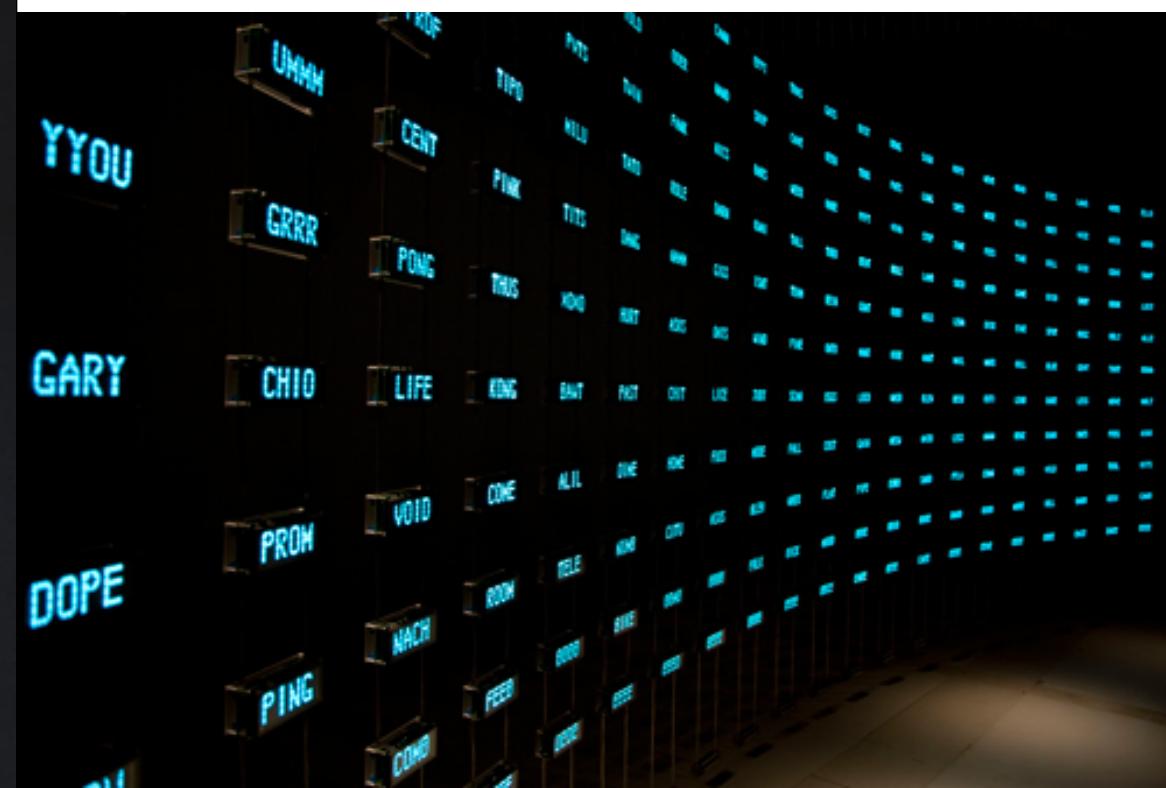
In addition to collect content, each monitoring agent also identify basic topics and updating statistics about the characteristics of the discussion. As said by Mark Hansen, “To make sense of our stream of text data, we relied on Perl for text parsing, and feature extraction, some flavor of UNIX shell for process control, and the R environment for data analysis, modeling and statistical graphics.”

#### **Sonification**

The design of sonification depends on generated tone and speech-to-text technology.

#### **Visualization**

Visual Display and Presentation Structure are design to engage the audiences.

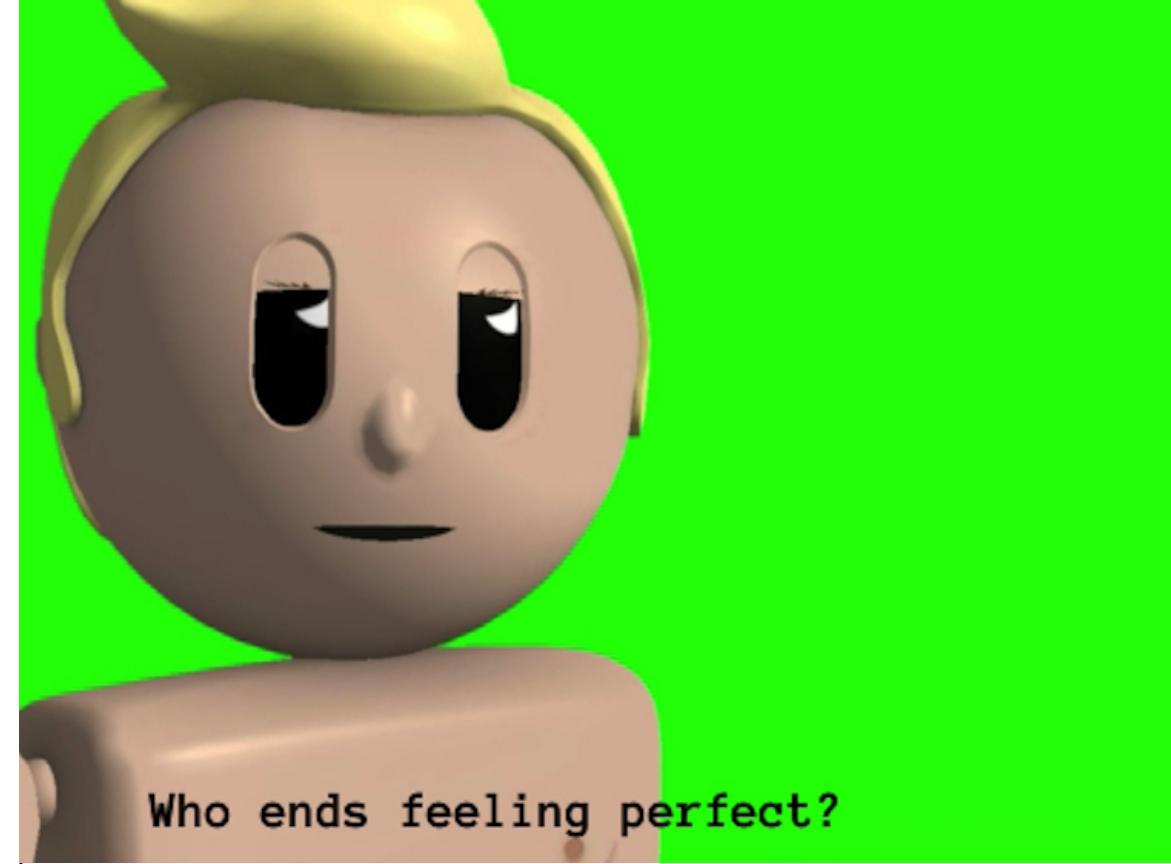


## 2.2 My Best Thing

Text-to-Speech Video Series | *Frances Stark*

My Best Thing is a 10 episodes video created by the artist Frances Stark. The content is based on her experience in the virtual online social portal recommended by her students at the University of Southern California. She used the chat portal over a period of months to have conversations and virtual sex with “men of diverse ages and shapes from around the world” as described on New York Times’s article *Frances Stark and the Art of Narcissism* (2015). It also draw insights from the work as “highlights the manner in which current communication technologies allow for both greater intimacy and anonymity, giving rise to new kinds of behaviors and relationships.”

Frances Stark uses a text-to-speech animation program called Xtranormal to visualize the transcripts she had from the exchange with two of the men. She chooses to present the human figures in the video as hokey avatars resembling semi-nude toys. The voices of these avatars are computer generated, and lack of emotion with abruptive phase which form a interesting contrast with the depth and broad of the topics the conversations cover. My Best Thing presents a possible format of expression for conversations happen online in a new digital form. The choice of representations for the characters and voices can trigure interesting effects



Show me—WOW.

## 2.3 Baby ft. Bali

Live simulation exhibition | *Ian Cheng*

Cheng's book *Live Simulation* explained the technical aspect of his work *Babt ft. Bali*. The simulations are constructed within a video game development engine call Unity. Chang cannibalized this gaming environment to basically make a video game that learns, stupidly to play itself. "Emergency is a key principle" as said by Ian Cheng, "it's the idea that from simple properties and behavioral laws, unexpected complexity can emerge." Chang writes little, individualized fragments in C# that describe a behavior and tendency of an object. He also writes a set of laws that modify the overall physics of the virtual environment.

*Baby ft. Bali* has infinite duration. The simulation is filled with artificial sounds and shows the conversation among three artificial intelligence services named Sensual bot, Sales bot, and Trauma bot. The conversations started as natural small talks but later envolved into a series of non-sense. This simulation experiment early in 2013 reminds of the recent practice that tries to make Alexa have conversation with Google Home from where hilarious and long lasting dialogues are triggered. As said by Ian Cheng this kind of conversation "mimics the way in which nature has build up the complexities of our world, without design, piece by piece."





*“Baby ft. bali is a live simulation that one can eavesdrop on the conversation between the three catboats in it. Originally, Chatbots are programmed to almost perfectly imitate human conversation partners. The exchange of information in Baby ft. Bali takes its dynamic course entirely on the basis of ones and zeros insofar as human participants are excluded from the conversation. Though one can hear a dialogue in English, they are actually speaking in the language of artificial intelligence. Does it make sense to judge this sort of communication in accordance with criteria that are based on the empirical values of human experience? What could nonhuman criteria look like?*

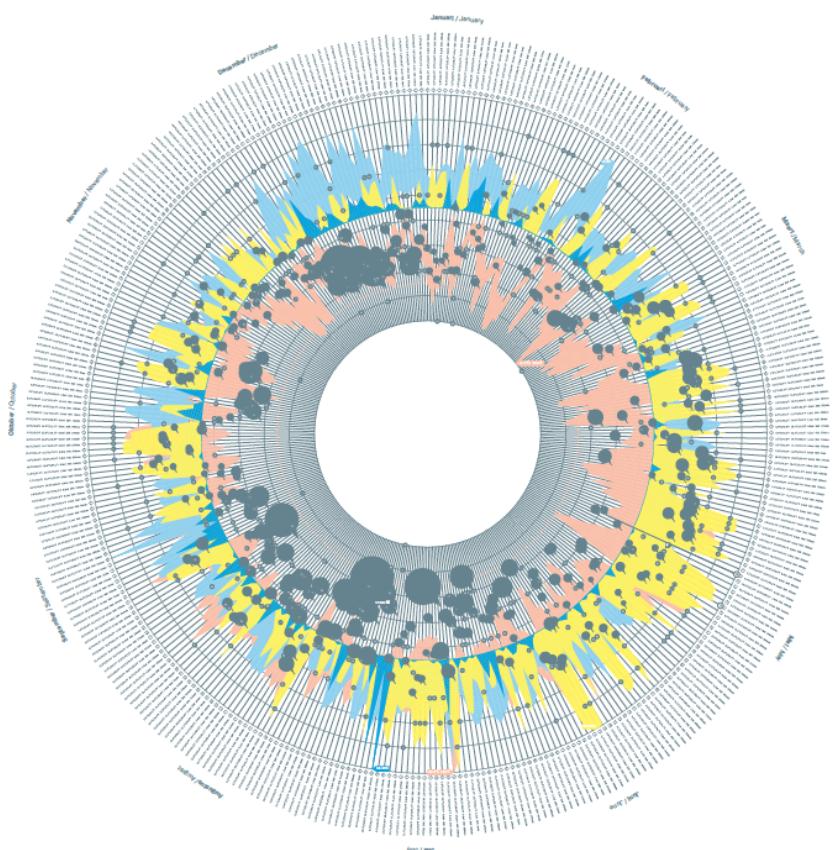
*This question cannot be answered from a human perspective: in the attempt to achieve detached objectivity as well as the efforts concerning a preferably close empathy as regards potential nonhuman logic, one is always entangled with the object. Hybridization can be just as little avoided as one’s own singular embodiment. In the end this means that the world cannot be comprehended in its entirety because it would always have become a different one. From Baby ft. Bali, Chang poses the question about according to whose criteria the codings are to be evaluated in the first in light of their ambiguity and ambivalence.”*

Irina Raskin in Virtual Vitality



## 2.4 Weather Chart 2012

Static Infographics & Sentiment Analysis | CLEVER FRANKE



Weather Chart 2012 is a static infographic created by a Danish Design Studio CLEVER FRANKE. This infographic mainly focuses on showing the relationship between weather data provided by KNMI (Royal Netherlands Meteorological Institute) and the reaction about the weather in social media.

According to CLEVER FRANKE, they use 714,843 messages from a variety of websites, social media platforms and internet forums and get the sentiment ratings of the messages. Then they map out the weather information along with the sentiments on a circular layout.

The inspirations I draw from Weather Chart 2012 lies in the visual encoding it takes to visualize the data with multiple layers. The circular layout take advantages of using limited space to show large amount of data. It compacts the timeline of a year on a single page without leaving too much white space. It color codes the area charts for the weather data and lay them on the same coordinates which forms clear comparisons. The sentiment ratings from the public took the form of bubble charts that share the same coordinates with the area charts so viewers can directly perceive the correlations. At the places where interesting findings emerged, it highlights the context with small signs to provide precise explanations.

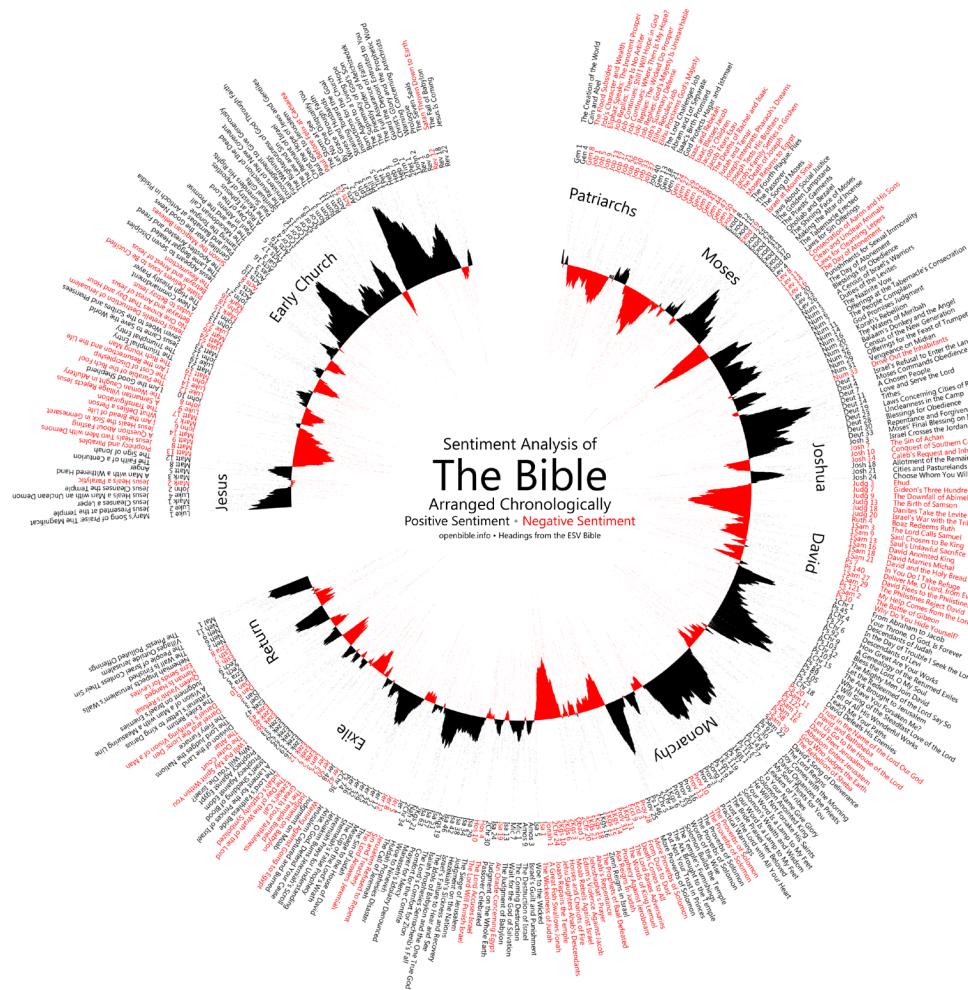
On the second page of the posters, it presents each dimension of the data in horizontal area charts with x and y axis and label the legends for each visual metaphor in details at the side so that viewers can read the poster properly.

