# You've Heard It All Before: A Case-Based Approach to Argument Formation

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#### Abstract

The use of case-based reasoning techniques can greatly simplify the process of argument formation. In accordance with this view, our SpeechWriter program generates one-sided arguments for stereotypical interpretations of events. Its cases have two parts, one representing an interpretation of an event (e.g. UNDERSTAND-ABLE TRAGEDY) and the other serving as a template for generating the text of the argument. Event representations are adapted to match against the interpretive part of the case, and the bindings produced by this match are then used to "fill in" the generative part. The process of argument formation is thus reduced to selecting an interpretation and adapting it to fit the chosen event.

#### 1 Introduction

Do you notice that politicians seem to say the same thing over and over again, even if they are talking about different events? When repeatedly advocating a familiar position, do you find yourself using similar phrasing each time? While making one argument, have you been reminded of another due to similar language or perspective? These three phenomena suggest that the processes of argument generation and understanding are case-based. That is, when an argument is produced or understood, it is not built up piecemeal through the application of general rhetorical rules, but is instead adapted from a single, pre-existing argument schema. To account for the repetition of word choices and phrasing, these schemas would organize the manner of an argument's expression, as well as its conceptual content. Certainly, the repetitiveness of some political speeches suggests that their arguments are not so much synthesized, which would be the method suggested by most current work in argument generation, as they are adapted through case-based planning[3][5].

Cases encompassing both the content and generation of arguments could be used, during understanding, to make sense of disconnected parts of an argument, facilitate

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the construction of new arguments, and produce remindings between arguments. We will argue that such memory structures reduce the process of argument production in particular to one of selection and adaptation. To demonstrate this point, we have written a program called SpeechWriter which can report on an event using any one of several interpretations, or points-of-view.

#### 2 Representation

SpeechWriter's cases can be thought of as having two primary parts. The first part is a template of the conceptual content of the interpretation or 'slant' the arguer is trying to establish. The second part is another template, used as a plan for generating the text of the argument. We call cases composed of these two parts "skeletons" [6]. These skeletons are not arbitrary, highly-specific prior arguments; rather, they are prototypes of common points-of-view. The process of making an argument by using a skeleton consists of three parts: choosing a skeleton, matching a description of a given situation against the conceptual template of the skeleton, and then producing argument text by following the plan of the generative template. The interpretive and generative tasks are thus integrated by sharing slots between the two templates.

For example, our UNDERSTANDABLE TRAGEDY skeleton has a PERPETRA-TOR slot. Within the interpretive template, this slot is represented as someone who, because of a flawed chain of reasoning, inadvertently harms another person. Within the generative template, however, this slot represents the object of a referring act appearing early in the argument text. One sample event we interpret using this skeleton is a representation of the airliner-downing that occurred a few years ago in which an American warship shot down an Iranian passenger plane. When the program matches the interpretive template to the representation of this event, the AMERICAN WARSHIP fills the PERPETRATOR role. Since the PERPETRATOR slot is shared with the generative template, the program would also know it should refer to the AMERICAN WARSHIP at a particular point early in the generated text.

#### 3 The process model

If adaptation of existing cases is to be a model of argument formation, the first step in the process has to be the retrieval of an appropriate case to adapt. At this time, we rely upon the program user to make these decisions, but we discuss a possible implementation of this task later in this paper.

SpeechWriter then performs the adaptation step, by matching the event representation, or "gist", to the interpretive part of the chosen skeleton. This process often involves a considerable amount of inference before the roles of the skeleton can be filled.

The generative part of this skeleton is adapted at the same time and by the same process that filled out the interpretive part. Adaptation of the generative part consists primarily of making decisions about how to state propositions or refer to objects in the gist which correspond to particular roles in the interpretive part. The earlier example of AMERICAN WARSHIP filling the shared PERPETRATOR slot illustrates this dual functionality.

The generative part of the skeleton is actually an incomplete plan. The more complete subparts of this plan are those phrasing patterns we recognize as stereotypical ways of expressing the interpretative part. For example,

"it was an understandable accident to JUSTIFIED-ACTION and think that JUSTIFICATION"

is a frozen phrase used as part of the generative template of UNDERSTANDABLE TRAGEDY. The less complete parts (here, in upper case) are those that have to be custom-made for each application of the plan. Once the skeleton has been matched to the gist, the generation plan completes each of its under-specified parts.

### 4 World knowledge

The adaptive process uses two kinds of world knowledge: knowledge about elements of the gist which are not part of the gist itself (like the fact that the US and Iran can be considered enemies), and inference rules concerning everything from the trustworthiness of enemies to the coordination of reference acts. Use of this world knowledge is driven by failures to find any element in the gist corresponding to some unfilled role of the interpretation.

One such failure handled by SpeechWriter occurs when the WORLDWIDE ATROC-ITY skeleton is matched to the airliner-downing representation mentioned above. For this point-of-view to be effective, SpeechWriter must find some justification for arguing that the U.S. was lying when it claimed the downing was unintentional. There is no such information in the gist, but world knowledge that the U.S. and Iran are enemies can be used to infer that the U.S. was lying, due to an inference rule that states enemies often lie to each other.

The inference rules themselves are intended only to model acceptable inferences, not irrefutable ones. They are vague and often contradict each other. (For example, in addition to the rule allowing the assumption that an enemy is lying, is a rule that one agent usually believes whatever another says.) Since rules fire only when the matching process runs into difficulty, the context which determines inference acceptability is the skeleton currently being matched. That is, the acceptability of one inference over another is determined by what the current interpretation requires to be inferred. The ability of the internal logic of stereotypical interpretations to choose the right inferences thus allows contradictory rules to coexist in memory. Consistency, therefore, lies only in the interpretation itself, which makes most formal methodologies for dealing with rule bases, e.g. examining the logical closure of the rules, meaningless. This is one of the primary ways SpeechWriter takes advantage of the inherent coherence of its cases.

