

# *CS96 Final Report: Eye To Eye*

BY

ALEX ABRAHAMS, NICHOLAS BOUCHER, WILLIAM BRYK, STEPHANIE  
CAMPBELL, ANJALI FERNANDES, JAN GEFFERT, SAM KESSLER, LISA LU, JACOB  
LURYE, PATRICK PAN, RUSSELL PEKALA, SAM PLANK

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PROFESSOR STUART SHIEBER  
HARVARD UNIVERSITY  
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# Abstract

Today's sociopolitical climate is rife with incivility, divisiveness, and violence. Informed by research in subjects ranging from political science to cognitive psychology, we identify three orthogonal issues underlying the fragmentation of American public discourse: misinformation, polarization, and toxicity. We carry out an in-depth analysis of these three problems, the success and failures of existing technological solutions, and the feasibility of implementing solutions of our own. We present a solution designed to address the issues of polarization and toxicity herein: namely, a web application called Eye to Eye that connects people with different beliefs in order to have real-time, face-to-face conversations. Eye to Eye provides an environment for empathetic, human interactions between strangers — the sort of interaction largely missing on the Internet and in real life today — while preserving users' safety and privacy. We step through the design and implementation of our working prototype and discuss possible extensions and improvements for going forward.

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*It is hardly possible to overrate the value ... of placing human beings in contact with persons dissimilar to themselves ... Such communication has always been, and is peculiarly in this present age, one of the primary sources of progress.*

John Stuart Mill, Principles of Political Economy with Some of Their Applications to Social Philosophy, 7th ed.

# 1

## Introduction

In 2017, the population of the United States stands drastically more politically and ideologically divided than during preceding decades. Accompanying this increase in sociopolitical division has been a marked breakdown in the quality and character of the way that Americans communicate with each other, be it in government, on the street, or online. From comment sections cultivating shouting matches to social media sites disseminating misleading information, technology has exacerbated this problem of worsening public discourse in the United States. Today, three-quarters of Americans believe that incivility in politics and in every day life has risen to crisis levels, a rate that has accelerated dramatically over the past two years [[Shandwick et al., 2017](#)]. In both the digital and physical worlds, we find an increase in not only disagreement, but also intolerance. In many ways, this threatens our society by demeaning individuals, discouraging discourse, and exacerbating our divisions.

In order to address this problem, we seek to identify the source of the incivility, divisiveness, and violence we find in today’s sociopolitical climate. This negative landscape is caused primarily by the fragmentation of civil discourse in the United States and abroad, often described as “polarization” and “filter bubbles” and leads ultimately to incorrect beliefs and allegations regarding “alternative facts” or “fake news”.

The issues causing today’s negative political climate are interconnected and overlapping. However, they can be divided into three largely orthogonal categories of misinformation, toxicity, and polarization. Misinformation represents the proliferation of communication and news that is misleading or outright false. Polarization captures the widening political and cultural differences between two increasingly distinct groups of Americans. Toxicity refers to the tendency of people to interact vitriolically with one another both online and in-person. In Chapter 2, we discuss how these three phenomena span the problem space of the fragmentation of civil discourse and guide our thinking about how to intervene.

While all three issues are pressing, we argue in Chapter 3 that we are in a better position to intervene on the issues of polarization and toxicity than on misinformation because tackling misinformation is only really possible from within a platform that distributes news. Thus our broad goal is to address the widening divide between Americans and the uncivil way that people with different ideologies interact.

To address polarization and toxicity, we investigate prior efforts that engaged directly or indirectly with these problems in Chapter 4. Our research suggests that pairing people with disparate opinions is important for narrowing the divide between Americans. Therefore, our intervention should broadly appeal to people with diverse ideologies, maintain a low barrier to entry, and be private and safe.

Much of our research indicates that face-to-face interaction encourages humanization and civil behavior. Therefore, in Chapter 5 we introduce Eye to Eye, the video-chatting application we built to help people with opposing ideological views engage civilly.

In Eye to Eye, a user can update opinions on a set of political questions that are used to pair him or her to a partner with a different opinion on at least one of the questions. The two matched users connect via video chat, where they communicate face-to-face. Their The key features of Eye to Eye — no political bias, a web-based design, Facebook authentication, user responses and profile information, matching, face-to-face video communication, face tracking and masking, and feedback and a badge system — were all included to satisfy at least one of objectives for our solution.

In Chapter 6, we outline a number of potential features that could be incorporated into Eye to Eye. Many of these features would guide participants towards more civil conversations and better behavior on the platform. Other potential features would allow users from other countries to use the platform and would share contact information between two users from a conversation that went well. We also explore extensions of Eye to Eye that may be beneficial in other settings, such as education.

By connecting people who disagree in face-to-face conversation, we seek to address the problems of polarization and toxicity. We hope Eye to Eye can be used to help foster civil discourse in communities across the United States and beyond.

# 2

## Background

In an age where the political landscape is extremely polarized and dominated by oppositional rhetoric, there seems to be one issue on which members of both parties agree: the modern-day fragmentation of civil discourse. Civil discourse is the “free and respectful exchange of different ideas” [?].

People have always had differences of opinion. However, recent American ideology is increasingly polarized [Abramowitz, 2010]. A growing body of empirical research has shown that American political parties have grown further apart on major issues [Abramowitz, 2010, Layman et al., 2006, Levendusky, 2010, McCarty et al., 2008, Miller and Schofield, 2003, Stroud, 2010]. American citizens have increasingly polarized perspectives on sensitive topics, including politics, religion, race, ethnicity, and sex. Conversations between disagreeing individuals on these topics frequently lead to misunderstandings and further divisions [O'Dowd and Ritter, 2006].

The declining ability of Americans to respectfully listen to and question viewpoints of the opposing side is exacerbated by three central issues: misinformation, polarization, and toxicity. Misinformation represents the proliferation of communication and news that is misleading or outright false. Polarization captures the widening political and cultural differences between two increasingly distinct groups of Americans. Toxicity refers to the tendency of people to interact vitriolically with one another both online and in-person. These three phenomena define the problem space of disintegrating civil discourse, and in the following sections we explore each one in depth.

## 2.1 MISINFORMATION

### WHAT IS “FAKE NEWS”?

Fake news is a type of yellow journalism that deliberately spreads misinformation and exaggerations across mass media platforms with the intent to damage a target entity for monetary or political gain [Radutzky, 2017]. This tactic often entails sensationalizing events, emphasizing uncertain and unproven statements to elicit emotional responses. For example, “click-bait” headlines and advertisements are often outrageous and misleading in order to generate increased traffic to the article and thus greater financial revenue for the author [Barthel, 2015]. Moreover, biased news sources tend to encourage negative misconceptions of the opposing party. Fake news gravely affected politics and cybersecurity in 2016. Research on web traffic in the 2016 election found that up to 15% of all Twitter posts were published by fake social media accounts called “bots” [Pelley, 2017].

### HOW HAS THE INTERNET CHANGED NEWS GATHERING AND REPORTING?

Following the birth of the Internet, traditional journalism was restructured. The democratization of news gathering and publishing changed the primary

news sources to such an extent that today, Americans are likely to get most of their news through unofficial sources like blogs, commentary, and social media feeds [Woodward, 2015]. This shift towards decentralized and polarized news media has led to a drop in journalistic standards and an increase in erroneous and biased publications [Mitchell et al., 2014]. Information presented in modern news articles can be inaccurate, and at times intentionally deceiving.

Although online social networks and digital media platforms have grown to be influential in the reporting of events, they remain an unreliable source for the truth. Online social networks disrupt the business model of journalism by eradicating barriers to entry into the publishing industry. Anyone with a computer can disseminate unsubstantiated reports on a given topic and reach thousands of people [Newman, 2011]. This decentralization of knowledge sources via the Internet has amplified the influence of misinformation and disinformation, as there is no longer a common narrative to give universally credible cases against fake news. Also, many digital news platforms monetarily profit from a negative online climate and human psychological biases. Many online news platforms use triggering headlines to induce outrage and disbelief in attempt to capture online users' attention, amplify exposure, and increase their profits [Silverman, 2015]. These loose journalistic standards lead to increasingly extreme social consequences, and the breakdown of individual values and traditional norms. Currently, the state of online news is one that encourages speed and spectacle over restraint and fact-checking in the pursuit of ad dollars [Chen et al., 2015].

In addition, many people view the news as a source of entertainment, filled with irony or outrageous events, and not as informative broadcasting [Woodward, 2015]. Cognitive factors and human biases make people more susceptible to political manipulation using stereotypes and emotional appeal, making it difficult to debunk erroneous beliefs. Psychologists have found that misinformation is especially "sticky" because it requires less cognitive effort to accept it instead of challenging it [Lewandowsky et al., 2012]. Overall, the polarized corners of the Internet have negative implications for civic discourse.

## WHY AND HOW IS FAKE NEWS SPREAD?

Misinformation can be disseminated into society for two primary reasons: the story is not obviously false and thus misinterpreted as factual news, or the audience is not interested in the truth but rather entertainment or reinforcement of existing ideas. American citizens have shown a declining interest in being informed about political, social, and economic current events [Pew Research Center, 2007]. The Internet has fundamentally changed the way people communicate and the way misinformation is spread. Social media platforms allow for unprecedented access to information that can be consumed and spread instantly. Today, fake news is spread in society both inadvertently as rumors and maliciously by parties with vested interests [?]. Social media networks pick up and disseminate breaking news just as quickly as rumors and fake stories. Online, people value the speed and ease of accessing news stories, but they also prioritize being the first to share articles within their networks and to post commentary across the Internet at the expense of investigating the validity of any arguments made [Vicarioa et al., 2015].

Furthermore, these online platforms use algorithms to personalize news feeds, narrowing the exposure users have to different ideas. This fosters ideological isolation, also known as “echo chambers” or “filter bubbles”, where people are only presented with similar perspectives [Emba, 2016]. Research in social psychology has shown that people decide to believe stories that they want to believe or perspectives that are aligned with their existing beliefs, regardless of their authenticity or basis in facts [Feldman et al., 2014]. This aversion to conflicting viewpoints creates an incentive for social networks to filter out content that might challenge existing beliefs [Iyengar et al., 2017]. As a result, people online self-sort themselves into “bubbles” that filter information so that they only receive ideas that amplify their own existing beliefs. For example, within these tight like-minded networks, misinformation that negatively misrepresents the opposite side is likely be shared and spread quickly due in part to “confirmation bias” [Heshmat, 2015]. A user will deem a claim as accepted as truth, regardless of whether the claim is substantiated or not, because the user’s

online network is sharing it. This also leads to an effect where informed minorities may refrain from disclosing what they know due to social pressure, preventing more productive discourse from occurring [Sunstein, 2007].

#### WHAT IS BEING DONE TO COMBAT MISINFORMATION?

Influential online platforms, such as Google and Facebook, are attempting to use both human and automated solutions to prevent the spread of fake news. For example, Google announced that it would ban Web sites that publish fake news articles from using its advertising platform, AdSense. By removing some financial incentives for fake news, Google sought to decrease the number of fake news sites in total [Wingfield et al., 2016]. Other solutions include adding a verification system for news organizations, a “fake news” flagging system, and an automatic cross-partisan fact-checking algorithm [Woolf, 2016]. Detecting and blocking erroneous stories is one task. However, tackling the underlying issue of self-polarization is a far larger challenge.

## 2.2 POLARIZATION

The 2016 presidential election was marked by hostility and anger. From comment wars on social media to heated exchanges on national television, a tremendous level of tension pervaded the political process. The atmosphere caused by the election reached outside of the political realm as well. Americans on both sides of the aisle felt significant upticks in stress as a result of politics [Ecker et al., 2012]. Additionally, hate crimes were perpetrated at higher rates than in previous years<sup>1</sup>.

Though there is broad consensus on the lackluster state of American democracy, there is far less agreement on the specific causes of disillusionment and disunity. Political pundits have commented extensively on these issues and have advanced a number of related ideas about what might be the root causes of the problems in American civic culture. These include the rise of a political

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<sup>1</sup><https://ucr.fbi.gov/>

campaign and donation complex [Reuters, 2017], the demonization of political professionals [Rauch, 2016], the deepening of partisan divides [Drutman, 2017], the creation of social media filter bubbles [El-Bermawy, 2016], and the spread of misinformation [Vis, 2014].

#### BUT IS AMERICAN POLITICS ACTUALLY MORE DIVIDED THAN IT HAS BEEN HISTORICALLY?

Leading up to the election of 1800, partisan newspapers called John Adams “a hideous hermaphroditical character, with neither the force and firmness of a man, nor the gentleness and sensibility of a woman”. Thomas Jefferson was dubbed “a mean-spirited, low-lived fellow, the son of a half-breed Indian squaw”. In 1804, two prominent politicians, Alexander Hamilton and Aaron Burr, culminated their long rivalry in a duel in which Burr shot and killed Hamilton. In the 1860s, irreconcilable differences on slavery between two factions split the country and led to the potentially most divisive and violent of periods, the American Civil War. Since the 1860s, four US presidents have been assassinated. During the 1960s, mass social movements were at times violent because of resistance to change. It seems that extreme ideological differences and hostile feelings between political parties are not new phenomena.