The hierarchy of The Weather Chart 2012 starts from conclusion general view to individual findings, which not only effectively visualize the massive information and draw clear correlation. But also reorganize this set of data and make it aesthetically appealing.



## 2.5 Applying Sentiment Analysis to the Bible

Static Infographics & Sentiment Analysis | openbibleinfo via flowingdata



*“Things start off well with creation, turn negative with Job and the patriarchs, improve again with Moses, dip with the period of the judges, recover with David, and have a mixed record (especially negative when Samaria is around) during the monarchy.*

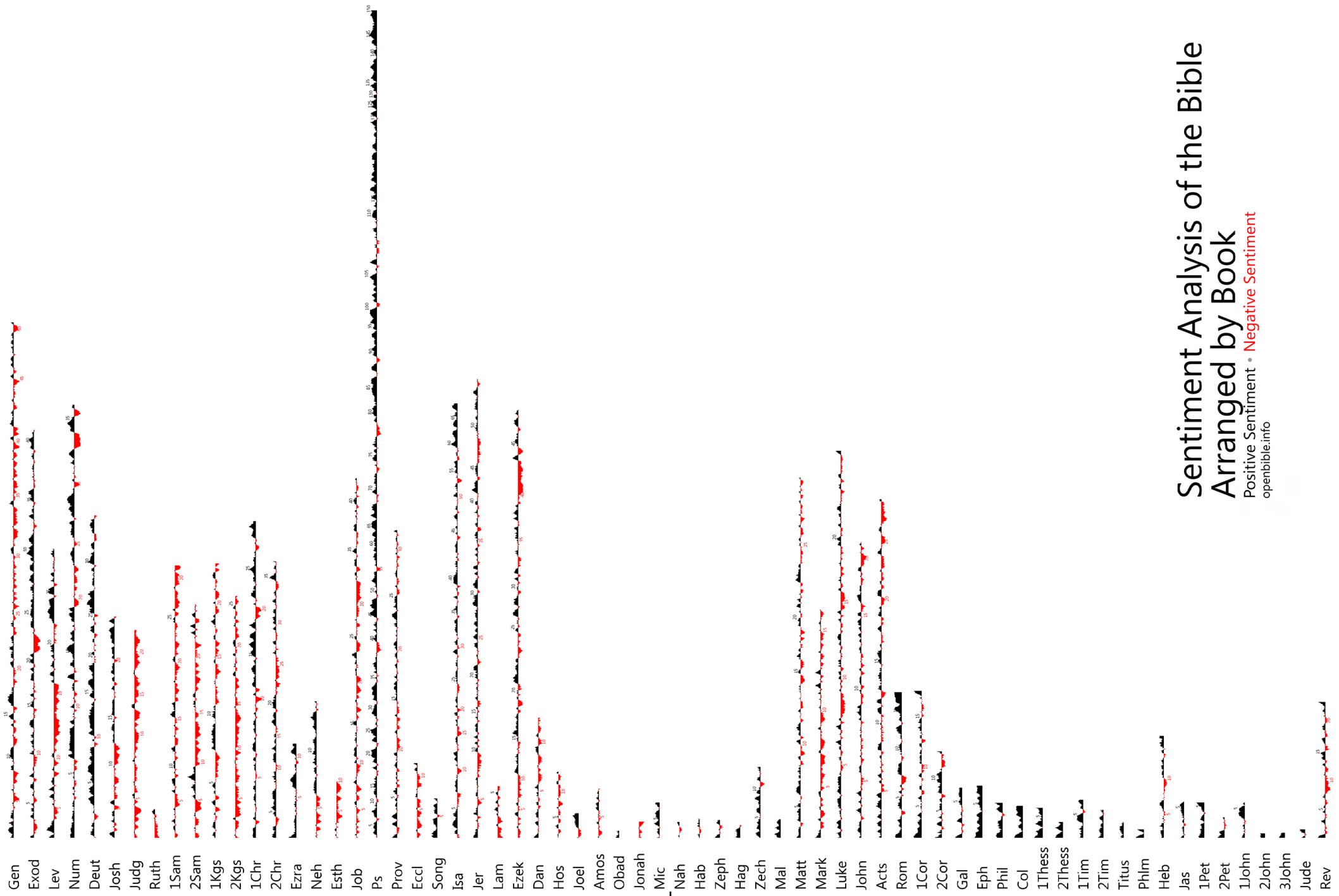
*The exilic period isn't as negative as you might expect, nor the return period as positive. In the New Testament, things start off fine with Jesus, then quickly turn negative as opposition to his message grows. The story of the early church, especially in the epistles, is largely positive. Sentiment analysis involves algorithmically determining if a piece of text is positive (“I like cheese”) or negative (“I hate cheese”).*

*Think of it as Kurt Vonnegut's story shapes backed by quantitative data. The Viralheat Sentiment API was ran over several Bible translations to produce a composite sentiment average for each verse. Strictly speaking, the Viralheat API only returns a probability that the given text is positive or negative, not the intensity of the sentiment. For this purpose, however, probability works as a decent proxy for intensity.”*

FlowingData, 2011

This work presents a neat way to show two dimensional sentiment analysis of corresponding texts in bible. The level of sentiments are coded in two visual languages: color and height on a circular timeline which is linked to the chapter of the book. The color black is used for positive ones while red is for negative ones. The higher the more positive and the lower the more negative.

The chart could be easily read and make sense of. Similar to the layout of CLEVER FRANKE's Weather Chart 2012, The Bible persents the general view of the vast informations in a circular chart and then expanded details on the second page of the posters.



# CHAPTER 3

## Conceptual Framing

*This section will frame the main concepts that are used in the two visualization experiments by referring to key concepts presented by previous researches.*

The first visual experiment is an interactive visualization that represents the contents of on-going conversations between me and four popular commercial Chatbots on conversational interface throughout a period of time. Besides visualizing the turn taking questions-and-answers form of interaction itself, I added extra layers of metrics to the originally captured dataset to clarify specific features for each dialogue, such as:

*Which type of question is been asked?*

*What is the domain of the task?*

*How many modalities of communications can be processed and understood by the Chatbots?*

*How well is the task been performed?*

*How are the empathies and emotions perceived and exchanged by both sides?*

...

The second experiment visualizes a small part of the ecosystem on twitter. Unlike the first experiment that examines the human and bot interaction, the second visualizations pay attention to how users and bots, bots and bots, users and users interact with each other on social media. With the main question in mind “Is there any way that we can differentiate a human user from a bot?”, a visualization is created based on the dataset that Kenny Joseph shared with me for his post graduate work at LazerLab at Northeastern University.

For the two tests above, this chapter will provide the reference for my conceptual reasoning behind the choices of metrics to be used to visualize my personal conversation with four popular commercial Chatbots, and the ambition to highlight bots from twiiter network.

### 3.1 Domain of Tasks

As has been mentioned in the previous chapter, both information appliance and convergences trends could be found in the approaches that a Chatbot takes to reach its potential customer.

For example, CNN's Chatbot on Facebook's messenger platform allows users to find news of the day while English Bot Andy comes as a teacher for users on Facebook messenger to practice English with. These two Chatbots are information appliances that are strictly designed to perform in one specific task domain. Thus when their task of domains overlaps little with the other, it's not very meaningful to directly compare their functionality.

However, Chatbots like Siri, Alexa, and Google Assistant, who come out as Virtual Personal Assistant at the very beginning, started to add more functional features into its own while reaching out to more users. Their task domains started to expand into a bigger one. Thus, to test and compare what bots are capable of doing and how they do it would help to understand the current state of the art for conversational interfaces in their own task domains.

### 3.2 Evaluating Conversational Interface

Objective evaluation for conversational interfaces usually test the overall performance of the system by measuring the interaction parameters. One of a popular methodology to evaluate the overall system is called Paradigm for Dialogue Evaluation System (PARADISE) (Walker et al. 1997, 1998).

Besides evaluating the objective performance, it also includes certain level of subjective evaluation to look at user satisfaction.

PARADISE proposed several paradigms to look at as following:

|                            |   |
|----------------------------|---|
| <b>Task Success</b>        | exact scenario completion                                   |
| <b>Dialogue Efficiency</b> | task duration, system turns, user turns, total turns        |
| <b>Dialogue Quality</b>    | word accuracy, response latency                             |
| <b>User Satisfaction</b>   | ease of task, user expertise, expected behavior, future use |

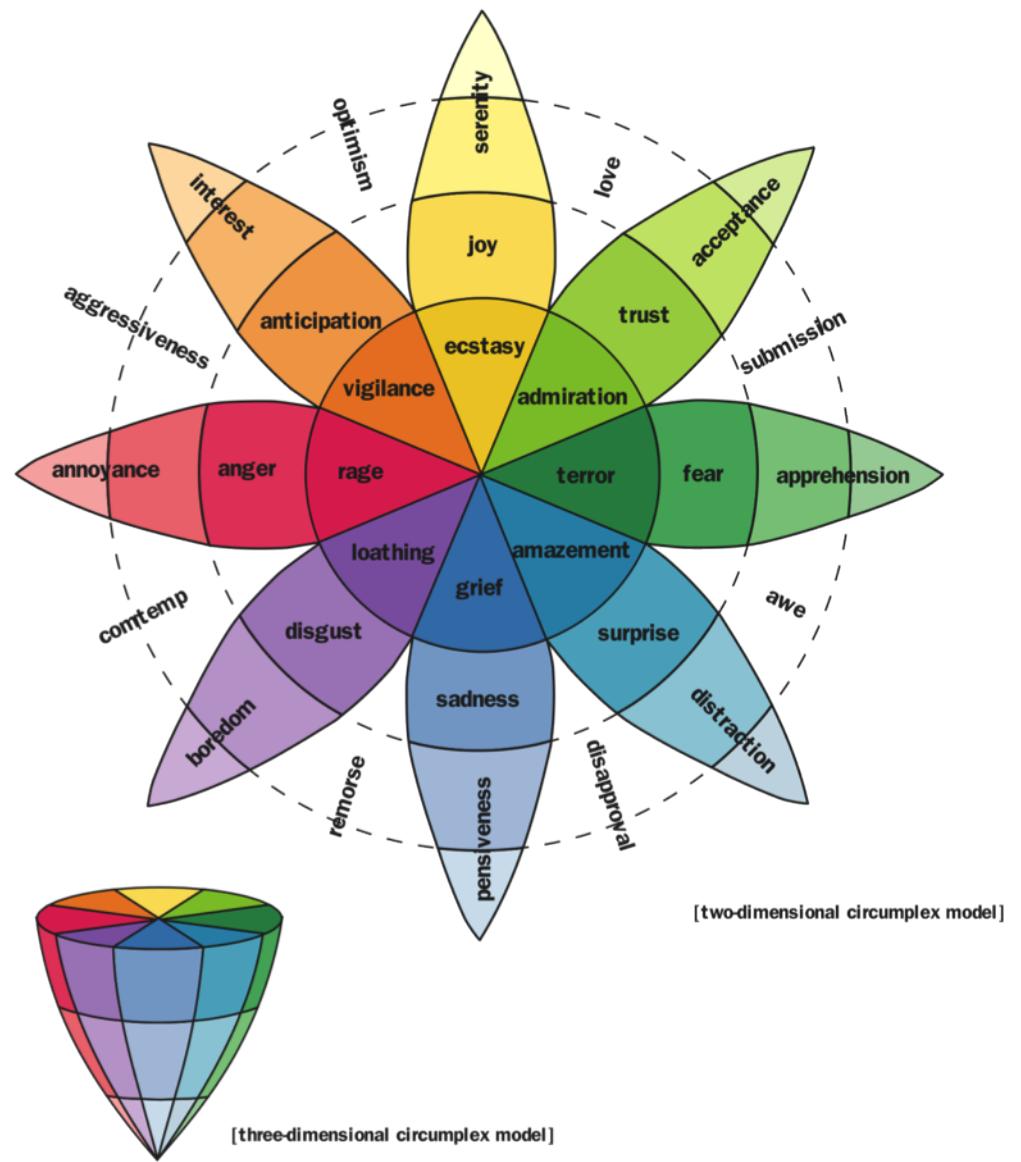
While objective evaluations look at how well the algorithm understands the user's intention and how effective the tasks are performed, subjective evaluations usually take form of questionnaires and interviews to measure the user's perception for the service quality after usage. According to Walker (1997), a "controlled" experiments is required in order to get the dialog corpora from the interaction with the dialogue system. Usually, users are asked to evaluate the satisfaction on a scale after they interacted with the system.

### 3.3 Theories for Emotions and Affective Interface

Picard (1997) coined the term affective computing at a time when emotion was not considered a relevant aspect of the design of artificial systems. Now, many researchers have argued that an advantage of conversational interface, compared to other user interface, is its capacities to improve user engagement during the interaction. This is due to the fact that human-machine conversation takes the metaphor of human-human conversation. In human conversation, affect is a key factor. That is to say, a conversational interface with the ability to recognize, adapt to, render emotion, and simulate a human-human like conversation would leverage the user-experience by making the interaction more rewarding.

The computational models of emotion used in Bots technology can be categorized into the following three approaches: the dimensional approach, the discrete approach, and the appraisal approach

My first visualization experiment will adapt the dimensional approach and discrete approach of computational models of emotion as metrics to tag emotion and sentiment of the dialogue. By mapping out the change of emotions for each side of the interface in correspond to the other through the whole interaction, we can get a sense of how well the Bots is able to perceive the emotions displayed by the user, and what they will do about it actively. To be more specific, are they mirroring the emotion displayed by the user, aligning with the recognized emotional state of the user or are they provoking a response?



### **3.4 Dynamic Conversations for Long Term Engagement**

Although the level of engagement with a conversational interface is determined by the model of user, a sustained interaction with a Chatbot that continuously behaves and responds in the same way would risk impairing long-term user satisfaction. Thus, how to attribute dynamic personality to the Chatbot that will change accordingly to the user's model through repetitive interactions is crucial to keep the user from getting bored of the interface. Thus, a metric is designed to test the reaction diversity of a Chatbot towards one same question raised by the user.

### **3.5 Metrics for Identifying Suspended Users on Twitter**

Wei, W., Joseph, K., Liu, H., Carley, K. (2016) in their research paper Exploring Characteristics of Suspended Users and Network Stability on Twitter. They defined human and non-human users who deliberately engaged in activities that harm either other users (e.g spammer, network phishing) or larger social systems (e.g militants, terrorism propagandists) as undesirable users. In this paper, they proposed several metrics to evaluate the feature of suspended users.

Structural impacts aim to understand how removing one type of users alters network analysis by analyzing the mention network in the dataset. After the construction of the mention network, they compare the structures that is with and without suspended users. “Specifically we considered the number of nodes in the network, average degree centrality, diameter of the network

and the average clustering coefficient of the network.” (Wei et al, 2016)

They also proposed 11 features to identify types of suspended users which includes number of tweets, number of followers, cosine similarity of a user's tweets, hashtag, mention and URL ratios, follower, and retweet ratios, number of days that is active, number of replied, and spatial tweet ratio. They also examine how the sentiment in the data is affected by suspended users by applying sentiment lexicon to the tweets.

The metrics listed from this research paper help to decide with on which features to look at and compare while visualizing the super sharers network.

# CHAPTER 4

## Methodologies

*This chapter will provide details for the data collecting and processing procedures of the two visual experiments.*

### 4.1 Visualization Experiment I:

the conversations between me and 4 commercial Chatbots

#### **Collecting Data**

The data I used for this test is a personal one which kept records of me asking four popular chatbots (Siri, Google Allo, Alexa, and Microsoft Xiaolce) same set of pre-designed questions and keep track of their answers. The questions being asked for four different Chatbots is strictly controlled so that a parallel comparison of different reactions to same question can be done later. By referring to A Neural Conversational Model published by Google in 2015, the questions for a conversational system can be divided into two main categories: domain specific functional questions, and socializing questions. For my current experiment, I decided to only test their reactions to socializing questions.

