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Recommendations to support interaction with broadcast debates: a study on older adults' interaction with *The Moral Maze*

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Abstract Current methods to capture, analyse and present the audience participation of broadcast events are increasingly carried out using social media. Uptake of such technology tools has so far been poor amongst older adults, and it has the worrying effect of excluding the demographic from participation. Our work explores whether a common desire to interact with debates can be tapped with technology with a very low barrier to entry, to both support better engagement with broadcast debates and encourage greater use of social media. This paper describes experiments where older adults interact with a BBC radio debate programme: *The Moral Maze*. As a result, we obtained common interaction patterns which then are used to define recommendations for software-supported interaction with debates based on theories of argumentation. Our goal is to combine research on computational models of argument and user-driven research on human-centred computing in a project with the potential for high-profile impact in addressing older adults inclusion in the digital economy.

Keywords Broadcast debates · Argument Web · Software recommendations

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1 Introduction

The constant emergence and change of current technologies in the form of digital products and services can cause certain groups of the population to feel excluded. Older adults represent one such group. We address the problem of reaching older adults who enjoy listening to broadcast debates but are not able to participate using current available technologies. We are interested in technology solutions which provide low barriers to use such as passive, audio-controlled interfaces which could be supported by nothing other than an open telephone line.[1]

Although this population is not excluded from giving an opinion through conventional methods, we want to enhance their experience and at the same time, target those who have something to say but who do not interact because of the technology barrier. We want to provide older adult audiences with a sense of engagement with the content of the debate and as well a sense of empowerment to make them feel they are participating and their voice is being heard. We focus on a segment of the population that enjoys listening to, and interacting with, broadcast debates, but are not generally connected to the Internet and do not use social media accounts. We target older adults since this is the more representative group of listeners of the programme and still a very unrepresented group of social media users, but the research is not limited to this demographic and could be applied to any user interested in broadcast interaction.

Technological innovations provide great potential for new social dynamics to emerge but need to be designed

[1] We consider older adults as persons over 65 years old without distinguishing based on cognitive or physical conditions.

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focusing on the dynamic needs and abilities of the final users. Current methods to capture participation of the audience in broadcast events have been limited to the use of the telephone line, short message services and email. More recently, the concept of a "second screen", a computing device commonly a tablet or a smartphone served with a special application, is being used to provide interactive features during television programs. The BBC in particular provides through the "BBC Red Button" technology the ability to see extra news stories, check latest sports results and interact with specific programmes. Increasingly, however, richer engagement is being supported through social media. If the interaction is viewed from the perspective of older adults who listen to the radio, the interaction naturally limits their participation, particularly because although email is now widely adopted amongst older adults, social media use is not. Social media platforms have the advantage in that they provide a large network of connected users a medium to interact immediately. The idea of *Twitter* as a "public opinion thermometer" has been widely studied, for example, in the context of political elections, see Pak and Paroubek (2010), Shamma et al. (2009). But these advantages have not been fully integrated into widespread solutions that instantly benefit the audience (in terms of feedback and engagement) and the producers of programmes (in terms of meaningful data to improve their format or content).

In this paper, we define recommendations to develop software-supported systems with broadcast debates based on the results of experiments and interviews with users. We set up a study in which recruited participants listened to a debate and interacted with the content presented. As an example of a "gold standard" of debate argumentation, we used the BBC Radio 4 programme "*The Moral Maze*", where expert panellists and invited witnesses engage in a mediated combative debate examining moral issues behind news stories.[2] In total, fourteen older adults were invited to participate over five group sessions. The participants were able to interact with the content of the programme and with each other, resulting in substantial exchange of opinions from which we obtained common "interaction patterns" with this debate format. The recommendations are based on research in argumentation theory (e.g. Reed 1997; Reed and Walton 2007; Walton et al. 2008) that provides a theoretical basis to understand human debate and computational models of argument (e.g. Lawrence et al. 2012; Snaith et al. 2012) that provide the technological background upon which we define the recommendations.

The remainder of this paper is as follows: Sect. 2 gives an account on the use of technology and social media amongst older adults. Section 3 gives an account of the topic of debates discussing the ways people currently interact with broadcast and online debates. Section 4 presents the methodology of the study conducted. The results are presented in Sect. 5 together with a discussion. Section 6 presents recommendations for software that supports interaction with broadcast debates. Finally, Sect. 7 presents a conclusion and future research paths.

2 The use of technology amongst older adults

Exclusion in the context of older adults deals with three main issues: the participation and integration beyond the labour market; aspects of geographical segregation; and exclusion as a form of institutional disengagement (Phillipson et al. 2001). Whilst these issues try to frame the problem from a sociological point of view, disfranchisement is a problem that affects mainly older people due to technological barriers. Most older adults feel that access to the internet and digital technologies can enhance some aspects of life so long as technology is seen as the means to an end, not the end in itself (Bolton 2010). But there exist barriers to technology adoption that prevent older adults that want to engage with technology to do it, e.g. lack of home access to the internet, low awareness of what technology can offer, inadequate marketing (i.e. marketing that offers aspects of products that does not interest older adults), inappropriate design (e.g. small buttons, complicated interfaces) and anxieties or fears related to technology (e.g. security, privacy, cost of equipment, etc.) (Bolton 2010).

