Argument Diagramming of Meeting Conversations

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1. INTRODUCTION

Within organizations the locus of a lot of knowledge production is found in dialogue, discussion, and argument: people expressing ideas, negotiating deals, arguing viewpoints, pursuing agendas and seeking common ground. The arena for most of this production is the meetingroom. The general visible results of meetings are normally meeting minutes, and maybe if one is lucky a list of action plans. Generally, a lot of energy and information that has been put into the actual outcome is never seen again. Meeting records however can also contain recordings of meetings where the whole meeting is captured by a number of cameras and microphones.

Smart meeting rooms have appeared at several institutions in order to record large corpora of meeting data aiming eventually to build models and systems able to capture the relevant content of the meeting. Once this content can be transformed into information sources, one will be able to exploit them to gain more knowledge about decision making, planning, assessment and rationale capturing [Pallotta et al., 2005]. This content, also known as organizational memory, can be made accessible afterwards for further study by e.g. a browser or a summarizer. For a complete overview of how technology can support meetings see Rienks et al. [2005].

Lisowska [2003] lists the kinds of queries people have about records of meetings. Two main groups of questions are distinguished. The first deals with questions about the interaction amongst participants during a meeting. These are questions such as: *Who was in favor of the proposal from X*, *Were there any objections raised to the final conclusion?*, or, *Were there any other solutions debated?*. The second type deals with elements from the meeting domain itself. Examples are *How long did the meeting take?*, *Who were the attendees of the meeting?*, or *What were the issues debated, and which problems are still unresolved?*.

We are interested in finding answers to questions dealing with agreement, disagreement, discussions, decisions and arguments. We have tried to find an approach that is able to capture the decisions of a meeting as well as the lines of deliberated arguments. We do not want to formulate an opinion about the *contents* of the argumentation, but we do want to identify the relations and the forthcoming *structure* between the arguments. In this paper we introduce the Twente Argument Schema, a diagramming model, developed in order to structure textual units by providing an annotation enabling people as well as automatic systems to find answers to questions related to the decision making process.

To obtain these structures we consider (remote-control) design meetings used in the EU project AMI[1] (Op den Akker et al. [2005]) from which the transcripts are known. As design can be considered an 'ill-structured' or 'wicked' problem, the approach in a collaborative problem solving process one encounters in these kinds of meetings is generally through a lot of argumentative discourse [Buckingham Shum, 2003]. We have tried to identify the various functions of the argumentative aspects of the different contributions made by the participants and have defined labels to relate these contributions to each other. The resulting structure provides extra insight into which issues were debated and which statements were put forward. The schema contains labels for transcript fragments as well as labels for relations between these fragments. The resulting structure captures the discussions and can be aligned with models structuring arguments developed by argumentation theorists (c.f. Toulmin [1958]).

Our paper is organized as follows: First we will elaborate on the various benefits and ways of argument diagramming in section 2. This shows the kinds of units and relations that are relevant to bring into the schema. Next, we show how argumentative structures generally occur in discourse and dialogues in Section 3. We discuss the requirements taken into account for our own diagramming model in Section 4 and in the final section 5 we present the Twente Argument Schema by defining its labels and the way they are to be applied. The examples used to illustrate the schema are mostly taken from the transcript of the AMI-FOB6 meeting, in particular the intelligence where four participants had to discuss which animals they considered the most intelligent: ants, cats or cows. The transcript of this discussion can be found in appendix I.

[1] www.amiproject.org

2. ARGUMENT DIAGRAMMING

The primary tool currently in use to give an account of argument structure is the argument diagram. There are many different kinds of argument diagrams. An argument diagram generally provides a map or snapshot of the overall flow and structure of the extended chain of reasoning in a given passage of discourse containing argumentation. A typical argument diagram gives a map of the overall structure of an extended argument. The diagram is generally a graph containing a set of points or vertices joined by lines or arcs. The points (nodes) are used to represent statements and conclusions of the argument, the lines (arrows) join the points together to represent steps of inference.

