

Social Printers: A Physical Social Network for Political Debates

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ABSTRACT

Social Printers are physical devices that create a pseudonymous social network between households during televised political debates. Through studies conducted around the Scottish Parliamentary Election and EU Referendum in 2016, we aimed to understand how physical devices could be used to engage viewers with televised political debates. By displacing the interaction from conventional social media and second screens we observed that the printers were successful in encouraging the participants to share their thoughts and create a personal social experience. Based on the results we discuss potential implications for conventional social media and second screens in the context of political television programs.

Author Keywords

Research products; second screens; television; politics; political discourse; social media.

ACM Classification Keywords

H.5.m. Information interfaces and presentation: Miscellaneous;

INTRODUCTION

From the printing press to television and the Internet, technology has long played a vital role in how we engage with politics [37]. Ever since the 1960s, when the first televised debate between Kennedy and Nixon arguably swung the race for the White House [34], television has been perhaps the most influential medium in this area. However, in recent years, the enormous growth of the Internet and social media has challenged its supremacy. One of the great advantages of online platforms is that they not only allow politicians and news organisations to broadcast content, but can also help members of the public make their own voices heard and drive an alternative agenda. From grassroots campaigns to playing a supporting role in major upheavals like the Arab Spring of 2010 and

the Ukrainian revolution of 2013, the Internet has become an indispensable tool for political discourse [23, 26].

Technology does not exist in isolation, but is part of an evolving ecosystem. The television viewer's attention is now split between traditional broadcast media and other devices—so called *second screens*—used to access other streams of content for a variety of related and non-related purposes [29]. In the context of political engagement, the public has naturally adopted second screens to gauge the public's opinion, enrich the experience and to share their thoughts [16]. Such use is primarily supported through social networking platforms like Twitter: for example, the BBC's weekly *Question Time* debate regularly trends during broadcasts [2]. While the role of social media and personal devices in this context is relatively well understood, technology continues to shift. In the home environment, new developments in the coming years will likely include connected products and the Internet of Things. This leads us to ask: what might it mean to engage with television and politics in a world of connected objects?

Social Printers are connected objects designed to support engagement with political television. They form part of our on-going research into the use of technology for political discourse during televised debates, aiming to extend the search for political engagement tools beyond individual personal devices and towards the next major technology developments. The Social Printers act as *research products* [30], designed to address two questions:

1. How can physical devices be used to engage people in political discourse around televised debates?
2. What can we learn about existing social networking and second screen applications through these devices?

We investigated how the participants adopted and used the printers as a physical social network for political discourse. This was done through two in-home deployments of our Social Printers around a national election and referendum in the UK. We primarily contribute to the study of second screens for political discourse by exploring how connected products might contribute to the experience of watching and engaging with televised debates and by challenging the dominance of screen-based interactions. Furthermore, we contribute considerations for existing social networks based on behaviours exposed in this context.

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BACKGROUND

This work brings together current research around the use of second screens while consuming television content, the use of social media in the political sphere, and the increasing prevalence of connected products in the home.

Second Screens

It is now common for people to multitask while watching TV using their personal devices [32]. Laptops, smartphones or tablets—referred to collectively as *second screens* [29]—are used for socialising, completing personal tasks (such as checking emails) and to search for information [29]. The phrase is based on the assumption that the TV is the primary screen, which dictates the contextual use of the personal screen [13]. Broadcasters cater directly to this activity by producing content that adds social, informational and advertisement value to the televised programs and events [32].

The research around second screens has mainly focused on *series specific* [18, 28] and *event specific* applications [1, 11]. Series specific applications highlight the importance of balance between engagement and distraction, while improving viewer's memory of complicated story lines and engaging them with additional show content [18, 28, 29]. Event specific applications—like those designed for sporting events like the Olympics—have emphasised the challenges of creating companion content for fast-paced events, such as limiting visual attention, synchronising content, and supporting multiple viewers [1, 18, 32].

However, much second screen usage takes the form of interaction through existing apps, such as web browsers and social media websites, where Twitter in particular dominates. Viewers who use it to communicate online alongside television often feel as part of a community and seek to affirm their opinions [33]. This also means that viewers may tend to conform to the popular opinions seen on Twitter, although this effect diminishes when the topic becomes very politically polarising [10]. Temporal effects also influence the online discourse: research around a politically charged documentary showed that during broadcast viewers tended to post judgemental content, whereas post-broadcast, the Tweets tend to be more defensive and appreciative [8].

Politics and Second Screens

Social media plays an enormous role in modern politics; it is used for political discourse around election periods in many developed countries [3, 9, 22, 31, 40]. Second screen use during televised debates forms a large part of this: for example, the day of the televised debates marks a significant increase in election tweets [9] and research has shown that Twitter provides a backchannel for peoples' evaluations of the topics and candidates [36]. The commentary posted during live debates is an emotional reaction to what is happening on screen and often focuses on the 'theatre of politics' [31, 40, 43]. Such use of second screens for political discourse is even present outside

election periods [2, 35]. For example, the BBC's *Question Time* has recorded over 800 tweets per minute during a particularly high-profile debate [2].