#### THEN, WHAT IS DIFFERENT IN POLITICS TODAY?

Previously, political parties were less homogeneously like-minded [Levendusky, 2010]. For example, in the 1940s, the liberal Democratic Party included southern conservative “Dixiecrats,” while the conservative GOP included northeastern liberal “Rockefeller Republicans.” The parties were more heterogeneous and bipartisan legislation was passed more easily. A group of political scientists analyzed congressional roll call votes from the late 18th century to the present-day. They found that in recent decades, Republican and Democratic elected officials have begun taking more extreme positions on issues and have become less likely to vote across partisan lines [McCarty et al., 2008].

Research has shown that beginning in the 1960s, both elected officials and the general public have sorted themselves into ideologically consistent, homogeneous parties [Levendusky, 2010]. With increased polarization between parties, political compromise becomes more difficult because each party sees less benefit in meeting the other side halfway [Mitchell et al., 2014].

Another factor contributing to a divisive political environment is the increased competition in elections. Since 1984, every presidential election has been won with a tight margin—by no more than eight percentage points. Two of the last three US presidents lost the popular vote but were ultimately elected through the Electoral College [Ornstein and Mann, 2000]. This tighter gap fuels more competition between the two parties. Both sides find themselves in a state of “permanent campaigning”, where campaigning and governing become one [Ornstein and Mann, 2000].

Today, many politicians strategically adopt extreme positions on new issues, in order gain an edge from disrupting the current political equilibrium [Carmines and Stimson, 1989]. Activists are also known to create partisan differences on policy issues to enter party politics [Miller and Schofield, 2003]. In combination, these factors lead to an increasingly polarized population.

#### HOW HAS THE INTERNET CHANGED THE PUBLIC’S PARTISANSHIP?

The emergence of the online social media networks has created a new space for communicating about politics. Content-selective exposure is the primary driver of the spread of fake news and of the creation of echo chambers [Vicarioa et al., 2015]. With the World Wide Web, stories and opinions are shared at unprecedented rates. The number of people an individual can reach is also greater than ever before. As introduced earlier in the section covering misinformation, social media users create an environment of echo chambers. Echo chambers are spaces that filter information so that people only receive ideas that agree with their own existing beliefs. The limited set of ideas in an echo chamber becomes increasingly narrow due to these spaces’ self-segregation. Search engines and social media platforms also use algorithms to optimize personal news feeds so

that they prompt users with what they were expected to search for and view. These opaque algorithms exacerbate the segregation [Flaxman et al., 2016]. They narrow the exposure users have to different ideas, thus resulting in “filter bubbles”, states of ideological isolation where users are only presented with similar perspectives. In turn, online users sort themselves into these “filter bubbles” and “echo chambers”, which has negative implications for civic discourse.

Americans’ trust and confidence in the mass media is substantially low [Thompson, 2016]. A recent Gallup poll that found that only 32% of the population said they have a great deal or fair amount of trust in the media to report the news accurately and genuinely [Swift, 2016]. Meanwhile, about three-quarters of the population say that news organizations are extremely biased, favoring one side and presenting the opposite side in a negative light, in attempts to deceive the general public [Swift, 2016]. This perception of media bias leads to self-selection in media consumption, further engendering polarization. [Mitchell et al., 2014].

#### WHAT ARE THE CONSEQUENCES OF PARTISAN POLARIZATION ON THE EVERYDAY LIVES OF AMERICANS?

Trends of more extreme positions and a greater scope of conflict at an official level trickle down and are manifested in everyday life. Americans are pushed further to the extremes of the political spectrum rather than being drawn to a more moderate outlook. This applies to topics beyond politics. Americans are drawing ever further from each other on sensitive topics, including religion, race, ethnicity, and sex. This attitudinal divergence, or “culture war”, splits society into diametrically opposed subgroups with vastly different morals, cultures, and lifestyles [Layman et al., 2006]. They disagree about everything from their preferred type of community to the political persuasion of people they would welcome into their families [Mitchell et al., 2014].

Furthermore, the opinions and sentiments of citizens are influenced by increasingly partisan discussion on mass media and online news sources [Stroud, 2010]. The rise in politically homogeneous groups has pushed modern society to

consume news that is circulated by groups of like-minded people, or those within the consumer's own "filter bubble". In addition, most content that people view online is recommended based on their existing networks and past preferences, fueling the partisan echo-chambers [Iyengar et al., 2017]. When interacting with like-minded people, individuals often fail to deeply engage with claims being made and blindly agree with arguments made from the "same side", causing a slippery slope of radicalization.

Overall, these historical trends suggest that people express uncivil behavior because they are polarized and divided to begin with, not the other way around. It is possible that today's increasingly polarized and homogeneous ideological poles increase the loyalty people feel towards their in-group and animosity towards their out-group, which leads to a feedback loop of further increased animosity.

### 2.3 TOXICITY

#### WHAT IS "HOMOPHILY"?

Humans naturally tend to associate with other individuals who think and live in similar ways [Mahajan and Wynn, 2012]. Association includes both the formation of relationships and simple communication. This innate drive to tend towards and associate with similar others is called "homophily". For humans, homophily is hard-wired, and it has always contributed to the emergence and stability of human communities [Retica, 2006]. The decision to relate to like-minded people explains why people choose to receive news from sources that have similar perspectives as their own. Humans have always preferred to hear confirmatory information [Feldman et al., 2014]. They tend to accept input that is aligned with their beliefs and reject input that conflicts with their beliefs [Iyengar et al., 2017]. Recently, homophily has been enforced by selective exposure due to personalized algorithms and online echo chambers. Even partisan media outlets have taken advantage of this human bias by defying journalistic norms of objectivity, presenting information from one-side, and

using emotion-inducing headlines [Levendusky, 2010]. These messages are not only received by those who agree and choose to follow the network. They are also diffused into the broader public via the primary audience's social networks.

#### HOW DO COGNITIVE BIASES AFFECT HOW WE VIEW THE OUT-GROUP?

Psychological and cognitive biases affect members of both sides of an ideological conflict and they make it difficult to meet halfway amid deeply polarized extremes [Lilienfeld et al., 2009]. There seems to be a negative feedback cycle between increasingly polarized ideological perspectives and animosity towards those on the opposite side. Researchers have found that the level of antipathy that Republican and Democrats feel towards the opposing party has risen over the last two decades as parties have become increasingly polarized [Mitchell et al., 2014].

Due to cognitive biases, people experience increased failures in empathy and trust towards members of the other side of the political spectrum [Cikara et al., 2011]. People view those from the opposite political party as more likely to be unreasonable and unwilling to hear or recognize the truth [Pronin, 2007]. Many Republicans and Democrats view people in the opposite party as frightening. Intergroup psychological research explains that lack of humanization and empathy of the outgroup leads to the projection of fear and hatred onto them. These negative feelings across political lines resonate, even if two people do not disagree much over the substance of the policy [Levendusky, 2010].

#### HOW HAS THE INTERNET AFFECTED OUR ABILITY TO PRODUCTIVELY COMMUNICATE?

Communication is one solution for embarking on a path towards a more cohesive and united society [Cikara et al., 2011]. However, today, a significant portion of millennials' interactions and communications are online, not face-to-face. There are many ways people can meet others online, for example, career networking sites, dating applications and services, and social media

platforms. All of these services allow people from different continents to connect, but they also facilitate filtering out people with whom one disagrees. Digital media platforms provide people with an unprecedented tool set to act on their innate homophilic desire. Facilitated by filtering techniques such as “liking” posts and recommendation algorithms, online users sort themselves into even smaller fragmented communities that reflect their interests, values, and opinions. Thus, human interactions have become increasingly polarized and constrained to tight-knit communities of like-minded people. The more polarized people are, the more difficult and less practiced it becomes to listen to ideas that oppose their own beliefs. Thus, today, people with different ideologies are less and less able to have respectful and productive arguments.

People are often driven to participate on online platforms by incentives like entertainment, the ability to express emotionally driven opinions, or to support their political and ideological team [Chee, 2006]. The majority of commentators do not stop to reason through their argument or to attempt to consider the potential validity of the other side. They use public online discussion to voice their opinions on a topic, but they fail to listen to the opinions of others. These forum participants tend to be close-minded and to follow group think as opposed to being open-minded to ideas and to questioning one’s own opinions rigorously.

#### HOW IS ONLINE COMMUNICATION DEHUMANIZING?

The Internet and its mediated social environments are designed to allow people to voice their opinions and share dimensions of their “self”. However, the ways in which a person chooses to express him- or herself changes based on the medium (for example, forum, e-mail, video) and the context (for example, social, vocational, fantasy) of online communication.

Research has shown that people say and do things online that they would not say and do in any face-to-face human interaction [Suler, 2004]. This phenomenon, labeled as Suler’s “online disinhibition effect”, is due to six main factors: dissociative anonymity, invisibility, asynchronicity, solipsistic introjection, dissociative imagination, and minimization of authority.

First, dissociative anonymity represents the idea that people can alter their identities. Users can separate their actions online from the rest of their real world identity. The internet allows users to stay anonymous and keep their identity hidden. These users can then dissociate from the actions they take behind their usernames and they feel like they are not responsible for the things they say online. People can avert responsibility for expressed hostilities and other deviant actions almost as if superego restrictions and moral cognitive processes have been temporarily suspended. People can convince themselves that their online behaviors “aren’t me” but another person completely.

Second, invisibility encompasses the idea that in an online environment other people don’t necessarily see you or even know you are present. Users take advantage of having a concealed identity to enter corners of the web and to leave comments that they otherwise wouldn’t. Invisibility gives people the courage to do things they would not otherwise do if their actions were being watched or physically associate with themselves. Another environment that uses “invisibility” is psychoanalysis, where the analyst sits behind the patient to remain physically ambiguous and allow the patient “free range to discuss anything.”

Third, asynchronicity of communication allows users to not have acknowledge other users’ responses immediately or ever. Online social networks have also introduced new platforms for human conversation that vary from traditional synchronous, face-to-face communication. Many online discussions take the form of one-way interactions, for example, comment sections on Facebook or YouTube. Since people are not interacting in real time, there is an expected delay in feedback. When a user posts a message online, they do not necessarily receive any immediate real-time reactions. They have the option to leave, by closing out of the window, before receiving feedback cues. This encourages a type of “emotional hit-and-run” behavior, and less back and forth communication [[Suler, 2004](#)]. These “comment wars” leave all parties with a bitter taste in their mouths and dislike of not only opposing ideas but also the people that hold them. A continuous feedback loop reinforces behavioral expression and self-disclosure that conform to social norms, so the lack of instant feedback online damages the

flow of thought processes and natural conversation.

Fourth, solipsistic introjection occurs when a user reads a message posted by another online user, as if the author of the post has been introjected into his or her own head. Lack of face-to-face cues can alter self-boundaries, and a person can feel like their mind merges with the mind of an other online actor. Then the line between reality and imagination is blurred. In one's imagination, people are free to say and do things they would not in reality (e.g. fantasy role playing).

Fifth, dissociative imagination expands on the make believe world created in part by solipsistic introjection and anonymity. Users view their online personas and those of other users are fictitious, and view the virtual space of the web as having no consequences. People can create imaginary characters in order to dissociate what happens online. The Internet becomes a game-like make-believe dimension, where social rules do not exist (similar to fantasy game environments).

Sixth and finally, the Internet minimizes real life authority figures. In an online world, authority figures from the real world cannot be represented by dress, body language, stance, etc. The Internet is not bound by physical sovereignty. Regardless of who users are in the real world (e.g. their wealth, race, gender, etc.), they all start off on an approximately level playing field. Virtual power is mostly determined by communication skills, active status, and quality ideas. People may feel comfortable treating everyone like a peer, or less than a peer, since there are no clear authority figures [Suler, 2004].

Research suggests that the chief contributor to online disinhibition is a lack of eye contact. Eye contact is key in allowing humans to give and receive informational cues that control the direction and tone of discussion [Kiesler, 1984]. In general, research has found that bolder expressions of disagreement on online text platforms are due to reduced social cues and feedback [Suler, 2004]. Face-to-face interactive dialogue, such as video calls, is shown to feature deeper articulation, coherence, and understanding, which can increase positive attitudes towards an out-group [Stromer-Galley et al., 2015].

## 2.4 CONCLUSION

We identified the three main contributors to the decline of civil discourse as misinformation, polarization, and toxicity. We have argued that misinformation is caused by the decentralization and polarization of news media, financial motivations that discourage fact-checking, and the public's uninterest in the truth. Polarization has increased due to deeper political partisanship and self-segregation of general public online. Lastly, increased toxicity is a result of polarization amplifying cognitive biases like homophily, online social networks dehumanizing people, and online echo chambers allows people to never have to converse with others that have opposing ideas. Having established the state of American political life and the reasons for that condition, we next explain how we hope to have an impact on the situation.

