Dialogue Cartography

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In a modern society that is becoming more digitally oriented, there has been a commensurate expansion in the amount of human interaction that now takes place online. Despite pockets of reasoned and constructive dialogue, the online arena is an increasingly polluted space, characterised by bias, segregation, and tribalism. Whilst it is tempting to ignore the more ill-tempered online interactions, it is unfortunate that such dialogue is persuasive within its community and it can be conjectured that this is having effects outwith the online arena, affecting real world political choices and decision making. it is reasonable to investigate, and furthermore, to attempt to understand, the competing arguments that are being made across the spectrum of online interaction.

One tool for working with arguments and dialogue is diagramming. Argument diagramming has been a useful way to abstract from the surface level linguistic expressions that make up the regular experience of arguments, in order to make plain and capture the underlying structure and to visualise said structure using a schematic representation. However arguments, simpliciter, don't capture everything involved in online interaction. A natural logical extension to this approach, is to extend argument diagramming to account for dialogue and it's associated dynamics. Such an extension provides tools for understanding not only the interaction dynamics associated with argumentative dialogue, the call and response between the locutors, and the connections between the things that the participants say, the dialogical transcript, and the argumentative structure that is co-created, but also for understanding how individual locutions can elicit or suppress future responses. An extension to traditional argument diagramming, computer supported argument visualisation enables more complex, and more extensive, arguments to be visually schematized. Furthermore, the use of computers within visualisation enables richer, more dynamic visualisations to be created, visualisations that are difficult to produce non-computationally, for example, enabling dynamic colouring or highlighting of argumentative threads in response to user interaction.

In this paper we present an integrated and comprehensive dialogue diagramming method for use in analysing, understanding, and mapping argumentative dialogues. We illustrate and explore the method by making use of, and mapping, two exemplar dialogues due to Walton, the tipping dialogue and the Santa Claus dialogue, and a third dialogue stemming from an online interaction. This way we demonstrate diagramming of the classical dialogues from the argumentation theoretic literature alongside contemporary online interactions.

Broadly, the diagramming method is graph-based, with elements of interest represented and depicted visually by nodes of varying types. Edges are used to connect nodes and depict specific relationships that hold between them. The range of both nodes and elements is constrained to specific types of element. This method makes use of a multi-zone approach in which the nodes, the elements of the diagram, are grouped into one of four different focal zones; variously the participant, dialogue, speech-act, and argument-structure focal zones. A diagram may contain zero or more instances of each zone.

The participant zone identifies the collection of participant nodes which represent the speakers who are participating in the dialogue. Whilst in many cases this will be confined to two, the classic duologue, but if we scale up from a two person interaction to three or more, for example, for perhaps political debates or to analyse arguments on web forums, then being able to map all the participants to see how they contribute to the dialogue is useful.

The dialogue zone is organised as a set of ordered nodes in which each participants contribution in a given turn is uniquely numbered with an integer, the turn ID, and is visually positioned to maintain the sequencing of interactiongs within the dialogue. The size of any individual node in the dialogue zone gives an easy comparative visual representation of how much was said by each participant during each turn.

The speech-act zone records the individual speech acts made during each turn. Each node from the dialgue zone is sub-divided into smaller components because a person might, during their turn, make a number of statements or ask a number of questions, or perform some other combination of individual speech acts. by breaking up each dialogue interaction in to individual acts, it is easier to map these to specific argument elements. This zone is also a self-contained sub-diagram that shows the reflexive relationships between speech acts, for example showing how one statement elicited a counter-statement or question, and how questions elicit responses. This sub-diagram gives a visual depiction of how much each participant is actually responding to things said by others and allows us to see, for example, if a participant is responding to something later in the dialogue, or if a given speech act is left un-responded to, for example, due to the other participants perhaps not having a good response and thus deciding to change argumentative tactic. Note that the speech-act sub-diagram has two natural orderings, the first is where each speech act node is ordered by participant, so the first group of statements are from one participant, and the next group from another participant, and so on. This is useful to visualise the interaction between participants, i.e. how they respond to each other on a turn by turn basis. The second natural ordering is the dialogue order, i.e order the speech acts in the order in which they arise during the dialogue. This ordering is useful to show the locality and clustering of responsive turns as the dialogue develops, moving through and establing various sub-arguments. It is not clear which order is best by default[1], however each shows useful information in different ways based on the same data but using a slightly different layout of that

[1]... an open question that forms part of ongoing research...

data.

Finally there is the is the argument diagram zone. This zone utilises a refined version of the SADFace/MonkeyPuzzle argument diagramming style[2] which recognises three types of node: atoms, schemes, and conflicts. Of note is that some atoms in this zone stem directly from the dialogue, and can be mapped directly back to at least one participant via intermediate speech-act zone and dialogue zone nodes. Other atoms in the argument diagram are examples of enthymematic components, parts of the argument that were left unspoked when the argument was made, but that are important to understanding the actual structure of the argument that is being co-constructed during the dialogue. Finally there are scheme and conflict nodes, scheme nodes to depict supportive realtionships between atoms, and conflict nodes to depict either mono-directional attack or bi-directional disagreement.

In addition to the aforementioned focal zones, we identify three types of interzonal mapping. Interzone mappings enable relationships between the nodes in each zone to be captured and delineated from those relationships between nodes that hold within a given zone.