The target demographic of this research (older adults aged 60 years and over) is not one that is typically characterised by engagement with technology, with just over 60 % people aged 65–74 having used the internet and only 30 % over the age of 75 (Office for National Statistics 2013). These numbers, however, are dropping, with the Office for National Statistics reporting in their Bulletin Internet Access Update (January–March 2013) (Office for National Statistics 2013) that there was a decrease of 23,000 adults (0.3 %) who had never used the Internet since 2013 and a decrease of 748,000 adults (10 %) compared with a year earlier. Similarly, in the USA, as of April 2012, 53 % of American adults aged 65 and older use the internet (Zickuhr and Madden 2012). Older adults are still less likely than all other age groups to use the internet, but the data from 2012 represent the first time that half of older adults are going online after several years of very little growth amongst this group.

For most older adults, email is the most common internet activity, as of August 2011, 86 % of internet users aged 65 and older used email. As for the use of social media, 25 % of older adults who use the internet have an active profile in the UK (Ofcom 2006) and 43 % in the USA (Zickuhr and Madden 2012). The population aged 60 and over is diverse, and there are multiple factors that may

[2] http://www.bbc.co.uk/shows/moralmaze.

influence how they adopt new technologies. Factors such as low income, living alone or living with others and disabilities amongst others have a direct impact on their use of technology. In contrast to the low numbers on technology adoption amongst older adults, access to TV and radio is more widespread. According to an Ofcom report (Ofcom 2012), around 51 % of older adults aged 65–74 have a digital TV and 25 % to digital radio [considering analogue TV and radio, 96 % of adults watch TV and 76 % listen to the radio (Ofcom 2011)]

We want to take advantage from these tendencies and target older adults that enjoy listening to debates and have already or are starting to adopt new technologies. We aim to benefit from the inner desire in people to respond or "shout back" at the radio or TV when listening to opinions and develop technology solutions with a low barrier to entry in order to encourage older adults to interact with broadcast debates.

3 Debate as a social activity

Debate is inherently a social activity where people interact presenting arguments for and against a viewpoint. *Broadcast debates*, in particular, are characterised by the presentation of controversial topics where audiences do not have an active role in the course of the debate. With the generalised use of social media and online forums, *online debates* are taking place in several websites and platforms throughout the Web.

Broadcast and online debates are different in the way they develop. Oral communication in broadcast debates is more dynamic since there is a higher level of immediacy and a lower level of retention from the audience. In contrast, in online debates, there is a more precise way to express arguments and ideas. Participants can read at their own pace having the option of re-reading, appealing more to a deliberative style.

Audience participation in both types of debate can be important especially if the debate itself can benefit from the input of the audience. Debates are an inherent feature of a democratic society where not only do government ministers debate issues but members of the public are also encouraged to engage in debates. E-democracy in particular aims to use current information and communications technology to promote a form of government in which citizens are eligible to participate equally in the proposal, development and creation of laws. In e-democracy systems, e.g. Cartwright et al. (2009), Sæbø and Nilsen (2004), policy proposals are discussed based on the use of web-based discussion boards where audience participation is highly desired and encouraged.

Audience interaction needs to be designed taking into account factors such as the audience demographics, the purpose of the debate and the technological platform in which it will be deployed. We discuss in the following subsections more specifically how people engage with online and broadcast debates, and some problems related to effectively interacting with debates using current technologies.

3.1 Interaction with online and broadcast debates

Message boards or Internet forums have faced a decrease in their popularity with the advent of Web 2.0 sites. Social media sites allow users to communicate and share resources whilst maintaining a network of connections (Kumar et al. 2010). The social interaction factor provides users the feeling they are sharing ideas and opinions with people that they know and with whom they share a common interest. The content of an online debate (i.e. topics, posts, replies) is normally represented with single-threaded conversations or tree-like structures. Message Boards, for example, provide a platform to post and reply to messages related to a topic.

The linear organisation of message boards separates topics which promotes categorised discussions but difficult to follow especially if threads have numerous posts, which can make the interface confusing. Web 2.0 platforms serve different purposes, and each of them has some sort of mechanism to exchange ideas, e.g.:

- General purpose social media sites (e.g. Facebook, Google+): Discussions focus around generic posts (Facebook and Google+ have introduced grouping facilities (i.e. hashtags) in their systems that can help to group discussions but are not explicitly designed group-specific discussions).
- Micro-blogging (e.g. Twitter): Discussions can be grouped by hashtags and direct replies.
- Blogs (e.g. Blogger, WordPress): Discussions are originated from blog posts as a thread of comments.
- Question–answer networks (e.g. StackExchange): Discussions are originated from a question, in the form of answers and comments.
- Social news networks (e.g. Topix, Reddit, Slashdot): Discussions are originated from a post classified under a topic where comments can be nested.
- Debate-tailored sites (e.g. Yourview, Debating Europe, Digital Freedoms, Debate.org): Discussions are originated from public policies or general interest topics.

In the UK, the BBC broadcasts eight TV and radio programmes with focus on debates (December 2013).[3] The

[3] Question Time (TV, BBC1), Free Speech (TV, BBC3), The Big Questions (TV, BBC1), Sunday Morning Live (TV, BBC1), The World Debate (BBC News), Brian Taylor's Big Debate (BBC Radio Scotland), The *Moral Maze* (BBC Radio 4) and The Intelligence Square Debate (BBC World News).

audience of these programmes can participate in the debates in several ways, most notably via email. With the widespread of social media, audiences can participate more diversely and more actively in the debates via independent platforms such as *Twitter* and *Facebook*. In political debates, for example, the audience is very participative posting and exchanging comments in order to decide their vote (these reactions have been target of multiple academic studies, e.g. Tumasjan et al. 2010). As an example, the 2012 presidential debates in the USA attracted 59 million viewers[4] and around 7.2 million tweets related to the debate.[5] Social media sites like Facebook and Twitter offer an easy way to participate in such debates, but they are far from being effective in terms of measuring the reaction to the arguments presented.