The first researcher to represent the structure of argumentation by using diagrams was Beardsley [1950]. His diagrams consisted of numbered statements and arrows indicating support relationships. Coherence between various aspects of the dialogue were revealed in this way. Argument diagrams often serve as a basis for criticism and reflection of the discussion. A related term in relation to argument diagramming is *design rationale*, which is a systematic approach to layout the reasons for decisions that led to the design of an artifact [Buckingham Shum, 1997]. Argument diagrams can be used for various other purposes. We list them here briefly:

- Argument diagrams provide a representation leading to quicker cognitive comprehension, deeper understanding and enhances detection of weaknesses [Schum and Martin, 1982, Kanselaar et al., 2003].
- Argument diagrams aid the decision making process, as an interface for communication to maintain focus, prevent redundant information and to save time. [Yoshimi, 2004, Veerman, 2000].
- Argument diagrams keep record and function as organizational memory.[Buckingham Shum, 1997, Pallotta et al., 2005]
- The development of argument diagrams may teach critical thinking.[Reed and Rowe, 2001, Van Gelder, 2003]

It is obvious that they can serve very similar functions when applied to records of meetings.

2.1 Diagramming methods

Several diagramming techniques have been developed, all with their own goals in mind and their own ways of creation. We discuss three of them : Wigmore's charting method, Toulmin's model and the model developed for the EUCLID project.

Wigmore's charting method Wigmore [1931] developed a graphical method for charting legal evidence and looks like the traditional diagramming methods one encounters nowadays in logic textbooks (e.g. Govier [2005]). The purpose of his charting mechanism is to represent proof of facts in evidence presented on either side of a trial, to make sense of a large body of evidence. His charts depict the arguments that can be constructed from this body of evidence as well as possible sources of doubt with respect to these arguments. In his model each arrow represents an inference or a provisional force. The nodes are the *facts* or the kinds of evidence that are put forward. Each type of evidence has its own shape. Circumstantial evidence is, for example, represented by a square, whereas testimonial evidence is represented by a circle. Furthermore there are possibilities for including a type of relation between facts where one fact 'explains away the other', whether the evidence was offered by the defendant, or whether the fact was observed by a tribunal or judicially admitted.

The Toulmin model In the late 1950's Stephen Toulmin developed a model where a schematic representation of the procedural form of argumentation is presented [Toulmin, 1958]. Toulmin's model is only concerned with pro argumentation and the acceptability of a claim, that is to say the role played by verbal elements in the argumentation during the justification process.

Toulmin regards an argument as a sequence of interlinked claims or reasons that between them establish the content and force of the position for which someone is arguing. He states that an argument consists of six building blocks: A *datum* which is a fact or an observation, a *claim* related to the datum through a rule of inference which is called a *warrant*, a *qualifier* which expresses a degree of certainty of a claim, a *rebuttal* containing the allowed exceptions and a *backing*, which can be used to support a warrant.

The EUCLID Model A final model we discuss is the EUCLID model, a hypertext-like model of arguments developed under the EUCLID project. This diagramming method relies on the segmentation of a discussion into a series of claims. This model is rather simple as the resulting claims can only be related to each other by either 'support' or 'refute' links [Smolensky et al., 1988].

What we see is that these diagrams all serve their own purpose and show differences in application domain or level of detail. They have one thing in common: they all have their own labels and with these labels they structure parts of discourse in a way to facilitate comprehension and point out possible flaws. As our model should be able to reveal similar structures, not from evidence used in trials but from meeting transcripts, we are faced with limitations. Not all argumentation will be in favor of a particular issue, neither will all the components as defined by the Toulmin model be present.

We now consider some software tools that are used for argument diagramming purposes and see what we can learn from them.

2.2 Diagramming tools

Nowadays several computer software tools are available that are able to help with the creation of an argument diagram. These Computer Supported Argument Visualization (CSAV) tools or applications are designed to assist in sorting and making sense of information and narratives found in minutes or other forms of discourse weaving threads of coherence. Users are able to manipulate, annotate and display the structure in various ways. Although all the tools provide means for the creation of an argument diagram they all have their own underlying model or method with their own set of components from which, in the end, the resulting diagrams can be created. The components, or objects and relations, and the rules for combining them are referred to as the 'representational notation' [Suthers, 2001]. We will now describe some features of these tools and look at their representational notations for defining their diagrams.

Most of these tools aim to provide a means for both students and scholars in argumentation to analyze the structure of natural argument. Araucaria [Reed and Rowe, 2001], named after a tree, is for example such a tool. In Araucaria argument premises are to be placed below the conclusions and all nodes (propositions) and the connections between them can be labelled according to their evaluation. Another educational tool aiming to increase critical thinking is Reason!able [van Gelder, 2002], which is designed to be used in undergraduate classes. The primary objects in reason!able are claims, reasons and objections. These components can be used to model argument trees. In the resulting argument trees, a 'child' is always evidence for or against a parent. Similar trees can be constructed with software package such as Athena[2] and Belvedere [Suthers et al., 1995].