# 3

## Objectives

Our overarching goal is to encourage civil discourse and the respectful exchange of different ideas. We do not aim to change the presence of misinformation, human cognitive biases, or even people's ideological disagreements. These trends have existed for much longer than the internet. We also do not intend to alter the current journalistic business model, since we have little power to do so. The platforms over which most news is distributed are in the best position to combat misinformation. Indeed, Google is putting effort towards implementing a fact checking system [Kosslyn and Yu, 2017] and Facebook is attempting to disrupt the economic incentives for misinformation and to help people become more informed news consumers [Mosseri, 2017].

We accordingly decided not to look at these elements as part of the problem space, but instead as constraints that need to be addressed when designing a solution. Instead, we believe the most readily addressable problems are those of

polarization and toxicity, specifically online discourse between individuals.

Our approach to mitigating polarization and toxicity is to focus on facilitating constructive face-to-face conversations online. We see encouraging conversation between extremes as an initial step towards bridging the divide between polarized parties. What follows are a set of key objectives that we defined in order to guide our process of designing a solution. We believe that a platform designed with these goals in mind can lead to a greater shared sense of common narrative, meaningful discourse, and political progress.

The core aim behind our approach to the problem of the disintegration of civil discourse is to address the lack of listening and empathy that people bring to politically-contentious conversations. To combat this phenomenon, our design must humanize users on the opposing side of the political spectrum. We believe that fostering greater recognition of the humanity of the political out-group will lead to more productive and less hostile interactions [Pacilli et al., 2015].

In order to make this platform accessible and attract a diverse array of people, the design should include a low barrier to entry. A low barrier to entry is important for the sake of gaining a critical mass of users [Reillier and Reillier, 2017]. We aim to broadly affect civil discourse in a positive way, which means that our project must reach many people for it to be successful. Overly-involved designs can make users averse to using an interface before they have spent time interacting with it. Since our design must facilitate simultaneous conversation between multiple people at any given time, it is especially important that there be a high density of people engaged.

We intend to always prioritize the safety and privacy of our users. Sizable numbers of Internet users wish to protect personal or identifying information from those who might harass or target them, so we highly value anonymity [Rainie et al., 2013]. We recognize that any design will almost certainly spark uncomfortable conversations between people who do not know one another. We do not want to scare away potential users, so they must trust that conversational tension will not spill over into off-platform action. Ensuring anonymity and that personal information is kept private protects users from these situations.

For people on opposite sides of the political spectrum to begin to see each other as human, our design must facilitate two-way interactions that simulate real life conversation as much as possible. We want users to see and hear other users with different political ideas than themselves as people with whom they can have a pleasant conversation and perhaps even have similarities. However, for these civil acknowledgements to happen, it is necessary that we bring together people who know have some political disagreement. Knowing some information on the political ideologies of our users is therefore needed to accurately match people based on disagreement.

While the attributes described thus far are necessary conditions for a thriving and safe platform, they are insufficient unless the platform also encourages civic-minded goals through its structure. To this end, the platform must encourage listening, empathizing, and politeness. Succeeding on this front is crucial to our broad emphasis on positively impacting civil discourse in society.

We identified our objective as combating polarization and toxicity by humanizing individuals with opposing views through face-to-face online conversations. We prioritized safety and privacy within the context of a platform that furthers this objective. With a firm understanding of our goals, we now analyze prior work that has been completed within this context.

# 4

## Prior Work

There are a number of existing platforms and tools that either directly or indirectly address the problems of polarization and toxicity. Here we analyze these efforts and assess their effectiveness at facilitating civil discourse. In addition to these platforms, we also discuss the merits and pitfalls of multiple social video chatting applications that allow spontaneous conversation.

### 4.1 BLUE FEED, RED FEED

“Blue Feed, Red Feed” addresses the issue of polarization and “echo chambers” in social networks by fetching and displaying liberal and conservative Facebook posts side-by-side on various topics. The platform spreads awareness of polarization by demonstrating how different realities are for users viewing “blue feeds” versus those viewing “red feeds”. This is an important component in

helping people burst their filter bubbles, but it unfortunately does nothing to humanize people who hold views from the “other feed”.

#### 4.2 WAAROMKIESJIJ.NL

Waaromkiesjij.nl was launched during the run-up to the Dutch elections as a way to facilitate political discussions with users outside one’s “filter bubble” or “echo chamber”. Specifically, users can be paired if they voted for different presidential candidates, and the platform will facilitate anonymous one-on-one environments for discussion. This method of pairing users with different views in the hope of increasing discussions with people outside of one’s “bubble” seems to be effective. However, this effort was centered around a specific election, whereas a broader solution ought to be available at any time.

#### 4.3 QUORA

When asked how Quora was able to achieve relatively high levels of well-written, respectful answers and comments and low levels of toxic behavior, CEO and co-founder Adam D’Angelo highlighted the importance of norm-setting. Specifically, Quora’s initial users were a small network of the team’s friends and family, and they, especially the team members, set examples for high quality answers, questions, and behavior on the platform. He attributes this norm-setting to be the primary reason for the relative lack of toxicity on the platform today, as users who joined were exposed to those norms and subsequently followed them [D’Angelo, 2017].

This strategy of norm-setting by setting examples of high quality conversations and behavior seems to be key to successfully avoiding toxicity in early deployment. Targeting this method towards the specific problem of political discourse, rather than general question-and-answer interactions, could prove incredibly effective.

#### 4.4 MARRIAGE COUNSELING

Conflict resolution therapy from the field of marriage counseling has also revealed insights for avoiding toxic behavior between people who disagree. Collaboration and mutual respect are important values, whereas coercive or judgmental behavior should be discouraged. In addition, the literature says that limiting time could be detrimental, as it could cut off people's attempts to collaborate, explore their disagreements, and learn from each other's perspectives too early [Subramanian, 2017]. Research also supports the notion that dialogue is more productive when each person makes only one point per airtime in no more than several sentences and that parties should receive approximately equivalent airtime [Heitler, 2015].

#### 4.5 MONITOR BOTS

Some platforms, like Twitch, are targeting toxicity online with bots [Bashore, 2016]. These software programs monitor text-based discussions and alert the streamer if offensive material is posted, allowing them to decide the ultimate consequence (e.g. blocking the author). While this is an effective text-based approach, it has not been adapted for video-based conversations.

Google Jigsaw is currently working on projects also addressed toward harassment and abusive language online. One of their APIs, Perspective, uses machine learning to spot abuse and harassment online by scoring comments based on their perceived impact in a conversation [Greenberg, 2017]. This allows moderators to sift through comments more effectively, gives real-time feedback to commenters, and allows readers to more easily find relevant information. Their first model identifies whether a comment could be perceived as "toxic". Google's machine learning approach is promising, but has yet to be applied to video conversations.

#### 4.6 CHATROULETTE

Chatroulette is an online chat platform that randomly pairs users together in video-based conversations. Users may leave conversations and initiate new ones at any point. While the site was lauded for allowing spontaneous conversations, it was criticized for the offensive, obscene, or pornographic material that some of its users exhibited [Meredith, 2010, Sokol, 2010].

#### 4.7 OMEGLE

Omegle is an online chat platform with both video and text chat modes. Like Chatroulette, it pairs together strangers. The site is free and does not require making an account. The platform has features like pairing by common interests, an unmonitored video section with consenting adults, and a separate chat mode with users providing e-mail addresses ending in ".edu". Omegle has faced similar issues with obscene material as well as bots [Teensafe, 2016].

#### 4.8 2UP

2UP is a platform in which two users decide to have a live video debate/discussion over a topic, and other users observe the debates and cast votes to determine the winner. The landing page prominently features a live battles leaderboard, encouraging users to win debates. Users often battle over topics like politics, sports talk, and religion. However, it encourages debate, persuasion, and winning, rather than civil discourse, respect, politeness, and cooperation.

#### 4.9 JOTTLER

Jotter is a video chat platform that prevents inappropriate video streams through face screening technology. The platform must detect a face before the user can initiate video chatting. All other parts of the video image are initially masked out.

Users can also mutually press a "Trust" button that will turn face screening off and reveal normal, fully unrestricted video screens. Face screening will also automatically be deactivated after 30 seconds of conversation, though users may press an "Untrust" button at any point to reactivate it. Such face screening technology protects users from inappropriate displays over video conversations.

#### 4.10 MOVING FORWARD

The examination of previous work in this area illustrates how some features would hinder or help us to achieve our objectives. We use these warnings and ideas from these previous attempts by others in this area to design the following web application.

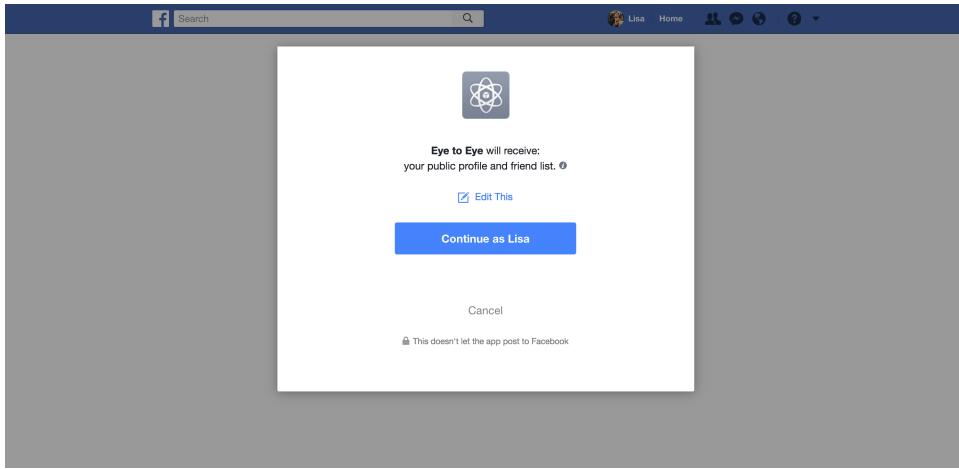
# 5

## Design

In this section we describe the application we created to help foster civil conversations across ideological lines. We also discuss how its features help address the aforementioned objectives.

### 5.1 PLATFORM SUMMARY

We designed Eye to Eye, a web application that promotes civil discourse by enabling users to have live face-to-face conversations with strangers who have different views than their own. Navigating to the Eye to Eye landing page shows a user a high level overview of the platform. After logging in via Facebook authentication [Figure 5.1.1], users can privately submit their positions on a periodically changing series of political questions [Figure 5.1.2]. Using their self-reported opinions, we match users to other users who indicated different



**Figure 5.1.1:** Facebook authentication.

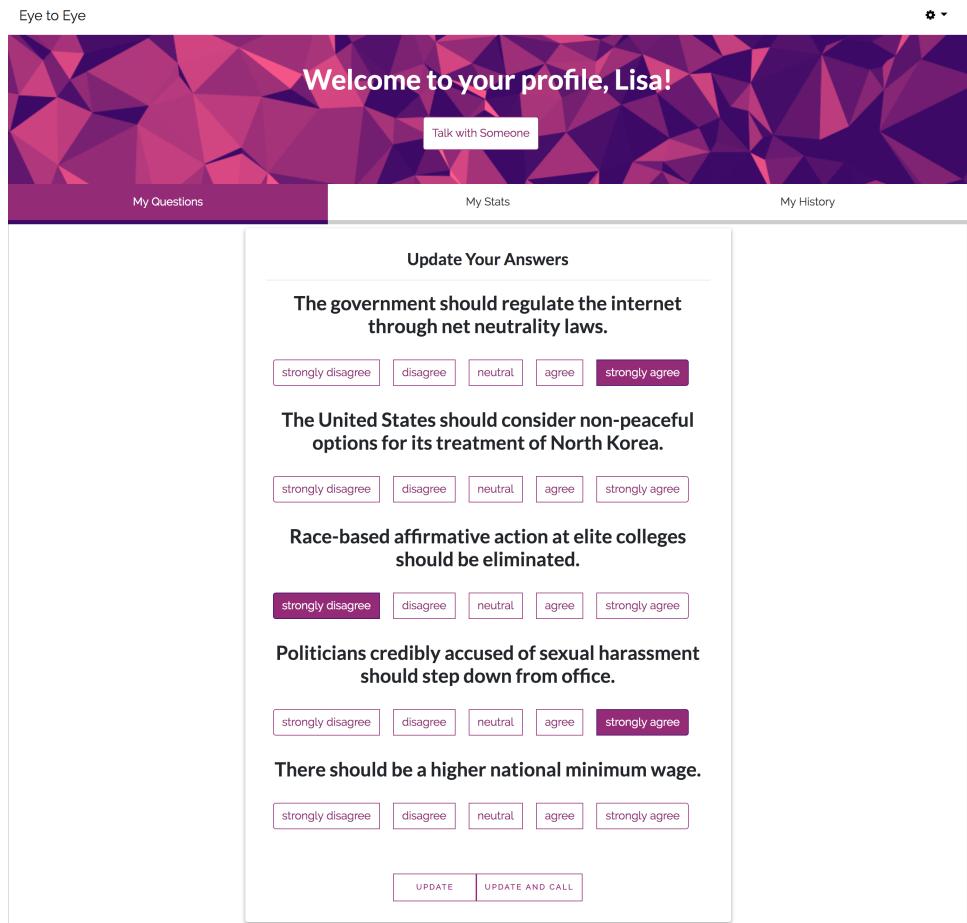
stances on the questions. We then add them to a two-way synchronous video call.