#### 5 A sample run

Indicate the event you would like SpeechWriter to tell:

1 : IRANIAN-PLANE-SHOT-DOWN-BY-AN-AMERICAN-WARSHIP

2 : PETE-ROSE-IS-CAUGHT-BETTING-ON-GAMES

Your choice: IRANIAN-PLANE-SHOT-DOWN-BY-AN-AMERICAN-WARSHIP

Indicate the speaker I should write a speech for:

1 : YITZHAK-SHAMIR

- 2 : MOAMMAR-GADDAFI
- 3 : RONALD-REAGAN

Your choice: MOAMMAR-GADDAFI

Indicate the interpretation you would like to use:

- 1 : JUST-DESERTS
- 2 : WORLDWIDE-ATROCITY
- 3 : UNDERSTANDABLE-TRAGEDY

Your choice: WORLDWIDE-ATROCITY

Executing the incomplete plan, before matching, produces the following story:

Because SOME PROPOSITION WAS TRUE OR FALSE, THE BAD GOVERNMENT committed an atrocity against mankind by DOING SOMETHING TO A GOAL-DIRECTED OBJECT CONTAINING AN AGENT and having the audacity to claim THE AGENT BELIEVED THAT SOME PROPOSITION WAS TRUE OR FALSE.

Initiating matching process with the following binding:

SPEAKER binds to MOAMMAR-GADDAFI

Initial binding leads to the following bindings:

INVALID-MOTIVATION binds to INSTANCE-OF-FRUSTRATED-IMPERIALISM

AGENT-OF-MAJOR-POWER binds to AMERICAN-WARSHIP

DESTRUCTIVE-ACT binds to SHOOTING

VALID-MOTIVATION binds to PLANE-IS-A-FIGHTER

A IS-AN-ENEMY-OF proposition was found in the skeleton but there was no corresponding element in the gist, so the AGENTS-OF-ENEMIES-ARE-ALSO-ENEMIES rule was applied, so the proposition could be inferred to have been an implicit part of the gist.

A BELIEVES-FALSE proposition was found in the skeleton but there was no corresponding element in the gist, so the ASSUME-ENEMY-IS-LYING rule was applied, so the proposition could be inferred to have been an implicit part of the gist.

BELLIGERENT-MAJOR-POWER binds to AMERICAN-ADMINISTRATION

AGENT-OF-MINOR-POWER binds to IRANIAN-AIRLINER

INNOCENT-VICTIMS binds to CIVILIANS

MINOR-POWER binds to MUSLIM-BROTHERHOOD

Executing the generative plan produces the following story:

Because MUSLIM PATRIOTS HAVE REFUSED TO BUCKLE UNDER TO AMERICAN IMPERIALIST PRESSURE, THE GREAT SATAN committed an atrocity against mankind by SHOOTING DOWN A CIVILIAN PLANE CONTAINING INNOCENT PEOPLE and having the audacity to claim THEY BELIEVED THAT THAT PLANE WAS A WARPLANE.

For the purpose of contrast, this is the argument produced when the UNDERSTANDABLE-TRAGEDY skeleton is chosen:

> We all know it was a tragedy. But we're talking about an incident in which A PLANE ON RADAR WAS OBSERVED COMING IN THE DIRECTION OF A WARSHIP IN COMBAT. And so, I think it was understandable TO SHOOT and think that THEY WERE UNDER ATTACK FROM THAT PLANE.

#### 6 Comparisons with other work

Previous work on argumentation has stressed the beliefs, plans, goals, and attack/support relationships that would lead an agent to make a particular argument or help him to understand those of his adversary. This project addresses the problem of forming and stating an argument once it has been chosen. Our work therefore relates to what has gone before in two ways. First, the arguments that we produce could serve as the nodes, or individual claims, of existing argument representations, such as argument graphs[2][1]. Therefore, our skeletons are just the kind of knowledge that should be indexed by these representations in order to facilitate skeleton selection, a procedure we currently ask the user to perform.

Second, the argument representations developed in previous work used a vocabulary similar to the one used in the conceptual part of SpeechWriter's skeletons. For this reason, skeletons can be seen as the natural "chunks" which would be stored if these previous systems had been designed to retrieve and adapt the arguments they had already produced. It is this storage and reuse of skeletons that characterizes best our use of the skeleton idea - they are the natural result of applying the CBR paradigm to the task of argument formation.

### 7 Future Directions

At this point, we have completed only an initial version of our skeleton-applying program, and many of the ideas proposed here exist only at a rudimentary level. In the coming year we hope to add to its abilities in the following ways:

- 1. Expand the corpus of skeletons and gists available to the program.
- 2. Work out a "first pass" solution to the skeleton-indexing problem which will allow the program, instead of the user, to pick a skeleton based on the gist it is to generate and the goals forming its model of the hypothetical speaker.
- 3. Allow skeletons themselves to be alterable by the matching process in the case where the gist cannot be matched to the skeleton as it stands. We hypothesize that new skeletons are acquired and old ones made more general through tweaking of this kind.

## 8 Conclusion

We believe that cases integrating the point-of-view and expression of arguments play a major role in the understanding and production of new arguments. In accordance with this view, our SpeechWriter program generates one-sided arguments for stereotypical interpretations of events. The program demonstrates the possibility of using cases to facilitate this process in the same way that the use of case bases has been used to facilitate planning processes in many other areas.

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# WORKING NOTES

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