Furthermore, these platforms are oriented to an audience with access to an Internet connection with social media accounts, excluding groups of older adults that do not have these facilities. In political contexts, for example, the participation of the audience in debates can promote a democratic and participative society since it would give an instant reaction to the arguments they are presenting.

Recent research on "Sentiment Analysis"[6] measures reactions from audiences taking Twitter feeds as the data source (Pak and Paroubek 2010). This approach, however, still presents some problems if we want to obtain meaningful data on the interaction, e.g. the sentiment identified needs to be linked with content from the debate.

3.2 Existing problems with current approaches

Debate is a social activity that needs to be treated accordingly in human–computer interfaces in order to maintain a structure over the flow of the conversation. The requirements of human–computer interaction within our physical, social and cultural environments are constantly evolving, and the fact is that those requirements do not always align with the way online interfaces provide us to input and present opinions. What happens in online communities is that the content of what it is said is disconnected from the act of saying it and even though the act of posting opinions is almost immediate, it is hard to classify it according to its content. The content of what it is being said remains available, but it is not a reliable representation of what happens in the real debate or the interactions with it and is just a widespread collection of messages with no structure.

Forums and message boards can provide a platform to represent and engage in debates, but these are limited since they do not provide an argumentative approach. The usability of these sites is oriented to handle posts grouping common topics; therefore, dialogues and debates are not represented in a natural and structured way. Furthermore, debate participants are not differentiated from the audience. In some of these systems, people can quote other participants' messages and reply to specific comments creating new threads related to a reply but the creation of these threads is not driven by a protocol and has no explicit dialogical aspect, i.e. there is no explicit way to question, challenge or simply agree with a post.

One of the problems is that it is hard to infer the implication of the participation in an automatic way, e.g. whether the participant agreeing, disagreeing, challenging, questioning, etc. Another related problem is that current approaches lack a "speech oriented" way to present and add content to debates. Although debates in general do not accept participation from the audience, this one-way communication channel is often discouraging for people that want to interact.

Current BBC programmes such as *Question Time* in BBC TV and *BBC World Have Your Say* in BBC Radio use the phone line, email, *YouTube*, *Twitter* and *Facebook* to interact with their audience, but although these platforms can provide real-time feedback to the producers, the moderation and classification of the content is not automated. As an example, in the last presidential debates in the USA, broadcast news companies like CNN and FOX News measure people reactions through polls and social media interactions almost in real time. Polls can offer a measure of audience reactions, but these are usually processed and presented with a significant time delay. Furthermore, polls are expensive to run and offer a partial view on the audience reaction. In contrast, social media offers an immediate way to interact but lacks tools to generate content-oriented information, i.e. it is difficult to get an immediate sense on how people are reacting and to what in specific. Participation from the audience is hard to analyse if it is not categorised or there is not a structure to classify automatically the participation.

We believe that to solve this problem, interfaces that support interaction with debates need to combine a "user-centric design" with a "practical argumentative approach" that encourages clarity and a clear presentation of arguments and the interaction with them. A proposed solution to represent and analyse arguments and debates is that of the Argument Web.

[4] http://www.nielsen.com/us/en/newswire/2012/final-presidential-debate-draws-59-2-million-viewers.html Accessed June 2014.

[5] http://www.digitaltrends.com/social-media/the-internets-reaction-to-last-nights-presidential-debates Accessed June 2014.

[6] Sentiment Analysis (Pang and Lee 2008) is the process of analysing human expressions (in the form of text mainly) with the use of natural language and computational linguistic processes in order to extract subjective information.

3.3 The Argument Web

The Argument Web is a vision for integrated, reusable, semantically rich resources that connect views, opinions, arguments and debates online, wherever they may occur whether in educational, political, legal or other domains (Rahwan et al. 2007). The Argument Web is underpinned by the Argument Interchange Format (AIF) which is a description, a standard and a series of implementations that allow exchanging argument resources between argumentation-based tools (Chesñevar et al. 2006). AIF+ (Reed et al. 2008) is a dialogical extension to AIF (Chesñevar et al. 2006) that allows explicit handling of the context of a dialogue enabling connection of *locutions* uttered by participants with the underlying *arguments* expressed by the content of those locutions.

With the use of these technologies, it becomes possible to link-up debates and discussions, and allow more in-depth, argument-based navigation of complex topics, whilst at the same time improving online critical literacy in general. Recent work has seen development of the *Argument Web* infrastructure and applications (Lawrence et al. 2012, 2012; Snaith et al. 2012). Previous research on broadcast debate and its computational representation using the *Analysis Wall* focused on a group of analysts collaboratively categorising the discourse (provided by argument segmentation) of a *Moral Maze* broadcast debate in real time using a large touch screen running a bespoke application which outputs to AIF+ (Lawrence et al. 2012).[7] The debates were available instantly on the Argument Web (Rahwan et al. 2007) for different compatible argumentation online tools to access such as *Carneades* (Gordon et al. 2007), *Arvina* (Lawrence et al. 2012) and *ArguBlogging* (Snaith et al. 2012). Another example of an AIF implementation is *Arvina* (see Fig. 1), a system that implements mixed initiative argumentation by allowing users to interact with "virtual agents" which represent the views of people whose arguments are already available on the Argument Web.