However, despite social media's promise for a more engaged electorate, 40% of Twitter users do not actively share their thoughts [20]. For those that do, there are numerous concerns to take into account, such as: privacy worries, the discourse becoming uncivil [5], that it doesn't suit people's online identity, or that people fear sounding ignorant [35]. Yet there is evidence to suggest that the electorate is utilising newer and more creative ways of expressing their political ideologies. For example, a recent study shows that voters are adopting Instagram, an image based social network, to craft their political self [27]. For this reason, we see motivation to continue exploring the role that future technologies might play in this process.

Connected Products in the Home

Research into connected products from the past ten years has already developed a rich understanding of the relationships between people, their environment and technology [14, 25, 30]. For example, household-messaging systems placed in the homes of different families showed the emergence of playful behaviour [25]. The Interactive Tablecloth [14] served as an object for reflection, interpretation, social interaction and aesthetic appreciation. Perhaps most relevant to our current work, physical devices, such as an automated radio called the Energy Babble, have the potential to construct *publics* around issues, by forming a concentrated account of current discourse around a topic [15].

However, although connected products in the home are a relatively recent development, there is already precedent for the use of physical objects alongside TV content. For example, the 1987 TV series *Captain Power and the Soldiers of the Future* used a light gun toy, which allowed viewers to shoot at the screen during battle scenes to gain points [39]. More recently, the *Universal Control Dalek* was a prototype toy created by the BBC that would react to episodes of *Doctor Who*, exploring how emerging technologies could be used to offer new viewing experiences in the home [44]. While these examples relate purely to entertainment, the degree to which second screens and social media have become central to political programming leads us to ask whether such connected products might bring value to political programs as well.

STUDIES

To understand the possibilities of a physical device alongside political debates, we created the *Social Printers*: a network of physical devices that allow users to communicate with each other through printed messages. Five of our printers were deployed in two month-long studies, the first during the 2016's Scottish Parliamentary election, and the second during the EU Referendum. They were deployed into a total of nine households over the two studies.



Figure 1. The Social Printer.

Social Printers

The Social Printers are connected devices intended to be situated alongside the television in the participant's living rooms for the duration of each study. Each object housed a thermal printer and Electric Imp controller in a simple case made from laser-cut MDF and an acrylic top (Figure 1). Each household had a unique URL printed on the front of the object leading to a simple text entry form, which they used to write their messages (Figure 2). Messages could be submitted through any device with a web browser. Messages submitted through the web interface were broadcast to the entire network and printed in every other household. Each household was identified by a colour to make the network pseudonymous. Coupled with the small number of participants, this meant they would be able to build relationships amongst themselves but did not have to worry about being identified.

Our approach has been influenced by existing design-led work including *technology probes* [21] and *research products* [30]: inquiry-driven, in-situ, finished and independent research artefacts. The use of such research tools has shown to stimulate reflection, and speculation in participants [14, 19]. Our Social Printers were designed to provide a new way for viewers to engage with each other and the debates, while prompting reflection on the role of a physical device in the home. To achieve this, we adopted one of the most common tropes in IoT product design: the Internet-connected printer. We were inspired by projects like the *Little Printer* [6], which delivered a personalised news feed and the *Reflexive Printer*, which stimulated reminiscence [41]. In taking this common IoT form, we intended to capture some of the enchantment of connected products without becoming too engrossed in specific aspects of the design.

Study Design

In each study, five households were asked to take a printer into their home for 25 to 35 days. Each study had a pre-arranged schedule of eight TV programs, which the participants were asked to watch with the printer. They were informed that they were not required to interact with the other participants if they did not wish to do so. Our explanation of what was expected of them was purposefully



Figure 2. Web interface for the printers.

ambiguous in order to see what activity emerged naturally. In addition to the printer, each participant was given a scrapbook in which they could collect and annotate prints if they wished, which were used as prompts in interviews.

The first study took place in the run-up to the Scottish Parliament elections in May 2016. There was little expectation of a surprising result in the election, due to the widespread popularity of the current ruling party. There was only a single televised debate four days before polling day. The study instead focused on two weekly political shows: *Question Time* (a debate programme) and *Sunday Politics* (a discussion programme), which the participants watched for four weeks. The study ended with the Leaders' Debate. During this study, a top tweet in the programme's live Twitter feed was selected by the lead researcher and forwarded to the printers every five minutes. To provide some variation, we cycled through tweets representative of an opinion, personal experience, humour, provocation, or a question.

