Turn and Face the Strange: Investigating Filter Bubble Bursting Information Interactions

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It is a 'truth universally acknowledged' that people prefer to minimize encounters with information they disagree with and ignore it where they find it. Algorithms purportedly support this avoidance by creating filter bubbles filled only with agreeable information potentially increasing polarisation and undermining democracy. How accurate is this portrayal, though? Recent research has begun to cast doubt. We challenge these assumptions and report a two-phase analysis of filter bubble-bursting behavior. The first phase reports novel incidental findings from an interview study on the role of information interaction in view change. Participants demonstrated a clear interest in a diversity of information, including information specifically opposed to their own views. The second phase reports findings from a diary study specifically designed to investigate people's interactions with information that reflected a different view to theirs. We examine how people found disagreeable information, how they responded to it and the factors affecting their responses. We find that people will sometimes actively seek and engage with disagreeable information, rather than avoid and ignore it. Our findings pave the way for future information interfaces that support this previously undiscussed information interaction.

CCS CONCEPTS • Information systems~Information retrieval~Users and interactive retrieval•Human-centered computing~Human computer interaction (HCI)~Empirical studies in HCI

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1 Introduction

How much do those around us influence what we think? Can we be trapped into specific ways of thinking by algorithms feeding us what we want, rather than what we need? These are the key questions posed by research on filter bubbles and echo chambers respectively. Echo chambers are the limited information ecologies created by surrounding ourselves with only those who are socially and ideologically similar to us, thus avoiding alternative viewpoints [45]. Filter bubbles are the algorithmic extension of this idea; the personalisation of search engines (or, more recently, social media feeds) exposes us to news and ideas we are more likely to find agreeable [8; 36]. Some have even argued that these information structures nudge us further and further from the centre on issues, encouraging us to engage with only certain viewpoints and resulting in polarisation [8].

If these structures are as powerful as suggested, they present significant social challenges—having been blamed for increasing climate change denial [4] and COVID vaccine hesitancy [38], and even influencing the outcome of the 2016 US election [47].

The ability to engage with a diversity of information has been described as a cornerstone of democracy [18]. Seeing views other than one's own may promote either debate or consensus [18]. Diverse information also affords the opportunity to reconsider and possibly change one's views [29]. Not getting this diversity of information, conversely, deprives people of these opportunities for developing new perspectives, and possibly reduces creativity and innovation as well [26; 28].

Popular discourse in this space suggests that people will avoid information diversity, preferring to stick within their filter bubbles and echo chambers [3; 42]. Recent research, however, has begun to question whether filter bubbles are as impermeable—or even as appealing—as this discourse suggests [8; 9; 21; 47]. Indeed, it is unlikely any algorithm can insulate people from *all* information they disagree with [9], and unwillingness to engage with alternative views may not be as entrenched as previously thought [8]. Regardless of their permeability, to break out of a filter bubble, people must first see, and then engage with views different than their own. The core question then, is whether they see and engage with alternative viewpoints, and if so, how?

In this paper, we present empirical evidence from two qualitative studies on people's interactions with information that reflected views different to their own. The first study identifies a propensity for deliberately engaging with information from alternative viewpoints among a highly specialized group: people who had recently changed their view on an important issue. Having both recently changed their view and being willing to discuss it, this group is unlikely to be representative of the general population. The second study therefore involved a broader group of social media users. It examines interactions with information reflecting alternative views on social media, exploring how people acquire and react to that information. We demonstrate that aversion to information reflecting alternative views, and avoidance of it where it is discovered, is far from universal. We identify engagement with information from alternative or opposing viewpoints as a new type of broad information need and identify factors that promote and inhibit this engagement. This paves the way for future novel information interfaces that facilitate finding and engaging with alternative views.

The remainder of this paper is structured as follows: firstly, we discuss relevant background literature, focusing on studies of filter bubbles and echo chambers (see Sec. 2). In Section 3, we report novel incidental findings from our study of information-facilitated view change that motivated our dedicated study of peoples' engagement with information they do not agree with. In Section 4, we explain and justify the study method, presenting findings in Section 5. We discuss both studies in the context of existing literature, offering suggestions for future information interfaces in Section 6. Finally, in Section 7, we draw conclusions and suggest avenues for future work.

2 Background

In this section we discuss relevant background literature, focusing first on theoretical discussions around filter bubbles and echo chambers, then on empirical examinations of information interaction around these information structures.

2.1 On the nature of filter bubbles and echo chambers

In 2001, Sunstein argued that despite the internet being a wellspring of information, it may have a deleterious effect on democracy by allowing people to increasingly engage only with likeminded others, avoiding news and opinion they find offensive or disagreeable—a concept he referred to as information cocoons or echo chambers [45]. Recently, Sunstein has extended this argument to social media, arguing it is exacerbating the problem described 20 years ago [44].

Ten years after Sunstein first mooted echo chambers, the idea of the filter bubble—algorithms that hide information they think we don't want to see by personalising our search results—was popularized by Pariser [36]. While Pariser focused on search, other commentary on filter bubbles focuses on social media feeds [8]. Unlike search, these feeds are not constrained by keyword relevance, and thus social media algorithms select what we see based entirely on engagement and personalisation. This has been raised as a particular concern due to the increase in use of social media for news access [2; 6].

