

The Future of Participatory Democracy in a Post-Truth Age

Saym Hussain 01348926
Esther Maltby 01227972
Jordan Kotler 01387524
Tomáš Knaze 01412280
Ella Cope 01349976

Tutors:
Dr Sam Cooper
Dr Freddie Page

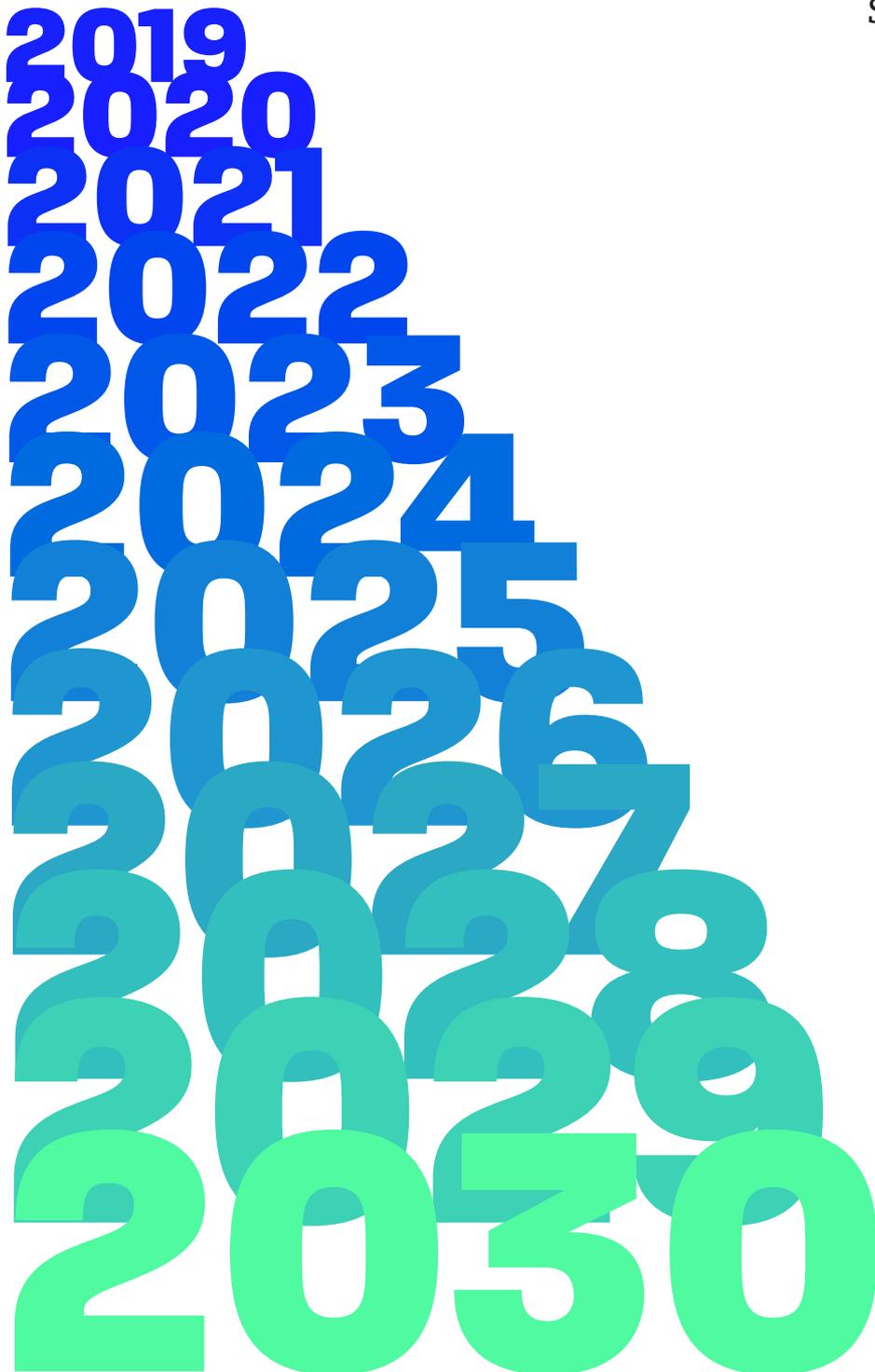


Table of Contents

1. Abstract	1
2. Introduction	1
3. Future Contextual Studies	1
4. Design Definition	4
4.1 Foresight Analysis	4
4.2 Future Narratives	5
4.3 Literature Review and Validation	6
4.4 Design Objectives	9
4.5 Preferred Future	9
5. Ideation	10
6. Conclusion	12
7. Project Management	12
8. References	13
9. Appendix	16

1. Abstract

The volatility of political discourse on social media, through misinformation and targeted advertising, has tested democracy and the integrity of truth within online spaces. This has given rise to the echo-chamber effect, compromising the ability for citizens to make rational and informed decisions when voting (the basic principle of democracy). This report discusses the complex political, psychological, and technological factors that will affect participatory democracy in the UK by 2030. In the report, it is argued that misinformation and the threat to individual freedom of thought poses a major risk to the integrity of democracy in 2030 but that there is also significant scope for a meaningful design intervention. Moreover, the report discusses potential concepts that could be implemented by 2030 to mitigate the identified problems and concludes on a design direction that involves a collective online space, which will later be developed and refined in the Design Engineering Futures project.

2. Introduction

This report explores the current and future proficiency of the United Kingdom's (UK's) parliamentary democracy within a digital age, researching worldwide case studies as evidence of trends and potential developments. The number of factors affecting the results of a democratic vote is increased by technological advancements. Current and potential future issues that compromise the democratic system are explored, particularly through the spread of increasingly indiscernible fake news¹.

The fabrication of information is not a new concept. Historically, leaders have used propaganda to slander opponents and influence public perception, with documented examples dating back to the Roman Empire (Posetti & Matthews, 2018). However, only in its contemporary form as fake news, has it been provided with channels to disseminate rapidly. A new paradigm for receiving information has been created through

social media, arguably influencing the opinions of people and the results of democratic votes.

The pertinence of this issue was highlighted by the UK's 2016 referendum on European Union (EU) membership. It was argued that both campaigns were frequently misrepresenting facts to voters, and targeting persuasive information at vulnerable groups². The Office for National Statistics describe the Leave campaign's claims to give back to the NHS "the £350 million" taken weekly by the EU, as "potentially misleading" (Office for National Statistics, 2017). Similarly, The Treasury Select Committee found the Remain campaign's statement referring to families being "worse off by £4,300 a year", as being "mistaken" and leading to "confused" voters (House of Commons Treasury Committee, 2016). The spread of misinformation³ from high profile sources and social media has led to increased scepticism in voters.

As modern society in the UK is based on democracy, democratic decisions directly affect citizens' lives and therefore the suitability of current methods must be assessed, in order to regulate the accuracy and fairness of political discourse.

3. Future Contextual Studies

Democratic Systems

The purpose of democratic systems is to allow citizens to exercise their power to direct the course of government. However, as technology and society advances, new challenges will emerge, threatening the effectiveness of democracy and raising the question: are current systems still fit for purpose? In order to ascertain the key problems to address, broader contextual research was conducted on current and preferable states of technology and society to understand their impact. Past and present case studies of democracies and issues affecting them were investigated to identify potential trends that will influence the future development of democratic systems.

A large spectrum of participatory democracies exists today, as different governments interpret democratic concepts in different ways. In most countries, representative democracies prevail on the state level, as direct democracy would be too complicated to implement. A group of representatives can utilise their expertise in policymaking to represent the interests of the citizens that voted for them. Although most countries claim to be governed according to democratic principles, the Democracy Index, which assesses countries based on 60 indicators in 5 different categories (electoral process and pluralism, civil liberties, functioning of government, political participation, and political culture) states that only

[1] Fake news - misinformation created and spread with the intent to influence political views

[2] Vulnerable groups - groups who face distinct disadvantages and are in need of extra protections due to factors such as geographic location, ethnicity, gender, age, ability and citizenship.

[3] Misinformation - false or inaccurate information with the intent to deceive

4.5% of the world's population lives in a full democracy (Economist's Intelligence Unit [EIU]), 2019). The EIU also states that the majority of people (43.2%) live in 'flawed' democracies. These are defined as countries with free and fair elections where basic civil liberties are respected. However, the EIU also explains that there are significant weaknesses in other aspects of democracy in these countries, including problems in governance, an underdeveloped political culture, and low levels of political participation. As future challenges emerge, the degree to which our democracies are considered flawed is likely to increase.

A deeper analysis of democratic components uncovers further flaws in existing methods. For example, voting systems including first past the post and single transferable vote, are subject to five voting paradoxes: the spoiler effect, cyclical preferences, failure of monotonicity, dictatorship and imposition (Exploratorium, 2016). Arrow's Impossibility Theorem states that there is no way to avoid all five paradoxes (Morreau & Zalta, 2016). Therefore, it could be argued that voting systems depend on the preferences of a country as there is no fair method of reflecting the opinion of the entire electorate.