There are some differences between the capabilities of these tools. Araucaria is for instance able to handle argumentation schemes in a way that if a complex of propositions is joined through a schema, the whole structure can be labelled and highlighted and has the ability to show counter arguments in a shaded box linked by a horizontal line to the proposition it counters. It is therefore also used for the creation of a collection of arguments fitting within typical argument schemes (Katzav et al. [2003]). In Athena, users are able to manually assign a relevance value to the relations and to manually evaluate the acceptability of the premises to see how much strength a parent would derive from its children. With Reason!able one is able to evaluate arguments on three different levels. The strength of the arguments (on a three level scale: no support, weak support and strong support), the degree of confidence in their truth and independent grounds for accepting or rejecting (e.g. because it was stated by an authority). The Belvedere environment allows the nodes to be labelled with labels as *Principle, Theory, Hypothesis, Claim, Data* where as in Reasonable, the nodes can be only of type *Claim*.

A somewhat different tool is Compendium [Selvin et al., 2001], which was designed as a tool to support the real time mapping of discussions in meetings, collaborative modelling, and the longer term management of this information as organizational memory. Another difference with the other tools is that the resulting diagram can contain, apart from arguments or conclusions, questions or issues as well as answers or ideas that have been expressed. Furthermore decisions can explicitly be indicated and references to external data sources can be included such as notes and spreadsheets.

This shows some of the tools that are used to capture argument diagrams. For the schema we are developing an annotation and visualization tool is also being constructed. With respect to the representational notations of the tools, it appeared that the positive (support) and negative (refute) relation between arguments are included in all of the tools. Only in the Belvedere environment are the relations somewhat finer grained: examples of their relation set are *support, explain, undercut, justify, conflict*. Another observation is that in all of the tools, except compendium, the main conclusion or thesis that was debated is represented as the uppermost node.

[2]www.athenasoft.org

3. ASPECTS OF A DIALOGUE

The argument diagrams discussed above visualize the structure of an argument. In many cases argument diagrams are constructed to analyze an argument that has been expounded in a text or that has been expressed through a dialogue. In this case, it is even possible that statements may be put into the diagram that were not expressed explicitly in the text. The purpose of the schema that we present in the next section is to annotate the statements from a text or the utterances in a dialogue with labels that indicate their argumentative function in the discourse or the argumentative relation that holds between them. In this sense, the schema attempts to capture information closely related to the kind of relations found in argument diagrams, but is in its nature closer to a dialogue act scheme or a scheme such as that stemming from Rhetorical Structure Theory.

Rhetorical structure theory from Mann and Thompson [1987] provides an inventory of relations that hold between the sentences (roughly speaking) in a text that account for one aspect of coherence: what has a sentence to do with the preceding or the following sentence. The list of relations posited is open-ended. The set of relations is meant to be general, though in specific genres of texts some relations are more likely to turn up than others. Some of the relations proposed in RST are: evidence, background, elaboration, contrast, condition, motivation, concession, restatement. Some of these, such as evidence and concessions, will typically occur in argumentative discourse.

In the original set-up by Mann and Thompson [1987] rhetorical relations are not considered to be speech acts. However, it is clear that they are not completely unrelated. Each of the relations could correspond to or constitute a speech act: provide evidence, give background information, elaborate, contrast, make a conditional statement, motivate, concede, restate. Ascher and Lascarides [2003], use rhetorical relations to account for a range of semantic processes in language, therefore consider rhetorical relations as speech acts that are relational.

For establishing the kinds of speech acts we want to use to mark the argumentative function of utterances, we have to look at the kinds of dialogues or texts that we want to consider. We are especially interested in dialogues where participants discuss the pros and cons of certain solutions to a problem, providing arguments in favor of or against the various solutions and raising new problems. This is not completely unlike the discussions that are modelled in the IBIS system. The IBIS model [Kunz and Rittel, 1970] is an approach to fit argumentation in a model in terms of issues and their alternatives that have been proposed and accepted by the participants. (Note that IBIS is not a graphical diagramming model) It is based on the principle that the design process for a complex problem is a conversation between the participants who each have their own area of expertise. In the process the problem is also called the topic. Within this topic, speakers bring up issues. Whenever speakers have an opinion on an issue, they can assume a position to state how they look at the issue. To defend their opinion on the issue they can construct arguments until the issue is settled. In this process the participants give their opinion and judgement about the topic and thus create a more structured view of the topic and its possible solution [Conklin and Begeman, 1988].