4 A study of older adults' interaction with debates

The aim of this study was to understand the way in which older adults engage with broadcast debates and identify common interaction patterns in order to define a protocol that supports interaction with broadcast debates. The study consisted of five sessions with 14 recruited participants (eight women and seven men aged 60 and over, $M = 68$) from the SiDE User Pool.[8] The participants were invited to listen to, and interact with a *Moral Maze* programme in groups of two or three persons. We split the sessions with three groups who have never listened to the *Moral Maze* and two sessions with participants who listened regularly to the *Moral Maze*. The sessions were audio-recorded, transcribed and analysed using a qualitative research software package.

4.1 The Moral Maze format

The format of the *Moral Maze* presents to the audience views of opinion leaders whom take the role of "panellists" and invited experts that take the role of "witnesses" discussing moral and ethical issues related to recent news stories. The panellists and witnesses generally group themselves into either a pro-liberal viewpoint or a more conservative one. This dynamic results often in combative and argumentative debate. The format of the debate is the following (see Fig. 2): The moderator starts delivering a preamble of the topic followed by the panellists issuing their initial position. The panellists then question and cross-examine each witness for around 8 min. The witnesses usually have contradicting positions towards the topic being discussed making the debate confrontational. Witnesses are not allowed to interact with each other. Strict turn-taking is enforced by the moderator which brings coherence to the debate and helps the listener to identify the person talking.

4.2 Research methodology

Participants were invited to take part in a group session in which they were given the possibility of interacting with a recorded *Moral Maze* debate.[9] We are aware that this is not the usual scenario in which participants listen to debates; nevertheless, we believe their essential behaviour would not be significantly different as they felt very comfortable during the study.

The study was divided into four segments; in the first segment, participants were given an explanation of the *Moral Maze* format and the aim of the study. The topic of the programme was not revealed to them until a few minutes before the session as we wanted them to react naturally to the arguments presented. In the second segment, participants listened to a recorded *Moral Maze* programme.[10] Participants were allowed to take notes and pause the recording at any time to express their opinion on the argument discussed. A planned pause was enforced by

[7] http://www.arg-tech.org/analysiswall.

[8] http://side.computing.dundee.ac.uk.

[9] Ethics for all areas of this study were approved through a university ethics procedure.

[10] The programmes used were: *Problem families* originally aired July 25th 2012 for sessions 1, 2, 3 and 5 and *The morality of gambling* originally aired March 2nd 2013 for session 4.

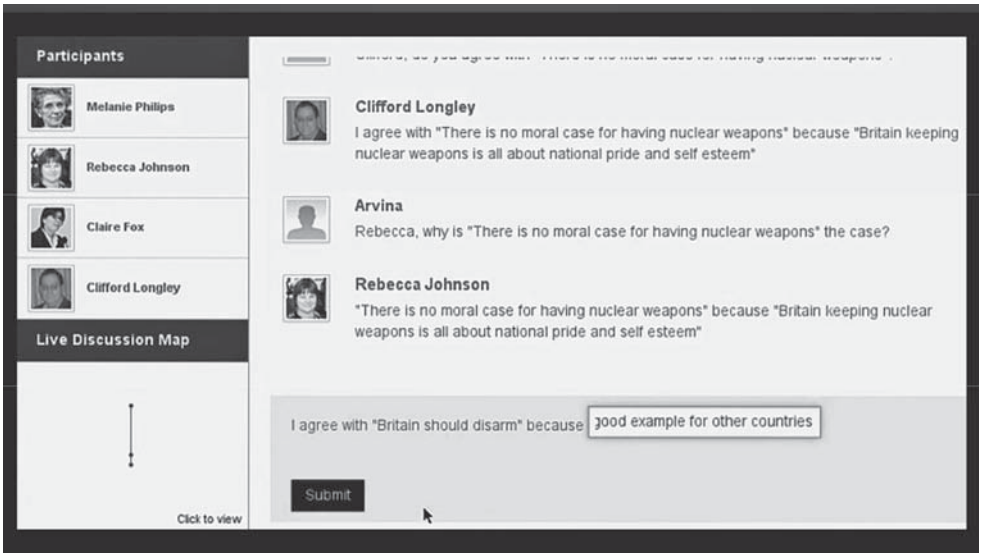

Fig. 1 Arvina Interface, a mixed initiative argumentation tool that allows participants to interact with "software agents" that take arguments from analysed debates

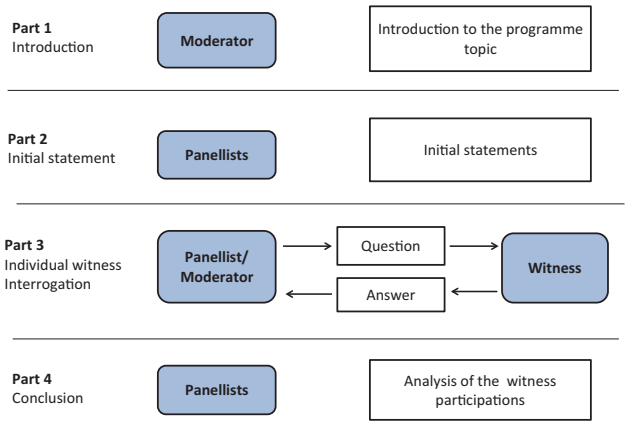

Fig. 2 The *Moral Maze* programme format

the researcher after each witness participation. In the third part of the study, we conducted an interview trying to reflect on the debate dynamic leaving out details of the content of the programme. Examples of interview questions are:

- Did you have the urgency to react to an opinion as soon as you listened to it?
- Did your initial position on the topic change with the debate?
- To what extent did you consider the opinions of others?
- Were the arguments of other participants helpful or interesting?