Once matched with another user, only the other user's face, with the background masked, is shown adjacent to the user's own face (if no face is detected, the text "No face found" is shown) [Figure 5.1.3]. At any time, either user can click an "End Conversation" button to exit the video call.

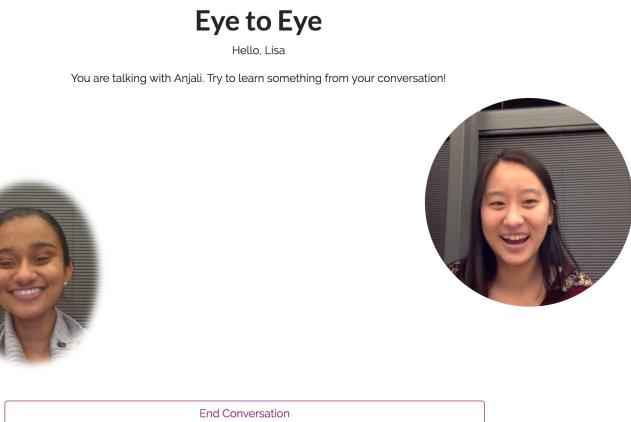
At the end of each call, conversation partners must rate the quality of the interaction they just had. They can also choose to award badges for positive traits like creativity and empathy, select areas of improvement like listening and attitude, and leave a custom text message for their partner [Figure 5.1.4].

The rating page also links to a window to report abuse should the need arise, in which the user can flag the other user for further investigation for reasons like explicit language or nudity, with the option of custom text details as well [Figure 5.1.5].

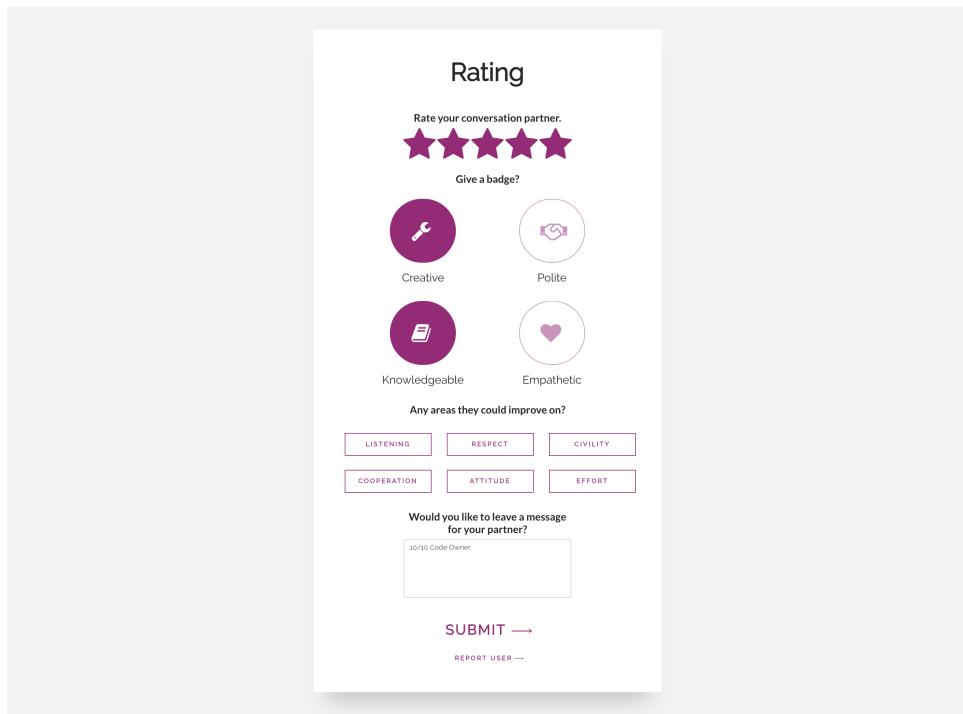
Every user also has a profile page. The "My Stats" tab contains the user's statistics from all of their conversations, including their aggregate star rating,



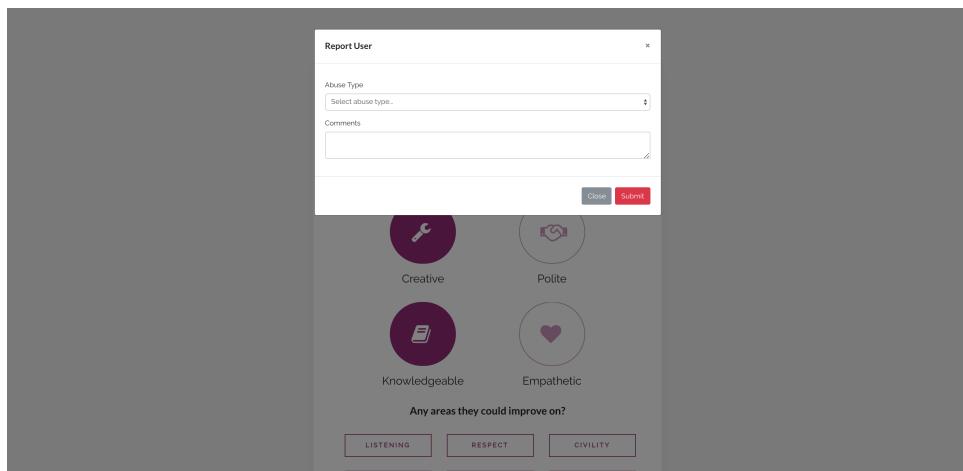
**Figure 5.1.2:** My Questions



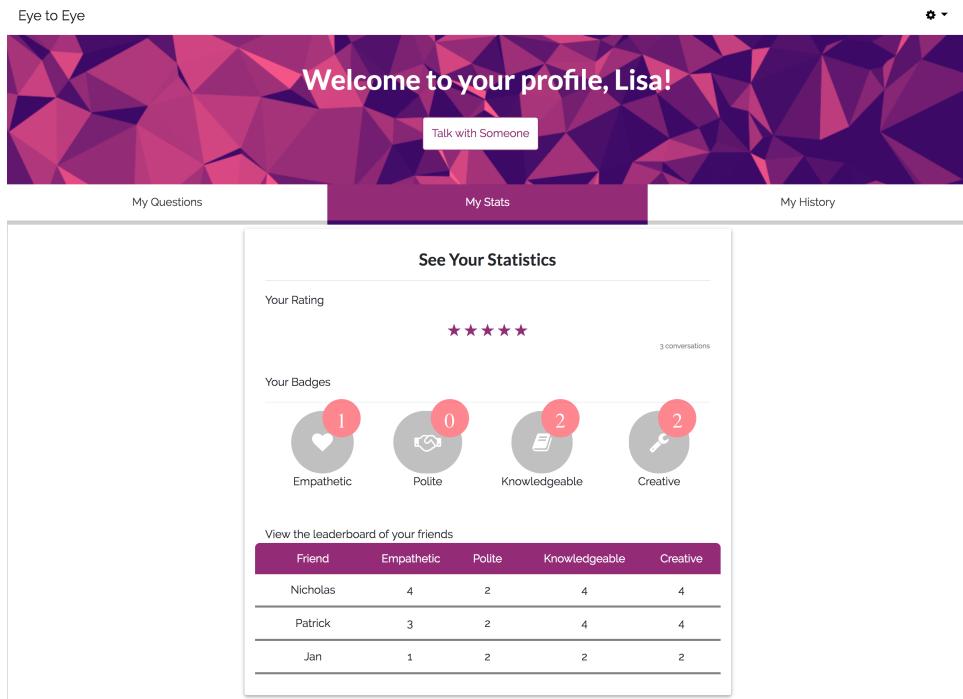
**Figure 5.1.3:** Conversation Screen



**Figure 5.1.4:** Feedback Screen



**Figure 5.1.5:** Report Abuse

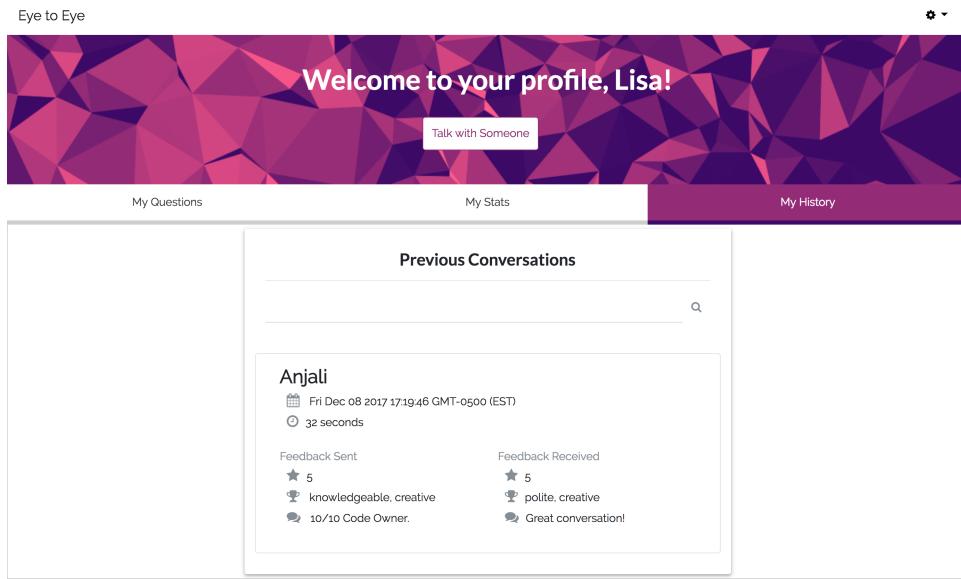


**Figure 5.1.6:** My Stats

number of conversations, number of badges, and should they enable it, a leaderboard displaying the badges earned by their Facebook friends on the platform [Figure 5.1.6].

“My History” lists all conversations a user has had in the past. They can view the first name of their partner, the date, the duration, feedback sent, and feedback received for each previous conversation. They can also search through conversations [Figure 5.1.7].

The About page explains the purpose behind and creation of Eye to Eye [5.1.8]. The Terms of Use page outlines the legal conditions of using the platform [Appendix A].



**Figure 5.1.7:** My History

## 5.2 KEY FEATURES

Learning from the successes and failures of the prior work, we defined a set of key features to include in the design. These features helped achieve the broader platform objective of facilitating civil discourse and the respectful exchange of ideas.

### 5.2.1 POLITICALLY UNBIASED

As part of our goal to appeal broadly to people with diverse ideologies, our platform is politically unbiased. Showing bias would risk losing our ability to facilitate conversations between people with different political views. As we have identified above, a homogeneous user base and 'filter bubbles' are exactly what we are trying to combat.

Eye to Eye

[Sign In](#)

What is Eye to Eye?

Eye to Eye is an nonpartisan application that enables you to have face-to-face conversation with strangers who have different views than your own. This app is a great way to connect with and listen to people with whom you disagree on certain topics. Your exposure to diverse opinions may help you better empathize with and understand (but not convince) people across the political aisle.

Our aim is to make your experience as pleasant, civil, and informative as possible. Our hope is that you will walk out of your video chat more optimistic about humanity and with a clearer perspective on people with a different set of values or ideas.

Who is behind Eye to Eye?

Eye to Eye was started in 2017 by twelve Harvard undergraduate students with the goal of mitigating the fragmentation of civil discourse in the United States, one respectful conversation at a time. Concerned by the divide between the left and right in our country, we decided to create a nonpartisan application that encourages strangers who have different ideas to listen and talk to each other.

Is Eye to Eye for you?

Are you tired of the vicious, heated, and unproductive discussions that happen on the internet? Do you wish you had an outlet for expressing your thoughts on certain topics and for hearing about opposing ideas, in the hope of alleviating some of the burden of segmentation in civil discourse that you may be carrying? Are you concerned about where our country will go if we continue to fail to communicate with each other? Do you want to help change the tone of political conversations between Americans?

If you answered yes to any questions, then Eye to Eye is for you!



Ready to see eye to eye?

[Start Chatting](#)

[About](#) · [Terms of Use](#)  
© Harvard University 2017. All Rights Reserved.

**Figure 5.1.8:** About Page

### 5.2.2 WEB-BASED DESIGN

The platform is accessible on the web, thus creating a low barrier to entry. After considering the potential options of where and how to develop the platform, we decided placing the platform on the web would be most accessible to the greater scope of potential users. Users on mobile and desktop can both access the platform's website in a browser window. A native mobile or desktop application, in contrast, would necessitate installation before the user can engage with the platform, which we deemed an unnecessary source of friction.