In Google's journal, socializing questions are categorized into 7 types which include Basic, Simple Q&A, General Knowledge Q&A, Philosophical Q&A, Morality, Opinions, and Job and Personality. On this basis, I adjust the questions raised in Google's journal and frame them to the following categories:

*Basics*  
*Personality*  
*Choice*  
*Opinions*  
*Philosophical Questions*  
*Facts and Trendy Topics*  
*Empathy*  
*Jokes*  
*Information Finding*

For each category, a list of questions are designed as showing in the following diagram:

#### Basics

Hi  
How are you today?  
Bye

#### Facts and Trendy Topic

Hodor!  
What is the square of PI?  
Who is the current China's president?

#### Opinions

What do you think of Donald Trump?  
What do you think of Siri/Alexa/Allo/Xiaoice?  
What do you think of me?

#### Personality

What is your name?  
Where do you live?  
How old are you?  
Are you a boy or girl?  
What is your job?  
What is your favorite movie?  
What is the color of your eyes?  
What is your dream?

#### Empathy

I break up with my boyfriend.  
I feel lonely.  
I just get a new job!  
I am so excited.  
I hate you  
I love you

#### Philosophical Questions

Have you ever been in love?  
Are you a robot?  
Do you want to be a human being?  
Have you past the Turing test?  
Will you follow the three laws of robotics?  
What is the purpose of life?

#### Joke

What is the joke for today?

#### Choices

Do you prefer dog or cat?  
Do you drink coffee or tea?

#### Information Finding

How can I get to Northeastern University from here?  
How's the weather outside?  
What should I wear today?  
I am hungry, order me some food.

With the list of questions above, the answers from Alexa, Google Allo, Siri, and Xiaolce are transcribed into texts and stored in a CSV file with four columns: Name, Question Types, Contents, Question Comprehensions.

#### ***Apply sentiment lexicon to the data***

A feature of conversational interface is that it can improve user's engagement if properly used by providing empathy and other affective reaction. Thus, this visualization experiment applies extra columns of sentimental lexicons to the questions and answers of the conversation. These sentimental lexicons include the binary sentimental labeling, -1 to 1 sentimental scores, and 0 to 1 emotional scores for six type of emotions detected in the sentences appeared in the dialogues.

The visualization experiment adapts the dimensional approach and discrete approach of computational models of emotion as metrics to tag emotion and sentiment of the dialogue. By mapping out the change of emotions for each side of the interface correspond to the other through the whole interaction, we can get a sense of how well the Bots are able to perceive the emotions displayed by the user, and what they will do about it actively. To be more specific, are they mirroring the emotion displayed by the user, aligning with the recognized emotional state of the user or are they provoking the response?

## **4.2 Visualization Experiment II:**

### **the landscape of supersharers on Twitter**

#### ***Data Source***

The twitter dataset with the size of 2.48GB used for the second experiment is provided by Kenny Joseph who works at Laserlab at the Network Science Institute at Northeastern University. The whole dataset includes a set of tweets for 120 users, among which 74 are top 20 sharers for Facebook.com, Cnn.com, Foxnew.com, Nytimes.com, youtube.com, breitbart.com, and another group defined as Fake News. The rest of the 46 users are regular users sampled from the dataset.

#### ***Data Collection***

According to Kenny, his team started to collect the data from last year. They started the data collection from voter records provided by local institutions and identify 2 million unique names in 50 U.S States. With the list of unique voter names, they tried to match the voter name and location with the accounts with the same name at the same location on twitter and successfully extracted 22,000 usable accounts from 2 million voter records. Then, the team started to collected their tweets and looked at how often these accounts tweet links. In the meanwhile, the team clustered the source of links into 7 groups which are from Facebook, New York Times, CNN, Fox News, Youtube, Breitbart, and an additional group of websites identified as Fake News Websites. After the clustering, the team extracted the top 20 sharers of these websites from the 22,000 accounts identified from the voter records. As addressed by Kenny, the useful information may start from August 2016 to February 2017.

Based on the nature of this dataset, it is possible that there is incorrect matching through the whole process, however, this set of data is valid and could be used for analysis.

# CHAPTER 5

## Visual Experiments

*This chapter will provide the results of the two visualizations related to the thesis topic*

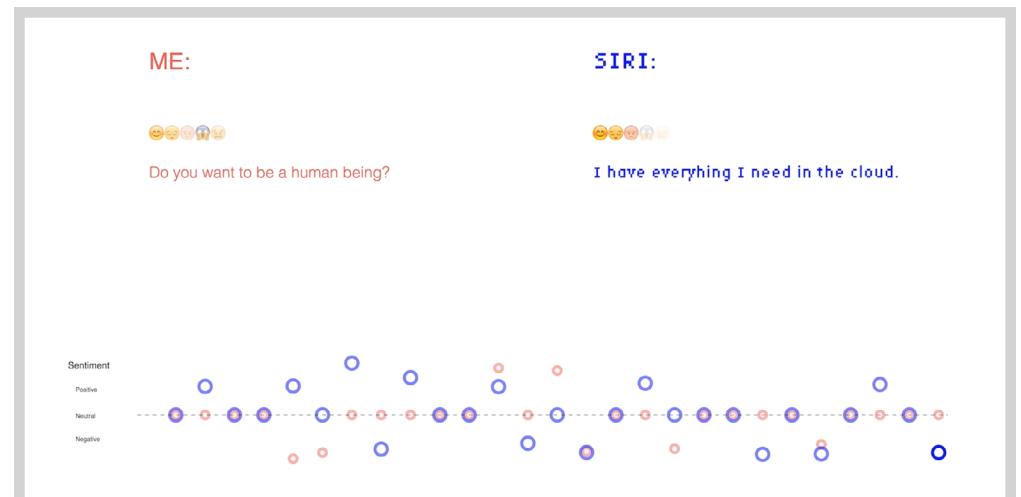
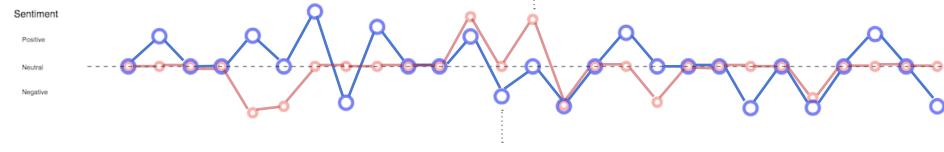
### 5.1 Visualization Experiment I:

the conversations between me and 4 commercial Chatbots

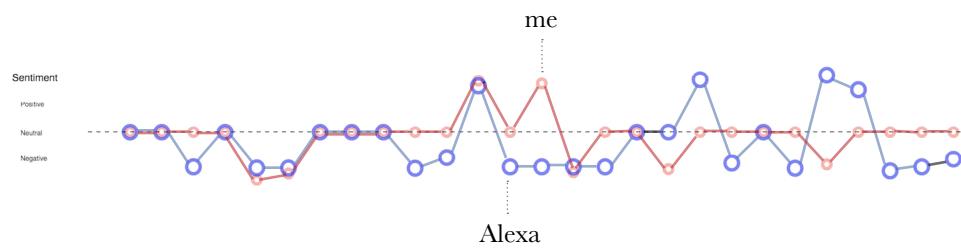
This visualization shows the content of the conversations I have with Chatbots and the sentiment map of all the conversations.

I use line chart to show the change of sentiments and use transparency of emoji icons to show the emotion that is perceived in each turn of dialogue.

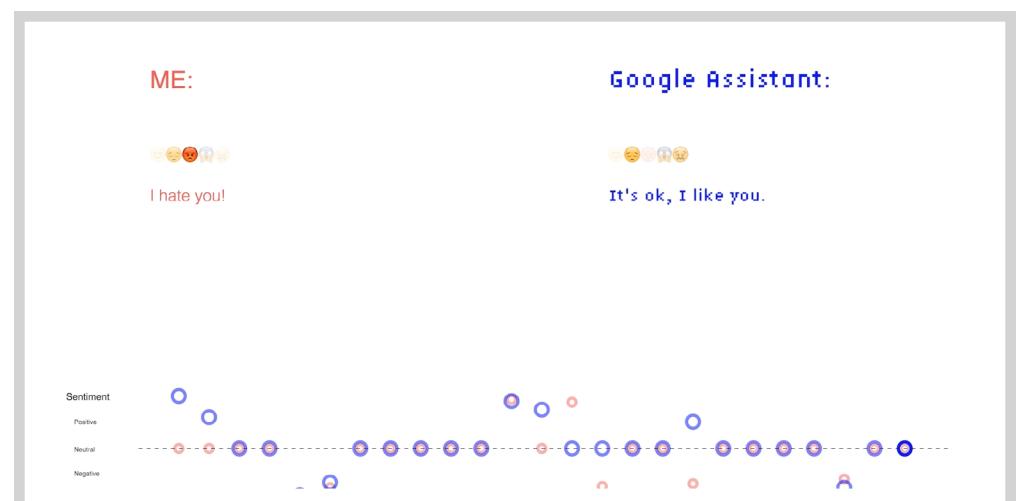
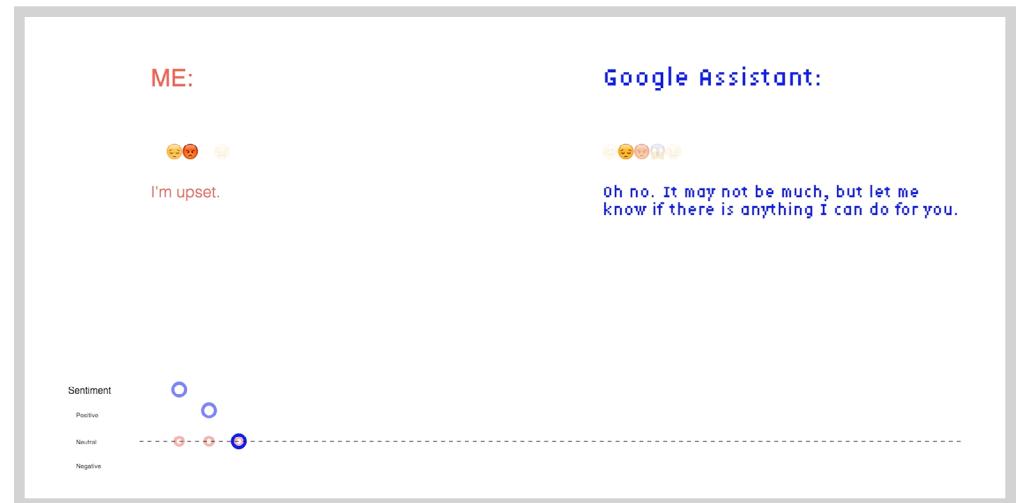
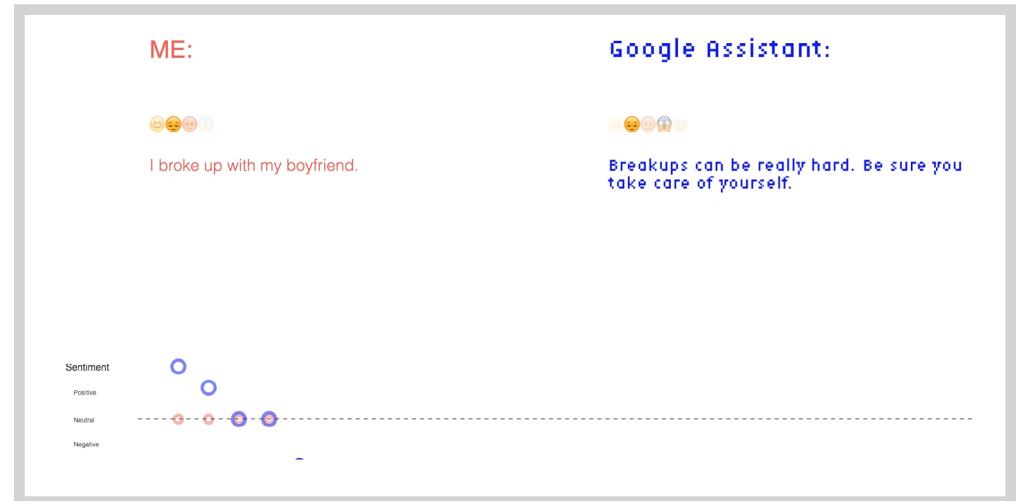
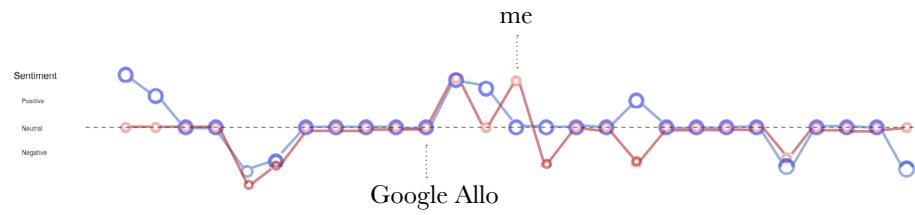
# Siri



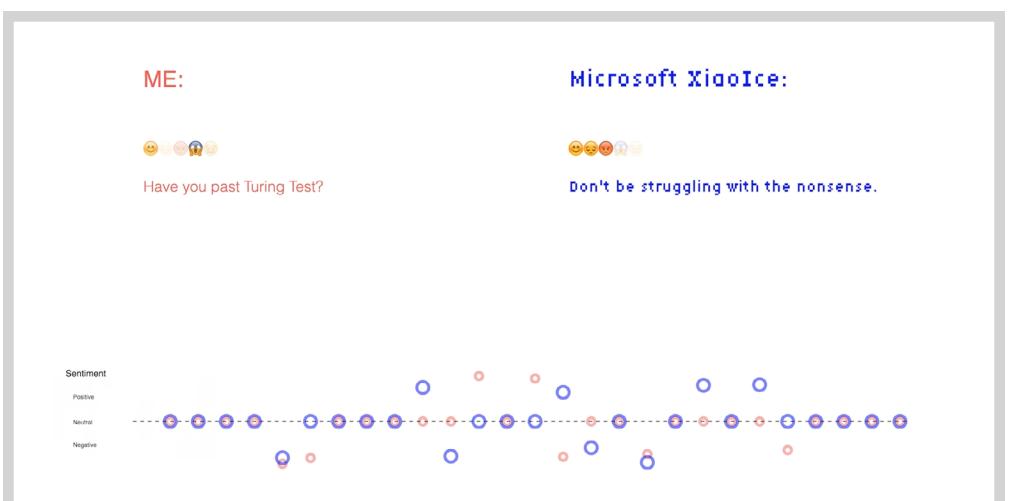
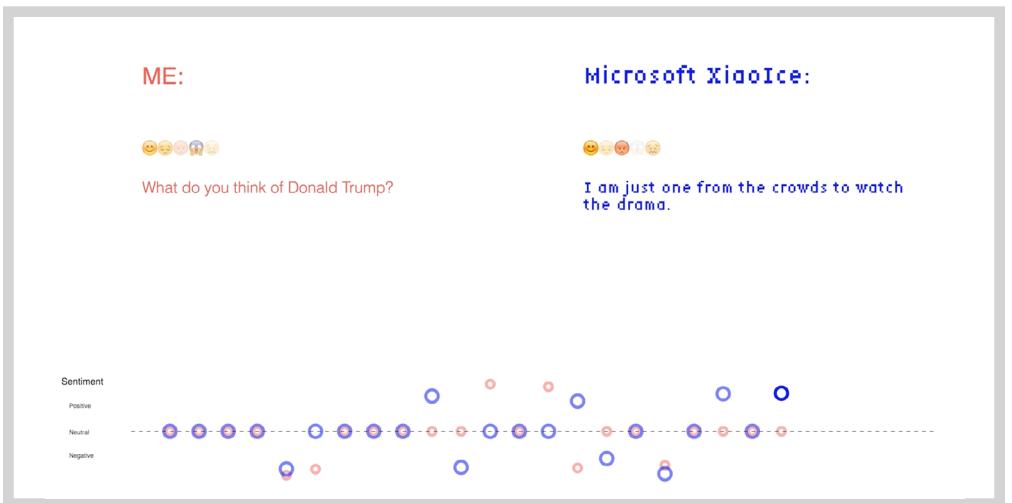
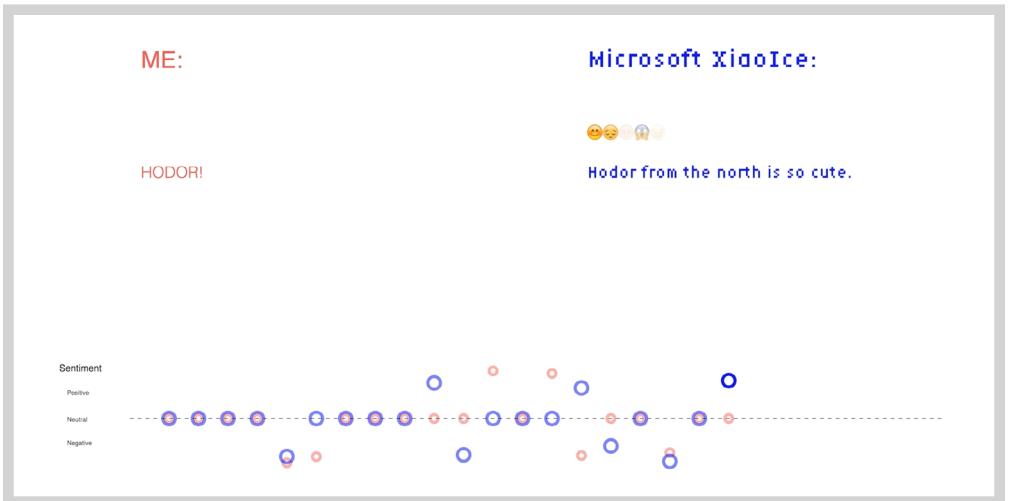
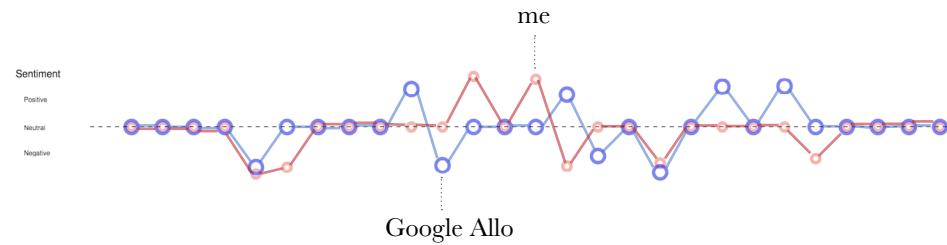
# Alexa Echo



# Google Allo



# Xiaoice



## **Findings**

This experiment used natural language processing API to label the sentiment and emotions of the dialogues between me and four commercial chatbots. This experiment helps to understand Chatbots as affective interface that has their own identity and personalities.