Finally, we conducted individual non-structured interviews to explore requirements for interfaces to interact with debates and their interest to use software tools to interact with debates. Example of the questions in this stage are:

- Would you be interested in interacting with these type of broadcast debates?
- How would you like to access and interact the arguments from the debate?
- Would you like to interact with the panellists and witnesses?
- How would you like to give feedback to the to the producers?

To understand the basic principles of interaction used by participants, we applied *open coding* techniques annotating the transcriptions of the sessions. Manual and automatic analyses of social interactions with debates have been done in the context of affective computing, e.g. Bigi et al. (2011), Gatica-Perez (2009), McKeown et al. (2012), but to our knowledge, none of these focus on argument analysis for older adults' interaction with debates.

One analyst performed the annotation in three rounds to obtain our final scheme in which we identified the most common types of locution used to interact with the content of the programme. Table 1 presents the main types of interactions used by participants.

We labelled manually locutions suggesting agreement and disagreement based on a set of keywords suggesting a strong positive or negative sentiment and the context in which they were uttered. We performed an inter-rater reliability test on annotation agreement with a second annotator who was given an annotation guide prior to the test. The Cohen's kappa statistic obtained from the annotations of 44 excerpts and five codes was 0.55, which is considered a moderate agreement rate. High-level pragmatic coding is typically more subject to content analysis interpretation. The coding was highly related to the context of the dialogue, which was not given in the inter-rater test.

Table 1 Types of interactions used by participants

Type of interaction	Examples taken from the study
Agreement	*I **agree** with her, her view is…*
	*That is **correct**, problem families represent…*
	***Definitely**, that was my point earlier…*
Disagreement	*I **disagree** with that, how can she be sure of…*
	*That's **nonsense**, there is no way, parents can be aware of…*
	***I don't know** about that, those numbers seem to be unclear…*
Equivocation	***I agree, but** they are not considering…*
	*I disagree **but on the other hand** , the case of…*
Justified Assertions	*I think the case is…because…*
	I believe the way things are…
	They don't have all the facts
Unjustified Assertions	*Probably the case is*
	I am not sure about…

Researchers in content analysis (Krippendorff 1980) suggest that values of kappa over 0.8 reflect very high agreement, whilst values between 0.6 and 0.8 reflect good agreement. On a second inter-rater reliability test using just the *agree* and *disagree* types of locution, the Cohen kappa factor raised to 0.69.

5 Results and discussion

We analysed how the participants interacted with the Moral Maze and retrieved common patterns used to express their opinion. The interactions were characterised by analytical and elaborated remarks about the topic discussed especially when participants expressed disagreement. In general, participants took notes constantly before participating and when they decided to pause the audio, they provided a long and detailed analysis of the argument being discussed. Moral Maze and non-Moral Maze listeners did not exhibit relevant differences in the way they interacted with the debate. Some of them were confused with the cross-reference strategy exhibited by the panellists but that just increased their participation. Once the non-Moral Maze listeners understood the format of the programme, they were as participative as regular listeners and did not show any sign of confusion. As for their interest to participate or interact with the content, none of the participants had a clear way in their minds to interact with the Moral Maze programme.

We identified the types of locutions used by participants by annotating the transcripts according to the type of utterance. In other words, we labelled known speech acts (e.g. assertions, questions, challenges, proposals, requests, etc.) and how they were combined in order to analyse how participants interact with debates. In the next subsections, we discuss in detail how participants interacted with the debate by discussing the way they constructed arguments and expressed agreement/disagreement (examples of participations are presented in Appendix).

5.1 Participants constructing arguments

We identified participants asserting claims (i.e. constructing their arguments by expressing their opinion) in two ways, as *Justified Assertions* when participants provided one or several reasons to support their point of view and *Unjustified Assertions* when participants did not provide a reason to back-up or sustain their opinions.

Unjustified Assertions indicate cases when participants did not want to engage with the debate and they were used more often with expressions of *Agreement*. To identify *Justified Assertions*, we looked for known patterns used to create arguments. From Argumentation theory,"Argumentation Schemes" are patterns used to construct arguments that can be questioned systematically (Reed and Walton 2007). The two most used schemes in the study were "Arguments from Position to Know" and "Arguments from Analogy". In an "Argument from Position to Know", a person asserts a claim to be true or false based on a fact that makes him an expert or well informed on the claim presented. Participants referred to personal experiences to exemplify their point of view making their arguments stronger. An "Argument from Analogy" is a commonly used kind of case-based reasoning, where one case is held to be similar to another case in a particular respect so it can be concluded both cases have the same property or outcome. Analogies were used by participants constantly in their interactions with the debate (we present example of these type of arguments in Appendix). Figure 3 presents a comparison between the use of locutions when participants agreed and disagreed.