Another existing flaw is caused by voter restriction laws which, if implemented poorly, may reduce the turnout for an election. It is argued that laws in American states with stricter identification requirements result in reduced voter participation and this occurs to a 'greater extent for less educated and lower-income populations, for both minorities and non-minorities' (Alvarez, Bailey & Katz, 2008).

Finally, gerrymandering is a common technique used in representative democracies with electoral constituencies, where the winner-takes-all system awards an entire region to the party with the majority vote. Gerrymandering works by redrawing constituency boundaries, aiming to group together enough single party voters (Republican or Democratic for example) to win a majority in that region without excess. This means each vote on the winning side has greater power because it is spread out (Chen & Rodden, 2013).

Social Media

A more external factor affecting democratic systems is social media. These media platforms have significantly changed the way people form, discuss and evaluate their opinions. They were originally built to encourage online social interaction, not to host political discussions, but this is increasingly how they are being used. Their primary aim is to maximise user engagement as this generates revenue from advertisements. Polarising and sensational content is pushed more heavily by platform creators as it drives clicks and views. This creates a misalignment between what people go on to the platform to experience, and what they actually achieve. In addition, with addictive user interaction features, there are known neurological and psychological effects from engaging with social media. This includes the

release of dopamine, which taps into the reward centre of the brain to reinforce addictive behaviours (Parkin, 2018).

Social media provides a platform for the rapid spread of information and opinions, leading to uprisings where people can exert power as a collective and challenge the system. As shown recently, it played a beneficial and significant role in the documentation, organisation, and assembly of the large-scale protests in Hong Kong (Shao, 2019). Social media is being used by protesters to conceal identities, spread information, mobilise demonstrators and avoid detainment. Conversely, Facebook and other platforms were used by Myanmar military personnel who shared hate posts and false information about the Muslim Rohingya minority group, turning the social network into a tool for ethnic cleansing (Mozur, 2018).

Newer social media platforms present a means of effectively sharing online information and opinion. Polis is a platform specifically tailored for sharing, discussing and preserving minority opinions. It allows users to enter statements for others to take a position on. The user can respond to posted statements in three ways: 'agree,' 'disagree,' or 'pass' and users who voted similarly are clustered into opinion groups (Oiticica & Fletcher, 2016). Polis visually defines and gives space to divergent opinion groups and breaks the community's deadlock by identifying the points of consensus, hence encouraging compromise. However, it could be suggested that Polis is therefore only competent at identifying problems rather than forming solutions.

Polis was implemented in Taiwan, where the government used it to connect with young people through a platform called vTaiwan. Users then engaged in large scale deliberation on topics ranging from online alcohol sales to allowing Uber to be introduced in cities in Taiwan (Horton, 2018). Horton states that two hundred thousand people participated in the Uber debate, resulting in seven final statements that aimed to create a level playing field for Uber and other taxi firms and had almost universal approval. The government then adopted these statements in the form of new regulations. It should be noted that the statements were not directly implemented into new legislation, and could still be overpowered by the government's veto. The platform has only been used to debate issues regarding technology due to concerns around the limitations of access to digital platforms for all citizens.

Social media has also created an environment where data about user interaction is stored and used to tailor content to the user. A prolific example is the Cambridge Analytica case. The firm took advantage of Facebook's loophole to collect data on over fifty million users without their consent (Chang, 2018). They then used peoples' responses to quizzes and third-party apps to build profiles of voters based on their interests and personality traits. Users who were determined to be undecided or easily persuadable on the account of their political views were then targeted with partisan and

often untrue ads. The company was involved with the Leave campaign in the UK's Brexit vote and with the Trump campaign in the 2016 US presidential race, both of which won their respective elections (Mayer, 2018).

Misinformation

Currently, misinformation on social media comes from three main sources: individual profiles, non-traditional media, and partisan news. Individual profiles can be run by either humans or bots and typically share misinformation in an informal and personal manner, through images, videos, and memes, to appear more relatable to consumers of the content. A study carried out by IEEE found that these profiles typically had short lifespans, were less likely to be verified, and had fewer updates than regular users (Oehmichen et al., 2019). In addition, they were more likely to favourite the content of others and showed a clear disparity between the number of accounts they follow in comparison to the number of followers they have (Oehmichen et al., 2019). Similar behaviours exist in the second group, non-traditional media, which involves blogs, forums, and sites such as YouTube that have mostly user-driven content and prominent individuals that can influence followers (Shin et al., 2018). The third group, partisan media, could be viewed as more credible as it involves established media outlets. Consequently, this group can still perpetuate misinformation with seemingly more legitimacy than user-driven sources. In the case of partisan media, the misinformation is largely due to a conviction of ideology rather than malice – although there are exceptions (Flaxman, Goel & Rao, 2016). Based on a joint paper from researchers at Oxford, Stanford, and Microsoft, the degree of political slant on news outlets and the discovery of such publications on social media increases information segregation via the 'echo-chamber' effect (Flaxman, Goel & Rao, 2016). This is because readers of partisan news may reinforce their existing beliefs through confirmation bias.

Misinformation creates misperceptions. How and to what extent people are affected by misperceptions can be classified into four categories, as shown in Figure 1. Those defined as 'active misinformed' pose a threat to political discourse as they perpetuate false narratives that spread rampantly (Flynn, Nyhan & Reifler, 2017). Correcting misperceptions, however, is not as simple as affirming the truth, as an individual's psychological system of reasoning affects how beliefs are formed and validated (Flynn, Nyhan & Reifler, 2017). We can split psychological reasoning into two categories: directionally motivated reasoning and accuracy motivated reasoning. The former 'leads people to seek out information that reinforces their preferences (i.e., confirmation bias), counter-argue information that contradicts their preferences (i.e., disconfirmation bias), and view pro-attitudinal information as more convincing than counter-attitudinal information (i.e., prior attitude effect)' (Taber & Lodge, 2006). The latter, however, is a rational approach whereby

individuals collect and analyse information with the intent to develop accurate beliefs (Taber & Lodge, 2006). Directionally motivated reasoning is caused by a threat to a core belief that forms part of one's identity and the natural human behaviour to resist this threat (Taber & Lodge, 2006). The majority of individuals use directionally motivated reasoning since it is easier to rely on existing structures rather than expend cognitive effort (Flynn, Nyhan & Reifler, 2017). Subject polarisation heightens these behaviours, allowing socio-political conversations to be easily exploited with misinformation due to their polarising nature (Flynn, Nyhan & Reifler, 2017).

	Informed	Misinformed	
Active	<ul style="list-style-type: none"> • More likely to share content • More likely to share validated content • More likely to share content driven by ideology 	<ul style="list-style-type: none"> • More likely to share content • Less likely to share validated content • More likely to share content driven by ideology 	Active users share proattitudinal information based on ideology
Passive	<ul style="list-style-type: none"> • More likely to share content • More likely to share validated content • More likely to share content driven by ideology 	<ul style="list-style-type: none"> • Less likely to share content • Less likely to share validated content • Less likely to share content driven by ideology 	Passive users are less tied to partisanship and equally likely to share proattitudinal and counterattitudinal content
	Informed users tend to use accuracy motivated reasoning	Misinformed users tend to use directionally motivated reasoning	

Figure 1 - Four Categories of Misperception (Flynn, Nyhan & Reifler, 2017).

Research Scope

In conclusion, the current democratic system can be summarised into three key stages. Initially, the electorate receives information through a range of sources. The primary news source in the UK is currently television, specifically BBC One (Jigsaw Research, 2019). However, there is evidence that 'UK adults are consuming news more actively via social media' and TV usage is 'decreasing' (Jigsaw Research, 2019). This information is then subject to scrutiny by each individual's reasoning which is affected by previously explored psychological biases (Wired, 2016). The information itself may be factual or fictional; websites such as MBFC News to 'fact check' stories are available, but misinformation in the form of memes or viral⁴ videos are hard to regulate and identify. This information is also increasingly personalised, based on information shared by users online.

Secondly, an opinion is formed, expressed, challenged and evaluated. This can happen formally online through platforms such as Polis, or less formally on social media as discussed. Conversation with peers may be persuasive or confirmative. One may seek further information on a

[4] Viral information - information that is able to disseminate rapidly

topic to obtain a broader understanding resulting in a confirmed or changed opinion. A common example of secondary research is consuming journalistic content through newspapers or the television.

Finally, the electorate has the right to express their opinion through a vote. It was concluded that due to the slow rate of constitutional change and lack of opposition to the current voting methods in the UK, this report will focus on the first democratic stage: receiving information.

4. Design Definition

4.1 Foresight Analysis

A scope wheel (see Figure 2) was used to conduct foresight analysis, which provides a graphical representation of the probable and possible future realities. This was used to inform ideation by predicting the timeline of penetration of significant technological, social, economic and environmental factors.