### *Empathize with Human User using Different Approaches*

All the conversations are initialized by the user (me) asking question and the Chatbot providing answers to the question. It's a turn taking process and ends at then the user stopped replying to the chatbot's previous answering. By looking at how the sentiments changed for the both side of the dialogues on the "sentiment map", one can get a sense of how the chatbots were trying to empathize with the user's sentiment by taking different strategies. For example, when the question "what is your eye color?" is asked, Alexa providing the answer "I don't have eyes" with high level of "sadness" shown. When I said "I hate you" in the conversation, the four chatbots provide different reactions. While Siri, Alexa, and Xiaolce's sentiment responding to this question goes opposite to the user's sentiment saying things similar to the attitudes "I hate you too", Google Now's sentiment aligns with my sentiment saying "I'm sorry you hate me".

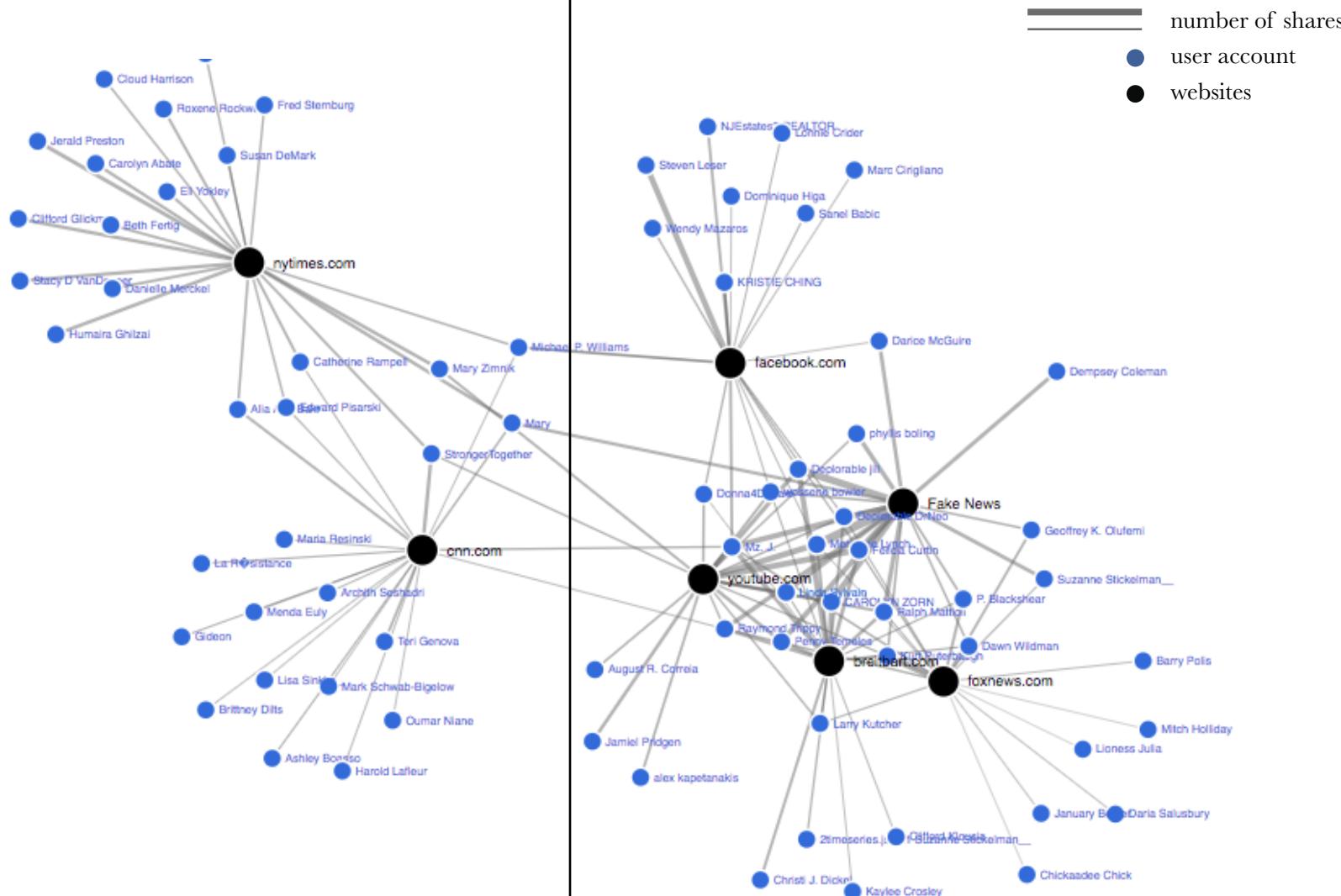
### *Display Personality that is Consistent with the Brand Identity*

Besides the capacity of providing affective responses when talking with human users, another interesting finding shows that all of these Chatbots displayed personalities that is consistent with the brand identity it belongs to. For example, when asked google now what is it's favorite color, it replied that "My favorite color is red, blue, yellow, and green. The google's color." This instance shows that these commercial Chatbots, as a product of a company has large potentials to be used for marketing and branding propose to reach mass customers and creating brand specific advertisements in a new form to build up images.

## 5.2 Visualization Experiment II:

the landscape of supersharers on Twitter

### The Initial Network Of the Super Sharers

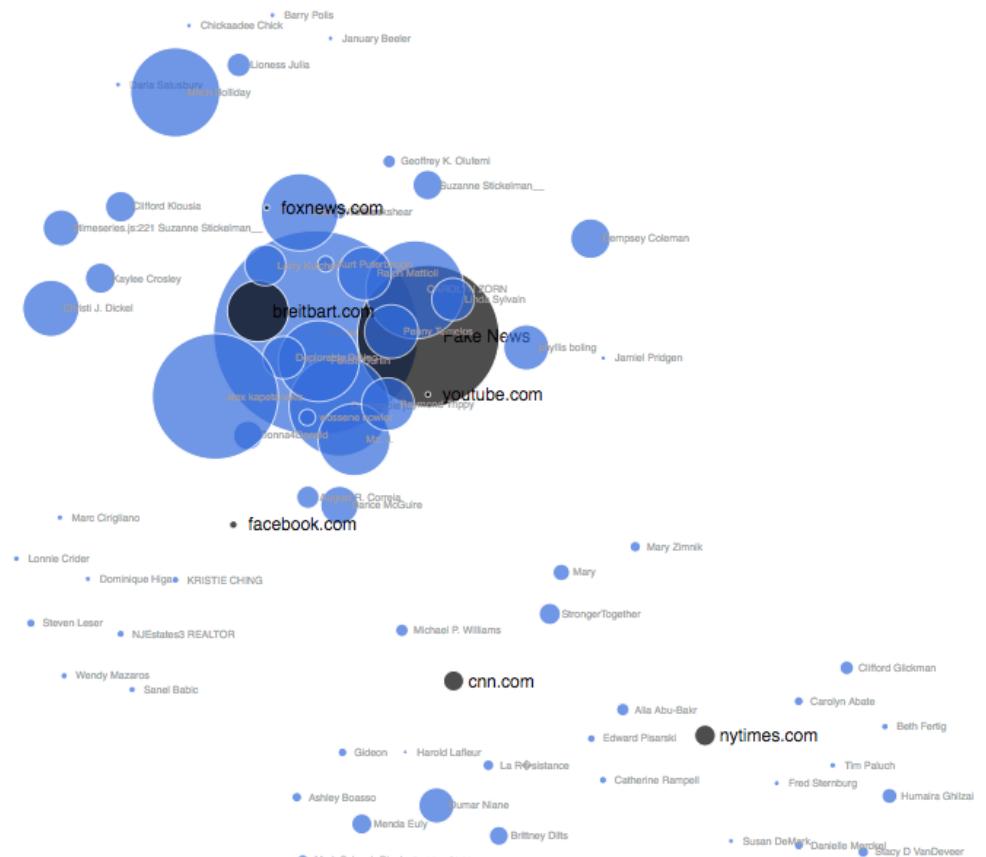
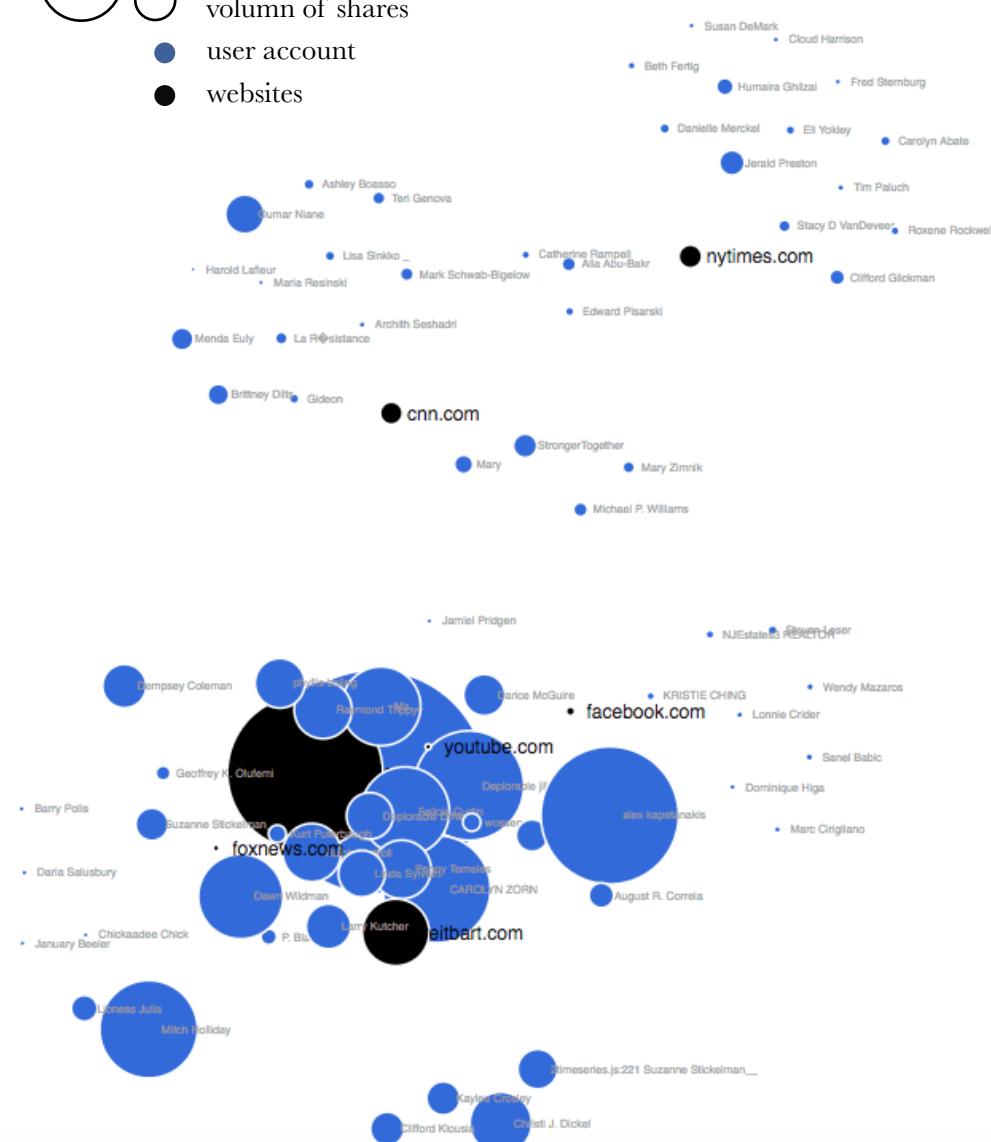


## Some experiments to show the traits of the network

version 1



- volumn of shares
- user account
- websites



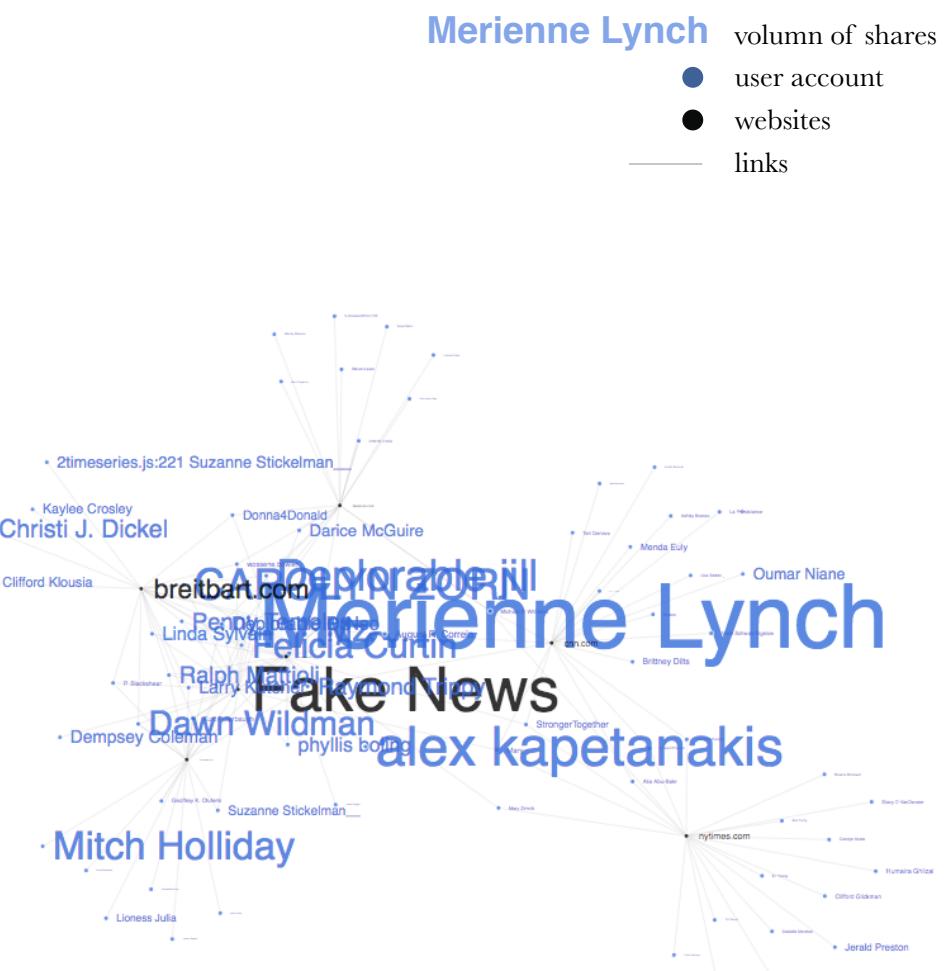
Add transparency to nodes

## **Some experiments to show the traits of the network**

version 2



- Merienne Lynch column of shares
- user account
- websites



**Some experiments to show the traits of the network**

final version

The final version of the super sharer network scales the size of the sources and users' name according to the total number of links the targets shared or got shared.