5.2 Participants agreeing and disagreeing

From the interview conducted after the study, we learned that participants listen to debates not only to stay informed or to learn about a topic, but also enjoy taking a side and defending a position if the topic is relevant to them. A participant answered the question: "Why do you listen to the *Moral Maze* in specific or any broadcast debate?":

> *The Moral Maze is particularly good to present both sides of a story, and I always find it useful to hear good arguments from both sides even though I do not agree with them. I do not always change my mind but I always learn new things.*

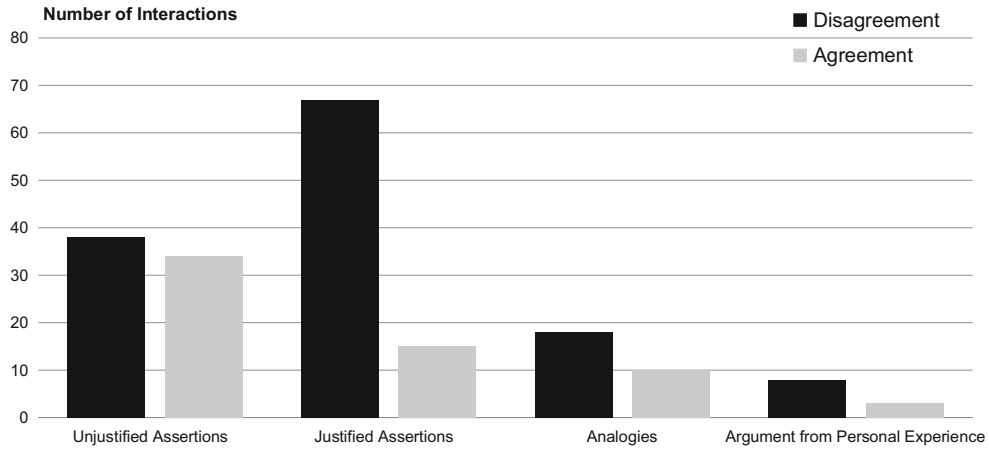

Fig. 3 Comparison on the use of locutions when agreeing and disagreeing

When agreeing, participants, instead of focusing on the argument presented, commented on previous arguments or summarised the opinion in their words to reinforce their agreement. Table 2 presents the predefined list of keywords used to label the transcripts. In order to identify *Agreement*, we looked for specific keywords that suggested a positive feeling towards the argument presented. The task of classifying the sentiment of a participation is not just a task of identifying keywords, but a process in which the context of what was said needs to be interpreted from the context of the dialogue. *Disagreement* was much more evident, and controversial arguments motivated people to participate. In general, it was easier to identify *Disagreement* due to the nature of the locutions. Also, participants were more eloquent and assertive.

Participants often used ambiguous language to conceal their opinion or to avoid committing themselves. The use of key phrases such as *but at the same time, I am not sure about that* indicate that participants equivocate. We use the term "equivocate" to indicate that participants wanted to avoid commitment, i.e. rather than agree or disagree directly, participants expressed their opinion taking a neutral side on the argument. Examples:

Table 2 Key phrases used express agreement, disagreement and to equivocate

Key phrases to agree	Key phrases to disagree	Key phrases to equivocate
I agree with	*No, that is incorrect*	*Maybe the case is*
That is correct	*I don't think*	*Yes, but at the same time*
Yes, certainly	*I think it is not the case*	*I don't know about that*
Precisely my point	*They are not considering*	
Absolutely	*That does not make sense*	

[…] Again they were saying poverty in itself is not a social problem, ***but at the same time*** *they may come under that 120,000 because the children aren't at school […]*

[…] ***I don't know about that*** *I think any society have problem families, problem people at the end of the day. […]*

But *Agreement* and *Disagreement* were not only expressed with respect to specific arguments throughout the debate. Although participants were able to pause freely the audio, they did not do it continuously in order to interact, and they were more participative when there was a small pause in the programme, for example when a witness finished his participation in the debate. Therefore, their participations were also targeted at specific persons. It was easier for participants to identify sets of positive opinions from a person and then comment on them as a whole. Examples:

[…] I did not understand everything the first man said. But most of his remarks were out of line. His view was completely biased. […]

[…] I agree with the first witness, that is precisely the point of view of people in the community […]

It also was important to determine how participants combined expressions of Agreement/Disagreement with the use of Assertions. This co-occurrence in locutions represents another way to analyse how participants construct their arguments and interact with the debate. For example, expressions of Agreement were used more with "Unjustified Assertions" and expressions of Disagreement more with "Justified Assertions" which explains why the participants used more time to disagree end explain their reasons.

We analysed whether there was bias in the type of assertion used related to the stance taken in the

Table 3 Phi coefficient contingency table for locutions that use assertions

ϕ Coefficient factor $= -0.3099$	Agreement	Disagreement	Totals
Justified assertions	15	67	82
Unjustified assertions	34	38	72
Totals	49	105	154

participation using the phi coefficient (ϕ), a measure of association for two binary variables. The variables were taken from participations using assertions and expressions of agreement and disagreement to create our 2×2 contingency table (see Table 3).

The coefficient obtained $\phi(N = 154) = -0.3099$ shows that the variables positively associated are Agreement using Unjustified Assertions and Disagreement using Justified Assertions. The significance of the phi coefficient can be tested obtaining the Chi-square, in this case $\chi^2(df = 1, N = 154) = 14.78\, p < 0.01$.

The Chi-square distribution value significant at the 1 % level for one degree of freedom is 6.635. Our obtained value (14.78) exceeds this; therefore, there is a statistically significant association between the type of assertion used related to the stance taken in the participation.

5.3 Interacting with broadcast debates

From the non-structured interview at the end of the study, we obtained from participants their interest to participate in broadcast debates. As we discussed, participants did not have a constant and immediate urgency to react to specific arguments and they prefer to wait for their time to speak to provide their opinion. The group sessions in general were very lively, and all participants confessed they enjoyed the exchange of opinions.

