DEBARGVIS: An Interactive Visualisation Tool for Exploring Argumentative Dynamics in Debate

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Abstract

Television debates play a key role in shaping public opinion, however, the rapid exchange of viewpoints in these settings often makes it difficult to perceive the underlying nature of the discussion. While there exist several debate visualisation techniques, to the best of our knowledge, none of them emphasise the argumentative dynamics in particular. With DEBARGVIS, we present a new interactive debate visualisation tool that leverages data annotated with argumentation structures to demonstrate how speaker interactions unfold over time, enabling users to deepen their comprehension of the debate.

1 Introduction

Broadcast political debates such as BBC1's 'Question Time' in the UK with over a million monthly viewers[1] serve as a cornerstone of political discourse as they provide a compact yet rich source of information that plays a key role in shaping public opinion. However, the rapid exchange of viewpoints in these forums presents a challenge: The wealth of information compressed into a short period of time can make it difficult to parse the underlying dynamics and the connections between speakers' arguments.

One way of representing such dynamics is through an argumentative analysis, which allows us to explore how claims are supported or attacked. Such an analysis is frequently visualised in the form of a graph with nodes containing claims and the relations between them represented in terms of edges. DebateGraph[2] or ArgVis (Karamanou et al., 2011) are, for instance, tools designed for public-facing deliberation analysis; other resources like Araucaria (Reed and Rowe, 2004) and OVA+ (Janier et al., 2014) are more research-oriented, while techniques, such as Reason!Able, target the improvement of critical thinking skills (Van Gelder, 2002). Graph-based representations tend to lack the explicit encoding of the temporal dimension which is crucial for capturing the dynamics of real-time debates. In contrast, visualisation techniques that focus on debate dynamics frequently do so by depicting different layers of the debate, e.g., topics, speaker interactions, and timeline, in distinct infographics (El-Assady et al., 2016b; South et al., 2020), making it difficult to get a holistic understanding of the debate landscape.

In the present paper, we aim to address this gap between argument graph representations and debate visualisations by introducing DEBARGVIS, an interactive tool for visualising argumentative dynamics in debate.[3] As use case we take QT30 (Hautli-Janisz et al., 2022), a corpus of broadcast political debates annotated with argumentative relations using Inference Anchoring Theory (IAT) (Budzynska et al., 2014, 2016). As Fig. 1 depicts, DEBARGVIS interactively combines timeline, debate participants, argumentative relations within and between speaker contributions, video of the debate and debate transcript. This provides users with an overview of the overall debate dynamics, such as how much each speaker contributes and how they interact with each other, while also allowing for a closer inspection of the debate's underlying argumentative structure.

2 Background

A variety of argument visualisation tools have been developed, employing different techniques to represent argumentative relations. One of the well-established approaches is the use of the node-link layout (Lowrance et al., 2000; Van Gelder, 2002; Reed and Rowe, 2004; Van Gelder, 2007; Gordon

[1]https://tinyurl.com/2fkmdyt9
[2]https://debategraph.org
[3]Tool preview (without the original BBC video): zlatakikteva.github.io/DebArgVis-Demo/, video demo: https://youtu.be/ra-RHZ5THN8

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Figure 1: Overview of the DEBARGVIS components.

et al., 2007; Karamanou et al., 2011; Janier et al., 2014), while others visualisation strategies include indentation-based formats (Karacapilidis and Papadias, 2001; Verheij, 2003; Mcalister et al., 2004), and nested layouts (Bell, 1998; Benn and Macintosh, 2012). For the most part, such tools focus on representing reasoning on a smaller scale, where individual arguments are accessible. In contrast, Kiesel et al. (2021) allows to to view and compare larger patterns of reasoning between essays, while Zhou et al. (2019) focus on structures in scientific papers. Hybrid tools, such as DebateGraph, allow for both closer inspection of the data and a general overview of the relations.