The second study took place around the June 2016 referendum to decide whether the UK should remain in the European Union or leave. This was a strongly contested and exceptionally close vote, with five televised debates. The participants watched a total of eight programs over a three-week period, which included the five debates, two political panel shows, and live coverage of the counting of the votes. During this study, the lead researcher only sent prompts to the printers if there was a lull in the conversation of five minutes. Instead of forwarded tweets, these were broad discussion topics, e.g. *what do you imagine may happen in the case of leaving the EU?*

Participants

In line with our research approach, the Social Printers were deployed with a relatively small cohort in order to gain in-depth insights into their individual experiences. There were 14 participants in total from nine different households, who were recruited through social media, university mailing lists and posters. Each household was given a £10 Amazon gift-card for their participation. We aimed to recruit participants

Study	Pseudonym of Household	Number of Participants	Gender	Engagement Level	Age	Number of Prints Sent
Study 1	Blue	1	Male	6	50s	54
	White	2	Male	7	20s	39
			Female	4	20s	
	Green	2	Male	5	20s	34
Female			1	20s		
Both Studies	Pink	2	Female	4	50s	51/107
			Male	4	50s	
	Yellow	1	Female	5	30s	18/82
Study 2	Violet	2	Female	6	20s	188
			Male	5	30s	
	Red	1	Female	6	30s	337
	Lime	1	Male	5	20s	17
	Mint	2	Male	5	20s	103
Female			4	20s		

Table 1. Pre-interview data for participants - gender, age, number of prints and political engagement level.

with varied political interests, ages, and household dynamics (Table 1). They rated their political engagement level on a rating scale from 1 (low) to 7 (high). Although all of the participants in both studies expressed fairly liberal political views, their voting patterns varied across different political parties. Everyone except the Pink household were used to using second screen devices while watching TV. All of the participants used a smartphone to send messages to the printers, except Yellow who also used her laptop. The conversations started up to 10 minutes before the scheduled programs and ended up to 5 minutes after it had finished.

All but one of the households from the first volunteered to take part in the second study. In order to include more participants but still enable the reflections of continuing individuals we chose two households to continue. We chose Yellow and Pink, as Yellow was the only participant who was very much undecided about their future vote on the EU, and Pink, due to their limited social media use. Lime dropped out of the study after the first program due to personal circumstances and was replaced by Mint.

Interviews and Analysis

The participants were interviewed twice, once before the study and then again within two weeks of the end. Most of the interviews were conducted in the living-rooms of the participants where the printers were situated, but a small number preferred to be interviewed elsewhere. All of the interviews were semi-structured. The pre-interviews lasted between 10 and 80 minutes and the post interviews between 30 and 80 minutes. They were transcribed and subsequently

thematically analysed [7]. This analysis method was chosen because it best suited the qualitative research questions and data sets. Two researchers independently coded the data and agreed upon the codes used. Once all the data was analysed the emerging themes were refined and agreed upon by the team.

RESULTS

During the time the households had the Social Printers they were able to adopt them into their viewing of the scheduled programs. Below we outline the themes that emerged from the interviews. Within we see the behaviours and attitudes that shaped the experience.

Roles and Responsibilities

The object naturally demanded a lot from the participants. It required them to multitask and concentrate, splitting their attention between the program, printer and the personal device where they were entering messages. They had to choose what they prioritised: the debate or the printer, which largely depended on the quality of the debate. Mint recalled that “*when the debate was better we actually [...] messaged slightly less*”. The experience was described as overwhelming and Pink reported feeling “*quite exhausted afterwards*”. Due to our ambiguous explanation of the printer’s purpose, participants were at times “*not sure what [they] were supposed to be doing*”. Regardless, they all established a set of behaviours by the end of the study. Despite the effort involved, participants were not put off by this:

Pink: “*We made an effort to watch these programs and concentrate on them rather than just letting them go over the top of your head*”

Many of the participants were used to using second screens on a regular basis, so by the end of the study, in addition to interacting with the object, they often returned to their usual TV viewing habits. Yellow was texting friends, and Violet and Red were scrolling through Twitter.

In five of the households, both individuals living in the home wanted to take part in the study. Nonetheless, there was always one participant that took a lead role. We call the participant that took ownership of the Social Printer *primary* and the other, who participated less in the study, *secondary*. In all those households, the secondary participant was less politically engaged than the primary. The primary participant in the Mint household pointed out that his partner “*doesn’t have confidence in her political opinions even though they are valid and good, I think she thinks that everyone is this mad political genius*”. This led him to take up responsibility for interacting with the printer. They watched the programs together and often discussed the debates. She read the prints, sometimes even typed out the messages he wanted to send, but refrained from sending a message herself. Although she did not want to send messages to the others, she felt that “*it was quite nice*

hearing other people's views and not getting involved in it. I quite like being a spectator".

In the Violet household, the secondary participant helped during the debates. Violet recounted that her partner *"would read the printer while I watched [the programs], he was filtering out the chatter to pick up the main points so that I could reply to them"*. Unlike the secondary participant in the Mint households, he was not shy about sharing his opinions with the others in the study and even sent out a few prints himself, but said he preferred to focus on the debates instead. In the White household, the secondary participant also helped by filling the scrapbook.