The suggestion that the internet may hide things from us, potentially allowing messages we agree with to become 'consistent and overwhelming' [35] (like effective propaganda) has attracted rapid and significant attention from ethico-legal scholars [17-19]. Democracy relies on an informed populace to make voting decisions, so information interfaces and systems that limit or bias information are viewed with great caution [17]. Based on concerns about the impact of limiting information to a single perspective, these same scholars have argued for policy measures to increase diversity in search results and social media recommendations [18]. One challenge they identify is how to measure diversity [19]; this echoes similar discussions of the challenges of measuring bias in news media [41].

More recent discussions of filter bubbles and echo chambers have pointed out that homophily—choosing to associate predominantly with others like oneself—is both natural and potentially beneficial [9]. Benefits, if any, stem from the ability to tease out the nuances of an argument with like-minded people, and that this process is critical to advancing our thinking [17]. These recent discussions have questioned whether social media does result in echo chambers, pointing out that 'context collapse' (where one's social groups become a single audience [5]) may mitigate against homophily. Similarly, they question whether algorithmic filter bubbles make a meaningful difference to information ecologies, noting that it is very hard to entirely avoid information we disagree with online [9]. This work also strongly questions the empirical evidence for filter bubbles; a question we examine in section 2.2.

A notable commonality of previous work is that it treats filter bubbles and echo chambers as though they are likely to be innately desirable to individuals interacting with information, albeit potentially harmful to society at large. In this paper, we question this assumption by focusing not just on peoples' (putative) attitudes, but also on their behaviour when they come across information they disagree with.

2.2 Information interactions with filter bubbles and echo chambers

While there has been considerable theoretical concern about filter bubbles and echo chambers, there is less research on how these structures influence information interaction in practice, particularly in terms of people's experience of information.

Much of the evidence on the impact filter bubbles and echo chambers doesn't interrogate which of these structure(s) are responsible for the putative effect on people's engagement with information. In fact without significant knowledge of the underlying (proprietary) algorithms this would be difficult in practice; it is difficult to

determine what people might have seen (or not seen) without knowing how the algorithms work. Instead, research examines whether there are divisions between groups of people, and whether those people are willing to engage with information from the 'other' side, mostly focusing on news content.

General studies of news engagement demonstrate that political polarity does not affect which news sources are engaged with: neither algorithmic nor social pressures push people away from the central news sources consumed by the majority [16; 47]. Looking specifically at social media, researchers have found clear social divides and strong evidence of homophily, but information is shared between groups [11]. Even when looking at politically partisan news readers, there is a willingness to read information from 'the other side', and readers spend longer on this type of news than they do on news with which they are more familiar [21]. The authors of that work suggest this time is possibly spent looking for flaws or constructing counterarguments, however, rather than engaging with an open mind. In contrast, our own previous work demonstrates that some people do deliberately engage open-mindedly with information that reflects alternative views to theirs [29]. We thus aim to provide a clearer picture of cross-ideological engagement.

While there is considerable evidence questioning the role of filter bubbles and echo chambers in view formation and change, some studies do suggest they may be influential. A large-scale survey found that 90% of news readers stuck within their political polarity, and that search engines and social media reinforced polarity while aggregators reduced it [14]. In this study, <5% of already-polarised participants engaged with news from any source that was unlikely to reflect their own view, a finding supported by [6]. Another study similarly demonstrated a low level of news engagement across political polarity on social media, with <20% of users clicking on news they were likely to disagree with [3; 14]. While some of this was due to what algorithms showed them, much was due to their own preferences. This finding is supported by a qualitative study of the echo chamber effect in a single social network on Facebook which demonstrated that people were unwilling to engage with alternative views, preferring instead to mute or ignore them [42]. Like people, algorithms are not unbiased: a study of YouTube has demonstrated algorithms also facilitate a division of viewpoints [22]. However, algorithms can also increase engagement with alternative views, as demonstrated by [48], which increased diversity and changed terminology on search results reflecting alternative views ultimately making them demonstrably more palatable to searchers.

Significant effort has gone into developing information interfaces that support engagement with alternative views; much of which has focused on presenting a diversity of viewpoints and highlighting where these views come from [6; 15; 24]. However, this research is based on a theoretical (rather than empirical) understanding of filter bubbles and echo chambers.

Ultimately, the influence of filter bubbles and echo chambers on information interaction is unclear, but there are research gaps. Little work has investigated whether information consumers *want* to engage with alternative views (rather than examining what they *do*) and, if so, how best to design information interfaces to facilitate this engagement. Similarly, only [42] has specifically examined the experience of engaging with information that does not reflect one's own view (in contrast with [33], which addresses reconciling opposing views), and only in a single social network on a single platform. While some interfaces have been designed to support 'filter bubble breaking' behaviour, they are not rooted in an understanding of that behaviour. In this paper we seek to understand whether the dominant narrative, of a protective, desirable filter bubble and carefully curated echo chamber, is what people really want. We examine how people come across information they disagree with, whether and how they seek it out, and what they do when they meet it. Do they turn away, or do they engage, and, if so, how and why?

3 Motivating Study

The genesis for the larger diary study reported in this paper was a new analysis of data from an interview study on the role of information interaction in view change (see [29]). This analysis focused on the concepts of filter

bubbles and echo chambers, and findings have not been previously reported. We present them here as motivation for the diary study described in the following sections.