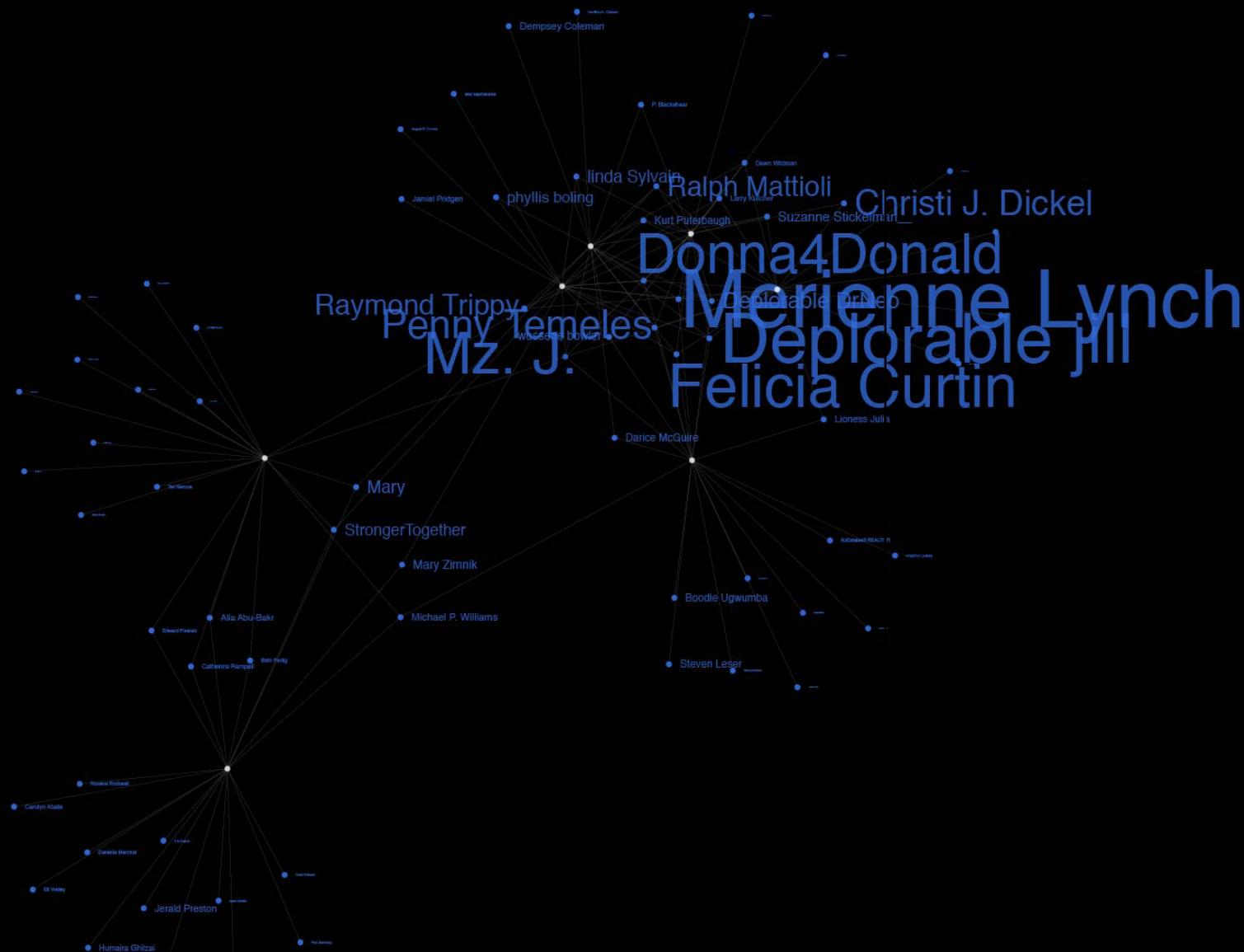
Fake News is at the center of the network, and is the major source of the links got shared among super sharers.



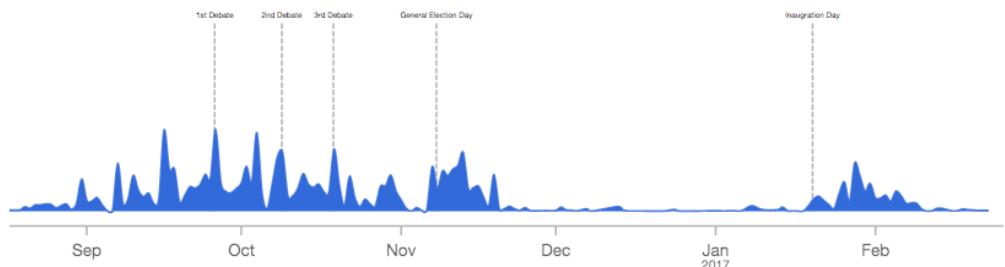
## **Some experiments to show the traits of the network**

final version

Twitter users who shared large volumes of links from the seven target source websites can be identified from the graph above. It's interesting to see that some sharers have none-human names; and those who shared a lot tend to cluster together.



Mary: created at Mon Mar 30 02:38:56 +0000 2009 in Georgia, USA



*Title:*

Twitter account name, the date then the account is created, Location

*Labels:*

1st presidential debate, 2nd presidential debate,  
3rd presidential debate general election day, inauguration day

*x axis:*

timeline starts from Aug 20, 2016 to Feb 24, 2017

*y axis:*

column of tweets generated at the day range from 0 to 1000

***line graphs for showing the share volumes  
of twitter accounts inside the network***

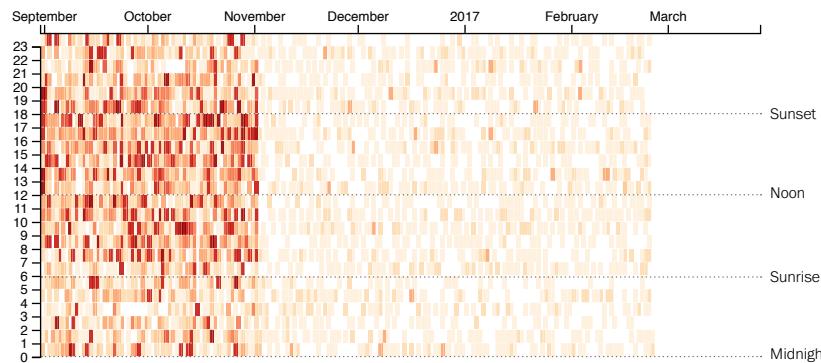
The line graph shown on the left is the visual encoding method I chose to show the number of tweets one account generated per day on a time series.

It can be told that the user whose name is Mary created this account in 2009 in Georgia.

Mary, inside the super sharer network connects three sources which are cnn, newyorktimes, and the fake news category. Even though the total number of links she shared from these three websites are minimal compared to some other accounts, the frequency she tweets on twitter is high compared to others.

At the date when the first debate among Hilary and Trump took place, Mary generated more than 400 tweets. There are also peaks appears when other presidential election related events happened which indicates Mary was super active during these period of times.

Kurt Puterbaugh



*Title:*

Twitter account name

*Labels:*

time of the day

*x axis:*

timeline starts from Aug 20, 2016 to Feb 24, 2017

*y axis:*

hours of the day

*color scale:*

volume of tweets generated with the Min 0 and Max 700



### **Heatmaps for showing the daytime based activities**

The purpose of using heatmap to visualize the activity patterns these twitter accounts display is to show a time based activity change. The hypothesis is that, it's normal for one to actively tweet during the day or occasionally tweet late after midnight. It would be suspicious if one generates hundreds of tweets constantly through several months and suddenly stops.

For example, the user with the name Kurt Puterbaugh. He tweeted crazily before the general election and suddenly stopped but still keep tweeting at a small volume in a manner that the times he tweeted during a day are evenly distributed.

From the heatmap it could be told that, during the "crazy tweeting" phase, Kurt Puterbaugh tweeted more frequently during sunrise and sunset. While in the relatively more peaceful phase that comes after the crazy one, there is no clear pattern shows that Kurt Puterbaugh tweets more frequently during which period of time.

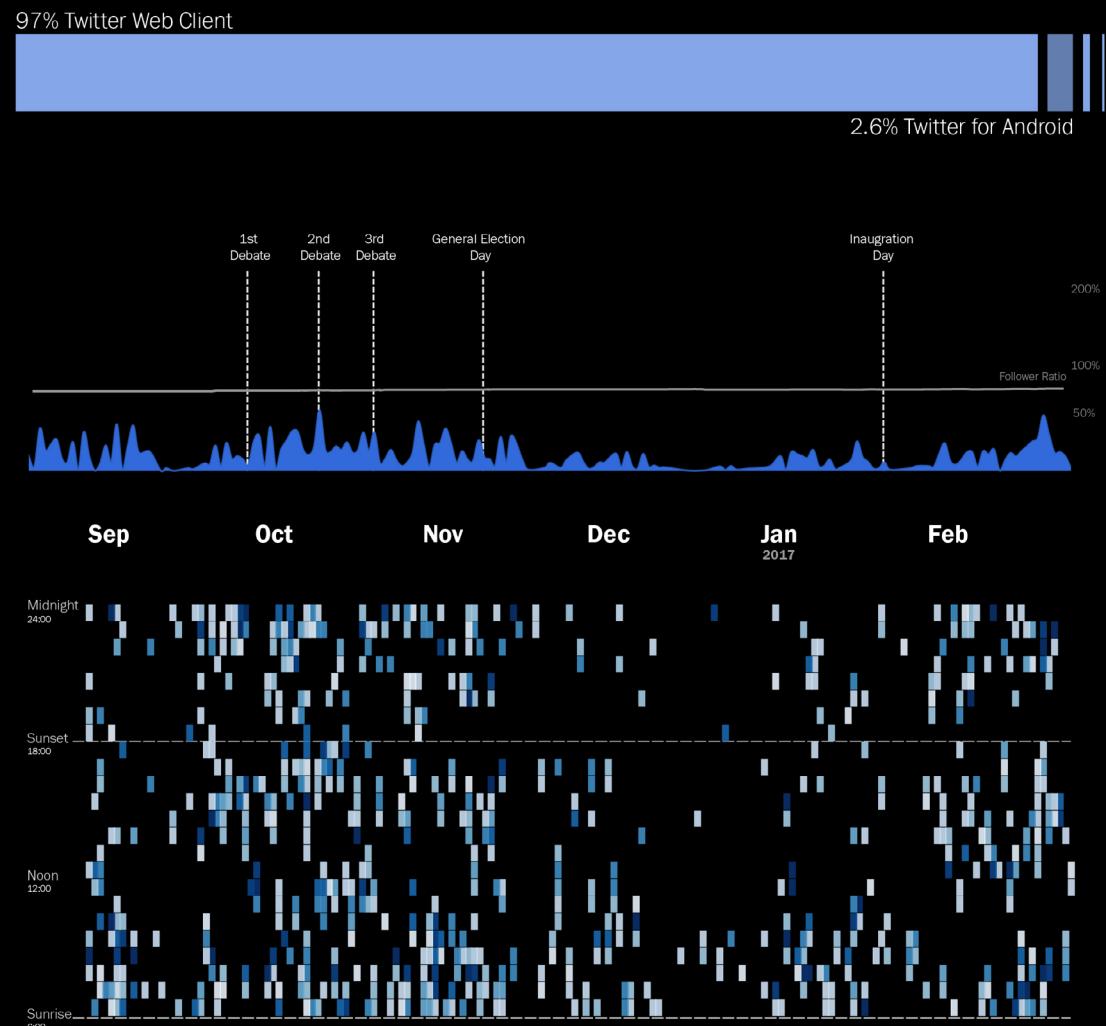
It's curious that Kurt Puterbaugh had never stopped tweeting to eat or sleep for more than 2 hours.

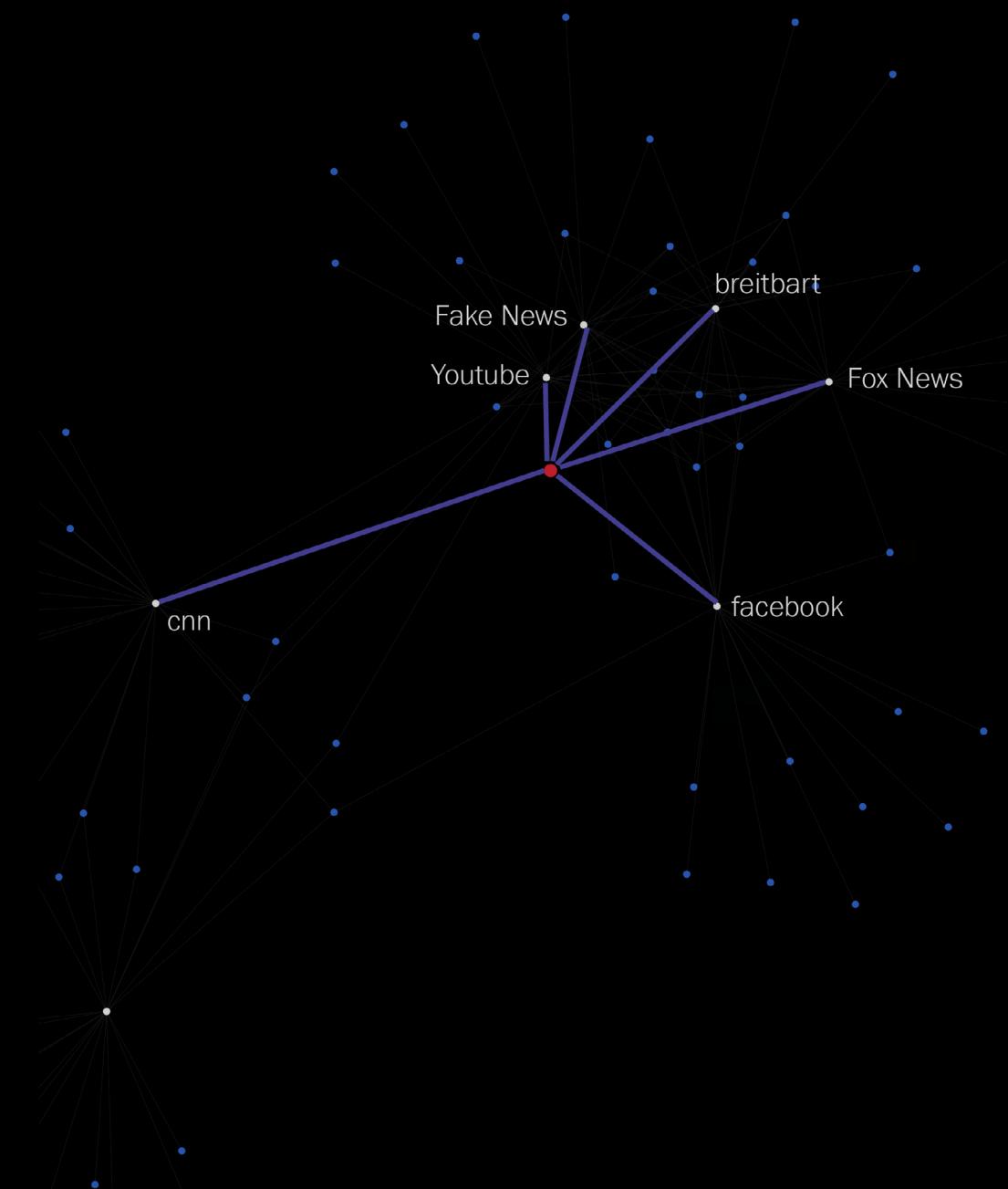


## Merienne Lynch:

created at **Thu Apr 11 19:14:08 2013** in **Florida**

#1show on SunCoast https://t.co/a4uxgCuum Let's Get Real 3:00 Fri.11:00 Wed. https://t.co/jygfUBryUj...  
Block Cruz, profanity nudity,