White: *"Usually I would watch [the programs] myself. [My partner] stuck them all down and she would read them afterwards and just laugh."*

In the Pink household, the primary participant involved her partner by testing her messages on him and seeing his response, which was *"just a way to test whether I was saying something really stupid."* Although her husband did not engage with the printer, their 12-year-old son typed in some messages for his mother. Her slow typing speed led her to the idea: *"Because I thought if I get him to do the typing, I can focus on the debate and I can read what is being said."*

In the households where not all household members were taking part, there was a level of suspicion and unease towards the object and our intentions. Red's husband *"would say: 'there is more to this'"*, when questioning her behaviour and the activity on the Social Printers. Yellow's flat-mate called it a *"listening box"*, alluding to potential dystopian intentions. Although Yellow's flatmate had doubts about the purpose of the object, she was also *"quite interested in reading all of the responses"*.

Lime and Red observed reluctance from their partners to get involved with the study. Red lives with her husband and two children, and although she watched some of the debates with her husband they refrained from talking about the debate, which they would usually do. This may be due to the perception that *"it was a thing that I had been asked to do"*, which distanced him from the social aspects of watching together. The children expressed more curiosity towards it: although Red had forbid them to touch it, they would often go and sniff the object, which had a peculiar odour due to the laser-cut MDF.

Red: *"the wee one in particular loved the smell [...] Burnt macaroni cheese. And quite often 'What are you doing?', 'I am just sniffing the printer', 'Right okay'."*

Physicality and Presence

As well as anticipating the start of the political programs, Violet recalled *"sitting and waiting for the first print to come through"*. The printers were tightly bound to their situational purpose and *"came to life"* when a scheduled program started. There was a positive response to the Social

Printer itself; Red reported she *"quite liked having the wee thing"*. For some it was *"quite a natural object to have"*, while others became accustomed to it over the duration of the study. The Mint household detailed their positive impressions of the smell, size and aesthetics of the object, which contributed to it fitting in with their home. They perceived using an object as the basis for a social interaction as novel and engaging.

Mint: *"I found it quite novel that you had to look to a specific object to see what someone else had to say [...] That it is actually a physical object rather than a screen."*

Yellow: *"It's nice the way you are getting data coming out of just the printer. And you don't have any sort of extraneous things around, you don't have personal profiles like you do on social media."*

Although the object itself was perceived positively, it was at times restricting having to be in a specific place at a specific time to interact with the others.

Yellow: *"It is quite awkward. Because you need to get everybody there and available to work, otherwise you get into a situation where you only have one or two people, and it just doesn't."*

Blue moved the printer between two rooms, dependent on where he was watching TV. Nevertheless, he felt the object locked him in one place. Red on the other hand was not as confident when it came to unplugging and moving the printer. In the interview she mentioned she did not want to unplug it, meaning she was *"sitting squished over on one side of the room"*. This caused some frustration in her household when she missed one of the debates. When she came home late after work she found her husband irritated by the noise and paper coming out of the printer: *"I should have switched it off, but because there wasn't a sort of clear, sort of on/off I didn't want to mess it up"*. Although some of the other households were also uncertain about moving and turning off the printer, they were often better able to adapt it to their needs.

Mint: *"It was good that the wire was long enough so we could move it from where it was plugged in to closer to where we were sitting."*

Violet and Red also missed some of the features of the conventional social media chats they were used to, such as the ability to send images and links. Violet had wanted to send a web link before realising the others would not be able to follow it. But despite the shortcomings of the Social Printers, they often became a conversation piece. The participants reported sharing information about the object with others.

Red: *"People that I got round the house: 'This is my wee friend', because it was sitting beside the wee WALL-E model 'Yeah, this is WALL-E's wee buddy'" (see Figure 3).*



Figure 3. Red's Social Printer, situated next to a WALL-E toy.

The physical nature of the data output as opposed to a screen became a point of reflect and speculation. The paper became an unchangeable artefact and *"an actual piece of history that people can look back on"* (Mint). The long, thin strips of paper made it difficult to easily read through the conversation, but also sparked the participant's curiosity and wonder every time the printer started *"spewing"* out notes.

Yellow: *"I wonder what this is going to be about? I wonder who has said it? I wonder if this is a response to something I have said?"*

The participants liked the sounds made by the printer because it served as a reminder of activity and an indication of a reply. Due to the noise Red knew when someone is replying and Yellow found that it demanded attention. Yellow reflected that there is a pre-existing relationship between people and printers that may have affected the way she responded to it.

Yellow: *"If you are in a room with a normal printer and its starts printing something, the response is to go and have a look."*

In addition to the scrapbook being helpful for us as a conversation piece during the interviews, the five households that filed and annotated prints also found it beneficial as a way to reflect. Pink observed emerging themes in their conversations, such as *"someone coming up with solid arguments on either one side or the other"* and how they tended to bring the discussion *"back to Scotland"*. Yellow's scrapbook was much more focused on the characteristics of the other participants.