Important conversational moves in this kind of dialog are: raising problems, putting forward assertions (solutions), retracting assertions, and putting forward arguments in favor of or against a solution. An assertion expresses a proposition and a form of speech indicating whether the assertor is committing to a specific position in a strong or a weak way. The schema that we present in detail in Section 5 accounts for the basic elements of these kinds of moves. It distinguishes acts in which issues are raised (questions put forward) and statements for a position that are made. It allows one to indicate whether a statement is strong or weak. Whether statements agree or disagree with each other can be marked in the relations. In many cases statements are not simply in favor or against but variations of each other: restatements, specializations or generalizations. This is something we account for as well in our schema. Before we present some further details, we will discuss some general issues that we took into consideration.

4. REQUIREMENTS FOR OUR DIAGRAMMING MODEL

As we intended to use an external graphical representation of argumentation, we had to decide on the representational notation that we could use. According to Bruggen [2003] the most important question that needs to be answered is *what* the representational notation of the external representation must contain before one starts defining this notation.

Our representation should visualize the structure of our design meeting discussions containing the contributions from the meeting transcripts in a crisp and coherent way, such that answers to questions asked about the meeting either follow directly from the discussion schemas or can be derived in a straight and easy manner.

Walton and Reed [2003] describe five what they call 'desiderata' for a theory of argument schemes. Although they regard argument schemes as form of an argument (structures of inference) representing common types of argumentation, the desiderata are also relevant for models describing the components and the relations between these components in order to constitute an argumentation diagram and thus relevant for our purpose.

The desiderata are:

1. Rich and sufficiently exhaustive to cover a large proportion of naturally occurring argument.
2. Simple, so that it can be taught in the classroom, and applied by students.
3. Fine-grained, so that it can be useful employed both as normative and evaluative system.
4. Rigorous, and fully specified, so that it might be represented in a computational language.
5. Clear, so that it can be integrated with the traditional diagramming techniques of logic textbooks.

These desiderata also hold for our schema.

The decision making process occurring in our design meetings can be decomposed into several subprocesses, with multiple levels of detail. An example is the nine-step model proposed by Schwartz [1994] which mentions the following phases: the problem definition, the criteria definition to evaluate the solutions, identify the root causes, generate solutions, evaluate solutions, select the best solution, develop an action plan, implement the action plan and evaluate the the outcomes and the process. A similar decomposition is presented by Briggs and Vreede [2001] who identify structures such as, diverge, converge, organize, elaborate, abstract and evaluate. So as we want to capture the decision process of a meeting our model should somehow be able to incorporate these relevant aspects.

With respect to all diagramming models we studied, they generally start with, or work towards a final 'conclusion'. In the domain of meeting discussions where people make decisions, there might be no conclusion at all (e.g. due to time constraints). We aim to capture contributions, or parts of contributions in the nodes of the diagram that is to be developed, regardless of whether consensus is reached. The support and object relations with respect to issues debated seem to be appropriate for our use.

The approach that we took was a so called 'goal driven design' approach. Based on the literature on argumentation theories and argument diagramming, we started by creating argument diagrams on a small corpus. In several rounds we tried to reach a consensus on how to label a meeting. When required, the representational notation was refined. The whole process was repeated until agreement was reached on the labels for the components. The next section describes the resulting schema and relates it to components of the other models described before as well as to the structural components inherent to conversations.

5. THE TWENTE ARGUMENT SCHEMA

The Twente Argument Schema is a schema that can be used to create argument diagrams from meeting discussion transcripts. As Newman and Marshall [1991] describe, if one is willing to make a decomposition of large and complex spaces, a separation of issues is required that groups arguments with respect to a particular topic they address. Therefore we wanted our model to be suitable to capture those parts of the meeting, containing discussions around a specific topic. This results in possibly more than one diagram per meeting. Following most of the diagrams studied, application results in a tree structure with labelled nodes and edges. The nodes of the tree contain parts of, or even complete, speaker turns whereas the edges define the type of relation between the nodes. A resulting argument diagram of the transcript of appendix I can be found in appendix II.