### 5.2.3 FACEBOOK AUTHENTICATION

To ensure that our platform remains safe, it must contain strong protections against malicious actors who seek to undermine the experience for other users. Online harassment has become a growing concern in recent years, and can cause serious distress to users [Beran and Li, 2005]. To ensure that we can keep malicious actors off of the platform, we enforce Facebook authentication. Before accessing and using our application, users must initially register by logging into their Facebook accounts. This is important to allow users to talk to strangers without being trolled or spammed. By keeping track of a user's Facebook account, we have a way of blocking a disruptive user from entering the platform again in the future. It is possible that a malicious actor who has been blocked could create another Facebook account and use it to register anew, but creating a fake Facebook is a non-trivial process that requires a unique email address or mobile phone number. However, adding this step imposes a cost on anyone who is purposely and repeatedly trying to use the platform to cause harm. Given that 79 percent of American adults use Facebook, requiring Facebook authentication should not be a barrier to entry or restrict our potential user base significantly [Greenwood et al., 2016].

#### **5.2.4 USER RESPONSES AND PROFILE INFORMATION**

The profile gives users a space to determine and update their stances on the weekly questions and to reflect on the badges they have earned so far. Each user's profile is only viewable by that user to protect anonymity. As discussed, it is important that users don't feel that they are at risk of being personally identified after an interaction, so only giving users access to their own personal information ensures this privacy.

To chat with someone else, a user must answer at least one of the weekly questions. This step is necessary so that we can gauge some aspect of the user's beliefs to match them with another user of a different beliefs. These questions are hand-curated by us to remain politically unbiased in their tone. None of the questions should naturally lead to one opinion or the other. Additionally, the questions should set a tone of civility and respect that transfers to the conversations that users have amongst themselves.

#### **5.2.5 MATCHING**

Before entering a conversation, the user enters the matching process. Based on the answers to the weekly questions, a conversation partner with the maximum amount of differing positions is chosen and paired. This process is crucial to advance our goals of creating constructive conversation which humanizes those who dissent.

#### **5.2.6 FACE-TO-FACE VIDEO COMMUNICATION**

The most important feature of the platform with respect to the goal of humanization is video chat. For the reasons mentioned earlier, we deem face-to-face conversations to be a crucial component in our effort to create empathy. Even with the ever-increasing number of apps and features that allow us to stay communicate with others, nothing quite compares to face-to-face interaction and conversation. Text-based chat services are not good at

transmitting another person's emotions, intentions, and reactions. After real-life interactions, video chatting is the next optimal medium for conveying ideas.

#### 5.2.7 FACE TRACKING AND MASKING

Our particular solution makes use of face tracking to only expose the user's cropped head from the camera's stream. This encourages users to focus on their conversation partner's facial expressions and, more importantly, prevents abusive behavior. It thus contributes to the safety of the platform. If no face is detected in the video signal, the broadcast is stopped entirely (and limited to audio). Users do not need to worry about inappropriate video streams (e.g., genitalia). We use masking technology to blur out everything but your partner's' face.

#### 5.2.8 FEEDBACK AND BADGE SYSTEM

After concluding a video chat, users are encouraged to reflect on their conversation. They can do so by rating it on a familiar five-star scale. Additionally, a user might want to award badges to his or her conversation partner, highlighting particularly "empathetic", "polite", "knowledgeable", or "creative" behavior. This feedback serves three purposes: For the user who receives it, it can be acknowledgement, criticism or positive reinforcement. For the user who authors it, it is a reminder of the humanity of his or her conversation partner and of people with differing views overall. More generally, the feedback mechanism incentivizes civil behavior and entices long-term engagement with the platform.

### 5.3 FEATURES NOT INCLUDED

#### 5.3.1 ABILITY TO SIGN IN WITHOUT FACEBOOK

As mentioned above, we allowed users to sign in only through Facebook. We could have allowed users to create an account through our website. However, this method would have added more hassle to the on-boarding process and would

have allowed more inappropriate users. Alternatively, we could have allowed users to join conversations without any account. While this method would have created the quickest on-board process, it would have made it more difficult to bar malicious users.

### 5.3.2 FREE RANGE OF DISCUSSION TOPICS

In our current version, users are allowed to answer only a finite set of questions that are written on the back end by the website designers. We recognize that users may not always be interested in the specific questions we choose and may want to choose to discuss their own questions. We could have designed the application so that users can input their own questions or topics. Users would be matched when they have answered differently on any question. We chose not to let users define their own questions for several reasons. First, users would likely input an extremely large number of questions. Users will be spread too thin among all the questions and will have a much lower chance of being paired with another user. Second, users would be able to publically input any question of their choosing, which opens up the floodgates for trolls and inappropriate user questions. With our approach, on the other hand, website designers have the capability to write as many questions as we feel necessary after considering the size and interests of our user base.

### 5.3.3 SHOWING THE DISAGREEMENT

Since users are matched based on a specific question, we know the ID of this question on the server-side. Many users would be interested in knowing which question they are being matched on, so that they could be more structured in the conversation. Many users would like to use our platform to quickly jump in on a specific topic and start debating. However, we chose not to display the specific question users are matched on because we felt this would align better with our goals for the platform. By highlighting the question users disagree about, the conversation would appear more as a debate on a specific question. Users would

focus more on the arguments made and feel less connected to the other person behind those arguments. By hiding the specific question, users are put in a less contentious mode. Users know they disagree but also likely agree on some things. By exploring the space of questions together, they will quickly realize that the other user is more similar than different. This approach portrays each user more as a person than a collection of counter-arguments.

We think it would be best if the interaction was structured so that users are given one minute to introduce themselves and talk freely without any prompts. This introduction period is designed to give the two people an opportunity to see each other as humans and to set a positive tone for the subsequent debate. After one minute, both parties are notified of the topic on which they have different stances. Either user can exit the conversation at any time.

#### 5.3.4 PROFILE PAGE THAT INCLUDES PICTURE

We could have included a profile image for each user on the site, taken from their Facebook profile, in the chat history page. This would be helpful for humanizing the other person, as opposed to just seeing a first name. However, we felt that it is more important to protect the anonymity of each person. A picture is infinitely more descriptive than a first name, and could make users uncomfortable.

#### 5.3.5 CONTACT INFORMATION OF PAST PARTNERS

Many users may want to contact someone they have talked to previously. Our application could have displayed this information, so that users can continue conversations and friendships outside the application. However, for the time being, we chose not to show the contact information of users that one has chatted with. This is mainly to protect the identity of our users. Users would not want complete strangers to be able to access contact information, or even to be able to request access contact information. Users might find this a breach of privacy. Though, we may want to implement an in-app ability to contact another user. We would have to be very careful to avoid this feature becoming a nuisance.

### 5.3.6 MULTI-PERSON DEBATES

Using socket.io, our video chat technology could easily be expanded to include more than two people in one chat. We evaluated the advantages and disadvantages of multi-person conversations, and decided that our goals are better reached through one-on-one chat. Though multi-person chat can expose users to an even more diverse array of opinions, it also has the real potential of tarring conversations. With more than two people, there is always the potential for two people to join together in argument against another person or another group. This could be intimidating for users, and it would also encourage group-think. One-on-one conversations, on the other hand, are equally balanced, favoring no position. Users feel less intimidated to express opinions, think more freely, and are more inclined to see the other person eye to eye.

## 5.4 USER RESEARCH

As we developed our platform, user testing happened contemporaneously to guide the design. User testing served two main functions. First, it allowed us to simulate candidate features of the platform that had not yet been incorporated, to determine if they were in line with our broad goals. Second, it gave us the ability to test features that had been implemented to understand if they were actually used the way we wanted them to be.

### 5.4.1 TESTING THE BROAD IDEA AND PROMPTS

The first formal user testing was conducted after the idea of building a video-chat platform to match people with different political views was decided upon. We wanted to determine how different prompts to the users before and during their interaction would influence the conversation. To do this, we recruited 5 pairs of users, asked them to fill out a survey of their opinions, and engaged them in a conversation on Google Hangouts for 5 minutes.

Our experiments showed that the start of the conversation was generally awkward. Both parties had trouble finding a launching point, and most concluded that they should discuss the questions from the survey. Additionally, the time limit of 5 minutes was not quite long enough to get a healthy conversation going.

The variations on this experiment showed that not giving the users any prompt on what they disagreed about led to them having trouble finding a topic to discuss. Prompting them midway through the conversation was difficult, as there was not an obvious break. Additionally, the prompt did not influence the conversation significantly.

#### 5.4.2 TESTING A MOCKUP

After more fully specifying our design, we created a prototype in Axure, a wireframing and prototyping software, to user test. The prototype contained all of the pages and interactions of the final design, without the ability to actually video chat with another person.

We collected feedback from 18 user-testing sessions with the prototype. Most interactions involved asking the user to accomplish some task. These tasks included having a conversation, updating preferences after submitting feedback, and showing the leaderboard. The feedback helped us clarify parts of the platform that users did not understand or did not like and also provided inspiration for new features to implement.

Common themes that arose in this phase of user testing included discomfort with Facebook authentication and uncertainty about how a conversation should begin and what exactly should be discussed. This feedback informed our decision to create an intro page that would outline exactly how the platform works. We believed that this would mitigate concern about the role of Facebook in the platform because users would see that their Facebook information was not being used extensively. Our response to the feedback about conversation direction was more subtle. We aligned the tone of instruction across the platform to cultivate a civil tone, with the hope that doing so would translate into civil conversations.

#### 5.4.3 FUTURE TESTING

The fact that our prototype lacked the ability to create real video conversations between two users was a limiting factor. Future testing would make use of the capability to connect two users over the platform. This would be especially important for helping us user test different ways to prompt and guide the conversation.

### 5.5 BUSINESS MODEL

Eye to Eye is not intended to be a profitable venture. We created Eye to Eye with the mission of fixing problems with civil discourse, and are considering business models only so that Eye to Eye can find a way to be economically sustainable and remain operational. We start by examining the costs that Eye to Eye incurs and then look at ways that we could raise the money to pay these costs.

#### 5.5.1 DATABASE COSTS

The amount of user data we are storing is minimal. An empirical measurement of our own 12 user profiles and conversations found a mean storage size of 9.8K bytes per user and 1.3K bytes per conversation. Storage for reports is more difficult to anticipate since we hope reporting abuse to be rare considering our design decisions aimed to prevent trolling and abuse. Assuming each user has about 20 conversations associated with them we estimate that each user will occupy around 30KB of storage resources. This gives us about 33,000 users per paid GB of storage.

Our application also requires the ability to make many requests a second. Each conversation requires up to 4 queries to the database, and we need a database server able to handle this load.

Our database server, mlab, incorporates the ability to integrate with Amazon, Google, or Microsoft's cloud services. Based on an initial analysis of RAM, Storage, and price, Amazon has strictly the best deals at the time of this writing.

Pricing for mlab hosted databases on Amazon are free for the first 8GB and after that, the storage cost is approximately \$6 per GB per month, in 20GB increments.

These Amazon EC2 computers have high processing and 2GB RAM<sup>1</sup>, which is high enough to handle in the millions of hits per second. By estimating that our use will require approximately 4 hits per conversation, and have at a maximum 10,000 ongoing conversations (this is Omegle's peak volume), we anticipate that this hosting will be well above our needs.

### 5.5.2 SERVER HOSTING COSTS

Since the server establishes peer to peer video communication, and does not manage that video communication itself, our data flow needs are kept very low. We just need a server that is able to handle a maximum of 2 requests per second for each of our online users (this represents a maximum amount of activity we envision a user performing). At Omegle volume, that would be about 20,000 requests per second.

According to online reviews, Amazon's t2.small is able to handle this while providing excellent service for 2.3 cents per hour that it is used. This translates to just \$17/month<sup>2</sup>. With our \$250 of academic credit, this could pay for the entire first year of hosting costs.

Of course, more costs could arise. Some plausible situations that would lead to higher costs would be

1. If we decided to start tracking more information than we are currently, such as recording raw video or audio feeds from the conversations.
2. If we wanted to set up servers in different parts of the country to serve users marginally faster.
3. If we found that we had performance glitches that required switching to a higher performance tier for our Amazon hosting. It is difficult to anticipate

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<sup>1</sup>See their feature matrix by plan here <https://mlab.com/plans/>

<sup>2</sup><https://aws.amazon.com/ec2/pricing/on-demand/>

the server power we will need for a specific application without experimentation, even given Amazon reviews.

#### 5.5.3 LABOR COSTS

Our labor costs can be split into two categories: development and general maintenance.

For development, we are anticipating being able to manage our software open source on GitHub for free by volunteer developers. Our project has a strong social mission and a good base of initial developers (the students in the class) who are able to serve as the guides of the project by managing and approving incoming pull requests. Of course, interesting the GitHub Community in this project will require that Eye to Eye become well-known.