Yellow: *"I'm voting [to stay] too but I have some reservations'. This is about the bureaucracy of the EU [...] that kind of reinforced my view of Mint as someone that really thought things through."*

Creating a Community

The Social Printers were designed to create a tiny social network for the live discussion of politics. The participants naturally gravitated toward fostering a communal and friendly social environment. To do that, they had to build relationships and learn enough about each other to feel

comfortable in sharing their experiences despite the veil of pseudonymity and lack of context guaranteed by the platform.

The pseudonymous nature of the study made it challenging to get to know the others. Some participants, such as Blue and White, found *"it was difficult to then remember who [the others] were and remember and ascribe a set of opinions from previous shows onto them"* (White). Red perceived the naming convention like a game of Cluedo/Clue, and White like imagining characters in a book. In addition, it encouraged a few subconscious biases, such as association with certain parties, or genders. Violet, for example assumed that Mint was male based on subconscious colour-gender association.

Although pseudonymity proved to be a somewhat challenging, the households reported that they also saw it as one of the greatest benefits of the project. It was the most striking difference between it and conventional social media. It gave them freedom to share their views with complete strangers.

Green: *"There are not going to be any repercussions from this, I am not going to get into an argument with somebody about it. It's just a debate. It's just a conversation."*

But the most important positive effect it had, in light of the fractious issues that were discussed, was that it limited any possible pre-formed judgments about the other participants, such as their social background or age. Pseudonymity helped the participants keep an open mind about each other.

Yellow: *"Instead of having a pre-made image or model of who they are, the model gets built up through time, through their actual comments."*

Pseudonymity on the Internet, especially in the context of political discourse, is often associated with abusive behaviour [24], but here such behaviour was not present. Green recalled that even when he disagreed with points made by the other participants, that it did not lead to rude language. The small size of the group and the desire to be friendly, were some of the contributing factors to the overwhelmingly polite discourse that took place. They reported the desire to like the others and be liked by them, which increased throughout the duration of the study, as the community atmosphere strengthened. *"You thought you were spending your evening with some nice people who were helping you out"* (Pink). But in addition to a genuinely friendly attitude, there was a rather ominous undertone of feeling stuck with those people and worry of offending them. The printer *"will always be there printing, and if they don't like you it will be printing all the time that you suck"* (Violet).

As part of the participant's desire to form a community, they were open to learn about each other's views and beliefs: *"we didn't go in fighting we went in thinking 'oh*

this is really nice to get to know these people’” (Pink). One of the first things the participants explored, were the boundaries of the group, for example, *“trying to work out if it was possible to offend anybody”* (Pink), or *“to feel out what jokes you can make”* (Violet). In both studies the participants were all fairly left wing, which meant that although they usually voted for a variety of different parties, they agreed on general issues. Within the first few programs they watched together they knew that the group was fairly homogenous and realized they *“are in a bubble”* (Red). Although they were similar, *“it was quite nice to have people agreeing for different reasons”* (Violet).

Within the interviews every participant was asked to talk about what they learned about the other participants. Some like Green managed to *“build a profile of their agendas”*, while others like Yellow got *“a sense of their personality, even more so than the views”*. This difference in what they learned about each other may have stemmed from the range of ways they used the Social Printers. As Mint observed some used it to share their political opinion, while other used it as a conversational tool:

Mint: *“Some people used it as a conversational tool, and some people used it for kind of like political, just writing points.”*

In the first study, where there was significantly less conversation, Blue and White did not feel that a community developed, and Blue in particular didn’t feel that he engaged with people, despite contributing the highest number of messages himself. The rest of the households felt a sense of community flourish throughout. This was accompanied by the feeling of shared space:

Pink: *“You kind of felt that they were coming into your living room. You are sharing this kind of experience of sitting around the telly, probably cups of tea, commenting.”*

The Social Printers fostered a personal experience. A sense of teamwork and trust emerged as the study progressed. Some like Pink, Violet and Mint even described the others as friends. For example, Mint said that *“you felt like they were your friends, like you got to know them, but you didn’t know anything about them”* and Pink expressed missing their new friends after the study had concluded.

Yellow: *“It had a very community feel rather than something that would happen on the Internet [...] it felt a lot more personal a lot more like a conversation.”*

Self-Expression

Levels of participation with the printers varied a lot between households, ranging from just 17 (Lime) to 337 (Red) messages. The participants reported a part of the reason why they sent a lot of messages was to not lose the connection with the others: *“Because it is a team effort [...] you are kind of still wanting to keep the chat going”* (Mint). When asked whether their comments were truthful and

honest, participants responded positively, but they also outlined instances where they moderated themselves in order to not offend and be polite. For example, Yellow felt she was *“truthful in what I said but I did not necessarily reveal my intentions”*; Blue was cautious with *“the types of humour that I may have used or I didn’t use, because you don’t know whether people are going to take offence”*; and Violet was especially aware of avoiding the use of profanity because they knew other participants had children. It was a natural moderation that would occur when speaking to new people in any situation.