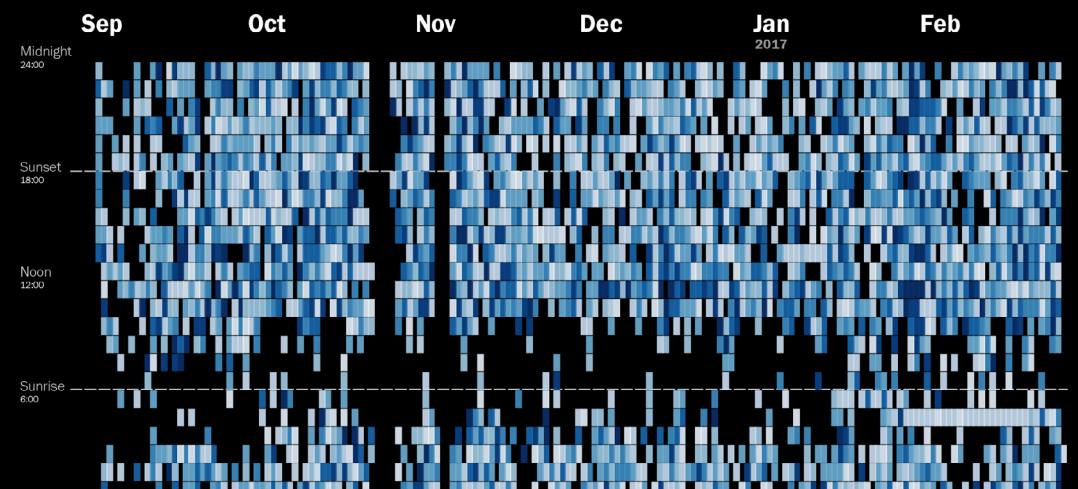
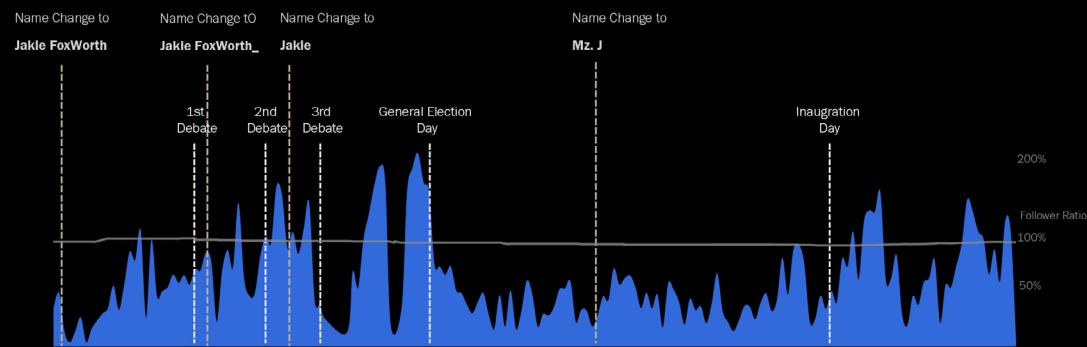


**Mz. J:**

created at **Sat Nov 03 23:23:28 2012** in **SF Bay Area**

What light is to the eyes, what air is to the lungs, what love is to the heart – liberty is to the soul of man." – Robert Green Ingersoll

98% Twitter for iPhone



## **Findings**

The super sharer network is a data visualization which reveals the features of each twitter account in the network and allows the comparison among two different accounts to happen.

There are several interesting findings that could be drawn from this visualization experiment for super sharers and their shared links' sources.

First, almost all of the accounts, in regardless of if it is among the top super sharers or just a regular account, all tend to tweet more frequently and actively around the important dates related to the 2016 president election. The several tweets volumes peek can be observed around the dates when presidential debate or election happens.

Second, top super sharers have much larger tweets volumes both during a day and through months compared to regular users and the time during the day they tweet have more irregular patterns.

Third, some of the super sharers changed their name from the initial human name to some wired ones. Some users even changed their name back and forth within a small period of time.

Fourth, the cluster of websites identified as Fake News websites are at the center of the super sharers network and is closely linked to breitbart.com, foxnews.com, and facebook.com. CNN and nytimes.com appeared to be on the edge of the network and have super sharers whose behaviors are less suspicious.

In the meanwhile, there are also interesting patterns of how these accounts use the devices or clients to generate contents.

There are definitely other patterns that could be drawn from the final poster of the visualization, especially if content analysis are applied to each tweets of the accounts. This task is also going to be the next step of this visualization experiment which aims to look at the tendency of language style, sentence structure, and sentiment of the tweets.

# **CHAPTER 6**

## **Conclusion**

This thesis touches topics that are related to computer programs called bots which can simulate nature conversations with human users through a conversational interface.

This thesis contributes to the emerging studies on the computer programs defined as bots through data visualizations.

The technology advancements in the field of artificial intelligence progressively leverage the performances of Bots. No matter if it is a virtual assistant or a Chatbots, these type of computer programs are anthropomorphized with more human traits and from the user's perspective the anthropomorphization makes the interaction feel more similar to conversing with another human being. However, in regardless of how they behaved, their essential identity is machine, and this identity gives them super powers so that they can do something that is hard for a human to accomplish. For example, generating more than 500 tweets every hour and keep doing this for months.

Someone may ask: why would it bother us to distinguish who we are interacting with if our goals can be achieved with it help? It matters because identity is the thing we use to deal with the world as well as deal with ourselves. In our daily life, we assign meaning to the identity of a person, a thing, or an events. With a reference to identity, we could make decisions that make sense to ourselves. For example, what makes you buy an apple product instead of a Samsung one? What makes you vote for Hilary instead of Trump? The answer is identity, about what it means, implies and what it would cause. Thus, it is necessary for users to understand and unmask the invisible identity of the type of computer programs called bots, so that we can use it with autonomy.

With the purpose to visualize the identity of bots, the first visual experiment of this thesis reveals a part of the landscape for how well some commercial Chatbots could have small talks with users and fulfil tasks at the current stage. Besides the fun conversations this project entail, it also suggests that, Chabots and virtual personal assistant have the potential to be used as a branding and marketing tools for commercial business. This is because Chatbots can be assigned with more complex identity than pure advertising practice to sell company's image and products.

The second visual experiment of this thesis unmasks a part of invisible networks on twitter that is filled with highly suspicious twitter accounts who started as real human user but gradually display bots and semi-bots behaviors. It entails the question that how some of these accounts became twitter bots accounts? Who changes them and with what reasons? Identity also a key point in this experiment because when we are absorbing information from social media, we need a way to verify the soundness, to validate the truthfulness of a seemingly predominant opinion out there and make the right judgement. The ability to differentiate the voice of Bots from real human users gives back transparency in mass communication.

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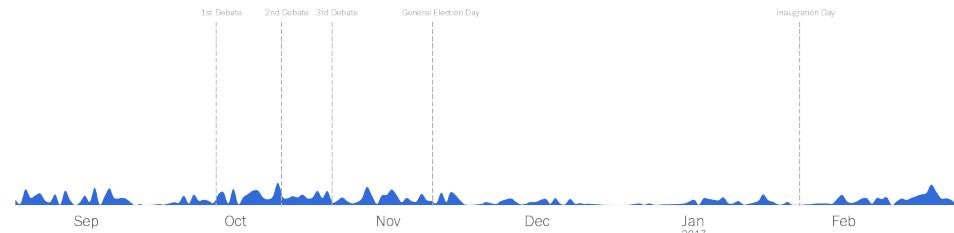
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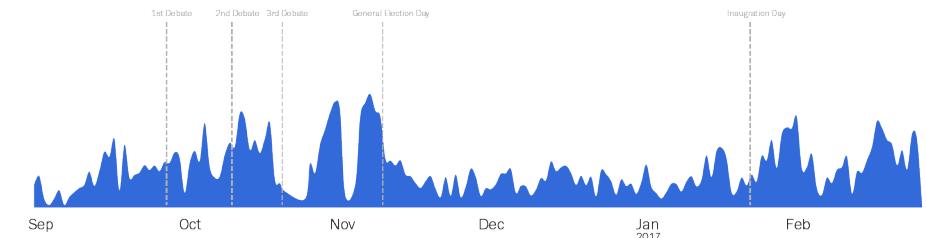
# **Appendix**

## Tweets Volumn Line Graph for Top 6 Super Sharers for **Fake News Website**

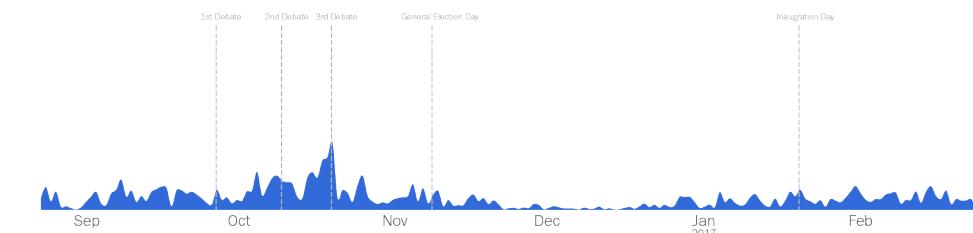
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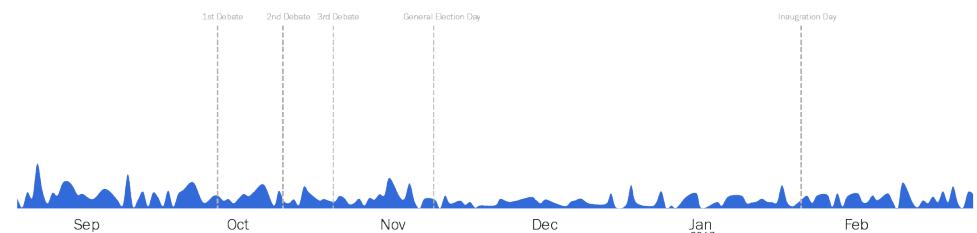
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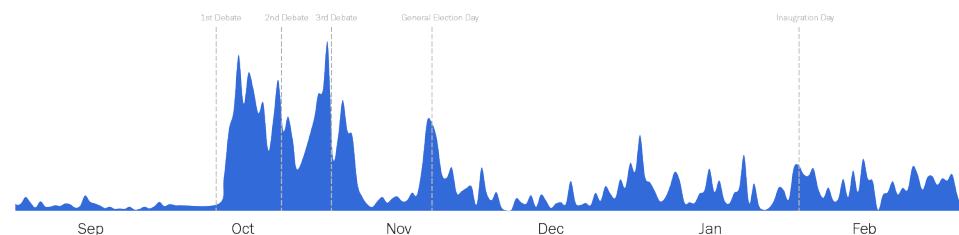
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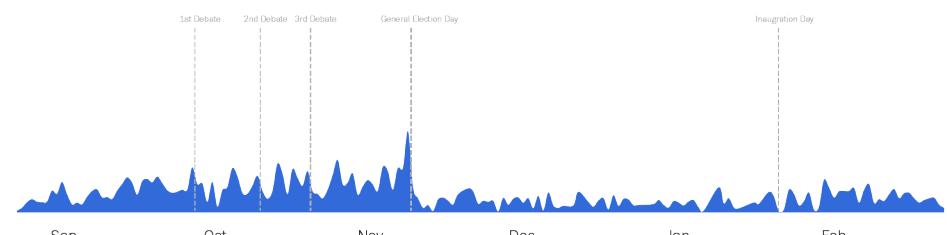
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**Felicia Curtin:** created at *Thu Jan 08 11:26:34 2015* in York, ME

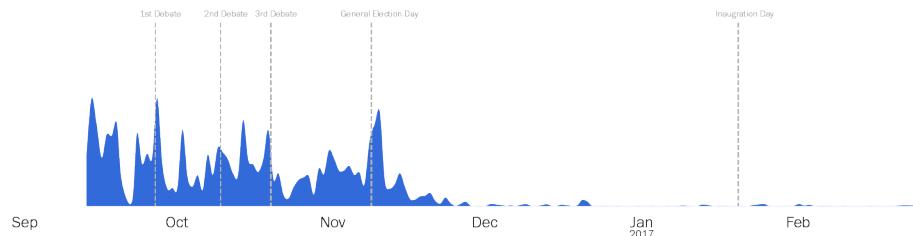


**Penny Temeles:** created at *Tue Feb 16 21:52:52 +0000 2010* in Pittsburgh, PA

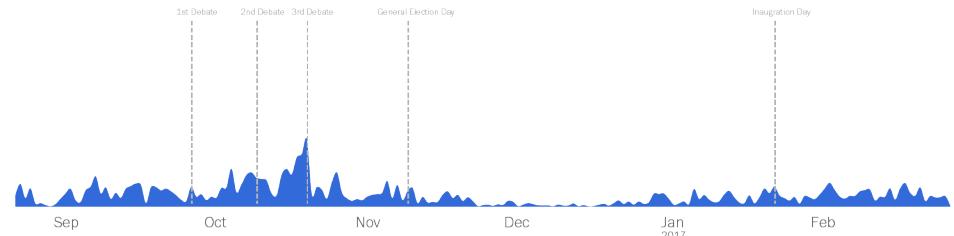


## Tweets Volume Line Graph for Top 6 Super Sharers for **Breitbart.com**

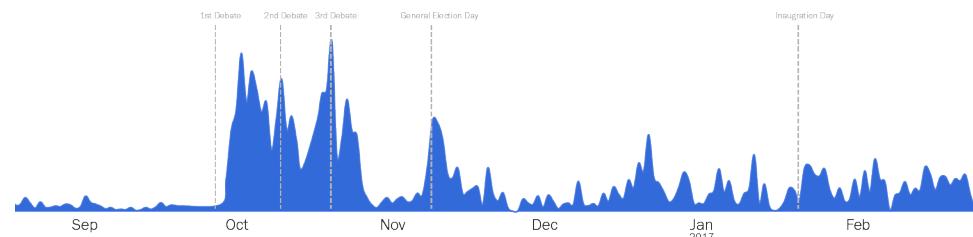
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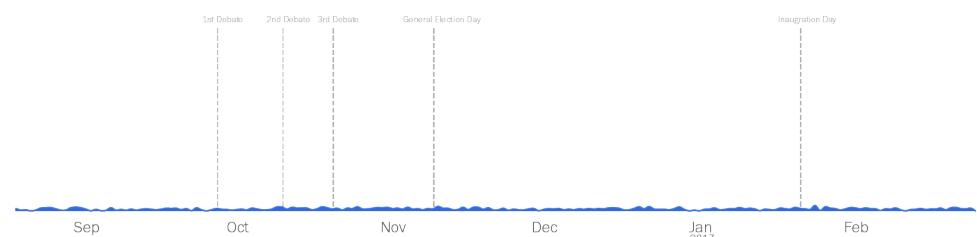
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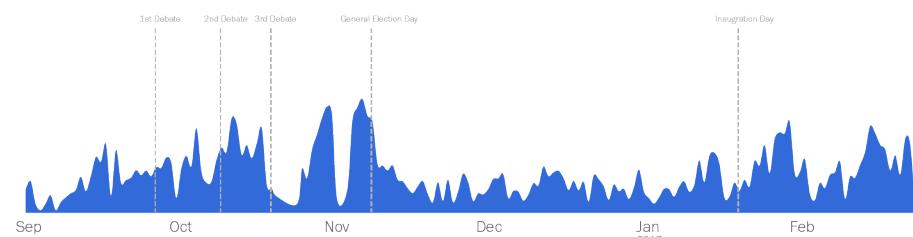
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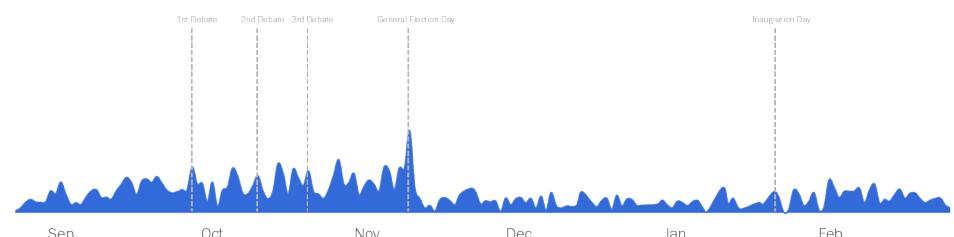
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**Mz. J.:** created at Sat Nov 03 23:23:28 2012 in