5.1 The Nodes

The content of the nodes correspond in granularity to the size of speech acts, resulting in most of the times in the size of a complete utterance. If utterances contain more than one act, they are split up into more than one node. (See e.g. utterance 29 of Appendix 1, which is split into two nodes (29a and 29b) in the diagram of Appendix 2). In line with Galley et al. [2004] backchannel utterances such as 'uhhuh' and 'okay' are filtered out, since they are generally used by listeners to indicate they are following along, and not necessarily indicating (dis)agreement. The nodes in our model consist of issues and statements.

In the IBIS model issues are represented as questions [Kunz and Rittel, 1970]. This is due to the fact that issues can be seen as utterances with a direct request for a response, in the same way as a question is generally followed by an answer. Fundamental questions with respect to conversational moves are *yes-no questions* and *why questions* [Kestler, 1982]. A yes-no question admits only two kinds of answer, be it either supportive, or negative. A yes-no question rules out the *option* 'I don't know' expressing uncertainty. Another type of question one could ask is an *open question*, this question can, in contrast to, yes-No questions be answered without the limitation of a predefined set of choices. The number of positions participants can take thus depends on the set of possible options enabled by the type of question or issue.

In our Schema we have defined three different labels for our nodes to represent the issues: The *'Open issue'*, the *'A/B issue'* and the *'Yes-No issue'*. The open issue allows for any number of possible replies possibly revealing positions or options that were not considered beforehand. This in contrast with the A/B issue, that allows participants to take a position for a countable number of positions which should be known from the context (c.f. 'Would you say ants, cats or cows?'). The yes-no issue, in line with the yes-no question directly requests whether the participants positions agree or disagree with the issue. The reader should note that we leave out the why question. This is done because a why question can be modelled as an open question with a clarification relation, explained in the next section.

Participants' positions are generally conveyed through the assertion of *statements*. The content of a statement always contains a proposition in which a certain property or quality is ascribed to a person or thing. A proposition can be a description of facts or events, a prediction, a judgement, or an advice (Van Eemeren et al. [2002]).

Statements can vary in the degree of force and scope. It can happen that meeting participants make remarks that indicate that they are not sure if what they say is actually true. Toulmin [1958] uses a qualifier in his model to say something about the force of what he calls 'claim'. When this qualifier is introduced, it is possible that the assertion is made with less force. As Eemeren [2003] points out that the force of an argument can also be derived from lexical cues. To be able to represent this we introduce the label *'weak statement'*.

5.2 The Relations

Relations can only exist between nodes. For this we have defined a number of relations that can exist between the labelled nodes. When engaged in a discussion or debate, the elimination of misunderstandings is a prerequisite in order to understand each other and hence to proceed [Neass, 1966]. Participants in a discussion, according to Neass, eliminate misunderstandings by clarifying, or specifying their statements. These moves can e.g. be observed in the criteria definition phase, of the decision making process.

If one clarifies a statement, the new contribution sheds a different light on the same content to increase comprehension by the other party. As this occurs regularly in the discussions examined we introduced the *'Clarification'* relation label. It is to be noted that a clarification contribution can also be made by a different person than the person making the initial contribution. An example of a clarification relation occurs between the following two contributions in our example 'Ants are the most intelligent animals' and the proceeding contribution of the same speaker shows why this is the case 'Ants can build big structures'. The second contribution here is used to clarify the first one by explaining why the speaker thinks that what was said by his first contribution is true.

A specification occurs in situations where a question is asked by one of the speakers and someone else asks a question which specializes the first question resulting in a possible solution space with more constraints. The contribution 'Which animal is the most intelligent?' can be specialized with the following proceeding contribution 'Is an ant or a cow the most intelligent animal?' which again can be specialized if one for instance asks 'Are ants the most intelligent animal?'. The other way around is however also possible. If one is not able to find a solution for the specific problem, one could enlarge the solution space through generalization. For these occasions we introduce the labels *'Specialization'* and *'Generalization'* Both labels can for instance be applied when a particular issue generalizes or specializes another issue.

Whenever the issue is defined, an exchange of ideas about the possible answers or possible solution naturally occurs in the decision making process. Whenever a statement is made as a response to an open-issue or an A/B-issue it might reveal something about the position of participant in the solution space. In general he provides an *'Option'* to settle the issue at hand. For example when a speaker asks 'Which animal is the most intelligent?' and the response from someone else is 'I think it's an ant' the option relation is to be applied. The opposite of the option relation is the *'Option-exclusion'* relation, and it is to be used whenever a contribution excludes a single option from the solution space.