3.1 Method for motivating study

The motivating study focused not on finding information that does not reflect one's view, but on the broader role of information interaction in view change. As more extensive details of the data collection approach have been previously reported [29], we provide an overview to explain the novel analysis presented here.

We interviewed 18 people recruited from a variety of sources about their experience of changing view on an issue that was important to them. We asked them to focus on the information interactions involved in the change, and collected information about the view change process. Changes they described included changes of political view, changing view on issues of personal importance (such as health or education decisions), becoming vegetarian, changes of view on high profile criminal cases, and in one notable case, coming to believe the earth may be flat.

Interviews were conducted in person or on Skype, and all but two were conducted by two researchers. They were transcribed professionally, and analysed using an inductive thematic analysis approach [7]. In this paper, we discuss the theme we identified on filter bubble breaking during view change. This theme surfaced without us mentioning filter bubbles, echo chambers, or related ideas; it was entirely participant driven.

3.2 Filter bubble breaking during view change

Arguably, to break out of a filter bubble or echo chamber, you first must recognise that you are engaging with a steady stream of similar information, and choose to change that. Participants expressed a high awareness of the potential for filter bubbles and echo chambers to limit what they saw. For example, P8 noted '*I have read about these things that are about echo chambers and things like that, and people wanting to reinforce their views and not willing to change it*.' Similarly, P9 said of himself *I'm from a working class, white, non-English background in a very rich country, so I'm sure that fits me into some kind of political bag and I'm sure some biases are inbuilt*.' Echo chambers were seen as behaviourally-constructed, and something that participants could avoid if they so chose; for example P11 stated '*this sounds like a negative behaviour I need to avoid. So what can I do to do that?*'. Other participants suggested they were not stuck in echo chambers, for example P16 stated '*I wouldn't say my social media is an echo chamber…I have journalistic instincts and values…and I'm not one to get drawn into whatever.'* In contrast, some participants, such as P14, saw value in being in an echo chamber to '*discuss nuance*': *'Well, it is [an echo chamber] in one respect, because it's obviously a group of people who all share, at a more macro level, the same political views. But on a more micro level, it's a safe place to discuss your thoughts*'.

Alongside a recognition of the social factors driving their information engagement, participants recognised algorithms were influencing some of what they saw. P10 said *'I have been following some people who talk about climate change and reducing CO2 emissions. And because I follow these people then whenever I go to the explore part of Instagram, I obviously see the suggestions for other pages on this*'; similarly, P16 noted '*there was some Twitter algorithm which was like, you're going to like all this US stuff, because you've been liking that a lot recently*'.

This recognition of the limitations of their social circles and algorithmic feeds was a key driver for participants wanting information from outside their filter bubbles or echo chambers; P11 noted there had '*been so many articles and other media about the echo chamber effect, and things like that'* that had made him aware of these information constructs and their possible negative effects on view change.

Of 18 participants, 10 described occasions where they had deliberately taken action to **expose themselves to views other than their own**, either regularly as part of their everyday information behaviour, or specifically on an issue that had come to their attention. Some actions were intended to ensure access to a diversity of information, others were specifically undertaken to ensure they saw positions they actively disagreed with.

Some participants mentioned **searching for information they disagreed with**: P17 said *'I think I Googled it and talked to people as well, to try and understand why [people voted for Brexit]*'. This participant deliberately

sought information diametrically opposed to her own view because she *'wanted to understand'* the '*other side*.' Other participants **engaged with specific information sources** they expected to contain views other than their own. For example, P8 regularly read *The Economist*, even though her views were broadly left wing: '*The Economist is…very dogged religiously liberal free markets, and sometimes I think they skirt over the issues that have to do with capitalism and globalisation. But I still read it because I like to keep an eye on what they're saying.'* Similarly, P9 consulted newspapers that were further right than him on the political spectrum to chance upon information he knew he was likely to disagree with: *'my political views are generally slightly left of centre…occasionally I go on the news and get an article from like The Sun or something that's quite right wing and I'll just read what's there just out of sheer interest*.' While some participants specifically sought disagreeable information, others sought a **plurality of views**, such as P11 who said *'so at times it tends to be quite central. If I see a particular point of interest, I'll go to The Guardian and The Times, and The Telegraph or The Mail just to see how differently those organisations interpret something,*' and P2 who said of the people she followed on Twitter *'I don't agree with all of them…but I don't want to be in this bubble where I only listen to people that have the same ideas as I do*'.

While participants were open to alternative views, there were **limitations to what they would engage with**; these limitations changed situationally. P14 noted that she would *'never'* believe anything in the Daily Mail because '*they've got a massive agenda'*. In contrast P2 noted that while generally she was prepared to engage with alternative views to her own, *'sometimes you feel pretty passionate about something. You cannot even think about the idea that someone might disagree with you.*'.

In summary, participants reported a high level of awareness of the algorithmic and social limitations of information in personalised environments, particularly on social media. In response to these limitations, many took steps to ensure they engaged with information reflecting either a more diverse range of views, or views they explicitly disagreed with. However, there were limits to this engagement based on both information sources and participants' personal views.