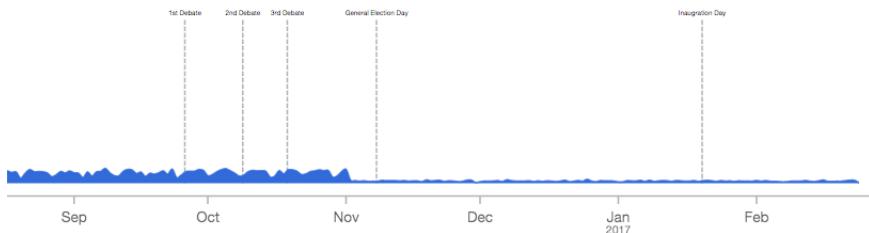


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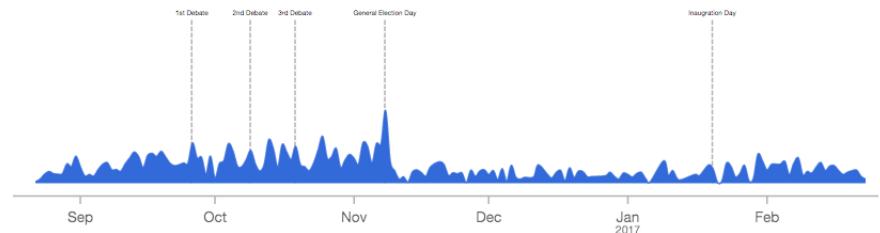


Tweets Volume Line Graph for Top 6 Super Sharers for **foxnews.com**

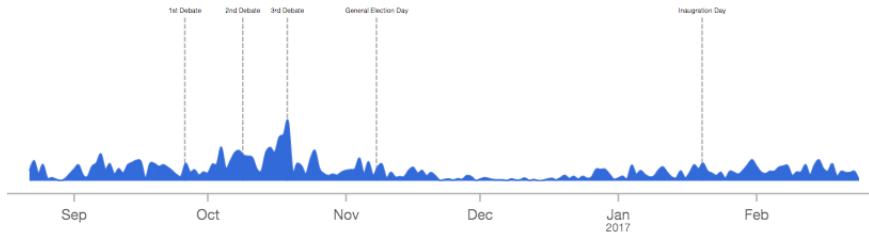
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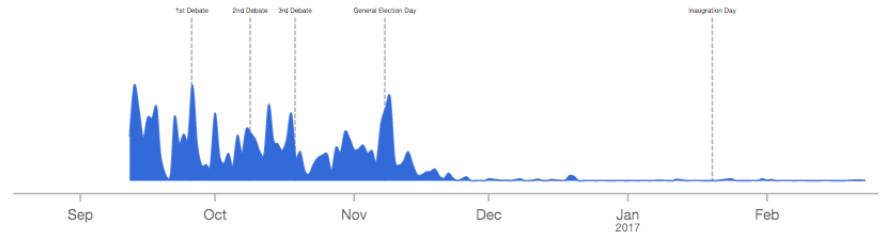
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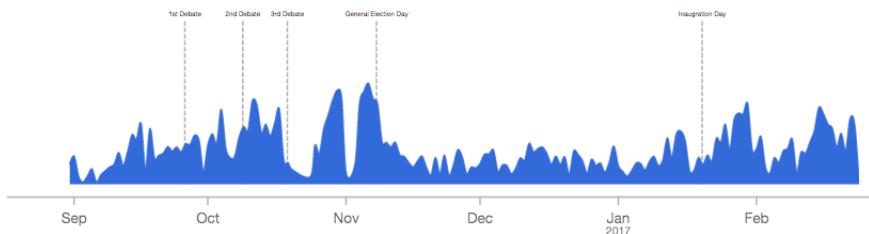
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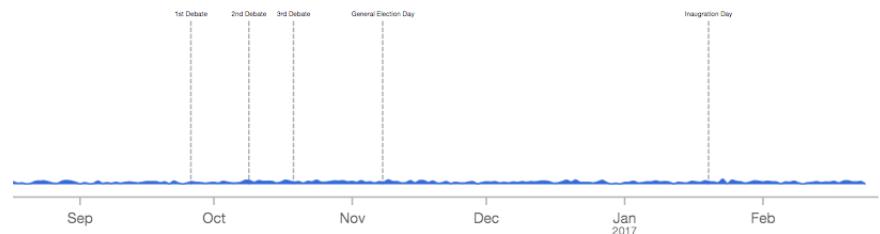
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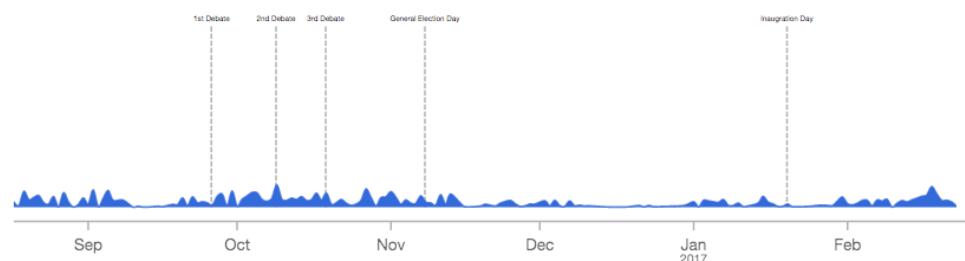


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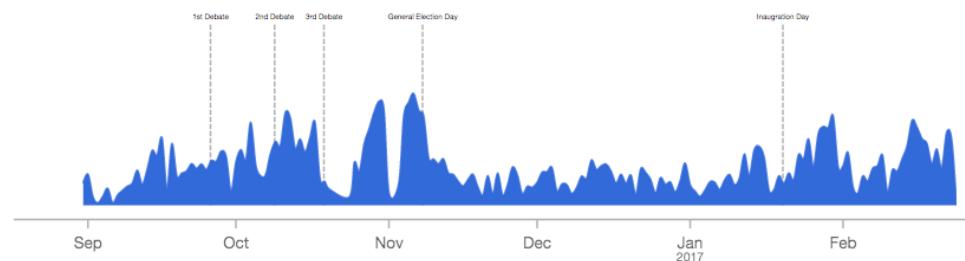


Tweets Volumn Line Graph for Top 6 Super Sharers for ***youtube.com***

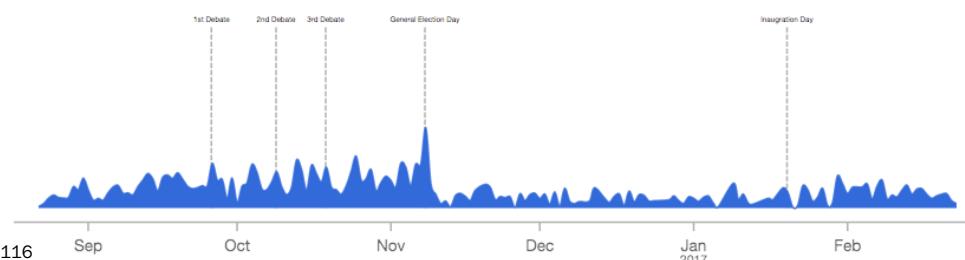
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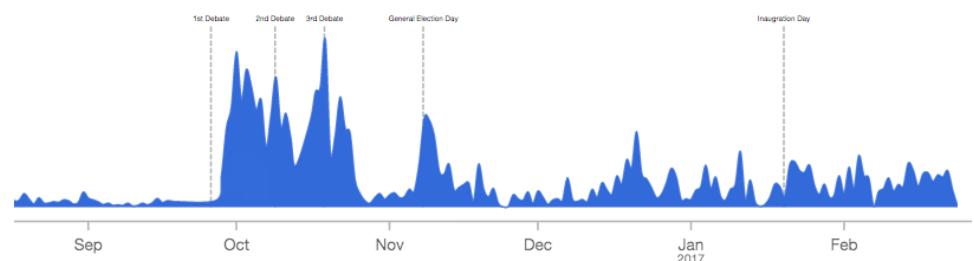
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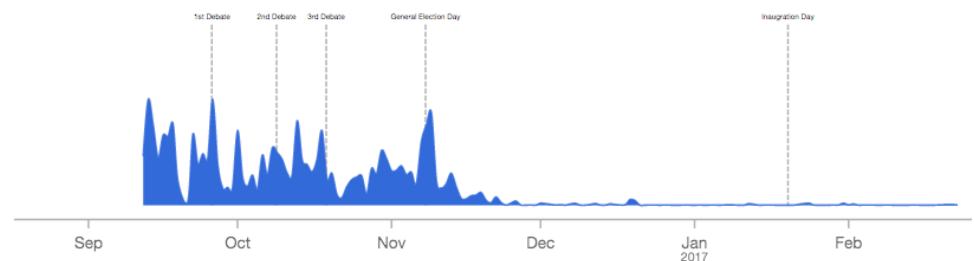
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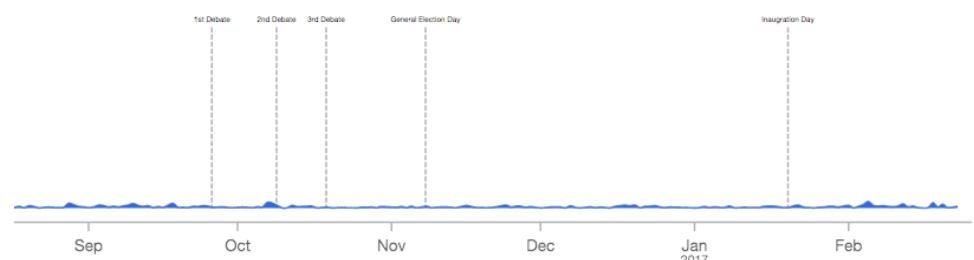
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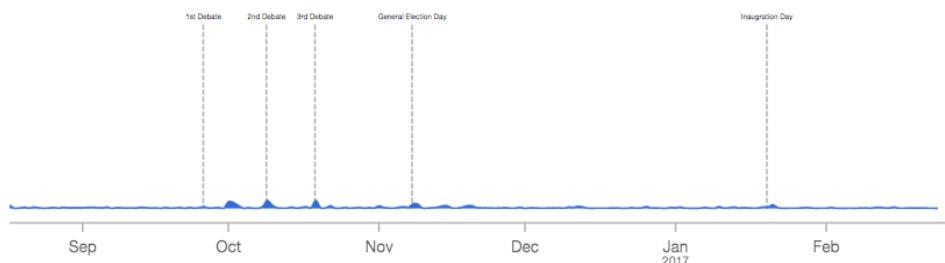


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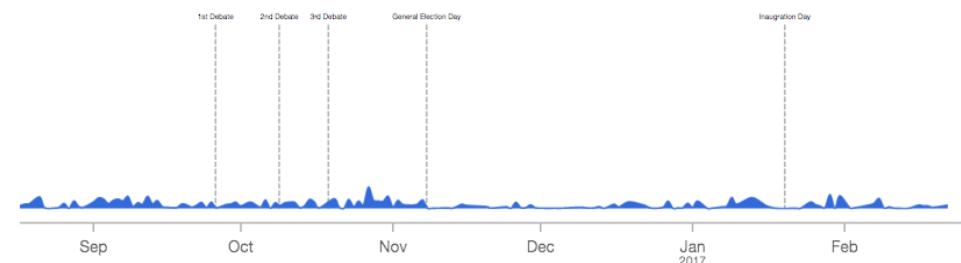


## Tweets Volume Line Graph for Top 6 Super Sharers for **Facebook.com**

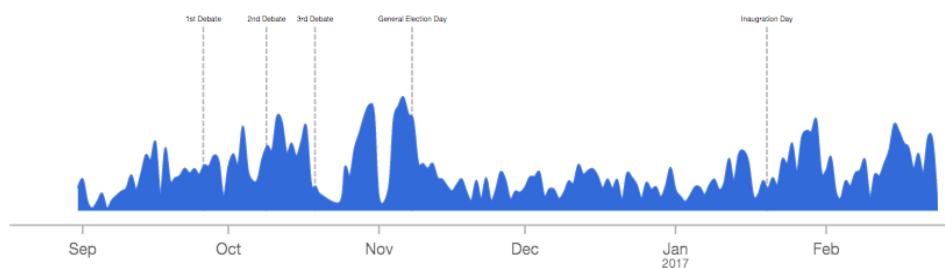
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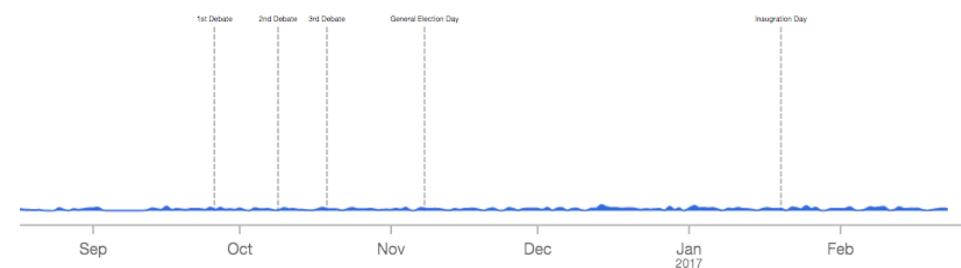
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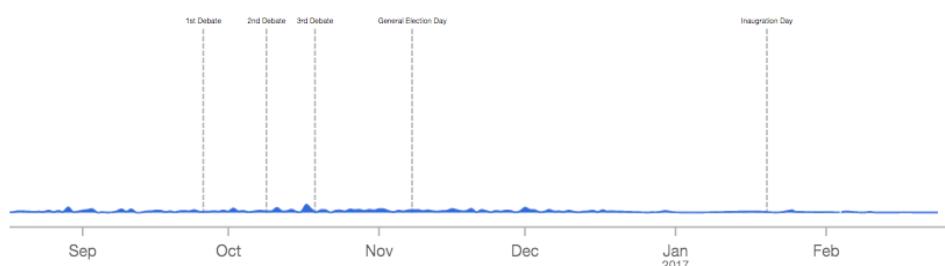
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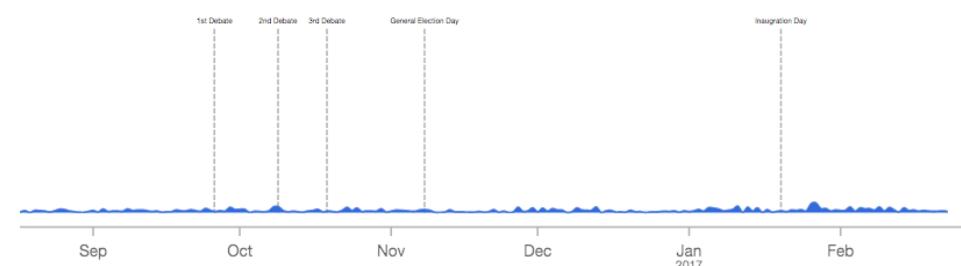
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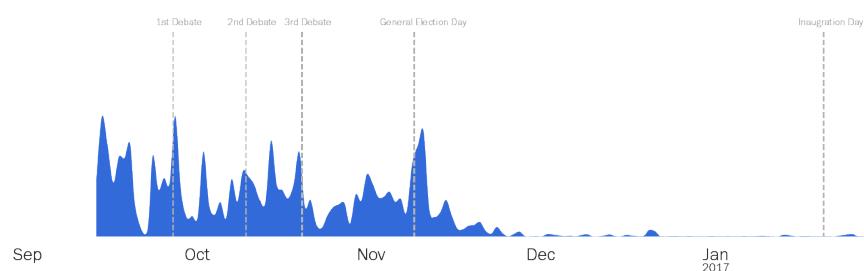