For a yes/no-issue the contributions that can be made are not related to enlarge or to reduce the solution space, but to reveal one's opinion to the particular solution or option at hand. In a conversation people can have a positive, negative or neutral stance regarding statements or Y/N-issues. For this purpose the labels *'Positive'*, *'Negative'* and *'Uncertain'* are introduced. With the aim to reveal whether contributions from participants are either supportive, objective, or unclear. We see that the positive and negative label are used in many of the models described in section 2.1 and 2.2.

The positive relation can exist for example between a yes/no-issue and a statement that is a positive response to the issue or between two statements agreeing with each other. When one speaker states that cows can be eliminated as being the most intelligent animals and the response from another participant is that cows don't look very intelligent, then the relation between these statements is positive. The negative relation is logically the opposite of the positive relation. It is to be applied in situations where speakers disagree with each other or when they provide a conflicting statement as a response to a previous statement or a negative response to a Yes/No-issue. In a case where it is not clear whether a contribution is positive or negative, but that there exists some doubt on the truth value of what the first speaker said, one should use the uncertain relation. From experience with the annotations it appears that in most cases it can easily be seen by the annotator whether the remark is mostly agreeing or mostly showing doubt.

The final relation of our set is to be applied when the content of a particular contribution is required to be able to figure out whether another contribution can be true or not. We named this the *Subject to* relation, which is somehow related to the concession relation in Toulmin's model. It is to be applied for example in the situation where someone states that 'If you leave something in the kitchen, you're less likely to find a cow' and the response is 'That depends if the cow is very hungry'. So the second contribution creates a prerequisite that has to be known before the first contribution can be evaluated. If the cow is very hungry the support could be either positive or negative. The uncertain label is not to be applied it this case, as the stance of the person in question is clear once the prerequisite is filled in. The uncertain label is merely to be used when an issue is preceded by a request for specialization or clarification.

5.3 Preserving the conversational flow

As we are working on transcripts, it is best for our model to be constructed sequentially in order to follow the line of the discussion. To preserve the order of the discussion in the model we decided that, when applying the schema, the algorithm or annotator should follow a depth first search algorithm [Cormen et al., 1990] when extending it. This means that in principle every next contribution becomes a child of the previous contribution, unless the current contribution relates stronger to the parent of the previous contribution. This way the resulting tree structure can still be read synchronously.

5.4 Freedom of the annotator

One of the drawbacks of argument diagramming that is often mentioned is that there is no correct diagram. Walton [1996] for instance showed that various different argument diagrams can be instantiated by one single text. Although this is true, an interesting point here is the analogy that can be drawn between RST and Argument Diagramming. As Reed and Rowe [2001] point out that Mann and Thompson suggest that the analyst should make *plausibility judgements* rather than absolute analytical decisions, it is implicated that there can be more than one reasonable analysis. This also goes for argument diagramming, where the evaluator is free to interpret and to create that diagram that he considers the most appropriate according to his or her perception. As long as the schema is applied correctly, its purpose anyhow will be apparent.

6. CONCLUSIONS AND FUTURE WORK

We have developed a method to capture argumentative aspects of meeting discussions in a way that an argument diagram can be created that shows how the discussion evolved, how the contributions of the participants relate, which issues were debated and which possible solutions were evaluated. The resulting argument maps are a valuable resource capturing organizational memory, that can aid querying systems and can be used in meeting browsers.

Currently we are developing a tool to help make annotations of meeting transcripts. This way we want to construct a corpus from which models are to be trained that hopefully one day will be able to derive the structures of the argumentation themselves. When the first annotations are ready, reliability analysis amongst annotators will be investigated and a study into automatic recognition of both labels and relations will be conducted. For the reliability of relational annotations we foresee an approach similar to the one described in Jovanovic et al. [2005] for adjacency pairs.

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8. APPENDIX I : TRANSCRIPT AMI-FOBM6

1)P2: Ants are the most intelligent animals in the world.

2)P0: Well taken as a whole maybe, but individually no

3)P2: ?? cats

4)P3: Yeah but there's an 'S' VOC laugh. There is a problem here

5)P0: Well it's a species, a species yeah

6)P3: I would say the most intelligent animal is in singular

7)P2: Which one?