The participant-dialogue interzone maps each participant to things they have said. In a two party dialogue this will mostly be just the participants taking turns to speak, but in multi-party dialogues it shows how speakers are contributing to the dialogue. This makes it clear which participants are more or less dominant in their contributions to the dialogue overall. The dialogue-speech act interzone maps each participant's turn to the individual individual speech acts that make up the turn. This gives a useful visual representation of how much was said during each specific turn. The speech act-argument interzone maps each speech act to argument atoms in order to visually relate the dialogue to the argument that it is a part of.

Figure **??** illustrates the diagramming method applied using the "off-the-shelf" generic diagramming software 'OmniGraffle' to diagram the "Tipping Dialogue". In addition to the diagramming method outlined above, a computational implementation has been created in the form of a JavaScript library which can be used to construct diagrams that are rendered in a Web browser and exportable to the JPG, PNG, and SVG formats.

Whilst the barebones of a single, scalable, and unified dialogue diagramming method is in place that identifies the range of basic node types, as well as the broad kinds of relationship, further work is ongoing to catalogue the range of specific types of relationship that can exist between nodes. Additionally, in terms of the software tooling the diagramming method, there are many opportunities for dynamic user interaction yet to investigate.

To summarise, we've outlined a method for Dialogue Cartography, for application in visualising the fine structure of argumentative dialogue.

[2]SADFace and MonkeyPuzzle are tools from the Open Argumentation Platform (`http://openargumentation.org/`)

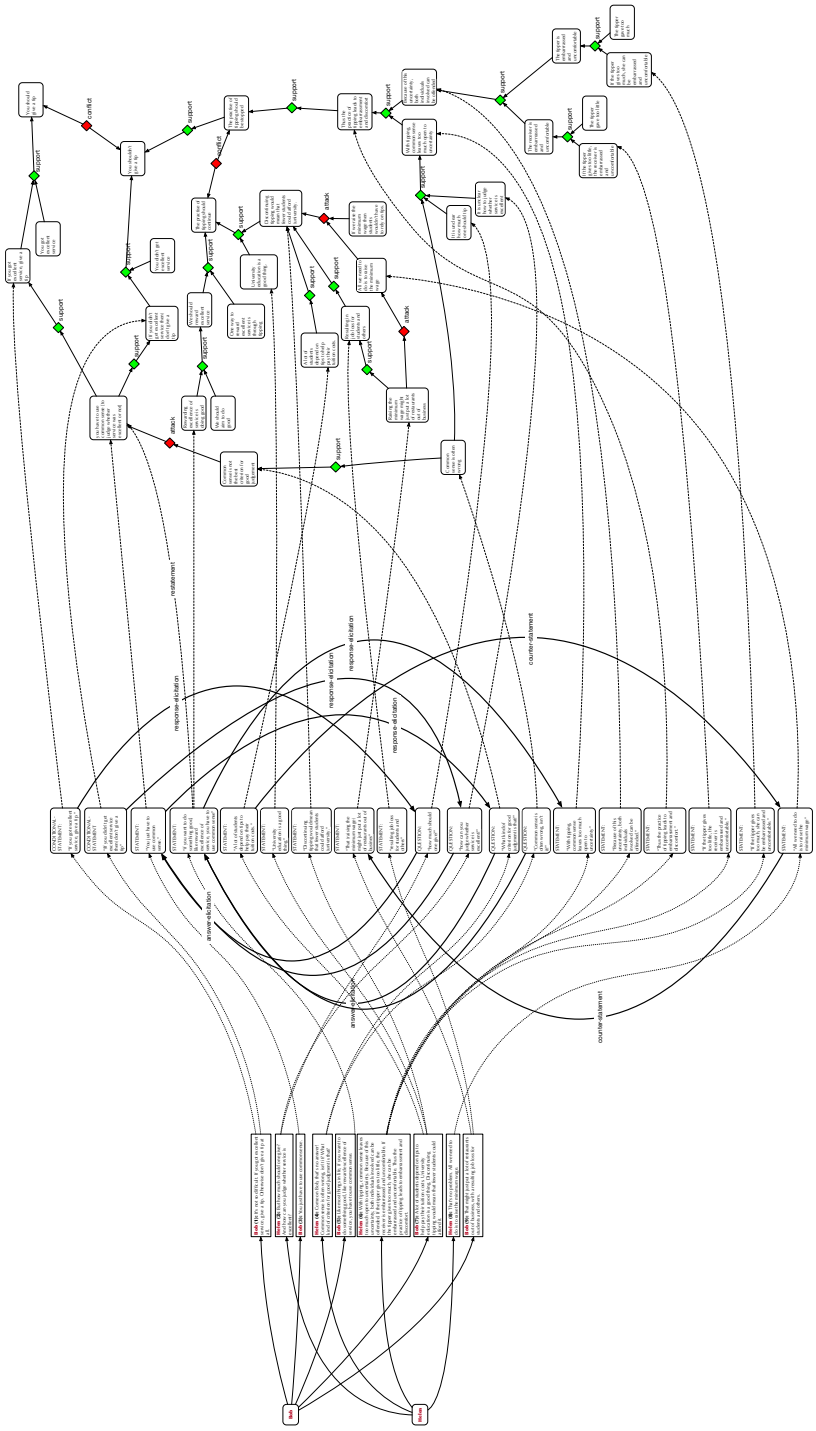

Figure 1: Application of the dialogue diagramming method to Walton's "Tipping Dialogue" using Omnigraffle