Such approaches are not necessarily tailored towards visualising large conversations or spoken debates, for which speaker interactions and temporal progression are important. Approaches that focus on addressing the conversational nature of the discourse include such tools as uVSAT that offers stance visualisation in social media (Kucher et al., 2016), ConToVi that focuses on topic-space in conversations (El-Assady et al., 2016a), and NEREx that provides named-entity based analysis of debates (El-Assady et al., 2017). Furthermore, such tools as VisArgue (El-Assady et al., 2016b) and DebateVis (South et al., 2020) offer sets of visual analytics across several debate dimensions, such as speaker interactions and topic progress along a timeline, while MultiConVis (Hoque and Carenini, 2016) focuses on topics and sentiment in online discussions. Finally, CI dashboard (Ullmann, 2019) includes an argument graph of the node-link layout type among other group discussion analytics in its suite. To the best of our knowledge, however, none of the existing approaches represent debate dynamics through argumentative speaker interactions along a timeline as we are proposing.

3 The QT30 Dataset

The QT30 corpus consists of 30 episodes of 'Question Time' (QT) (Hautli-Janisz et al., 2022), a political talk show in the UK broadcast on BBC1, where the audience challenges a panel of political figures regarding current topics. The panellists then respond and freely discuss the issues with each other. The data is annotated with Inference Anchoring Theory (IAT) (Budzynska et al., 2014, 2016), a framework that captures how arguments evolve and are reacted to in dialogue, anchoring argument structure in dialogue structure by way of illocutionary connections. Data annotated with IAT is split into elementary discourse units (EDUs) between which argumentative relations of support (either between a premise and a conclusion or in a form of agreeing with a statement), attack, and rephrase (either a reformulation of a statement or an answer to a question) are identified. IAT adheres to the AIF+ (Argument Interchange Format variant suitable for dialogue) (Reed et al., 2008), which is a well-established framework for representing argumentation. Therefore, DEBARGVIS can be adapted and used with any debate data in the same format. In addition to the corpus annotations, we separately access the debate transcript and video.

4 Visualisation

With DEBARGVIS we aim to develop a timeline that reflects several dimensions of a debate, including (i) temporal sequence of utterances; (ii) attribution of utterances to speakers; (iii) argumentative relations between utterances; (iv) content of the utterances; (v) debate topics; (vi) additional audio-visual context in video format. The visualisation therefore comprises five components: The *timeline* in Fig. 1 is used to capture (i), (ii), and (iii); the *slider* is used to navigate the *timeline*; the *transcript window* includes (iv); *topic bubbles* contain (v); and a *video player* introduces (vi).

Timeline The timeline is the focal visualisation component. It displays when an utterance is made, who made it, and the argumentative relations between utterances in a diagram with an x-axis representing elapsed time (around one hour in the case of QT debates) and speaker names on the y-axis. The first five names belong to panel members, 'public' represents any member of the audience who is invited to participate in the debate, and Fiona Bruce is the moderator. Speaker contributions are indicated with thin bars in the timeline, where each bar corresponds to an EDU. Thus, each part of a speaker's contribution is usually represented by several consecutive bars. Each individual speaker and the public as a whole are associated with their own colour. Attached to the bars are arrows indicating the argumentative relations based on the IAT annotations. Each relation has a source bar and a target bar. The relations of support (labelled as 'arguing') are in green, of attack ('disagreeing') in red, rephrase ('restating') in purple, and answers to questions ('answering') are in orange.

Slider High density of the utterance bars on the timeline limits the ability to closely examine the data. We mitigate this by introducing a slider in the form of a compressed version of the timeline. When a white transparent rectangle initially located to the left of the diagram is used to move along the slider, a corresponding area in the timeline is expanded.

Transcript Window and Video Player The transcript window displays the text corresponding to the utterance bars in the timeline. It allows the users to examine the content of the speakers' contributions. Each transcript block associated with a different speaker is colour-coded accordingly. The

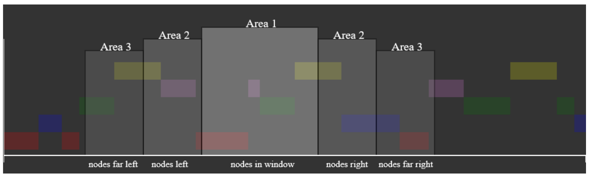

Figure 2: Three areas that are expanded when interacting with the timeline using the slider.