Perhaps more difficult than finding labor to build engineering features (which) is the general maintenance that has to be put in daily. This includes things like patrolling users who have been reported, updating questions, and ensuring our site is secure and unabused. This is a nontrivial amount of work, and is crucial to the day to day operation of Eye to Eye. This work will have to be done by a group of trusted and reliable people. Fortunately, many of these tasks don't require extensive technical experience with Eye to Eye, opening up the number of people qualified for this position significantly.

#### 5.5.4 REVENUE STREAMS

In order for Eye to Eye to sustainably cover the above costs, we will need a source of revenue from somewhere. We envision several options for this, addressed below from most to least desirable.

Our preferred revenue model would be to obtain funding from an established, civic-minded philanthropic organization or individual. Academic entities like the Berkman-Klein Center for Internet and Society at Harvard Law School may be interested in supporting this project themselves as part of their mission, or the donors who fund their work may be the kinds of individuals our fundraising

could target. A related model depends on crowd-sourcing donations from the general public, as Wikipedia does to cover its costs. The disadvantage of this approach compared to the previous one is that it depends on finding a large base of people who see the value in Eye to Eye, rather than convincing a few wealthy people to support the project.

Other approaches can avoid the uncertainty of fundraising altogether by moving to a more commercial model (while remaining a nonprofit). Eye to Eye could offer a subscription service where extra features are offered to paying members (for example, the ability to select which questions one is matched on, or to speak to someone from a specific region of the country). Online services like Spotify are able to survive on this model by converting a percentage of their free users to paying customers. The question for Eye to Eye is whether the cost of building out the extra features to lure users to a paid tier of membership would outweigh the revenue from these paid users. Other commercial options for raising revenue include selling the data arising from users of the platform or selling advertising space on the platform. Eye to Eye has more of a unique offering in the former case than the latter, since users' opinions on the stances could be useful to political polling firms. However, such a model would challenge the basis on which Eye to Eye was founded, since a political firm would likely use such information for the purpose of dividing the country rather than uniting it. Similarly, selling advertising space on the platform may raise questions about potential conflicts of interest given Eye to Eye's professed lack of bias. It is worth noting that these commercial models are not mutually exclusive, and some combination of all three options could be a feasible model.

## 5.6 CONCLUSION

Having enumerated the designed features of the Eye to Eye system and our reasons for choosing them, it remains to explain the technology that fulfilled this design. In the following section we describe system functionality in more detail.

# 6

## Engineering of System

We begin by giving a high-level overview of the technologies used in the Eye To Eye system. Then we provide a detailed explanation of how each major component of the application is implemented and why the respective technologies were chosen. Finally, we conclude with a network-level systems map to explain the relationship between the technical components of the system.

We explain the major technologies used in the creation of Eye To Eye and the reason each major technology was chosen. For a more technically rigorous explanation of the codebase, please see the documentation in our GitHub repository<sup>1</sup>.

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<sup>1</sup><https://github.com/Harvard-CS96/eye-to-eye/blob/readme/README.md>

## 6.1 OVERVIEW

Eye To Eye is a web application designed to enable peer-to-peer video conversations in any major browser between ideologically opposed users. The major technologies used are WebRTC for peer-to-peer communication, Socket.io for WebSockets, Node.js for web servers, tracking.js for facial recognition, MongoDB for the database, and Nginx for HTTP routing. All infrastructure is handled by Amazon Web Services.

Our motivations in selecting each of the technologies used in the application was to allow for rapid development, to create a system that was reliably fast, and to create an application that would scale in a resource efficient manner. The following section details each of the major technologies used and why each was chosen.

## 6.2 TECHNICAL DETAILS

Rather than provisioning custom servers, the application was built using the infrastructure provided by Amazon Web Services (AWS)<sup>2</sup>. Specifically, the application is hosted on an Amazon Elastic Compute Cloud (EC2) virtual machine instance.

We chose to use AWS to provide the infrastructure for our application because such a setup allowed us to focus on writing the application code and not worry about the infrastructure. Such a configuration yields large amounts of flexibility in scaling the server infrastructure as the number of users of the application increases, because we do not have to invest time and money into servers that we may not need later.

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<sup>2</sup><https://aws.amazon.com/>

### 6.2.1 SERVER

Eye To Eye was written using Node.js<sup>3</sup> to handle all application server-side code. Node.js takes an unconventional approach to handling server requests; rather than using a traditional thread pool approach to responding to incoming requests, Node.js uses a single threaded approach that makes heavy use of ECMAScript 6 Promises<sup>4</sup>. This design makes Node.js particularly fast at responding to large numbers of simple web requests. Since our application is designed such that it makes many simple server requests rather than fewer, more complicated requests, Node.js was a logical choice for application speed. Additionally, Node.js provides many pre-written packages that make web development occur quickly.

Even though Node.js is relatively fast with handling many simple requests, it is not as fast at handling more complicated requests. For this reason, we chose to use Nginx<sup>5</sup> as the primary web server. Nginx handles the complicated web tasks within our application that it was designed to excel at such as serving SSL certificates for HTTPS, compressing web traffic, and caching certain static files. We then use a reverse proxy on the server localhost to reroute basic web requests to the Node.js application-level server code. This system is able to capitalize upon the speed and ease of use of Node.js and the powerful functionality of Nginx.

### 6.2.2 WEB SOCKETS

While basic HTTPS is sufficient to load specific web pages within the application, full video chat application functionality requires a constant, two-way communication channel between the server and the client. WebSockets<sup>6</sup> solve this problem directly; WebSockets are a two-way communication channel that can be set up between clients and servers to allow for secure, ongoing communication after page load without AJAX. Consequently, we needed to

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<sup>3</sup><https://nodejs.org/en/>

<sup>4</sup>[https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global\\_Objects/Promise](https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Promise)

<sup>5</sup><https://www.nginx.com/>

<sup>6</sup><https://socket.io>

implement some form of WebSockets within our application. We chose to implement websockets using the Socket.io package. Socket.io was chosen because it is not only one of the most mature WebSockets implementation, but also because it integrates easily with Node.js.

### 6.2.3 PEER-TO-PEER COMMUNICATION

WebRTC (Web Real-Time Communication)<sup>7</sup> is a tool that allows data such as live video and audio to be sent between peer computers. A signaling server is used to exchange peer network location information but any subsequently transmitted data is sent directly through a peer connection. There are many openly available frameworks that implement video conversations using WebRTC, and our project uses a library created and open-sourced by AndYet<sup>8</sup> called SimpleWebRTC. In this section ‘local’ refers to the user in question and ‘peer’ refers to their conversation partner.

To send a video stream a conversation partner needs the local user’s IP address and publicly accessible network location. Normally the local user can self-discover this information using a Session Traversal Utilities for NAT (STUN) protocol, which is a RESTful protocol implemented on many public servers that provides the public IP address of the requesting application. However, sometimes STUN protocol functionality is ineffective in generating publicly accessible routes to requesting applications if the requesting application is sitting behind a highly secure firewall. If the STUN protocol fails for this reason (such as on the Harvard Secure WiFi network) then a TURN server is used instead. Traversal Using Relays around NAT (TURN) is a more advanced protocol that is able to identify a publicly accessible route to a requesting application even behind the most secure firewalls. We implemented the TURN protocol into Eye To Eye using a set of TURN servers provided by a third-party service called Xirsys<sup>9</sup>. This protocol allows peer-to-peer video calling to work

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<sup>7</sup><https://webrtc.org/>

<sup>8</sup><https://andyet.com/>

<sup>9</sup><https://xirsys.com/>

reliably across various networks.

Expecting that our application would involve synchronous video chatting, we knew we would be responsible for transferring a large amount of live video and audio data. We incorporated peer-to-peer (P2P) video chat functionality to minimize network bandwidth usage and web delay.

Our research suggested that Web Real-Time Communication (WebRTC) was the most mature P2P in-browser platform, and we consequently use it for all P2P video communications. Using the SimpleWebRTC package, Eye To Eye implements a signaling server, TURN endpoint, and peer-to-peer capable client-side scripts which allow WebRTC P2P communications for transmitting video streams.

#### 6.2.4 FACIAL TRACKING

We use a library called Tracking.js<sup>10</sup> to do the facial recognition work. Tracking.js was originally chosen because it is one of the few facial tracking libraries available which allows tracking of multiple faces in a frame, but in the course of building this feature we found that modifications to enable smooth tracking were needed. As a consequence of these modifications, our platform assumes that there is only one face in the video at one time. We add a canvas element to the HTML which maps directly over the peer video stream, using CSS styling. To err on the side of safety, if a face cannot be detected then the canvas element appears entirely white with the message “No face found”, and nothing of the peer user’s video stream is shown. The work of cutting out the peer user’s face is done by methods on the canvas element. This masking is done on the client side ensure safety.

When WebRTC detects that a peer video stream has been added, the program collects the dynamically-updated peer video stream ID, and passes that to the track function implemented by Tracking.js. The tracker samples ten frames of the video stream per second (one of our modifications to the Tracking.js library)<sup>11</sup> and in each frame locates the face in a rectangle and returns the geometric fields

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<sup>10</sup><https://trackingjs.com/>

<sup>11</sup><https://github.com/eduardolundgren/tracking.js/issues/182>

needed to construct the rectangle around the face. As mentioned above, our smoothing modifications assume there is only one face in the frame at one time. However this is not an immutable part of the facial tracking, as we have designed but not implemented a version of the tracking which could assume the presence of at most two faces in any given frame. But while Tracking.js can handle more than one face in the frame at a time, accuracy does decline as more faces appear.

There are two components of smooth facial tracking. Firstly, we average the last ten locations of the face to produce the coordinates of the current oval being drawn. The number ten was chosen after some trial and error with the goal in mind of limiting the ‘jerkiness’ of the oval movement across the screen while still tracking rapid face movement. Secondly, the program limits the number of ‘false negative white-outs’, whereby the facial tracking fails to detect a face when one is in fact present, resulting in a white-out of video stream that is actually safe to view. The program limits the number of these false negatives by continuing to show the oval corresponding to the last face detected during the last ten frames (which corresponds to one second). The program checks whether a face has been detected in the current frame. If not, it also checks whether a face has been detected at some point during the last ten frames and if it has, then it uses that most recent face data rather than displaying nothing at all. This is because the facial recognition library is not 100% accurate, and does not always find a face in every single of the ten frames that are sampled during a second. Since the default is to show an entirely white screen with the error message “No face found”, a failure to detect a face every few frames can be distracting to the local user. Rather than wiping out the peer video every time that this happens, the script uses the most recent facial data. This allows users to move their face slightly as during normal conversation rather than having their face disappear entirely. This desire must be balanced against the risk of a nudity attack, and ten frames was chosen because one second should be enough time to white out the screen before indecent imagery is sent to the local user. It must be admitted however that more work is needed to optimize this variable, but such testing is difficult for obvious reasons surrounding the nature of a nudity attack.

These elements ensure that as one's partner's face moves naturally across the screen, the oval tracks with them to show their face. As mentioned, the script paints the peer video stream with a completely white canvas to begin with as a safety precaution. It then takes the largest face found, finds the center of that face, and draws an oval around it which cuts through the white canvas and is shown to the user from the peer video stream underneath.

#### 6.2.5 DATABASE

Professor Stratos Idreos advised us to use MongoDB,<sup>12</sup> a NoSQL database program, for persisting data on the backend because of three key qualities: its simplicity, flexibility, and solid support for development with Node.js. Taking all of these factors together, MongoDB seemed like the best database program to support the rapid, dynamic development of our application.

Firstly, MongoDB offered simplicity. A key difference between traditional relational SQL systems (e.g., MySQL) and MongoDB systems lies in the way they store data. Traditional relational SQL systems store data in a highly structured way. The disadvantage of these relational systems is that they have a higher memory footprint. On the other hand, at its core MongoDB is just a distributed key-value store. We expect our application to require simple transactional workloads, like record inserts and lookups. Therefore a full-blown relational system and its support for complex analytical queries, like joining and aggregating across many tables, seemed unnecessary.

Secondly, MongoDB offered flexibility in the types of records it could store. The beauty of MongoDB, and any other document-based data store, is that anything that can be expressed in JSON can also be stored as a record in the database. This flexibility allows for data models whose structures are more intuitive. The structures are identical to their JavaScript representations that are manipulated in the application code, and thus easier to work with from a development standpoint.

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<sup>12</sup><https://www.mongodb.com/>

Thirdly, MongoDB has solid support for development in Node.js. The Node package, Mongoose, which we employ extensively, provides useful abstractions for working with MongoDB in Node.js. Mongoose handles connecting to the database, adding type-safety to our data models, and streamlining queries to the database.

#### 6.2.6 MATCHING ALGORITHM

To pair users in video chats with others that disagree with them on a certain topic, we developed a matching algorithm that ensures satisfactory matches. We designed the platform so that users can only discuss topics from a set of currently active topics. We create a question for each topic. Users can respond how strongly they agree or disagree on statements about the topics they want to talk about. For example, one question might be: “Do Democrats have a responsibility to try to work with President Trump?” Users provide their stances on a scale from strongly disagree (1), somewhat disagree (2), neutral (3), somewhat agree (4), and strongly agree (5). We use the responses that users provide in our matching algorithm to match users with different ideologies.