3.3 Motivation for further study

The narrative our participants expressed—awareness of being in a filter bubble or echo chamber—runs counter to descriptions of participants in much previous research (for example [3; 14]). While the concept of the filter bubble has occasionally been challenged, the idea that people congregate in social echo chambers, and that there is a high personal cost for challenging these structures, is well supported by the literature [31; 42]. Furthermore, while heralded as a social and political benefit, deliberate engagement with a diversity of views, or with opposing views, has not been discussed in previous information interaction literature.

While the behaviour of participants in our motivating study was interesting, it raised as many questions as answers. Firstly, our participants were relatively unusual: people who had both recognized a view change in themselves, and who were willing to discuss it. This is often not the case [37]. Perhaps this openness also extends to their information engagement. Secondly, self-reports of past behaviour may not be accurate [43]. Thirdly, participants engaged with information that reflected different views to their own because they had deliberately sought (rather than passively encountered) it, or at least created an information environment where encounters were likely to occur [26].

We thus had several questions about filter bubble breaking behaviour: does it occur outside the context of view change? What kinds of behaviour do people who come across information they disagree with engage in when they are not looking for that information? Do incidental encounters result in view change, or even engagement, or is the unwillingness to engage described elsewhere more typical? To investigate these questions, we designed a diary study to capture encounters with information that reflects a different view to their own relatively contemporaneously. The diary study focused on how they found this information, whether they responded and how, the factors affecting their response and whether this prompted further interactions. We now describe the method for this study.

4 Diary Study Method

Based on our previous study, where many encounters with view-changing information occurred on social media, we wanted to understand what happened when people encountered information at odds with their view ('disagreeable information'). Outside of the context of view change, we had little understanding of how frequent such encounters were, nor how they occurred, nor how people reacted to them. Diary studies have commonly been used to study information experiences that may be infrequent and hard to subsequently recall [1; 27; 30]; we chose this approach. As with previous studies, we followed our diary studies up with semi-structured interviews to clarify elements of the diary and elicit further information about participant motivations and experiences [27]. Based on concerns about social media facilitating filter bubbles and echo chambers along with our earlier finding that much disagreeable information is found on social media [29], we focused this study on social media platforms.

We recruited 10 regular users of social media (who used at least one social media platform several times a week) through a combination of social media advertising, personal contacts and snowball sampling. This number, while small, is typical of other studies of information interaction (for example [1; 20; 27]), and allowed us to form an initial impression of whether—and how—people engaged with disagreeable information. Nonetheless, the sample size is a limitation of this study, as is our sampling approach: we advertised on our own social media, and thus our participants may be 'people like us' who are more than usually willing to engage with disagreeable opinions. We asked participants to refer other participants, and our social media feeds to repost our advertisements. It, however, is unlikely that we reached very right-leaning people with deeply entrenched views, who are less likely to engage with views other than their own [47]. Participants were aged 18-30; 5 men and 5 women. They reported using social media platforms, including Reddit, TikTok, Facebook, Twitter, YouTube and Instagram. We refer to participants as P1-10.

4.1 Diary study

The diary period ran for one week in September 2020, during which participants were asked to take screenshots of information they disagreed with on social media and describe their interactions with it. Diaries were recorded in Google Docs; a new Google Doc was sent to participants at the end of each day, along with several prompts. The first prompt in each diary was '*did you see anything on social media that you disagreed with, or that changed your view today?*' This question was followed by a series of lightweight prompts intended to elicit details about participants' interactions with disagreeable information, for example '*what were you doing when you found this information?', 'how did you feel when you saw it?', 'did you interact with it in any way, for example by commenting or sharing?', 'what about this information didn't align with your view?'*. Participants were encouraged to use the prompts as a starting point to provide a rich description of their information interactions. All but one participant provided at least one diary entry. Participants recorded 48 initial interactions in their diaries; these could seed further interactions, such as reading comments in a discussion thread or seeking follow-up information. 7 participants reported 3-6 initial interactions each; one reported 13 and one just a single interaction. The remaining participant reported no interactions with disagreeable information.

While we analysed the diary entries in their entirety, we do not include the screenshots provided by our participants in our results; complete anonymity is not possible due to photos, names and post searchability. Reporting social media data in a way that individuals—particularly non-participants—can be identified is poor ethical practice [40; 46].

4.2 Follow-up interviews

Semi-structured follow-up interviews were conducted over Zoom within a week of the diaries being completed. Interviews lasted between 7 and 69 minutes, most around 45 minutes. The 7 minute interview was with P8, who

didn't record any diary entries; we interviewed him briefly to confirm he had not seen any disagreeable information, and ask why he thought that was.

Each participant's interview focused on their diary entries, using them as memory aids to elicit further detail about their interactions with disagreeable information. Our questions focused on understanding ambiguities in the diaries, the nature and strength of participants' views, how participants found the information recorded in their diaries, how they responded to it and what influenced decisions around those responses. Examples of specific questions we asked included: '*had you gone to Reddit with any specific purpose in mind?', 'did you interact with this information in any way?',* '*why did you look at the comments underneath this tweet?*' and *'did you have any strong feelings about anything highlighted in this before you saw it?*' Interviews were transcribed automatically, then corrected by hand

4.3 Analysis

Diaries and interview segments were combined to form a single narrative for each participant, and analysed using thematic analysis [7]. Analysis was done manually on paper by a single researcher; a second researcher conducted an independent inductive analysis sensitised by the themes from our preliminary study. The resulting themes describe interactions with disagreeable information, and factors affecting the willingness to engage with disagreeable information. These themes are presented next. In line with Braun and Clarke's assessment that the number of times a theme occurs does not reflect the importance of the theme, we deliberately do not give specifics of the number of instances of any theme or code [7]. In keeping with Braun and Clarke's approach, we use quotations from participants to demonstrate each code, and codes are all bolded in their initial appearance.