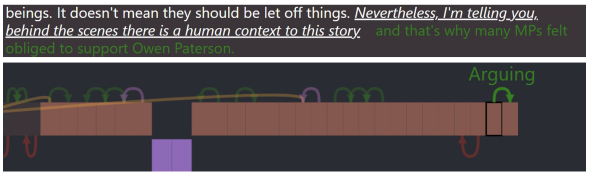

Figure 3: Argumentative relations displayed in the transcript (above) and timeline (below).

video player adds an audio-visual view of the debate.

Topic Bubbles The purpose of the topic map is to help users gain a deeper understanding of the content by representing the topics covered in the debate. In order to extract topics from the text, Latent Dirichlet Allocation (LDA) (Blei et al., 2001) is used as a 'black box' on the transcript. It returns nine topics, each represented by seven words.

Interaction with the Components The slider can be clicked and dragged and has a major effect on the timeline, transcript, and video player. When the white rectangle is dragged across the slider, the corresponding area on the timeline is enlarged by increasing the width of the bars, while the rest of the timeline gets compressed and dimmed in colour to draw attention to the selected area. Two areas adjacent to the selected section on both sides are enlarged to lesser degrees, which creates a 'fish-eye' effect shown in Fig. 2. Simultaneously, dragging the slider navigates to the text in the transcript window corresponding to the utterance bars in the selected area, along with the corresponding video segment. Starting the video uses the slider functionality by constantly updating the x-value of the center of the sliding window to the current time of the video. Thus, when the video is playing, the sliding window moves automatically.

The users can also interact with the timeline by hovering over the utterance bars. If the utterance bar is a source of an argumentative relation(s), it will be italicised and underlined in the transcript window, while the target(s) of the relation(s) will change their colour to the one of the corresponding relation as shown in Fig. 3. If the target of the relation is outside of the selected area, its text will be displayed over the timeline. Hovering over text in the transcript window will highlight the corresponding utterance bar in the timeline and all potential argumentative relations associated with it both in the timeline and the transcript. In this way, the users are able to closely inspect any arguments in the debate. When hovering over utterance bars outside of the selected area, the corresponding text will be displayed over the timeline.

Topic bubbles can also be interacted with: Hovering over a word in a bubble will highlight all bars in the timeline with a corresponding utterance containing that word, and hovering over the bubble itself highlights the utterances that include the topic. At the same time, text corresponding to the bars is highlighted in the transcript.

Implementation The visualisation is implemented in JavaScript using D3, an open-source visualisation library.[4] The source code is publicly available in the repository at https://github.com/DarkSilver-1/DebArgVis-Code.

5 Use Case

In order to showcase how the tool can be used to make meaningful observations regarding the debate dynamics, we use DEBARGVIS to visualise one of the QT30 debates from November 2021 depicted in Fig. 1. At first glance, we notice the general debate structure, where relatively longer panel member turns, indicated by sets of consecutive utterance bars in one colour, are interspersed with public contributions in orange and much shorter input from the moderator in blue. The debate seems balanced as all participants get to contribute to the discussion at various points throughout the debate. Moreover, the length of the speakers' turns suggests that, for the most part, all panel members have relatively equal speaking time, with the exception of Paul Scully, whose turns are on the shorter side.

Further inspection of the visualisation results allows us to make several observations regarding the argumentative patterns within the debate. We find a number of long-distance relations, primarily marked by orange 'answering' arrows between moderator and panel members. The other relation that similarly stands out is 'disagreeing' between the public or moderator and the panel, as well as, in a few instances, between different panel members. Relations of 'arguing' and 'restating' are much rarer between speakers. These patterns indicate that the driving force behind the debate are the moderator and the public with whom the panel members have direct interactions, while exhibiting limited engagement with each other. Relations of 'arguing' and 'rephrase' are significantly more frequent within speaker turns, indicating a general tendency of speakers to support the claims they are making.

We also note how long-distance relations are contained within four separate debate segments. Such behaviour is related to the way 'Question Time' is organised, where the debate is driven by four questions asked by the public at different points in the episode.[5]. This suggests that each question prompts a largely self-contained discussion. Notably, the first two questions appear to be more complex, evidenced by a higher number of long-distance relations within these segments, which together take up about 50 minutes of the episode's total runtime of about one hour.