As for their interest to interact with broadcast debates, all the participants use email and less than a half use social media, but none have ever interacted with the *Moral Maze*.[11] Some of them have written an occasional email or letter to other debate programs or newspapers. On the question of whether they would be interested in participating in debates if the topic were interesting enough, about a half of them admitted that they would be interested in something that could help them to interact with any debate.

Participants expressed their desire to use simple commands and interfaces. A participant said:

> *I do not want to login and browse hundreds of menus to participate, the simpler the better.*

Another participant expressed issues with the format of the programme that could prevent him from participating:

> *The programme goes back and forth a lot, I don't see how I can keep track of everything. If I were to participate, I'd just give my an opinion on the issue.*

> *It's hard to realise who is talking. Sometimes I disagree with something and I want to comment on that specifically but Im not sure who Im referring to.*

On the next section, we present software recommendations to help older adults deal with some of this concerns based on the analysis on how they interacted with debates.

6 Recommendations for software-supported interaction with debates

In this section, we present recommendations for software-supported interaction with debates for older adults. The results of the study can be translated into software requirements from two perspectives: the first one is related to *usability requirements* for interacting with debates, and the second one is related to the underlying *computational argumentation requirements* necessary to interact with the Argument Web (Rahwan et al. 2007) content (cf. Sect. 2.4).

Regarding usability requirements, current online systems such as forums or social media sites are not designed to interact with content from debates (cf. Sect. 3.2); instead, the system needs to support a simple kind of dialogical interaction mediated by an easy-to-use technology. One possibility is a new online tool to facilitate these interaction. Another possibility of these technology is to adapt the phone line to interact live with the debate. We leave it for future work to determine the requirements for this technology. However, whatever medium mediates the interaction, it still needs to be governed by a protocol that is rich enough to allow people to interact in a meaningful way, but simple enough not to present a technological barrier to use.

The repetitive interaction patterns observed in the study, i.e. the type of locutions and the co-occurrence between them, were used to define a protocol for interacting with the content of the debate. The recommendations presented in the next section represent, to our view, things that could make help participants to interact in a easier and in a more structured way and at the same time, create Argument Web content which can be used to give them feedback on their participation and the participations of others.

[11] Currently, BBC Radio offers a generic online feedback forum for all radio programs.

6.1 A protocol to interact with broadcast debates

A dialogue protocol is a specification that defines the rules under which a dialogue should develop (McBurney and Parsons 2001). It is usually defined by the permitted utterances (the syntax of the protocol), its meaning in the context of the dialogue (the semantics of the protocol) and the rules that define the conditions under which the dialogue develops (participant roles, commencement and termination rules, etc). We define here the allowed locutions to interact, i.e. the syntax and rules of the protocol, and leave semantic specification for future work.

If we consider the *audience* of a broadcast debate to be a participant of the dialogue with a special role, we can define syntactic and semantic rules to it in the same way as any other participant role. Based on the results of the study, we defined two levels to interact with a debate and defined a protocol to interact with segmented arguments from the debate (we assume that the arguments from debate are already segmented, argument segmentation is out of the scope of the protocol definition).

We believe that if participants are prompted to first state, their position related to an argument, i.e. if they agree or disagree and then provide a reason for it with the help of a scheme, it would be easier for them participate and at the same time, generate content that can be related to the Argument Web. Figure 4 presents a protocol to interact with debates as a diagram with options to interact with the debate. The first step is to either *Agree* or *Disagree*, with a specific argument or with a person (Fig. 4a, b). The second step follows the previous commitment to *Agree* or *Disagree* and aims to provide a statement or argument related to an argument from the programme. Finally, these arguments optionally can be created using specific schemes making it easier for participants to express their opinion. The software recommendations are as follows:

The protocol supports the use of locutions for to agree and disagree.

- R1. **Participants should be allowed to indicate *Agreement* with *specific arguments* from the debate**. See Fig. 4a.
  Participants used several expressions of ***Agreement*** to interact with the debate (cf. Table 2). We described how participants stopped the recording to express agreement to specific arguments from the debate, see Sect. 5.
- R2. **Participants should be allowed to indicate *Agreement* with a person, independently of the arguments presented**. See Fig. 4a.
  We discussed in Sect. 5.2 how participants expressed *Agreement* with persons rather than specific arguments.
- R3. **Participants should be allowed to indicate *Disagreement* with *specific arguments* from the programme**. See Fig. 4b.
  Participants used several expressions of *Disagreement* to interact with the debate (cf. Table 2). We described how participants stopped the recording to express disagreement to specific arguments from the debate, see Sect. 5.
- R4. **Participants should be allowed to indicate *Disagreement* with a person independently of the arguments presented**. See Fig. 4b.
  We discuss in Sect. 5.2 how participants expressed *Disagreement* with persons rather than specific arguments.
- R5. **Participants should be able to provide their opinion without committing to Agree or Disagree with a specific argument or person**. See Fig. 4c.
  We discussed in Sect. 5.2 how participants equivocate to avoid committing themselves to agree or disagree.
  The protocol allows linking the Agreement and Disagreement indicators (from recommendations R1–R4) to *opinions*. In Sect. 5.1, we discussed how participants constructed arguments using Justified and Unjustified assertions. Furthermore, the *t* test in Sect. 5 indicates a strong correlation between the use of agreement and disagreement with types of assertion.
- R6. **When indicating *Agreement*, participants should be allowed to provide their opinion**. See Fig. 4d.
  This recommendation complements recommendations R1 and R2 by referring to the actual opinion of the participants when they used assertions, see Sect. 5.1.
- R7. **When indicating *Disagreement*, participants should be allowed to provide their opinion**. See Fig. 4d.