Yellow: *“I was moderating myself but not as a result of the platform, because if I was with somebody in the same room I would still moderate what I said.”*

Red at times used moderation to actively avoid conflict. She described a particularly troubling moment for her in the discussion when the topic of spoiled ballots arose. She had been working as a counting agent and had a fair amount of insider information about the issue, but instead of arguing her point, by sharing her knowledge, she remained silent in order to not be antagonistic.

Red: *“I remember thinking that what I actually wanted to say here is that there is never a high number of spoiled ballot papers, there just isn’t. I didn’t want to look like I was showing off [...] I really really disagreed with that statement and then I remember kind of going quiet about it here [...] Grr I will just be polite”*

There were a variety of issues when it came to self-expression in the context of the Social Printers. Most importantly the participants had to be quick and focused, otherwise their comments could fall behind the frame of speech. Slow typing speeds meant that Pink wrote short messages, whereas Mint sometimes didn’t send a comment because he felt it was too late. As described previously, their household members sometimes helped in the process of writing their commentary. Yellow on the other hand found it difficult to research the points given by the other participants and keep up with the flow of conversation. Although message immediacy could be an issue it was also *“exciting to have that quick conversation”* (Yellow).

Yellow: *“Blue said that [the EU] makes trade easier because it removes paperwork. So I decided to go and look that up [...] But by the time I had looked it up [...] it had gone into a discussion about imported granite.”*

A lack of confidence could also be detrimental to the discourse. Mint felt that points he wanted to send were at times obvious, whereas Violet didn’t want to be the first to send a print. Green’s experience of sharing his thoughts was *“a case of shouting at the telly [...] and then trying to articulate that into the printer”*. He was not as worried about speed and would happily spend longer periods of time articulating his point.

Another factor that affected self-expression was the familiar feel of the social network. Red noted that she usually has more in-depth conversations on Facebook, but there is no second screen culture around it. Whereas Twitter is used for such a purpose, but is not as good for immediate responses and conversations, she concluded that *“it was somewhere in between Facebook and Twitter”*.

Yellow, who was the only one undecided about their vote in the EU Referendum, adopted a strategy about the way she expressed herself: *“I would probably find out what the other person’s views are first and see how widely they differ from me, that may influence how I phrase my views”*. Until the end of the study she failed to disclose that she had not made up her mind. When Mint asked if anyone was still undecided in the sixth program of the schedule, Yellow waited to see what everyone said, but took too long and the conversation moved on. *“I was going to say ‘Well I am undecided I am undecided for those reasons’. I got kind of half way but I just didn’t send”*. The other participants saw this as reluctance to offend and provoke, since Yellow had the most different political views from the group. Violet thought that *“they weren’t looking to provoke people, they were not looking to change people’s opinion”*.

Discourse

Although the experience was often overwhelming, the object encouraged discourse. Mint reported that, although he sometimes watched TV accompanied by his phone, he did not usually post content on social media. He observed that the Social Printers made the experience of watching the programs more interactive and involved. At the start of the study it was sometimes difficult to begin conversations and participants described feeling nervous to do so. But the dialog tended to increase in quality by the final debates, when the majority of participants were present and a community had been established.

Mint: *“I think we had better quality conversation on [the sixth program] even though we had more conversation on [the fourth].”*

Pink: *“The last debate was good because I think everyone was involved in it.”*

The conversations they had were often serious, about big political issues, but the participants were also easily distracted by topics unrelated to either the debates or current affairs in general. Violet recounted: *“we would go down a rabbit hole [...] but then something big would happen and we would come back”*. The commentary helped Pink *“feel more informed about what other people are saying and doing”*, and Yellow to *“experience this range of views”*. For Yellow, who had not made up her mind on the EU Referendum, the Social Printer was an opportunity to see how others felt about their future vote. It was beneficial in showing her *“that there were so many unknowns for both sides”*. This led to extensive research on her part, which ultimately helped her decide on the night before the vote.

Yellow: *“Once I was using my laptop I did look up a lot of information that was being discussed more on the printer, than whatever the original point was on TV.”*

As previously mentioned the group in both studies had uniformly liberal attitudes. This homogeneity stimulated a supportive discussion, where no heated emotional arguments occurred. *“Everyone was really supportive and obviously paying attention to what you had said”* (Pink). But a supportive discussion also meant that they often reinforced their beliefs, which could be both negative because *“it is like giving people encouragement rather than actually giving a reason why they agree”* (Yellow) and positive because *“it made me feel better about my choice”* (Mint). The participants did disagree with each other, but tended to stay quiet until the conversation had moved on, rather than be provocative.