The first identified trend was the increasing ramifications of the intrinsic link between people's personal and digital self. Technologies such as emotion recognition and the Internet of Things (IoT) (made more accessible through the spread of 5G internet) would create a digital footprint of each individual's actions and a large amount of data for which they are accountable.

Online social interactions may increase, leading to a deterioration of physical interpersonal skills.

Secondly, economic and social divides within society may be heightened. As resources become more scarce due to climate change and are not readily available to everybody, people may act irrationally and become self-interested instead of upholding collective values. Anonymity may also cost a premium leading to further segregation of groups from contrasting economic backgrounds. This increases the influential power of those with profiling data over those who cannot afford privacy⁵.

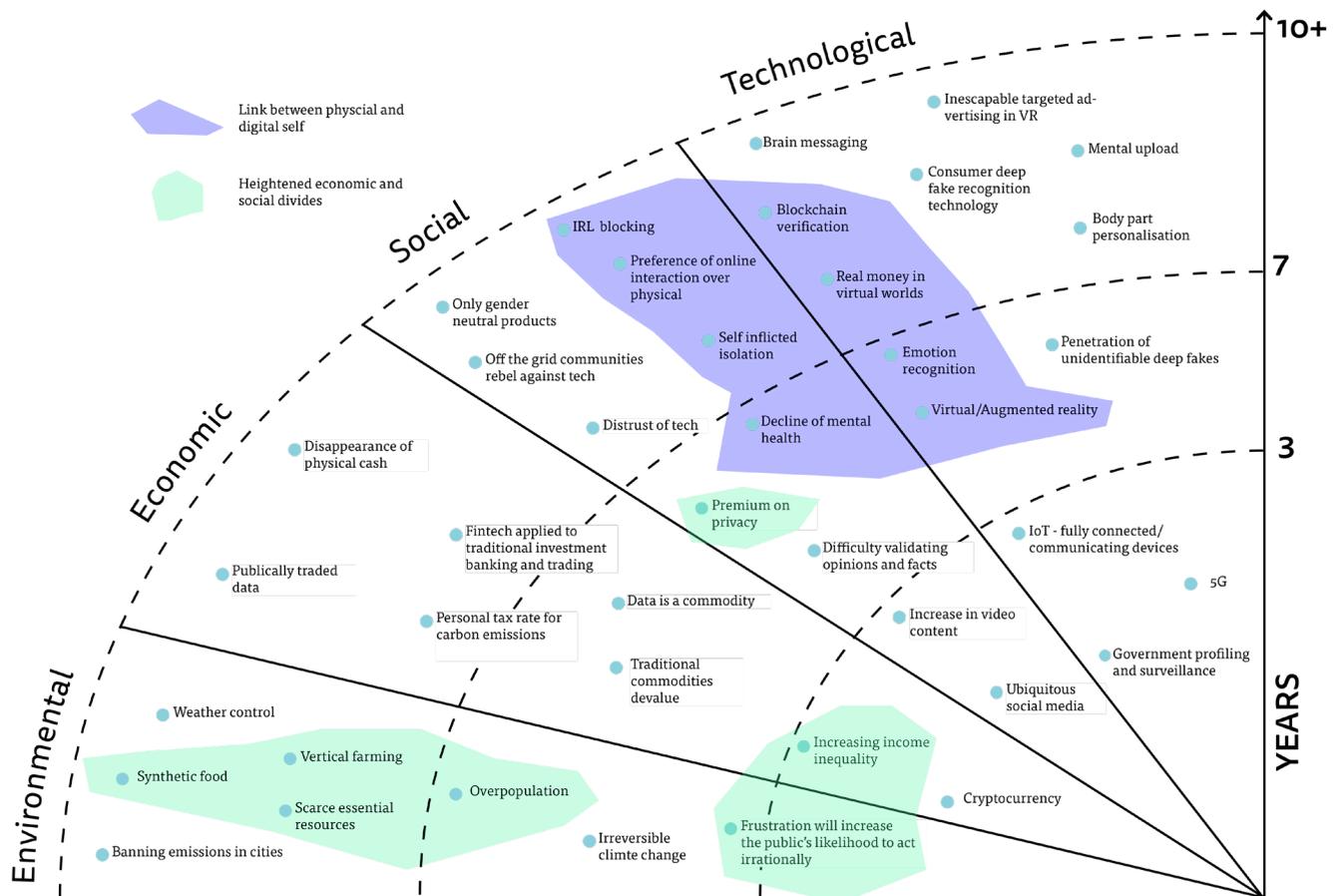


Figure 2 - Future Scoping Diagram

[5] Privacy - the right to maintain the confidentiality of personal information

4.2 Future Narratives

To explore the scope of the projected future⁶, narratives were constructed around three personas of different lifestyles, cultures, and socio-economic backgrounds. Their routines encapsulate how developing technology, changing political climates and the rapidly growing digital world could affect everyday lives within future democratic systems.

Eve

67, retiree

Eve wanders into the kitchen in her kimono to the smell of fresh coffee and sits in front of the TV. The channels are still running from satellite instead of 5G, so the reception is poor. There are reports of climate strikes in India; Southern parts had been flooded from the extreme monsoon rainfall. Eve frowns; the inbuilt TV camera identifies her emotion as 'sadness' and suggests to change the channel to 'Comedy Classics', she denies.

Adverts come on and Eve sees a video for new insulin pills - her doctor had recently recommended an Apple watch to monitor her levels non-invasively using an infrared sensor for her minor blood sugar issues. The advert featured her favourite actor Tom Hanks. The deepfake recognition tool offered her an update to more recent celebrity personas. She had refrained from purchasing it to avoid the hassle of converting her pounds to E-coin.

As she is about to leave for some grocery shopping, she realises she left her phone on her bedside table. She needs it to lock the door as her son recently installed a biometric smart lock after her husband passed away, to better secure her apartment. Eve needs to get the bus to the grocery store as her local one recently closed down. Most people get their shopping delivered through subscription services. At the bus stop she presses the button to request a bus; it arrives in a few minutes. On her way to the shop she looks at billboards along the road. However, she doesn't own an AR device so they all just show static content.

Back home, Eve checks in with her friends on social media. There's an election coming up and she often uses it to share videos created by her preferred political party. Suggestions for similar content pop up on the screen around the video, which are exclusively tailored to the sources she uses and people she follows.

Her son bought her the latest VR glasses for Christmas so they can meet more often. She only uses it for calls with her children and grandchildren. She hasn't purchased the ad-blocking add-on so she always sits through a brief meeting with someone advertising their products before she can meet her family. Eve is excited to see them! Today it is another political party advertisement that she showed support for on myNet, talking about the election and the catastrophic implications the other party's win would have on her life. Some of their

statements take her by surprise so she listens intently until the room fades away and she's greeted by her kids, her favourite part of the day...

Jared

14, schoolboy

It is 7:00 am and Jared's watch gently buzzes. Jared pulls himself out of bed and waves his hand in the air - nothing happens. He wishes the watch was as unintelligent as it was when he got it for his birthday. With a deep sigh, he takes a few steps around his room until his activity stops the buzzing and the noise. 'Hey, Alexa', he slowly says. The curtains in his room begin to open and his sleep report displayed on the television shows only 3 hours of good quality sleep, alongside today's selected headlines and the latest on the current election campaigns.

Jared set up a shortcut on his Amazon bedroom hub to repeat this routine every day before school, but it still doesn't clean the mess in his room from a week's worth of neglect. Sat on the toilet, he opens Boka - a new augmented social media app where you can overlay your content with an animated layer. He scrolls through his feed and sees some memes that his online friend Trixie made; she runs a meme page that is quite popular within their online community. Within the content feed, he sees an Amazon advertisement for sleeping pills but keeps scrolling. After seeing some posts from his classmates showing off their AI pets along with more petitions to reduce the voting age, he realises he is late and continues getting ready for school. Jared worries about his history presentation today, he does not feel comfortable with most face-to-face interactions, so the thought of public speaking is making him particularly anxious.

Travelling back from school he is relieved another day of lessons is done and looks forward to the seclusion of his room. Scrolling Boka, Jared sees a video of Gordon Ramsay being arrested. The caption reads, 'SMUGGLING MEAT? BIG MIS-STEAK' Jared is worried as he only went to Ramsay's restaurant last month for his birthday and intuitively this video looks legitimate. He researches it to find out more, and finds no verified sources with the information so he assumes it must be a fake. He did think his burger tasted a bit too good to be true though.

Jared gets out by the local shop and collects his dinner from the Amazon Chef counter. It recognises his face and after a few seconds, cooks up a vegan super salad with some extra vitamins to aid sleep. He hates the food but the new system he was recommended tracks his BMI and automates his meal plan, so he does not have to think about it.

[6] Projected future - the extrapolated, 'baseline' future as a result of no intervention

Alex

34, office worker

Alex wakes up and heads out of the house on the way to work - a repetitive routine. Running late, he enters the train station and manages to jump on the train just before the doors close. It has been a relief since TFL rolled out a subscription service for all modes of transport based on your live tracked location.