8)P3: Or maybe we have to consider we have to consider intelligence as a group maybe?

9)P0: a ?? a cat, a cow or ??

10)P1: Um

11)P3: Cause cow as a group, I would bet on cow VOC laugh.

12)P2: I think we we can eliminate cow anyway

13)P3: It doesn't look very intelligent. You have any clue of cow intelligence? VOC laugh

14)P0: I think they have some kind of secret manifestation of intelligence.

15)P2: Oh yes no no no no

16)P0: They hide it very well. Well you can't because when they're observed, they instantly hide it. So you can't know.

17)P3: When when they

18)P0: This was a guess I think.

19)P2: So the mother um I would rate it as ants cats, ants cats and cows

20)P0: What?

21)P2: In that in that order I'd rate them as ?? VOC laugh

22)P3: I would rate cats, cow, ants

23)P0: I would say ants.

24)P2: Ants yeah

25)P0: Yeah

26)P3: You would say ants first

27)P0: As a group

28)P2: Yeah as a group yeah

29)P3: As a group yeah but that's not really intelligence that's organization

30)P2: Well

31)P1: Um yeah yes um as an organization they are very intelligent

32)P2: Um the cats hardly live together, you know

33)P3: Yeah but is-t it can be a proof of intelligence if they can um they can have um critique opinion against other cats, where as ants just agree, so they don't really

34)P0: Yeah

35)P0: What doe-s what does it prove? is it just

36)P1: Actually an interesting point is that ants have survise/survived o-n on the earth for millions of years without evolution

37)P0: Well they have a very plastic if it's English, plastic nature. They can be modified at will the the the queen

38)P1: They can't?

39)P3: They can

40)P0: The queen decides what she produces depending on the conditions

41)P2: That is Bees right?

42)P0: No I think it's true for ants

43)P2: Ants also

44)P0: So

45)P1: All- all of this it true, but it this not related to intelligence.

46)P3: Yeah good a good adaptation capacity they have good group behaviour.

47)P2: but they don't have any initiative or

48)P0: Well yeah but

49)P1: What's intelligence?

50)P1: What I'm trying to say

51)P2: Well cats have initiative to steal food for themselves

52)P3: Yeah if you let something anywhere a cat will try to

53)P2: Ants

54)P2: Ants do have the same instinct you leave your sugar box open anywhere they come there and they make it you know VOC laugh VOC laugh VOC laugh

55)P0: Yeah

56)P1: I-f if there's something, an ant will eventually find it

57)P3: That's much more difficult with a cow. VOC laugh If you leave something in a kitchen, you are less likely to find a cow VOC laugh VOC laugh u-

58)P0: You know you are in trouble yeah?

59)P1: It depends if the cow is very hungry.

60)P2: Well cow usually, well cows usually, well I don't know here, but in India the cows usually have a tendency to go into an some others field to eat the green grass if it doesn't gets it. Well depending on the situation the cow can also become intelligent

61)P0: ?? a mad cow maybe VOC laugh

62)P3: Ok

63)P3: Um yeah

64)P2: Well it once like

65)P0: I don't know, I see but, ants build, they're able to build um well they modify our gardens

66)P2: Yeah

67)P0: Cats can't

68)P0: Yeah ants can build big structure, very complex things

69)P3: Yeah

70)P0: High span and

71)P1: What do you mean by modifying the environment? If you put a cat in an environment with a a lot of rats, it will change the ??

72)P0: Yeah it is not really building

73)P2: So

74)P1: So we are still divided I think

75)P3: I think um that that's strange too because intelligence as a group group intelligence

76)P0: Yeah

77)P0: Well if you look at the brain

78)P3: Yeah

79)P0: We could look at it this way

80)P3: Yeah yeah but that is different individual yeah that can yeah that's interesting

81)P0: I don't think .. I wouldn't look at an ant as a brilliant individual of I mean by itself it's nothing right?

82)P3: Yeah

83)P3: Yeah ok

84)P2: Ah well it is well you should look for that um story of other than French

85)P0: Yeah yeah you're right

86)P3: I vote for ant as ..

87)P0: Yeah same

88)P2: Ok, so we finalize that ants are the most intelligent ones compared to the given list?

89)P0: I vote for ants as well.

88)P1: Me too

9. APPENDIX II : ARGUMENT DIAGRAM OF THE INTELLIGENCE DISCUSSION