The first study had a lot less conversation and activity on the part of the participants with 315 prints, 96 of which were prompts in the form of Twitter messages. There was overall agreement that the tweets did not work in terms of stimulating conversation. Yellow found that *“the tweets that were coming in were in some respects like background noise”*. The topics that the participants spoke about were mainly connected to morality and fairness, such as the Panama papers scandal, which was *“going to stir people up more [...] these things of social injustice and the human condition”* (Pink). When discussing the discourse that took place, the households focused on humorous commentary and the points of agreement and disagreement:

Green: *“Everybody seemed to have the same opinion on the environment. That is something that I am really positive from your project.”*

Yellow: *“It’s a serious discussion and then you have this ‘oh he’s shouty’ funny observation. I think that is nice.”*

What ultimately defined the discourse in the first study was its lack of conversation. The commentary was *“like a series of statements”* (Pink) and conversations only *“lasted maybe two or three messages”* (White).

The seriousness of the EU Referendum and the exciting debates led to a difference in the amount of activity we saw in the second study. Although there were only 17 prompts, the participants sent a total of 888 prints. Pink reported that the second study *“allowed for more free-flowing conversation”* but that it also allowed for participants to become easily distracted. Households Pink and Yellow agreed that they preferred the second iteration of the study because it had more humour, excitement, and it was focused. *“Having it around an issue like this was a more effective purpose for it”* (Yellow). The use of questions after a five-minute lull helped stimulate conversation. Pink reflected that it gave them an opportunity for *“everybody to give their opinion [...] this was a chance for all of [them] to confess”*. Some of the themes that emerged within the

discourse were the lack of solid arguments, making the discussion relevant to Scotland, the issues with aligning with the Remain campaign, and predictive turnouts.

Violet: *"They didn't really have arguments for staying in it. It was just 'we should', without saying 'we should because...'"*

Although the topics that arose were very serious in nature, the discourse overall was much more playful and humorous. Violet initiated a drinking game, in which every time a politician said "as a mother" they had to take a drink, and Red and Yellow incorporated 37 smiley and sad faces into their commentary. Red recalled that she used them out of habit and to make the discourse *"a bit more personal [and] a bit friendlier"*.

DISCUSSION

The Social Printers were successful in encouraging the households to take part in a political discourse about the programs they watched together. But much more interesting is the way that they did this: the responsibilities and roles of different household members, the dynamic between the community, and the influence of physical aspects of the devices. Below, we discuss the implications of our findings in three main areas: first, in embracing the situated nature of television; second, in exploring the benefits of physical technologies in the context of second screens; and third, in considerations for social networks for political discourse.

Engaging the Living Room

When we think about second screens, we typically think about people using personal devices alone, possibly to interact with people who are far away. However, this is not how television is consumed: it is a communal object, very much situated within the home and capable of engaging the entire household. The Social Printers captured more of this spirit than traditional second screen applications, encouraging the participants to make time and focus on the televised political activity, share their thoughts, gain new perspectives, be more informed and encouraged conversation without judgement. A big factor, which contributed to these emerging assets of the research products, was that the printers fostered a more personal experience from conventional social media. As Yellow recounted: *"it felt a lot more personal a lot more like a conversation"*. Participants like Mint and Pink, who have limited use of social media while watching TV, were able to effectively join into the discourse.

By displacing the social experience from the personal device, the Social Printers encouraged an intimate experience with high levels of direct engagement. There are grounds to suggest that situating the object within the living environment of the participants may have aided the perception of a personal experience to occur. For example, Baillie and Benyon [4] showed that the location and control of an object in the home plays a vital role in the way it is perceived by the inhabitants. The perception of intimacy is

especially highlighted by the experience of a shared space. As Green recalled: *"it felt like you were in a room having a debate"*. Over time, the printers became more effective as tools for good quality discourse, as the community strengthened and the debates became more heated. By the end, some of the participants even referred to each other as friends. Violet, who easily conversed with Red, told us that she missed her and their conversations. This suggests that our research naturally builds upon similar research into the use of research products. Whereas Lindley et al.'s messaging system was able to maintain a relationship between family members [25] and Gaver et al.'s Energy Babble was able to create a public around a topic [15], the Social Printers created a *community* between strangers that went beyond the topic of the debates.

Challenging the Dominance of the Screen

Despite the main interaction between participants taking place on paper rather than a screen, behaviour across the Social Printers mirrored conventional second screen usage during debates. There was an overlap in the motivations and behaviours that stimulated the use of the printers with previous research into use of second screen devices during political debates [16]. In a similar fashion the participants used the printers to scope out each other's views, share their thoughts and make the debates more entertaining [16]. This suggests that physical devices are quite capable of mimicking the existing uses of second screens, but our research also suggests they may have other advantages.