As he stands on the packed train he lifts his Apple watch to check how his character is doing in a new online game released last week. Since struggling with bouts of severe social anxiety Alex started spending more time on online servers - he is much more comfortable socialising online and in VR within the safety and comfort of his own home. He has already made over 3000 new followers and connections. And after all, travelling has become too unaffordable for him. The most he could pay with his office job was the lowest band of TFL's subscription fee.

A new friend request! The profile shows no mutuals. He scans through the information displayed on it. Since last month it is legally required from social platforms to display 5 pieces of information about the users in an attempt to tackle the rising numbers of AI users sponsored by private advertising companies. The profile seems reasonable, so he confirms.

A notification pops up on his watch: the new user has sent him a message! He opens it; it's a 3D meme of the leading candidate of the Conservative Party running for the upcoming election in a few weeks. Once he reaches work, curiosity gets to him. He uses one of the government verified search engines to research the politician he saw in the meme. On the margins of the search engine there are countless adverts for the new deepfake validation software. Alex tries hard to ignore the ads since he can't even afford to upgrade his devices to ones that would support the software. Annoyed by the adverts, he resorts to asking some of his friends on the forum for opinions. His open forum question is flooded with replies within seconds. Luckily, this forum has a built-in fact-checking bot, which is quick to highlight incorrect statements and rate opinions on a scale of bias. Everyone seems to think that this politician is a fool. Alex leaves the forum and resumes his work; he is not heavily invested in the election.

4.3 Literature Review and Validation

The phenomena introduced in each of the narratives above are supported through research and are explained in the following validation.

5G

By 2025, the GSM Association expects 5G networks to cover 34% of the global population, and predicts that the number of connections will grow to 1.1 billion (Obiodu & Giles, 2017). Data speeds have been increasing exponentially with each wireless generation.

1G, introduced in 1984, offered no data service. (Garg, 2014) 2G introduced digital voice transfer, SMS and download speeds of 14 kb/s. (Garg, 2014) The internet could be browsed for the first time on mobile with 3G, with speeds of up to 2 Mb/s. (Garg, 2014) The introduction of 4G brought speeds up to 1 Gb/s, enabling high definition audio and video streaming (Garg, 2014). Download speeds on a 5G network can reach 10 Gb/s. New opportunities will open up as a result, as users will be able to access larger amounts of data significantly faster. It will be easier to quickly share and shape public opinions on political or social issues through social networks. Opinions formed by a large number of connected people due to their ability to exchange information anytime and anywhere will become a key driver of social change (Husenovic, Bedi & Maddens, 2018).

Internet of things (IoT)

5G is expected to accelerate the evolution of IoT. IoT is a system of interconnected computing devices, ranging from light bulbs to smart greenhouses, autonomously communicating with each other. The increased data volume of 5G will make it possible for more devices to send larger files simultaneously across a wireless connection. 4G networks can support up to 6000 devices on one cell. With a 5G network, up to one million devices can be handled by a single cell (Mehavarunan, 2019). 75.44 billion IoT devices are expected to be in use worldwide by 2025 as a result (Lucerno, 2016). These are estimated to generate 79.4 Zettabytes of data (Shirer, 2019).

AR and VR

5G will encourage innovation. Communication capabilities and computing power will extend across many new types of devices (451 Research, 2019). This will help bring computing-intensive technologies like augmented reality (AR) and virtual reality (VR) from the niche into the mainstream since all the processing will be done remotely. AR is a computer-generated simulation overlaid on the real world, whereas VR refers to an entirely self-contained, completely immersive experience. Google and Facebook have invested heavily in AR and VR technology over the last ten years (Sochurkova, 2018), creating a market that is expected to grow to \$95 billion by 2025 (Bellini et al., 2016). This suggests that both AR and VR will become more integrated with the platforms that are used daily by billions of people.

Targeted Ads

Before the internet, traditional broadcast and print media used a linear model where the content was created by journalists, distributed on networks and papers, and then consumed by people (Zuckerman, 2018). This was a strictly hierarchical model with media organisations controlling distribution and consumers having limited capacity to affect the wider conversation. However, with the rise of social media, the power of distribution has shifted to the users and the algorithms designed to

optimise the content for users, as described in *Figure 3*. This has left traditional content providers struggling to gain the attention of social media users (Zuckerman, 2018).

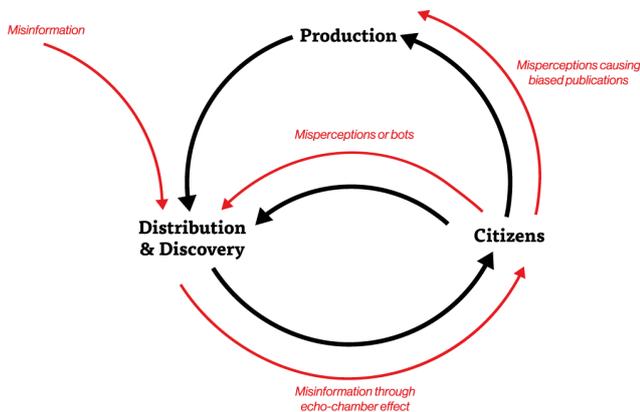


Figure 3 - Dissemination of Information, adapted from (Zuckerman, 2018).

As a result, online advertising has become increasingly targeted - with personal information, such as purchase history, being shared by users and collected by third parties. Banner ads introduced in 1994 had extremely high click-through rates of 44%, this number has decreased to only 0.05% today (Chaffey, 2019). Engagement with advertising in VR or AR, on the other hand, is 30 times more effective compared to online and mobile advertisements (Hall & Takashi, 2017). Also, advertisements have adapted and become more personalised over the years to try to appeal to users, through demographic targeting, pop-ups, sponsored posts and even native adverts which blend into their environment they are in to achieve higher engagement.

This trend is set to continue in order to provide consumers with even more relevant content. New data sources will be exploited to collect user data, further compound in ad personalisation from metrics such as eye movement, facial expressions, sleep patterns or smart fridge contents. Surveillance camera footage is already used in contexts other than security, such as customer patterns analysis and marketing (Liu et al., 2007).

Companies will use increased computing power and new data science techniques to understand and extract insights about their users. According to McKinsey, sixty per cent of enterprises are in the process of adopting AI (Bughin et al., 2017). Using techniques like embedding and text mining, AI models can understand how users are reacting to marketing content by scanning through comments and social media feeds (Royce, 2019).

However, there are concerns over whether this process is too invasive. As corporations learn more about users, they become skilled at targeting vulnerable groups, as demonstrated by the Cambridge Analytica case. The General Data Protection Regulation introduced in 2018 dictates that companies cannot process data held on

their users (often using cookies) without consent (Koch, 2019) - but it is unclear how many users choose to disable cookies and the potential value of the data that they provide.

Content is often available advertisement-free when the user pays a premium, for example when using the global audio streaming service, Spotify (Spotify, 2019). This trend may advance into protecting one's data for a fee, exacerbating inequality levels as targeted advertisement can further manipulate users from lower-income backgrounds. Virtual Private Networks (VPNs) can currently be purchased to serve this purpose by creating an encrypted connection across a network. They are primarily used for 'protection against cyber criminality', 'bypassing internet censorship' and 'achieving privacy' (Pavlicek & Sudzina, 2018).

Social Media

From its conception in the late 1990s, social media has revolutionised the way people interact, with 67% of the UK now being active users, including 91% of 16-24 year-olds (Kemp, 2019). The platforms have evolved over time, from early examples such as Myspace to current market dominators including Facebook and Twitter. This suggests that although the specific platforms may change, the overall use of social media is likely to increase.

The main motivations for using social media have also evolved; from originally staying in touch with friends, to now also staying up to date with current affairs (41%) and finding funny or entertaining content (37%) (Valentine, 2018). There is also a trend for users to undertake more passive networking through using social networks 'as sources of content rather than platforms that require active contributions' (Valentine, 2018).

The widespread problem of online abuse on social media has been countered by high profile campaigns such as 'Don't feed the trolls' (Ahmed & Papadopoulos, 2019). Platforms have also undertaken measures such as moderating comments and predicting whether an article may promote trolling. However, according to the Royal Society of Public Health, 7 in 10 young people say they have experienced cyberbullying (Cramer & Inkster, 2017) and this issue is becoming increasingly prevalent in the public domain. It could be suggested that forms of blocking could soon extend to separating users from those with opposing views to minimise conflict, and therefore minimise sources of information users have access to and increase information segregation.

Visual Culture and Viral Content

The phenomenon of virality has become more prominent in the digital age as more people can quickly access information through online platforms. The life cycle of misinformation on social media is analysed to understand how it can affect political discourse.