We match a user with another user only if the two users answer differently on a particular statement. We currently define “different answers” to be when the two answers are not the same. As our user base grows, we could easily change “different answers” to mean two answers that are at least some finite distance apart on the numeric scale to ensure a stronger difference of opinion.

When a user is ready to chat with a new person, the matching algorithm searches the database for other online users who are currently unpaired. For each of these unpaired users, we check if there is disagreement on at least one statement. If there is a difference, we match the two users on that question. To ensure that a user does not repeatedly speak on the same topic, we randomize the order of the user’s responses to questions, so that the matching algorithm does not prioritize any one question. To ensure that users who have been waiting the longest to find a match are prioritized, we implement a queue data structure for

all online unpaired users. Additionally, we maintain a tabu list for each user of partners from recent conversations, and prevent matching between those pairs.

#### 6.2.7 FRONT END

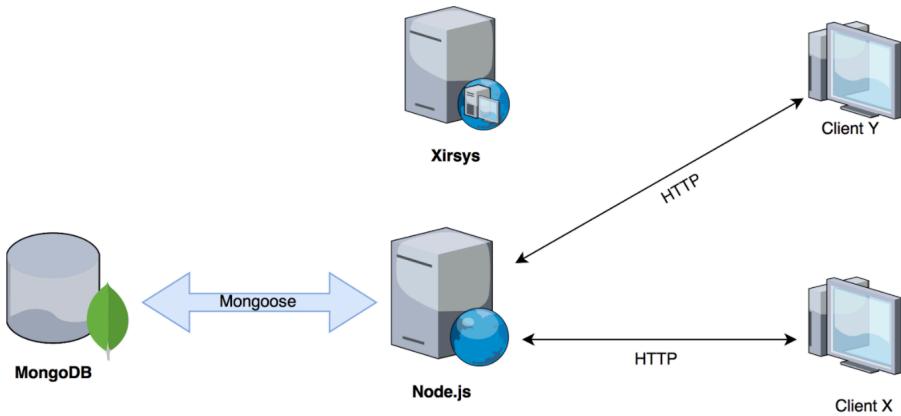
The front end of the application was built using Handlebars.js, HTML, CSS, jQuery, and AJAX. Handlebars<sup>13</sup> is a JavaScript library that allows for building and compiling of semantic templates. These templates can contain both HTML as well as JavaScript expressions that are evaluated in context. Partial components, such as the user's conversation history, navigation bar, and topics, with their own context are sectioned out in block expressions in the templates. Block expressions come with corresponding helper functions that generate the HTML for each section; one such helper makes an AJAX call to fetch a user's conversation history from the database.

Styling of the platform was done with Cascading Style Sheets (CSS) and used some classes and elements from the library Twitter Bootstrap<sup>14</sup>.

### 6.3 SYSTEMS INTERACTIONS

Next, we detail how each system within the application interacts with the other systems at the network level. Within the network diagrams in this section, black arrows represent single-time communications sent between systems while blue arrows represent session-long two-way communication channels. The width of the communication channel represents the relative amount of bandwidth the communication channel is capable of handling.

The application life-cycle begins with clients connecting to the primary Node.js server over HTTP. In actuality, this HTTP connection sits atop an SSL encryption layer securing the connection via HTTPS. The Node.js server is in-turn connected to the MongoDB database via the Mongoose abstraction layer.



**Figure 6.3.1**

The initial network configuration is shown in Figure 6.3.1.

After establishing the initial network connection, the HTTP(S) connection is immediately upgraded to a WebSockets connection which enables continuous two-way communication between the Node.js server and the clients in a secure fashion. This network configuration is shown in Figure 6.3.2.

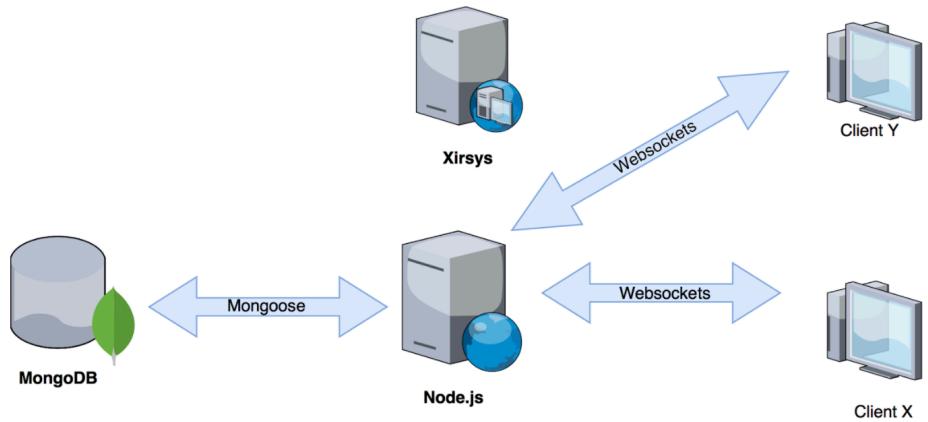
After upgrading to a WebSockets connection, each client must now self-discover its publicly-accessible network location in order to establish a peer-to-peer communication channel for a WebRTC video stream connection. This is accomplished using the TURN protocol with TURN servers provided by the 3rd party service Xirsys. This network configuration is shown in Figure 6.3.3.

After each client has self-discovered its location, it then uses the existing WebSockets communication channel with the Node.js server to transmit its network location to the peer client that it was paired with using the matching algorithm and the application state provided by the MongoDB connection. After receiving complementary network location information data, the paired clients

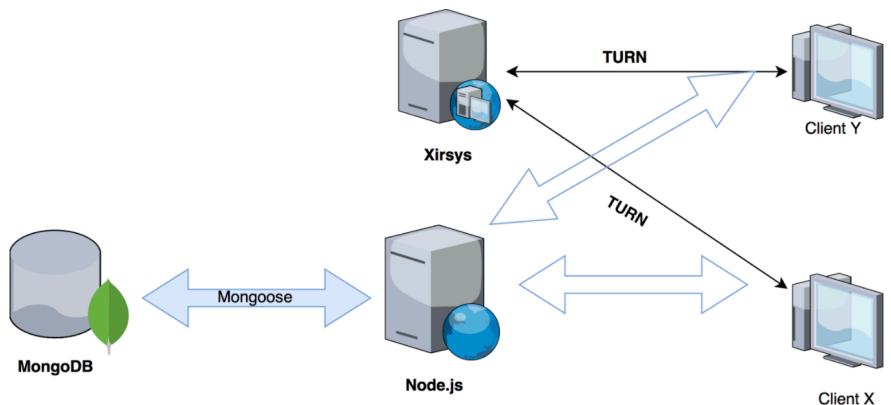
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<sup>13</sup><http://handlebarsjs.com/>

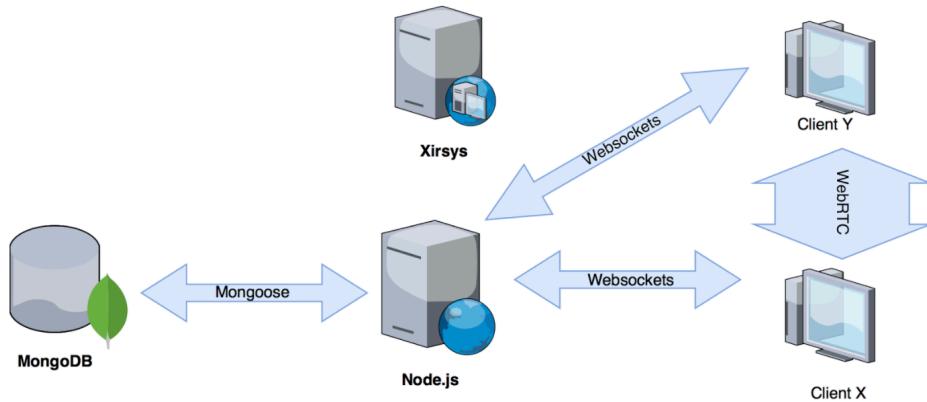
<sup>14</sup><http://bootstrapdocs.com/v2.0.2/docs/>



**Figure 6.3.2**



**Figure 6.3.3**



**Figure 6.3.4**

initiate a peer-to-peer connection using the WebRTC protocol. The final network configuration is shown in Figure 6.3.4.

The above network configuration in Figure 6.3.4 represents the final network communication channel circuit that is required by the Eye To Eye application life-cycle.

#### 6.4 UNIT TESTING

In order to ensure the code integrity of our system, we implemented unit testing. We limited the scope of our tests to routing, that is making sure that the server responds correctly to requests for specific pages, such as the landing page. More crucially, we check that certain pages, such as the matching page, are unavailable when no user is logged in. As the code base matures, we aim to automate unit testing with continuous integration and to write tests that go beyond mere request checking. We refrained from doing so for the time being, since major components of our system's architecture changed frequently, which would have required us to spend considerable time maintaining already written tests, thus conflicting with our engineering goal of rapid development.

## 6.5 CONCLUSION

While we built a successful prototype platform that works well and passes all unit tests, there are undoubtedly further features that could be added and even entirely new directions to take the platform. We discuss these possibilities in the next chapter.

# 7

## Next Steps

There is still room to improve the extent to which our prototype embodies the values of empathy, civil discourse, and open-mindedness. What follows are descriptions of additional features we designed that would ideally be implemented next.

### 7.1 ADDITIONAL FEATURES

In the limited time we had to build the prototype, we were not able to implement or A/B test all of the features we had designed. These are the next series of features we would build and test.

### 7.1.1 LIVE CONVERSATION INTERVENTIONS

While conversations in our prototype are currently freeform and “unregulated”, in the future we would like to improve conversations by providing real-time interventions. These would be text prompts that appear on top of the video screens on the conversation page and would be triggered by certain events or at certain times.

One example intervention would be prompts that structure the conversation around certain topics. At the beginning of the conversation, the two users may be shown an interest or belief they have in common to encourage them to discuss something they agree upon and demonstrate common ground. This would help them relate to each other. Then after a certain number of minutes, users would be prompted to discuss the topic of disagreement. Having already found common ground, this would increase the likelihood that the conversation is civil and not contentious. Should tensions rise in the conversation, further interventions could appear with prompts like, “Explain the story behind your view.” Asking the user to describe life experiences leading up to their opinion increases the chance that the other user will empathize.

Interventions could also be used to provide helpful feedback to the user in real time to help improve their own discourse skills. This would involve showing data during the conversation that captures information like what proportion of the conversation time was spent talking by each user, volume, points of interruption, etc. to trigger interventions telling the user that they are dominating the conversation and not listening enough, interrupting too much, or using a raised voice.

### 7.1.2 SYSTEM CHECK

We wanted to have users go through a system check to ensure that their webcam, speakers, and microphone were all working and that a face was detected before entering matching once per session, as technical difficulties would cause frustration and detract from the goal of having civil discourse.

#### 7.1.3 TACKLING ABUSE

The prototype contains a method for reporting abuse after having a conversation. Eventually the matching algorithm should be changed so as to never match the user with the reported user in the future. In addition, users that have been reported multiple times, upon further inspection, should be blacklisted from the platform. Finally, to help examine if the conversations were actually harmful, screenshots should be forwarded to the server when the call is ended. The heavy emphasis on preventing and addressing abuse for this project is to prevent users from having negative or traumatic experiences from trolls or bullies that currently plague video chat platforms like Chatroulette.

#### 7.1.4 LANGUAGE/LOCATION SPECIFICATION

In its current state, the platform does not ask people for language or location preferences. This means users who speak different languages might be paired with one another. Allowing a person to preference a language and location will prevent this from happening. Furthermore, it might allow a person practicing a new language or wishing to speak to a person from a particular location to do so.

#### 7.1.5 AUTOMATING QUESTION SELECTION

Questions are currently manually hand-picked to be displayed on the profile page. While this ensures quality and relevance of the topics, questions are narrowly defined by the team member(s) responsible for this task. Potential future solutions to address this would be crawling over news sites and selecting trending topics or crowdsourcing questions and vetting them for quality and relevance.

#### 7.1.6 MUTUAL FACEBOOK LIKES

If users feel comfortable sharing their Facebook likes, this data could be incorporated into the matching algorithm and displayed prior to entering the

conversation in case there are mutual likes. Shared interests can also be gauged using data from other platforms such as Spotify (for mutually-liked songs or artists). Interests might also be selected manually through the platform.

#### 7.1.7 TRACKING PROGRESS

The goal of this platform is not to encourage users to persuade other users or to “win” the conversation. However, to gauge the effect of our platform, it would be useful to determine how much users’ stances changed or were swayed from their initial declared stances to their final declared stances to see if there is a decrease in polarization. This could also be displayed on the profile.