Finally, we observe that the debate is well moderated as the speaker turns are rarely interrupted. The interruptions are indicated by a gap in the continuous set of utterance bars by one speaker with an utterance by a different participant. One example of such an instance can be found at the 32-minute mark on the timeline when the moderator interrupts Paul Polman with a question. In fact, most of the interruptions are made by the moderator when she invites different audience members to contribute or reiterates questions to the panel to prompt a desirable response. Only in a few rare instances the panel members interrupt each other.

Based on these observations, we conclude that this debate, while giving a relatively equal opportunity for the panel members to respond to the audience members, does not focus on allowing the panel members to interact with each other, who instead have more exchanges with the public and the moderator.

6 Conclusion

With DEBARGVIS we present an interactive tool for the visualisation of argumentative dynamics in debate, with a particular emphasis on the temporal dimension of the data and speaker interaction. We

[4] https://d3js.org/

[5] Questions are marked on the timeline in Fig. 4 in the Appendix A.

demonstrate the tool's applicability through a visual analysis of a 'Question Time' episode, which allows insights into several aspects of the debate, such as quality of its moderation, the lack of direct interaction between the invited panel members, and a focus on addressing the audience's questions.

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Limitations

One of the main limitations of our visualisation tool is that currently it is tailored to the data annotated with IAT. While there is more corpora available in this format, such as a corpus of US2016 presidential debates (Visser et al., 2020), this limits the tool's applicability. The decision to use IAT data specifically is based on the fact that the information it offers goes beyond relations of support or attack, to which argument mining corpora are frequently limited. Such information includes, for instance, an indication of when questions are answered, which can provide valuable insights given the nature of the data genre. That being said, it should be possible to adapt the tool to differently annotated corpora, provided a transcript and video are available.

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A Four Questions from the Public in the Debate

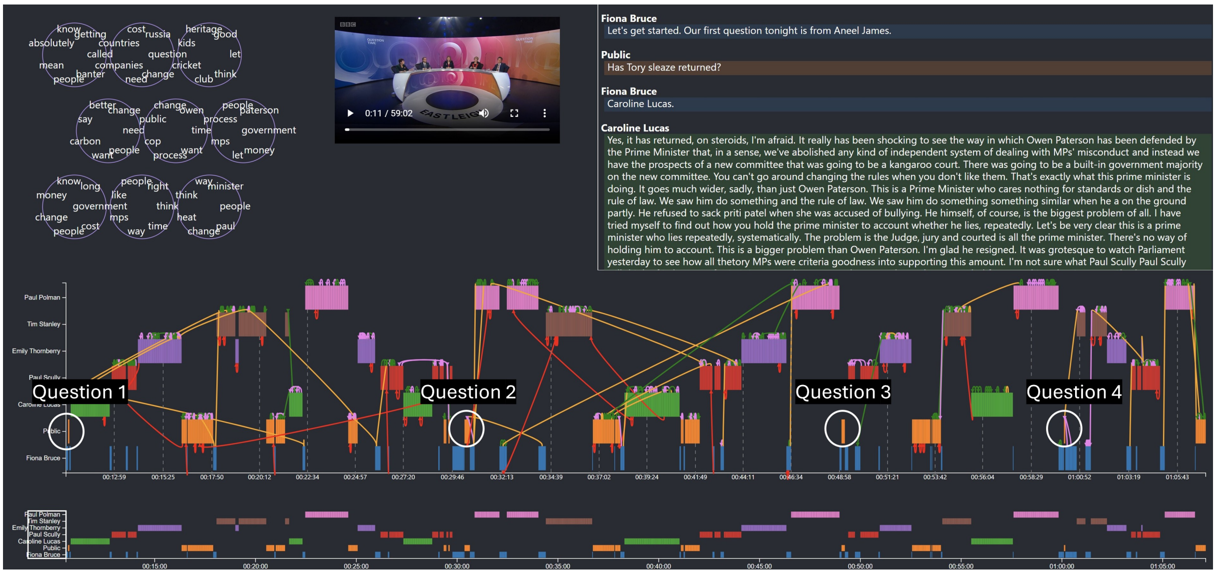

Figure 4: Points in the debate at which the public is invited to introduce new questions for discussion.