Viral content tends to evoke a mix of strong emotions from the reader such as surprise, fear, or anger (Dobele et

al., 2007). Apart from the core information, techniques that are used to evoke these emotions involve emotive language, bold colour, font, graphic and shocking imagery to help to get views, and thus, engagement.

This has been extremely beneficial in the realm of advertising, where the ability for information to spread quickly and unassisted allows companies to save on direct marketing costs and access further customer bases (Varis & Blommaert, 2015). Moreover, techniques to increase virality have been tremendously powerful in political advertising as the content is designed to easily capture the attention of people and convey the core message quickly (English, Sweetser & Ancu, 2011). However, since viral content often has financial or ideological motives, there is a reduced incentive to confirm its validity. As a result, misinformed content may be interpreted as legitimate news, which opens a dangerous pathway to misinformation.

Looking further into the relationship between visual culture and viral content, the visual identity of content contains two things: something it denotes (literally means) and something it connotes (means subconsciously). The language of visual culture has evolved extremely quickly and faced a rapid change in the digital age. Memes, as described by Dawkins in his book 'The Selfish Gene' are 'small cultural units of transmission which are spread by copying or imitation' (Dawkins, 2006).

By taking parts of images out of context, placing them in new visual environments, and subverting them to new meanings, memes become a highly emotive hybrid of an image. Moreover, they also have a humorous and satirical tone which instantly diffuses the intensity of polarised political arguments, (an inherent viral property), and widespread appeal. Memes can easily become revolutionary political tools. See Figure 4 and Figure 5.

A recent study on the diffusion of misinformation on social media explains how the extreme techniques designed for virality affects the dissemination of misinformation. It explains that compared to facts, which tends to be static and reliant on the content itself for virality, misinformation tends to be dynamic and re-circulates as it is shared either organically or with bad intent (Shin et al., 2018). This results in a stark difference between the reach of the two types of information, with facts typically experiencing only single spikes in virality and misinformation experiencing multiple peaks due to its tendency to evolve (Shin et al., 2018). The cyclical nature of misinformation plays into a known psychological factor called the 'truth effect' where reinforcing an idea increases its perceived credibility (Koch & Zerback, 2013). This re-circulation is also particularly effective because newer information is viewed as more relevant, hence more likely to be shared (Xu, 2013). The initial paper goes on to explain that with each share or cycle of virality, the misinformed content can evolve in 3 ways: levelling (where less exciting

detail is lost), sharpening (where certain details are exaggerated), and assimilation (where new details, not seen in the original cycle, are added) (Shin et al., 2018).



Figure 4 - 'Once he'scone he'scone' from (jeremycorbyndoingthings / instagram, 2019)

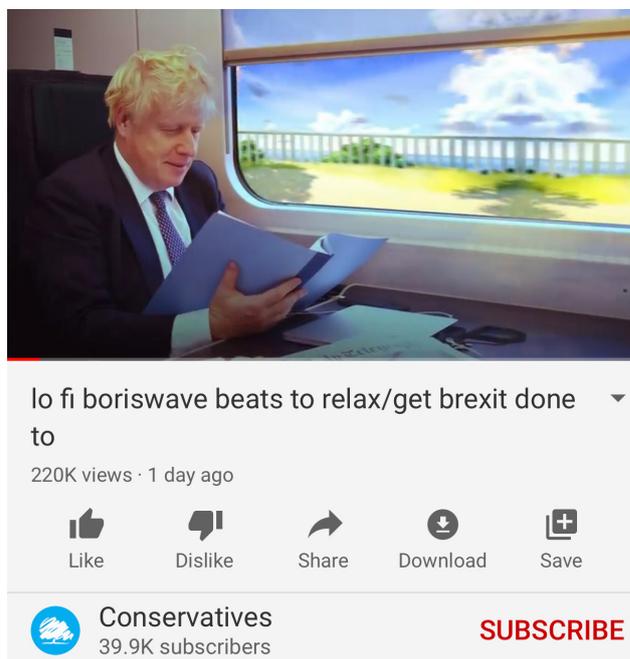


Figure 5 - Figure 5 - YouTube meme targeting students engaged with lo-fi music culture with relatable content (Published from the official Conservative Party channel)

Deepfakes

Deepfakes are an emerging technology whereby one person's face can be mapped onto another person's body. The 'deep' comes from deep learning, a branch of machine learning that focuses on neural networks (Zucconi, 2018). Recent developments in this area of computing theory have allowed deepfakes to become more advanced and realistic. Currently, celebrities and politicians are targets for these videos, due to the amount of footage that is currently available for 'training' models to recognise features in a subject's face. Free software such as DeepFaceLab and FakeApp are sufficient to make convincing videos and as computational power is becoming more accessible, these videos will continue to spread.

There is currently little defence against deepfakes but researchers at the University of Southern California and UC Berkeley have been developing techniques to identify doctored videos (Manke, 2019). Just as one can train a model to recognise features in a person's face, one can also train a model to autonomously recognise when that face has been digitally reconstructed. The result is an arms race between those making more advanced deepfakes and those improving software to detect them.

The potential effects of these videos are vast and significant. Once a video is spread and watched by masses of people their misperception⁷ will be formed. Even if the video is subsequently debunked, it is very difficult to target the specific individuals who were affected in the first place and change their opinion. Videos of political leaders could cause riots and destabilise financial markets long before they are exposed as being fake. As a result, detection tools will have to be implemented to catch the content as it is being made or shared, while maintaining privacy and surveillance rights of the public.

Blockchain

Blockchain is an immutable digital ledger based on a decentralised system that works in real-time. It is peer-to-peer, meaning that no third parties are required for authentication and leads to increased trust by users (Bradley, 2018). It was first implemented in 2009 as the public ledger for those making transactions using Bitcoin. However, in 2014 it was separated from the cryptocurrency as other forms of potential transactions were explored. For example, The New York Times's Research and Development team are currently experimenting with using blockchain technology to authenticate news photographs by recording and sharing metadata about them (The News Provenance Project, 2019). Current challenges being faced include scalability in terms of the available computational power and latency problems, meaning that information may not be shared in real-time (Fernández-Caramés & Fraga-Lamas, 2019).

Emotion recognition

Emotion recognition is the process through which artificial intelligence software is capable of identifying the emotion that someone is feeling based on their facial expression. The first company to bring this type of software to market was Affectiva in 2009 (Schwartz, 2019). Affectiva originally started selling their software as a market research tool to monitor consumers' reactions to advertisements and products but has since branched out into social media and even the automotive industry. (Schwartz, 2019) Affectiva claims to have analysed over 8 million faces to date (and have tackled many problems with emotion recognition such as disparities in expression due to cultural and gender (Affectiva, 2019). Emotion recognition software is readily available and companies such as Realeyes offer free 'demos' on their websites, highlighting the developed state of the industry.

The validated predictions of the state of society, media and technology in 2030 provide evidence of the problems that will arise. To successfully mitigate these problems and to ensure the preferred future is achieved, five design objectives have been defined.

4.4 Design Objectives

- A** Effectively regulate fake news to ensure consumers are aware of which information is validated. Enable people to assess the information they receive, distinguishing between fact and opinion.
- B** Encourage people to seek other viewpoints with the intention to understand them, without necessarily accepting them as their own.
- C** Empower people to make individual and autonomous informed decisions and maintain freedom of thought, in a climate of targeted and tailored information streams.
- D** Ensure individuality and the personalisation of technology without infringing upon data rights or restricting a user to only consuming information from predetermined sources.
- E** Protect more vulnerable groups⁸ from personalised persuasive advertising as a result of increased surveillance.

4.5 Preferred future

The preferred future⁹ scenario is set in the UK in the year 2030. This year was selected because significant challenges were identified from the foresight analysis to already be in force by this date. 2030 is a close enough date for predicted trends to be substantiated, while still allowing scope for technology to develop. Within the preferable scenario, people are informed of the validity

[7] Misperception - a strong belief or false interpretation that is based on misinformation and contradicts widely known evidence.

[8] Vulnerable groups - groups who face distinct disadvantages and are in need of extra protections due to factors such as geographic location, ethnicity, gender, age, ability and citizenship.

[9] Preferred future - the desired future this report aims to achieve

of news before they consume the content, so they can make an informed assessment of its implications. For example, circulating fictitious content such as deepfakes are identified.

In the preferred future, no members of society are restricted to only seeing targeted or modified content so everyone has access to verified news. The electorate is therefore able to make individual decisions on democratic issues and exercise freedom of thought based on the information it receives. The spectrum of opinions formed can coexist in the same environment, allowing for higher engagement in debates to gain a greater overall understanding of issues. Political parties can campaign through technological streams and their content undergoes the same authentication checks as their rivals to ensure a fair contest. This results in an elected government to closer reflect the interests of society.

5. Ideation

Based on the design objectives, the following concepts outline potential directions that each address different design objectives.

Concept 1

A social media platform, as illustrated in Figure 6, could be used as a central source of validated news, containing stories from sources with differing opinions and agendas. The aim would be to provide users with a holistic view of current affairs, utilising a peer review system to identify and police fake news.