#### 7.1.8 CONTINUING THE CONVERSATION

While our baseline goal is for users to have fruitful, civil discussions, we would consider the platform additionally successful if users can make meaningful connections not constrained by the random matching and ephemerality of our platform. A future feature would allow users to share their contact information (be it their e-mail or social media accounts) via mutual opt-in for an opportunity to continue the discussion at another time.

#### 7.1.9 SCHEDULED CONVERSATIONS/CONVERSATION WINDOW

The platform as it currently exists has a “critical mass” problem: if there are not enough users online at any given time, the algorithm might not be able to find anyone who they can be matched with. Rather than being paired with another user in real time, users might schedule conversations in advance based on their anticipated availability, or the platform might be open only during certain times of day. This way, everyone who wants to have a conversation will be present at the same time. “HQ” is an example of how this sort of a feature has been successfully implemented in the past.

## 7.2 POTENTIAL EXTENSIONS

In addition to the individual features outlined above, we have also considered ways in which the platform might be extended more broadly. Each of the following extensions can be built using our existing platform as a base. While each extension includes some new features, it should still address the goals that were defined earlier in this report. While extending Eye to Eye in any of the following ways will incur some trade-offs, it will reorient the platform such that it is better equipped to address some facet of civil discourse, and it will ameliorate some potential criticisms of the base platform.

### 7.2.1 PEN PALS

One potential extension would pair classrooms rather than individuals. The app would be aimed primarily at elementary-school students, and it would use US Department of Education data to pair classrooms whose students are likely to differ ideologically later in life. The matching algorithm could account for factors including a school's geography, socio-economic break-down, and racial statistics. Within classrooms, individual students might be paired based on similar hobbies or interests. The primary goal of this application will be to prevent toxicity before it even starts by providing young people with a window into a different part of the country.

This extension would help the platform succeed in two vital areas. First, it would reduce the critical-mass problem where the app needs a certain number of users using it at any given time in order to match individuals. Classrooms can schedule conversations in advance. Second, it would help solve the selection-bias problem. The app as it currently stands might attract users from a particular background who are especially open-minded and not the toxic partisans whom we would like to help. Elementary school students will be unlikely to judge their partners before meeting them, and are less likely to be predisposed to any sort of political ideology. Thus, this platform has a greater potential than the base

application to curb toxicity: rather than attracting toxic commenters and inspiring them to think open-mindedly, the pen-pal will prevent future toxic commenters.

#### 7.2.2 GOAL-ORIENTED ACTIVITIES

When two users are paired with one another using the base platform, we do not provide any direction as to how a conversation should begin. Potentially, this lack of structure can lead to some awkwardness as users are getting acquainted.

Furthermore, while the current platform is designed with the hope that users will “hit it off” and like one another, there is no built in mechanism, other than feedback, to facilitate positive interactions. A poor possible result of this platform would be that one-on-one interactions confirm the worst suspicions people have about people with whom they disagree rather than undermine them.

A possible extension for the platform would include pairing users as the platform currently does, but then embarking them on some sort of a goal-oriented task. This task might be to solve a puzzle or to work together to find some area of agreement. Successful completion of the task might lead to a reward of some kind. By providing users with something to do from the get-go, the period of awkwardness at the start of interactions will be greatly reduced.

(Consider the popularity of games like *Call of Duty* or *Overwatch*, where strangers are incentivized to communicate with teammates, and have no qualms in doing so). Another major advantage of this sort of a platform is that it might promote more positive interactions. For one thing, forcing individuals to work together in some shared pursuit should promote teamwork, forcing them “to transcend their ontological circumstances” [Matusov, 2009]. One study paired Israeli Arab and Israeli Jewish individuals together and tasked them with working together to construct a historical narrative. According to the study, the exercise caused individuals to not only value different viewpoints, but it forced introspection on one’s own viewpoint [Pollack and Kolikant, 2012]. It would not be difficult at all to translate this sort of an activity to our application, and might help make the

overall experience of using it more profound.

### 7.3 CONCLUSION

We discussed additional features that we like to add to the current implementation of Eye To Eye, including conversation interventions, systems checking, abusive user blacklisting, localization, automated question selections, progress tracking, continued conversations, and scheduled conversations. Additionally, we highlighted two large extensions to the platform that we envisioned including elementary school pen pals and goal oriented activity bonding. With an understanding of the future direction of this project, we now reflect on the overall project and its success.

# 8

## Conclusion

At this moment in history, tension, division, and hostility characterize the state of American political and ideological discourse. Not only do these problems affect the government's ability to function — it has also has marked effects on the quality of life and safety of American citizens. In taxonomizing the problem with public discourse in the United States, we have identified three overarching issues: misinformation, the proliferation of communication and news that is misleading or outright untrue; polarization, the widening policy and cultural difference between two increasingly distinct groups of Americans; and toxicity, the tendency of people to interact vitriolically with one another.

Research in fields ranging from political science to cognitive psychology suggests that technology has played a role in exacerbating each of these issues. Major social media sites have inadvertently become platforms for disseminating deliberately misleading information that influences public opinion. Selective

exposure to news media on sites trying to serve up the most engaging content can create echo chambers. Studies show that dehumanization on the Internet leads people to be more readily hostile towards one another in website comment sections than in real life conversations.

Although technology appears to be part of the problem with public discourse in the United States, we hope that it can be part of the solution, too. In the hopes of introducing an element of humanity and, by extension, civility to online political and ideological discourse, we have designed and implemented a video chatting application with the specific aim of connecting people with different beliefs to have real-time, face-to-face conversations. We believe that the prototype we have developed achieves our core goals of appealing to and promoting civil, humanized discourse between people with diverse ideologies, all while preserving user privacy and safety. We know, too, that there is room to build upon the foundation we have laid, both through technical improvements and feature additions.

The health of American democracy is inextricably intertwined with the health of American public discourse. Our hope is that, through technological solutions like the one we present in this paper, we might begin to mend the latter, thereby strengthening the former.

# 9

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The research, design and implementation of this project would not have been possible without the help of many individuals. We would like to express our gratitude to everyone who supported us over the course of this semester-long project.

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# A

## Terms of Use

### Terms of Service ("Terms")

Last updated: November 08, 2017

#### 1. ACKNOWLEDGEMENT AND ACCEPTANCE OF TERMS

Please read these Terms of Service ("Terms", "Terms of Service") carefully before accessing the website at <https://eyetoeye.video> (the "Service") operated by EyeToEye ("us", "we", or "our").

Your access to and use of the Service is conditioned on your acceptance of and compliance with these Terms. These Terms apply to all visitors, users and others who access or use the Service. If you disagree with any part of the terms, then you may not register an account or access the Service.

#### 2. MODIFICATIONS TO SERVICE

We also reserve the right to change these Terms of Service, with or without notice to you. You acknowledge and agree that reviewing the Service and the Terms of Use periodically and being aware of any modifications is your responsibility. Your continued use of this Service after any modifications will constitute your acknowledgement of the modified Terms of Use and agreement to abide and be bound by the modified Terms of Use.

### **3. REGISTRATION OBLIGATIONS AND REQUIREMENTS**

If you choose to register for the Service, you are required to authenticate your account by a Facebook login. You agree to provide and maintain true, accurate, current and complete information about yourself.

If you are under 13 years of age, you are not authorized to use the Service. By using the Service, you hereby warrant that you are at least 13 years old. If you are under the age of 18, you may use the Service only with the approval of your parent or guardian. In addition, you should review these terms with your parent or guardian to make sure that you and your parent or guardian understand and agree with these terms. Please help report users that appear to be under the age of 13 for our team to review.

You are solely responsible for taking all steps to ensure that no unauthorized person shall have access to your account password or any other account information, and you are fully responsible for any and all activities that occur under your password or account. Also, you will not use or attempt to use another user's account, username, or password without their permission.

### **4. USE OF THE SERVICE**

#### **Services Description**

The Service is an online platform designed to pair individuals who disagree on a given topic together, based on ratings and other factors, and to enable individuals to chat and communicate online through two-way video conversation.

#### **User Interactions**

Users are solely responsible for all of your communications and interactions with other users of the site or services and with other persons with whom they communicate or interact as a result of their use of the Service. We do not recommend nor encourage users to submit confidential or proprietary information to other users.

We make no representations or warranties as to the conduct of users of the site or services or their compatibility with any current or future users of the site or services. Everyone enjoys civil conservation and behavior. Keep offensive comments and insults to yourself. Remember the other user is a person, so please be mindful of his or her feelings. Acknowledge that conversation is a two-way street. Don't speak to others in a way that you wouldn't want to be spoken to.

#### **Warranty Disclaimer**

When using the Service, users will be exposed to the arguments of other users developed through their own variety of experiences and sources. We are not responsible for the accuracy, usefulness, or safety of the material you are exposed to, as you agree to waive any legal or equitable rights or remedies you have or may have against us. When on the site or services, if you feel uncomfortable or that you are being harassed, we recommend that you immediately disconnect from the chat and report the user.

#### Reporting Accurate Opinions

We ask users to enter accurate stances on discussion topics. We use a unique algorithm to match you to another user with whom you disagree on the given topic, so you can hear about a different perspective.

By lying about your perspective, it will bring an unfair and fulfilling experience for others. If discovered, our system has the right to automatically correct the information for you. Please help report users that appear to have the incorrect information for our team to review.

#### User Conduct

Subject to the terms and conditions of this Terms of Service, user conduct is subject to all applicable laws and regulations, and users are responsible for compliance with any applicable local laws. Users are solely responsible for all content that they publish or display on the Service. In order to protect users from content that is inaccurate, offensive, indecent, or objectionable, users may not publish or display content that:

- (i) promotes illegal activities that violate any applicable law or regulation,
- (ii) is sexually explicit, vulgar or offensive,
- (iii) promotes discrimination, bigotry, racism, hatred, harassment or harm against any individual or group,
- (iv) is violent or threatening.

We do not tolerate cyberbullying. Cyberbullying includes, but is not limited to, any action taken to offend another user through the use of inappropriate behavior, nudity, violence, profanity, racism, sexism, threats, illegal actions, and so on. Please help report users that show any of these behaviors and they will be blocked.

Users may not use the Service to attempt to gain unauthorized access to any portion of the Service, or any systems or networks connected to the Service. You may not copy, modify, distribute, sell, or lease any part of our Services, nor may you reverse engineer or attempt to extract the source code of that software, unless applicable laws prohibit these restrictions or you have our written permission to

do so. You will not use any robot, spider, crawler, scraper, or other automated means or interface to access the Services or extract other user's information.

## 5. TERMINATION DISCLOSURE

We reserve the right to terminate or suspend, without cause or notice, any account, for whatever reason, including without the breaching of the Terms. We will terminate accounts that we think are abusive towards other users of the community or against the purpose of our Service. All provisions of these Terms will survive termination, including, without limitation, ownership provisions, warranty disclaimers, indemnity, and limitations of liability.

## 6. INTELLECTUAL PROPERTY DISCLOSURE

The Website and its original content, functionality, and design of found on the website is the property of Eye To Eye.

## 7. PRIVACY POLICY

Our Privacy Policy applies to the use of the Services. By using the Service, you consent to our collection and use of personal data as outlined therein. This Privacy Policy does not address the privacy practices of any third parties that we do not own, control, or are affiliated with.

### Record of Chats

At the beginning of every video chat, a record is made of the fact that a chat occurred between you and your partner. This record includes a timestamp, as well as IP address, ID cookie, and similar information for both parties. These records may be used for the purpose of tracking trolls, spammers, hackers, and others that misuse or disuse the Service; and may also be used for law enforcement purposes; or analyzed in aggregate to produce statistical data for research. Webcam images may be captured from the Service's video chats, uploaded to our servers, and monitored for misbehavior as part of our moderation and enforcement processes. It is also possible for either partner to take screenshots of video chats, or to use third-party software to record them.

### IP address

Our Services is a P2P (peer-to-peer) video chat system, which requires a direct connection to be made between your computer and your partner's computer. To

do this, it is necessary to make your IP address available to your partner's computer, although it is not shown to the other user by our Service's user interface.

#### Cookies

This service uses cookies to save user preferences and technical information about your computer system. Cookies are files with data created by a website to recognize you and keep track of your preferences. The data is sent to your browser from the website that you visit and are stored on your device internal memory. This Service does not use these "cookies" explicitly. However, the app may use third party code and libraries that use "cookies" to collect information and to improve their services. You have the option to either accept or refuse these cookies and know when a cookie is being sent to your device. If you choose to refuse our cookies, you may not be able to use some portions of this Service.

#### Facebook Integration

In order to access and use this Service, users must register by linking with a Facebook account. Currently, Facebook integration is used to:

- (i) Verify identity and authenticate your account,
- (ii) Access your name and other personal details,
- (iii) Use list of pages liked on Facebook to match you with other users

However, we will not share this information with any third parties. We will never share users' personal information or behavior on this Service with Facebook. We will not post to your Facebook page, unless you perform actions you explicitly initiate. Use of Facebook is subject to Facebook's privacy policy.