5 Diary study findings

This section describes how participants found disagreeable information, their responses and the factors driving and inhibiting these responses. Finally, we discuss participants' reflections on the information sources, platforms and algorithms they used when they found this information.

5.1 Finding disagreeable information

None of the experiences of disagreeable information our participants described began with search; instead, they involved purposeful browsing and passive information encounters. This is perhaps unsurprising, given most social media platforms incorporate feeds that promote information encounters [28].

Nevertheless, there were times where participants deliberately **sought out** information they knew they were likely to disagree with. Sometimes this was part of a regular routine, such as P3 reading a long Reddit thread about Melbourne each night, knowing it was likely to present a range of views about lockdown, or P1 who regularly read a Reddit thread (r/ChangeMyView) '*because there are really interesting posts on there. Very contentious topics as well, so it's interesting to read what other people's views are*'. Participants also found disagreeable information when they **deliberately engaged with contentious information**, such as P1 seeking out a subreddit about COVID cases in Melbourne while watching a TV update *'to see how other people were reacting'*, or P3 selecting '*very intensely downvoted or upvoted posts'* to *'maybe just take a little look… to see what content there is in those comments*'.

Passive information encounters with disagreeable information tended to happen where participants were *'just scrolling'* through social media feeds, *'taking a break'* (P2) or *'before I go to sleep'* (P4). Disagreeable information encountered under these circumstances included a *'slutshaming'* TikTok video (P4) and anti-lockdown commentary from friends and associates (for example P3 and P9). Some disagreeable information in these encounters was promoted by people outside participants' social networks, such as comments on a post by Australian politician Dan Andrews, which prompted P2 to state '*I don't know how Facebook works'* or a video P1 found '*just on my YouTube homepage*'. More commonly, though, it was shared by people participants knew, either

someone on the periphery of their lives (for example the Instagram influencer on whom P5 did a 'deep stalk') or someone from their past. Referring to a disagreeable Facebook poster, P3 explained '*this guy was in primary school…at the end of primary school you add everyone on Facebook*.'

5.2 Responses to disagreeable information

One response to information participants did not agree with was **disengagement**—such as P3 who '*laughed a little bit and scrolled on'* after seeing an offensive post on Grindr or P6 who *'just left and continued scrolling'* after seeing something she disagreed with on Twitter. We saw this response less often than we might expect, but this is likely because scrolling past disagreeable information on the internet is unlikely to be noteworthy or memorable. In two cases participants disengaged more actively, **unfriending** people who posted things they disagreed with. For example, P3 unfriended someone who posted anti-lockdown sentiment after seeing too much of it: '*I'd just had enough*'. Some disengagement was more public, such as P9 who posted about anti-lockdown views *'if any of you guys do hold those views, just unfriend me now'*.

Another common response to disagreeable information was **reading comments or replies**. One example of this was P5, who when someone started *'retweeting all the replies that agreed with her,' 'started looking at threads and reading replies'* because *'I like to know what people are thinking'*. Similarly, P2 *'read the replies'* to a post on a state leader's Facebook post to see '*what other people had to say*.'

Four participants engaged in **active information seeking** after they encountered disagreeable information. This could be because they did not understand something about the view, for example P1 who *'didn't know what sunk cost fallacy was, so I had to Google that'*. Others needed more information to understand what was being expressed, such as P3 who when he saw Indian President Modi being compared to Trump and Bolsonaro '*wiki'd [sic] him a little bit*'. Finally, some participants engaged in information seeking to test their own views, such as P10 who, when she saw a post favourably comparing the Swedish COVID response to lockdown, *'took a little bit of time to research and look at articles'.*

Another response our participants engaged in was '**liking/disliking'** using social media mechanisms. P1 reported disliking '*to show the OP that people disagree with them*', whereas P3 wanted to let *'other people know the view is discouraged*'. In contrast, P1 liked comments to '*[show] the commenter and people reading the comments "hey, this is a good comment'"*. Participants often liked or disliked in preference to commenting because it was easier; P6 said: *'I would have had to make an account to comment…otherwise you can just upvote or downvote'*.

While less common, some participants did report **sharing their own views**. Some did this by commenting on a post they disagreed with. For example, P9 replied directly to opposing posters to *'debunk their opinion'* when discussing a COVID-related arrest in Melbourne. In contrast, when P7 came across an anti-China post on a friend's WeChat, he did not want to confront the friend directly. However, he did post his views on his own feed, saying people can just *'pass it on [sic, meaning pass by]'* if they're not interested. As well as sharing publicly, P9 reported he had shared his views on a group chat of likeminded friends because '*it felt like it was a safe place to rant',* whereas if he commented publicly he would *'have to form a more coherent and logical argument'.* In contrast to these participants who shared their views, eight participants explicitly reported **not sharing their views**, such as P3 who described himself as *'a very passive consumer'* and P4 who said *'in general I just lurk*'.