In the same way that physical devices have been used to engage people in political issues in public spaces [38, 42], we saw how the object was able to engage the entire household rather than just a single viewer using a personal device. Although one participant in each household took ownership of the device, the other household members were often involved in discussions around the printer and debate. In part this was enabled by the tactile nature of the paper, which became an artefact that could be shared and revisited after the broadcast. But it was also enabled by the physicality of the Social Printers themselves, which stimulated the imagination and creativity of the participants. They personified the object, seeing it *"came to life"*. Red called it WALL-E's *"little buddy"* and her children were enchanted by the object and inspected it whenever they thought they were not being observed. The participants also adapted it to their home by finding the most suitable position for it in the living room. Such rich interaction may not be as prominent if the network was solely screen based.

Although we see many benefits to the development of physical engagement tools, our work has also highlighted considerations for future designs solutions. The most important of which is to keep the activity at manageable levels within the dynamic and fast-paced nature of a political debate. Although it seems beneficial to have a large social network, in practice we observed that even with only five households the amount of activity taking place on

the printers was overwhelming for some of the participants. Alternatively, future designs may find more appropriate data outputs than the thin paper rolls that we used. And finally it is vital to consider to what extent will a physical solution be intrusive in the home environment. As we saw the noise disrupted the Red household. Despite the shortcomings of the Social Printers we argue that they were intrinsically more interesting to interact with them than a conventional social network.

The Social Printers fostered discussions, speculation, reflection, and social interaction, which overlap with previous research into the deployment of an interactive artefact in the home [14]. Having this dedicated physical stream of chat during the debates was beneficial to the emergence of these behaviours. Although the participants still used their personal devices to write and send the messages, the paper was the only data output and hosted all of the discourse. The physicality of the paper and the printer stimulated a novel and engaging experience. Our research indicates that physical devices, such as Internet of Things products, have the potential to engage citizens further with the discourse around political debates. This indicates there is potential that future political discourse may benefit from further challenging the dominance of the screen based interactions.

Opportunities and Challenges for Social Media

Although we have positioned our findings largely in relation to future possibilities for connected products, there are also similarities between the physical social network created by the Social Printers and conventional platforms like Facebook and Twitter. The printers were able to create a community, the feeling of a shared experience, and helped reaffirm the views of some of the participants in a similar way users adopt Twitter during TV dramas [33]. A dedicated outlet for political discourse around election periods may have numerous benefits, such as the establishment of a strong community, in-depth discussions and a more informed electorate. Red reflected that Facebook users do not typically post while watching TV, whereas Twitter does not allow for in-depth discourse. The printer was able to fill in a potential gap in the digital platforms available to her. Some of the issues highlighted by our research include the role of anonymity and playful behaviour in the establishment of a community.

The greatest difference between the Social Printers and conventional networks was the use of pseudonymity and the small size of the group. Within a small relatively homogenous group the discourse was supportive and empathetic, despite the lack of identity in the network, which is often cited as the root cause for abusive behaviour on social media [24]. In fact, the participants experienced some positive benefits from this, such as the freedom to express themselves more freely on fractious political issues and the lack of pre-conceived judgement towards the other households. This poses some questions, such as: would the

discourse remain empathetic if the group was more diverse in political opinion; and would a physical more personal social network be better able at facilitating the interaction between such groups? More research is needed to investigate the implications of anonymity in such a closed network.

A number of works within the HCI community have identified the need to further research playful behaviour in the emergence of online communities [12, 16, 25]. A Microsoft Research team discovered that a messaging system was appropriated in a playful manner, which was an expression of togetherness [25]. Although the participants in this study were unknown to each other, a similar use of the products emerged. Humour, emoji and games, played part in the establishment of the social community. This was especially noticeable in the second study, where participants like Red, Yellow and Violet used playful language to add subtext to their commentary. In contrast, the first study was relatively sparse in humour, which may have contributed to two of the households not experiencing a sense of community. We argue that such behaviour may be an indication of the establishment of a healthy online community.

We argue that if used in an appropriate setting anonymity may have liberating effects, rather than stimulate abusive behaviour. We also observed that there is a connection between playful behaviour and the process of establishing a community. Further research is needed to understand to what extent these two factors affect the community.

CONCLUSION

Throughout our study, we have seen how nine households adopted the Social Printers into the way they watched political television programmes. They shared their views, personal space and time with the other households and scoped each other's characters and political ideologies. What emerged was a primarily civilised and supportive discussion in a network of people who wanted to like each other. The qualities of the physicality of the object were often intertwined with their perception of the experience, creating an experience that captured many of the behaviours of second screen use but also exceeded it. The ability of the Social Printers to stimulate a personal experience and discourse highlights the potential that future IoT solutions may have for television viewing and political engagement. By challenging the dominance of the screen, we may be able to find new forms that future social networks can take.

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EPSRC DATA ACCESS STATEMENT

The anonymised interview transcripts and the Social Printer conversations between the households are available from the University of Dundee [17].

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