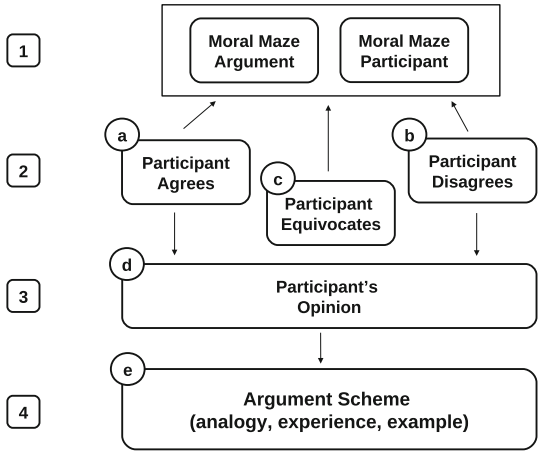

Fig. 4 A protocol to interact with *Moral Maze* content. (*1*) Moral Maze content, (*2*) participant can either Agree (*a*), Disagree (*b*) or equivocate (*c*) (*3*) Participant can provide his opinion (*d*). (*4*) Participant can use a specific scheme to provide his opinion (*e*)

This recommendation complements recommendations R3 and R4 and refers to the actual opinion of the participants when they used assertions, see Sect. 5.1. We discussed how this combination of locutions was the most common in the study, see Sect. 5.2.

- R8. **When providing their *opinion,* participants should be allowed to specify a type of argument** (either argument from position to know or argument from analogy). See Fig. 4e.
  At this point, participants can use of common schemes to present arguments, we discussed in Sect. 5.1 how participants used common argumentation schemes to provide their opinion.

7 Conclusions

The research presented in this paper aims to better understand how older adults would like to engage with broadcast debates. We aim to provide a way in which communities of older adults engage with debates through the deployment of novel information and communication technologies. We focus on a segment of the population that enjoys listening to and interacting with broadcast debates, but are not generally connected to the Internet to interact. Although we target older adults since they are still a very unrepresented group of social media users, the results are not limited to this demographic and could be applied to any user interested in broadcast interaction since we do not take into account cognitive or physical conditions of users. By identifying the underlying content of the locutions used in the study, we were able to capture common interactions patterns with the *Moral Maze* which were used to define an interaction protocol for software-supported interaction with debates. Preliminary interviews suggest that users interested in broadcast debates could benefit from using an application to interact with segmented content. The protocol presented together with the participants' suggestions can be used to define specific usability requirements for the interface. The main contribution of this paper is that it presents software recommendations to support the interaction with debates based on a qualitative analysis of older adults interaction with broadcast debates. These recommendations lay the foundation for building practical, deployed systems compatible with the Argument Web that can benefit older adults and support inclusive engagement priorities with broadcasters. By doing so, we hope not only to equip part of the audience with the ability to have their voice heard, but also in the longer term to provide a driver for engagement with social media for this user group.

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Appendix: Participants' quotes

1. Examples of **Unjustified Assertions**:

   I think the government viewpoint was simplistic to be honest.
   I think that person is not understanding the situation. It's almost a middle class view.
2. Example of **Argument from Analogy**:

   […] It is a trick. Gambling companies trick people. (**Assertion**) *For example, banks were mis-selling private pensions some time ago attracting people with free commissions. How is that different from these people enticing people in to gambling with a 20 pounds free start? It's a mis-selling of a product.* (**Justified Assertion with Argument from Analogy**)
3. Example of **Argument from Position to Know**:

   […] You cannot tackle the problem by raising the price of beer, the problem is how people are educated. (**Assertion**) *I was on a train last month where four guys came on and each one had a carrier bag of beer and they started playing cards loudly with money all over the table. If you'd doubled the price of the beer, it would have made no difference for them. For some people is not about the price, it's about lack of education and consideration* (**Justified Assertion with Argument from Position to Know**).
4. Examples used by participants to **agree** (sentiment identifiers are in boldface):

   […] ***I agree with that****, what I think is that they're come now to a more accurate definition in that these are families with five to seven deprivations […]*
   […] ***Precisely****, what she just said is the main point in this debate, it's got individuals in the messes but also got society in to messes as well […]*
5. In the following example, *Female 1* **agrees** to an direct question raised by the Researcher:

   Researcher: *Do you agree that the figures are important to sustain an argument when you throw in a number like 120,000?*

Female 1: *To some extent, you have to accept the numbers that you're given because I don't know anything different […]*

6. Examples of **disagreement** used by participants:

[…] ***No****, it would only need a few, half a minute of somebody giving their story about how they got to the state they're in with gambling. […]*
[…] ***I think it's not*** *just the poor family who has the moral problems. There is a general lack of - in my opinion, morals in a lot of families, forget about their income status […]*

7. Example of **Justified Assertion with Disagreement**:

[…] we don't want to tell people what to do (**Disagreement**) *but if you see somebody driving badly, the police will say: you should be driving on the other side of the road.* (**Argument from Analogy**) *The trouble is the social work departments have become afraid that if they left a child with the parents, if something happened to that child there would be a big enquiry and they would then be seen as negligent* (**Justified Assertion**). *So, the default situation for a social worker is to take the child away. […]*

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