Finally, albeit rarely, participants reported **changing their views** in response to disagreeable information they encountered. One example came from P7, who reported deciding to *'work harder on getting a job*' after reading a post from an old school friend, where his original view was '*I got time, like, one more year to graduate*'. P5 also reported changing her view, in this case about laws around payment for news content in Australia. At first, she was concerned: '*the way Google phrased it [the laws] were gonna change the way we search*', but then she talked to a friend who said '*nah nah, this is good, we need them to pay [writers] money,'* so she went from being '*on Google's side but then I changed to the government's side'.*

5.3 Factors affecting engagement

Participants reported a variety of both intrinsic and extrinsic factors that affected their engagement with alternative views. Some of these factors affected their willingness to read or watch content with which they disagreed, others affected their willingness to express an opinion, and two factors affected both.

5.3.1 Motivations to read disagreeable information.

One of the most common reasons for reading information participants knew they were likely to disagree with was **seeking controversy**. One example came from P10, who decided to read the comments on a poll *'because I knew they'd be spicy'*. Similarly, P3 examined '*very intensely upvoted and downvoted*' comments on a Reddit subforum. One reason participants gave for seeking controversy was **understanding the spectrum of views** on an issue. For example, P2 read the comments on Dan Andrews's post because there were '*people hearting or whatever, some people were angry or laugh reacting…so I really was curious as to what are people actually posting on his page? How many people are actually mad at him?'.* Similarly, P10 *'wanted to understand how many people were actually against this*' in a discussion of Melbourne's lockdown and P6 wanted to '*get, like, a general idea of what Australia's opinion was'*.

Another motivating factor for participants to engage with disagreeable information was to evaluate their own views. One approach was to **compare their own views to those of others**, such as P4 who said '*I kind of want to see what other people are thinking, the same as me or differently'* and P1 who wanted *'to see where I sit compared with other people'.* Similarly, P5 wanted to *'verify again, like if what I'm thinking is correct or just to like know what the other side is, just to become more aware of the situation'*. In other cases, participants **were seeking validation of their views**, for example P6 who said *'even though it's kind of a controversial opinion [American racism being different from racism elsewhere], I would like to see other people like backing it up, and making me feel like my opinion is validated*'. Similarly, P3 stated *'people having the same kind of feeling, makes my feelings more valid*'.

In line with wanting to validate their own views, two participants reported consuming disagreeable information so they could **construct a counterargument**. P9 stated *'so by getting like opposing information and seeing what they were arguing and the points they were making I was able to like, think of those points and then come up with counters, to their points*'. This approach was supported by P10 who stated *'to make your own arguments, you need to know the other side'*.

Finally, participants were sometimes genuinely interested in **understanding and empathizing** with those who held a different view to them. P8, who did not make any diary entries because he did not find any disagreeable information, described himself as someone who '*liked to understand both sides of an issue*', and when someone posted something he did not initially agree with, he tried to *'see things from their point of view'* and question *'whether I need to broaden my own views'*. Similarly, P10 said it was important to her to *'be empathetic that people's opinions come from somewhere'*, and P3 said he *'could probably empathise a bit with where that person was just coming from in terms of people wanting freedom*' in response to a post criticizing Melbourne's lockdown, even though he personally supported it. Even P9, who read others' views to support constructing counterarguments, commented that doing so *´did open me up to, this whole other opinion and the arguments they were making'.*

5.3.2 Willingness to express an opinion.

Participants reported a variety of factors that influenced their motivation for sharing their own views, either in the form of liking or disliking comments, or posting a comment of their own.

One of the major factors in whether participants sought to express their own views was their **relationship with the people posting**. P9 noted that personally knowing the people posting content (rather than it being promoted by an algorithm) made him more likely to read it. He stated *'if I had just come across it normally while scrolling I probably would've scrolled past, but because it was shared by two of my friends, I was like wait, what is this?*'.

Relationships also influenced the way people reacted to posts. P7, for example, reported liking a post by someone he wanted to reconnect with because '*I actually just want to draw some attention from him*'. P8 noted that he avoided interacting with disagreeable information to preserve relationships '*I'd hate to destroy a relation [sic] over one silly argument'*. Whether the people posting were friends was another factor affecting decisions to interact, for example, P2 said '*when it's a stranger, does it really matter if one more anonymous person likes it?*' and '*I don't care about arguing with someone who disagrees with me on the internet…no-one's mind gets changed'.* P4 reflected this distinction, saying '*if it's someone I know then I care more about sharing my opinion and hearing what they have to say. If it's people on the internet, it's kind of like, well, people think some stuff and I think some stuff'.* P9 enjoyed debating with strangers on the internet but noted that, with strangers, his arguments needed to be clearer and better formed.

Disagreeable information that was **perceived as serious**, or which had **a strong emotional impact** was more likely to spur participants to engage or express their opinions. P2, for example noted she swiped through a post about chihuahuas '*because it was lighthearted, and not as serious*', whereas after reading a post about COVID, she *'spent a bit more time reading the thread and googling [sic]'.* Similarly, P9 who did not initially share his views on a planned lockdown protest because he thought *'oh, it's just like a fad, it'll pass'* did share his opinion by the end of the week when it became apparent the protest was actually going to happen. The seriousness of the topic could lead to a strong emotional reaction, such as for P1, who discussed a post about COVID support payments that made him '*more upset than some of the others.'* in turn making him *'more inclined to react'.* Similarly, when P9 saw a disagreeable article repeatedly, he became irritated and posted because *'I've had it up to here'*.