Journalists could post stories and blockchain verification would be utilised to document the stream of information on the platform and identify the content modifications required. Auditors (a community separate from the source of the story) would then review these stories by investigating the source, author and any modifications from the original saved to the blockchain, before rating the content up or down on its validity. Validated content would then be prioritised by promoting it higher on a user's feed, thus reducing engagement with fake news and impeding its spread.

Machine learning would be utilised to facilitate fact-checking. On registration, auditors would be required to provide proof of identity, certifications and other details, which would then verified using a third-party application programming interface (API). This information would be encrypted and saved on the blockchain. Experts within a field would then be identified by the machine learning algorithm and their assessment of specific facts would be weighted more highly than other users'.

Stories on a particular topic would be analysed using AI and grouped by the authors' standpoint on the issue. These groups would then be visualised on the user interface as a mind map. This would be particularly useful for polarised topics as users would be informed of the proportion of opinion they have engaged with, and

although they would not be obliged to read opposing viewpoints, they would gain an awareness of the spread of content. Overall, the aim of Concept 1 would be to encourage an informed readership.



Figure 6 - Concept 1 Illustration

Concept 2

To create a more transparent relationship between the users and the third parties using their online information, a three-dimensional visualisation system could be created for users to explore the 'blueprint' of their online identity - as illustrated by Figure 7. This blueprint would summarise the existing data points that the user has in the online world. Using VR and AR, users could then explore and interact with the visualisation of their information through their own online eyes.

The system would allow users to understand the fine line between their real and online selves, allowing them to reclaim their power and control online and be aware of the digital trace they have left behind. This would enable individuals to explore and educate themselves through a more tangible perspective of what their data is worth and how much of it there is.

When expanded, the visualisation system would indicate the coordinates of origin and list a full statistical and financial breakdown about the outcome of the use of their information by third parties. The report would also indicate sources that gathered the data. In addition to providing factual information, the system would be able to inform an individual on whether they are subjected to or engage with a high proportion of polarised views, potentially challenging the user's opinion of themselves.

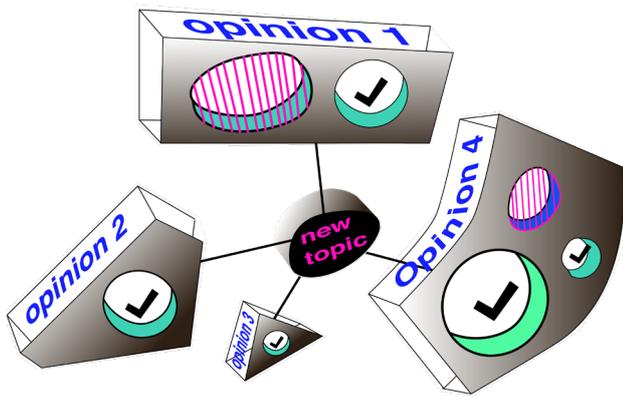


Figure 7 - Concept 2 Illustration

Concept 3

An interactive news platform could be created, where users permit the platform to monitor and collect live facial images - as illustrated in Figure 8 Using advanced emotion tracking software, the user's experience would be influenced by their emotional expression at the time, improving their journey through the platform's available media.

This would be implemented by identifying microexpressions in the user's face, which indicates their initial response. If they are enjoying the content then the article would continue with a similar tone and sentiment. Otherwise, the article will adapt, leading the user down a different branch of content with the same factual content but presented differently. This would create a tree of multiple experiences for groups of users, with the intent of informing as many people as possible by maintaining user engagement for the whole article, reducing the effect of opinion and attitude.

If a reader's emotion is recognised as confused, the article would offer definitions of the terminology or reword sentences using simpler language. Readers would be guided towards content that is presented in a form that they are more easily informed by but without having to express this explicitly. This feedback would also help the content creators critically evaluate the articles and media that they publish. If a reader is offended by a certain paragraph, image, or video, their face would respond accordingly and this would highlight the specific areas that caused the response.

Furthermore, emotion recognition could be extended to live media. For example, a televised electoral debate could utilise the real-time response of viewers to change the direction of a conversation if one topic is becoming too polarising or too confusing to viewers. This would also provide political leaders with a far more effective feedback loop of information. Instead of trying to decipher thousands of online comments and opinions after a live announcement or speech, the public opinion could be instantly established and categorised, for example, by age, demographics, location and income.

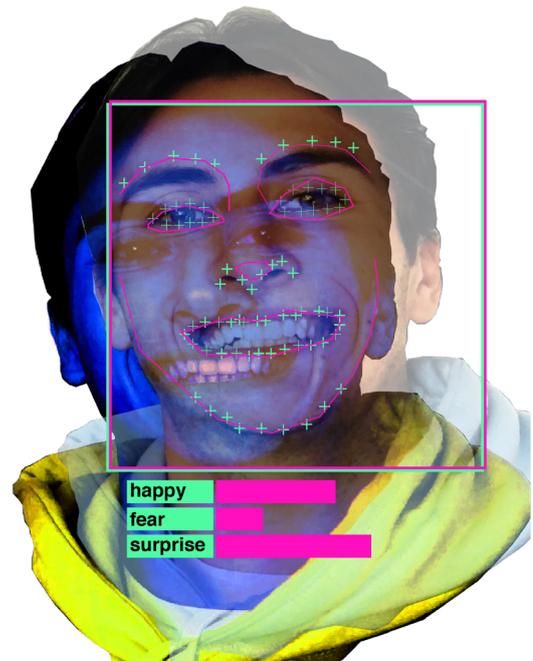


Figure 8 - Concept 3 Illustration

Concept 4

An educational platform could be used for learning to improve analytical thinking. The teaching process would consist of multiple levels of courses that require different levels of engagement and achieve different depths of understanding.

On the initial level, the user would complete quick challenges in the form of a quiz. Solving the challenges would encourage the user to invent a method of approaching the problem, consider the possible influencing factors and, as a result, utilise and practice analytical thinking. The initial level aims to engage the user with the platform. After the initial contact, the first level challenges could be continued or the user can start the higher-level courses.

The complexity and depth of teaching would increase level-by-level, as well as the amount of effort and engagement required. The higher-level courses could be experienced in VR or AR - as illustrated in Figure 9. They would be interactive to increase information retention, presented in the form of a conversation with a virtual tutor. The tutor's teaching method (general manner of speech, pace, way of introducing concepts, etc.) would be specifically tailored to every user. AI would be used to understand what kind of tutoring method could be the most effective, based on each user's online activity.

To encourage long term engagement, a virtual reward system could be implemented. Similarly to the tutoring style, the rewards would be tailored to each user specifically, making them more desirable to the individual. The challenge completion and reward cycle could develop the use of the platform into a habit.



Figure 9 - Concept 4 Illustration

6. Conclusion

To determine a concept for further development, each concept was evaluated using a rating matrix (see Appendix, Table 1), comparing the extent to which each design objective was addressed. It can be seen that Concept 1 has the highest overall score and is the single most effective solution. However, as each concept covered different objectives to varying degrees and the desired solution would function on a systematic level to resolve all the defined problems, it was decided that elements from each idea would be combined to form an overarching solution. Therefore, the concept will be developed as follows:

The collective online space is primarily based on Concept 1 (the highest scoring in the matrix) and would be merged with the form of popular social media in 2030, rather than being a standalone platform. This will give access to a large number of accounts who are proficient at interacting with the then-existing format. It will act as a central source for digital content and ideas, allowing users to explore information and opposing beliefs accurately and holistically. Peer review and blockchain technology will be used to validate news and users would be visually informed of opposing viewpoints to their own, as described in Concept 1.

News stories on the platform would use emotion recognition to track a user's reaction and adapt the tone or formatting to maximise a user's engagement, and therefore, knowledge. However, this form of software also poses challenges with over-tailoring content. For example, live feedback of a political speech might allow parties to explain only specific information on their policies, prioritising maximum appeal rather than explaining their full agenda. Furthermore, if polarising content can be easily identified, the system may be exploited, creating more polarising stories for financial benefit. This risk will need to be carefully mitigated during design development, for example, by only allowing the presentation of an article to be adapted for different users, rather than any factual content. The aim would be to capitalise on the beneficial capabilities of this technology.

Whilst on the platform, users could explore the blueprint of their profile, as explained in Concept 2, to be informed of the impact of their online activity.

Finally, the concept of an educational platform is one that hypothetically addresses key design objectives, specifically Objective C, involving individual assessment and consideration of information. However, in practice there may be little motivation for the majority of users to engage with it, resulting in a poor effect. The concept itself is considered an important one, but may not be effective in its current form and requires development before merging with the collective online space.