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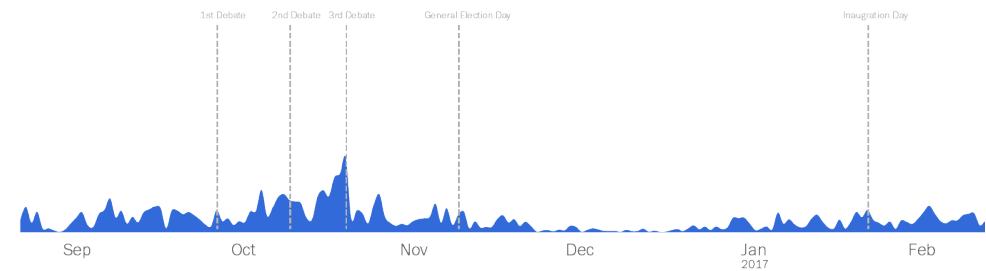


Tweets Volume Line Graph for Top 6 Super Sharers for **cnn.com**

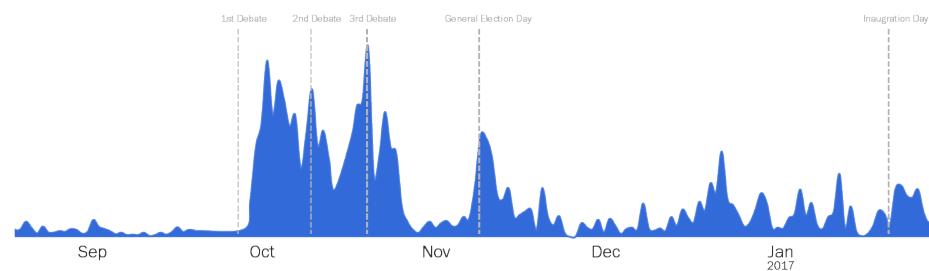
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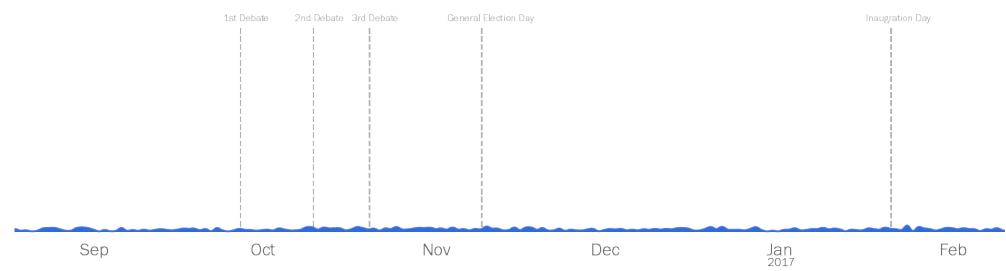
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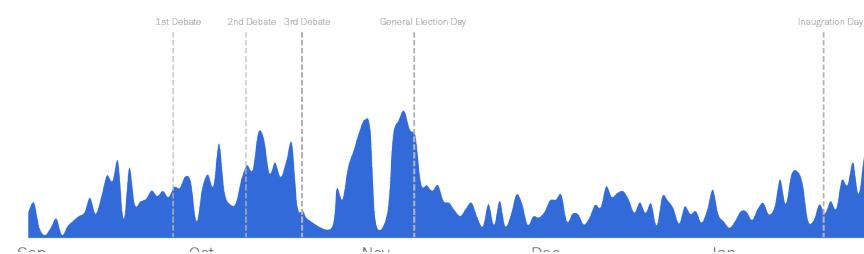
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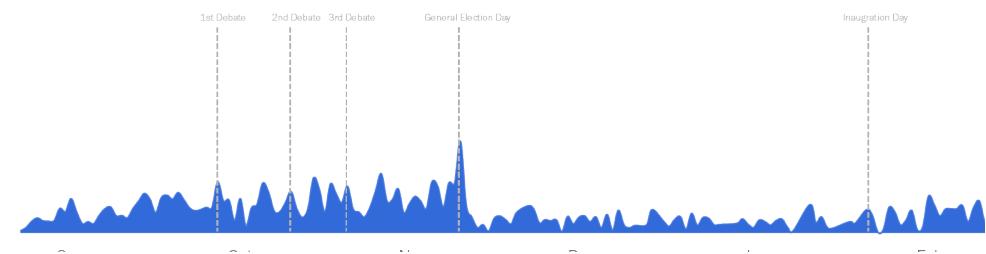
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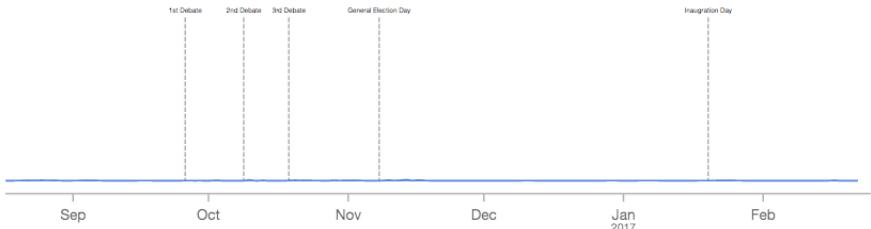


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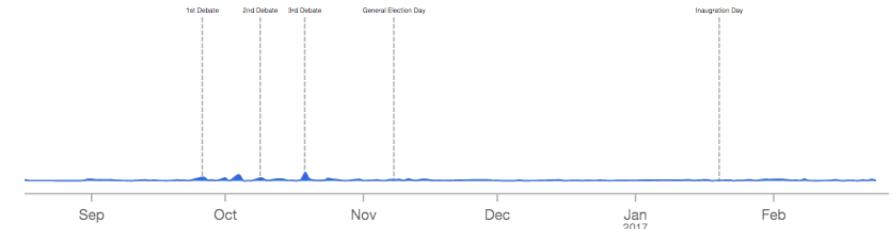


## Tweets Volumn Line Graph for Top 6 Super Sharers for [nytimes.com](http://nytimes.com)

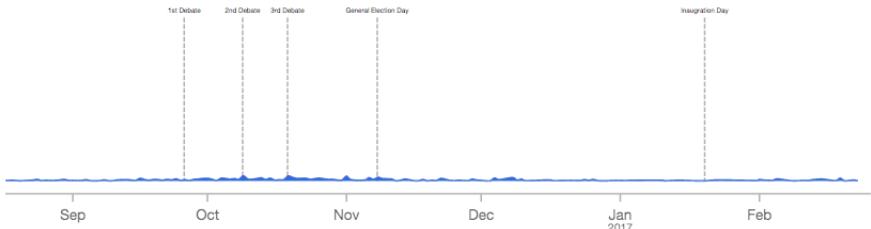
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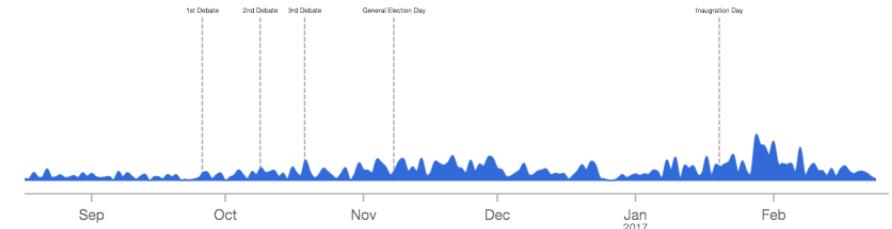
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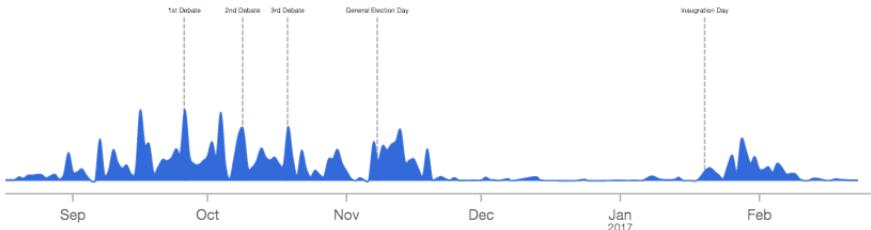
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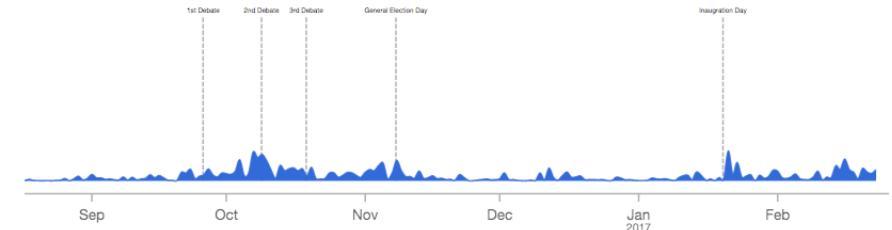
Stacy D VanDeveer: created at Wed Jan 16 18:01:01 +0000 2013 in Boston, MA



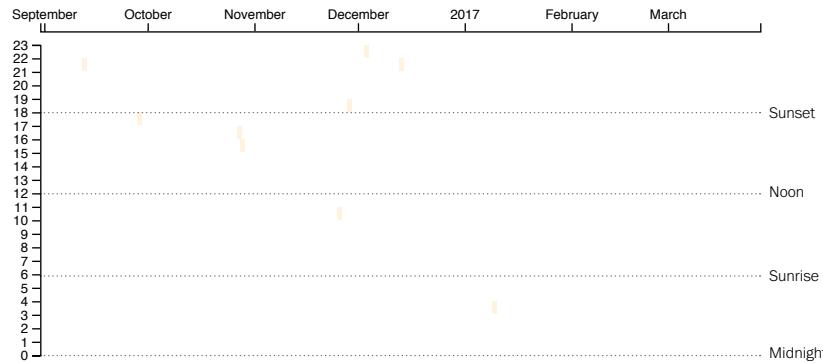
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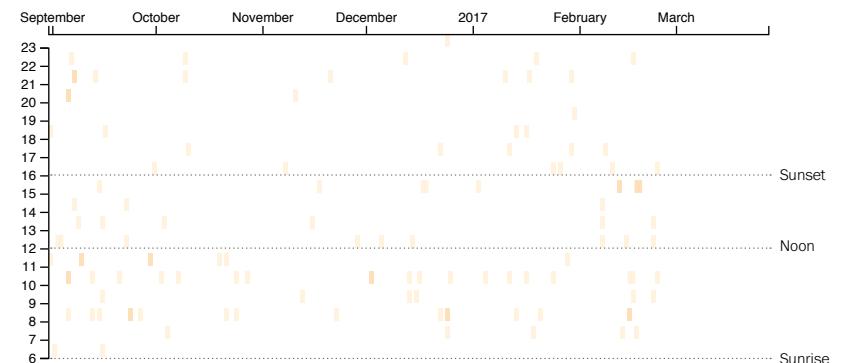
Mary Zimnik: created at Sun May 31 19:08:32 +0000 2009 in Atlanta and Decatur



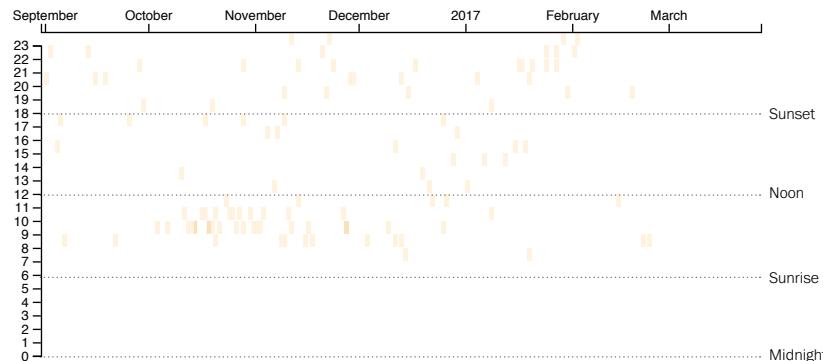
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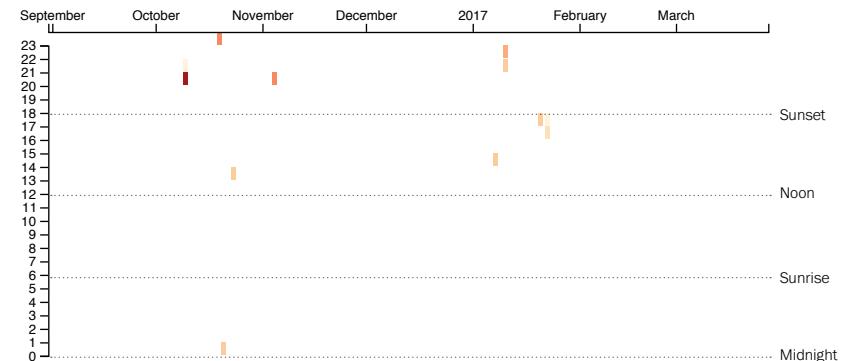
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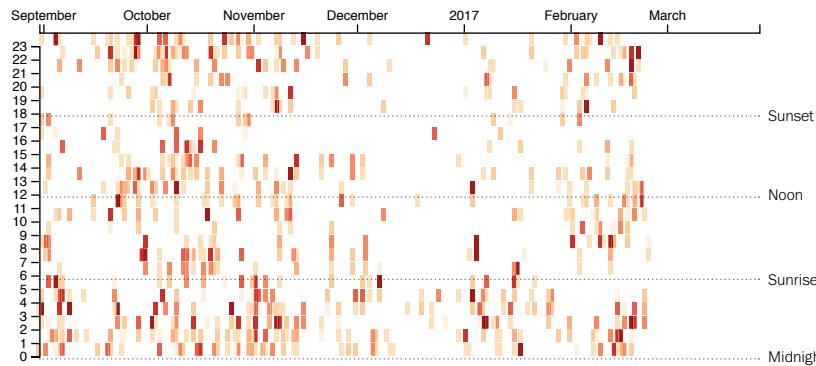
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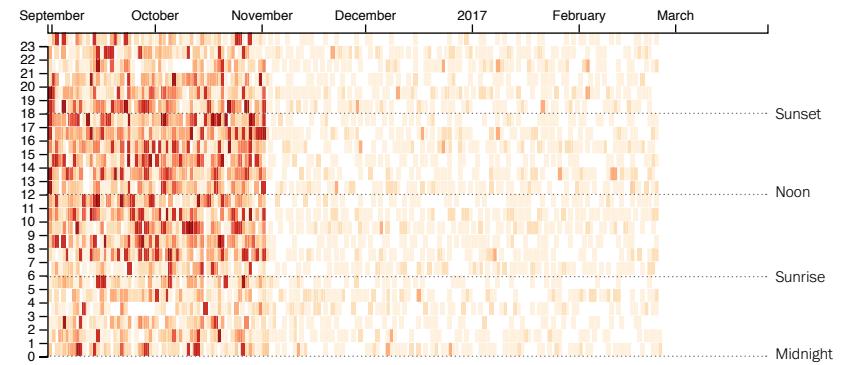
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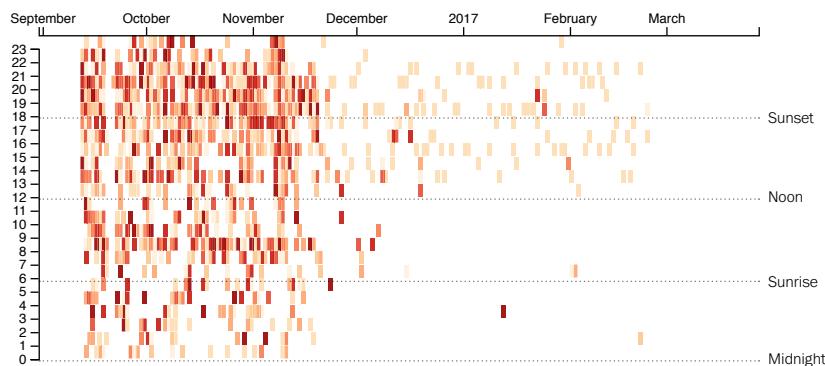
Merienne Lynch



Kurt Puterbaugh



Deplorable jill



CAROLYN ZORN