Participants wanted to see **representation of their views** in discussions, and this affected their engagement. If their opinion had not been represented, this could motivate them to post, such as self-described 'lurker' P4, who described one of her reactions as '*what the hell? And people were agreeing with it as well, and I was like someone has to say this [to disagree]'.* Similarly, P9 said of anti-lockdown arguments *'I've had enough with those posts and arguments, I wanna say something and put forward a different opinion*'. Conversely, if participants felt their views were well represented, they were less inclined to react to posts. P2 said '*when I see someone's already commented it's kind of like Oh, you know, they've already done it, so I don't have to'.* Similarly, P3 didn't 'angry react' to a Grindr profile that had already received several angry reacts: '*the marginal benefit of me reacting additionally on top of that's not really gonna…have an impact or anything*'.

Participants sometimes expressed an opinion to try to **influence others**, such as P7 who posted in response to anti-China posts to '*influence [the poster] to think another way'.* P2 thought it was important to challenge disagreeable information '*for the good of all of us, [so] things that I think are incorrect or disagreeable won't just go unchallenged...other people will just accept them at face value*'.

Presentation of self was a key factor in decisions to express an opinion. P7, for example, feared creating an enduring opinion profile that may have future consequences: '*I just wanna stop generating these traces. In the future, you know, something will happen and it will leave all these really bad histories for me'*. Similarly, P2 said '*I don't like connecting what goes on on the internet to myself',* and P9 said *I think because we have...family and friends [on Facebook], we generally don't want to share controversial opinions*'. Sometimes though, self-presentation motivated people to act. P3 unfriended someone because *'I don't wanna be associated with it [anti-lockdown sentiment]*', and P8 '*didn't want to be known as a social media drama queen'*, so avoided posting.

Related to presentation of self is the **attention management** some participants reported. Some avoided posting opinions to avoid *'get[ting] attacked'* (P7). P6 said she '*just would never like post anything publicly…it really freaks me out*'. Others did not share their opinion because they felt it would be drawing attention to the opposing view, such as P10 who said *'you guys would totally see me react, and nah I'm not interested in that*'.

Finally, and most prosaically, **interface design** motivated some decisions to express an opinion. P9 noted he did not comment on TikTok *'because it has a character restriction, and like, it's very hard to get your opinion out*'. Similarly, P4 did not comment on Reddit because she '*would've had to make an account to comment*'. Similarly, P3 noted it was too much effort to react to a post he disagreed with '*I'm lazy—it's an additional function that I would*

have to do'. This suggests that it is possible for design to influence this behaviour, also reflected in participants' comments about the sources, platforms and algorithms they used when they found this information (see 5.4).

5.4 Sources, platforms and algorithms

Participants reflected not only on their interactions with information they disagreed with, but also on the information sources, platforms and algorithms they used when they found it.

Participants routinely reported using **different platforms for different purposes**, for example P3 stated '*Instagram is a platform for me to connect and share…not a platform for me to look at political content*'. Platforms were not used in the same way by all participants, though. P6, for example, used Facebook to keep up with people she knew personally, whereas on Twitter (where she found most of her disagreeable information): '*I just follow like, random people who are fans of like the same artists that I am, or that sort of thing, so I tend to just get like completely random opinions of people like on the other side of the world*'. In contrast, P9 used Facebook to '*follow, like, all those news articles a bit more, so I've got more exposure to those different opinions and views and more serious matters from Facebook*'. Similarly, P4 described Reddit as *'probably the most predictable…[for] something on the front page, I'll usually agree with the comments*'.

One common theme was **bias**. Three participants described certain news outlets as biased, such as P10 who described 9News in Australia as *'trash…not informative journalism'* and P3, who did not want information *'filtered by some sort of journalist or something'.* Participants also recognised communities as biased, for example, P4 who described the commenters on 7 News as *'don't know, like 52 year old boomers on their iPad'* and P6 who described people she followed on Twitter as *'outwardly… feminist and that kind of thing. I think you call them Social Justice Warriors*'.

Finally, participants recognised the role of **algorithms** in what they were seeing, for example P4 who was annoyed that after she watched something she disagreed with, TikTok kept showing her more of the same because '*the algorithm sorts you into which posts you might like*'. P10 said of Facebook that '*you may not subscribe to these people, or these pages, but according to maybe the algorithm of what you've been looking at, what you're spending most of your time with, what makes you react longer, so, I assume it has a timer on me interacting with these certain posts, so it will keep feeding me more of those posts, 'cause it keeps me on Facebook*'. Even where participants were unsure of how algorithms worked, they hypothesised about their impact. P2, for example stated '*I think it was a friend of mine liked it or commented on it which is why it got recommended…I don't know how Facebook works anymore*'.

5.5 Summary

All but one of our ten participants interacted with information they disagreed with somewhere on social media over the course of a week. This information was predominantly passively encountered, though participants sometimes engaged in purposeful browsing to find it. Interactions with disagreeable information varied, but included reading the comments, sharing one's own view, disengaging and looking for more information. Factors that affected participants interactions included relationships with the people posting information, the importance or emotional weight of the topic, wanting to understand and evaluate the opinions of others, and the interface limitations of various platforms. Finally, participants were acutely aware of many of the factors information researchers are concerned about, such as algorithmic influence and bias.