7. Project Management and Planning

The shared files were compiled on Google Drive - grouped by week, planning, and report content folders. Each week contains the notes contributed by each team member and any minutes recorded from meetings. Esther was primarily in charge of minute taking and they were useful to refer back to, particularly when Sam and Freddie made suggestions of new areas to research. Using shared documents worked well, especially when editing each other's sections of the report using the comment tool. However, sections of the report had to be edited out due to overlap with parts written by other team members. Time could be saved next term by communicating more closely on the exact content of each section.

The planning folder contains a Gantt chart with details on what each stage of the project specifically involved. The Gantt chart was made at the beginning of the term and was amended as the term progressed and after we had formed a clearer idea of the time allocation needed for each stage of the project. The ideation was discussed at a meeting with Laurenz Reichl (GID graduate) on 26/11/19, but upon reflection, it would have been useful to meet him sooner in order to have time to include some of his suggestions in the report. However, this will provide a good basis for beginning the engineering design process next term.

Planning for term 2 is also outlined in the planning folder, and the feedback from the interim review will be used to expand on this. Moving forward it will be necessary to break down each component of the proposed solution, to identify specific areas of further opportunity or fault. Imagining worst-case scenarios of concept implementation, a method suggested by Laurenz Reichl, will provide a useful way to perform this identification, as these are often the scenarios that highlight inherent flaws in the concept. This will help to ensure that when the concept is fully developed it is as effective as possible.

Overall, enough time was allowed for the submission and a report was produced that reflected the work of the term well.

Links To Project Management Log and Documentation

https://drive.google.com/drive/folders/1LJhp4WT-CRon-k9rB_xEVYXDK-Sog3EXg?usp=sharing

<https://airtable.com/invite/l?inviteId=invOAtRM-ivJHKhakK&inviteToken=c3b6e44388f3a07289a-7fa6912590806538cd6fe3d29afedfaddcccd9fc60ea07>

8. References

451 Research (2019) 5G: Innovation, disruption and opportunity ahead. [Online]. 2019. Available from: <https://451research.com/5g-innovation-disruption-and-opportunity-ahead> [Accessed: 3 November 2019].

Ahmed, I. & Papadopoulos, L. (2019) Don't Feed the Trolls. [Online]. p.12. Available from: https://252f2edd-1c8b-49f5-9bb2-cb57bb47e4ba.filesusr.com/ugd/f4d9b9_ce178075e9654b719ec2b4815290f00f.pdf.

Alvarez, R.M., Bailey, D. & Katz, J.N. (2008) The Effect of Voter Identification Laws on Turnout. [Online]. Available from: <https://papers.ssrn.com/abstract=1084598> [Accessed: 26 November 2019].

Anon (2019) Affective Human Perception AI Analyzes Complex Human States. [Online]. 2019. Affective. Available from: <https://www.affective.com/> [Accessed: 26 November 2019].

Anon (2016a) The economic and financial costs and benefits of the UK's EU membership. [Online]. p.87. Available from: <https://publications.parliament.uk/pa/cm201617/cmselect/cmtreasy/122/122.pdf>.

Anon (2016b) Voting Paradoxes | Exploratorium. [Online]. Available from: <https://www.youtube.com/watch?v=tJag3vuG834> [Accessed: 26 November 2019].

Anon (n.d.) Zachary Quinto Explains How To Hack An Election | WIRED. [Online]. Available from: https://www.youtube.com/watch?v=hltT7APUjTA&list=PLIc-J6p7QvGTosJuz4Aup4_lXwRXY4hIG3&index=3 [Accessed: 26 November 2019].

Barone, A. (2019) The Future Of Cryptocurrency. [Online]. 25 June 2019. Investopedia. Available from: <https://www.investopedia.com/articles/forex/091013/future-cryptocurrency.asp> [Accessed: 26 November 2019].

Bellini, H., Chen, W., Sugiyama, M., Shin, M., et al. (2016) Virtual & Augmented Reality. Understanding the race for the next computing platform. [Online]. Available from: <https://www.goldmansachs.com/insights/pages/technology-driving-innovation-folder/virtual-and-augmented-reality/report.pdf>.

Bradley, R. (2018) Blockchain explained... in under 100 words. [Online]. 26 September 2018. Deloitte Switzerland. Available from: <https://www2.deloitte.com/ch/en/pages/strategy-operations/articles/blockchain-explained.html> [Accessed: 26 November 2019].

Bughin, J., Hazan, E., Ramaswamy, S., Michael, C., et al. (2017) ARTIFICIAL INTELLIGENCE THE NEXT DIGITAL FRONTIER?p.80.

Chaffey, D. (2019) Average display advertising click-through rates. [Online]. 10 September 2019. Smart Insights. Available from: <https://www.smartinsights.com/internet-advertising/internet-advertising-analytics/>

[display-advertising-clickthrough-rates/](https://www.smartinsights.com/internet-advertising/internet-advertising-analytics/display-advertising-clickthrough-rates/) [Accessed: 26 November 2019].

Chang, A. (2018) The Facebook and Cambridge Analytica scandal, explained with a simple diagram. [Online]. 23 March 2018. Vox. Available from: <https://www.vox.com/policy-and-politics/2018/3/23/17151916/facebook-cambridge-analytica-trump-diagram> [Accessed: 25 November 2019].

Chen, J. & Rodden, J. (2013) Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures. *Quarterly Journal of Political Science*. 8 (3), 239–269.

Cramer, S. & Inkster, B. (2017) #StatusOfMind. [Online]. Available from: <https://www.rsph.org.uk/uploads/assets/uploaded/d125b27c-0b62-41c5-a2c0155a8887cd01.pdf>.

Dawkins, R. (2006) *The Selfish Gene*. 30th Anniversary. New York, Oxford University Press Inc.

Dobele, A., Lindgreen, A., Beverland, M., Vanhamme, J., et al. (2007) Why pass on viral messages? Because they connect emotionally. *Business Horizons*. [Online] 50 (4), 291–304. Available from: doi:10.1016/j.bushor.2007.01.004.

English, K., Sweetser, K.D. & Ancu, M. (2011) YouTube-ification of Political Talk: An Examination of Persuasion Appeals in Viral Video. *American Behavioral Scientist*. [Online] 55 (6), 733–748. Available from: doi:10.1177/0002764211398090.

Fernández-Caramés, T.M. & Fraga-Lamas, P. (2019) A Review on the Application of Blockchain to the Next Generation of Cybersecure Industry 4.0 Smart Factories. *IEEE Access*. [Online] 7, 45201–45218. Available from: doi:10.1109/ACCESS.2019.2908780.

Flaxman, S., Goel, S. & Rao, J. (2016) Filter Bubbles, Echo Chambers, and Online News Consumption. *Public Opinion Quarterly*. [Online] 80, nfw006. Available from: doi:10.1093/poq/nfw006.

Flynn, D.J., Nyhan, B. & Reifler, J. (2017) The Nature and Origins of Misperceptions: Understanding False and Unsupported Beliefs About Politics. *Political Psychology*. [Online] 38 (S1), 127–150. Available from: doi:10.1111/pops.12394.

Frascona Sochurkova, M. (2018) Facebook embraces and invests in Augmented Reality | Newsfeed.org. [Online]. 18 December 2018. Available from: <https://newsfeed.org/facebook-continues-to-invest-more-in-augmented-reality/> [Accessed: 25 November 2019].

Garg, A. (2014) Digital Society from 1G to 5G: A Comparative Study. *International Journal of Application or Innovation in Engineering & Management*. Volume 3, 186 to 193.

Hall, S., Cocorocchia, C., Takahashi, R. & Alter, A. (2018) Creative Disruption: The impact of emerging technologies on the creative economy. [Online]. p.26. Available from: http://www3.weforum.org/docs/39655_CREATIVE-DISRUPTION.pdf.

Hall, S. & Takashi, R. (2017) Augmented and virtual reality: The promise and peril of immersive technologies. [Online]. October 2017. Available from: <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/augmented-and-virtual-reality-the-promise-and-peril-of-immersive-technologies> [Accessed: 25 November 2019].