6 discussion

One of the key contributions our work makes to the literature is on the permeability of filter bubbles. Previous studies have attempted to quantify this permeability [14; 47; 48]. For a filter bubble (or echo chamber) to be permeable, though, participants have to be willing to engage with information they find disagreeable, and participants' views on filter bubbles and echo chambers support this view. We have provided a qualitative

description of behaviour that—at least in the view of our participants—is designed to break filter bubbles. Participants in both studies reported in this paper contradicted popular narratives around filter bubbles and echo chambers. Not only were they theoretically willing to engage with alternative views, but their behaviour demonstrates that they *do* engage. It has been suggested that engagement across ideological lines occurs mostly to construct counterarguments, rather than to engage [21]; our data belies this: only two participants mentioned constructing counterarguments. Many more participants wanted to understand alternative views, or empathise with the people who held them.

Where our participants' experiences did align more with previous research, was on the issue of echo chambers. Our participants reported not wanting to engage with strangers, for fear they would be shouted at or called '*social media drama queens*' (P8), but their relationships with posters also affected how they reacted. As in previous literature, old friends were discarded, but relationships with current friends were protected, and a site for open discussion [25; 42].

The echo chamber metaphor highlights a paradox in our results. Participants found the likes/dislikes and comments they read useful, but were often loath to engage themselves, particularly in the form of comments. While lurking is common [32], it reinforces filter bubbles and thus encouraging comments and discussion could be considered positive. Participants themselves mentioned interface barriers to engagement (such as lengthy sign-in processes) and reducing these barriers while maintaining the accountability that reduces trolling [49] is a key challenge the future design of information interfaces. Participants were also (rightly) concerned about privacy and self-presentation, though, and understanding the relationship between views presented online and participants privacy concerns and self-concept is a complex challenge, ripe for further information interaction research.

Where participants did post their own views, or react, they did so because they wanted to see their views represented and influence others, a finding that is similar to work on misinformation [10]. This finding supports theoretical work on filter bubbles, which posits diversity as a key defense against polarisation and division [18]. Similarly, posts disagreeing with misinformation have been shown to reduce trust in the misinformation [12], so supporting opposing reactions may be an important protection against its spread. Some work on information interfaces to show a diversity of viewpoints has already begun [6], but more work is needed on how best to present these views. Creative thinking is needed, because diversity can promote backlash instead of engagement [4; 23; 34]: how do we get the benefits without the backlash? Interfaces that support diversity would also support one of the tasks our participants frequently engaged in: understanding the landscape of opinion and evaluating their own opinion in relationship to it. Assessing one's own beliefs and opinions relative to others has been shown to reduce the spread of misinformation, and mitigate against polarisation [4] so supporting these tasks is important, but again how we might do this remains unclear.

One final key lesson for information interaction in our data is the role of the passive information encounter. Participants in our motivating study had structured their information environments to contain diverse information (ideal for serendipity [26]), and none of the initial interactions with information from alternative views described in this paper occurred through active search. This supports previous theoretical suggestions about the importance of the role of serendipity in limiting the impact of filter bubbles and echo chambers [39]. Non-search information behaviour, serendipity and interfaces to support them are significantly under-researched [13; 28], and our work reinforces the importance of understanding and supporting these behaviours.

7 Conclusions and future work

In this paper we report findings from two studies of information interaction with views different to, or disagreeable to, those held by participants. The first study is a motivating study, based on a new analysis of interview data collected to understand the role of information interaction in view change. This data demonstrated that seeking out alternative views, or structuring an information environment where one regularly comes across alternative views, are important, but previously unrecognized information tasks.

The participant group in the motivating study was inherently biased: people who had changed their views, and thus were likely to have interacted with information that they disagreed with. To better understand what 'normally' happens when people interact with information that they disagree with, we ran a one-week diary study with 10 participants, followed by interviews to clarify and expand on what participants had written in their diaries. This study demonstrated that interactions with disagreeable information were common (all but two participants reported at least three interactions), but that view change as a result is relatively uncommon (only 4 out of 47 interactions resulted in view change, each from a different participant). Participants typically passively encountered, rather than actively sought, disagreeable information. Once encountered, participants sometimes disengaged with disagreeable information. In contrast to the popular narrative, though, it was much more common to engage further: participants reported reading comments, engaging in active information seeking, evaluating their own views, expressing their own opinions, or—rarely—changing their view. Participants were motivated to engage by a range of factors, including issue importance, representation of their own view, wanting to empathise with 'the other side', and emotional impact.

This study has some limitations: participants were relatively young, the diary was for a short period (only a week), and the study focused on social media. Future work could address these gaps. The major contribution of this work, though, is a new and rich qualitative understanding of how social media users find information they disagree with, and how they react when they do: finding is less search driven, and reactions are less closed-minded than previous research would lead us to expect.

Knowing that social media users actively engage with information different to their own views, and that this sometimes affects their views, opens the door to future work designing and evaluating information interfaces that support people who wish to engage with information even where it is disagreeable. This is a form of information interaction that is previously unaccounted for in information interface design.: Information interaction research is ideally placed to create new designs that support those who, like our participants, wish to turn and face the strange.

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