- Horton, C. (2018) The simple but ingenious system Taiwan uses to crowdsource its laws. [Online]. 21 August 2018. MIT Technology Review. Available from: <https://www.technologyreview.com/s/611816/the-simple-but-ingenious-system-taiwan-uses-to-crowdsource-its-laws/> [Accessed: 25 November 2019].
- Husenovic, K., Bedi, I. & Maddens, S. (2018) Setting the Scene for 5G: Opportunities & Challenges. [Online]. Available from: https://www.itu.int/en/ITU-D/Documents/ITU_5G_REPORT-2018.pdf [Accessed: 20 October 2019].
- Jigsaw Research (2019) News Consumption in the UK: 2019.p.122.
- Kemp, S. (2019) Digital 2019. [Online]. p.221. Available from: <https://wearesocial.com/uk/digital-2019>.
- Koch, R. (2019) Cookies, the GDPR, and the ePrivacy Directive. [Online]. 9 May 2019. GDPR.eu. Available from: <https://gdpr.eu/cookies/> [Accessed: 26 November 2019].
- Koch, T. & Zerback, T. (2013) Helpful or Harmful? How Frequent Repetition Affects Perceived Statement Credibility. *Journal of Communication*. [Online] 63 (6), 993–1010. Available from: doi:10.1111/jcom.12063.
- Liu, X., Krahnstoever, N., Yu, T. & Tu, P. (2007) What are customers looking at? In: 2007 IEEE Conference on Advanced Video and Signal Based Surveillance. [Online]. September 2007 pp. 405–410. Available from: doi:10.1109/AVSS.2007.4425345.
- Lucero, S. (2016) IoT platforms: enabling the Internet of Things. [Online]. p.21. Available from: <https://cdn.ihs.com/www/pdf/enabling-IOT.pdf>.
- Manke, K. (2019) New technology helps media detect 'deepfakes'. [Online]. 20 June 2019. University of California. Available from: <https://www.universityofcalifornia.edu/news/new-technology-helps-media-detect-deepfakes> [Accessed: 26 November 2019].
- Mayer, J. (2018) New Evidence Emerges of Steve Bannon and Cambridge Analytica's Role in Brexit. [Online]. Available from: <https://www.newyorker.com/news/news-desk/new-evidence-emerges-of-steve-bannon-and-cambridge-analyticas-role-in-brexit> [Accessed: 25 November 2019].
- Mehavarunan (n.d.) The Future of IOT: 4 Predictions about the Internet of Things - Thrive Global. [Online]. Available from: <https://thriveglobal.com/stories/the-future-of-iot-4-predictions-about-the-internet-of-things/> [Accessed: 25 November 2019].
- Morreau, M. (2016) Arrow's Theorem. In: Edward N. Zalta (ed.). *The Stanford Encyclopedia of Philosophy*. Winter 2016. [Online]. Metaphysics Research Lab, Stanford University. p. Available from: <https://plato.stanford.edu/archives/win2016/entries/arrows-theorem/> [Accessed: 26 November 2019].
- Mozur, P. (2018) A Genocide Incited on Facebook, With Posts From Myanmar's Military. *The New York Times*. [Online] 15 October. Available from: <https://www.nytimes.com/2018/10/15/technology/myanmar-facebook-genocide.html> [Accessed: 25 November 2019].
- Obiodu, E. & Giles, M. (n.d.) The 5G era: Age of boundless connectivity and intelligent automation. [Online]. p.42. Available from: <https://www.gsmaintelligence.com/research/?file=0efdd9e7b6eb1c4ad9aa5d4c-0c971e62&download> [Accessed: 20 October 2019].
- Oehmichen, A., Hua, K., Amador Díaz López, J., Molina-Solana, M., et al. (2019) Not All Lies Are Equal. A Study Into the Engineering of Political Misinformation in the 2016 US Presidential Election. *IEEE Access*. [Online] 7, 126305–126314. Available from: doi:10.1109/ACCESS.2019.2938389.
- Office for National Statistics (2017) Leave campaign claims during Brexit Debate - Office for National Statistics. [Online]. 7 February 2017. Available from: <https://www.ons.gov.uk/aboutus/transparencyandgovernance/freedomofinformationfoi/leavecampaignclaimsduringbrexitdebate> [Accessed: 26 November 2019].
- Oiticica, C. & Fletcher, S. (2016) Pol.is – Participedia. [Online]. 30 November 2016. Available from: <https://participedia.net/method/4682> [Accessed: 25 November 2019].
- Parkin, S. (2018) Has dopamine got us hooked on tech? *The Observer*. [Online] 4 March. Available from: <https://www.theguardian.com/technology/2018/mar/04/has-dopamine-got-us-hooked-on-tech-facebook-apps-addiction> [Accessed: 26 November 2019].
- Pavlicek, A. & Sudzina, F. (2018) Use of virtual private networks (VPN) and proxy servers: Impact of personality and demographics. In: 2018 Thirteenth International Conference on Digital Information Management (ICDIM). [Online]. September 2018 pp. 108–111. Available from: doi:10.1109/ICDIM.2018.8846991.
- Posetti, J. & Matthews, A. (2018) A Short Guide to the History of 'Fake News' and Disinformation: A New ICFJ Learning Module. [Online]. 23 July 2018. International Center for Journalists. Available from: <https://www.icfj.org/news/short-guide-history-fake-news-and-disinformation-new-icfj-learning-module> [Accessed: 26 November 2019].
- Prigg, M. (2012) The Facebook camera that can recognise you every time you walk into a shop. [Online]. 13 August 2012. Mail Online. Available from: <https://www.dailymail.co.uk/sciencetech/article-2187801/Were-watching-The-camera-recognise-Facebook-picture-time-walk-shop.html> [Accessed: 25 November 2019].
- Quattrociochi, W., Scala, A. & Sunstein, C.R. (2016) Echo Chambers on Facebook. [Online]. Available from: <https://papers.ssrn.com/abstract=2795110> [Accessed: 25 November 2019].
- Royce, B. (n.d.) Reducing time to insight with AI. [Online]. Think with Google. Available from: <https://www.thinkwithgoogle.com/intl/en-154/insights-inspiration/industry-perspectives/reducing-time-to-insight-with-ai/> [Accessed: 25 November 2019].
- Schwartz, O. (2019) Don't look now: why you should be worried about machines reading your emotions. *The Guardian*. [Online] 6 March. Available from: <https://www.theguardian.com/technology/2019/mar/06/facial-recognition-software-emotional-science> [Accessed: 26 November 2019].
- Shao, G. (2019) Social media has become a battleground in Hong Kong's protests. [Online]. 15 August 2019. CNBC. Available from: <https://www.cnbc.com/2019/08/16/social-media-has-become-a-battleground-in-hong-kongs-protests.html> [Accessed: 25 November 2019].
- Shin, J., Jian, L., Driscoll, K. & Bar, F. (2018) The diffusion of misinformation on social media: Temporal pattern, message, and source. *Computers in Human Behavior*.

[Online] 83, 278–287. Available from: doi:10.1016/j.chb.2018.02.008.

Shirer, M. (2019) The Growth in Connected IoT Devices Is Expected to Generate 79.4ZB of Data in 2025, According to a New IDC Forecast. [Online]. 18 June 2019. IDC: The premier global market intelligence company. Available from: <https://www.idc.com/getdoc.jsp?containerId=prUS45213219> [Accessed: 25 November 2019].

Spotify (2019) Music for everyone. [Online]. 2019. Available from: <https://www.spotify.com/uk/premium/> [Accessed: 26 November 2019].

Taber, C.S. & Lodge, M. (2006) Motivated Skepticism in the Evaluation of Political Beliefs. *American Journal of Political Science*. [Online] 50 (3), 755–769. Available from: doi:10.1111/j.1540-5907.2006.00214.x.

The Economist Intelligence Unit (n.d.) Democracy Index 2018: Me too? [Online]. p.68. Available from: http://www.eiu.com/Handlers/WhitepaperHandler.ashx?fi=Democracy_Index_2018.pdf&mode=wp&campaignid=Democracy2018.

The News Provenance Project (2019) The News Provenance Project is exploring new ways for publishers to help fight misinformation. [Online]. July 2019. Available from: <https://www.newsprovenanceproject.com/> [Accessed: 26 November 2019].

Valentine, O. (2018) Top 10 Reasons for Using Social Media - GlobalWebIndex. [Online]. 11 January 2018. GlobalWebIndex Blog. Available from: <https://blog.globalwebindex.com/chart-of-the-day/social-media/> [Accessed: 25 November 2019].

Varis, P. & Blommaert, J. (2015) Conviviality and collectives on social media: Virality, memes, and new social structures. *Multilingual Margins: A journal of multilingualism from the periphery*. [Online] 2 (1), 31–31. Available from: doi:10.14426/mm.v2i1.55.

Xu, Q. (2013) Social Recommendation, Source Credibility, and Recency: Effects of News Cues in a Social Bookmarking Website. *Journalism & Mass Communication Quarterly*. [Online] 90 (4), 757–775. Available from: doi:10.1177/1077699013503158.

Zucconi, A. (2018) An Introduction to Neural Networks and Autoencoders. Alan Zucconi. [Online]. Available from: <https://www.alanzucconi.com/2018/03/14/an-introduction-to-autoencoders/> [Accessed: 26 November 2019].

Zuckerman, E. (2018) Four problems for news and democracy. [Online]. 8 October 2018. Medium. Available from: <https://medium.com/trust-media-and-democracy/we-know-the-news-is-in-crisis-5d1c4fbf7691> [Accessed: 26 November 2019].

9. Appendix

Table 1 - Concept Evaluation Matrix

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	Total
<i>Concept 1</i>	5	5	3	1	2	16
<i>Concept 2</i>	2	4	3	1	4	14
<i>Concept 3</i>	3	3	2	4	2	14
<i>Concept 4</i>	3	3	5	1	2	14